Improving New Zealand's childhood immunisation rates

Evidence Review

5 July 2019

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Document status:	Final
Version and date:	FINAL
Author(s):	Léonie Walker, Emma Ward, Daniel Gambitsis
Filing Location:	W/MoH Public Health/communicable diseases 2018-19/04 Deliverables Literature review – Immunisation
Peer / technical review:	Marion Clark
Verification that QA changes made:	Léonie Walker
Proofread:	Marion Clark, Jacqui Haggland
Formatting:	Alice Hartley
Final QA check and approved for release:	Jacqui Haggland, Project Sponsor

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GLOSSARY

AEFI	Adverse Events Following Immunisation
BCG	Bacillus Calmette-Guérin vaccine
CDC	Center for Disease Control and Prevention
DHB	District Health Board
DT	Diptheria
Tetanus DTaP	Diptheria, Tetanus, acellular Pertussis vaccine
DTP/ DPT/ DTwP	Diptheria, Tetanus, whole cell Pertussis vaccine
ESR	Environmental Science and Research
EVAP	European Vaccination Action Plan
GP	General Practitioner
HCW	Healthcare workers
Hep B	Hepatitis B vaccination
HPV	Human Papillomavirus
IMAC	Immunisation Advisory Centre
MMR	Measles, Mumps, Rubella vaccine
MO	Missed Opportunity
NHI	National Health Index
NIR	National Immunisation Register
NIS	National Immunisation Survey
NZE	New Zealand European
OIS	Outreach Immunisation Service
PHC	Primary Health Care
PHO	Primary Health Organisation
PMS	Practice Management System
PN	Practice Nurse
RCT	Randomised Controlled Trial
UTD	Up to date
VPD	Vaccine Preventable Disease
WHO	World Health Organization

EXECUTIVE SUMMARY

Purpose

The Ministry of Health (the Ministry) is concerned that in New Zealand, as in many countries overseas, rates of immunisations for many infectious diseases, and among many age groups are falling. The fall was particularly noticeable over the period late 2016 to 2018. The Ministry is also concerned about the widening equity gap in immunisation coverage rates for Māori. There is an urgent need to review the evidence base for the factors leading to this decline and inform the development of interventions and policy solutions to counter it. This review seeks to explore the national and international evidence base for the effectiveness of interventions and policy settings to improve rates.

Research evidence

Systemic barriers are the leading cause of under-immunisation

After many years of steady improvements and declining disparities in New Zealand's childhood immunisation coverage, since 2016, reversals of trends for both coverage and equity have emerged. Research into the barriers to immunisation both in New Zealand and other Organisation for Economic Cooperation and Development (OECD) countries has shown similar findings. Systemic barriers to access are linked to socioeconomic factors, rurality and parental difficulties in juggling families, work and complex vaccine schedules. These systemic factors have more negative impacts on coverage than anti-vaccination views.

Interventions

Complex interventions of many types have been trialled and reported on both in New Zealand and overseas. Success (as with the interventions themselves) has been variable. Those that address specific, identified barriers; are context and culture specific; and have the support of health professionals and communities alike, are more effective. The evidence predicts that careful tailoring of multi-faceted interventions in specific geographical and community contexts will produce more effective results than generic, single-component interventions.

Education

Educational interventions, including sophisticated internet source and social media management have been demonstrated to counter misinformation and conspiracy theories related to anti-vaccination. Evidence also exists that entrenched parental anti-vaccination views account for only five percent of non-vaccination in New Zealand, and that these parents are not amenable to compulsion, coercion or education by health professionals. Appeal to other values such as social responsibility has shown promise elsewhere.

Legislation

Legislative and policy approaches taken across the world vary greatly. Many less developed and more authoritarian or collectivist countries have gone down the route of compulsion. The exceptions to this pattern include some states in the United States of America (where many have "conscientious objection" as an option), and Australia. After two years of this policy, there is mixed evidence for the success of this approach in Australia. Where non-vaccination is linked to removal of benefits and/or exclusion from education facilities, this has been shown to further disadvantage

struggling, chaotic and vulnerable families who are affected by systemic barriers but are ***unlikely*** to be anti-vaccination. This approach has had little impact on wealthier, more educated families where non-vaccination is more often deliberate due to anti-vaccination views.

Policy Implications

Address systemic barriers

Addressing the wider social determinants of health and extending the role of culturally appropriate support for families to attend immunisation sessions would improve immunisation rates and reduce inequity. Practical examples include mandating health navigators to include childhood immunisation support (reminders, transport) for those in need, and the provision of more local and flexible immunisation services, including community outreach.

Consider health workforce issues

In some, particularly rural, communities, increasing the availability of credentialled vaccinators, (for example school nurses, Well Child nurses, community pharmacists able to immunise children) may increase ease of access.

Further incentivise recording, reminding and recalling

Primary Health Organisations (PHO's) and general practices (GPs) have to balance meeting targets and the costs of providing services. Those working with harder-to-reach client populations may need additional resourcing for providing comprehensive recall, education and follow-up services to improve coverage.

As the health information technology (IT) systems and the Integrated Data Infrastructure (IDI) further improve, tracking and tracing children and families, and linking this to immunisation records will facilitate targeted interventions. Reducing the proportion of records submitted to the National Immunisation Register (NIR) without full details could further improve records.

Maintain access to high quality information for parents

Most, but not all, have access to high quality information via the internet. Particularly for the less health literate, or for those without good access to these sources, other provision may be required. Investment in accessible, high quality education for parents and caregivers to counter the anti-vaccination movement will continue to be required.

Compulsion in the New Zealand context

Aside from mandating exclusions from schools and early learning centres in the context of active outbreaks of disease, in the New Zealand context "hard" compulsion settings are likely to be both unsuccessful (as they do not address the identified main barriers) and resisted. This approach also risks further alienating the vaccine hesitant, reducing public trust in doctors and increasing inequity.

1. INTRODUCTION

1.1. Background

Immunisation is the process of inducing immunity by vaccination. Vaccination is the introduction of antigens prepared from killed or attenuated organisms in order to stimulate the immune system to produce antibodies and/or cellular immune responses to prevent infection or lessen the disease process. (Pal, 2016)

High coverage levels are important for both individuals and communities to reduce transmission of diseases within populations. Unimmunised individuals are both at increased risk of becoming ill if they encounter an infectious carrier and pose a greater risk to others of further spreading disease-causing organisms. While rates of many diseases in New Zealand have been reduced by fifty-plus years of vaccination, there remains a risk of re-emergence from pockets of low vaccine coverage or re-introductions to New Zealand by carriers from countries with higher rates of particular diseases and lower immunisation rates.

An important aspect of immunisation is the concept of herd, or community immunity. Different diseases require different levels of herd immunity due to differences in virulence, pathogenicity, infectiousness and the length and timing of periods of high contagiousness. For herd immunity against measles to be effective, it is calculated that approximately 95 percent of the population must be immune.

In addition, the administration of vaccinations at the recommended ages (timeliness) is essential, particularly in children, as many vaccines require multiple doses for effective immunity to be developed. Delayed or missed immunisation leaves a child unprotected. The community in which the unvaccinated child lives is therefore also at risk.

Those with compromised immune systems (for example the very old, the very young, those with specific illnesses or those undergoing chemotherapy for cancer or immunosuppressants to prolong transplants), depend on high levels of immunity in their communities to reduce the chances of picking up an infection.

1.2. Purpose of this evidence review

Immunisation is one of the most cost-effective of all public health interventions and is an essential component of both Well Child and adult preventive health services.

Achieving adequate immunisation for herd immunity against all vaccine preventable diseases is a key Health Target. The Ministry of Health (the Ministry), District Health Boards (DHBs) and the health sector are committed to reaching a goal of 95 percent of all New Zealand eight-month olds having completed their primary course of immunisations (six weeks, three months and five months immunisation events) on time.

New Zealand's child immunisation rate is low by comparable international standards, and stands at 90.1 percent for 8 month, 91.1 percent for 24 month and 87.9 percent for five year olds.[1] Although there are variations in rates both geographically and by population group. Māori rates of immunisation are particularly low. The Ministry is concerned that in New Zealand, as in many countries overseas, rates of immunisations for many infectious diseases and among many age

[1] https://www.health.govt.nz/our-work/preventative-health-wellness/immunisation/immunisation-coverage/national-and-dhb-immunisation-data Reporting period ending March 2019

groups are falling. International and anecdotal evidence shows growing influence of a vociferous anti-vaccination lobby, and it will be important to determine if New Zealand rates are also impacted by this.

The recent emergence of outbreaks of vaccine-preventable contagious disease (VPD), especially measles is particularly concerning.

There is an urgent need to review the evidence base for the factors leading to this decline and inform the development of policy solutions to counter it. This review seeks to explore the national and international evidence base for interventions and policy settings to improve rates.

1.3. Research question

The research question and sub-questions were agreed with the Ministry at the outset of the review.

1. *What is the evidence describing best practice to increase immunisation of children under five in New Zealand, and specifically, what can be done to reduce inequities in immunisation coverage?*

Sub-questions seek to use an equity lens to provide further insight.

a. *What health systems approaches have been shown to increase immunisation internationally?*

b. *What policy approaches have been taken internationally to increase immunisation?*

1.4. Structure of this report

The remainder of this report is structured as follows.

- Section 2 outlines the review's methodology;
- Section 3 outlines the review's findings;
- Section 4 outlines the identified policy approaches; and
- Section 5 outlines the applicability of the identified approaches to New Zealand.

2. METHODOLOGY

The review takes a robust integrative approach. Integrative reviews are the broadest type of research review methods, allowing for the inclusion of multiple types of evidence in order to more fully understand the phenomenon of concern. In addition, integrative reviews fulfil a wide range of purposes: to define concepts, to review theories, and to review evidence. The varied sampling frame (in this case academic and grey literature, and internet / social media) of integrative reviews allows a comprehensive portrayal of complex concepts, theories, or health care problems.

After a detailed search, a final list of key documents (academic, peer reviewed or statistical and other information from official sources) were chosen for their relevance to the New Zealand context, and their currency. The research questions were addressed using and citing from this finalised list of quality-controlled material. Web sources are also referenced, and their provenance and credibility as sources noted. The full list of documents reviewed is included in the Bibliography.

2.1. Search Strategy

2.1.1. Sources

Academic / medical literature: Breadth of search (Databases)

- Discover (CINAHL Complete, Medline and PsycINFO)
- National Institute for Health and Clinical Excellence
- PubMed

Inclusions

From the results of the search, literature was prioritised according to the following criteria:

- Published, peer-reviewed literature
- New Zealand specific
- *Reviews* and analysis of relevant internet forums
- Official reports and government inquiries
- (Inter)national authority and intergovernmental reports and guidelines
- Currency (published between 1 January 2008 and June 2019)
- Relevance to primary research questions, and
- Full article available in English language.

Exclusions

The literature review excluded:

- Non-peer reviewed material (other than that associated with official Ministry-type data and for the section examining internet messaging)
- Any material out of scope for the research questions
- Non-English language sources, and material published before 31 December 2007.

Misidentified, irrelevant papers and duplicates were removed.

2.1.2. Search terms

The keywords and search strings that were included in the search strategy are outlined below. The search is reported in Appendix 1: Search Record.

Search string: (Each initially ***AND*** New Zealand, then AND New Zealand OR Australia)

- Increasing childhood immunisation rates
- Impact of Anti-Vaccination movement
- Countering falling immunisation rates
- Childhood immunisation AND international policy

2.1.3. Grey literature

Official (e.g. Ministry) material was sourced using full text Google Scholar. We also conducted a scan of the national and international internet forums relating to vaccination and anti-vaccination.

A senior team approach was taken to the review process to ensure consistency. The integrative review methodology is shown in Appendix 2: Process.

2.1.4. Documentation and citations

Searches were tabulated by source, search string, any inclusions and exclusions, and documented using a standard review PRISMA results flow chart, shown in Appendix 3: PRISMA Search Results.

All cited documents were sourced full text. Citations were managed using Zotero.

2.1.5. Analytical framework

The analytical framework followed a multi-stage, systematic approach which focussed on:

- Quality of published material was reviewed using an established methodology.
- Qualitative reviews and reports were analysed using a framework of population, setting and context.

High quality systematic reviews of interventions in OECD countries were initially prioritised. Material was also selected if it met the inclusion criteria, was current, and from New Zealand or Australia. While a full quality review was not formally undertaken of every paper, systematic reviews were assessed against AMSTAR 2 criteria, and the chosen intervention publications were peer reviewed sources only, apart from two New Zealand communications from credible sources.

3. FINDINGS

3.1. Summarising the New Zealand childhood immunisation schedule and systems

New Zealand provides free immunisations to all residents, according to a schedule of delivery at seven specified ages between 6 weeks and 12 years. The immunisation schedule in use for under five-year-olds currently specifies three vaccines at age 6 weeks and 3 months (a rotavirus oral vaccine, a combination vaccine covering diphtheria, tetanus, pertussis, polio (DTPP), hepatitis B, and Haemophilus influenzae type b; and the third a pneumococcal vaccine). The 5-month schedule repeats this but omits the rotavirus. Four further vaccinations are required at 15 months (Haemophilus influenzae b, Measles, Mumps and Rubella (MMR), Pneumococcal and Varicella (chickenpox). At 4 years, MMR and DTPP are repeated. The list of funded vaccines is reviewed every three years by PHARMAC. The complexity of multiple immunisation events and a frequently changing schedule present challenges to even the most committed parents, particularly where there are several children of different ages in families.

The National Immunisation Register (NIR) was introduced in 2005 and is a national computerised record of the immunisation details for all New Zealand children. It is hoped that this will ensure that even when children move or change health care providers that their record can be accessed and checked by their new provider. The statistics available from the NIR are also valuable for planning initiatives targeting particularly vulnerable groups or populations with low rates of coverage. There are a considerable number of web-based information sources on immunisation, and readily available leaflets for use in general practices (GPs) or other public spaces such as libraries.

Targets are set by the Ministry for DHBs and PHOs to achieve specific percentage immunisation rates for their enrolled population, and financial incentives in the form of an immunisation subsidy (IMMS) paid on administration of approved vaccines to eligible patients. Immunisation claims are submitted electronically, and a target of 85 percent of claims providing National Health Index (NHI) numbers in addition to date of birth and surname. It is not publicly reported what proportion of claims for service are made without an NHI, or any potential impact of this on NIR statistical reporting.

Terminology

The terms ‘uptake’ and ‘coverage’ are used inconsistently in the literature. In New Zealand, ‘uptake’ is defined as the proportion of the eligible population who received a vaccine during a specific time period and ‘coverage’ as the proportion of an eligible population that is vaccinated, regardless of when they received the vaccine. Schedule completion is defined as being up-to-date (UTD) for age with schedules for the countries involved.

3.2. Understanding current childhood immunisation rates, trends and patterns: a brief summary of the data

3.2.1. Timeliness

At eight months, 90 percent of children are fully immunised and 92 percent at 2 years of age. Māori and other ethnicities (including Middle Eastern, African and Latin American) have lower coverage at eight months compared to New Zealand European, Pacific and Asian children.

3.2.2. Equity

In particular, immunisation coverage for Māori aged two years declined sharply over the last two years - from around 93 percent during 2015-2016 to around 88 percent this year. Immunisation coverage for our most vulnerable children aged two years living in a high deprivation area (NZ Dep 9-10) is around only 90 percent compared to around 93 percent for other deprivation levels.

It is perhaps surprising that the patterns of decline in coverage are very similar when comparing between deprivation scores. There are linkages between ethnicity and deprivation in New Zealand, and between ethnicity, rurality and service provision. For many public health measures (for example smoking cessation), rates of change vary by deprivation – with improvements being seen earlier and in a more sustained way among the least deprived compared to the most deprived. This results in a well-described phenomenon of "*Intervention induced Inequalities*"[2] It is against this backdrop of decline that a review of the evidence base for improving immunisation coverage was commissioned.

3.3. Trends - Summary graphs

The graphs in Figures 1 to 6 show the proportion of New Zealand children (reported as a percent) fully immunised at 8 months, 2 years and 5 years. There are also graphs showing proportions of children immunised for different ethnicities and different levels of deprivation.[3]

Immunisation coverage has been slowly but steadily declining since a peak in December 2015. The fall was particularly noticeable over the period late 2016 to 2018. The graphs are from the New Zealand Immunisation Advisory Centre 2018.

[2] Lorenc T, Petticrew M, Welch V, Tugwell P. What types of interventions generate inequalities? Evidence from systematic reviews. J Epidemiol Community Health. 2013;67(2):190–193. doi: 10.1136/jech-2012-201257.

[3] NZ Immunisation Advisory Centre 2018

Figure 1: Coverage at eight months by ethnicity

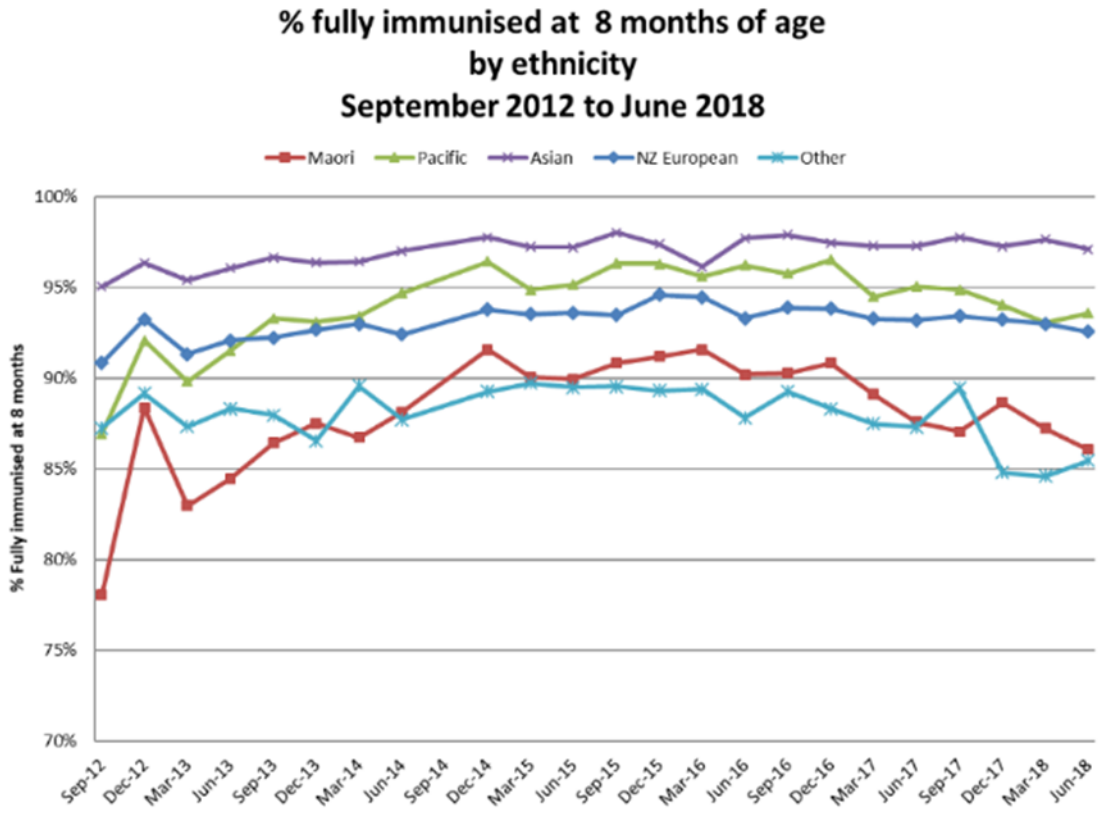


Figure 2: Coverage at eight months by deprivation

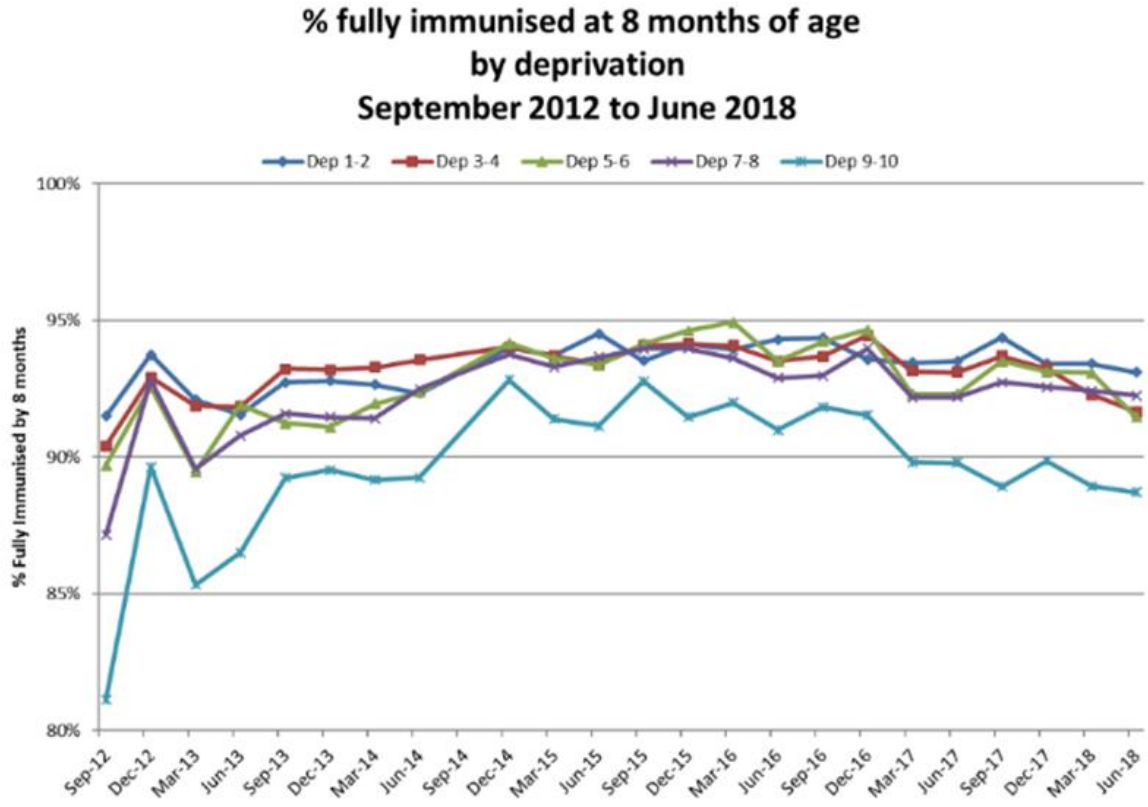


Figure 3: Coverage at two years by ethnicity

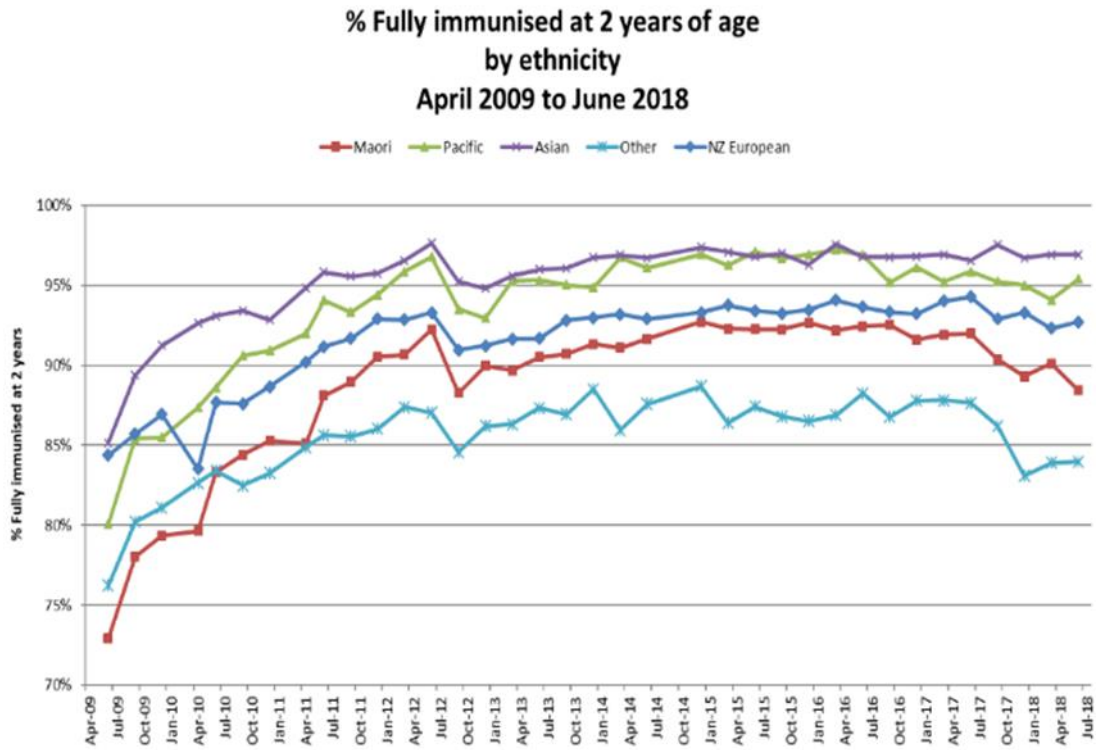


Figure 4: Coverage at two years by deprivation

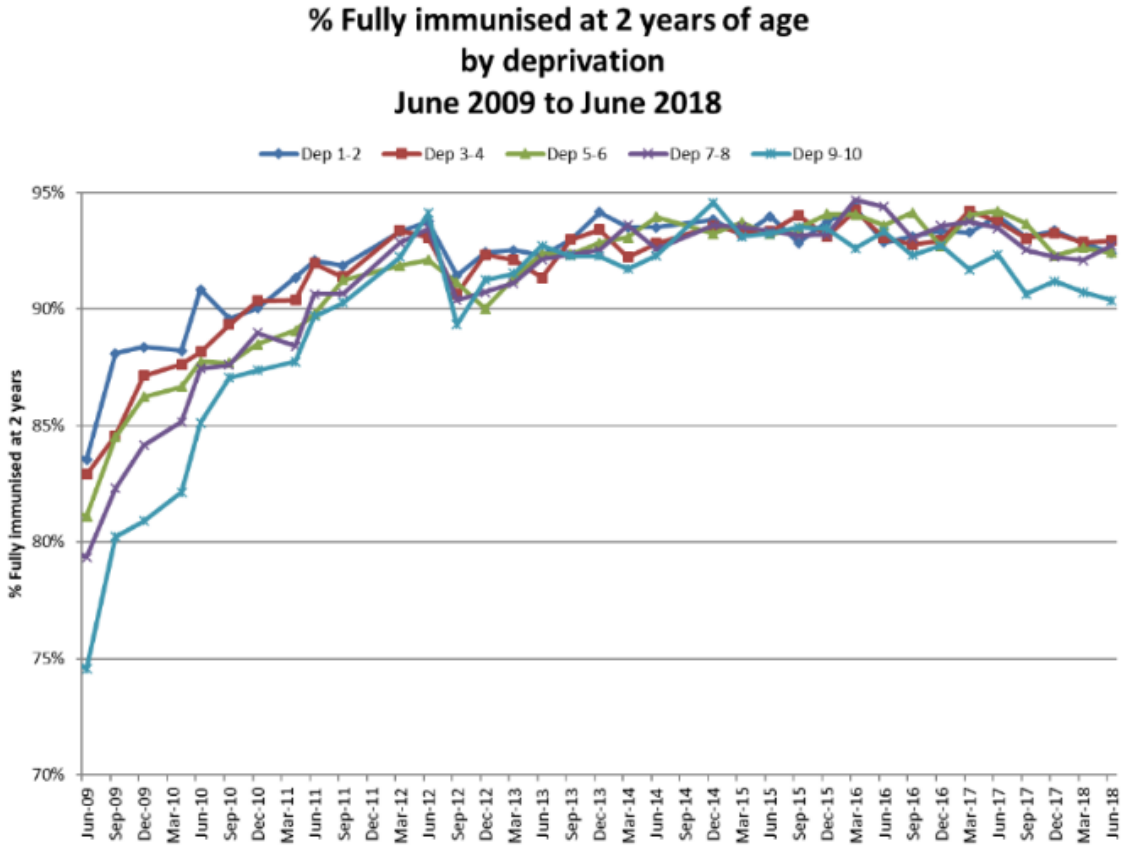


Figure 5: Coverage at five years by ethnicity

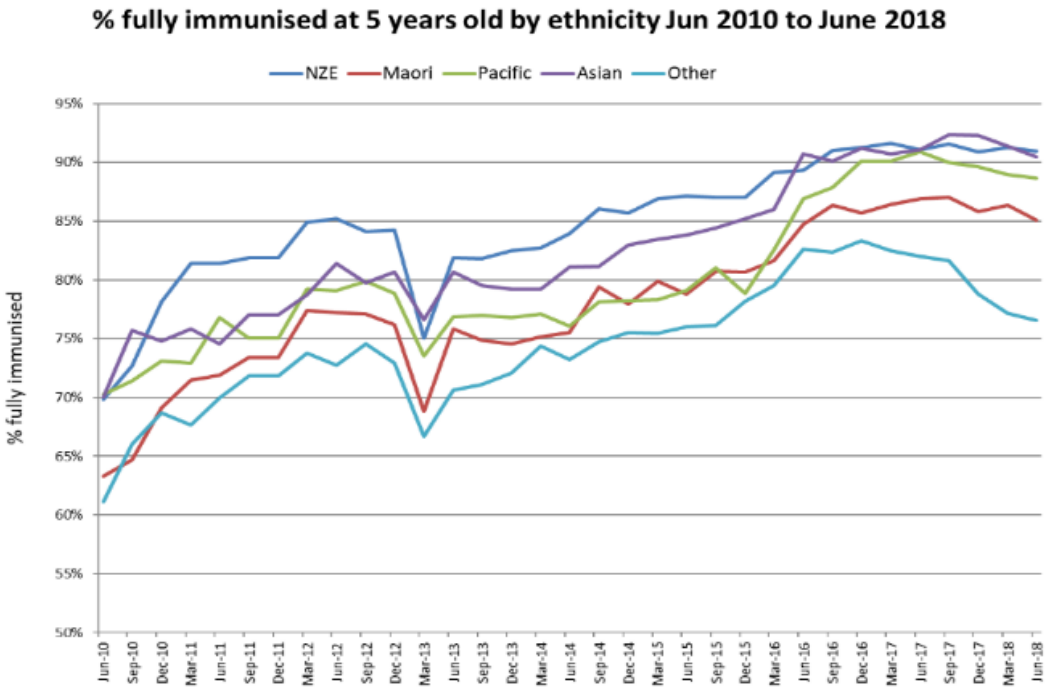
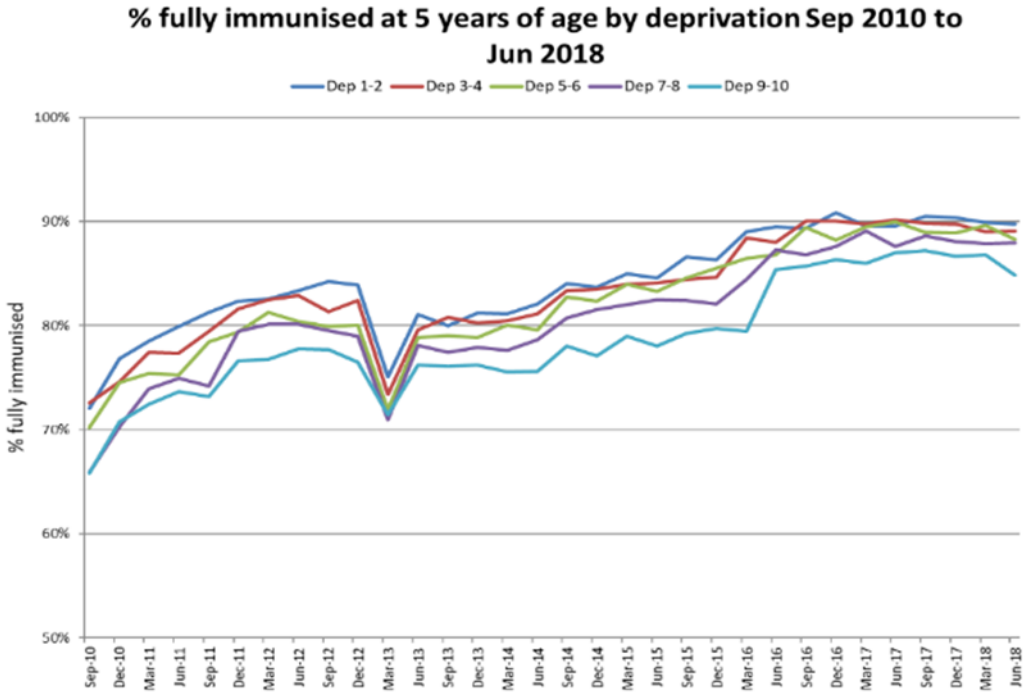


Figure 6: Coverage at five years by deprivation



3.4. Summary of the reasons behind falling immunisation rates

Concern exists nationally and internationally that parents are being influenced by a vociferous anti-vaccination movement. Examining the "decline" and "opt off" NIR rates is instructive. The data from 31st December 2018 and end March 2019 show that the proportion of active decliner parents is very similar across all ages up to 5 years at between 4.7 percent and 5.2 percent, with the proportion of opt offs being between 0.6 percent and 0.8 percent These data have not been reported for previous years.[4]

Systemic issues contribute significantly to barriers to immunisation in the general population. Socioeconomic deprivation, child and family factors, urban or rural settings and GP factors such as presence or absence of staff shortages were all reported to be key drivers of under immunisation. (Petousis-Harris et al 2012). Additional factors for specific communities in New Zealand (other than Māori) have also been identified. Foreign-born migrant children had lower age-appropriate reported vaccination rates by vaccine of interest, ethnicity and visa category compared with NZ-born children. Migrant children from Pacific ethnicities had lower reported coverage than other ethnicities. High rates of not age-appropriately vaccinated were noted among foreign-born children on refugee, Pacific and humanitarian visa schemes. However, the high coverage achieved with quota refugee children immunised as part of the refugee resettlement programme was a notable achievement. (Charania et al 2018).

A recent Ministry review of barriers specific to Māori is reproduced in Table 1 below.[5] There were other identified barriers that are just as likely to affect other parents, these include:

- anxiety about pain of injection for the child/ immunisation is a distressing experience;
- midwife discouraging of immunisation; and
- lack of confidence in effectiveness of immunisation.

Key:

*** Evidence is available from multiple sources, includes direct evidence from the target group.

** Evidence is from limited sources or is indirect (e.g. vaccinator opinion)

* Anecdotal evidence only.

Table 1: Barriers to access for Māori including potential approaches identified from the literature

Barrier	Evidence strength	Comments	Potential Approaches
Socioeconomic barriers			
Transport cost/ access	***	• The NZ Health Survey showed that Māori (adults and children) are 1.5 to 3-times more likely than non-Māori to have an unmet need for a GP or After-Hours medical services due to a lack of transport. • Family Start providers identified transport as an issue. • Some DHB feedback is that it is not a major issue.	Systemic

[4] https://www.health.govt.nz/our-work/preventative-health-wellness/immunisation/immunisation-coverage/national-and-dhb-immunisation-data Accessed 20 June 2019

[5] Reproduced in part from Ministry of Health Scoping brief on Māori immunisation research 28 Jan 2019.

Barrier	Evidence strength	Comments	Potential Approaches
		• Outreach Immunisation Services (OIS) addresses the transport barrier but cost and capacity issues limit how much these services can be expanded.	
Cost: debts at practice or made to pay for appointment	***	• Immunisation is free but practices continue to confront families about debt despite Ministry policy that this is not acceptable. • An anecdotal report from one DHB estimated that around one-third of the Māori families with their outreach service have said that are not comfortable attending a general practice because of debts and feeling judged. • Some practices may charge if the doctor is seen rather than a nurse immunising.	Ministry action
Housing insecurity or transiency	**	• Includes homelessness, temporary accommodation, transiency • For those affected, it is a significant barrier to immunisation. • DHB feedback is that the housing situation is much more difficult now than previously. Requires more use of OIS and more time to find the families.	Systemic
Families in crisis/complex lives/competing priorities	**	• Chaotic, complex lives – may be driven at least partly by poverty and, for some families, substance abuse and violence • Likely to interact with, and be difficult to disentangle from, other barriers	Systemic
Cultural appropriateness and provider relationships			
Access to and relevance of immunisation information	***	• Includes low health literacy, information not being accessible or relevant • An example is the audience research for pregnant women. Most Māori women said they were not provided with information about immunisation in pregnancy from their LMC, and they would have immunised if they had been provided with information about the benefits of immunisation. • The audience research on delayers found that there was little or no understanding of the importance of immunising at the recommended ages or the consequences of not immunising on time. Most parents considered immunisation to be important, but there was a lack of urgency re timeliness.	Education intervention
Lack of comfort/ general practice culturally inappropriate	***	• The initial greeting and attitude/manner of the receptionist is key. (They need to be welcoming and friendly, and pronounce names correctly) • Waiting room needs to be welcoming and reflect themes of whānau, whakapapa and mana.	Systemic Cultural competence training

Barrier	Evidence strength	Comments	Potential Approaches
		• Needs not met (e.g. told not to breastfeed or not allowed to hold baby during immunisation, don't feel comfortable at practice)	
Bad previous experience with practice staff/ GP	***	• Māori women have reported that they don't feel empowered or listened to. Feel belittled and intimidated. • Especially young Mums say they are "made to feel stupid" • Breakdown of relationship with social worker can also affect consent for children in care.	Cultural competence training
Other	*	• Unwillingness to engage with any authority/living "under the radar"/worried about CYFS/WINZ etc • Reluctance to be "told what to do by health experts"/authoritarianism • Sense of distrust/suspicion of the doctor or nurse's agenda	Education intervention
Service delivery barriers			
Lack of flexibility of GP model	***	• Includes: GP hours don't suit, GP's books closed, unable to get an appointment when needed, unable to attend for immunisations within an appointment. • Note that offering immunisations in After Hours may not work for Māori families. Māori adults are around 20 percent less likely to go to After Hours medical services than non-Māori (mainly due to cost), and are 1.5 time more likely to go to Emergency Department than non-Māori. While not statistically significant, similar trends are seen for Māori children.	Systemic Service delivery change
Preference for home visits/ outreach	***	• Some Māori report that they feel more comfortable at home, and it is easier than going to the practice when you have a lot of children. • Can be seen as an opportunity for manaaki (to have a cup of tea and get to know the nurses) • From the Delayers audience research, it was found that some Māori parents previously had bad experiences at the practice and had a strong preference for their infants to be immunised in more family supportive environments • Note that the reverse is true for many Pacific families who feel uncomfortable with unknown people coming into their homes, so they prefer clinics	Service delivery change
Unable to get time off work or other time constraints	***	• Many lower paid jobs have less flexibility for personal appointments	Systemic; Service delivery change

Barrier	Evidence strength	Comments	Potential Approaches
Difficulty arranging childcare/reluctant to bring other children to GP	***	• May be reluctant to bring other children to the practice, or find the situation difficult to manage • May not want to expose children to germs at the practice	Service delivery change
Immunisation concerns			
Concern over ingredients of vaccines/ safety	***	• Concern over aluminium, formaldehyde • Autism myth still around • A study using data from the New Zealand Attitudes and Values Study looked at a large number of variables and found that lower education and being of Māori ethnicity showed the strongest association with decreased confidence in childhood vaccine safety.	Education intervention
Don't immunise because baby is unwell	***	• Includes family decision to not immunise and practice/GP advice to not immunise because child is unwell (anecdotal feedback that practices/GPs don't follow Immunisation Handbook guidelines that children with non-serious illness can be immunised) • Many Family Start providers identified this as an issue.	Service delivery change Ministry action
Anti-immunisation			
Anti-immunisation influence of social media	***	• There are strong anti-immunisation views on social media while pro-immunisation views are less obvious. • The GSK/Insentia analysis showed a massive increase in discussion of immunisation in media around Vaxxed and Dr Lance O'Sullivan protest. While the huge majority was positive, the increase in "noise" can immobilise decision making.	Education intervention
Own anti-immunisation view or influence from other family members (esp Grandmother/ father)	***	• Grandmothers have a very strong influence. • DHB feedback is that there is increasing resistance from fathers. *"Recognising the importance of whānau for Maori in decision-making is essential to support the uptake of the immunisation schedule by Maori parents. It is important to link immunisation messages to the family group in a way that does not blame or use guilt. Messages that position children as the centre of the family (its taonga or treasure) and stress the importance of the wellness of children for the family, may be more effective with Maori parents."*	Education intervention
Preference for natural/ Māori medicine	*	Quote from DHB *"In earlier years Nans supported immunisation but this appears to have back-tracked with a real suspicion around what vaccines (ingredients) are going to do to their mokopuna. We are often told they are looking at Maori homeopathic medicine."*	Education intervention Cultural competence

Barrier	Evidence strength	Comments	Potential Approaches
Don't see need for immunisations/ complacency	***	• Don't see the serious diseases around anymore. Perceive the diseases as rare or mild, or irrelevant to their children • *"Back in the day my ancestors didn't have immunisations"* • *"If you get a disease, you just suffer and get over it"* • Note however that the Delayer Audience Research found that Māori were in fact more likely to take disease seriously because they were more likely to have first-hand experience of illness/death from disease. Is this something that is lessening over time as younger generations have not witnessed disease?	Education intervention

The *strong* message from the review was that structural, economic, cultural and other barriers were more influential as barriers to immunisation than parental anti-vaccination opinions. Nevertheless, these are *briefly* reviewed below.

3.5. The anti-vaccination movement and parental decisions in NZ

There has been a documented and concerted world-wide anti-vaccination movement for at least thirty years. However, the advent of widespread access to the internet and social media has undoubtably increased its reach into parental consciousness (Davies, Chapman & Leask, 2002).

> *Anti-vaccination groups sought to present themselves as legitimate authorities with scientific credibility: about one in four websites implied official status at national or international level. A majority of sites propounded the scientific validity of their claims by referencing from extensive literature dominated by self-published works and the alternative medicine press. Allegedly damning research was often quoted, but without citation of its source. Referencing was frequently incomplete and often indiscriminate, including letters to editors of newspapers and television interviews. Research published in indexed medical journals was also quoted; however, the conclusions drawn were often inconsistent with those of the authors. Overall this produced a spectre of the existence of masses of data on the dangers of vaccination.*

Most recently, a high-profile film "*Vaxxed: from cover-up to catastrophe*" has screened world-wide including in New Zealand from 2016. The film (highly emotive, and slickly directed by discredited British doctor Andrew Wakefield), makes continuing claims of conspiracy and cover-up of a link between the MMR vaccine and autism. Further, it claims that there was omission of crucial negative data by senior scientists at the Centre for Disease Control and Prevention (CDC). The film was received with widespread dismay in the medical and community and has since been comprehensively rebutted across the scientific and lay media.

The film screened in Northland in February 2017 and Table 2 shows a reduction in coverage in that region in that year.

Table 2: Coverage in Northland

	Reported coverage < 5-year olds UTD: DHB reporting data [6]		
	Dec 2016	**Dec 2017**	**Dec 2018**
Northland	79.9 percent	65 percent	83.1 percent
Total NZ	**88.6 percent**	**78 percent**	**88 percent**

A Google search "Vaccination NZ" (04-06 June 2019) was encouraging. The top 50 reviewed "hits" were all either official, high quality information Ministry sites, sites linked to reputable child health NZ sources, or pro-immunisation stories and reports in the media.

New Zealand parents searching for guidance even on respectable sites are however also exposed to more negative messages. The top auto-suggested result when typing the search terms "Should I vaccinate my child" on Google (June 2019) was "Should I vaccinate my child NZ". This indicates that parents are searching for local information. Following links from this search led to seven sites which were pro-vaccination, two claiming to present "both sides" (one of which was supportive but presented opposing arguments), and two anti-vaccination results. Of the two negative results, one was from an alternative health/wellness website and written by an author working to discourage 'conventional western medicine', while another was from a website promoting natural medicines. Of the Google-suggested books that appeared in a carousel in one iteration of this search, four were pro-vaccination, and two were not.

Parental Facebook groups for example – *Parents Chitchat* – gave a rich snapshot facing parents in this contested space:

- Posts about vaccination included arguments about personal autonomy and personal anecdotes illustrating "both sides".
- Discussion threads about child reactions to vaccination & vaccination requirements.
- Question threads about specific vaccinations (for example whether to get whooping cough vaccination)
- Question threads about whether to get flu injections for kids – Posts included:
  - comments calling anti-vaxxers "criminals"
  - discussion of rights to parental autonomy
  - vaccine-related health risks, dubious science
  - personal anecdotes
  - complaints about being denied childcare; and
  - claims their (unvaccinated) children were never sick.
- Results from a recent poll of members examining whether members are pro- or anti-vaccinations reported that 125 were for, and five against.
- Posts made about the current measles outbreaks elicited
  - personal anecdotes in support of vaccination

[6] https://www.health.govt.nz/our-work/preventative-health-wellness/immunisation/immunisation-coverage/national-and-dhb-immunisation-data

- warnings against reliance on advice of "rogue" anti-vaccination doctors and nurses, and
- attacks of anti-vaxxers, accusing them of contributing to the dangers posed by outbreaks.

It is worth noting that the more mainstream of these sites showed evidence of posts and responses being moderated – with (presumably the more militant) postings being removed. There are also internet forums that specifically advertise themselves as supporting parental rights to refuse vaccination for their children. People looking at these sites get information they already agree with and few (if any) alternative views in online "echo chambers". This results in anti-vaccine messages being shared and replicated in isolated groups, which polarises contesting views even further. An example of such a site is the Natural Health Anti-Vaxx Community Facebook Page.

3.6. Addressing barriers to immunisation rates - international evidence

3.6.1. Systematic Reviews of different types of specific interventions (international)

There is a growing body of research, including systematic reviews, showing that multi-component, locally designed interventions are most effective in reducing inequities in immunisation uptake.

A recent review by Crocker-Buque, Epstein and Munier-Jack (2017) of the evidence for interventions in OECD countries specifically aimed at reducing inequalities in child immunisation rates reported ten different potential intervention components. Being a National Centre for Clinical Excellence review, the paper only reported high quality randomised controlled trials (RCTs), quasi-experimental (including interrupted time series and before-and-after studies), and ecological and observational cohort studies. In common with much of the health promotion literature, interventions are frequently excluded from systematic reviews as they are often small-scale, not (or poorly) controlled, and/or very site and population specific. The heterogeneity of even well controlled studies also makes meta-analysis inappropriate.

Complex interventions with many different components are detailed in the review. These, similarly to the observed New Zealand barriers, included:

- access to immunisation services (due to cost or service availability)
- lack of understanding about the importance of immunisation
- vaccine hesitancy (defined as indecision around accepting a vaccination), or
- interventions designed to increase opportunistic immunisation or reduce the need for more pro-active vaccine seeking behaviours.[7]

The interventions addressed different barriers to immunisation, based on perceptions of the main barriers for the specific communities targeted.

To map against the barriers to Māori immunisation listed in Table 1 above, the intervention components reviewed (mostly delivered in various combinations) are grouped by approach and summarised in Table 3 below.[8]

[7] A detailed summary table describing the studies is found at: https://jech.bmj.com/content/71/1/87.

[8] Adapted from Crocker-Buque, Epstein and Munier-Jack (2017)

Key to approaches in Table 3 below to match the approaches suggested in Table 1 above:

- **Systemic:** holistically targeted, and aiming to overcome inequalities caused by systemic disadvantage (poverty, education, discrimination)
- **Educational:** primarily aimed at addressing lack of knowledge (individual or community)
- **Service delivery / Ministry led:** designed to increase access by changed time, cost, manner, health care worker or place of service delivery.

Table 3: International intervention approaches

Intervention	Approach	Evidence strength
Interventions involving the identification or targeting children and young people from specifically defined high risk groups	Systemic	Variable
Development and dissemination of promotional materials or media campaigns	Educational	Variable
Community involvement, or training of community champions	Educational	Variable
Allied health professional training or prompts	Educational	Limited
Community involvement, or training of community champions	Educational	Variable
Direct parental education approaches	Educational	strong
Patient recall, reminder, tracking or surveillance, including digital strategies	Service delivery	Variable
Outreach, including targeted home visits	Service delivery	Variable
Additional services, such as clinics with accessible opening hours	Service delivery	Variable
Use of Standing Orders allowing non-prescribing health professionals to give medicines including vaccinations without a doctor's prescription in certain situations	Service delivery	Limited

In summary, the Crocker-Buque review concluded:

> *Complex, locally designed interventions demonstrated the best evidence for effectiveness in reducing inequalities in deprived, urban, ethnically diverse communities. There is some evidence that postal and telephone reminders are effective, however, evidence remains mixed for text message reminders, although these may be more effective in adolescents. Interventions that escalated in intensity appeared particularly effective. Computer-based interventions were not effective.*[9]

Note: International papers reviewed did not explicitly refer to Cultural Competence. The term has very specific meaning for health professionals working in the New Zealand context where it is crucial to Māori confidence in and access to healthcare. The necessity for all health interventions and health professionals or service delivery to be culturally appropriate is a key requirement for

[9] The full results can be viewed at: https://jech.bmj.com/content/71/1/87#T1

reducing health inequalities (Wilson, 2008). Few international studies targeted inequality specifically, although several reported differential effects by the ethnic group.

Immunisation services do not address the social determinants of health. However, immunisation programmes often consider these factors and adapt vaccine service delivery to meet the needs of all populations to increase uptake. If not seen and designed through an equity lens, immunisation programme activities can inadvertently increase inequity.

> *Inequities are not resolved by providing the same immunisation services to all; they are resolved by providing different immunisation services that satisfy the needs of all" (Boyce et al 2019).*[10]

3.6.2 Systematic review of international interventions specifically addressing lack of parental schedule awareness or knowledge of safety and efficacy of vaccines

Harvey, Reissland and Mason (2015) published a systematic review and meta-analysis of 28 suitable studies looking at parental reminder, recall and parental educational interventions to improve early childhood (0-5 years) immunisation uptake. Table 6 below illustrates just one representative example of each of their types of reviewed interventions.[11]

Table 4: Summary of interventions

Intervention, country	Example description	Findings
Postal reminders Before / after study design, UK	Postal reminders sent to all children who were due or overdue any immunisations. Overdue appointments were sent up to 3 invitations to attend. Third time defaulters were referred to the HV for follow-up.	Post-implementation, uptake was significantly improved following postal reminders.
Combined recall and reminder Nonrandomised Controlled Trial, USA	A: Postcard reminder (n = 314) B: Telephone reminder (n = 307) C: Postcard + telephone reminder (n = 306) Control: Routine care. No reminder (n = 346) Intervention: Postcards were sent 1 week before appointments. A bilingual clerk telephoned parents up to 3 times on the weekday evening before the appointment.	No significant difference in uptake was found between intervention and control groups. Reminders significantly increased uptake for a subgroup of children who were not up-to-date at baseline.

[10] Boyce et. al. (2019), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6337057/.
[11] From Harvey, Reissland and Mason (2015).

Intervention, country	Example description	Findings
Education RCT, Pakistan	A: Redesigned card (n = 378) B: Centre-based education (n = 374) C: Redesigned card + centre-based education (n = 376) Control: Routine care (n = 378) Intervention: Parents were given a redesigned reminder card detailing date and location of their appointment and instructed to place the card in a visible location and/or received a 2–3 min education session emphasising the importance of immunisation at the EPI centre.	Immunisation uptake was significantly improved in all intervention groups. Reminder cards and centre-based parental education significantly increased uptake.
Lay health workers (LHW) Before and after RCT USA	A: LHW home visits (n = 218) Control: Reminder at enrolment visit (n = 216) Intervention: LHW home visits provided immunisation education and clinic referral, followed by 6-month reminder period.	LHW home visits significantly improved immunisation uptake in the intervention group compared to routine care.
Home vaccination RCT Australia	A: Home vaccination service (n = 81) Control: Routine care (n = 88) Intervention: Home vaccination at a time convenient to parents.	Home vaccination significantly increased immunisation uptake compared to routine care.
Financial incentives (Australia “no jab no pay” cross sectional before and after study design)	Governmental parent incentive scheme. To receive childcare benefits and Maternity Allowance parents must demonstrate complete immunisation of child. [This is covered in more detail later]	Significantly more children were fully immunised in 2000 following the introduction of the governmental incentive compared to 1997 before it was introduced.
Individual case management RCT USA	A: Case management + Health Passport (n = 209) Control: Health Passport only (n = 210) Intervention: In-depth assessment at home when infant <6 weeks and subsequent visits 2 weeks before scheduled appointment by case manager. Managers provided information and helped sort lack of insurance or transport.	Immunisation uptake was significantly improved by 13.2 percent in the case management group compared to routine care.
Being tracked and escorted to the clinic by LHW. RCT USA	A: Tracking/outreach + prompting (n = 732) B: Tracking/outreach only (n = 715) C: Prompting only (n = 801) Control: Routine care (n = 767) Intervention: Tracking/outreach was provided by LHWs who worked with parents of under immunised infants to bring them to the primary care office using postcards, telephone calls and home visits. Prompting was provided by the primary care office that used reduced missed opportunities by immunising necessary children regardless of visit type.	Tracking/outreach and prompting significantly increased immunisation uptake by 20 percent and reduced the delay in immunisation by 63 days.

The conclusion by the reviewers of these well-designed trials (including meta-analysis of subsets of comparable studies), was that all the interventions reported were effective to some extent, but that receiving both postal and telephone reminders was the most effective reminder-based intervention. Their conclusions stated that "current evidence most supports the use of postal reminders as part of the standard management of childhood immunisations. Parents at high risk of noncompliance may benefit from recall strategies and/or discussion". This review updated a previous Cochrane review (Vann Jacobson & Szilagyi, 2009) which similarly reported that systems designed to remind parents that their child was due (reminder) or overdue (recall) for their immunisations were linked to an increase in uptake. It is clear though that no individual study was undertaken in the same way, with the same population or outcome measure. No cost-benefit analyses were provided, nor detail as to who bore the cost of providing the additional services (post cards, phone calls, home visits or additional education), nor whether these interventions subsequently became standard care for those settings. It should also be noted that there may be publication bias (where only interventions found to have had an effect get written up and published). Additionally, pilots and trials (with their novelty, enthusiastic champions and funding for additional resource) are frequently more successful than when the same approaches are rolled into business as usual.

3.6.3 International systematic review addressing vaccine hesitancy

Vaccine hesitancy has been defined by Bedford et at (2018) as applying to those parents whose deliberations demonstrate something akin to indecision, as opposed to anti-vaccinators or those systemically deterred by socio-economic or practical factors.

Specific to the increasing international concern of the growing impact of vaccine hesitancy[12], Jarret et al (2015) published a systematic review of 166 peer reviewed and 15 grey literature evaluation studies designed to understand and address parental concerns about childhood vaccinations. Most interventions were multi-component and the majority of strategies focused primarily on raising knowledge and awareness. Thirteen relevant but less rigorous studies provided evidence of moderate quality for the use of social mobilisation, mass media, communication tool-based training for health-care workers. These captured multiple dimensions of public trust, confidence and hesitancy.

None of these interventions were without shortcomings, and given the variability in context, target population and outcome, the potential application of these interventions must be cautiously considered when applying them in different circumstances.

As shown in Table 5, interventions were grouped into three main themes to address different aspects of hesitancy. [13]

Table 5: Understanding vaccine hesitancy

Grouping	Issues
Individual / social group influences	Knowledge /awareness
	Risk/benefit (perceived / or self-taught)
	Beliefs and attitudes about health and prevention

[12] https://www.who.int/immunisation/sage/sage_wRisk/benefitscientific)g_vaccine_hesitancy_apr12/en/
[13] (Adapted from Jarret, 2015)

Grouping	Issues
	Health system and providers trust and personal experience
	Immunisation/product use as a social norm
	Experience with past vaccination.
Vaccine and vaccination-specific issues	Mode of delivery
	Risk/ benefit (scientific)
	Role of health care professionals
	Costs
	Vaccination schedule
Contextual issues	Comms and media environment
	Influential leaders
	Religion / culture / gender/ socio-economic
	Politics / policies
	Geographical barriers
	Historical influences
	Pharma industry distrust

Details for specific interventions to address each of these reasons for hesitancy are available in the review. Despite few appropriate studies and variability in the quality of the evidence, several interventions showed some positive impact on vaccination uptake, including:

- social mobilisation approaches;
- mass media communication;
- decision tool-based training for Health Care Workers (HCW);
- non-financial (parental) incentives; and
- reminder–recall activities.

3.7 Summary of international intervention research

The most effective interventions employed multiple strategies. The interventions with the largest observed increases in vaccine uptake were those that (not in order of importance):

- directly targeted unvaccinated or under-vaccinated populations;
- aimed to increase vaccination through knowledge and awareness;
- improved convenience and access to vaccination;
- targeted specific groupings (e.g. HCW);
- mandated vaccinations or imposed sanctions against non-vaccination; and/or
- engaged religious or other influential leaders to promote vaccination.

The greatest improvements (>20 percent) in knowledge, awareness or attitudes were observed with education initiatives, particularly those embedding new knowledge into routine processes which were most successful at increasing knowledge and changing attitudes. Interventions that were tailored to specific populations and their specific concerns were most effective of all. Interventions associated with a less than 10 percent increase in uptake included those that focused on quality improvement at clinics (e.g. improved data collection and monitoring, extended clinic hours, passive interventions (e.g. posters, websites) and incentive-based interventions using conditional or non-conditional cash transfers. It must be noted that incentive-based interventions usually targeted general preventive health and not just vaccination and were largely used in low income countries. Lastly, reminder–recall interventions were associated with variable changes in uptake.

3.8 New Zealand vaccine intervention research

Table 6 below includes New Zealand based research aimed at understanding barriers but where solutions were explored. All the articles reviewed in Table 6 are available on request

Table 6: Summary of selected New Zealand vaccine intervention research

Study	Description	Conclusions:
Hill, Burrell, & Walls (2018). Factors influencing women's decisions about having the pertussis-containing vaccine (Tdap) during pregnancy.	A retrospective, self-reported postal survey of early postpartum women in Canterbury that assessed participant knowledge, beliefs, attitudes and influencing factors about the Tdap vaccine conducted from June to October 2013.	*A clear health professional recommendation for maternal Tdap immunisation was a significant factor influencing pregnant women and would most likely improve the uptake of the vaccine.*
Lee, Duck, & Sibley, (2017). Personality and demographic correlates of New Zealanders' confidence in the safety of childhood vaccinations.	Used the 2013/14 NZ Attitudes and Values Study survey (N = 16,642) to explore NZ attitudes towards the safety of childhood vaccinations. 68.5 percent were confident that ''it is safe to vaccinate children following the standard NZ immunisation schedule," 26 percent were sceptical and 5.5 percent were strongly opposed.	*Having higher subjective health satisfaction, living rurally, being Māori, single, employed and not a parent were all associated with lower confidence (in vaccines), while a higher income and educational attainment were associated with greater confidence. This highlights the importance of improving public education about the safety and necessity of vaccinations.*
Pal, M. V. (n.d.). Ethnic Disparities in Uptake of Pertussis Vaccination: A Focus on New Zealand Asians	Mixed methods study of parental attitudes, and uptake and hospitalisation rates. Although other ethnicities reached similar coverage rates by the end of the pertussis immunisation series, timeliness of immunisations among Asians remained significantly higher at every dose compared to other ethnic groups. This correlated	*Health professionals need to have current vaccinator training to alleviate parental concerns and encourage positive parental attitudes. Focus now needs to be on improving timeliness of immunisations and interventions such as pre-calls in general practices are important in improving timeliness of immunisation among other ethnic groups.*

Study	Description	Conclusions:
	with the low pertussis-related hospitalisation observed among Asians.	
Petousis-Harris et al (2012). What contributes to delays? The primary care determinants of immunisation timeliness in New Zealand	Case studies to describe the on-time immunisation delivery of New Zealand infant scheduled vaccines by primary care practices and identify characteristics of practices, health professionals and patients associated with delays in receipt of infant immunisations.	*Interventions supporting practice teams and providers in primary care settings could produce significant improvements in immunisation timeliness. (Specifically, staff shortages).*
Petousis-Harris, et al (2019). Pneumococcal Conjugate Vaccines (PCV) Turning the Tide on Inequity: A Retrospective Cohort Study of New Zealand Children Born 2006–2015.	Retrospective cohort study of NZ children aged <6 looking at hospitalisations preventable by PCV.	*In contrast to the increasing trend of hospitalisation rates for infectious disease in New Zealand, the use of PCV appears associated with reductions in ethnic and socioeconomic disparities in hospitalization for IPD, ACP, and OM. The decline was greatest among Māori, Pacific Islanders and lowest socioeconomic groups.*
Groot et al. (2007). Māori and community news constructions of Meningococcal B: The promotion of a moral obligation to vaccinate.	A thought-provoking analysis of the framing of vaccination from an apolitical and bio-medical / Western rather than Māori world view: and potential impact on uptake.	*A prominent limitation was the focus on individual biological processes at the expense of an adequate consideration of socio-economic, relational and situational features of health at individual, community population levels. …the resulting moral tale showcases vaccination as the only effective weapon in the fight against Meningococcal B, and stigmatises those who do not comply with the advice of health professionals as irresponsible individuals.*
Reynolds, G., Timo, M., Dev, A., Poole, T., & Turner, N. (n.d.). Effective general practice: audit and feedback for the primary series of immunisations,	Audits at one general practice for infants requiring the primary series of immunisations (6-week, 3-month and 5-month vaccines) over a 12-month period and compare findings with the NIR audit.	*The NIR database underestimates actual coverage due to difficulties establishing the eligible population dataset* *Timeliness at 5 months however was only 51 percent UTD.*

Study	Description	Conclusions:
Roberts, et al (2017). Outreach immunisation services in New Zealand: a review of service delivery models.	Aimed to identify the most effective service delivery models and make recommendations for more effective and cost-efficient OIS delivery in New Zealand. Methods: Data collection and thematic analysis through a detailed review of OIS contracts and service specifications, an online survey and in-depth interviews with stakeholders and providers, and an analysis of cost data	*There is considerable range in costs and style of OIS delivery, and efficiencies can be gained. Models need to fit with locality needs and include adequate resourcing, staff with good local knowledge, close relationships with other key child health services and preferably co-location, sustainable funding, and regular service reviews. OIS are part of an effective integrated service that relies on accurate data, positive relationships and a rapid response when children fail to present for vaccination in a timely fashion.*
Rumball-Smith, J., & Kenealy, T. (2016). Childhood immunisations in Northland, New Zealand: declining care and the journey through the immunisation pathway,	Data from the NIR was used to identify 11,972 children born 2009 and 31 2013 and who had their first immunisation (due at 6 weeks age) in Northland. Caregivers of 897 (7 percent) of children declined the 6-week vaccination. Of these decliners, 90 percent declined subsequent vaccination at 3 and 5 months.	*Conclusions: 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.*
Taylor, L., Turner, N., & Poutasi, C. (n.d.). A study into best practice in achieving high rates of childhood immunisation shows the keys include effective teamwork, creating good connections with parents and caregivers, and taking a systematic approach.,	Key informant interviews from general practices chosen due to immunisation coverage for their enrolled population of greater than 90 percent for one or more of the immunisation age milestones for infants up to two years of age	*This study demonstrates the importance of the general practice prioritising immunisation, including the need to ring-fence time and resources for staff, supporting teamwork and encouraging targets and performance monitoring. Effective service delivery also requires good use of systematic approaches to enable early and ongoing engagement with the population, supported by effective use of electronic tools. Finally, high performing general practices focus on creating good immunisation and look to reduce missed opportunities, including using broader networks to find those children who are traditionally harder to reach.*
Turner, et al (2017). The challenges and opportunities of translating	An intervention study was undertaken of general practices with low immunisation coverage	*Key challenges included inaccurate family contact information discrepancies with referral processes*

Study	Description	Conclusions:
best practice immunisation strategies among low performing general practices to reduce equity gaps in childhood immunisation coverage in New Zealand.	rates and a high percentage of the enrolled population being of Māori ethnicity. Intervention groups received customised action plans and support for a 12- month period while control groups received 'business as usual' support.	*to other providers, building rapport with families and vaccine hesitancy. The action plans included strategies to improve processes at the practice, contact and engagement with parents, and partnership development with local service providers. Conclusions: Creating customised action plans and providing support to providers were helpful approaches when attempting to improve childhood immunisation coverage rates. One strategy will not by itself improve childhood immunisation rates and this highlights the importance of having a toolkit of strategies from which to draw.*
Charania et al (2018). Exploring immunisation inequities among migrant and refugee children in New Zealand.	Vaccination rates were compared between three cohorts of children aged up to 5 years: foreign-born children who migrated to NZ; children born in NZ of migrant mothers; and a comparator group of children born in NZ to non-migrant mothers	*Foreign-born migrant children had lower age-appropriate reported vaccination rates by vaccine of interest, ethnicity and visa category compared with NZ-born children. Migrant children from Pacific ethnicities had lower reported coverage than other ethnicities. It is important to monitor vaccination coverage by migrant and refugee background to inform improvements to policy and practice for wider population health benefits*.

4. POLICY APPROACHES

4.1. International policy approaches to childhood immunisation

Tables 7 - 11 include links to international jurisdictions' resources on immunisation and vaccination. This includes government and government-commissioned policies, strategies, frameworks, evaluations and research. Links are included from Australia, the United Kingdom, the United States, Canada, Europe and the WHO.

4.1.1. Australia

Table 7: International policy approaches to childhood immunisations in Australia

Policy	Description/Summary	Link
Australia		
No Jab No Pay and No Jab No Play	New immunisation requirements for federal government family assistance payments (the 'No Jab, No Pay' policy) came into effect on 1 January 2016. Under this policy, only parents of children (aged 20 years, up from 9 years previously) who are 'fully immunised' or on a recognised catch-up schedule are eligible for the Child Care Benefit, Child Care Rebate and/or the Family Tax Benefit Part A end-of-year supplement. Some states and territories require a child to meet immunisation requirements, or provide an immunisation record, to enrol in early childhood services.	Fact sheet: Budget initiative Department of Social Services website Department of Human Services website No jab no play resources for immunisation providers (Victoria) Press Release (South Australia) First No Jab, No Play laws introduced into Parliament
National Immunisation Strategy for Australia 2019 to 2024	The National Immunisation Strategy 2019-2024 comprises eight strategic priority areas to complement and strengthen the National Immunisation Program. Its aim is to outline the framework for the prevention and severe outcomes of disease by maximising immunisation coverage in people of all ages. It is consistent with Australian, State and Territory government collective efforts and outlines Australia's key role in the Asia-Pacific region.	National Immunisation Strategy for Australia 2019 to 2024
National Framework for Communicable Disease Control	The Framework brings together government agencies and committees under the goal of strengthening defences against communicable diseases. It recommends outcomes required to achieve the two key objectives: • Improved communicable disease prevention, detection and response • Improved organisation and delivery of CD control • And in doing so, supports the delivery of an integrated, national CD response.	National Framework for CDC

Policy	Description/Summary	Link
National Centre for Immunisation Research and Surveillance, Annual Immunisation Coverage Report 2017	Uses data from the Australian Immunisation Register and the National HPV Vaccination Program Register. Covers immunisation rates and trends. Identifies areas for further improvement, particularly timeliness of vaccination for indigenous children and coverage of vaccines specifically targeted to indigenous children.	National centre for Immunisation research and surveillance
Childhood Immunisation Education Campaign Evaluation Report	In March 2018, the Department of Health launched the second wave of the 'Get the facts about immunisation' campaign in Australia. While nationally immunisation rates in Australia are high, with 94 percent of 5-year-old children fully vaccinated, it's still not high enough. The Campaign aims to reach parents of children aged 0 to 5 years and expectant parents through the online communication channels. Evaluation research was undertaken to assess the campaign impact against its awareness, attitudinal and intentional objectives.	Childhood Immunisation Education Campaign evaluation report

4.1.2. United Kingdom

Table 8: International policy approaches to childhood immunisations in the United Kingdom

Guidelines	Description/Summary	Link
National Institute for Health and Care Excellence (NICE) Guidance: Vaccine Uptake in under 19s	This quality standard covers increasing vaccine uptake among children and young people aged under 19 in groups and settings that have low immunisation coverage. It describes high-quality care in priority areas for improvement.	NICE vaccine uptake
NICE Guidance: Immunisations: reducing differences in uptake in under 19s	This guideline covers increasing immunisation uptake among children and young people aged under 19 years in groups and settings where immunisation coverage is low. It aims to improve access to immunisation services and increase timely immunisation of children and young people. It also aims to ensure babies born to mothers infected with hepatitis B are immunised	NICE reducing differences

4.1.3. United States

Links provided in Table 9 include those to evaluations of policy implementation.

Table 9: International policy approaches to childhood immunisations in the United States

Policy and Ministry guidance	Description/Summary	Link
Mandatory vaccination	State laws establish vaccination requirements for school children and day care facilities. States may also	(Vary by State)

Policy and Ministry guidance	Description/Summary	Link
	require immunisation of healthcare workers and of patients/residents of healthcare facilities. All states require children to be vaccinated against certain diseases as a condition for school and day-care attendance. States commonly permit exemptions on medical grounds and religious grounds and some for philosophical or conscience reasons. The State of California has eliminated all non-medical exemptions to vaccine requirements for school entry.	
Department of Health and Human Services 2010 National Vaccine Plan, Implementation Plan, Mid-course review, and Evaluation of the mid-course review.	The Plan articulates a comprehensive strategy to enhance all aspects of vaccines and vaccination, including research and development, supply, financing, distribution, safety, informed decision making by consumers and health care providers, VPD surveillance, vaccine effectiveness and use monitoring, and global cooperation. The plan is built around 5 broad goals.	National Vaccine Plan vacc_plan/2010-Plan vacc_plan/2010-2015- National Vaccine Plan Mid-Course Review vac plan review
Centers for Disease Control and Prevention (CDC) web page on Reminder Systems and Strategies for Increasing Childhood Vaccination Rates	Includes resources and publications describing the need for increasing immunisation levels. Outlines strategies that providers can adopt to increase coverage in their own practice.	cdc.gov/vaccines reminder-sys.
Vaccination Coverage Among Children Aged 19–35 Months — United States, 2017	In 2017, coverage with most recommended vaccines among children aged 19–35 months remained stable and high but was lower in more rural areas and among uninsured or Medicaid-insured children. A small but increasing proportion of children received no vaccines by age 24 months. The report notes that collaboration with state immunisation programs, eliminating missed immunisation opportunities, and minimizing interruptions in insurance coverage are important to understand and address coverage disparities among children eligible for the Vaccines for Children program and those in rural areas.	Coverage 19-35 months CA
Community Preventative Services Task Force (CPSTF) findings on Increasing Vaccination. The CPSTF was established by the US Department of Health and Human Services to develop guidance on	The Task Force has reviewed a range of intervention approaches for increasing vaccination. This includes enhancing access to vaccination services, increasing community demand for vaccinations, and provider or system-based interventions. The website includes links to findings and research-tested intervention programs.	-increasing-vaccination

Policy and Ministry guidance	Description/Summary	Link
which interventions work and which do not.		

4.1.4. Canada

Table 10: International policy approaches to childhood immunisations in Canada

Policy	Description/Summary	Link
National Immunisation Strategy	The National Immunisation Strategy is a strategy for dealing with new challenges in current and future vaccination needs of all Canadians. The strategy helps Federal, Provincial and Territorial governments and key stakeholders work together to improve vaccination programs across Canada.	National-immunisation-strategy
Objectives 2016-2021	In its 2016 Budget, the Government of Canada committed $25M over five years to increase immunisation coverage rates. Objectives were established to capitalize on this new investment, leverage momentum and build on priorities.	Objectives 2016-2021
Vaccination Coverage Goals and Vaccine Preventable Disease Reduction Targets by 2025	Vaccination coverage goals were developed for infants, childhood, adolescent and adult vaccines that are publicly funded in all provinces and territories (PT). Progress toward the goals will be reported based on the data collected using national coverage surveys. To ensure children are protected through routine vaccination, a **high vaccination coverage goal of 95 percent** has been established for all childhood vaccines by two and seven years of age.	Vaccine-preventable-diseases-reduction-targets-2025
Childhood National Immunisation Coverage Survey, 2017 (Statistics Canada)	In addition to collecting data on vaccinations received by Canadian children, the survey also asked parents about their beliefs and knowledge of vaccination. Research has shown that parents' beliefs and knowledge influence their decision to vaccinate their child. In 2017, the vast majority of parents or guardians ofz2-year-olds agreed that vaccines are safe (94 percent), effective (96 percent) and help protect their child's health (97 percent). 95 percent of parents or guardians ofv2-year-old children agreed that vaccinating their children helped to protect the health of others in their community, who may not be able to get vaccinated because of health-related reasons. Furthermore7 in 10 of these parents or guardians (69 percent) felt that delaying a vaccine could put their child's health at risk.	Childhood national immunisation coverage 2017
Ontario Ministry of Health and Long-Term	Immunisations are not mandatory in Canada. However, in Ontario and New Brunswick, proof of	Programs/immunisation/ispa.aspx

Policy	Description/Summary	Link
Care Immunisation requirements for school attendance	immunisation is required for children and adolescents to attend school. In these same provinces, exceptions to immunisations can be made for medical or ideological reasons. Ontario's Immunisation of School Pupils Act (ISPA) requires that children and adolescents attending primary or secondary school be appropriately immunized against designated diseases, unless they have a valid exemption. Under the Immunisation of School Pupils Act, children can be exempted from immunisation for medical reasons or due to conscience or religious belief. Parents and guardians are responsible for reporting vaccines administered to school aged children to their local medical officer of health. In June 2018, the government cancelled a new requirement for doctors and nurses to report vaccines to public health. Ontario is working on a more integrated reporting approach for health care providers.	
Department of Education and Early Childhood Development New Brunswick Proof of Immunisation policy	Immunisation policy as a condition of school entry.	Proof of immunisation policy

4.1.5. Europe

Table 11: International policy approaches to childhood immunisations in Europe

Policy	Description/Summary	Link
European Vaccine Action Plan 2015-2020	The European Vaccine Action Plan 2015–2020 (EVAP) was drafted to complement, regionally interpret and adapt the Global Vaccine Action Plan in harmony with Health 2020 and other key regional health strategies and polices. EVAP sets a course through a regional vision and goals for immunisation and control of vaccine-preventable diseases from 2015 to 2020 and beyond, by defining objectives, priority action areas and indicators, taking into account the specific needs and challenges of WHO European Region Member States.	european-vaccine-action-plan-2015-2020
Council Recommendation of 7 December 2018 on strengthened cooperation against vaccine-preventable diseases	Includes recommendations on vaccination across the EU. The Council conclusions on childhood immunisation call for the refinement of immunisation registers and information systems to improve the monitoring of vaccination programmes and facilitate the exchange of information between vaccine service providers.	Council recommendation 7

Policy	Description/Summary	Link
Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions *Strengthened Cooperation against Vaccine Preventable Diseases*	This Communication presents a framework for actions to be undertaken by the Commission, with the collaboration of Member States, under three key pillars: 1) tackling vaccine hesitancy and improving vaccination coverage; 2) sustainable vaccination policies in the EU; 3) EU coordination and contribution to global health.	Strengthened cooperation
State of Vaccine Confidence in the EU 2018	Report on the overall state of confidence in vaccines among the public in all 28 EU member states and among GP in ten EU member states. As vaccine confidence varies by vaccine, confidence is assessed for vaccines in general as well as for the measles and seasonal influenza vaccines, in order to reflect vaccines targeting different population groups. Confidence in (and demand for) vaccines is influenced by a number of factors, including the importance, safety, and effectiveness of vaccines. This is the largest ever study on attitudes to vaccines and vaccination in the EU. It covers a range of insights into vaccination behaviours that may immediately impact on public policy.	vaccine_confidence_in EU 2018
The Organisation and Delivery of vaccination services in the European Union	The 2018 report has three components. The first is a review of the current situation within the EU on vaccine uptake and vaccine-preventable disease. The second is an umbrella review of systematic reviews on health system related factors influencing vaccine uptake. The third is a summary of country fiches that describe the organization and delivery of vaccination programmes in EU Member States.	2018_vaccine_services_review
European Centre for Disease Prevention and Control, Catalogue of interventions addressing vaccine hesitancy	This catalogue developed by the London School of Hygiene and Tropical Medicine Vaccine Confidence Project is part of the European Centre for Disease Prevention and Control's activities aimed to provide tools and information resources to support EU/EEA countries in addressing the challenging issue of vaccine hesitancy. The project was developed in the context of ECDC's support to EU/EEA Member States in prevention and control of vaccine-preventable diseases, including effective communication to promote immunisation.	ECDC-interventions-vaccine-hesitancy.pdf
European Centre for Disease Prevention and Control, Let's talk about	This guide provides practical evidence-based and peer-reviewed advice for public health programme managers and communicators involved with	enhancing-confidence-vaccination-and-uptake

Policy	Description/Summary	Link
hesitancy: enhancing confidence in vaccination and uptake	immunisation services. It identifies ways to enhance people's confidence in vaccination and addresses common issues which underlie vaccination hesitancy.	
European Centre for Disease Prevention and Control, Let's talk about protection: enhancing childhood vaccination uptake	Focuses on strengthening the capacities of healthcare providers to better address concerns about vaccination and tackle obstacles to vaccination uptake.	enhancing-childhood-vaccination-uptake
European Centre for Disease Prevention and Control Web page – Addressing misconceptions on measles vaccination	Outlines steps proposed in scientific literature to help public health professionals address vaccination misconceptions in the best possible way.	addressing-misconceptions-measles
Germany The 20 Most Frequent Objections to Vaccinations – and Responses by Immunisation Experts of the Robert Koch Institute and the Paul-Ehrlich-Institut	Robert Koch Institut - The Robert Koch Institute (RKI) is the government's central scientific institution in the field of biomedicine. It is one of the most important bodies for the safeguarding of public health in Germany. These answers provide information on the issues raised in order to allow an informed and balanced view of the benefits of vaccination.	Authoritative responses

4.1.6. World Health Organization

Table 12: International policy approaches to childhood immunisations by the WHO

Policy	Description/Summary	Link
Global Routine Immunisation Strategies and Practices (GRISP) 2016	GRISP contains two components namely nine transformative investments to achieving better immunisation outcomes and a comprehensive framework of strategies and practices for routine immunisation.	GRISP 2016
Global Vaccine Action Plan (GVAP) 2011-2020	Sets ambitious goals and targets to catalyse a concerted drive to minimise the burden of vaccine-preventable diseases in every country	GVAP_2011_2020
Annual Assessment by the Strategy Group of Experts on Immunisation on the progress towards GVAP targets 2018	Assessment report on progress towards the GVAP targets and objectives. Suggests a pathway towards the development of a post-2020 strategy.	GVAP targets 2018

The WHO also provide a mandate to reduce inequality in vaccine coverage worldwide. Their definitions of the concepts of equity and immunisation and recommended critical actions to address these are shown below (Boyce et al 2019).

Concepts of equity and immunisation

- **Inequity in immunisation**: Avoidable differences in immunisation coverage between population groups that arise because barriers to immunisation among disadvantaged groups are not addressed through policies, structures, governance or programme implementation.
- **Equitable access to vaccines:** All individuals are offered the same vaccines through delivery services that meet their needs.
- **Social Determinants of Health:** The underlying conditions in which people are born, grow, live, work and age. These determinants include parental income, education, living standards, gender equality, distribution of power, policy frameworks and social values.

Critical actions in addressing inequities in immunisation

- Acknowledge that immunisation coverage may be affected by social determinants and that parental concern about vaccination is only one of several potential reasons for sub optimal uptake.
- Reveal and monitor disaggregate data to show inequities in uptake.
- Conduct research to identify root causes of identified inequities.
- Apply an equity lens on all activities that impact on immunisation by first considering how different population groups may be impacted differently.
- Ensure fair and inclusive structures, decision making and policies that go beyond prioritisation based on cost effectiveness.

5. APPROACHES FROM THE LITERATURE APPLICABLE IN NEW ZEALAND

5.1. Improving access

"*Access*" covers several different barriers for parents. These include costs, distance to travel, clinic time availability, cultural acceptability, and enrolment.

- Costs include costs to parents of travel, parking, time off work, and (sometimes) a calling in of debts owed for previous general practice services.
- Distance can include costs or availability of public transport or access to a car and fuel.
- Clinic times include clinic times that clash with work, school pick-ups, availability of child-minding for children not requiring vaccination at the same time, or other family / whanau responsibilities.
- Cultural acceptability can cover language barriers, perceived or real disapproval, and different health beliefs.
- Lack of enrolment can be caused or exacerbated by frequent changes of address, and by variable fostering /whangai arrangements in extended families.

These complexities reinforce the need for specific responses to specific barriers. In a review of the health navigator role in Australia, Canada, New Zealand and the USA, Clifford (2015) posited a useful role for health navigators in indigenous communities but found the heterogeneity and low quality of the studies meant firm conclusions could not be drawn. A review by Bidwell in 2013 of initiatives designed to address health inequities particularly for Māori and Pacific children and families similarly found that the quality of published evidence was low, but was able to conclude that;

> *Some initiatives work directly at contacting individuals and families in disadvantaged communities to help them address the barriers to the care they need. These include the health navigator, community health worker, and partnership community worker models.* and
>
> *Factors associated with successful interventions include careful planning, good targeting of a particular high needs population, adequate resourcing, and buy-in both by the targeted population and the relevant health services in the area. Having members of the targeted community as the front-line workers, backed by a well-resourced and appropriate range of health services that operate in locations and at hours that suit the community of interest are also of key importance.*

5.2. Incentivising parents

Incentivisation of parents (whether by financial or other inducements) to immunise has been reported to have increased uptake in very poor communities in India (Jarret 2019). The Australian "No Jab No Pay" legislation and policy approach is a withholding of payment until vaccinations are up to date. This approach has been shown to reduce inequity of coverage among very poor aboriginal Australians but has also had the unintended consequence of hardening attitudes in some "conscientious refusers", playing into conspiracy theories (Beard, Leask and McIntyre, 2017). Further, Fielding, Bolam, & Danchin (2017) provide credible evidence that this policy actually increases inequity: as wealthier "refusing" parents have no benefit entitlement to lose,

while poorer refusers may sacrifice family benefits to the detriment of many other determinants of health. Compulsion is covered further below.

5.3. Incentivising doctors

There is little disagreement that incentivising doctors to increase vaccination rates, in the form of additional fees for service at least, has had a positive impact on rates. (Bond et al 2002; Beutow, 2008). The ability for a practice to record when a parent "declines" and so not be penalised for low rates among their patient roll removes perceptions of conflict of interest. Hamblin et al in 2018 writing about the impact of including vaccination in the national Health Quality and Standards data set went further;

> *Thanks to the National Immunisation Register and national initiatives, immunisation rates in NZ have risen markedly in the last several years, from 67 percent in 2007, to around 80 percent in 2009 (still well below the 2009 Australian rate of 92.2 percent), to the current rate in December 2013 of about 92 percent (Australia's 2014 rate is 92.6 percent). The immunisations QSI demonstrates how equity is not a measure that sits apart from other indicators of health in the country. QSIs are stratified to show variations between different socioeconomic and ethnic groups. In 2007 the national immunisation rate for Māori children was just 63 percent. Pleasingly, in December 2013*, that had increased to 91 percent. Disparities in immunisation coverage have reduced to the point where there is now little if any socioeconomic and ethnic variation across the country.*

*2013 pre-dated recent drop in coverage rates – see section 3.1.

There is evidence that increasing the use of nurse vaccinators, school nurse vaccinators and potentially if credentialled in future, pharmacy (accredited) child vaccinators, may increase access and lower costs overall [14].

5.4. Compulsion

In 2010, a meeting in Europe (2010 Venice Study) exploring mandatory immunisation proposed the definition that a 'mandatory' vaccine is one that every child in the country/state must receive by law without the possibility for the parent to accept or refuse it, independent of whether a legal or economical implication or sanction exists for the refusal.

Attwell, Drislane and Leask (2019) reviewed the international policy relating to mandatory childhood vaccination policies. Sixty-two countries were identified as having mandatory policies, 11 of which had also implemented no-fault compensation schemes to protect those who fall victim to the extremely rare cases of provable no-fault vaccine injury. In addition to easing the burden of vaccine damaged families, no-fault compensation is thought to increase parental and health care worker confidence in programmes. The detailed country findings are shown in Appendix 4: Countries with mandatory vaccination policies.

As described by MacDonald et al in 2018, immunisation programs described as mandatory vary widely, even in high income countries, ranging from:

[14] NZNO Submission, 2010 https://www.parliament.nz/resource/0000103881

- Laws requiring immunisation although anyone can opt out without penalty; no enforcement (soft i.e. flexible mandates e.g. France before changes in 2018.
- Laws requiring immunisation but can easily opt out with personal or philosophical objection without penalty (medium soft mandate e.g. Ontario, Canada before changes in 2016.
- Laws requiring parental education about immunisation (rather than immunisation itself); may opt out with personal or philosophical objection but requires specific forms and notarization but no penalty for noncompliance (medium hard mandate i.e. "informed consent" mandates e.g. Ontario, Canada.
- Laws requiring immunisation but can opt out with personal or philosophical objection that requires specific forms and added effort. There is a penalty for noncompliance and strict enforcement (higher medium hard mandate) e.g. Australia before changes in 2016.
- Laws requiring immunisation with serious financial penalties or social restrictions; only allow medical exemptions; strict enforcement (hard mandates e.g. State of California USA post 2016, Australia after 2016).

Vaccines, like any drug, are neither 100 percent effective nor 100 percent safe. An ethical consideration relevant when assessing the justification of a mandatory programme for a country or state is compensation for causally associated serious, albeit rare, adverse events following immunisation (AEFI). MacDonald states *"there is a strong argument that mandatory immunisation programs can be ethically justified when AEFI compensation programmes for serious AEFIs also exist*."

Attwell, Drislane and Leask (2019) in their more recent analysis also indicated that no-fault compensation existed in some countries independently of compulsion in response to political and economic pressures, and threats of costly and counter-productive threats of litigation. Other countries (such as Australia) had comprehensive disability insurance schemes offering support and individualised funding for people with disabilities to assist with day to day needs and ongoing well-being. Note: non-Australian citizens (including New Zealanders living and working in Australia) may not have access to this support.

MacDonald et al also provide a comprehensive checklist of major components to contemplate when considering mandatory immunisation is being considered, and this is reproduced in the appendix.

Findings post implementation of the Australian mandatory legislation showed that vaccine uptake among 5-year olds increased from 92.59 percent to 94.34 percent. Of those previously registering conscientious objection, 19 percent were reported to have been vaccinated within 9 months of the policy, meaning that 81 percent had yet to comply.

Despite being written in 2006, Jessica Kerr's New Zealand paper *"Immunisation and the law: slippery slope to a healthier society*" is still an excellent summary of the legal and ethical dilemmas surrounding compulsion. The paper is well worth reading in full, but the summary is reproduced below:

> *The immunisation of children against communicable diseases is a crucial public health intervention. Yet the understandable prioritisation of parental autonomy within New Zealand immunisation policy has contributed to consistently unsatisfactory coverage rates, in both absolute and comparative terms. If our immunisation law could be strengthened to*

> *eliminate 'passive' non immunisation without fatally undermining parental choice, the goals of 'population immunity' might be achievable. Of the three reform options explored by this paper, two are rejected as unworkable. The first, a universal mandatory immunisation requirement, might be justifiable in principle but would encounter prohibitive public opposition. The second, an 'informed choice' requirement limited to beneficiaries, is unprincipled and potentially ineffective. The recommended option is more moderate and equitable. Creating a presumption in favour of immunisation at the point of school entry would shift the legal focus from 'informed consent' to United States style 'informed refusal'. The degree of effort required to invoke a statutory exemption to immunisation would depend upon the extent to which policy makers were satisfied that only parents implacably and legitimately opposed to immunisation were invoking it. Barring a dramatic increase in the size of the anti -immunisation lobby, it is suggested that an informed refusal requirement could successfully eliminate passive non - immunisation, thereby potentially achieving population immunity while substantially autonomy.*

In New Zealand there is a long history (predating the anti-Vaxx movement) of vaccine questioning, particularly from around 1988 and the formation of the Immunisation Awareness Society by Hilary Butler, a concerned Auckland mother.[15] While the ethical and professional issues are different from parental "rights" not to consent to medical treatment of their child, recent testing of the legality of compulsion to vaccination among health care workers in New Zealand as a condition of employment was equivocal. Once again, Australia took a more bullish line, introducing a policy of compulsory vaccination of health care workers in 2009. Success in the implementation of that policy was associated with effective communication, including support of clinical leaders, provision of free vaccine, access to occupational health services which included immunisation, and appropriate data collection and reporting systems (Helms et al 2011).

The Royal Australasian College of Physicians emphasise absolutely that advocacy for immunisation is a professional duty. Their stance regarding compulsion is more nuanced, but helpful.

> *(doctors should) .... "recognise that parents who are absolutely opposed to any vaccines are unlikely to change their minds. Some vaccine-refusing parents may still be susceptible to negotiation about selective vaccination e.g. diphtheria-tetanus and vaccines to prevent meningitis. A positive experience with even limited vaccines may increase the chances of further immunisation. Enforcement of immunisation is unlikely to be seen as a child protection matter unless there is imminent danger or a high likelihood of subsequent serious disease, such as post-exposure rabies prophylaxis or hepatitis B vaccine for a baby born to a carrier mother. It is inappropriate to refuse to treat unvaccinated children, firstly because it represents unethical coercion and secondly because the children will be further disadvantaged. Maintaining contact with such families can be of benefit to care generally, whether or not any immunisation is achieved.*

[15] Day, A. S. (2008). *Child Immunisation: reactions and responses to New Zealand government policy 1920-1990* (Doctoral dissertation, ResearchSpace@ Auckland).

Research by Bedford et al (2018) found that for vaccine refusing (as opposed to vaccine hesitant) parents, direct contact even by doctors attempting them to change their mind was not successful. Other Australian research (Rossen et al 2019) concluded that

> *"Given the sensitivity of fence sitters and rejecters to liberty-related moral concerns, our research cautions against the use of adversarial approaches—e.g., No Jab, No Pay legislation—that promote vaccination uptake by restricting parental freedoms, as they may backfire amongst parents ambivalent toward vaccination".*

In New Zealand, many GPs feel that damage to the doctor-patient relationship caused by compulsion and their role as "instruments of the state" could outweigh public good (personal communication). This would include disquiet at being contracted to provide compulsory vaccination and a requirement to communicate vaccination status in the event of financial or legal penalty without the patient's consent.

Finally, in a recent paper reviewing the impact of compulsion in Australia two years after implementation, Beard, Leask and McIntyre (all highly respected public health / immunisation authorities) concluded:

> *Most parents of incompletely vaccinated children in Australia do not disagree with immunisation* ***but have been unable to overcome a range of logistic and access barriers****. It follows that measures to improve access to services, assist families challenged by logistic issues, and minimise missed opportunities to vaccinate are the most important means to raise levels of complete immunisation. Measures shown to be effective, both overseas and in Australia, include client reminder and recall systems, incentives, enforcing childcare entry vaccination requirements, audit and feedback of health professionals, opportunistic vaccination in primary, secondary and tertiary care, catch-up plans, standing orders, home visiting, and minimising out-of-pocket expenses to access services and vaccines. Based on the above considerations, we believe that the stated intent of No Jab, No Pay and of state-based No Jab, No Play legislation — to target vaccine refusal and, in turn, the spread of vaccine-preventable diseases — may prove to be misplaced for two reasons. First, vaccine refusal is the least important of the three factors (refusal, hesitancy and barriers to access) contributing to lower vaccine coverage. Second, there is limited evidence that monetary sanctions are effective in this context of families receiving government assistance, among whom the potential for unintended impacts on the health and welfare of children may be greatest. Unintended adverse impacts are arguably even more likely from the highly restrictive Victorian legislation reducing access to appropriate early childhood education.*

Rossen et al in 2019 instead advocated the adoption of persuasive moral appeals to vaccine-hesitant parents. ("Rejectors" were predicted to be unlikely to be amenable to such arguments). Capitalising on apparent moral preference for liberty by framing vaccination as an opportunity to keep their child's immune system fit and healthy, enabling it to live a life free and unrestricted by disease, or as an opportunity to protect the liberty of other children who are unable to be vaccinated by contributing to the provision of herd immunity is predicted by their research findings to be more effective than further compulsion.

5.5. Summary inferences for New Zealand based on this research

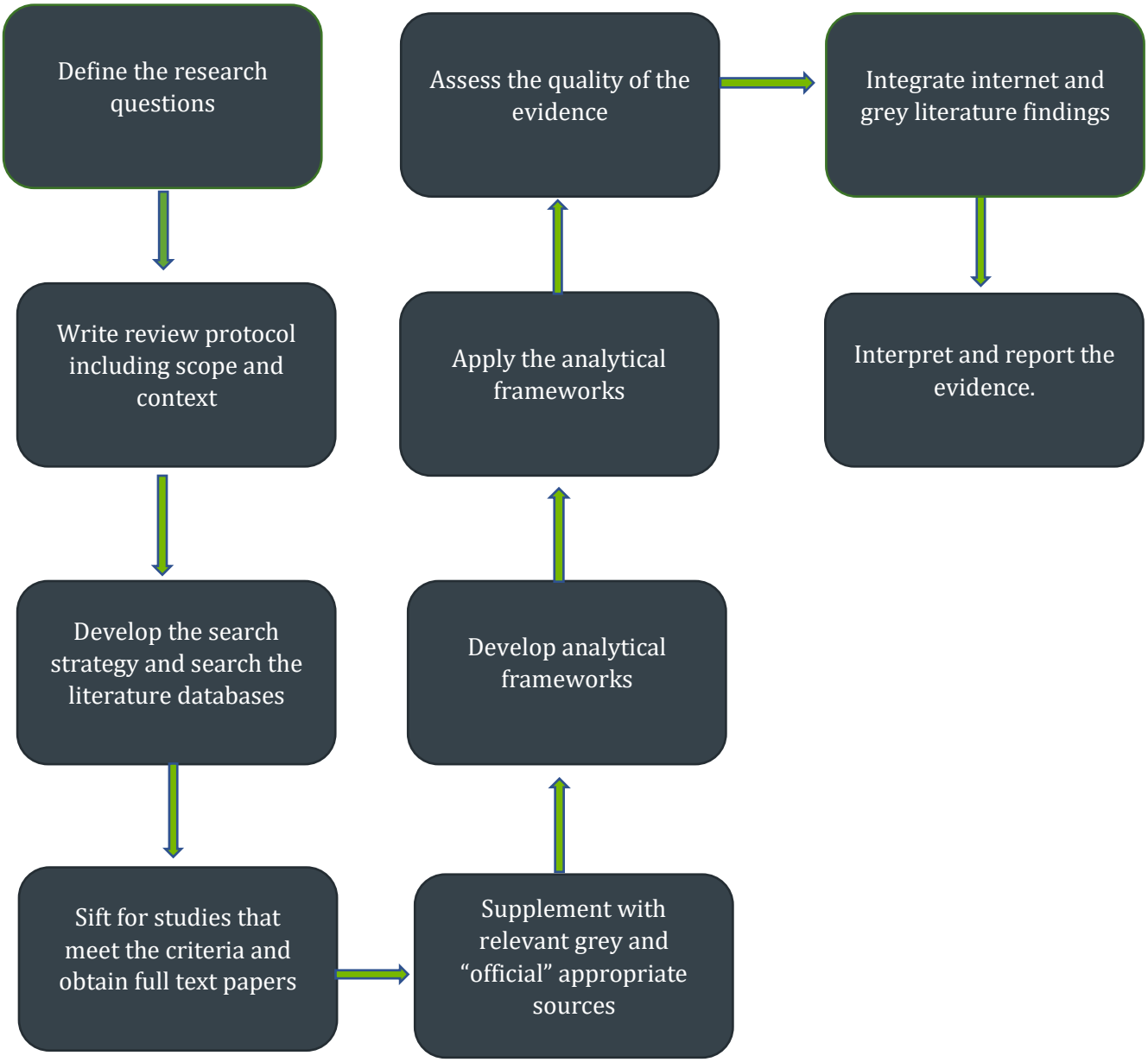
- Improved recording and reporting may both assist follow-up and achieve more accurate data to inform provision. It is concerning that the NIR and practice data may not match.
- Good primary care support (funding, staffing, and training) improves uptake. Effective follow up, time to inform hesitant parents, and utilising opportunistic vaccination opportunities all require resources.
- Cultural understanding can help shape effective interventions and counter hesitance. Particular understanding must be made of the impact of colonialism in NZ on mistrust of health professionals by some Māori parents.
- Multiple strategies, each specifically tailored to address specific barriers are required
- Service delivery models need to be flexible to match local need. These include how outreach is provided.
- Compulsion, and punitive approaches are unlikely to be effective, may exacerbate inequity, and risks alienating both health professionals and vulnerable families.

APPENDIX 1: SEARCH RECORD

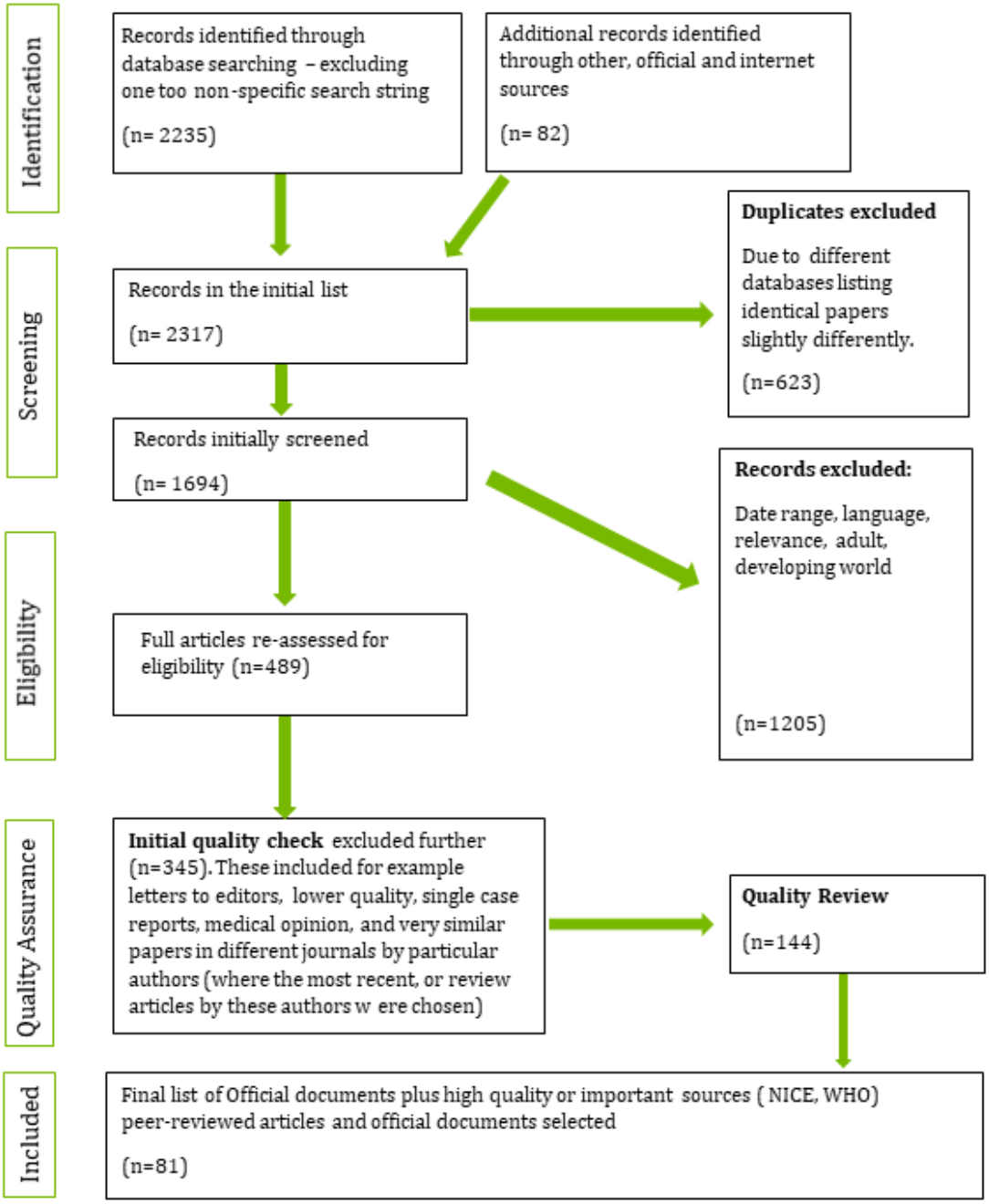
Search date	Database	Search term string	Hits	Notes
4.06.2019	PubMed	Increasing childhood vaccination or immunisation	284426	*Too generic, first 300 hits reviewed, all USA specific This search was discarded.*
24.05.2019	Discover (CINAHL Complete, Medline and PsycINFO)	Increasing childhood vaccination or immunisation	2166	*English language only, 2007 to present (for ALL subsequent searches)*
24.05.2019	Discover	Increasing childhood vaccination or immunisation AND AUS or NZ	20	Excluding some duplicates previously selected
25.05.2019	Discover	Falling childhood vaccination or immunisation	108	Excluding some duplicates previously selected
2.06.2019	Discover	Falling childhood vaccination or immunisation AND AUS or NZ	19	Excluding some duplicates previously selected
2.06.2019	Discover	childhood vaccination or immunisation AND AUS or NZ AND International policy	31	OECD countries similar to AUS or NZ only kept
4.06.2019	NICE and Cochrane	childhood vaccination or immunisation	226	Age-specific and most recent kept

APPENDIX 2: PROCESS

Step by step review process



APPENDIX 3: PRISMA SEARCH RESULTS



APPENDIX 4: COUNTRIES WITH MANDATORY VACCINATION POLICIES

Table 1
Countries with mandatory vaccination policies identified by our search strategies; characteristics of the countries including income group and the whether a no-fault vaccine injury compensation scheme has been implemented[1].

Country/Jurisdiction (World Bank Classification)	World Bank Classification Income Group (High, low, middle)	One or More than One Vaccination Required	Exemptions Allowed	No-Fault Compensation Scheme	Year NFC Introduced
Albania [4]	Upper middle	More than one	Unknown	No	N/A
Andorra [4]	High	More than one	Unknown	No	N/A
Antigua [14,28]	High	Unknown	Unknown	No	N/A
Argentina [14,29,30]	Upper middle	More than one	Unknown	No	N/A
Australia [31]	High	More than one	Medical or Secretary	No* [32]	N/A
Azerbaijan [4]	Upper middle	More than one	Unknown	No	N/A
Barbados [14,33]	High	More than one	Unknown	No	N/A
Belgium [3,4]	High	One (and more in some regions [4])	Medical	No* [34]	N/A
Belize [35]	Upper middle	More than one	Medical	No	N/A
Bhutan [36]	Lower middle	More than one	Unknown	No	N/A
Brunei [37]	High	More than one	Medical	No	N/A
Bulgaria [4]	Upper middle	More than one	None listed in official policy	No* [34]	N/A
Canadian Provinces: Ontario, New Brunswick [38]	High	More than one	Religious, Medical, or Out of Conscience	No* [38,39]	N/A
Costa Rica [14,15]	Upper middle	More than one	Not Conscience or Religion [40]	No	N/A
Croatia [41]	Upper middle	More than one	Unknown	No* [39]	N/A
Cyprus [3,4,14]	High	More than one	Unknown	No	N/A
Czech Republic [3,4,33]	High	More than one	Medical	No* [34]	N/A
Dominica [14,42]	Upper middle	More than one	Unknown	No	N/A
Egypt [43]	Lower middle	More than one	Unknown	No	N/A
Federated States of Micronesia [14,44]	Lower middle	More than one	Unknown	No	N/A
France [3,4,45]	High	More than one	Medical	Yes* [13]	1963
Greece [3,4,14]	High	More than one	Unknown	No	N/A
Grenada [14,46,47]	Upper middle	More than one	Religious	No	N/A
Guyana [14,17]	Upper middle	More than one	Medical	No	N/A
Honduras [15]	Lower middle	More than one	Unknown	No	N/A
Hungary [3,4]	High	More than one	Medical	Yes* [13]	2005
India (Tamil Nadu) [33,48]	Lower middle	More than one	Unknown	No	N/A
Italy [3,4,19]	High	More than one	Medical	Yes* [13]	1992
Jamaica [14,49]	Upper middle	More than one	Medical	No	N/A
Kazakhstan [4,14]	Upper middle	More than one	Unknown	No	N/A
Korea (Republic of) [14,50]	High	More than one	Unknown	Yes* [13]	1994
Kosovo [15]	Lower middle	More than one	None listed in legislation[51]	No	N/A
Kuwait [33,52]	High	More than one	Unknown	No	N/A
Latvia [3,4]	High	More than one	Medical	No* [4,34]	N/A
Macedonia [4]	Upper middle	More than one	Unknown	No	N/A
Malta [3,4,14]	High	More than one	By permission of Superintendent	No	N/A
Marshall Islands [14,53]	Upper middle	More than one	Medical, Religious, Personal Belief, Minister of Health	No	N/A
Moldova [4,15]	Lower middle	More than one	Not conscience[54]	No	N/A
Monaco [4]	High	More than one	Unknown	No	N/A
Mongolia [15,55]	Lower middle	More than one	Unknown	No	N/A
Montenegro [4]	Upper middle	More than one	Unknown	No	N/A
Nepal [56]	Low	More than one	Medical	No	N/A
Pakistan [57]	Lower middle	One	Unknown	No	N/A
Palau [14,58]	High	More than one	Unknown	No	N/A
Paraguay [14,15]	Upper middle	More than one	Unknown	No	N/A
Poland [3,4]	High	More than one	Unknown	No* [34]	N/A
San Marino [4,14,59]	High	More than one	Medical; Right to refuse	No* [60]	N/A
Serbia [4,61]	Upper middle	More than one	Medical	No	N/A
Singapore [62]	High	More than one	Unknown	No	N/A
Slovakia [3,4,63]	High	More than one	Medical	No* [34]	N/A
Slovenia [3,4]	High	More than one	Medical	Yes* [34,64]	2004
St Kitts [14,65]	High	More than one	Unknown	No	N/A
St Vincents [14,46]	Upper middle	More than one	None listed in legislation	No	N/A
Suriname [14,66]	Upper middle	More than one	Unknown	No	N/A
Taiwan [67]	High	More than one	Medical	Yes* [13]	1988
Tajikistan [4]	Low	More than one	Unknown	No	N/A
Trinidad [14,68]	High	More than one	Medical; immunity	No	N/A
Uganda	Low	More than one	Medical	No	N/A
Ukraine [4]	Lower middle	More than one	Medical	No	N/A
Uruguay [69]	High	More than one	Unknown	No	N/A
U.S. states [70,71]	High	More than one	Medical, Religious, Philosophical; Varies by State	Yes (Federal Scheme)* [13]	1988
Uzbekistan [4,14]	Lower middle	More than one	Unknown	No	N/A

[1] Our first reference in column 1 is the VENICE study [3], and/or the WHO list [18] and/or the Sabin report on European vaccination policy [4] or the Sabin global database (for non-European countries) [19]. This allows readers to see the basis of our initial classification. We then augment this with additional references where possible. We cite our sources for the verified presence or absence of no fault compensation schemes in the fifth column.

APPENDIX 5: CHECKLIST FOR CONSIDERATION RE MANDATING

Table 2
Checklist of major components to contemplate when mandatory childhood immunization is being considered.

Component	Example options
Basis and method of implementing mandatory immunization. *What is the justification for mandate? Why now? What means will be used to enact mandate?*	Legislation Regulation Ministerial decree Departmental policies or practices Or a Combination of the above
Scope of application: *Where will the mandate be applied?*	County-wide State, Province, Territory Specific Program: e.g. visitors to country
Focus: *What will be the structure of the mandate? If flexible, exemptions will be permitted?*	Type of Mandate Soft i.e. flexible, Medium Soft Medium Hard Hard i.e. rigid Exemptions Medical contraindication Opt out Religious Personal/ philosophical
Vaccines: *What vaccines to be covered by mandate and why?*	All infant/childhood vaccines Specific vaccines only Only infant vaccines Only infant/young child vaccines Specified list of infant and/or child Vaccines Single vaccine
Penalties and Incentives: *What penalties and incentives will accompany mandate, if any?*	Financial Fines Incentive payment Restricting access to universal goods and services Daycare attendance Public Private School attendance Primary/Secondary Public Private Required education session(s) or lectures for parent/caregiver (i.e. mandatory informed choice) Freedom restrictions Incarceration parent/caregiver No entry theme parks Other
Enforcement. *Will there be enforcement of mandates? If yes, what is locus of enforcement: Who, how, when and where will enforce mandate?*	Public health Schools Police/courts Other
If No-Will compliance be monitored? (e.g. record immunization status on school entry)	
Assessment and Evaluation: *How will the impact of the planned mandate be assessed and evaluated? What outcomes will be measured (just vaccination coverage and rates of VPD, or also unexpected outcomes and costs)? Who will do this and to whom will this be reported?*	
Compensation for Serious Adverse Event Following Immunization: *Is there a program? If yes- what is basis of the compensation program?*	Legislative – no fault Regulations- no fault Industry based- no fault Default - no compensation program – law suits
If no, how will compensation decisions made? How will serious causally linked AEFI be dealt with? What will be compensated? (e.g. medical costs, disability pensions benefits for noneconomic loss and death)	Criteria based Case-by-case
Accountability: *To whom is the mandatory immunization program accountable? When and how often will the program be reviewed, evaluated and updated based upon the evaluation findings? If major revisions are needed, who has the authority to do this?*	

APPENDIX 6: LINKS TO LEGISLATION IN JURISDICTIONS WITH MANDATORY IMMUNISATION - OECD

Australia

Family Assistance (Immunisation and Vaccination) (Education) Determination 2018

https://www.legislation.gov.au/Details/F2018L00828

Social Services Legislation Amendment (No Jab, No Pay) Act 2015

https://www.legislation.gov.au/Details/C2015A00158

United States

For further information see:

https://www.cdc.gov/phlp/publications/topic/vaccinations.html

Example of state legislation - California

https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB277

Canada

Example of Provincial legislation – Ontario

Ontario Immunisation of School Pupils Amendment Act 2016

https://www.ola.org/en/legislative-business/bills/parliament-41/session-1/bill-198

Immunisation of School Pupils Act Ontario

https://www.ontario.ca/laws/statute/90i01

BIBLIOGRAPHY

Attwell, K., Drislane, S., & Leask, J. (2019). Mandatory vaccination and no-fault vaccine injury compensation schemes: An identification of country-level policies. *Vaccine*, *37*(21), 2843-2848.

Attwell, K., Smith, D. T., & Ward, P. R. (2018). 'The Unhealthy Other': How vaccine rejecting parents construct the vaccinating mainstream. *Vaccine*, *36*(12), 1621–1626.

Baumann, K. E., Paynter, J., Petousis-Harris, H., Prymula, R., Yang, Y. T., & Shaw, J. (2018). Comparison of vaccination coverage of four childhood vaccines in New Zealand and New York State: Vaccines in New Zealand and New York. *J. Paediatrics and Child Health*. (The Royal Australasian College of Physicians) https://doi.org/10.1111/jpc.14289

Beard, F. H., Leask, J., & McIntyre, P. B. (2017). No Jab, No Pay and vaccine refusal in Australia: the jury is out. *Medical Journal of Australia*, *206*(9), 381-383.

Bedford, H., Attwell, K., Danchin, M., Marshall, H., Corben, P., & Leask, J. (2018). Vaccine hesitancy, refusal and access barriers: The need for clarity in terminology. *Vaccine*, *36*(44), 6556–6558.

Bidwell, S. (2013). Improving access to primary health care for children and youth: a review of the literature for the Canterbury Clinical network Child and Youth Workstream. *Christchurch: Canterbury District Health Board*.

Bond, L., Davie, G., Carlin, J. B., Lester, R., & Nolan, T. (2002). Infectious disease: increases in vaccination coverage for children in childcare, 1997-2000: an evaluation of the impact of government incentives & initiatives. *Australian & New Zealand journal of public health*, *26*(1), 58-64.

Boyce, T., Gudorf, A., de Kat, C., Muscat, M., Butler, R., & Habersaat, K. B. (2019). Towards equity in immunisation. *Euro surveillance: European communicable disease bulletin*, *24*(2),

Brieger, D., Edwards, M., Mudgil, P., & Whitehall, J. (2017). Knowledge, attitudes and opinions towards measles and the MMR vaccine across two NSW cohorts. *Australian and New Zealand Journal of Public Health*, *41*(6), 641–646.

Brown, K. F., Kroll, J. S., Hudson, M. J., Ramsay, M., Green, J., Long, S. J., … Sevdalis, N. (2010). Factors underlying parental decisions about combination childhood vaccinations including MMR: A systematic review. *Vaccine*, *28*(26), 4235–4248.

Buetow, S. (2008). Pay-for-performance in New Zealand primary health care. *Journal of Health Organization and Management*, *22*(1), 36-47.

Charania, N. A., Paynter, J., Lee, A. C., Watson, D. G., & Turner, N. M. (2018). Exploring immunisation inequities among migrant and refugee children in New Zealand. *Human Vaccines & Immunotherapeutics*, *14*(12), 3026–3033.

Charania, N. A., Watson, D. G., & Turner, N. M. (2018). Perceptions of caregivers and providers regarding the potential introduction of the varicella vaccine to the childhood immunisation schedule in New Zealand: A qualitative exploratory study: Universal varicella vaccination in New Zealand. *Journal of Paediatrics and Child Health*, *54*(1), 28–35.

Clifford, A., McCalman, J., Bainbridge, R., & Tsey, K. (2015). Interventions to improve cultural competency in health care for Indigenous peoples of Australia, New Zealand, Canada and the USA: a systematic review. *International Journal for Quality in Health Care*, *27*(2), 89-98.

Corben, P., & Leask, J. (2016). To close the childhood immunisation gap, we need a richer understanding of parents' decision-making. *Human Vaccines & Immunotherapeutics*, *12*(12), 3168–3176.

Corben, P., & Leask, J. (2018). Vaccination hesitancy in the antenatal period: a cross-sectional survey. *BMC Public Health*, *18*(1), 566.

Danchin, M. H., Costa-Pinto, J., Attwell, K., Willaby, H., Wiley, K., Hoq, M., … Marshall, H. (2018). Vaccine decision-making begins in pregnancy: Correlation between vaccine concerns, intentions and maternal vaccination with subsequent childhood vaccine uptake. *Vaccine*, *36*(44), 6473–6479.

Enkel, S. L., Attwell, K., Snelling, T. L., & Christian, H. E. (2018). 'Hesitant compliers': Qualitative analysis of concerned fully-vaccinating parents. *Vaccine*, *36*(44), 6459–6463.

Favin, M., Steinglass, R., Fields, R., Banerjee, K., & Sawhney, M. (2012). Why children are not vaccinated: a review of the grey literature. *International Health*, *4*(4), 229–238.

Fielding, J. E., Bolam, B., & Danchin, M. H. (2017). Immunisation coverage and socioeconomic status–questioning inequity in the 'No Jab, No Pay' policy. *Australian and New Zealand journal of public health*, *41*(5), 455-457.

Gaudino, J. A., & Robison, S. (2012). Risk factors associated with parents claiming personal-belief exemptions to school immunisation requirements: Community and other influences on more skeptical parents in Oregon, 2006. *Vaccine*, *30*(6), 1132–1142.

Gianfredi, V., Moretti, M., & Lopalco, P. L. (2019). Countering vaccine hesitancy through immunisation information systems, a narrative review. *Human Vaccines & Immunotherapeutics*, https://doi.org/10.1080/21645515.2019.1599675

Gidding, H. F., Quinn, H. E., Hueston, L., Dwyer, D. E., & McIntyre, P. B. (2018). Declining measles antibodies in the era of elimination: Australia's experience. *Vaccine*, *36*(4), 507–513.

Goodyear-Smith, F., & Turner, N. (2005). *Comparison of general practitioner and practice nurse perceived barriers to immunisation uptake*. New Zealand Family Physician, 32(3), 164-171.

Grant, C. C., Chen, M.-H., Bandara, D. K., Marks, E. J., Gilchrist, C. A., Lewycka, S., … Morton, S. M. B. (2016). Antenatal immunisation intentions of expectant parents: Relationship to immunisation timeliness during infancy. *Vaccine*, *34*(11), 1379–1388.

Groot, S., Ngata, R., Hodgetts, D., Waimarie Nikora, L., Karapu, R., & Chamberlain, K. (2007). Māori and community news constructions of Meningococcal B: The promotion of a moral obligation to vaccinate. *MEDIANZ: Media Studies Journal of Aotearoa New Zealand*, *10*(2), 71–89.

Harvey, H., Reissland, N., & Mason, J. (2015). Parental reminder, recall and educational interventions to improve early childhood immunisation uptake: A systematic review and meta-analysis. *Vaccine*, *33*(25), 2862–2880.

Hayman, D. T. S., Marshall, J. C., French, N. P., Carpenter, T. E., Roberts, M. G., & Kiedrzynski, T. (2017). Global importation and population risk factors for measles in New Zealand: a case study for highly immunized populations. *Epidemiology and Infection*, *145*(9), 1875–1885.

Helms, C., Leask, J., Robbins, S. C., Chow, M. Y. K., & McIntyre, P. (2011). Implementation of mandatory immunisation of healthcare workers: observations from New South Wales, Australia. *Vaccine*, *29*(16), 2895-2901.

Hill, L., Burrell, B., & Walls, T. (2018). Factors influencing women's decisions about having the pertussis-containing vaccine during pregnancy. *Journal of Primary Health Care*, *10*(1), 62.

Jarrett, C., Wilson, R., O'Leary, M., Eckersberger, E., & Larson, H. J. (2015). Strategies for addressing vaccine hesitancy – A systematic review. *Vaccine*, *33*(34), 4180–4190.

Jost, M., Luzi, D., Metzler, S., Miran, B., & Mutsch, M. (2015). Measles associated with international travel in the region of the Americas, Australia and Europe, 2001–2013: A systematic review. *Travel Medicine and Infectious Disease*, *13*(1), 10–18.

Kerr, J. (2006). Immunisation and the law: slippery slope to a healthy society. *Victoria U. Wellington L. Rev.*, *37*, 93.

Lee, C. H. J., Duck, I. M., & Sibley, C. G. (2017). Personality and demographic correlates of New Zealanders' confidence in the safety of childhood vaccinations. *Vaccine*, *35*(45), 6089–6095.

MacDonald NE, Harmon S, Dube E, Steenbeek A, Crowcroft N, Opel DJ, Faour D, Leask J, & Butler R. (2018) Mandatory infant & childhood immunisation: Rationales, issues and knowledge gaps. Vaccine 36, 5811-5818.

MacIntyre, C. Raina, Kpozehouen, E., Kunasekaran, M., Harriman, K., Conaty, S., Rosewell, A., … Nicholl, S. (2018). Measles control in Australia – threats, opportunities and future needs. *Vaccine*, *36*(30), 4393–4398.

MacIntyre, C.R., Karki, S., Sheikh, M., Zwar, N., & Heywood, A. E. (2016). The role of travel in measles outbreaks in Australia – An enhanced surveillance study. *Vaccine*, *34*(37), 4386–4391.

Mueller, S., Exeter, D. J., Petousis-Harris, H., Turner, N., O'Sullivan, D., & Buck, C. D. (2012). Measuring disparities in immunisation coverage among children in New Zealand. *Health & Place*, *18*(6), 1217–1223.

O'Leary, S. T., Brewer, S. E., Pyrzanowski, J., Barnard, J., Sevick, C., Furniss, A., & Dempsey, A. F. (2018). Timing of Information-Seeking about Infant Vaccines. *The Journal of Pediatrics*, *203*, 125-130.e1.

Pal, M. (2016). *Ethnic Disparities in Uptake of Pertussis Vaccination: A Focus on New Zealand Asians* (Doctoral dissertation, ResearchSpace@ Auckland).

Pearce, A., Marshall, H., Bedford, H., & Lynch, J. (2015). Barriers to childhood immunisation: Findings from the Longitudinal Study of Australian Children. *Vaccine*, *33*(29), 3377–3383.

Petousis-Harris, H., Goodyear-Smith, F., Turner, N., & Soe, B. (2004). Family physician perspectives on barriers to childhood immunisation. *Vaccine*, *22*(17–18), 2340–2344.

Petousis-Harris, H., Grant, C., Goodyear-Smith, F., Turner, N., York, D., Jones, R., & Stewart, J. (2012). What contributes to delays? The primary care determinants of immunisation timeliness in New Zealand. *Journal of Primary Health Care*, *4*(1), 12.

Petousis-Harris, H., Howe, A. S., Paynter, J., Turner, N., & Griffin, J. (2019). Pneumococcal Conjugate Vaccines Turning the Tide on Inequity: A Retrospective Cohort Study of New Zealand Children Born 2006–2015. *Clinical Infectious Diseases*, *68*(5), 818–826.

Pritchard, E. N., Jutel, A., & Tollafield, S. (2011). Positive provider interventions for enhancing influenza vaccination uptake among Pacific Peoples in New Zealand. *NZ Med J*, *124*(1346), 75-82.

Reynolds, G., Timo, M., Dev, A., Poole, T., & Turner, N. (2014). Effective general practice: audit and feedback for the primary series of immunisations. *Journal of primary health care*, *6*(1), 40-48.

Roberts, L., Turner, N., McArdle, B., Nowlan, M., Taylor, L., Webber, R., & Rouse, P. (2017). Outreach immunisation services in New Zealand: a review of service delivery models. *Journal of Primary Health Care*, *9*(1), 62.

Rossen, I., Hurlstone, M. J., Dunlop, P. D., & Lawrence, C. (2019). Accepters, fence sitters, or rejecters: Moral profiles of vaccination attitudes. *Social Science & Medicine*, *224*, 23-27.

Rozbroj, T., Lyons, A., & Lucke, J. (2019). Psychosocial and demographic characteristics relating to vaccine attitudes in Australia. *Patient Education and Counselling*, *102*(1), 172–179.

Rumball-Smith, J., & Kenealy, T. (2016). *Childhood immunisations in Northland, New Zealand: declining care and the journey through the immunisation pathway*. *129*(1438), 7.

Smith, L. E., Amlôt, R., Weinman, J., Yiend, J., & Rubin, G. J. (2017). A systematic review of factors affecting vaccine uptake in young children. *Vaccine*, *35*(45), 6059–6069.

Taylor, K. A., Stocks, N., & Marshall, H. S. (2014). The missing link: Family physician perspectives on barriers and enablers to prescribing a new Meningococcal B vaccine and other recommended, non-government funded vaccines. *Vaccine*, *32*(33), 4214–4219.

Taylor, L., Turner, N., & Poutasi, C. (2017). A study into best practice in achieving high rates of childhood immunisation shows the keys include effective teamwork, creating good connections with parents and caregivers, and taking a systematic approach. *Kai Tiaki Nursing New Zealand* 23(6):25-27

Thomson, A., Vallée-Tourangeau, G., & Suggs, L. S. (2018). Strategies to increase vaccine acceptance and uptake: From behavioral insights to context-specific, culturally-appropriate, evidence-based communications and interventions. *Vaccine*, *36*(44), 6457–6458.

Turner, N. M., Charania, N. A., Chong, A., Stewart, J., & Taylor, L. (2017). The challenges and opportunities of translating best practice immunisation strategies among low performing general practices to reduce equity gaps in childhood immunisation coverage in New Zealand. *BMC Nursing*, *16*(1), 31.

Turner, N., Taylor, L., Chong, A., & Horrell, B. (2017). Identifying factors behind the general practice use of the term 'decline' for the childhood immunisation programme in New Zealand. *Journal of Primary Health Care*, *9*(1), 69.

Ward, K., Chow, M. Y. K., King, C., & Leask, J. (2012). Strategies to improve vaccination uptake in Australia, a systematic review of types and effectiveness. *Australian and New Zealand Journal of Public Health*, *36*(4), 369–377. 6405.2012.00897.x

Ward, P. R., Attwell, K., Meyer, S. B., Rokkas, P., & Leask, J. (2018). Risk, responsibility and negative responses: a qualitative study of parental trust in childhood vaccinations. *Journal of Risk Research*, *21*(9), 1117–1130.

Ward, Paul R., Attwell, K., Meyer, S. B., Rokkas, P., & Leask, J. (2017). Understanding the perceived logic of care by vaccine-hesitant and vaccine-refusing parents: A qualitative study in Australia. *PLOS ONE*, *12*(10), e0185955

Wilson, D. (2008). The significance of a culturally appropriate health service for Indigenous Māori women. *Contemporary Nurse*, *28*(1-2), 173-188.