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Vaccine success and challenges in northern Australia

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ABSTRACT

Aboriginal and Torres Strait Islander people living in rural and remote Australia have lower vaccine coverage rates and experience higher rates of notification and hospitalisations for vaccine preventable diseases than non-Aboriginal people. This paper explores important public health and research activities being undertaken in the Northern Territory to reduce this disparity in vaccine program performance, with a particular focus on rotavirus, meningococcal, human papilloma virus and COVID-19 vaccines.

Keywords: Aboriginal and Torres Strait Islander, COVID-19, human papilloma virus, immunisation, meningococcal, Northern Territory, rotavirus, vaccine.

Introduction

Australian Aboriginal and Torres Strait Islander people living in remote locations have lower vaccine coverage rates and experience higher notification and hospitalisation rates for vaccine preventable diseases, than non-Aboriginal people living in major Australian cities.[1] This paper explores important public health and research activities in the Northern Territory over the past 10–15 years, which aim to reduce the disparity in vaccine coverage and vaccine program performance, highlighting success and ongoing challenges.

Rotavirus vaccines

Rotavirus remains a leading cause of childhood gastroenteritis.[2] Before the introduction of rotavirus vaccines into the Australian National Immunisation Program, it was estimated that rotavirus was responsible for 10 000 hospital admissions, 22 000 Emergency Department presentations, and 115 000 primary care presentations of Australian children aged <5 years every year.[3] The burden among Aboriginal and Torres Strait Islander children was greater, with a hospitalisation rate more than five times that of non-Aboriginal children aged <12 months.[4] In addition, the regular occurrence of large rotavirus outbreaks among children living in rural and remote communities placed enormous strain on families, remote health care clinics and aeromedical retrieval services.[5]

The introduction of rotavirus vaccines into the Northern Territory Childhood Vaccination Schedule in 2006 and the Australian National Immunisation Program in 2007, was associated with an immediate and sustained decrease in national rotavirus hospitalisations (>70%).[6] However, in the Northern Territory the decline in rotavirus hospitalisations was less substantial.[6] In 2010, Aboriginal and Torres Strait Islander children in the Northern Territory remained more than 20 times more likely to be hospitalised with rotavirus than non-Aboriginal children in other states and territories.[6] In addition, rotavirus vaccine effectiveness was reported to be as low as 19% and 21% during two rotavirus outbreaks in Central Australia in 2009 and 2017,[7,8] with 65 children admitted to Alice Springs Hospital with rotavirus gastroenteritis between March and June 2017.[8]

Strict upper age limits for rotavirus vaccine administration (dose 1 Rotarix recommended between 6 and <13 weeks and dose 2 Rotarix before 25 weeks old) contribute to poor rotavirus vaccine program impact, due to reduced vaccine coverage and limited opportunities for catch-up of missed immunisations in later infancy.[9] For the 2014 Northern Territory birth cohort, 83.2% of Aboriginal and Torres Strait Islander children compared with 90.6% of non-Aboriginal children, had received a complete two-dose course of rotavirus vaccine by age 12 months.[10] This underscores the importance of

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public health and primary health care activities to enhance vaccine timeliness in early childhood.

The ORVAC study – Optimising Rotavirus Vaccine in Aboriginal Children, is an adaptive clinical trial that relaxes the upper age limit of rotavirus vaccine administration and administers a third 'booster dose' of oral Rotarix rotavirus vaccine to Northern Territory Aboriginal children aged 6–11 months.[11] This clinical trial – a partnership between the Menzies School of Health Research, Darwin and Telethon Kids Institute, Perth – has demonstrated that administering a booster dose of oral rotavirus vaccine improves the proportion of children with evidence of vaccine seroresponse (85% post third dose of Rotarix vs 72% post-placebo; ORVAC Stage 1; 2018–2020),[12] and continues to enrol children to evaluate the clinical impact – decreased medical presentations with gastroenteritis in the first 3 years of life (ORVAC Stage 2; 2022–2027). An early generation rotavirus vaccine, Rotashield, was associated with an increased risk of intussusception among infants aged >3 months.[13] A systematic review of post-licensure studies suggests no increased risk of intussusception with Rotarix;[14] however, this continues to be monitored closely in the ORVAC study given the increased upper age limits of administration (age >6 months).

Meningococcal vaccines

Meningococcal disease is a rare but serious disease commonly causing septicaemia and meningitis, though atypical presentations including septic arthritis, pneumonia and epiglottitis can also occur.[15] There are several serogroups that cause invasive disease in Australia, A, B, C, W, X, and Y.[15]

Meningococcal infection is notifiable in the Northern Territory, and between 2012 and 2016 there were twelve cases of invasive meningococcal disease notified in the Northern Territory, with 11 cases caused by serotype B and 1 case caused by serotype C.[16] However, in 2017 there were 31 cases of invasive MenW disease and 3 cases of MenW conjunctivitis. All cases occurred among the Aboriginal and Torres Straits Islander population of the Alice Springs, Barkly and Katherine regions; and the majority (94%) of cases occurred among children and adolescents aged <15 years.[16] This outbreak prompted an intense public health response and targeted vaccination program, with more than 17 800 MenACWY vaccines administered to children aged 1–19 years in the Alice Springs, Barkly, Katherine, East Arnhem and Darwin Rural regions between February 2017 and March 2018.[17] It was estimated that 81% of eligible Aboriginal and Torres Strait Islander children and 49% of eligible non-Aboriginal children were vaccinated during this period.[17]

The MenACWY replaced the MenC vaccine on the Northern Territory Immunisation Schedule in December 2017 and was added to the National Immunisation Program from mid-2018.[18] By May 2019, it was estimated that 76% of Northern Territory Aboriginal and Torres Strait Islander children had been vaccinated with MenACWY, compared to 60% of non-Aboriginal children.[18] Since 2018, invasive meningococcal disease notifications have declined from 1.1 cases per 100 000 in 2018, to 0.8 cases per 100 000 in 2019 and 0.3 cases per 100 000 in 2020, although the reduction in 2020 may be partly attributable to the impact of public health measures implemented for the COVID-19 pandemic.[19]

Meningococcal B serotype remains an important cause of invasive meningococcal disease in Australia, causing 94% (24/25) cases among children aged <5 years and 80% (8/10) cases among adolescents aged 15–19 years, in 2020.[19] MenB vaccines were added to the National Immunisation Program for Aboriginal and Torres Strait Islander children aged <12 months in July 2020.[1] MenB vaccines are also currently being administered to adolescents through an observational study by the University of South Australia called 'B Part of it NT', which will evaluate the effect of 4CMenB vaccines on rates of meningococcal carriage, invasive meningococcal disease and gonorrhoea, among Northern Territory adolescents aged 14–19 years.[20]

HPV vaccines

Genital human papilloma virus (HPV) is a common infection transmitted through sexual contact.[21] In most cases, genital HPV infections are asymptomatic and self-resolve within 12–24 months.[21] However, a small proportion of HPV infections persist in the genital epithelium, and can cause cancer of the cervix, vagina, vulva, penis and anus.[22] Northern Territory Aboriginal and Torres Strait Islander women have a disproportionately high incidence of cervical and vulval cancer.[23]

In 2007, the Australian Government funded Gardasil – a three-dose vaccine protecting women against the four most common types of HPV known to cause cervical cancer and genital warts.[21] In the Northern Territory, a mass-vaccination program was delivered to all female secondary school students through a partnership between the Centre for Disease Control and Health Promoting School Nurses.[24] Catch-up vaccinations were also offered to women aged 18–26 years through remote community clinics and private GPs.[24] In addition, Women's Health Workshops were held in remote communities and HPV vaccine resources were translated into three Aboriginal languages for broadcast on Aboriginal radio stations in Central Australia and the Top End.[24] More than 32 500 doses of Gardasil HPV were administered between April 2007 and July 2008, including 14 600 first dose encounters, 11 700 second dose encounters and 6200 third and final dose encounters.[24] Reasons for the lower number of second and third dose HPV encounters during this time period more likely reflect problematic program delivery (unable to complete second or third visits to school/communities) or a delay in recording administered immunisations with the immunisation register, rather than a loss of confidence or intolerance of the HPV vaccine, as only 11 adverse events were reported to the Northern Territory Centre for Disease control during the same period, and all were reported to be mild.[24]

In 2013 the HPV vaccine program was extended to include boys aged 12–13 years, and in 2018 the new two-dose Gardasil-9 vaccine was funded under the National

Immunisation Program.[1] By 2020, 76.2% of Aboriginal and Torres Strait Islander girls and 63.7% of Aboriginal and Torres Strait Islander boys in the Northern Territory had received a complete course of HPV vaccine, slightly lower than the national average of 80.5% of all Australian girls and 77.6% of all Australian boys.[1]

Nationwide, HPV vaccination has resulted in a large demonstrable decrease in HPV-related disease.[25] However, there is a need to further increase HPV vaccine coverage, especially among Aboriginal and Torres Strait Islander women in the Northern Territory who continue to have higher rates of histologically confirmed high-grade cervical disease and lower participation in screening programs.[26]

COVID-19 vaccines

Australia's early response to the COVID-19 pandemic was among the most successful in the world.[27] From March 2020, individuals entering the Northern Territory from overseas and designated Australian 'hotspot' regions were required to undertake a 14-day period of quarantine.[28] As a result of this swift and successful public health strategy, there was no sustained SARS-CoV-2 community transmission or deaths in the Northern Territory until December 2021.[28]

The COVID-19 vaccination program began in the Northern Territory in February 2021 with priority for quarantine and border workers, frontline health care workers and vulnerable populations including the elderly. There were early concerns about limited vaccine supply, remote workforce shortages, and vaccine hesitancy within some sectors of the Northern Territory community.[29] Local vaccination programs were led by the Aboriginal Community Controlled Health Services sector, GPs and pharmacies and the Northern Territory Department of Health. The vaccination program was further supported by health promotion activities from NT land councils, Aboriginal controlled health organisations, and arts and language centres.[30] The Menzies School of Health Research partnered with Aboriginal leaders to produce short-videos about COVID-19 and COVID-19 vaccines in local languages, which were shared widely with government departments, clinicians, Aboriginal community-controlled health organisations, and on social medial platforms.[30] The Menzies School of Health Research also partnered with the Telethon Kids Institute to host a COVID-19 vaccine workshop – Sharing Success Stories & Smashing Myths – which provided an opportunity for health services in northern and central Australia to share success stories when promoting vaccine uptake. Despite these collaborative efforts, by June 2022, two-dose COVID-19 vaccination coverage remains as low as 60% in the Barkly region and in some Central Australian communities (vaccine eligible population aged >5 years).[31] Across all regions of the Northern Territory, two-dose COVID-19 vaccine coverage is lowest among children aged 5–11 years.[31]

Additional research work is being undertaken by Menzies School of Health Research in conjunction with the Doherty Institute in Melbourne, to examine the B- and T-cell response to natural COVID-19 infection and COVID-19 vaccination among Aboriginal and Torres Strait Islander people.

Conclusions

Ongoing monitoring of vaccine-preventable disease burden and vaccination coverage, is essential to address existing and emerging health disparities, particularly for Aboriginal and Torres Strait Islander populations in northern Australia.[10] Working in partnership with Aboriginal people to understand the drivers of vaccine hesitancy in each region and to deliver culturally appropriate education about vaccines and vaccine preventable diseases, is critical for the successful participation of Aboriginal and Torres Strait Islander communities in vaccination programs.[29]

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