



Clinical Decision Support in the Electronic Health Record: A Template to Improve Tetanus Immunization Rates

Marilyn Robins, MSN, RN, ACNP-BC, CNP; Cynthia Reese, PhD, RN, CNE; Beth Phelps, DNP, RN, ACNP-BC, CNP

Clinical Issue/Practice Problem

- Tetanus is a noncommunicable disease that occurs in open wounds or nonintact skin allowing the Clostridium tetani spores to thrive, and though incidence has decreased, it remains a potentially fatal disease (CDC, 2011).
- Missed opportunities for immunization are a major problem both locally and nationally (CDC, 2015).
- Clinical decision support (CDS) in the electronic health record (EHR) is not being used optimally by providers when providing care to patients.
- The purpose of this quality improvement project was to determine if the use of a CDS immunization template (based upon CDC (2016) guidelines) embedded into the EHR improved tetanus immunization rates in the urgent care setting.

Summary of the Supporting Literature

- Focused on issues of improving immunizations by reviewing the evidence supporting use of a CDS in the EHR
- Databases used were Cumulative Index of Nursing and Allied Health Literature (CINAHL), PubMed/Medline, Ovid MEDLINE, Inventory of Evaluation Publication, Cochrane Database of Systematic Reviews, Psych Info, and the American Medical Informatics Association.
- Eight studies met inclusion requirements for the literature review, four were most helpful:
- Au et al. (2010) found that electronic templates with pre-loaded immunization records and EHR alerts increased significantly the immunization rates in children from 65% to 76% ($p < .000$)
- Austin et al. (1994), meta-analysis of 3 RCT's of physician reminder-information interventions significantly improved compliance. OR 2.819, 95% CI [2.664-2.975].
- Dexheimer et al. (2011), used a computerized provider order entry system reminder for pneumococcal vaccination rates in the emergency department (ED), with 10.8% increase in vaccination rates among elderly ED patients.
- Loo et al. (2002); improved pneumococcal and influenza vaccines in the elderly, supporting use of EHR reminders. Pneumococcal vaccine: unadjusted OR 2.05; 95% CI [1.31-3.23]; $p = .002$; and influenza: unadjusted OR 1.68; 95% CI [1.34-2.10]; $p < .001$.

Key References

Au, L., Oster, G. H., Yeh, G. H., Magno, J., & Paek, H. M. (2010). Utilizing an electronic health record system to improve vaccination coverage in children. *Applied Clinical Informatics*, 221-231. doi: 10.4338/ACI-2009-12-CR-0028. Retrieved from <http://dx.doi.org/10.4338/ACI-2009-12-CR-0029>

Centers for Disease Control and Prevention. (2011). Tetanus surveillance — United States, 2001–2009. *MMWR*, 60, 365–96. Retrieved from <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6012a1.htm>

Centers for Disease Control and Prevention. (2015). Missed opportunities for tetanus post exposure prophylaxis – California, January 2008-March 2014. *MMWR*, 64(9), 243-246. Retrieved from <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6409a2.htm>

Centers for Disease Control and Prevention. (2016). Adult immunization schedule easy to read. Retrieved from <http://www.cdc.gov/vaccines/schedules/hcp/adult.html>

Dexheimer, J. W., Talbot, T. R., Ye, F., Shyr, Y., Jones, I., Gregg, W. M., & Aronsky, D. (2011). A computerized pneumococcal vaccination reminder system in the adult emergency department. *Vaccine*, 29(40), 7035-7041. doi:10.1016/j.vaccine.2011.07.032. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3168965/>

Loo, T. S., Davis, R. B., Lipsitz, L. S., Irish, J., Bates, C. K., Agarwal, K.,... Hamel, M. B. (2011). Electronic medical record reminders and panel management to improve primary care of elderly patients. *Archives of Internal Medicine*, 171(17), 152-1558. doi:10.1001/archinternmed.2011.394. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/21949163>

Project Implementation

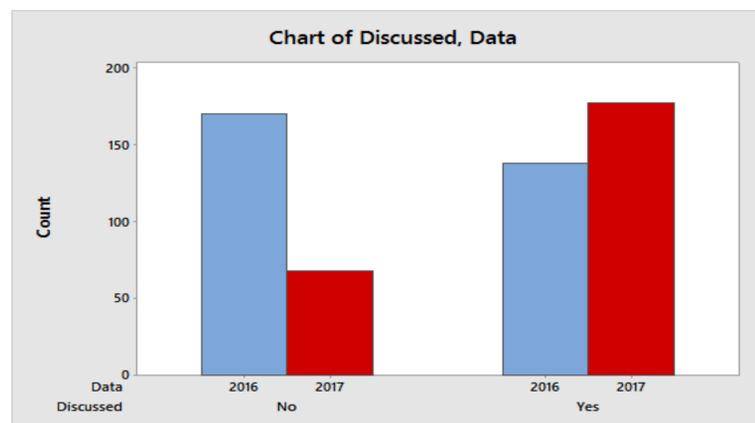
- Quality of Health Care framework (Donabedian 2003) guided this project, organizing information by structure, process, and outcome.
- Stakeholders: patients, providers, urgent care and the clinic, nursing staff, Information Technology (IT), and Business and Clinical Intelligence (BCI) departments
- IRB approval obtained from University of Illinois COM at Peoria
- Steps in implementation process:
 - met with IT and BCI regarding project feasibility
 - developed EHR template based on CDC (2014) guidelines
 - identified ICD-10 diagnoses requiring tetanus coverage
 - obtained IRB approval and 15 providers (MDs, APNs, and PAs) signed informed consent
 - conducted project education sessions with providers and nursing staff
 - population of patients in study: those 19 years and older presenting to urgent care with ICD-10 diagnoses requiring up-to-date (UTD) tetanus coverage
 - pre-template comparison data collected between Feb. 28 and April 30, 2016 ($n = 308$)
 - post-template comparison data collected during same timeframe in 2017 ($n = 245$)
 - Data analysis included descriptive statistics on the pre and post template timeframes, as well as Chi-square (χ^2) test of independence.

Outcomes

- The first dependent variable was the percentage of patients meeting inclusion criteria in which the provider documented discussion with the patient regarding tetanus immunization status.
- Prior to implementation of the template (2016) discussion of tetanus immunization status was documented 44.8% of the time; and in 2017, with use of the template documentation increased to 72.2%.

	Group				Total <i>n</i>
	Pre-template 2016		Post-template 2017		
	<i>n</i>	%	<i>n</i>	%	
Discussion of Tetanus status					
Yes	138	44.8	177	72.2	315
No	170	55.2	68	27.8	238
TOTAL	308	100	245	100	553

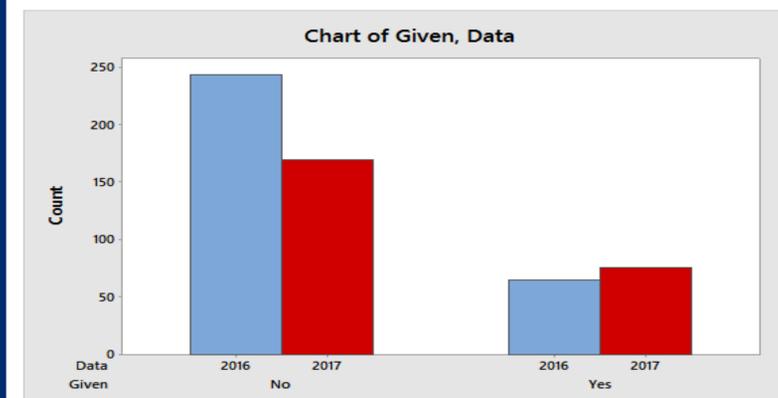
$$\chi^2 = 41.99, df = 1, p < .001, power = .999$$



- The second dependent variable was the percentage of patients requiring and subsequently receiving a tetanus immunization.
- Prior to implementation of the template (2016) 73.3 % of patients received tetanus immunization when indicated. In 2017, the percentage of patients receiving tetanus immunization increased to 87.4%.

	Group				Total <i>n</i>
	Pre-template 2016		Post-template 2017		
	<i>n</i>	%	<i>n</i>	%	
Tetanus immunization					
Given	226	73.3	214	87.4	440
Not given	82	26.7	31	12.6	113
TOTAL	308	100	245	100	553

$$\chi^2 = 7.064, df = 1, p < .008, power = .818$$



Clinical Implications for Practice and Next Steps

- Future versions of the EHR that was just launched is capable of a colored template that is identical to the CDC table, and this may replace the current tetanus template.
- The Donabedian Framework can be used to guide future development of EHR CDS templates.
- This quality improvement project impacted clinical practice through incorporation of the CDC recommendations that promoted better patient health care outcomes by improved tetanus immunization rates in the urgent care setting.
- The results of this project support the use of the computerized CDS systems, and CDS should be provided to clinicians through the EHR, when possible in their practice settings.
- Future incorporation of this template format into the electronic health record may be beneficial, but more research should be conducted to provide the evidence needed for guidelines.

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