

# Minimum healthcare worker influenza immunization rates required to decrease influenza transmission in two acute-care hospitals

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Annual influenza immunization is widely recommended for healthcare workers (HCWs) to reduce the burden of healthcare-acquired influenza (HAI).<sup>1,2</sup> Aside from the benefits to HCWs in reducing their own risk of illness, HCW immunization is associated with a decrease in morbidity and mortality and the risk of influenza-like outbreaks, particularly in residents in long-term care settings.<sup>3–6</sup>

In acute-care hospitals, an inverse relationship between HCW influenza immunization rates and healthcare-acquired influenza (HAI) has been reported, but data are lacking regarding the minimum immunization rate that needs to be achieved to prevent HAI in this setting.<sup>7–9</sup> Our goal was to assess the association between HCW influenza immunization and the incidence of HAI across 2 acute-care facilities to inform our HCW immunization programs.

We performed a multicenter prospective cohort study at 2 acute-care hospitals including 1 tertiary-care, university-affiliated, teaching hospital (638 beds) and 1 community-based academic hospital (431 beds). HCW influenza immunization rates and the incidence of HAI among patients were collected for the 2013–2014 to 2018–2019 influenza seasons from all inpatient acute-care wards including maternity, pediatrics, and psychiatry wards but excluding long-term care and rehabilitation wards as well as the emergency department and outpatient areas. The 2017–2018 season was excluded due to significant vaccine mismatch. The annual HCW influenza immunization rate was defined as the proportion of HCWs immunized prior to December 15 (the date for submission to public health authorities); it included all nurses as well as allied and support staff assigned to an inpatient ward but excluded physicians, students, and volunteers because they are not assigned to specific units. HCW influenza immunization at both facilities was voluntary and did not require a signed declination. During the 2014–2015, 2015–2016, and 2016–2017 seasons, there was a vaccine or mask policy. A case of HAI was defined as laboratory-confirmed influenza A or B, detected from upper-respiratory-tract swabs tested via multiplex polymerase chain reaction (PCR), with symptom onset >72 hours after admission. All patients were assessed for new onset of fever and/or new or worsening respiratory symptoms (eg, cough, shortness of breath, sore throat, and runny nose/congestion) on a daily basis. Those patients meeting these criteria were tested for Influenza. If a test had not already been ordered, the infection prevention and control professional recommended that one be obtained. The incidence of HAI was calculated per 1,000 patient days and the association between inpatient ward HCW influenza immunization rate and the incidence of HAI were compared using a Poisson regression analysis adjusting for hospital and influenza season.

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**Cite this article:** Williams VR, et al. (2021). Minimum healthcare worker influenza immunization rates required to decrease influenza transmission in two acute-care hospitals. *Infection Control & Hospital Epidemiology*, 42: 109–110, <https://doi.org/10.1017/ice.2020.1252>

Over 5 influenza seasons, HCW influenza immunization rates and cases of HAI were collected on 36 inpatient acute-care wards: 20 wards at facility A and 16 wards at facility B. The median HCW influenza immunization rate was 58.9% (IQR, 46.6%–70.3%) overall; 57.3% (IQR, 42.5%–66.4%) at facility A and 66.6% (IQR, 50.6%–76.8%) at facility B. In total, 144 cases of HAI were identified, for an overall incidence of 0.23 per 1,000 patient days, including 0.24 and 0.22 per 1,000 patient days at facilities A and B, respectively. In the regression analysis, HCW influenza immunization rates of  $\geq 65\%$  and  $70\%$  were not associated with a decrease in HAI incidence. In contrast, a HCW influenza immunization rate of  $\geq 75\%$  was associated with a trend toward reduced HAI (IRR, 0.65; 95% CI, 0.39–1.08;  $P = .096$ ), whereas inpatient wards  $>80\%$  immunization had significantly lower risk of HAI (IRR, 0.28; 95% CI, 0.089–0.89;  $P = .03$ ) (Table 1). During the 2017–2018 mismatch season, the HAI was highest compared to other seasons at 0.46 per 1,000 patient days. When the regression model was repeated including 2017–2018, the overall association was no longer significant.

Previous modeling studies have demonstrated that increasing HCW influenza immunization rates correspond to protection of patients against HAI with no maximum beyond which there is no effect<sup>8</sup>; however, the minimum target is not well established. Our multicenter study indicates that acute-care hospitals with HCW immunization rates as high as  $70\%$  may offer no significant protection of patients from HAI. Rates of at least  $75\%$  and ideally  $80\%$  are required to see a significant impact on prevention of HAI. Our results are similar to a study in oncology patients where increased HCW influenza immunization rates from  $56\%$  to  $94\%$  resulted in decreased HAI incidence.<sup>9</sup>

The minimum target for hospital influenza immunization has significant implications for the type of interventions required to prevent HAI. Most hospital HCW immunization programs rely on education and improved access to vaccine, but these are unlikely to achieve the minimum  $75\%$  threshold.<sup>7</sup> Achieving a rate  $>80\%$  requires higher effectiveness systems of care such as institutional policy requiring influenza immunization or opt-out programs that require education for HCW declining vaccination.<sup>8,10</sup>

Our study has several limitations. It included only 2 acute-care hospitals, and we excluded the mismatch season during which no association between immunization rate and HAI was detected. The HCW influenza immunization rates also excluded physicians; therefore, we may have underestimated the benefit of influenza immunization. We cannot exclude confounding of the incidence of HAI by the use of masks during the mask or vaccine policy; however, this would have biased toward a lack of difference from immunization. Cases of HAI in patients with onset of symptoms after discharge were not included unless they were readmitted to the study facility, which may have underestimated true HAI incidence.

**Table 1.** Multivariate Poisson Regression Analysis of the Association Between Healthcare Worker Influenza Immunization Rates and Hospital Acquired Influenza in Patients

HCW Influenza Immunization Rate, %	IRR	95% CI	P Value
≥65	1.09	0.77–1.54	.64
≥70	0.72	0.47–1.11	.14
≥75	0.65	0.39–1.08	.09
≥80	0.28	0.089–0.89	.03

Note. HCW, healthcare worker; IRR, incidence rate ratio; CI, confidence interval.

Our study suggests that acute-care hospitals must target influenza immunization rates >75% to see appreciable reductions in HAI. In the context of a COVID-19 pandemic, it will be even more important for hospitals to augment their immunization programs beyond educational initiatives to achieve this minimum threshold.

**Acknowledgments.** We thank members of Occupational Health and Safety at both participating hospitals, for their support in data collection of healthcare worker influenza immunization rates.


**Financial support.** No financial support was provided relevant to this article.

**Conflicts of interest.** All authors report no conflicts of interest relevant to this article.

## References

1. An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI) Canadian Immunization Guide Chapter on Influenza and Statement on Seasonal Influenza Vaccine for 2019–2020. Public Health Agency of Canada website. [https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/canadian-immunization-guide-statement-seasonal-influenza-vaccine-2019-2020/NACI\\_Stmt\\_on\\_Seasonal\\_Influenza\\_Vaccine\\_2019-2020\\_v12\\_3\\_EN.pdf](https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/canadian-immunization-guide-statement-seasonal-influenza-vaccine-2019-2020/NACI_Stmt_on_Seasonal_Influenza_Vaccine_2019-2020_v12_3_EN.pdf). Published 2019. Accessed January 20, 2020.
2. Grohskopf LA, Alyanak E, Broder KR, Walter EB, Fry AM, Jernigan DB. Prevention and control of seasonal influenza with vaccines: recommendations of the advisory committee on immunization practices—United States, 2019–20 influenza season. *MMWR Recomm Rep* 2019;68(No. RR-3): 1–21.
3. Carman WF, Elder AG, Wallace LA, *et al*. Effects of influenza vaccination of health-care workers on mortality of elderly people in long-term care: a randomised controlled trial. *Lancet* 2000;355:93–97.
4. Potter J, Stott DJ, Roberts MA, *et al*. Influenza vaccination of healthcare workers in long-term care hospitals reduces the mortality of elderly patients. *J Infect Dis* 1997;175:1–6.
5. Lemaitre M, Meret T, Rothan-Tondeur M, *et al*. Effect of influenza vaccination of nursing home staff on mortality of residents: a cluster-randomized trial. *J Am Geriatr Soc* 2009;57:1580–1586.
6. Shugarman LR, Hales C, Setodji CM, Bardenheier B, Lynn J. The influence of staff and resident immunization rates on influenza-like illness outbreaks in nursing homes. *J Am Med Dir Assoc* 2006;7:562–567.
7. Salgado CD, Giannetta ET, Hayden FG, Farr BM. Preventing nosocomial influenza by improving the vaccine acceptance rate of clinicians. *Infect Control Hosp Epidemiol* 2004;25:923–928.
8. van den Dool C, Bonten MJ, Hak E, Wallinga J. Modeling the effects of influenza vaccination of health care workers in hospital departments. *Vaccine* 2009;27:6261–6267.
9. Frenzel E, Chemaly RF, Ariza-Heredia E, *et al*. Association of increased influenza vaccination in health care workers with a reduction in nosocomial influenza infections in cancer patients. *Am J Infect Control* 2016;44:1016–1021.
10. Pitts SI, Maruthur NM, Millar KR, Perl TM, Segal J. A systematic review of mandatory influenza vaccination in healthcare personnel. *Am J Prev Med* 2014;47:330–340.

# Serious antibiotic-related adverse effects following unnecessary dental prophylaxis in the United States

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PREVIOUS PRESENTATION. These data were presented in part as the SHEA featured oral abstract # 1895 Presentation date, October 4, 2019, in Washington, DC.

**Cite this article:** Gross AE, *et al*. (2021). Serious antibiotic-related adverse effects following unnecessary dental prophylaxis in the United States. *Infection Control & Hospital Epidemiology*, 42: 110–112, <https://doi.org/10.1017/ice.2020.1261>

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Dentists prescribe 10% of outpatient antibiotics; a significant portion of these are for infection prophylaxis following dental procedures.<sup>1,2</sup> Current guidelines primarily recommend antibiotic prophylaxis prior to dental procedures that manipulate the gingival tissue or the periapical region of teeth or that perforate the oral mucosa in patients at high risk of an adverse outcome should they develop infective endocarditis.<sup>3</sup> Recent data show that 80.9% of