

Vaccination practices in U.S. emergency departments, 1992–2000

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Received 23 December 2003; received in revised form 28 June 2004; accepted 29 June 2004

Available online 28 August 2004

Abstract

To determine how frequently emergency department (ED) patients are vaccinated against influenza and pneumococcus, we analyzed all adult ED vaccinations in the combined databases of the annual National Hospital Ambulatory Medical Care Surveys, 1992–2000. During this period, EDs gave 27,738,000 vaccinations (95%CI: 25,878,000–29,598,000). Of these, 93% (87–100%) were against tetanus. The count of pneumococcal or influenza vaccinations was too small to permit estimation of a national total. Large-scale vaccination of ED patients appears feasible, given the tetanus experience, but ED patients are rarely vaccinated against influenza or pneumococcus. Reasons for this disconnect between burden of disease and preventive practices are discussed.

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Keywords: Vaccination; Emergency department; Influenza

1. Introduction

In the United States, influenza causes about 114,000 hospitalizations [1] and 36,000 deaths per year, and the rate is increasing [2]. The total number of pneumococcal illnesses is unknown, but for culture-confirmed invasive disease, about 63,000 cases and 6000 deaths occur annually [3]. About 20,550 (33%) of these cases occur in those aged ≥ 65 , and 96% of these are hospitalized [3]. Vaccination against influenza is recommended for those aged ≥ 50 , against pneumococcus for those aged ≥ 65 ; and younger people with certain chronic diseases are eligible for both [1,4]. National objectives include vaccination of 90% of those aged ≥ 65 , but only 65 and 60% have been vaccinated against influenza and pneumococcus, respectively [5,6].

Some patients, especially the uninsured, have contact with the healthcare system predominantly in emergency departments [7]. The American College of Emergency Physicians

states, “ED personnel should consider participating in routine immunization programs for the elderly if other sources are not readily available.” [8] Single-center studies have found that most eligible emergency department (ED) patients have not been vaccinated against pneumococcus or influenza, though ED-based vaccination has been found cost-effective and acceptable [9–15]. Anecdotal evidence for the feasibility of ED-based vaccination may be found in the case of tetanus vaccination, which seems very common. To our knowledge, no one has studied ED vaccination practices on a nationwide basis. We describe all ED vaccinations for the period 1992–2000, using data from the National Hospital Ambulatory Medical Care Survey (NHAMCS), and we test the hypothesis that vaccination against influenza and pneumococcus is rare while tetanus vaccination is common.

2. Methods

NHAMCS data from 1992–2000 were combined for analysis [16–26]. NHAMCS is a four-stage probability sample

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of visits to general and short stay hospitals, excluding federal, military, and Veterans Affairs hospitals, in the U.S. Conducted annually, NHAMCS achieved a representative sample of the U.S. by sampling EDs within geographic primary sampling units during randomly assigned 4-week-periods. Trained hospital staff filled out standardized data collection forms by reviewing all ED charts during the 4 week study period. The U.S. Bureau of the Census regional staff supervised data collection. Data abstraction was performed centrally by experienced NCHS coders. Completed data collection forms were sent to the NCHS where they were coded using the International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM). Quality controls included computer checks to assess inconsistencies with value ranges, a two-way 10% independent procedure for medical and drug coding, and adjudication by NCHS for ambiguous or illegible responses for fields including reasons for visit and diagnosis [16–26].

The database contains up to three patient complaints, screening and diagnostic procedures done during the ED visit, and up to six medication codes, which include vaccination. The International Classification of Diseases (ICD) and major U.S. surveillance programs follow the burden of “influenza and pneumonia” as a category, represented by ICD-9 codes 480–487 [3]. To assess the burden of influenza and pneumococcal disease in the study sample, we measured the frequency of ICD-9 codes 480–487. To assess the burden of tetanus, we measured the frequency of ICD-9 codes 037, 634–638 with .0, 639.0, 771.3, and 670. We assessed vaccine eligibility indirectly. For influenza and pneumococcus, we relied upon prior U.S. estimates, which have shown that 60% of the people aged ≥ 65 are vaccinated against pneumococcus and 65% against influenza [6]. We multiplied these percentages by the number ED visits by adults of eligible age during influenza season, October through January, producing a qualitative estimate of the number of adults eligible for vaccination. For tetanus, we generated a qualitative estimate of vaccine eligibility by measuring the number of adults with open wounds.

National estimates (rounded to the nearest thousand) were obtained using assigned visit weights, with 95% confidence intervals (95% CI) calculated using the relative standard error. Ratios were tested as different from one using binomial tests of proportions. Generalization from the NHAMCS sample to the U.S. population is robust for frequencies of ≥ 30 [16]. Since there were <30 instances of vaccination against pneumococcus and <30 against influenza, we pooled vaccinations against these two pathogens. Analyses were performed using STATA 7.0 (StataCorp, College Station, TX).

3. Results

From 1992–2000, ED staff gave approximately 27,738,000 adult vaccinations (95% confidence interval 25,878,000–29,598,000). Of these, 266,000 (68,000–

463,000) were pneumococcal or influenza vaccination, and 25,907,000 (24,141,000–27,673,000) tetanus. The ratio of tetanus to either influenza or pneumococcal vaccination was 97 ($p < 0.001$). Tetanus accounted for 93% (87–100%) of all ED vaccinations. The only other vaccination type given in sufficient frequency to allow national estimates was hepatitis (combining all subtypes), accounting for 0.7% (0.3–1.1%) of all ED vaccines. Other vaccines included: rabies, diphtheria, polio, yellow fever, typhoid, varicella, BCG, measles and combinations, mumps, rubella, cholera, and meningococcus. Annual rates of vaccination could not be calculated because the sample size for individual years was inadequate for estimation of national totals; subjective inspection of the data did not reveal any year-to-year change.

Further study revealed that a single Midwestern hospital, in a single year, accounted for 48% of vaccinations against influenza or pneumococcus. NHAMCS prohibits contact of participating hospitals, and thus we are prohibited from further analysis of this observation. Excluding this outlier would result in a count of influenza/pneumococcus vaccination of 29 for the 9 years of observation, too small for estimation of a national total or comparison to tetanus, since at least 30 observations are required for statistical projections from the NHAMCS database.

ICD-9 codes for pneumonia or influenza were assigned at 13,489,000 (12,384,000–14,593,000) visits, or 2.1% (2.0–2.3%) of all ED visits. There was only one case of tetanus and one case of puerperal tetanus in the sample, too few for estimation of a national total.

In order to obtain an indirect estimate of vaccine eligibility, we observed that in 2001, only 60% of people aged ≥ 65 were vaccinated against pneumococcus and 65% against influenza [6]. Applying these proportions to the NHAMCS sample for October through January suggests that 25,810,581 ED patients in the study sample were eligible for pneumococcal vaccination and 27,961,462 for influenza vaccination, not including those aged 50–64 and those with indications other than age. This may be considered a conservative estimate because those aged 50–64 are eligible for influenza vaccine, and because vaccination coverage was likely even lower during 1992–2000 than in 2001; also, ED patients may have less access to health care than the general population [6,7]. We can summarize by saying that well over 27,000,000 adult ED patients were eligible for influenza or pneumococcal vaccination, but very few were vaccinated. In contrast, of 48,489,000 ED patients with open wounds, 33% (30–36%) were vaccinated against tetanus. We don't know how many of the remaining 67% were ineligible due to recent tetanus vaccination, and many of them may have had superficial, non-tetanus-prone wounds.

4. Comment

To evaluate the contribution of emergency departments to the fight against vaccine-preventable disease, we used data

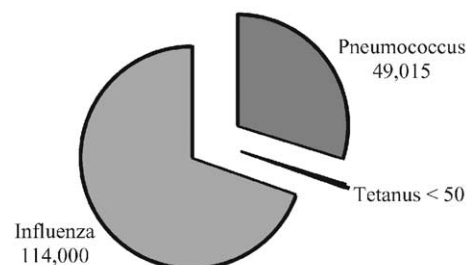
from the National Hospital Ambulatory Medical Care Survey to study vaccination practices in U.S. EDs from 1992–2000. Vaccination against pneumococcus or influenza was too infrequent to permit estimation of a national total, after exclusion of an outlier. This outlier may have represented a site where vaccine trials were ongoing, but NHAMCS prohibits identification of individual hospitals in the sample. Only two categories of vaccination were frequent enough for estimation of a national total: tetanus and hepatitis. Tetanus vaccination was given at 25,907,000 (95% confidence interval 24,141,000–27,673,000) visits, and accounted for 93% (87–100%) of all vaccinations. Hepatitis vaccination (combining all subtypes) accounted for 0.7% (0.3–1.1%) of all vaccinations.

Like all NHAMCS studies, ours is limited by its retrospective nature. Vaccination was not an explicit primary outcome measure in the survey, and it is possible that some vaccinations may have been omitted by the researchers who abstracted data from the patient records. In order to be sure vaccinations were not omitted due to the limited number of available fields for recording medications, we assessed the number of visits with all six medication fields filled out in visits with any vaccination versus visits with no vaccination. The result was 1.65 and 1.33%, respectively, suggesting that six fields were adequate to record the medications administered in more than 98% of visits.

Our observations reveal a lack of correspondence between disease prevalence and preventive treatment, since tetanus is rare while influenza and pneumococcal disease are common (Fig. 1). There are about 50 tetanus cases and 25 deaths/year in the U.S., vs. about 114,000 hospitalizations for influenza alone [1,2,27,28]. In our own sample, a diagnosis of pneumonia or influenza was given at 13,489,000 (12,384,000–14,593,000) visits, or 2.1% (2.0–2.3%) of all ED visits, while tetanus was diagnosed only twice. We do not mean to suggest any quantitative relationship between the frequency of influenza and pneumococcal disease and the number of people who should be vaccinated, nor do we mean to suggest that ED staff should relent in their battle to prevent tetanus. We find these observations to be interesting in a qualitative way. Qualitatively, the number of ED patients who are vaccinated against tetanus is “a lot,” and the number of ED patients who get tetanus is “approximately none.” Conversely, the number of ED patients who are vaccinated against influenza or pneumococcus is “approximately none,” and the number of ED patients who get the diseases is “a lot.”

Vaccine eligibility also fails to provide an explanation for choice of preventive services. We could not measure eligibility directly, but we did observe that tetanus vaccination was given to 1/3 of patients with open wounds. In contrast, too few patients were immunized against influenza or pneumococcus for estimation of a national total, despite the fact that well over 27,000,000 were eligible. Safety also fails to explain the practices we observed, as mild local and systemic reactions are common, but serious adverse events are rare for all three vaccines [1,4,29].

Annual Hospitalizations, Persons Aged ≥ 65 in the U.S.



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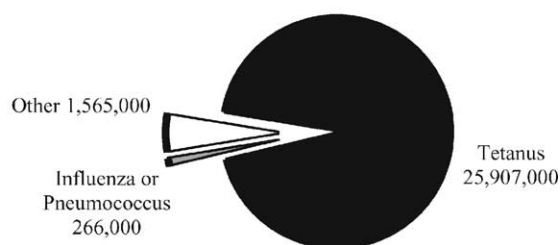


Fig. 1. Comparison of burden of disease to emergency department vaccination practices.

Perhaps ED vaccination decisions are based on vaccine efficacy. Tetanus vaccination is virtually 100% effective [29]. In contrast, there is debate as to whether pneumococcal vaccination is efficacious in elderly U.S. patients, the main eligible group. Historical claims of 60–70% efficacy were based on indirect analytical methods [30] and retrospective studies in populations not representative of this group [31]. Two recent meta-analyses and a large high-quality cohort study found either no evidence for preventive efficacy in the elderly, or evidence for prevention of bacteremia only [32–34]. Influenza vaccine, on the other hand, is 70–90% effective in healthy adults [1,35–38]. Though the antibody response wanes with age, the vaccine is 30–70% effective in reducing hospitalizations and 50–80% effective in preventing death in the elderly, and is cost-effective [38–45]. Therefore, vaccine efficacy might explain why pneumococcal vaccination is omitted in favor of tetanus vaccination, but it would not explain why influenza vaccination is not given.

Could the recommended timing of vaccination influence decision-making? Patients may not remember vaccinations given in the distant past, and ED staff may wish to avoid unnecessary repetition of vaccinations. This concern would seem quite valid for pneumococcal vaccination, because it is only indicated once in a lifetime (plus a booster in some circumstances). Tetanus, on the other hand, is indicated every 5–10 years, and it appears that ED staffs are comfortable repeating a vaccine at this time interval. But why, then, would

they not wish to give influenza vaccine, which is indicated annually, five to ten times more frequently than tetanus vaccination?

Relevance to emergency practice might be a logical objection to certain preventive services. For example, in the case of pap smears to detect cervical cancer, ED staff may think, “Not my problem,” since cervical cancer is not a major problem in emergency medicine. But use of vaccination in the fall to mitigate the seasonal deluge of influenza patients in the winter would seem quite relevant indeed.

We suspect that current vaccination practices are driven largely by perceptions about the limits of emergency care. Tetanus vaccination of wounded patients is “secondary” prevention, while influenza and pneumococcal vaccination exemplify “primary” prevention. ED staff may think primary prevention is outside their role in the healthcare system. We think this is very interesting, from the standpoint of the history of medicine. The Hippocratic Oath says, “I will not cut, and certainly not those suffering from stone, but I will cede this to men who are practitioners of this activity;” yet many graduates of modern medical schools go on to become surgeons and urologists. Indeed, emergency physicians frequently drain abscesses, place chest tubes, and perform other surgical activities foresworn in the Hippocratic Oath. Is this not analogous to the limitations ED staff seem to perceive in their role in preventive care, judging by our observations?

We did not address the logistical challenges of influenza vaccination, though the commonness of tetanus vaccination suggests that the obstacles are not insurmountable. National authorities have sought to increase the frequency of vaccination in settings like the ED, and the Centers for Medicare and Medicaid Services have authorized payment when nurses administer vaccines without a physician’s order [46,47]. This could provide a mechanism for funding the small incremental increase in nursing staff that would be required for a vaccination program in a busy ED. ED-based pneumococcal vaccination has been studied, with findings of feasibility and acceptability [9–15].

In summary, we examined emergency department vaccination practices for influenza, pneumococcus, and tetanus. We reviewed burden of disease, vaccine efficacy, and recommended frequency of vaccination, and arrived at three conclusions: (1) large-scale vaccination of emergency department patients is feasible, as emergency departments are already part of a successful vaccination campaign to prevent tetanus. (2) Emergency physicians rarely vaccinate against pneumococcus. Since, this vaccine is only recommended once or twice in a lifetime, and given questions about vaccine efficacy, there may be less urgency in implementing ED-based routine vaccination. (3) Emergency physicians rarely vaccinate against influenza, though EDs are overwhelmed every flu season.

We conclude with a recommendation that ED staff give strong consideration to routine influenza vaccination of adults, while perhaps deferring pneumococcal vaccination to other providers.

Acknowledgment

Contributors: We are grateful to Andrea Pelletier, MS, MPH, for her contributions to the analysis, and to Ron Walls for his mentorship and help with obtaining financial support. *Funding:* Supported by a Faculty Collaborative Grant from the Department of Emergency Medicine, Brigham and Women’s Hospital (Boston, MA), and by the Emergency Medicine Foundation Center of Excellence Award (Dallas, TX). Dr. Camargo is supported by grant HL63841 from the National Institutes of Health (Bethesda, MD).

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