

Health-Care Personnel Pertussis and Tdap Vaccination

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Evaluating Vaccinating Health-care Personnel with Tdap

- ❑ **Tdap vaccine**
 - Second dose of Tdap
 - Effectiveness
- ❑ **Pertussis in health-care personnel (HCP)**
 - Burden of disease
 - Transmission
 - Exposure management
- ❑ **Impact of vaccinating HCP**
- ❑ **WG conclusions**
- ❑ **Discussion**

Second dose of Tdap is safe and immunogenic.

Response to Second Tdap at 5- or 10-yr Interval

Safety and Immunogenicity

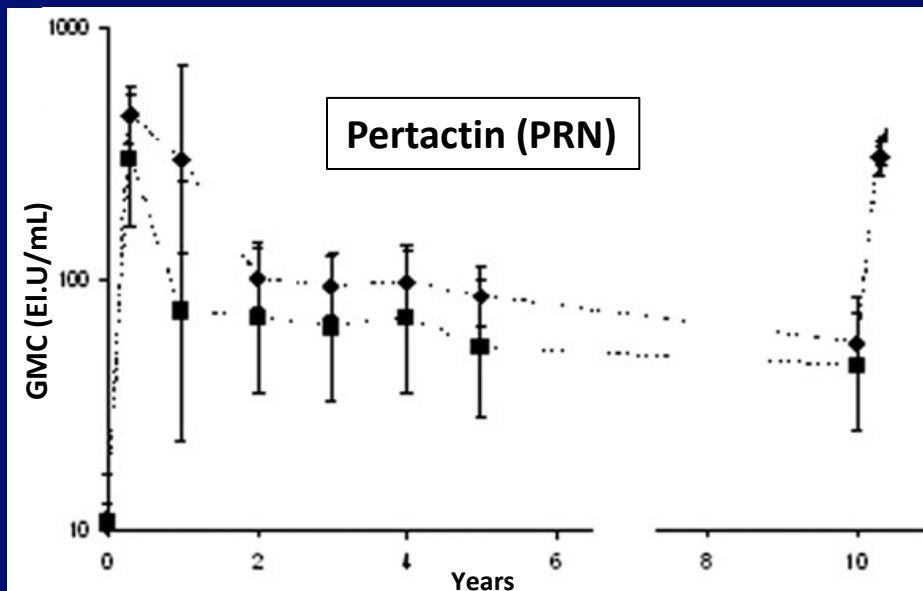
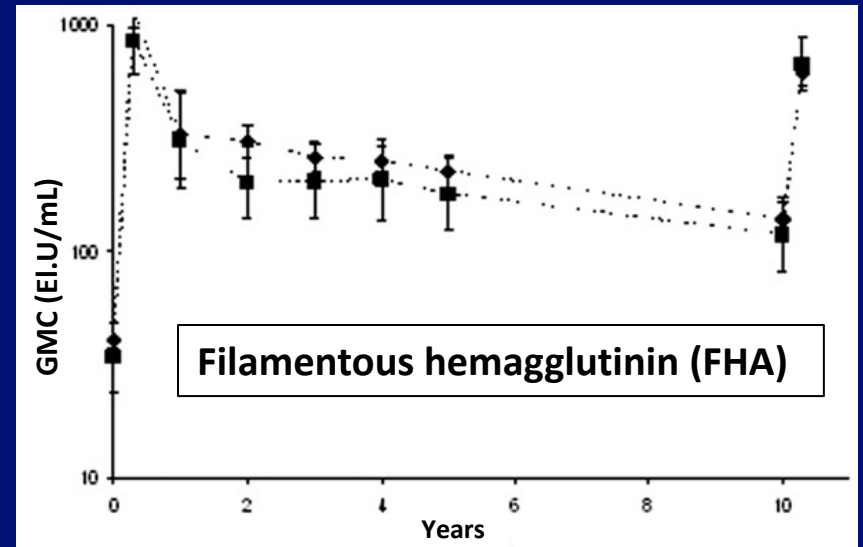
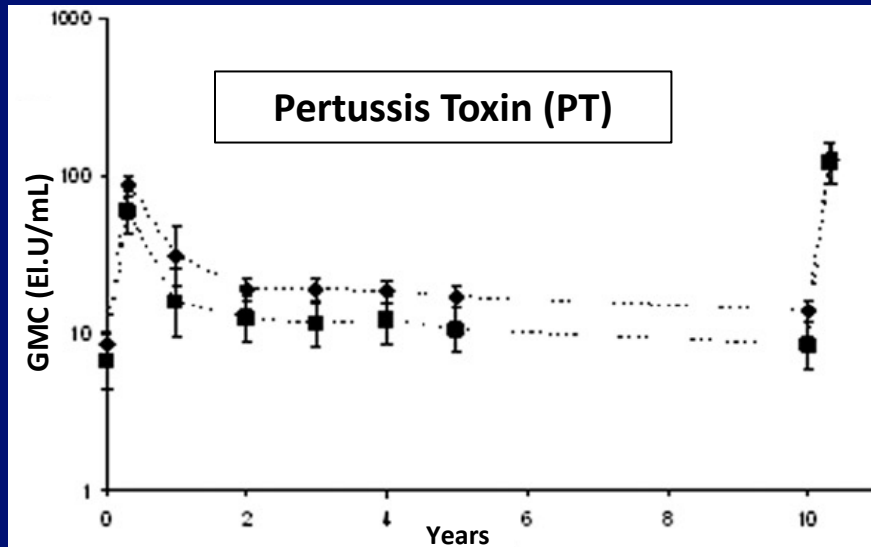
□ Safety

- Generally comparable after first Tdap
- Majority of local and systemic adverse events: mild to moderate; self-limited
- Of few serious adverse events reported, none related to second Tdap
- Rates comparable at the 5- and 10-year interval

□ Immunogenicity

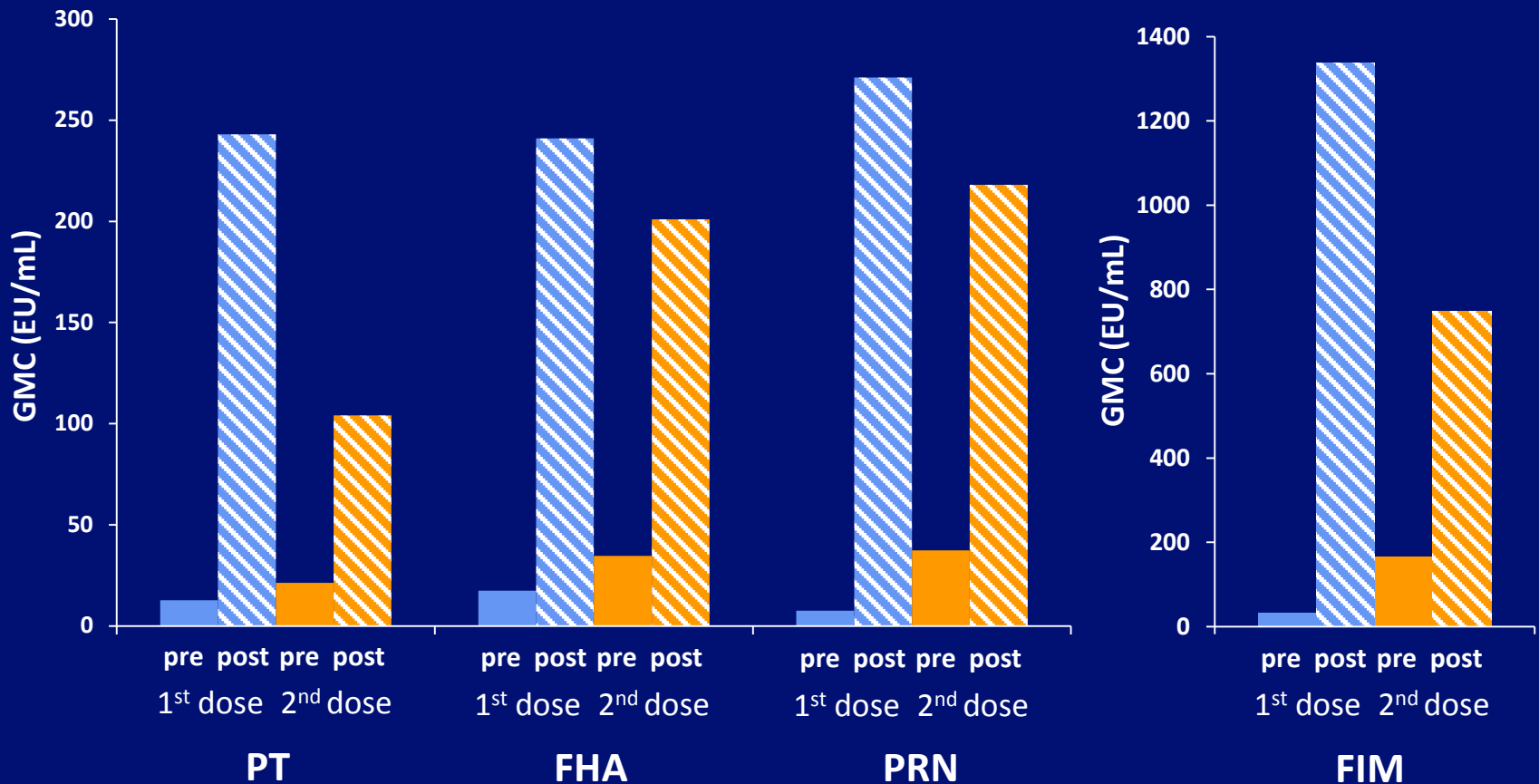
- Tetanus and Diphtheria – essentially 100% protected
- Pertussis
 - Response at 5 and 10 year intervals similar
 - Comparable to historic and contemporaneous first dose

Pertussis: Antibody GMCs Over 10 Years Before and After First Tdap and 1 Month After Second Tdap (Boostrix) Adults (n=164)



Diamonds = Tdap group
 Squares = Td + ap group
 Error bars = 95% CIs

Pertussis GMC Concentration Before and After First and Second Tdap (Adacel) After 5-year Interval



1st dose n=381-451
2nd dose n=425-451

PT: pertussis toxin; FHA: filamentous hemagglutinin;
PRN: pertactin; FIM: fimbriae types 2&3

Sanofi Pasteur – revaccination with Adacel

- ❑ **Adults administered 9-11 years after previous Tdap**
 - US study completed and presented to WG and ACIP (2013)
 - Canadian study will finish later this year
 - Plans to submit to FDA

GSK Revaccination Program for Boostrix



- GSK is conducting clinical studies in the US for revaccination after prior vaccination with Boostrix
 - GSK recently completed a revaccination study of young adults, 20-28 years old, who were initially vaccinated 10 years earlier when they were adolescents (11-18 years old).
 - Revaccination study in adults, 28-73 years old who were initially vaccinated approximately 9 years ago, when they were 19-64 years old, will begin next year.
 - Plans to submit the data to the FDA for consideration of a label update for BOOSTRIX will be dependent on pertussis epidemiology and ACIP recommendations
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Tdap vaccine is effective but protection starts to wane within three years.

Estimates of Tdap vaccine effectiveness in adolescents

Author	Year	Country	Age Range	Study Design	Vaccine Effectiveness (95% CI)
<u>Primed with mixed whole and acellular pertussis vaccines</u>					
Rank	2009	Australia	12-19	Screening	78 (61-88)
Wei	2010	St. Croix	11-18	Cohort	66 (-36-91)
Skoff	2011	US	11-17	Case-Control	72 (39-87)

Rank C, et al. *Pediatr Infect Dis J.* 2009 28(2):152-3; Wei SC, et al. *CID* 2010 51(3):315-321; Skoff et al. *NIC* 2011, Washington, DC;

Tdap duration of protection among populations born during 1998-2000, that only received acellular vaccines, Wisconsin, 2012

Year of Tdap Receipt	Vaccine Effectiveness, % (95% CI)
No Tdap	Reference
2012	75.3 (55.2-86.5)
2011	68.2 (60.9-74.1)
2010	34.5 (19.9-46.4)
2009/2008	11.9 (-11.1-30.1)

²Koepke et al. Estimating the Effectiveness of Tdap Vaccine for Preventing Pertussis: Evidence of Rapidly Waning Immunity and Differences in Effectiveness by Tdap Brand. The Journal of Infectious Diseases 2014.

Tdap Vaccination: Unclear Effect on Preventing Transmission

- ❑ Vaccinated person's symptoms not as severe – may be less likely to transmit
- ❑ Australian cocooning evaluation
 - Moderate reduction in risk of pertussis in infants – parents vaccinated at least 4 weeks before infant disease onset
 - Effect seen for mothers vaccinated post-partum
 - Unclear if infant disease risk lower because impact on transmission or lack of exposure to infants
- ❑ Baboon model
 - Acellular pertussis vaccines protect against disease but not infection
 - Bacterial colony counts comparable to unvaccinated animals
 - Transmitted pertussis to other cohoused baboons

Quinn HE et al. Parental tdap boosters and infant pertussis: a case-control study. *Pediatrics*. 2014 Oct;134(4):713-20.

Warfel JM et al. Acellular pertussis vaccines protect against disease but fail to prevent infection and transmission in a nonhuman primate model. *Pediatrics*. 2014 Jan 14;111(2):787-92.

Pertussis occurs in health-care personnel but probably not significant contribution to overall burden of disease

Pertussis in Health-care Personnel

- ❑ Occupational exposures to pertussis occur in health-care settings**
- ❑ Frequency and proximity of patient interaction puts HCP at increased risk for infection with potential to expose many**

Transmission of Pertussis in Health-care Setting

- ❑ **Documented nosocomial infections in health-care settings**
 - Index case: HCP, patient, visitor

- ❑ **Outbreaks in variety of health-care settings**
 - Numerous published reports
 - States recently hard hit with pertussis have not identified or reported health-care outbreaks
 - California, Wisconsin, Washington

Valenti WM, et al. 1980; Steketee RW, et al. 1988; Fisher MC, et al. 1988; Addiss DG, et al. 1991; Christie CDC, et al. 1995; Shefer A, et al. 1995; CDC. MMWR 2005:55(03); Boulay BR, et al. 2006; Pascual FB, et al. 2006; Vranken P, et al. 2006; Bryant KA, et al. 2006; Zivna I, et al. 2007; Baggett HC, et al. 2007; CDC. MMWR 2008:57(22); Leekha S, et al. 2009; Yasmin S, et al. 2013.

Pertussis in Health-care Personnel

❑ Measured risk and burden of disease - not well defined

- National surveillance not collect HCP status for pertussis cases
- Estimated 1.7-fold increased risk for HCPs compared to adult population
 - Based on 384 reported adult pertussis cases; 32 (8%) were HCP
- 1.3 to 3.6% - annual incidence in ED residents, nursing and patient-care staff
 - Based on serologic evidence; some asymptomatic

❑ 1-6% yearly infection rate among adolescents and adults based on serologic studies

Deserres G, et al. Morbidity of pertussis in adolescents and adults. *J Infect Dis* 2000; 182:174-179.

Wright, SW, Decker MD, Edwards KM. Incidence of pertussis infection in healthcare workers. *Infect. Control Hosp. Epidemiol.* 1999. 20:120-123.

Cherry JD. The present and future control of pertussis. *Clin Infect Dis.* 2010 Sep 15;51(6):663-7.

Impact of Pertussis in Health-care Facilities

- ❑ **Pertussis exposure management is complicated, time-consuming and costly**

- ❑ **Cost estimates for investigation and control measures can be substantial**
 - \$84,000-\$98,000: cost of managing pertussis exposures over 12-month period
 - \$74,000-\$263,000 per hospital-based pertussis outbreaks

Zivna I, et al. Impact of Bordetella pertussis exposures on a Massachusetts tertiary care medical system. Infect Control Hosp Epidemiol. 2007 Jun;28(6):708-12.

Calugar A, et al. Nosocomial pertussis: costs of an outbreak and benefits of vaccinating health care workers. Clin Infect Dis. 2006 Apr 1;42(7):981-8.

Baggett HC, et al. Two nosocomial pertussis outbreaks and their associated costs - King County, Washington, 2004. Infect Control Hosp Epidemiol. 2007 May;28(5):537-43.

Yasmin S et al. Healthcare-Associated Pertussis Outbreak in Arizona: Challenges and Economic Impact, 2011. J Ped Infect Dis. 2013 3(1):81-84

Guidance on Post-Exposure Prophylaxis for Health-care Personnel

- ❑ **Based on HCP's likely contact with patients at risk for severe disease (e.g., NICU), and not Tdap vaccination status**
 - PEP for HCP likely expose patient at risk for severe pertussis (e.g., hospitalized neonates and pregnant women)
 - Other HCP either receive PEP or monitored daily for 21 days after exposure and treated at onset of signs and symptoms

- ❑ **Data inconclusive on need for post-exposure prophylaxis (PEP) in Tdap-vaccinated HCP**
 - Pertussis infection did not develop in
 - 38/44 (86.4%) HCP with no PEP
 - 41/42 (97.6%) HCP with PEP
 - Infection based on serologic evidence; no symptomatic pertussis
 - Predefined non-inferiority criteria not met

Tdap Vaccine for Health-care Personnel

- ❑ **Since 2006, HCP recommend a single dose of Tdap and routine Td booster every 10 years**

- ❑ **Hospital-based Tdap coverage rates among HCP dependent on institutions Tdap vaccination program**
 - 30% - campaign
 - 100% - hospital mandate

- ❑ **31.4% - Nationally reported Tdap coverage among HCP**

Calderon M, et al. Implementation of a pertussis immunization program in a teaching hospital: an argument for federally mandated pertussis vaccination of health care workers. *Am J Infect Control*. 2008 Aug;36(6):392-8.

Weber DJ, et al. Assessment of a mandatory tetanus, diphtheria, and pertussis vaccination requirement on vaccine uptake over time. *Infect Control Hosp Epidemiol*. 2012 Jan;33(1):81-3

CDC. Noninfluenza Vaccination Coverage Among Adults — United States, 2012. *MMWR*. 63(05);95-102.

Impact of Tdap Vaccination of Health-care Personnel on Nosocomial Transmission

- ❑ Earlier models calculated benefits and costs of vaccination program for HCP in preventing a nosocomial pertussis outbreak
- ❑ Vaccinating HCP substantially reduced the risk of hospital-based pertussis outbreak and was cost-effective/cost-saving
 - Inputs included Tdap vaccine efficacy estimates higher than current estimates
 - Assumptions include vaccination would decrease transmission and prevent secondary cases
- ❑ No direct evidence; model update planned

Greer AL, Fisman DN. Keeping vulnerable children safe from pertussis: preventing nosocomial pertussis transmission in the neonatal intensive care unit. *Infect Control Hosp Epidemiol.* 2009 Nov;30(11):1084-9.

Greer AL, Fisman DN. Use of models to identify cost-effective interventions: pertussis vaccination for pediatric health care workers. *Pediatrics.* 2011 Sep;128(3):e591-9.

Calugar A, et al. Nosocomial pertussis: costs of an outbreak and benefits of vaccinating health care workers. *Clin Infect Dis.* 2006 Apr 1;42(7):981-8.

WG Uncertainties Tdap Vaccine

- ❑ More learned about acellular pertussis vaccines**
 - Acellular-primed adolescents - Tdap effective but protection wanes substantially within a few years
 - Whole-cell primed adults - Tdap protects but difficult to study
 - As population ages, will only be acellular-primed cohort

- ❑ Is assumption valid that Tdap vaccination protects contacts?**

- ❑ Timing of any potential indication on additional doses of Tdap or are we compelled to make an off-label recommendation?**

WG Assessments

Pertussis and Vaccinating Health-care Personnel

- ❑ Pertussis transmission occurs in health-care settings**
- ❑ Frequency and proximity of patient interaction puts HCP at increased risk of exposure to pertussis**
 - Unclear how much pertussis exposure results in disease**
- ❑ Lack of updated disease and vaccine data specific to HCP**
- ❑ No small thing to implement recommendations for HCP**
- ❑ No supportive evidence that additional doses would be beneficial in prevention of disease and transmission in a health-care setting**
 - Even if additional Tdap doses recommended, no change to risk management of pertussis exposures**

WG Conclusions

At this time, ACIP Pertussis Vaccines WG does not propose changes to the current ACIP Tdap recommendation for HCP.

Focus on current Tdap program

- ❑ Improve adult coverage, including HCP**
- ❑ Vaccinate pregnant women to protect infants**

Pertussis-related Projects MVPDB & Collaborators

❑ Pertussis Vaccine

- Vaccine effectiveness
 - Emergence of pertactin negative strains (Vermont)
 - Cohort Study (HMOs)
 - Case-Control Study (California)
- Clinical Characteristics of Vaccinated and Unvaccinated Pertussis Cases (EIP's EPS)

❑ Health-care personnel

- Incidence of pertussis in HCP (EIP's EPS)
- Update - cost of an outbreak and benefits of vaccinating HCP (DVD, ISD)

❑ Tdap Pregnancy

- Cocooning/pregnancy Tdap evaluation (CA, CT, MN, NM, NY, OR)
- Infant blood-spot study - Effectiveness of maternal antibodies against pertussis (WA, NY, CA)

Additional CDC Activities

❑ Assessment Branch (ISD/NCIRD)

- Measuring Tdap coverage among pregnant women
 - PRAMS (with DRH/NCCDPHP)
 - Internet panel survey on pregnant women during influenza season

❑ Immunization Safety Office (DHQP/NCEZID)

- Safety monitoring in pregnant women following Tdap administration
 - Vaccine Adverse Event Reporting System (VAERS)
 - Vaccine Safety Datalink (VSD)
 - Clinical Immunization Safety Assessment (CISA) Project

❑ Health Communications Science Office (NCIRD)

- Formative Research Plans to Develop a Maternal Tdap Vaccination Campaign

DISCUSSION