Journal of Hospital Infection 90 (2015) 163–166

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin

Short report

Bordetella pertussis infection in paediatric healthcare workers

K.S.A. Cunegundes*, M.I. de Moraes-Pinto, T.N. Takahashi, D.A.B. Kuramoto, L.Y. Weckx

Department of Pediatrics, Federal University of São Paulo, São Paulo, SP, Brazil

ARTICLE INFO

Article history:
Received 14 April 2014
Accepted 14 February 2015
Available online 28 March 2015

Keywords:
Healthcare workers
Infection
Pertussis
Serology

SUMMARY

An increased incidence of pertussis has been observed recently in adults, and healthcare workers (HCWs) are considered a risk group for transmission to infants. Prevalence of recent pertussis infection was assessed in HCWs from a paediatric department of a tertiary care hospital in Brazil. Serum pertussis toxin IgG antibodies were measured by enzyme-linked immunosorbent assay. Of 388 HCWs included in the analysis, 6.4% had serology suggestive of recent infection. Medical residents [odds ratio (OR): 4.15; 95% confidence interval (CI): 1.42–12.14; $P = 0.009$] and those working >40 h a week (OR: 3.29; 95% CI: 1.17–9.26; $P = 0.024$) had increased risk of pertussis infection.

Introduction

An increasing incidence of pertussis has been reported in adolescents and adults in some countries. These groups are recognized as playing an important role in transmitting *Bordetella pertussis* infection to incompletely immunized young infants.[1] Pertussis among healthcare workers (HCWs) is of special concern because of the potential nosocomial transmission to high-risk patients and other HCWs.[2]

In the State of São Paulo, Brazil, pertussis incidence was stable until 2010 when it increased in infants from 29 per 100,000 to 133 per 100,000 in 2011. However, this trend has not been observed in older age groups.[3]

The aims of this study were to assess the prevalence of recent pertussis infection in HCWs working in the paediatric department of a tertiary care university hospital and to examine the factors associated with increased risk of infection in this group.

Methods

This study was conducted in the paediatric department of São Paulo Hospital of the Federal University of São Paulo, Brazil, a 740-bed tertiary-care referral hospital, from October to December 2011. The department employs 689 HCWs: 343 physicians, 82 nurses, and 222 nursing assistants.

A previous survey reported a prevalence of 50% of high-titre pertussis antibody in HCWs.[4] Assuming a confidence level of 95% and statistical power of 80%, a minimum sample size of 385 participants was required to estimate the prevalence of pertussis infection in HCWs.

* Corresponding author. Address: Rua Borges Lagoa, 770, São Paulo, CEP 04038-001, Brazil. Tel.: +55 (11) 5576 4993.
E-mail address: kelly.sac@hotmail.com (K.S.A. Cunegundes).

http://dx.doi.org/10.1016/j.jhin.2015.02.016

Physicians, nurses, and nursing assistants working in the paediatric department were contacted and asked to participate in the study. HCWs were included until the minimum sample size was achieved.

The Ethics Research Committee of Federal University of Sao Paulo (0558/11) approved the study protocol and written informed consent was obtained from all participants.

A self-completed questionnaire was used to assess: demographic characteristics, pertussis vaccination during childhood and adulthood, history of pertussis, cough symptoms (more than 14 days in the previous 12 months), contact with pertussis cases (suspected or confirmed) in the previous 12 months, and household contact with children.

As high antibody titres of IgG anti-pertussis toxin could be a result of recent vaccination, participants were excluded from the analysis if they had been vaccinated with adult-formulation tetanus–diphtheria toxoid and acellular pertussis vaccine (Tdap) during the previous 12 months.[5]

A blood sample was collected from each HCW. Quantitative IgG antibodies to pertussis toxin were determined by a commercial enzyme-linked immunosorbent assay (ELISA) (SERION ELISA *classic* Bordetella pertussis-IgG, Virion\Serion, Würzburg, Germany).

A cut-off value of 62.5 IU/mL was employed as suggestive of pertussis infection within the previous 12 months. The reported sensitivity and specificity of this cut-off as an indication of recent pertussis infection are 80% and 95%, respectively.[5]

Statistical analysis was undertaken using Minitab 16 (Minitab, Inc., State College, Pennsylvania, USA). Categorical variables were analysed using the Pearson chi-square test or Fisher's exact test. Continuous variables were analysed using Student's *t*-test. Variables were incorporated into the multiple logistic regression analysis when they were significantly associated with recent pertussis infection in the univariate analysis. $P < 0.05$ was considered significant.

Results

Among the 689 physicians, nurses, and nursing assistants working in the paediatric department (paediatric ward, neonatal unit, paediatric intensive care unit (PICU), emergency and outpatient clinics), 414 HCWs were contacted, and only 23 (5.5%) refused to participate in this study. Three were excluded because they reported having been vaccinated with Tdap in the previous 12 months, leaving 388 to be studied. The characteristics of participants are shown in Table I.

Overall, 6.4% of HCWs had pertussis serology suggestive of infection in the past 12 months (Table II).

Medical residents were analysed as a group because they work as trainees within the system and are not limited to any specific area cited above. They had the highest rate of recent pertussis infection at 19.5%.

HCWs from the emergency clinic and PICU had an intermediate prevalence of recent infection (6.5% and 9.3%, respectively) when compared with other groups of HCWs. The data were analysed in three groups: low prevalence (<5%) in neonatal unit, outpatient clinics and paediatric wards; intermediate prevalence (5–10%) in emergency and PICU; and high prevalence (>10%) which were the medical residents.

Table I
Characteristics of healthcare workers included in the study ($N = 388$)

Characteristic	Value
Mean age (years) (range)	36.4 (21–67)
Female	332 (85.4%)
Occupation	
Physician	201 (51.8%)
Nurse	64 (16.5%)
Nursing assistant	123 (31.7%)
Patient care area/group	
Outpatient clinics	155 (39.9%)
Paediatric wards	78 (20.1%)
Emergency	46 (11.8%)
Medical residents in paediatrics	41 (10.5%)
Paediatric intensive care unit	43 (11.0%)
Neonatal unit/postpartum unit	25 (6.4%)
Weekly working hours >40	191/388 (49.2%)
Previous pertussis vaccine in childhood with at least three DTwP doses	253/302[a] (83.7%)
Knowledge on adult pertussis vaccine (Tdap)	163/388 (42.4%)
Previous vaccination with Tdap	28/388 (7.2%)
History of whooping cough	51/388 (13.1%)
Cough illness lasting ≥2 weeks in the previous 12 months	67/385[a] (17.4%)
Contact with whooping cough patients in the previous 12 months	223/377[a] (59.1%)
Household contact with children	152/387[a] (39.2%)

DTwP, diphtheria, tetanus and whole-cell pertussis vaccine.
[a] Not all participants answered this question.

The variables associated with pertussis infection were patient care area, weekly working hours, and years since graduation (Table II).

Comparing HCWs who reported, and those who did not report, cough in the previous 12 months, no difference in geometric mean antibodies was found (11.1 versus 11.6 IU/mL, *t*-test, $P = 0.338$).

On multivariate analysis, medical residents showed an increased risk of pertussis infection when compared with HCWs from other areas (OR: 4.15; 95% CI: 1.42–12.14; $P = 0.009$). HCWs from emergency clinic and PICU (OR: 2.49; 95% CI: 0.90–6.89; $P = 0.080$) and those who worked >40 h per week (OR: 3.29; 95% CI: 1.17–9.26; $P = 0.024$) also had a higher risk of pertussis infection.

Discussion

This study has found antibody levels suggestive of recent pertussis infection in 6.4% of paediatric HCWs. A wide range of rates of pertussis infection in HCWs have been reported by serological surveys, partly because different antigens and cut-off values were used, but also due to the different epidemiological conditions. Incidence rates vary from 1.3% among US medical residents to 6% among German paediatric personnel and 22% among emergency department staff in Australia.[6–8]