

A review of pertussis cases admitted to a Canadian pediatric centre – the need for strategies to protect young infants. *Can J Infect Dis Med Microbiol* 2013;24(3):162-163.

To the Editor,

The incidence of *Bordetella pertussis* infections has been increasing (1-4). The Centers for Disease Control and Prevention (Georgia, USA) has reported the greatest number of cases since World War II, including epidemics in Washington, Minnesota and Wisconsin (USA) (3,4). Canada has also reported significant increases in disease activity in British Columbia, Ontario and New Brunswick (5-7). Recent studies suggest that pertussis vaccine immunity may not be as long-lasting as previously believed (8). Pertussis often goes undiagnosed in adults, who are often the source of infection for young infants; however, it is children (particularly infants too young to be fully immunized) who typically carry the highest disease morbidity, and the vast majority of pertussis-related deaths occur among infants <1 year of age (9,10).

Due to the increased focus on pertussis internationally, as well as the number of infant pertussis cases this year, we reviewed all pediatric hospitalizations due to pertussis at the Winnipeg Children's Hospital (WCH, Winnipeg, Manitoba) in the past five years. The review was also used as part of a survey-based study of postpartum women to determine potential hurdles to preventive measures for the protection of infants <3 months of age in Manitoba.

Children (<18 years of age) with a laboratory-confirmed diagnosis (nucleic acid detection) of pertussis admitted to WCH from January 1, 2007 to December 31, 2011 were included. WCH is the only major tertiary care centre for pediatrics (86 beds) for Manitoba and the regions of eastern Saskatchewan, northwestern Ontario and southern Nunavut, with a total catchment area of >1.2 million people. The cases were identified through a search of medical records using the *International Classification of Diseases – Ninth and Tenth Revision* codes for pertussis (033.0), in addition to a review of available pediatric infectious diseases consultant service databases.

The charts were abstracted for relevant data including age, duration of admission, intensive care unit care, immunization history, sick contacts, symptoms, laboratory results, management and complications. A spreadsheet (Excel 2007, Microsoft Corporation, USA) was used for descriptive statistics.

Forty-two children (18 male) were hospitalized due to pertussis, all were <1.5 years of age and from various regions in Manitoba. The mean age at admission was 83 days. The interquartile range (IQR) was 27.75 to 80.75 days of age at admission. The most common symptom at presentation was cough (86% of cases; mean duration of nine days; IQR four to 13.3 days) (Figure 1).

In 21 (50%) of the cases, patients had a sick contact at home; however, their symptoms were most often unspecified. Only three of these were stated to have experienced a cough illness, of whom two were tested and found positive for pertussis. Of these 21 cases, the most frequently reported sick contacts were siblings (60%) and the mother (33%). Twenty-four children (55%) were <2 months of age and, therefore, had not received their first diphtheria, tetanus, acellular pertussis (DTaP) dose. Only two children had received their second primary series dose and only one received the full three doses.

Most (67%) were admitted to the ward and 33% to the perinatal intensive care unit either on presentation or shortly after admission. The mean length of admission was 17 days (IQR five to 21.5 days). All patients were treated with a full course of a macrolide (either azithromycin for five days or erythromycin for 14 days), except one patient in whom the treatment was unspecified. Many patients

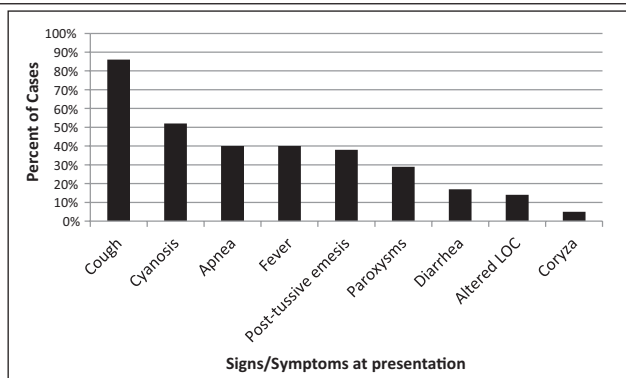


Figure 1 Reported signs and symptoms at presentation for the 42 pediatric hospitalizations due to pertussis infections from 2007 to 2011 at the Winnipeg Health Sciences Centre, Winnipeg, Manitoba. LOC Level of consciousness

(60%) required supplemental oxygen. Complications identified included respiratory failure requiring intubation and ventilation (24%), dehydration requiring intravenous fluids (19%) and hernia (2%). The mean length of intubation was 6.3 days, with an IQR of two to seven days. There were no deaths during the study period, although one involving a four-week-old infant did occur outside the study period in the summer of 2012.

Our review of children hospitalized with pertussis at WCH demonstrated that all cases occurred in very young infants, with most too young to have received their primary immunization series. These infants, on average, experienced considerable lengths of stay in hospital, with one-quarter requiring intubation and mechanical ventilation. These infants frequently had exposure to an ill household contact. A limitation of our retrospective review was the frequent lack of confirmation of pertussis or immunization status in these contacts. In addition, our sample sizes were small and may be a reflection of a single-centre review. Despite these aspects, the review reinforces the fact that young infants are at greatest risk for severe morbidity and mortality from pertussis. Our centre's experience would appear to mirror what has been described across Canada following implementation of acellular pertussis immunization programs, although we did not review the pre-acellular vaccine era. Bettinger et al (11) noted that data from the Immunization Monitoring Program ACTive (IMPACT) surveillance network revealed a shift in the pertussis epidemiology following this change. After 1999, the incidence decreased in children <5 years of age as well as the reported numbers of pertussis-associated encephalitis cases. In the same period, there was an increase in the proportion of cases <3 months of age. One notable difference in our review was that the mean length of admission was almost double, while length of intensive care unit stay was similar. This difference was also apparent when compared with IMPACT data collected before 1997 (12). This may be due to differences in patient populations, comorbid conditions or local practice patterns.

There continues to be a need to devise and implement strategies to protect these most vulnerable of patients. Ideally, this should involve increasing herd immunity through several approaches. Maintaining high levels of coverage with DTaP in children and Tdap in adolescents, as well as improving on the extremely poor uptake of Tdap in adults should be priorities (13). Waning of vaccine immunity may require changes in the schedule of boosters (8). 'Cocooning' of newborn infants by immunizing all close adult contacts postpartum has been recommended by the Advisory Committee on

Immunization Practices (ACIP) since 2005 (14). Given difficulties in implementation, insufficient protection for the first few weeks of life and lack of effectiveness data, the ACIP recommended immunization during pregnancy after 20 weeks' gestation, with postpartum immunization if this is missed (14). Recently, this was further updated, with a recommendation to administer Tdap in each subsequent pregnancy (15). Recent publications have not identified any unusual patterns or safety concerns (14,16). Currently, the National Advisory Committee on Immunizations recommends that vaccination in pregnancy should be deferred until after delivery unless the disease risk outweighs the risk of vaccine to both mother and fetus (17). In Manitoba, Tdap is recommended as a single booster for teens and adults, especially those in contact with high-risk groups, such as young infants, as of July 2012 (18). At our centre, there is no formal cocooning or maternal immunization Tdap program yet in place, but we anticipate that this could change based on local and national disease epidemiology, and if the National Advisory Committee on Immunizations recommends a maternal immunization strategy similar to that followed by the ACIP. We are currently surveying mothers on the postpartum floors of the two major teaching centres in Winnipeg on their knowledge and attitudes toward pertussis, pertussis immunization, and preferences and perceived barriers toward potential future maternal immunization strategies (pregnancy versus cocooning). Our goal is to use this information to advise stakeholders about best strategies for and potential roadblocks to upcoming pertussis prevention plans because uptake of other recommended immunizations during pregnancy, such as influenza, has been sub-optimal (19). We believe that a multipronged approach to prevent pertussis in infants is needed, and that further data regarding clinical efficacy and optimal timing of maternal Tdap immunization, as well as the impact of any potential blunting of infant immune responses to DTaP, will help to optimize this plan.

Matias Wengiel BSc(Hon) MD(c)

Faculty of Medicine

Sergio Fanella MD FRCPC FAAP DTM&H

Faculty of Medicine, Department of Pediatrics and Child Health,
University of Manitoba,
Winnipeg, Manitoba

REFERENCES

- McIntyre P, Wood N. Pertussis in early infancy: Disease burden and preventative strategies. *Curr Opin Infect Dis* 2009;22:215-23.
- Forsyth K, von Konig C, Tan T, Caro J, Plotkin S. Prevention of pertussis: Recommendations derived from the second Global Pertussis Initiative roundtable meeting. *Vaccine* 2007;25:2634-42.
- Centers for Disease Control. Pertussis (Whooping Cough). CDC, 2012. <www.cdc.gov/pertussis/outbreaks.html#articles> (Accessed July 31, 2012).
- Centers for Disease Control and Prevention. Pertussis Epidemic – Washington 2012. *MMWR* 2012;61:517-22.
- Fraser Health. Medical Health Officer Updates. <www.fraserhealth.ca/your_health/mhouupdates/2012/pertussis-outbreak-worsens-in-washington-state-and-continues-in-fraser-health> (Accessed November 27, 2012).
- Government of New Brunswick. Communicable Disease Control. <www2.gnb.ca/content/gnb/en/departments/ocmoh/cdc/content/whooping_cough.html> (Accessed November 27, 2012).
- Public Health Ontario. Monthly Infectious Diseases Surveillance Report. <www.oahpp.ca/resources/documents/2012%2006%20PHO%20Monthly%20Report.pdf> (Accessed November 27, 2012).
- Witt M, Katz P, Witt D. Unexpectedly limited durability of immunity following acellular pertussis vaccination in preadolescents in a North American outbreak. *Clin Infect Dis* 2012;54:1730-5.
- Paisley R, Blaylock J, Hartzell J. Whooping cough in adults: An update on a reemerging infection. *Amer J Med* 2012;125:141-3.
- Healy C, Rench M, Baker C. Implementation of cocooning against pertussis in a high-risk population. *Clin Infect Dis* 2011;52:157-62.
- Bettinger J, Halperin S, De Serres G, Scheifele D, Tam T. The effect of changing from whole-cell to acellular pertussis vaccine on the epidemiology of hospitalized children with pertussis in Canada. *Pediatr Infect Dis J* 2007;26:31-5.
- Halperin S, Wang E, Law B, et al. Epidemiological features of pertussis in hospitalized patients in Canada, 1991-1997: Report of the Immunization Monitoring Program – Active (IMPACT). *Clin Infect Dis* 1999;28:1238-43.
- Centers for Disease Control and Prevention. Tetanus and pertussis vaccination coverage among adults aged ≥18 years United States, 1999 and 2008. *MMWR Morb Mortal Wkly Rep* 2010;59:1302-6.
- Centers for Disease Control and Prevention. Updated recommendations for use of tetanus toxoid, reduced diphtheria toxoid and acellular pertussis vaccine (Tdap) in pregnant women and persons who have or anticipate having close contact with an infant aged <12 months; Advisory Committee on Immunization Practices (ACIP), 2011. *MMWR Morb Mortal Wkly Rep* 2011;60:1424-6.
- Centers for Disease Control and Prevention. Media Advisory. <www.cdc.gov/media/releases/2012/a1024_Tdap_immunization.html> (Accessed November 27, 2012).
- Zheteyeva Y, Moro P, Tepper N, et al. Adverse event reports after tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccines in pregnant women. *Am J Obstet Gynecol* 2012;207:59e1-7.
- Public Health Agency of Canada. Canadian Immunization Guide Seventh Edition – 2006. <www.phac-aspc.gc.ca/publicat/cig-gci/p04-pert-coqu-eng.php> (Accessed November 27, 2012).
- Government of Manitoba. News Releases. <<http://news.gov.mb.ca/news/index.html?item=15054>> (Accessed November 12, 2012).
- Gorman J, Brewer N, Wang J, Chambers C. Theory-based predictors of influenza vaccination among pregnant women. *Vaccine* 2012; <<http://dx.doi.org/10.1016/j.vaccine.2012.10.064>> (Accessed February 6, 2013).