Pertussis vaccination uptake in pregnancy: lessons to be learned from an integrated healthcare approach

Emma J Deverall, Benjamin Gilmore, Sam Illing, Roshini Peiris-John

ABSTRACT

AIM: To determine the proportion of pregnant women vaccinated with the pertussis booster in the third trimester of their pregnancy, and explore factors influencing coverage.

METHODS: A clinical audit was undertaken at Rotorua hospital using electronic databases to determine pertussis immunisation among women who birthed from 25 March to 25 April, 2017 (n=111). Lead maternity carers (LMCs) were surveyed to assess knowledge of the vaccine and explore suggestions to increase vaccination coverage.

RESULTS: Only 44% (n=49) of women were vaccinated in 2017. Women 25 years and under, and women from Rotorua were less likely to be vaccinated. A woman not being recalled to the GP for vaccination was the biggest reason for not being vaccinated (n=27). Every woman in Taupo/Turangi was recalled in pregnancy, leading to greater vaccine uptake compared to women in Rotorua.

CONCLUSION: Overall, the proportion of pregnant women vaccinated for pertussis continue to be low with coverage being disproportionally lower for younger women. The integrated healthcare approach in Taupo/Turangi has resulted in improved vaccine uptake. Interventions that allow general practitioners, LMCs and primary health organisations to work together can improve vaccination rates of pregnant mothers in New Zealand.

Despite being a vaccine-preventable disease, pertussis causes significant morbidity and mortality worldwide, with 140,000–250,000 cases reported annually from 2012–2016.[1] In New Zealand, pertussis epidemics occur every 3–5 years. Although immunisation rates have been increasing, pertussis remains a major public health issue in New Zealand. During the recent outbreak in 2012, over 5,500 cases were reported with over 350 cases per month reported from mid-2011 to late-2013. This outbreak resulted in hundreds of hospitalisations and three deaths of infants, including two who were too young to be immunised.[2] Ethnic disparities in pertussis disease rates and vaccination coverage rates are evident. Māori have the lowest coverage rate (62%) with an incidence rate of 734 per 100,000 in under-one-year-olds, while Pacific peoples have a coverage rate of 73% and the highest incidence rate in under-one-year-olds (934 cases per 100,000).

Infants are the most at risk of serious disease complications and death from pertussis, and are best protected by maternal immunisation during pregnancy and on-time immunisation during infancy.[3,4] Maternal immunisation is 91–93% effective at preventing spread to infants aged under eight weeks old.[5] Prenatal immunisation has led to a 50% reduction in pertussis among infants under age 13 weeks in the UK, and has been estimated to reduce total annual

infant cases by up to a third, hospitalisations by 39% and deaths by 51% in the US.[6,7] Immunisation during pregnancy is now recommended by national health organisations in several countries, including the US, UK, Belgium and New Zealand.[5,8,9]

In 2013, New Zealand's Ministry of Health introduced fully funded pertussis immunisation for women between 28–38 weeks of gestation. However, the Ministry estimates maternal immunisation coverage to be as low as 13%, with considerable variation between district health boards.[2] A recent letter in the *New Zealand Medical Journal*[10] showed that mothers of over 80% of children with pertussis aged less than 20 weeks in Auckland had not received maternal vaccination. Their suggestion was to promote the effectiveness of the maternal vaccine to would-be parents, lead maternity carers (LMCs) and general practitioners (GPs).

An audit conducted at Rotorua hospital in 2015 indicated a 35% immunisation uptake. To improve the vaccination rate for women in the community, a package of care was developed to support and educate GPs in their provision of primary care to pregnant women. LMCs were offered secure email addresses to strengthen communication between them and other primary care providers. Rotorua Maternity Day Assessment Unit (DAU) also offered immunisation to women using hospital services. The study reported here aimed to determine the proportion of pregnant women vaccinated for pertussis in the third trimester of their pregnancy following the steps taken to improve coverage in Rotorua, examine variation by selected demographic variables and explore factors influencing coverage.

Methods

All women who birthed in Rotorua hospital from 25 March 2017 to 25 April 2017 were included (n=113). The birth registry (available on the Rotorua electronic health system) was accessed to extract information about the variables of interest: whether the patient had received pertussis vaccination in this pregnancy, age, ethnicity, parity, GP and LMC. If they had not received the vaccine, it was asked if the women had been seen in pregnancy, seen but not recalled, declined the vaccine or lost to follow up. If the general practitioner (GP) was listed as 'not found' on hospital records, this was confirmed by accessing patient records within the patient management system through the Rotorua Area Primary Health Services (RAPHS) or by calling GP practices. If no GP was identified then the mother was excluded from the audit. Women who were vaccinated in the DAU were identified by accessing DAU records of LMCs.

The LMCs of the women who gave birth during the study period were surveyed to assess views and knowledge of the vaccine as well as to explore suggestions to increase immunisation rates. Information collected included knowledge of subsidy, safety, appropriate trimester, use of the secure emails provided as an intervention after the last audit and reasons for not use, and recommendations for improving coverage. The questionnaire was interviewer administered at the birthing unit at Rotorua hospital or by a telephone call.

Ethical approval for the study was received from the Rotorua Hospital Ethics Committee.

Results

A total of 113 women gave birth within the audit period. Two women were excluded as they were enrolled in GP practices outside of the Lakes District Health Board (the study location). This left 111 women eligible for the audit.

The overall proportion of pregnant women vaccinated for pertussis from March–April 2017 was 44% (n=49). Those 25 years and under, and living outside of Taupo/Turangi, were less likely to be vaccinated (Table 1). Māori (cf. non-Māori) and nulliparous women (cf. multiparous women) were less likely to be vaccinated, although these differences were not statistically significant. Almost half (49%) of the women (n=45) were vaccinated by a GP. Twelve women (11%) had unknown immunisation status as they were not enrolled at a practice and their notes could not be accessed.

Women in Taupo/Turangi were more likely to be vaccinated at a rate of 76% compared to 45% in Rotorua. Taupo women have access to a greater number of interventions within an integrated healthcare approach. Rather than arrange secure emails for LMCs,

Table 1: Characteristics of study population by vaccination status.[a]

	Total (n=111)	Yes (n=49)	No (n=50)	p-value[b]
Age[c]				
≤25 years	50	15 (30.0%)	26 (52.0%)	0.006
>25 years	58	34 (58.6%)	21 (36.2%)	
Ethnicity				
Māori	54	20 (37.0%)	28 (51.9%)	0.224
NZ European	32	15 (46.9%)	14 (43.8%)	
Other	25	14 (56.0%)	8 (32.0%)	
Parity				
PO	46	19 (41.3%)	22 (47.8%)	0.598
P1+	65	30 (46.2%)	28 (43.1%)	
Location[d]				
Taupo/Turangi	21	16 (76.2%)	5 (22.7%)	0.012
Rotorua	69	31 (44.9%)	38 (55.1%)	

[a]Excludes women with unknown vaccination status (n=12).
[b]Chi-square test.
[c]Excludes women with age unknown (n=3), all were not vaccinated.
[d]Excludes women from areas outside of Taupo/Turangi and Rotorua (n=9), only two of whom were vaccinated.

Table 2: Reasons for not being vaccinated.

	Not seen in the pregnancy (n=16)	Seen; no recall (n=27)	Vaccination declined (n=3)	Seen; recalled, lost to follow-up (n=1)	Unknown (n=3)
Age					
≤25 years (n=26)	8	15	2	1	-
>25 years (n=21)	8	12	1	-	-
Unknown (n=3)	-	-	-	-	3
Ethnicity					
Māori (n=28)	9	14	3	1	1
NZ European (n=14)	2	10	-	-	2
Other (n=8)	5	3	-	-	-
Parity					
PO (n=22)	6	13	2	-	1
P1+ (n=28)	10	14	1	1	2
Location					
Taupo/Turangi (n=5)	2	-	-	-	3
Rotorua (n=38)	14	21	2	1	1
Other (n=7)	-	6	1	-	-

Taupo maternity unit takes responsibility for notifying GPs of their patient's pregnancy. GPs are then able to enter patients for recall to discuss vaccination, and a nurse attends antenatal classes for opportunistic immunisation. After-hours vaccination is available at the pharmacy. In Turangi the Community Child Health Nurse from Pinnacle Midlands Health Network vaccinates pregnant women at a monthly clinic.

A woman not being recalled to the GP for vaccination was the biggest reason for not being vaccinated (Table 2). Every woman in Taupo/Turangi was recalled in pregnancy. Only three women declined the vaccine and only one was lost to follow up after recall.

There were 24 LMCs responsible for births during the study period; one was on leave at the time of surveying, leaving 23 eligible.

While all midwives routinely discussed vaccination with their patients, and understood it was subsidised, four (17.3%) were unsure the vaccine was safe, and two (8.7%) were unsure if it was effective.

None of the midwives used the secure emails provided by Rotorua, as an intervention was put in place after the last audit. Reasons for this included: hard to access (n=8); not set up (n=7); women referred from GPs (n=3); laborious (n=2); problems with account (n=2); and cost (n=1). Midwives felt that advertising through local and social media (n=5), along with patient education resources (n=7) may help improve vaccination rates.

Discussion

Overall, the proportion of pregnant women receiving pertussis booster vaccination within Rotorua DHB continues to be low, with coverage disproportionally lower for younger women, and little improvement in coverage from 2015 to 2017. The proportion of pregnant women receiving pertussis vaccination in Taupo/Turangi, however, was greater than women in Rotorua.

This was an audit consisting of a small sample from a secondary hospital, and care must be taken when interpreting the results. The main limitation of the audit is that 11% of the original population could not have their immunisation status identified due to not being registered at a GP clinic. Although largely unlikely, there may also have been incorrect documentation of immunisation by providers who opportunistically vaccinated mothers in locations away from their GP clinics. Despite these limitations, this study provides useful insights into current practice and explores opportunities for improving uptake.

Previous studies in New Zealand have shown pertussis vaccination uptake to be influenced by mothers' desire to protect their baby (96%), following health professional advice (84%), awareness of pertussis in the community (50%) and being funded (43%).[11] Those who did not accept the vaccine were either unaware of it (73%), had safety concerns (68%) or were doubtful of its effectiveness (56%). Pregnant mothers whose midwife recommended vaccination are more likely to be immunised.[2] While we found all midwives routinely discussed vaccination with their patients, one in four were unsure of its safety and effectiveness. Programmes to update midwives on current knowledge on vaccine safety and effectiveness would be useful.

Clearly, immunisation uptake could be improved by increasing awareness of funded pertussis immunisation during pregnancy and by increasing opportunistic immunisation. Although we found LMCs are relatively well informed, it appears that the message for all pregnant women to be offered pertussis vaccination in pregnancy is not being comprehensively translated into practice with variations found between localities.

In Rotorua, unvaccinated women were commonly seen by their GP, yet not recalled for vaccination. It is not possible to determine if this was a missed opportunity for vaccination, as data on gestational age when seen or the purpose of the visit was not recorded.

Overall, there is a need for more focus on improving delivery of vaccines to young pregnant women. The significantly higher rate of pertussis vaccination for women living in Taupo may be due to the way in which multiple healthcare providers bring vaccination to the community, rather than any attempt to bring the women to the vaccine. Key components of this programme are:

1. Notifying GPs of pregnancy: finding new ways to promote communication between GPs and LMCs, such as the Taupo-maternity unit letter, could also work;
2. Vaccinations available in antenatal clinics and;
3. Opportunistic vaccination at pharmacies and parent education sessions. Community-based opportunistic vaccination in Rotorua could include local maraes.

The availability of a greater number of interventions within an integrated healthcare approach in Taupo/Turangi has led to a higher uptake of vaccination among pregnant women compared to women in Rotorua. It is essential that we continue to develop and foster the relationships and resources that allow GPs, LMCs and primary health organisations to work together to improve the vaccination rate of pregnant mothers. Adoption of the integrated healthcare approach, as found in Taupo/Turangi, could help improve the vaccination rate of all pregnant mothers in New Zealand.

Competing interests:
Nil.

Acknowledgements:
The authors would like to thank Sue Taft, Child Health and Immunisation Coordinator, Rotorua Area Primary Health Services (RAPHS) for assistance with data collection and Fiona Lafferty, Community Child Health Nurse, Pinnacle Midlands Health for her contribution on how the process works in Taupo. We also acknowledge the lead maternity carers and GP practices in the Lakes DHB region for their support.

Author information:
Emma J Deverall, Obstetrician, Lakes District Health Board, Rotorua; Honorary Senior Lecturer, Department of Obstetrics and Gynaecology Faculty of Medical and Health Science, University of Auckland, Auckland; Benjamin Gilmore, Medical Student, Faculty of Medical and Health Sciences, University of Auckland, Auckland; Sam Illing, Rural Hospital Trainee, Bay of Plenty District Health Board, Whakatane; Roshini Peiris-John, Senior Lecturer, Faculty of Medical and Health Sciences, University of Auckland, Auckland.

Corresponding author:
Emma Deverall, Women Child and Family Corridor, Rotorua Hospital, Private Bag 3023, Lakes District Health Board.
emma.deverall@lakesdhb.govt.nz

URL:
http://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2018/vol-131-no-1473-13-april-2018/7541

REFERENCES:

1. World Health Organisation. Vaccine-preventable disease monitoring system 2017. Available at: http://www.who.int/immunization/monitoring_surveillance/data/gs_gloprofile.pdf?ua=1 Accessed: 8 August 2017.
2. Ministry of Health. Pertussis Control Strategies 2015: A consistent approach for New Zealand. Wellington: Ministry of Health, 2015.
3. Nowlan M, Turner N, Kiedrzynski T, et al. Pertussis control strategies: A consistent approach for New Zealand: Synopsis of Ministry of Health Workshop, April 2015. NZ Med J. 2016; 129(1433):78–85.
4. Healy CM, Munoz FM, Rench MA, et al. Prevalence of pertussis antibodies in maternal delivery, cord, and infant serum. J Infect Dis. 2004; 190(2):335–40.
5. Dabrera G, Amirthalingam G, Andrews N, et al. A Case-Control Study to Estimate the Effectiveness of Maternal Pertussis Vaccination in Protecting Newborn Infants in England and Wales, 2012–2013. Clin Infect Dis. 2015; 60(3):333–7.
6. Amirthalingam G, Andrews N, Campbell H, et al. Effectiveness of maternal pertussis vaccination

in England: an observational study. Lancet. 2014; 384(9953):1521–8.

7. Terranella A, Asay GRB, Messonnier ML, et al. Pregnancy Dose Tdap and Postpartum Cocooning to Prevent Infant Pertussis: A Decision Analysis. Pediatrics. 2013; 131(6):E1748–E56.

8. World Health Organisation. WHO vaccine-preventable diseases: monitoring system. 2017 global summary. Available at: http://apps.who.int/immunization_monitoring/globalsummary/countries?countrycriteria%5Bcountry%5D%5B%5D=NZL&commit=OK# Accessed: 7 August 2017.

9. World Health Organisation. Number of reported mumps cases, New Zealand 2016. Available at: http://apps.who.int/immunization_monitoring/globalsummary/JPG/NZLMUMPS_Cases.jpg Accessed: 7 August 2017.

10. Reynolds G, Grant N, Thornley S, Hale M. Low uptake of maternal vaccination in notified pertussis cases aged less than 20 weeks. NZ Med J. 2017; 130(1449):72–4.

11. Hill L. Factors Influencing Women's Decisions about Having the Pertussis Containing Vaccine during Pregnancy [Masters of Health Science]. Christchurch, New Zealand: University of Otago; 2015.