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Are we ready to eliminate invasive meningococcal disease in Aotearoa New Zealand?

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Summary

Invasive meningococcal disease (IMD) is a serious infection that has devastating impacts on families. Most cases are children and young adults, and each case has a significant risk of death and permanent disability such as limb amputation. Aotearoa New Zealand (NZ) has experienced high rates of IMD for the last 30 years, but recent international and local experience shows that we may finally have an opportunity to be permanently free of this disease. In this Briefing we consider the desirability and feasibility of eliminating IMD in NZ, and outline the potential next steps for evaluation of this strategic option.

It is now over a decade since meningococcal disease experts Martin Maiden and Mattias Frosch posed the question: “Can we, should we, eradicate the meningococcus?”[1]

Their conclusion was that eradication – permanent reduction to zero of the worldwide incidence[2] of *Neisseria meningitidis* infection – was neither feasible nor desirable. However, country-level elimination of IMD appeared far more promising. Instead of wiping out both benign and harmful variants of the pathogen, an elimination approach would aim to prevent the invasive (and most severe) form of the disease that typically presents as meningitis and/or septicaemia, often with a characteristic rash. Maiden and Frosch identified one important obstacle to IMD elimination: in 2012 there was no effective vaccine against all forms of the most common pathogen group, serogroup B.

Much has happened since the publication of that analysis. An effective vaccine against serogroup B was developed and rolled out from 2014 onwards, starting in the UK. An ambitious and well-designed vaccination programme achieved more than 99% reduction in serogroup A disease in several African countries that had previously experienced extremely high disease rates.[3] And closer to home, NZ’s successful elimination strategy for the Covid-19 pandemic has shed new light on preventing a range of infections that spread by the respiratory route. IMD elimination now looks to be a potentially achievable goal for NZ.

Desirability of elimination

The desirability of eliminating IMD in NZ is clear. This disease is rightly feared for its swift progression within hours from a flu-like illness to life-threatening complications. IMD deepens existing infectious disease inequities, with far higher rates experienced by Māori and Pacific Peoples compared with other ethnic groups.[4] The full burden in NZ is unmeasured: international evidence[5] suggests that 10-20% of survivors experience long-term complications that include limb amputation, hearing loss, mental distress, and cognitive difficulties. Unsurprisingly, caregivers also experience significant and long-term impacts on their quality of life.[5]

IMD case numbers in NZ were climbing year-on-year from 2014 until the Covid-19 pandemic (Fig 1). This rise was largely driven by new, more severe and more transmissible ‘MenW’ strains circulating worldwide.[6,7] As a result IMD has had an 8% case fatality risk in NZ over the 12 years 2010 – 2021, compared with 4% in 1995-2006 during the serogroup B epidemic (Data source: ESR).

Figure 1. Notified cases of meningococcal disease in NZ, 1995-2020 (Data source: ESR).

Feasibility of elimination

Vaccines

Vaccines are now available against all of the major serogroups that cause IMD in NZ. Table 1 (Appendix) shows the numbers of notified cases for each serogroup over the past 10 years, demonstrating that 88% of notified cases were caused by serogroups for which a vaccine is available. This number rises to 98% of the notified cases where a serogroup could be identified. No vaccine has complete effectiveness, meaning that not all cases would have been prevented by vaccines, and non-vaccine control measures would still be required alongside a comprehensive vaccine programme.

NZ currently has a mix of universal and targeted, funded and unfunded recommendations for meningococcal vaccines. Recent changes to expand vaccine funding are a very positive step. But an elimination aim would require a broader approach to optimise protection with vaccines and to address highly inequitable barriers to access: meningococcal vaccines are extremely costly for families to self-fund. Codesigning a vaccine strategy with Māori communities will be essential to address mistrust in the health system that has hampered rollout of other vaccines.[8] (See the Appendix for further discussion of vaccines.)

Non-vaccine control measures

Like Covid-19, meningococcal disease is spread by respiratory transmission. Public health and social measures used to control transmission of Covid-19 were associated with a global reduction in meningococcal disease incidence,[9-11] even though the pandemic also presented barriers to vaccine delivery.[12-16] NZ's country-wide lockdown in March to May 2020 eliminated transmission not only of Covid-19, but also an array of other infections including meningococcal disease: there were zero meningococcal disease notifications during April and May of that year and the total case numbers for 2020 were the lowest in over 25 years. We are currently conducting research on this unexpected pandemic benefit to identify potential insights for improved outbreak control (see Appendix).

Conclusions and next steps

Elimination of meningococcal disease appears to be both desirable and feasible, but to date NZ's approach to control has been reactive rather than proactive, leading to ongoing cases of this life-altering and life-limiting, but also preventable disease. Cases are beginning to rise once again now that pandemic protections have been removed and we are currently approaching the peak annual season for IMD, ie, late winter and early spring.

It is time to evaluate elimination of IMD in NZ as an achievable strategic goal to both protect health and reduce health inequities. With effective vaccines available for all of the major disease-associated serogroups and a large number of measures for controlling outbreaks, the case for elimination is becoming clearer. A systematic consideration of strategic options would include examination of the following types of evidence:

- Mathematical modelling to establish the effectiveness, costs, and benefits of different vaccine options;

- A review and analysis of the impacts of public health and social measures on IMD transmission (currently in progress at the University of Otago) to identify any currently under-utilised outbreak control approaches;
- Genomic epidemiological studies to map importation and spread of hyperinvasive lineages from abroad, and to understand the dynamics of carriage in NZ; and
- An investigation of the long-term impacts of IMD on survivors and whānau to inform infection control policy and provide appropriate long-term disability and mental health support.

While this evaluation is in progress, interim measures could include ensuring sufficient allocation of resources at community level to achieve equity in vaccine protection and making meningococcal vaccines available free of charge to all Year 11 students.

Finally, a major lesson from the Covid-19 pandemic is also relevant to IMD elimination: the pandemic response implemented by Māori and Pacific communities was highly effective, including running vaccination programmes with high uptake once community providers were adequately resourced to do so. Likewise, codesign of an IMD strategy with those most at risk will be essential to the success of the strategy, building on existing strengths to implement solutions that lie within communities. Te Aka Whai Ora would have a key leadership role in this type of initiative, ensuring that Māori have a strong influence on the design and delivery of health services.

A vital initiating step in the evaluation of elimination as an achievable goal will be the establishment of a formal partnership between Māori and Pacific leadership, Government, and topic experts. This partnership will provide the appropriate expertise to assess, design, and then, if the evaluation is positive, implement an equitable and effective country-level IMD elimination programme.

What is new in this Briefing

- Advances in vaccines mean that IMD is now a largely preventable disease.
- The Covid-19 pandemic response has shown how public health and social measures can further reduce IMD risk.

Implications for public health policy and practice

- It is now time to conduct a comprehensive assessment of the measures needed to eliminate IMD from NZ and their cost-effectiveness.
- A vital initiating step in the evaluation of elimination as an achievable goal will be the establishment of a formal partnership between Māori and Pacific leadership, Government, and topic experts.
- This partnership will provide the appropriate expertise to assess, design, and then, if the evaluation is positive, implement an equitable and effective country-level IMD elimination programme.

Need to know more?

KidsHealth - Information for parents and carers on what to look for and when to seek help

Manatū Hauora/Ministry of Health - Information about meningococcal vaccines

Meningitis Foundation - Further resources and personal stories.

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Appendix: What would an elimination strategy look like in practice?

An effective elimination strategy would combine vaccines with public health and social measures, using a multi-layered approach to prevention. Partnership between Māori and Pacific leadership, Government, and topic experts will be essential to the success of an elimination programme. Ensuring that elimination is sustained in the long term will mean also addressing the drivers of infectious disease in NZ, such as poverty, poor housing, and racism in the health system. These factors continue to drive inequities in the incidence of a wide range of serious infectious diseases in NZ.[17]

Vaccine-based prevention

Probably the largest single advance in the feasibility of IMD elimination was the development of effective vaccines against serogroup B disease, available to the NZ public from 2018.[18] Until that time, vaccines had been available for the other major IMD-associated serogroups (A, C, W, and Y), but not for B, which is the most common serogroup. A novel vaccine was developed and rolled out in the early 2000s in response to the large meningococcal B epidemic occurring in NZ at the time, but that vaccine was specific to the epidemic strain and the vaccine campaign was discontinued in 2008.[19]

Potential strategies to support an elimination aim could include vaccinating an entire age cohort of children which was successful in the UK for serogroup C IMD, and including MenACWY vaccination of adolescents in the schedule to protect against hyperinvasive serogroup W lineages[20] and serogroup C, as they have the highest case fatality risk.

Table 1. Notified meningococcal disease cases in Aotearoa in the ten years 2012 - 2021, showing serogroups and potential coverage using existing vaccines. (Data source: ESR)

Serogroup	Number of cases	Percent	Vaccine available in Aotearoa NZ
Group B	417	53.1	Meningococcal B recombinant
Group C	89	11.3	Quadrivalent meningococcal conjugate vaccines; Meningococcal group C conjugate
Group W	114	14.5	Quadrivalent meningococcal conjugate vaccines
Group Y	68	8.7	Quadrivalent meningococcal conjugate vaccines
Other*	46	5.9	N/A
Group E	2	0.3	No
Group X	1	0.1	No
Missing	48	6.1	N/A
Total	**785**	**100**	**Cases where a vaccine is available for that serogroup = 87.6% of the total and = 98.3% of those with an identified serogroup**
* Laboratory-confirmed but not grouped			

Public health and social measures

NZ's pandemic elimination strategy demonstrated the effectiveness of extinguishing Covid-19 outbreaks using regional restrictions on large gatherings, and intensive contact tracing, supported with genomic epidemiology. These measures are also suitable for managing outbreaks of IMD which is a much less transmissible infection than Covid-19 and has the additional option of antibiotic prophylaxis for close contacts. The border restrictions of 2020 and 2021 may also have helped to reduce IMD cases by limiting importation of new lineages, but would not be appropriate for IMD control. Household crowding and attending large gatherings are recognised risk factors for IMD outbreaks in NZ,[21] highlighting the potential for prevention of community transmission by improving housing conditions and indoor air quality.

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