Vaccine 36 (2018) 214–219

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

A quality improvement initiative to increase Tdap (tetanus, diphtheria, acellular pertussis) vaccination coverage among direct health care providers at a children's hospital

Changhong Jiang [a], LaQuita Whitmore-Sisco [a], Aditya H. Gaur [a,b,c], Elisabeth E. Adderson [b,c,*], for the Tdap Working Group [1]

[a] Occupational Health Program, St. Jude Children's Research Hospital, 262 Danny Thomas Place, Memphis, TN 38105, USA
[b] Department of Infectious Diseases, St. Jude Children's Research Hospital, 262 Danny Thomas Place, Memphis, TN 38105, USA
[c] Department of Pediatrics, University of Tennessee Health Sciences Center, 50 N. Dunlap, Memphis, TN 38103, USA

ARTICLE INFO

Article history:
Received 7 July 2017
Received in revised form 14 November 2017
Accepted 27 November 2017
Available online 6 December 2017

Keywords:
Pertussis
Vaccination
Health care provider
Infection prevention
Quality improvement

ABSTRACT

Objectives: Health care providers (HCP) are at high risk of acquiring and transmitting pertussis to susceptible family members, co-workers, and patients. Public health authorities recommend administering a single dose of Tdap (tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis) vaccine to all adults, including HCP, to increase adult immunity to pertussis. We set a quality improvement goal to increase Tdap vaccination coverage among HCP who provided direct patient care at a children's hospital from 58% to 90% over 18 months.
Design: A multidisciplinary working group comprised of Occupational Health Program (OHP) staff and representatives of various medical services drew from a variety of qualitative methods and previous studies of vaccination programs in the healthcare system to understand barriers to Tdap vaccination within the institution and to develop interventions to increase vaccination rates.
Interventions: Interventions included changes to OHP processes, a general education campaign, improved access to vaccine, and personal engagement of HCP by task force members.
Results: Overall vaccination rates increased to 90% over 15 months, a rate that has been sustained by systematically assessing new employees' vaccination status and vaccinating those without documentation of previous Tdap vaccination.
Conclusions: Tdap vaccination coverage in our institution was significantly increased by an intensive, multipronged educational campaign, and by improving processes of screening and vaccination of HCP. The use of direct engagement of vaccine hesitant populations to increase vaccination rates warrants further study.

1. Introduction

Pertussis is a highly transmissible respiratory infection caused by *Bordetella pertussis*. It is endemic throughout the world, including in the United States, where outbreaks have been reported with increasing frequency in the last decade [1]. Pertussis is associated with substantial morbidity and mortality in children <1 year of age [1]. Older children, adolescents and adults with pertussis, even if otherwise healthy, are also at risk of debilitating cough, hospitalization, and serious complications [2]. Morbidity related to pertussis in adults includes pneumonia in up to 5% of those infected, and rib fractures associated with coughing in up to 4% [2].

The incidence of pertussis in the United States fell dramatically after the introduction of pertussis vaccine in 1940 but, of concern, has progressively increased since the early 1980s [3]. The cause of this resurgence is multifactorial, and includes the declining protective immunity over time after vaccination [3,4]. While the short-term efficacy of current pertussis vaccines is good, this protection wanes relatively quickly following vaccination [5,6]. Older children and adults who are susceptible to infection play an important role in the transmission of pertussis [6,7].

* Corresponding author at: Mailstop 320, 262 Danny Thomas Place, Memphis, TN 38105, USA.
E-mail address: Elisabeth.Adderson@stjude.org (E.E. Adderson).

[1] The Tdap Working Group included Patrick K. Campbell, MD, PhD, Matthew J. Ehrhardt, MD, Kenice Ferguson-Paul, MD, Daniel M. Green, MD, Patricia M. Flynn, MD, Diego Hijano, MD, Melissa M. Hudson, MD, Nicholas D. Hysmith, MD, Seth Karol, MD, Katherine Knapp, MD, Wing Leung, MD, PhD, Monika Metzger, MD, R. Ray Morrison, MD, Sheena Mukkada, MD, Alberto Pappo, MD, Raul C. Ribeiro, MD, Giles W. Robinson, MD, Jeff Rohman, MS, Jeffrey E. Rubnitz, MD, St. Jude Children's Research Hospital.

https://doi.org/10.1016/j.vaccine.2017.11.071
0264-410X/

Health care providers (HCP) are at high risk of acquiring and transmitting pertussis to susceptible family members, co-workers, and patients. Kuncio et al., for example, reported that occupational exposures of HCP to pertussis occur frequently in pediatric health care settings, noting 1193 confirmed HCP pertussis exposures associated with 219 pediatric index cases over a 9-year study period [8]. In addition to the morbidity and direct costs to HCP, occupational pertussis exposures and resultant disease have substantial indirect costs, including those related to diagnostic testing, the prescription of antimicrobials, and the time and effort needed by occupational health staff and infection preventionists to manage cases and exposures. Estimates of the total costs of health care-associated pertussis outbreaks in institutions have ranged from $81,382–$263,357 (approximately $360 per patient) [9–11]. Vaccinating HCP against pertussis not only may protect susceptible patients and co-workers from infection, but is predicted to be cost effective, with an estimated 2.4–4.0-fold return on investment [9,12].

Despite these facts, Tdap vaccination coverage among HCP has been suboptimal [13,14]. Miller and colleagues noted that only 12% of HCP in the 2007 National Immunization Survey and 26.9% in the 2011 survey reported having received Tdap vaccination [15]. Vaccination rates among St. Jude Children's Research Hospital (SJCRH) employees were reviewed in December 2015, following several pertussis exposures in the hospital. At that time only 58% of HCPs who provided direct patient care, defined as activities involving direct contact with the patient and/or exposure to the patient care environment (such as patient room cleaning), had a documented history of Tdap vaccination. Poor uptake of other vaccines to prevent infections in the health care setting, most notably seasonal influenza vaccine, has been attributed to poor understanding of diseases and indications for vaccination, and to obstacles that prevent convenient and easy access to vaccine [16]. We theorized that these factors might also account for the poor uptake of Tdap vaccine in our institution. Interventions to improve vaccination rates in hospital settings have focused, with variable success, on mitigating obstacles to vaccination and/or instituting mandatory vaccination policies [17–20]. This quality improvement project was conducted to determine whether HCP compliance with recommendations for pertussis vaccination (Tdap vaccine) could be improved by education and changes in vaccination processes. We set a quality improvement (QI) goal to increase the Tdap vaccination coverage among HCPs who provided direct patient care from 58% to 90% in 18 months.

2. Methods

SJCRH is a 77-bed freestanding children's hospital. The facility includes an 8-bed intensive care unit, 130 single examination rooms in 19 ambulatory clinics, a 24-h infusion center/after hours clinic, and an outpatient procedures area. Approximately 6800 children and adolescents with cancer, hematological disorders, and human immunodeficiency virus, and survivors of childhood cancer are evaluated yearly. SJCRH employs approximately 4472-persons, including 1090 who provide direct patient care. The Occupational Health Program (OHP) consists of one medical director and 4 registered nurses. Services provided by the OHP include pre-employment health evaluations, a comprehensive vaccination program, illness and injury evaluations, and management of employees exposed to potentially infections agents. Tdap vaccination has been offered at no cost to employees since 2006, but was not systematically promoted until 2015.

The QI Tdap Working Group was comprised of staff of the SJCRH OHP and representatives of various institutional medical services (e.g. Oncology, Infectious Diseases). Members acted as liaisons with their departments and divisions, in their administrative capacity as supervisors of key clinical operations (e.g. Medical Directors of Respiratory Therapy and Anesthesia), and as educators. Hospital senior management both championed and participated in the project but team members and staff of the OHP had no dedicated financial or technical support for the project. The team drew from a variety of qualitative methods, previous studies of the characteristics of vaccination programs in the health care system, and the model of seasonal influenza vaccination of HCP to develop an understanding of barriers to Tdap vaccination within the institution and to develop interventions to increase vaccination rates. The Model for Understanding Success in Quality (MUSIQ) framework was used to assess contextual features of the effort that promoted its success [21]. We used run charts to visually assess vaccination rates overall and variation among occupational groups. Vaccination rates before and after the project were compared using Chi square tests.

3. Strategy

Opportunities for improvement were identified by developing high level process maps and interviewing persons involved in occupational health and patient care processes. Leaders in hospital administration, nursing, and human resources were engaged and provided key support to the effort. In planning interventions, the working group drew extensively from institutional and published experience with seasonal influenza vaccination campaigns. SJCRH has, historically, favored educational initiatives and incentives to promote employee vaccination initiatives over mandatory vaccination policies, and the group elected to begin improvement efforts with similar interventions.

An initial review of OHP processes revealed that the database containing employee vaccination data was incomplete, and that structure was not optimal for frequent analysis of vaccination data. The OHP, therefore, manually reviewed vaccination logs and revised data collection systems to permit more comprehensive and automated reporting of employees' vaccination status. New work processes ensured Tdap vaccination status was evaluated at every existing or new employee's encounter with the OHP (including new hires during employment health screening) and, if absent, vaccination with Tdap vaccine at that encounter was encouraged. Staff who had recently given birth were identified and asked to discuss Tdap vaccination with their health care providers or provide a record of vaccination if Tdap had been administered during pregnancy. Reporting forms were further modified to include employee job classification in order to identify and target any important differences in vaccine uptake among different categories of care providers. These included physicians, nurse practitioners, nurses, allied health providers (e.g. psychologists, pharmacists), and unlicensed care providers (e.g. nursing care and patient care attendants).

An educational campaign targeting HCP included electronic bulletin boards prominently located throughout the institution that featured the "Bug of the Month – Pertussis" and the "Drug of the Month – Tdap vaccine". Access to Vaccine Information Sheets was provided through a link on the OHP intranet web page. Information on vaccines and vaccination recommendations were regularly included in the hospital's daily email newsletter for the duration of the project.

Prior to the QI effort, Tdap vaccination was usually provided at the OHP office, in a building that was physically distant from sites where patient care was conducted. Easier access to vaccine was promoted by offering Tdap at temporary vaccination clinics in high traffic patient care areas, such as outside the hospital cafeteria, on