8-24-2010

Acceptability of Seasonal Influenza Vaccines Among Low-Risk Adults In An Urban Emergency Department

Kamila Sikora

Acceptability of Seasonal Influenza Vaccines Among Low-Risk Adults In An Urban Emergency Department

A Thesis Submitted to the
Yale University School of Medicine
in Partial Fulfillment of the Requirements for the
Degree of Doctor of Medicine

by
Kamila Janetta Sikora

2010

ACCEPTABILITY OF SEASONAL INFLUENZA VACCINES AMONG LOW-RISK ADULTS IN AN URBAN EMERGENCY DEPARTMENT.

Kamila J. Sikora and Karen Jubanyik. Department of Emergency Medicine, Yale University School of Medicine, New Haven, CT

Emergency departments (EDs) are the only source of medical care for many adults and have been found to be feasible venues for vaccinating high-risk patients against seasonal influenza. Since the CDC guidelines expanded in 2008 to include any adults wishing to protect themselves and those around them from the flu, the vaccination of low-risk patients in the ED has not been evaluated. This study sought to assess the acceptability among adult patients of all ages for vaccinating against seasonal influenza in the Urgent Care area of an urban ED, which treats primarily healthy adults. A convenience sample of adult patients in the Urgent Care area was surveyed in November 2009. Subjects were asked about their vaccination history, as well as their perceived need and potential acceptance of a vaccine in the ED. Demographic data obtained included age, race, education, insurance status, medical history, access to primary care and contact with high-risk individuals. 381 patients were approached, of whom 352 completed the survey (92.4%; 56% male, 44% female; mean age 36 years, Standard Deviation 12.4), and 349 were vaccine-eligible. 250 (72%) denied any significant medical history. While 169 patients (48.4%) had an influenza vaccination history, only 69 (20%) were vaccinated in 2009. Of the 280 not vaccinated this year, 179 (64%) would have accepted the vaccine in the ED. Factors associated with increased odds of vaccine acceptance in the ED included: age younger than 50 years (Odds Ratio [OR] 3.28, 95% Confidence Interval

[CI] = 1.74 to 6.21, p<0.01), Latino/Hispanic ethnicity (OR 2.89, 95% CI = 1.52 to 5.51, p<0.01), and close contact with high-risk individuals (OR 2.28, 95% CI = 1.33 to 3.92, p<0.01). These results suggest that the majority of relatively healthy adult patients would accept the seasonal influenza vaccine in the ED. Although a shortage of vaccines and increased vigilance during a concurrent H1N1 outbreak may have influenced overall acceptability, we conclude that influenza vaccinations during the ED patient encounter would generally be acceptable to patients as a means to improve their overall health, and indirectly the health of their high-risk close contacts.

Acknowledgements

To Dr. Karen Jubanyik, your guidance and support over the last two years have meant more than you can imagine. Thank you for your patience and understanding with this thesis, and for your example of clinical excellence and compassion that I will keep with me as I strive to develop my future as an emergency physician. To Drs. Lori Post, Federico Vaca and Steven Bernstein, thank you for your thoughtful guidance and direction with this project. My sister, Asia, thank you for always believing in me and for being my guide through statistics and computer programs. Please know that I admire you, and I am grateful to have you in my life. My parents, thank you for your endless love and support. You are my heroes, and I will never forget all that you have done to give us opportunities for a better life. You showed me the importance of education and diligence since my earliest days of school, and all that I accomplish is a tribute to you. I pray that I may always make you proud. To my role models and mentors throughout medical school—Drs. Benjamin Doolittle, Robert Nardino, Barry Wu, Frank Bia, Michele Barry, Philip Wai, Christopher Moore, Laura Bontempo, and Gerard Rudy—you have all contributed to my development as a physician and a person. The lessons you have taught me and the example you have set will continue to influence me long after I graduate. To Aimee Two, Swapna Reddy, Amanda Silverio, Anita Nageswaran, and all my other friends, thank you for being a part of my journey—from the laughter to the tears, from moments of panic to causes for celebration. No matter the distance, I am grateful to know, we will always be at each other's sides.

Table of Contents

Introduction

Background & Current Influenza Immunization Practices

Despite vaccination efforts since the 1960s, seasonal influenza continues to be a major cause of morbidity and mortality worldwide. An estimated 36-51,000 influenza-related deaths occur each year in the United States, accounting for over $87 billion lost, of which over $10 billion are direct medical costs[1-3]. As our population ages, these numbers will undoubtedly climb. Influenza vaccines have the potential to prevent 50-60% of laboratory-confirmed influenza in community-dwelling elderly persons over the age of 65, while reducing their risk of death by 48% and their risk of influenza- or pneumonia-related hospitalizations by 27%[4, 5]. In adults younger than 65, the vaccine is even more effective, capable of preventing as much as 70-90% of laboratory-confirmed influenza cases[4].

Vaccination efforts have traditionally been targeted at individuals with an increased risk of complications associated with influenza (children younger than five, adults over 50, and persons with chronic medical illnesses). Although the vaccine has also been recommended for contacts of high-risk individuals since 1985, formal targeted efforts to vaccinate such healthy individuals have only been directed at healthcare workers, not household or other close contacts. In 2008, the Advisory Committee on Immunization Practices (ACIP), a working group within the US Center for Disease Control and Prevention (CDC), expanded its recommendations to also include vaccination of "any adult who wants to reduce the risk of becoming ill with influenza or of transmitting it to others," as well as vaccination of all children 5-18 years old, while maintaining a primary focus on those 6-59 months old (Figure 1).

The 2009 National Health Interview Survey (NHIS) found that only 34.9% of adults had been vaccinated against the flu for that season. By age, the vaccination trends within the prior 12 months were 67.6% of adults older than 65 years, 41.7% of 50-64 year-olds, and 22.9% of 18-49 year-olds. Significant disparities were also found among racial and ethnic groups. In the high-risk age bracket of adults over the age of 65 years, only 51.5% of Hispanic/Latino individuals and 52.3% of non-Hispanic/Latino black individuals had been vaccinated, compared to 70.2% of non-Hispanic/Latino white individuals[6]. When considering other at-risk groups, the NHIS, the National Immunization Survey, and the Behavioral Risk Factor Surveillance System (BRFSS) survey report that only 25.5%-to-35.1% of high-risk 18-49 year-olds, 13.4% of pregnant women, and 17% of adult household contacts of high-risk individuals were vaccinated in the 2006-2007 season[7-9]. While the numbers for vaccinated adults (both high-risk and their close contacts) are slowly rising, they continue to fall far short of the Healthy People 2010 national health objectives set by the US Department of Health and Human Services[8, 10]. These goals include 90% coverage for persons older than 65 years and nursing home residents, as well as 60% coverage for non-institutionalized high-risk 18-49 year-olds[8, 10, 11].

Annual influenza vaccination has long been indicated for elderly persons due to their increased rates of complications associated with the flu[8]. Among the elderly, a 2006

Cochrane meta-analysis by Rivetti et al. found the vaccine to be significantly more effective in preventing pneumonia, hospital admission and death resulting from influenza in those who reside in long-term care facilities, as opposed to those who live in the community[12]. This was in contrast to results found by Nichol et al. showing that the benefit favored those who are community-dwelling[5]. Regardless of the contradictory findings, elderly persons are at greater risk for influenza-related complications, and should therefore be vaccinated.

However, the individual vaccination of such high-risk persons may be insufficient to provide them with protective immunity. Even during influenza seasons when the vaccine efficacy for the circulating virus is as high as 70-90%, the senescent immune systems of elderly patients may not produce adequate immunogenic responses[13-15]. Goronzy, et al. quantified this among a cohort of 65-98 year-olds receiving the trivalent influenza vaccine. Only 17% of them were able to generate proper antibody titers to all three components of the vaccine, and 46% produced no antibody response at all[16]. When considering chronic illness in addition to advanced age, the variability of a vaccine-generated humoral immunity is further amplified. During the 2003-2004 influenza season, Herrera et al. evaluated vaccine effectiveness in 50-64-year-old adults with and without high-risk medical conditions. Although the vaccine was 60% effective in preventing laboratory-diagnosed influenza in the healthy adults, it was only 48% effective in adults with high-risk medical conditions. This translated into 90% vs. 36% effectiveness in preventing influenza-related hospitalizations in healthy vs. high-risk adults, respectively[13]. To further this association, after following a cohort of over 72,000 adults over the age of 65 for eight years, Jackson et al. reported that the historic misperception that the influenza vaccine protects senior citizens from illness and death related to the flu may have been biased by healthy seniors actually being more likely to be vaccinated than those who had medical problems in the first place[17]. They also found that functional limitations (i.e. being unable to perform activities of daily living, such as bathing oneself) of seniors over the age of 65 were associated with a lower likelihood of influenza vaccination, as well as an increased risk of death during the influenza season[18].

Potential Changes in Vaccination Practices to Improve Outcomes in the Community

The aforementioned studies demonstrate that vaccination of high-risk patients actually provides them with only limited immunity against influenza. Even if vaccination rates do reach the Healthy People 2010 goals, they may still be insufficient for improving overall societal health. In fact, a cyclic regression model conducted by Simonsen et al. found that despite an increase in vaccination rates from 15% in 1989 to 65% in 1997, there were no significant decreases in excess mortality among elderly and chronically ill populations[19]. If vaccinating the high-risk populations is not sufficient to decrease their morbidity and mortality, perhaps preventive measures should be refocused to stop the initial transmission of the virus to these individuals. Rather than relying on their own immune systems to protect them from illness, a general decrease in the amount of circulating virus in the community could prevent them from being exposed to influenza in the first place. In 2009, Medlock and Galvani created a mathematical model to account for "age-specific transmission dynamics" during the 1918 and 1957 influenza pandemics. The results of their analysis showed that vaccine distribution to school-aged children and 30-to-39-year old adults would produce the most optimal outcomes in total influenza-associated infections and deaths. This beneficial effect would also extend to years of life lost, economic costs (including future lifetime earnings) and contingent value (accounting for the death of young adults resulting in greatest societal disutility)[20]. While this data is based on outdated life expectancies and causes of mortality in the United States, they suggest a beneficial role for vaccinating society's non-high risk individuals. In recognition of these benefits, the ACIP influenza vaccination guidelines should extend support beyond just the vaccination of persons at increased risk for complications of the flu. Promoting the vaccination of young healthy people in the community could accomplish just that goal.

The overall health of the community can be improved by empowering individuals of all ages to protect their own health through acquired personal immunity, as well as the health of those around them through a decrease in transmission of the virus to their at-risk close contacts. Since the CDC first recommended immunization of healthy household contacts of high-risk persons in 1985, numerous studies have evaluated the costs and benefits of vaccinating non-high risk individuals. Results vary among cost-benefit analyses evaluating the vaccination of healthy working adults. The greatest financial burden was found by Bridges et al., who reported a net cost of $11.57 per person administered the vaccine (as compared to those receiving placebo). This sum included the costs of vaccines and their administration, as well as the cost of physicians' visits, prescriptions, hospitalizations and lost work hours secondary to influenza illness[21]. Notably, this net financial cost per person was also associated with the intangible benefits of 34% fewer influenza-like illnesses (ILI), 42% fewer physician visits and 32% fewer work days lost during years with a good vaccine match (86% efficacy) for circulating viruses. However, the cost jumped to $65.59 during years with a poor match (50% efficacy). The authors also noted that the likelihood of net savings would be increased if one took into account the decreased rate of viral transmission to close contacts, as well as improvement in quality of life[21]. In contrast, the greatest net savings were found by Nichols et al, who reported $46.85 saved per healthy adult receiving the vaccine (as compared to those receiving placebo), and observed reductions in the number of work days lost by 43% and the number of physician visits by 44%[22].

The potential to improve overall public health by vaccinating of a threshold number of individuals demonstrates a concept known as herd immunity. Herd immunity has been successful in combating a number of other infectious diseases, including varicella-related diseases, adult pneumococcal pneumonia, and hepatitis A. There are also promising examples reporting that this concept could work with influenza. In one neighborhood in Moscow, a single dose of inactivated vaccine was provided to 57% of 3-6 year-old and 72% of 7-17 year-old children. When compared to a control neighborhood, in which children were not vaccinated, non-vaccinated elderly had 3-4 times fewer episodes of influenza-like illnesses when the children in their neighborhood were vaccinated[23]. In another study conducted by Reichert, et al., vaccination of Japanese schoolchildren against influenza led to an overall decrease in winter mortality, with an estimated 37-49,000 lives spared between 1977 and 1994. Further proof of this direct correlation came after the discontinuation of this program in 1994, when the effects on annual mortality were quickly reversed[24]. Providing yet another example, the vaccination of day-care children (24-60 months old) in San Diego, California was associated with a 42% reduction in febrile illnesses among all unvaccinated household contacts of these children, and a greater that 70% decrease in febrile respiratory illnesses, school absenteeism, earaches, physician visits, and antibiotic prescriptions among school-aged contacts[25]. Lastly, Weycker and colleagues evaluated the potential herd benefits of vaccinating children by a computer simulation model of influenza transmission and found that vaccinating just 20% of children would reduce the total number of influenza cases by 46%, while vaccinating 40% would decrease morbidity and mortality in the elderly by up to 70%[26].

Extending this concept from just children to the general population should only improve the potential to prevent influenza-related illnesses. In 2000, Ontario, Canada implemented the world's first universal influenza immunization program (UIIP). As a result, the province experienced a 74% decline in influenza-associated mortality between 1997 and 2004 (other Canadian provinces only had a combined 57% decline)[27]. This dramatic improvement was also seen in the number of influenza-associated hospitalizations, doctor's office visits and emergency department visits[27]. In light of these proven benefits to vaccinating healthy individuals, efforts should be made to at least increase the vaccination rates of household contacts to high-risk persons far beyond its most peak rate in the United States of 21.1% in 2004[28].

Evaluating Influenza Vaccination Programs in the Emergency Department

In the United States, where access to primary and preventive health care services is limited, one way to improve vaccination rates may be to make these services available through the emergency department. The role for vaccinations in the ED is widely recognized and accepted, although the extent to which such services are provided is a topic of debate. The emergency department has historically offered vaccinations against tetanus and rabies. Occasionally hepatitis, measles, mumps, rubella, cholera, and meningococcus have also been available. In the past decade, 93% of emergency department vaccinations were against tetanus, as one in three patients with open wounds in the ED receives this vaccine[29]. As a result, in 2009, there were only 17 reported cases of tetanus in the US[30]. Meanwhile, 114,000 hospitalizations and up to 51,000 deaths occur each year secondary to influenza[29]. In an effort to expand influenza vaccination coverage the ACIP's 2008 Recommendations on Prevention and Control of Influenza included a statement that: "Acute health-care facilities (e.g., emergency departments and walk-in clinics) *should* offer vaccinations throughout the influenza season to persons for whom vaccination is recommended or provide information regarding why, where, and how to obtain" the vaccine[8]. The American College of Emergency Physicians (ACEP) supports the establishment of relationships between emergency departments and outpatient clinics/physicians in order to refer unvaccinated patients, as well as the role of EDs in assisting with vaccination campaigns in the event of an epidemic or outbreak of a vaccine-preventable disease, such as influenza[31]. Given the annual occurrence of influenza epidemics, and the inability to predict the severity of viral pathogenicity in a given year, EDs would better serve their patients by establishing programs to offer the vaccine annually. Making this a part of the standard of care each flu season may also better prepare EDs to distribute other vaccines in the event of new infectious disease outbreaks. Furthermore, greater vaccination coverage of the emergency department patient population would be a step toward breaking down the health barriers associated with lack of means and medical coverage.

For many Americans, the emergency department serves as their only point of contact with the health care system. According to the most recently published National Hospital Ambulatory Medical Care Survey (NHAMCS), there were over 120 million visits to hospital emergency departments in the United States in 2006 (up 32% from the 90.3 million visits ten years prior), and overall utilization is continuing to rise with 40.5 visits per 100 persons annually[32]. With recent economic struggles nationwide, the percent of people with a regular place to go for medical care (not including a hospital ED) has decreased from 87.9% in 2003 to 85.4% as of June 2009, with Hispanic/Latino adults being the most underserved at 76.3%[6]. Of those patients who have primary medical doctors (PMDs), a survey in 2002 showed that while 80% of their physicians offered the vaccine in their practices, only one-fourth used a telephone or mail reminder system to contact their high-risk patients regarding the need for annual vaccination[33]. Because immunization is time-dependent, requiring about two weeks to ensure a proper immune response prior to viral exposure, a lack of contact with one's PMD in the months preceding flu season provides the same benefit as the absence of a PMD altogether.

Given their access to a large portion of the population, emergency departments have the potential to help fill this great void in public health. In a recent evaluation of risk status among ED patients in a Tucson, Arizona ED, Hiller et al. found that the ED population had a greater risk for influenza-related complications than the general adult population. Medically high-risk patients (including those who are pregnant) comprised 41.5% of that ED population, compared with 30.8% of the general population. Still only 43.5% of those who were high-risk had been vaccinated. Interestingly, 13.7% of the high-risk patients presenting to the ED during the peak of the influenza season (February 1-7) in 2006 also had at least one visit to the ED during the preceding three months. They therefore could have potentially avoided their subsequent visit by vaccination at that time[34]. Clearly the ED patient population is in particular need of additional preventive health services in order to avoid the need for future such visits.

Several studies have been conducted to evaluate the acceptability and feasibility of administering influenza vaccines (often alongside pneumococcal vaccines) among *high-risk* adult patients in the emergency department (Table 1). The first study to address this question came in the form of a questionnaire distributed by Polis, et al. over two decades ago, when only 20.1% of the 350 surveyed high-risk patients had even heard of a vaccine against the flu[35]. Years later, in the fall of 1992, Rodriguez and Baraff were the first to attempt an actual influenza vaccination program in the emergency department at the University of California-Los Angeles (UCLA). Over eight weeks, they examined a convenience sample of 763 patients over the age of 65, 63% of whom had not received the vaccine that season or were unsure of their vaccination status. Of those unvaccinated patients, 50% consented to and received the vaccine after contraindications were ruled out[36]. In 1996, Slobodkin and his colleagues at the Cook County ED in Chicago, Illinois screened 24% of non-emergency patients (a sample size of 2631 persons) in the ED over 6 weeks, and by standing order, offered the influenza and pneumococcal vaccines to patients at high risk for influenza-related complications. Thirty percent of the patients screened were found to be high risk, but only 21% had already received the vaccine. Ultimately, 62% percent of the non-immunized patients actually received the vaccine in the emergency department, although 71% had given consent[37]. In 2001, Pearson and her colleagues at the Emergency Department of Sir Mortimer B Davis Jewish General Hospital in Montreal, Quebec conducted a similar study over four weeks early in the influenza vaccination period. Thirty-six percent of those screened (754 patients) were considered eligible for the vaccine based on age or chronic disease, but only 35% of them had already received it. Of those who were not already vaccinated, and had no plan to do so, 65% accepted the vaccine in the ED[38]. In 2003, Rimple, et al. sought to immunize high-risk patients over a 3 week period at an urban ED in Albuquerque, New Mexico. Sixty-nine percent of the 648 patients who completed screening were found to be at high risk for influenza-related complications. Of these, only 16% had already been vaccinated, a number which increased to 83% when the vaccine was offered and administered in the ED[39]. Most recently, Cassidy et al. screened 2858 ED patients in a private, urban hospital in Baton Rouge, Louisiana during the 2005-2006 flu season and reported a 25% rate of up-to-date vaccination status. Of those who had not yet been vaccinated 46% were found to be high-risk, of whom 54% agreed to a vaccine in the ED, and 39% were actually vaccinated. When evaluating reasons for acceptance, 50-64-year-olds with a history of prior immunization were more likely to accept the vaccine, as were patients with co-morbidities, and those approached earlier in the flu season (December vs January/February)[40]. These studies all confirm that although vaccination rates have varied greatly in both the United States and Canada, they have long been below adequate for high-risk patients. High-risk patients presenting to the ED without up-to-date vaccinations generally accepted seasonal flu vaccines during their visit.

Through the years, patients sited many different barriers to accepting an influenza vaccine in the ED (Table 1). Among these were: a perceived lack of need for the vaccine[37, 39, 41, 42], concern of adverse reactions/side effects[35-37, 39, 41, 42], belief that the vaccine actually causes the flu[35, 37], belief that the vaccine does not work[37, 38], and a desire to discuss their decision with their PMD[36, 38, 41].

While all the previously conducted studies verify the acceptability and feasibility of influenza vaccinations among high-risk patients in the ED, they are based on outdated CDC ACIP vaccination guidelines, which only accounted for vaccination of such high-risk groups. This researcher found no studies in the United States to evaluate the acceptability of the vaccine among young and *healthy* adult patients in the emergency department. In an effort to decrease overall morbidity and mortality associated with seasonal influenza, a month-long survey was conducted in the Urgent Care area of the Yale-New Haven Hospital Emergency Department to evaluate the acceptability of the vaccine among this patient population.

Statement of Purpose

The purpose of this study was to assess the acceptability of seasonal influenza vaccinations among the various demographic groups of patients in the urgent care area of the emergency department. As part of this evaluation, we sought to also assess the barriers to patients accepting an influenza vaccination in the emergency department. Ultimately the study should answer the question of whether emergency departments could better serve their patients, and their patients' close contacts at high-risk for complications of influenza, by filling this unmet immunization need in primary and preventive care.

Hypothesis

The majority of unvaccinated healthy adults presenting to the Urgent Care section of the Emergency Department would be willing to accept a seasonal influenza vaccine during visits for other uncomplicated medical issues.

Specific Aims

This study sought to assess influenza vaccination rates among relatively healthy adults in a socioeconomically and ethnically diverse urban community. Among unvaccinated adults, especially those who are at high-risk for complications of the flu or in close contact with such individuals, we sought to identify factors associated with gaps in seasonal influenza vaccination status. The overall aim was to evaluate the acceptance of influenza vaccines by patients during this encounter with the medical system.

Methods

Study Design and Administration

A convenience sample of adult patients was surveyed during the month of November 2009 in the Urgent Care area of an urban ED serving over 70,000 adults per year. The Urgent Care area is open from 8 a.m. to 10 p.m. daily, and a medical student distributed surveys to patients awaiting test results or contact with their care provider during a total of forty hours each week. Prior to survey administration, all subjects were provided information on the study and given the option to decline. All information sheets and surveys were translated into Spanish, and the surveying medical student was proficient in Spanish.

The survey consisted of questions about patients' vaccination history, their perceived need for the vaccine, and whether they would accept a vaccine in the ED (Figure 2). If unwilling to accept the vaccine in the ED, patients were also asked their reasons for refusal. This was presented as an open-ended question during the first two weeks of the study, and standardized options (including "other") were provided during the second two weeks. Demographic data obtained included age, race, education level, insurance status, and access to primary medical care. Information was also collected to assess patients' risk for complications associated with influenza, as well as their contact with high-risk individuals. Patients requesting additional information about the seasonal influenza vaccine were given Yale-New Haven Hospital-prepared information sheets about the vaccine. Because there was a shortage of available seasonal influenza vaccines during the course of this study, there were none available to distribute to patients in the ED.

Interested patients were referred to other vaccination locations through the Flu Vaccine Locator on a website run by the Department of Health and Human Services[43].

Statistical Analysis

All data were entered into Microsoft Excel 2008 for Mac, Version 12.1.0 (Copyright 2007, Microsoft Corporation). Data were then transferred to Small Stata 11.0 for Mac (Copyright 2009, StataCorp) for all descriptive analysis. Univariate analysis was conducted to determine odds ratios with 95% confidence intervals for the following dependent variables: vaccination status this year, vaccination status in previous years, no history of vaccination ever, belief that one should be vaccinated, plans for vaccination, and willingness to receive a vaccine during their visit to the emergency department that day. The independent variables included: age, sex, race/ethnicity, insurance status, educational background, access to primary care, medical indications for vaccination, and contact with individuals at increased risk for complications of the flu. Variables were dichotomous, with binomial data entry to document presence or absence of a variable. Chi-squared testing was used to calculate p-values, with significance being considered at $p<0.05$.

Ethical Considerations

This study was approved with expedited review by the Human Investigation Committee at the Yale University School of Medicine. No signed informed consent was required since no medical interventions were made, all patient data were unidentifiable, and survey responses were confidential. After being given an information sheet and a chance to ask questions, patients were given the option to decline responding to the survey with no resulting prejudice affecting their medical care.

Results

A total of 381 patients were approached, of which 352 completed the survey (92.4% of those asked). 349 patients (99% of those surveyed) had no contraindications to the vaccine, and the three patients who had contraindications were all allergic to egg products. The final surveyed sample used in this analysis was composed of 197 males (56%), and the mean age was 36 years ± Standard Deviation (SD) 12.4 years. Table 2 presents the demographic breakdown of survey respondents. The majority of patients were younger than 50 years (292 persons, 83.7%). The most common racial/ethnic group was black (non-Hispanic), comprising 36.1% of the populations (126 persons), while whites made up 30.7% (107), and Hispanic/Latino persons made up 27.2% (95). Most patients had some form of health insurance (253 persons, 72.4%), either private (93 persons, 26.6%) or government-sponsored (160 persons, 46.8%). Eighty-four patients (24.1%) had no form of healthcare coverage. One hundred eighty (51.6%) had a primary medical doctor. Most patients (266 persons, 76.2%) were high school graduates or had passed a General Education Development (GED) test.

One hundred fifty-eight (45.3%) had a history of vaccination against seasonal influenza in previous years, but only 69 (19.8%) had already been vaccinated for this influenza season (Table 2). The rate of vaccination improved over the course of this month-long study, from 16% during the first half of the month to 24% during the latter half (Table 3).

Of those who had previously been vaccinated, 20 (12.6%) reported feeling sick after receiving the vaccine in the past, but none reported serious adverse reactions such as Guillain-Barré syndrome, or anaphylaxis. Of 280 (80.2%) who had not yet been vaccinated this year, 116 (41%) believed they should be vaccinated, 107 (38%) already had plans to receive the vaccine this year, and 179 (64%) would have accepted the vaccine in the ED (Table 2).

One hundred eighty patients (51.6%) reported never having been vaccinated against seasonal influenza. Of these patients, 49 (27.2%) have a chronic medical condition placing them at increased risk for complications of the flu, and 121 (67.2%) have close contacts at increased risk for complications of the flu, of which 78 (64.5%) would have accepted a vaccine in the ED. In total, 92 (51.1%) of the patients who had never been vaccinated believe that they should be vaccinated, 55 (30.6%) were planning to receive the vaccine this season, and 108 (60%) would have accepted the vaccine during that visit to the ED (Table 4).

As shown in Table 5, previously vaccinated patients had greater odds of being vaccinated this year (Odds Ratio [OR] 9.49, 95% Confidence Interval [CI] = 4.49 to 20.06, $p<0.01$). In addition, if they had not yet been vaccinated, their odds were greater for believing that they should be vaccinated (OR 2.72, 95% CI = 1.57 to 4.71, $p<0.01$), and already having plans to obtain the vaccine this year (OR 2.46, 95% CI = 1.47 to 4.13), as compared with those who had never been vaccinated (OR 0.37, 95% CI = 0.21 to 0.64, $p<0.01$ believing they should be vaccinated; OR 0.41, 95% CI = 0.24 to 0.68, $p<0.01$ with plans). These trends carried over to willingness to accept a vaccine in the ED, but were not statistically significant (OR 1.63, 95% CI = 0.96 to 2.77, if previously vaccinated; OR 0.61, 95% CI = 0.36 to 1.04, if never vaccinated, p=0.07).

Various demographic characteristics influenced patients' seasonal influenza vaccination practices and beliefs. Tables 6 and 7 summarize the relationships between patient age and influenza vaccination. As seen in Table 6, adults under the age of 50, when compared to those over 50, had lower rates and odds of vaccination this year (15.4% vs. 42.1%; OR = 0.25, 95% CI = 0.13 to 0.47, p<0.01), as well as in the past (40.4% vs. 70.2%; OR 0.29, 95% CI = 0.15 to 0.54, p<0.01). While age does not significantly impact one's belief that they should be vaccinated or their plans to do so, the odds are greatest that the subgroup of patients 18-29 years old will accept a seasonal influenza vaccine in the ED (OR 1.67, 95% CI = 1.07 to 2.61, p=0.02), when compared to other age groups. The majority of all patients younger than 65 would accept a vaccine in the ED (71.9% of 18-29 year-olds, 57.1% of 30-49 year-olds, 70% of 50-64 year-olds), although the odds were lowest for those who are 30-49 years old (OR 0.58, 95% CI = 0.35 to 0.95, p=0.03) (Table 7).

The relationship between racial/ethnic identities and vaccination status manifests in all non-white individuals having greater odds of never having been vaccinated than whites (OR 1.62, 95% CI = 1.03 to 2.55, p = 0.03) (Table 8). Latino/Hispanic patients had the greatest odds of believing they should be vaccinated (OR 2.55, 95% CI = 1.39 to 4.64, p<0.01), which also translated to a greater willingness to accept the vaccine in the ED

(OR 2.89, 95% CI = 1.52 to 5.51, p <0.01). This association, however, was not seen in other minority groups, with black patients having the lowest odds of accepting a vaccine in the ED (OR 0.57, 95%CI = 0.24 to 0.96, p=0.03) (Table 9).

Neither sex nor educational backgrounds significantly influenced patients' vaccination practices and beliefs this year, or in previous years. Although males in this study were less often vaccinated than females (16.2% vs 24.3%), the odds that sex influenced vaccination status were not statistically significant (OR 0.61, 95% CI = 0.36 to 1.03, p = 0.06 for males). Among groups with various levels of education, some non-statistically significant trends were seen among the non-vaccinated patients this year. Those who never completed high school, or the equivalent, appear to have greater odds of believing they should be vaccinated (OR 1.75, 95% CI = 0.97 to 3.14, p = 0.06), having plans to be vaccinated (OR 1.28, 95% CI = 0.73 to 2.23, p = 0.39), or being willing to accept the vaccine during their current visit to the ED (OR 1.39, 95% CI = 0.76 to 2.44, p = 0.31). In fact, as patients reported completion of higher levels of education, the odds of their vaccine acceptance in the ED appeared to decrease (OR 1.13, 95% CI = 0.69 to 1.84, p = 0.63 for high school graduates/GEDs; OR 0.60, 95% CI = 0.33 to 1.10, p = 0.09 for college graduates).

Tables 10 through 14 demonstrate the relationship between patients' access to the medical system and influenza vaccination. Insurance status does affect vaccination practices among our patients, although the specific form of insurance may not matter (Tables 10, 11). Patients with any form of insurance were more likely to have been vaccinated this year (22.9% vs. 13.1%; OR 2.29, 95% CI = 1.14 to 4.63, $p = 0.02$) and in the past (48.6% vs. 36.9%; OR 1.65, 95% CI = 1.01 to 2.68, $p = 0.04$) (Table 10). Among those who had not been vaccinated this year, having government-issued/public insurance was associated with increased odds of planning to obtain the vaccine (OR 2.48, 95% CI = 1.49 to 4.13, $p<0.01$). Overall, the majority of unvaccinated patients would accept an influenza vaccine in the ED, regardless of their insurance status (63.6% of those with insurance, 61.6% of those without) (Table 11).

Access to a primary care physician was associated with a greater likelihood and odds of vaccination this year (26.7% vs. 12.4%; OR 2.56, 95% CI = 1.44 to 4.55, $p<0.01$) and in the past (53.3% vs. 36.7%; OR 1.97, 95% CI= 1.28 to 3.04, $p<0.01$) (Table 12). When this survey was administered in November 2009, those patients who had been to their PMD within the previous two months had the greatest odds of already being vaccinated this year (OR 2.79, 95% CI = 1.53 to 5.08, $p<0.01$) (Table 13). Patients with PMDs who remained unvaccinated were also almost twice as likely to have plans to be vaccinated this season (51.5% vs. 26.4%; OR 2.97, 95% CI 1.77 to 4.99, $p<0.01$). Most patients were willing to accept a vaccine in the ED, regardless of their access to primary care (62.9% vs. 64.9%) (Table 14).

A total of 101 surveyed patients (28.9%) reported having some chronic medical condition that would place them at increased risk for complications of influenza, and eleven (3.2%) were pregnant or hoping to be pregnant during the coming flu season (Table 2). Of those with chronic illness, chronic lung disease and diabetes were the most common, affecting

14.9% and 6.8% of the surveyed population, respectively. As seen in Table 15, pregnant patients were not significantly more or less likely to have already been vaccinated this year. However, patients with chronic illness had 1.79-times greater odds of vaccination this year than those with no medical indications for vaccination (95%CI = 1.03 to 3.12, p=0.04). These increased odds were not, however, significantly present in previous years. Neither pregnancy nor chronic medical illness significantly changed a patient's odds of believing they should be vaccinated, having plans for vaccination, or being willing to accept the vaccine during their visit to the ED (Table 16).

Patients in close contact with individuals at increased risk for influenza-related complications had consistently greater odds of previous vaccination (overall OR 1.85, 95% CI = 1.12 to 3.04, p = 0.01), although the odds were not significant thus far for this vaccination season (OR 1.72, 95% CI = 0.89 to 3.33, p = 0.10) (Table 17). Similarly, people with no known high-risk close contacts had significantly greater rates and odds of never having received a flu vaccine than those with high-risk contacts (63.4% vs 47.5%; OR 1.94, 95% CI = 1.18 to 3.17, p<0.01). Of those who had not yet been vaccinated this season, individuals with any close contact with high-risk individuals were significantly more likely to believe they should be vaccinated (63.5% vs. 48.8%; OR 1.83, 95% CI = 1.08 to 3.11, p=0.02), have plans to be vaccinated (42.5% vs. 27.5%; OR 1.95, 95% CI = 1.10 to 3.45, p = 0.02) and be willing to accept the vaccine in the emergency department that day (69.5% vs. 50%; OR 2.28, 95% CI = 1.33 to 3.92, p<0.01) (Table 18). These trends are all consistent regardless of whether patients' contacts are at high-risk based on medical conditions or age. However, the trends among unvaccinated healthcare workers are reversed (OR 0.52, 95% CI = 0.23 to 1.17, p = 0.11, believing they should be vaccinated; OR 0.65, 95% CI = 0.27 to 1.55, p = 0.33, with plans to be vaccinated; OR 0.50, 95% CI = 0.22 to 1.11, p = 0.08, accepting a vaccine in the ED).

Patients who had not yet been vaccinated this year and would refuse the vaccine in the ED were asked to provide reasons for their refusal. The summary of patients' responses is presented in Table 19. The most common reasons for vaccine refusal in the ED included belief that the vaccine will cause illness (25.3%), a lack of perceived need for the vaccine (24.1%), belief that one is healthy enough to fight off the flu without vaccination (18.4%), and concern of side effects from the vaccine (13.8%). Less common responses included a fear of needles (8.1%), desire to consult one's primary care doctor (6.9%), distrust of all vaccines (2.3%), and belief that the vaccine does not actually protect one from illness (1.1%). No respondents reported a preference to get the vaccine elsewhere.

Discussion

Emergency departments serve as healthcare safety nets for much of the population, especially those who are young and uninsured. Patients often present to the emergency department with primary care needs, however preventive care is rarely addressed during these visits. Some vaccination practices have been successfully implemented in the emergency department, of which tetanus vaccination is most notable. Since 2008, the American College of Emergency Physicians (ACEP) has acknowledged that "individuals at risk for [vaccine-preventable] diseases are often not appropriately immunized and that

EDs may be called upon to play a more prominent role in the event of an emerging (or biothreat) outbreak”[31]. Given the antigenic shifts that annually create new influenza epidemics, and the high number of patients hospitalized for influenza-related illness each year, it is appropriate for emergency departments to consider the implementation of influenza vaccines in the care of their patients. Several studies have found vaccination against seasonal influenza to be feasible in the emergency department for patients considered high-risk for complications of the flu based on their age or chronic medical conditions[35-42, 44]. However, it is clear that high-risk individuals may not be sufficiently protected by the vaccine due to senescence of their immune system impairing their ability to develop humoral immunity. For this reason, EDs should actually offer the vaccine to not only high-risk patients, but also the younger, healthier patients whose immunity against the flu could actually protect those at high-risk form initial exposure to the virus.

This study evaluated the possibility of vaccinating patients in the Urgent Care area of the emergency department. As demonstrated in Table 2, this patient population is generally young (mean age 36, ± SD 12.4 years, 84% younger than 50), healthy (71.1% with no chronic medical conditions), and without adequate access to primary medical care (48.4% without a PMD). The overall good health and relatively mild chief complaints of the urgent care patient population limited medical contraindications to vaccination, such as moderate or severe febrile illness.

The month of November was chosen for this study in order maximize opportunities for vaccination from other resources (e.g. primary care physicians, outside clinics or pharmacies), while still making it available in the ED early enough to ensure proper immunoprotection before seasonal influenza hits the community. The Advisory Committee on Immunization Practices recommends that health-care providers begin offering the vaccine by October, or immediately after it becomes available[8]. Indeed, of those patients who have PMDs, the odds of vaccination were greater if they had seen their PMDs within the prior two months when vaccines should have been available (OR 2.79, 95% CI = 1.53 to 5.08, $p<0.01$) (Table 13). In 2009, November was actually very early in the immunization season due to a low vaccine supply. This is reflected by the substantial growth in vaccination rates as the month progressed, which is demonstrated in Table 3. Because greater than eighty percent of influenza seasons begin in January or later, with over sixty percent peaking in February, vaccinating patients during the month of November should allow adequate time for achieving sufficient antibody protection most years[8].

This study was conducted too early in the immunization season to fully compare vaccination rates for this year with those of previous years. However, the rates of prior vaccination within this population were actually higher than the rates reported by the 2009 National Health Interview Survey (NHIS)[6]. 40.4% of 18-49 year-olds, 68.6% of the 50-64 year-olds, and 83.3% of those older than 65 reported prior vaccination in this population, while early results for the 2009 NHIS indicate rates of only 22.9%, 41.7%, and 67.6%, respectively, last year. Of note, the incongruence seen here may be attributed to the wording in this questionnaire, which asked about *any* previous vaccinations, rather than vaccination last year alone.

Overall, among the patients surveyed in our emergency department, those over the age of 50 were significantly more likely to have already been vaccinated this year, and in previous years. Patients younger than 50, who had not been included in vaccination recommendations prior to 2008, if they were in good health, had 3.28 (95% CI = 1.74 to 6.21, p <0.01) times greater odds of never having been vaccinated before. Still, although they had lower vaccination rates this year and in the past, the majority recognize a need for influenza vaccination, and would be willing to accept the vaccine, if offered, in the ED (Table 6). This is especially true for the 18-29 year-olds, who have the greatest odds of accepting a vaccine during their ED visit (OR 1.82, 95% CI 1.09 to 3.06, p=0.02) (Table 7). Such results indicate that the vaccination of younger patients may indeed serve as a potential avenue for protecting older age groups from initial exposure to influenza virus in the community. For patients older than 65, the 50% vaccination rate reported this year, and 83.3% reported for the past, may be compared to the 76.8% (95% CI = 74 to 79.6%) reported among Connecticut residents older than 65 in the 2007 Behavioral Risk Factor Surveillance System (BRFSS) survey, or the 64.8% reported nationally in the 2009 NHIS[6, 9]. These comparisons, however, are probably inaccurate as the small sample size of only six patients is unlikely to be an accurate representation of the local population. Regardless, it is clear that vaccination rates for this high-risk age group remain far below the Healthy People 2010 target of 90%[11]. In contrast, among 50-to-64 year-olds, another age group recommended for universal vaccination, this year's early vaccination rate of 41.2% actually appears promising, especially when compared to the 42.5% annual rate in the 2009 NHIS, and 46.6% Connecticut rate in the 2007

BRFSS[6, 9]. The odds of this age group being vaccinated are in fact significantly greater than others (OR 3.65, 95% CI = 1.89 to 7.02, p<0.01).

Racial/ethnic minorities make up a significant proportion of this surveyed ED population, with 66.5% of those surveyed being non-white (Table 2). Non-whites overall had 1.62-times greater odds of never having been vaccinated than whites (95% CI = 1.03 to 2.55, p = 0.03) (Table 8). Because non-whites together comprise the majority of this ED population, an obvious need is demonstrated by this discrepancy. Among the non-vaccinated patients of each racial/ethnic group, the majority responded favorably to the need for vaccination and would accept a vaccine in the ED (Table 9). However, when considering the potential impact of influenza vaccine administration in the ED, one should take into account that while Hispanic/Latino patients do have the highest odds for vaccine acceptance (OR 2.89, 95% CI = 1.53-5.51, p<0.01), black patients have the lowest (OR 0.57, 95% CI = 0.34-0.96, p=0.03).

Interestingly, the educational backgrounds of this patient population did not appear to independently influence their vaccination status. While over three quarters of the patients surveyed had at least high school diplomas or the equivalent GED, they did not appear to be any more or less likely to accept a vaccine, believe that they should be vaccinated, or have plans to receive the vaccine this season. In fact, the general trend suggests that although the majority of people with more formal education do respond positively to the idea of vaccination, they are at lower odds for believing they should be vaccinated, and for accepting a vaccine in the ED.

In contrast, healthcare coverage and access to a primary care physician do appear to be significant determinants of influenza vaccination. According to this survey, a greater degree of need exists within in our population than that which is reported in the 2009 National Health Interview Survey. While nationally 15.1% (95% CI = 14.14% to 16.08%) of those surveyed were uninsured, 24.1% of our patients reported having no form of health insurance (Table 2)[6]. While we could not account for the effects of "underinsurance," a complete lack of coverage clearly had adverse affects on an individual's vaccination status. Those who have any form of health insurance, whether private or government-sponsored, have 2.29-times greater odds than patients with no coverage of already being vaccinated this year (95% CI = 1.14 to 4.63, p=0.02), and 1.65 times greater odds of having been vaccinated in the past (95% CI 1.01 to 2.68, p=0.04) (Table 10). Although it affected their vaccination status up to that point, insurance status did not appear to be related to individuals' acceptance of the influenza vaccine in the ED, with the overall majority agreeing to be vaccinated. However, of all the patients who were not yet vaccinated this season, those with government sponsored insurance had the greatest odds of having plans to receive the vaccine elsewhere this year (OR 2.48, 95% CI = 1.49 to 4.13, p<0.01), a difference that may be attributed to the reimbursement for influenza vaccines by Medicare (Table 11).

The discrepancy in access to primary care is also a significant factor in vaccination status. According to the 2009 NHIS, 14.6% of the population does not have a usual place to go for their medical care, an increase from 12.1% in 2003[6]. Of these, the least likely groups to have places to go for primary care were 18-44 year-olds, who make up the majority of patients in the urgent care section of this emergency department, and Hispanic/Latino persons, who also comprise a significant proportion. In this population, having a PMD was associated with a higher rate and greater odds of vaccination early this flu season (26.7% vs. 12.4%; OR 2.56, 95% CI = 1.44 to 4.55, $p<0.01$), as well as in the past (53.3% vs. 36.7%; OR 1.97, 95% CI = 1.28 to 3.04, $p<0.01$) (Table 12). Among those with a PMD, their odds of vaccination were significantly greater if they visited their PMD in the previous two months (OR 2.79, 95% CI = 1.53 to 5.08, $p<0.01$), during which time they may have received the vaccine or been informed of its importance (Table 13). For those patients who had not yet been vaccinated, having a PMD also meant they were more likely to have plans to obtain the vaccine this year (51.5% vs. 26.4%; OR 2.97, 95% CI = 1.77 to 4.99, $p <0.01$). Yet despite these obvious advantages that primary care has on vaccination status, 44.4% of patients with PMDs still had never been vaccinated against the seasonal flu (Table 14). Ultimately, although it affected outside access to vaccination, access to a PMD did not affect vaccine acceptance in the ED.

While the aforementioned demographic factors influence vaccination in patients overall and should be considered as part of a mission to decrease the overall rates of illness and viral transmission, the medically high-risk patients remain a high priority for vaccine distribution. The general ED population has an overall greater risk of complications from the flu, than the general US population[34]. Among this study's surveyed population 28.9% had a chronic medical condition and 3.2% had plans to be pregnant during the influenza season, making them at increased risk of complications of the flu. While those with a chronic medical condition were more likely than healthy adults to have already been vaccinated this year, 48.5 had never before received a flu vaccine (Table 15). As all the prior studies on ED influenza vaccinations suggest, this demonstrates a great need that emergency department providers could potentially address (Table 1). Indeed ED vaccinations could help the medical community move toward achieving its Healthy People 2010 goal to vaccinate 60% of non-institutionalized high-risk 18-64 year old adults[11].

Of note, while the sample size of pregnant patients surveyed was quite small (n=11), EDs should not overlook the substantial need for vaccination of this group. Pregnant women are at an increased risk for acute respiratory disease and cardiopulmonary hospitalizations secondary to influenza infection, especially during the third trimester of pregnancy[45, 46]. Still, vaccination rates for these women are alarmingly low, ranging from 3.5% (according to vaccine registries from 1998-2003) to 12.8% (according to a 2003 telephone survey)[47]. In a survey administered to obstetrician-gynecologists in 1999, only 39% were in the practice of administering flu vaccines to their patients, suggesting that, despite attention to prenatal care, these women remain medically underserved[48]. Thus the ED may make the most of patient visits by offering the vaccine to these women.

Although vaccination programs in emergency departments may not be capable of reaching an adequate number of people to generate herd immunity in the community, they at least provide an opportunity to positively affect the health of those who often have limited contact with the healthcare system. Using patient encounters in the emergency department to vaccinate interested healthy adult patients also has the potential to prevent the spread of the influenza virus to the chronically ill, very young, and elderly in the community. While this study did not find an association between high-risk contacts and vaccination this year, a clear difference in previous vaccination histories does exist between the two groups. The odds of never having received a flu shot are in fact significantly greater for those with no known high-risk contacts. Even among those with high-risk contacts, less than 50% reported vaccination. Fortunately, those with high-risk close contacts who had not yet been vaccinated often at least recognized a need for their own immunization. These patients had greater odds of believing they should be vaccinated, planning to be vaccinated this year, and accepting a vaccine in the ED (Table 17). Thus their visits to emergency departments also present an opportunity by which to protect those at greatest risk for complications of the flu. Of note, these trends did not extend to unvaccinated healthcare workers, who were surprisingly less likely than non-healthcare workers to believe they should be vaccinated, have plans to obtain a vaccine, or be willing to accept a vaccine in the ED. Further analysis of this subgroup, however, is beyond the scope of this study.

Patients expressed several reasons for vaccine refusal in the emergency department (Table 19). Among them, beliefs that the flu shot will make them sick, that they are not at risk for the flu, or that they are healthy enough to fight off the flu, were the most common. Concerns regarding vaccine side effects were also relatively high. These barriers to vaccination highlight the need for patient education. As described above, formal education has not been a positively influential contribution to patient knowledge and beliefs about the flu vaccine. Thus physicians and other healthcare providers must take on the role of our patients' teachers, in order to allow for truly informed consent or dissent with regards to influenza vaccinations. While many individuals are indeed not at high risk for complications of the flu, and are healthy enough to fight it, they should understand the important effect that their vaccination may have on protecting their friends and family who may be high-risk. For those patients who site a fear of needles as their reason for vaccine refusal, the live attenuated influenza vaccine, in the form a nasal spray, is a safe alternative if they are healthy, not pregnant, and between the ages of two and 49 years[8].

Limitations

A significant amount of bias may have affected our data. First, the timing of the study may have contributed to sampling bias, which may ultimately limit comparison of vaccination rates this year, and in previous years. As mentioned above vaccination rates reported so early in the season are lower than those that would be reported at the end. Thus this year's vaccination rates are not comparable to those of previous years. Furthermore, while the reported rates of prior vaccination within this population may not be comparable to the rates reported by the 2009 National Health Interview Survey (NHIS) because the wording in this questionnaire addresses *any* previous vaccinations, rather than vaccinations last year alone[6].

Because all data were obtained from patients' personal accounts and memory, recall bias likely affected our outcomes pertaining to vaccination status this year and in previous years. Furthermore, since patient records were not reviewed, it is likely that some patients at high-risk for complications of the flu were not accurately identified as having known chronic medical conditions. Likewise, patients' knowledge of the health of their household contacts may be inaccurate, thus limiting the understanding of vaccination practices among patients with close contacts at high-risk for complications of the flu.

Unique to this year, a number of complications arose from a concurrent H1N1 outbreak. This produced a fair amount of validity bias, and subsequently limited the generalizability of these results to other seasonal influenza vaccination seasons. First, an early shift in vaccine production to manufacturing of H1N1 vaccines created a shortage of seasonal influenza vaccines for the course of this study in November 2009. This affected results by decreasing the number of patients already vaccinated this early in the typical influenza season. If compared to the month of November in previous years when vaccine supply was ample, the 20% vaccination rate this year may be quite low. The limited vaccine supply also affected this study by altering it from its original form, which would have involved actual vaccine administration to patients willing to accept it in the ED. Instead, researchers were forced to limit the study to a questionnaire surveying *potential* vaccine acceptance. One may assume that this hypothetical acceptance rate would drop if patients were faced with the option of actually receiving a flu shot.

Beyond affecting seasonal influenza vaccine availability, the H1N1 pandemic may have also influenced our study by skewing public perception and understanding of influenza. This would introduce further recall bias because patients who reported having been vaccinated this year may have only received the H1N1 vaccine, which was more readily available than the seasonal influenza vaccine for some time. Additionally, patients may not have had a clear understanding that there are two separate vaccines, and that the seasonal vaccine does not prevent illness from H1N1. In such a case, their increased vigilance regarding "the flu" may have falsely elevated their beliefs that they should be vaccinated, plans for vaccination, and willingness to accept the vaccine in the ED. In order to minimize this effect, patient education was provided regarding the differences between the two forms of influenza and their respective vaccines. Results summarized in Table 5 affirm that patients who had been vaccinated in the past had significantly greater odds of being vaccinated this year, believing that they should be vaccinated, having plans to receive the vaccine, and being willing to accept the vaccine in the ED. In contrast, those who had never been vaccinated had lower odds of vaccine acceptance. So despite the increased public awareness of "the flu," individuals' perceptions of vaccination this year did not necessarily deviate from those of previous years without H1N1.

This study is also limited in its applicability because it only measured acceptability of influenza vaccines among patients in the ED, and not the healthcare workers who would be administering the vaccine. Additionally, because the vaccine was not actually administered, the results of this study do not demonstrate or evaluate the feasibility of vaccine administration in the ED. When considering the implementation of an influenza vaccination program, one must take into account that the distribution of this survey was done by an individual specifically designated to that task, and it only reached a convenience sample of patients. While physician assistants and nurse practitioners in the department were originally expected to help distribute the survey during their patient encounters, their time constraints with patient care made them unable or unwilling to do so. If vaccines were actually administered in the ED by fulltime staff, one would imagine this additional step in patient care to likewise be hindered by other constraints on the time of healthcare providers. A recent survey from Fernandez, et al. at Boston Medical Center found that while 73% of attending physicians “agreed/strongly agreed” that influenza vaccines should be administered to patients in the ED, only 54% of residents and 32% or nurses felt the same way[49]. When the ED staff who are most likely to administer the vaccine are the least receptive to including that role in their patients’ care, the feasibility of vaccination programs can be greatly hindered. Indeed some of the previous studies evaluating influenza vaccinations in the ED found that the acceptance of the vaccine was greater than the actual vaccine administration (Table 1). Beyond provider constraints, additional barriers to feasibility may be financial. Significant burdens may be placed on the EDs and hospitals funding formal vaccination programs, as well as the patients and their insurance companies paying for the vaccine.

Lastly, when evaluating the potential impact of these results on future vaccine distribution in the ED, one must consider that the overall effect the vaccinations will vary from year to year, given the occasional inability to match the vaccine to the circulating virus. Each year, the vaccine is composed of three expected antigens from influenza A

(H3N2), influenza A (H1N1), and influenza B, which are based on anticipated point mutations in hemagglutinin and neuraminidase viral genes[8, 16]. These strains are chosen annually by the Food and Drug Administration's Vaccine and Related Biological Products Advisory Committee based on available epidemiological surveillance data[50]. Because vaccine production begins during the months of February and March prior to the coming flu vaccine, prediction of upcoming antigenic shift may be inaccurate, with efficacy in healthy young people ranging from 0-50% if the vaccine-virus match is poor, to 70-90% if the match is good[8, 51]. While ED vaccinations in a "good match" year could prevent illness in many of our patients and their high-risk close contacts, such positive effects may not be seen if the match is poor.

Future Directions

This study demonstrated a significant interest among patients for accepting a seasonal influenza vaccine in the emergency department. However, as mentioned above, because the study was limited to a survey, rather than actual administration of the vaccine, true acceptance rates are not known, nor is the feasibility of vaccine administration in the ED. Future studies should focus on vaccine administration to interested patients, as part of normal departmental functioning. This would allow for further identification of potential methods and barriers to not only acceptability, but also feasibility of vaccinating emergency department patients. As demonstrated in other trials, useful methods to maximize delivery of the vaccine to interested patients include some form of standing orders within the system and/or a designated nurse for vaccine administration[36-40]. While designating staff for this specific purpose is likely not feasible or affordable in the long term, ACIP does agree that standing orders should exist for all hospitalized patients to be vaccinated against seasonal influenza, and this practice could likewise succeed if formally implemented in the ED[8]. Acceptability by patients would also likely benefit from the availability of both the intranasal and intramuscular forms of vaccine.

Conclusions

Unvaccinated adult patients would accept the seasonal influenza vaccine in the ED. A shortage of seasonal influenza vaccines and an increased vigilance secondary to a concurrent H1N1 outbreak may have influenced the acceptability of this study. However, implementing availability of universal seasonal influenza vaccinations in the ED has the potential to reach two important patient populations –those who are at high risk for complications associated with influenza infection, and those who are young and healthy but serve as potential sources for viral transmission to their high-risk close contacts. While the majority of all non-vaccinated patients would accept the vaccine in the ED, factors associated with greatest odds of vaccine acceptance included age younger than 50, Hispanic/Latino ethnicity, and close contact with high-risk individuals. As these groups make up a significant portion of the ED population, their vaccination could indeed make a difference in the health of their communities.

Emergency physicians are often faced with addressing severe medical consequences of conditions that are preventable by adequate primary medical care. As the economy continues to struggle, and universal healthcare coverage continues to be politically elusive, the association between lack of vaccinations and lack of healthcare coverage will increasingly affect our patients. Therefore, as part of proper medical care and service for our patients, distribution of annual influenza vaccines should be a part of this important patient encounter with the medical system.

References

1. Thompson WW, Shay DK, Weintraub E, Brammer L, Cox N, et al. Mortality associated with influenza and respiratory syncytial virus in the United States. JAMA 2003;289:179-86.
2. Martin DR, Brauner ME, Ploutte JF. Influenza and pneumococcal vaccinations in the emergency department. Emerg Med Clin N Am 2008;26:549-70.
3. Molinari NA O-SI, Messonnier ML, Thompson WW, Wortley PM, et al. The annual impact of seasonal influenza in the US: measuring disease burden and costs. Vaccine 2007;25:5086-96.
4. Nichol KL. The efficacy, effectiveness and cost-effectiveness of inactivated influenza virus vaccines. Vaccine 2003;21:1769-75.
5. Nichol KL NJ, Nelson DB, Mullooly JP, Hak E. Effectiveness of influenza vaccine in the community-dwelling elderly. N Engl J Med 2007;357:1373-81.
6. Centers for Disease Control and Prevention, Early Release of Selected Estimates Based on Data From the January-June 2009 National Health Interview Survey. 2009. (Accessed December 31, 2009, at www.cdc.gov/nchs/nhis/realeased200912.htm#2.)
7. Centers for Disease Control and Prevention. 2007 National Health Interview Survey. 2007. (Accessed December 30, 2009, at www.cdc.gov/NCHS/nhis/nhis_2007_data_release.)
8. Fiore A, Shay DK, Broder K, Iskander JK, Uyeki TM, et al. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Morb Mortal Wkly Rep 2008;57:1-60.
9. Centers for Disease Control and Prevention C. State-specific influenza vaccination coverage among adults--United States, 2006-07 influenza season. MMWR Morb Mortal Wkly Rep 2008;57:1033-9.
10. Lu P, Bridges, CB, Euler GL, Singleton JA. Influenza vaccination of recommended adult populations, U.S., 1989-2005. Vaccine 2008;26:1786-93.
11. U.S. Department of Health and Human Services D. Healthy people 2010: Understanding and improving health. 2nd ed. Washington, D.C.: U.S. Government Printing Office; 2000.
12. Rivetti D JT, Thomas R, Rudin M, Rivetti A, et al. Vaccines for preventing influenza in the elderly. Cochrane Database Syst Rev 2006;3:CD004876.
13. Herrera GA, Iwane MK, Cortese M, Brown C, Gershman K, et al. Influenza vaccine effectiveness among 50-64-year-old persons during a season of poor antigenic match between vaccine and circulating influenza virus strains: Colorado, United States, 2003-2004. Vaccine 2007;25:154-60.
14. Dorrell L, Hassan I, Marshall S, Chakraverty P, Ong E. Clinical and serological responses to an inactivated influenza vaccine in adults with HIV infection, diabetes, obstructive airways disease, elderly adults and healthy volunteers. Ing J STD AIDS 1997;8:776-9.
15. McElhaney JE BB, Devine R, Grynoch R, Toth EL, et al. Age-related decline in interleukin 2 production in response to influenza vaccine. J Am Geriatr Soc 1990;38:652-8.

16. Goronzy JJ, Fulbright JW, Crowson CS, Poland GA, O'Fallon WM, et al. Value of immunological markers in predicting responsiveness to influenza vaccination in elderly individuals. J Virol 2001;75:12182-7.
17. Jackson LA JM, Nelson JC, Neuzil KM, Weiss NS. Evidence of bias in estimates of influenza vaccine effectiveness in seniors. Int J Epidemiol 2006;35:337-44.
18. Jackson LA, Nelson JC, Benson P, Neuzil KM, Reid RJ. Functional status is a confounder of the association of influenza vaccine and risk of all cause mortality in seniors. Int J Epidemiol 2006;35:345-52.
19. Simonsen L RT, Viboud C, Blackwelder WC, Taylor RJ, et al. Impact of influenza vaccination on seasonal mortality in the US elderly population. Arch Intern Med 2005;165:265-72.
20. Medlock J, Galvani AP. Optimizing influenza vaccine distribution. Science 2009;325:1705-8.
21. Bridges CB, Thompson WW, Meltzer MI, Reeve GR, Talamonti WJ, et al. . Effectiveness and cost-benefit of influenza vaccination of healthy working adults: a randomized controlled trial. JAMA 2000;284:1655-63.
22. Nichol KL LA, Margolis KL, Murdoch M, McFadden R, et al. The effectiveness of vaccination against influenza in healthy, working adults. N Engl J Med 1995;333:889-93.
23. Ghedon YZ, Kaira AN, Elshina GA. . The effect of mass influenza immunization in children on the morbidity of the unvaccinated elderly. Epidemiol Infect 2006;134:71-8.
24. Reichert TA SN, Fedson DS, Glezen WP, Simonsen L, et al. The Japanese experience with vaccinating schoolchildren against influenza. N Engl J Med 2001;344:889-96.
25. Hurwitz ES HM, Chang A, Shope T, Teo S, et al. Effectiveness of influenza vaccination of day care children in reducing influenza-related morbidity among household contacts. JAMA 2000;284:1677-82.
26. Weycker D, Edelsberg J, Halloran ME, Longini IM Jr, Nizam A, et al. Population-wide benefits of routine vaccination of children against influenza. Vaccine 2005;23:1284-93.
27. Kwong JC, Stukel TA, Lim J, McGeer AJ, Upshur RE, et al. The effect of universal influenza immunization on mortality and health care use. PLoS Med 2008;5:e211.
28. Pengjun L BC, Euler GL, Singleton JA. Influenza vaccination of recommended adult populations, U.S., 1989-2005. Vaccine 2008;26:1786-93.
29. Pallin DJ, Muennig, PA, Emond, JA, Sunghye K, Camargo CA Jr. Vaccination practices in US emergency departments, 1992-2000. Vaccine 2005;23:1048-52.
30. Centers for Disease Control and Prevention C. Notifiable diseases and mortality tables. MMWR Morb Mortal Wkly Rep 2010;59:137-50.
31. American College of Emergency Physicians (ACEP). Immunization of Adults and Children in the Emergency Department. 2009. (Accessed December 21, 2009, at http://www.acep.org/practres.aspx?id=29516.)
32. Pitts SR, Niska RW, Xu J, Burt CW. National hospital ambulatory medical care survey: 2006 emergency department summary. Natl Health Stat Report 2008;6:1-38.
33. Davis MM, McMahon SR, Santoli JM, Schwartz B, Clark SJ. A national survey of physician practices regarding influenza vaccine. J Gen Intern Med 2002;17:670-6.

34. Hiller KM, Sullivan, D. Influenza vaccination in the emergency department: are our patients at risk? . J Emerg Med 2009;37:439-43.
35. Polis MA, Smith JP, Sainer D, Brenneman MN, Kaslow RA. Prospects for an emergency department-based adult immunization program. . Arch Intern Med 1987;147:1999-2001.
36. Rodriguez RM, Baraff LJ. Emergency department immunization of the elderly with pneumococcal and influenza vaccines. Ann Emerg Med 1993;22:1729-32.
37. Slobodkin D, Kitlas J, Zielske P. Opportunities not missed – systematic influenza and pneumococcal immunization in a public inner-city emergency department. Vaccine 1998;16:1795-802.
38. Pearson E, Lang E, Colacone A, Farooki N, Afilalo M. Successful implementation of a combined pneumococcal and influenza vaccination program in a Canadian emergency department. Can J Emerg Med 2005;7:371-7.
39. Rimple D WS, Brett M, Ernst AA. An emergency department-based vaccination program: overcoming the barriers for adults at high risk for vaccine-preventable diseases. Acad Emerg Med 2006;13:922-30.
40. Cassidy W, Marioneaux DM, Windham AF, Manning S, Fishbein D, et al. Factors influencing acceptance of influenza vaccination given in an ED. Am J Emerg Med 2009;27:1027-33.
41. Kapur A, Tenenbein M. Vaccination of emergency department patients at high risk for influenza. Acad Emerg Med 2000;7:354-8.
42. Wrenn K, Zeldin M, Miller O. Influenza and pneumococcal vaccine in the emergency department: Is it feasible? . J Gen Intern Med 1994;9:425-529.
43. Flu Vaccine Locator. 2009. (Accessed Nov 30, 2009, at http://www.flu.gov/.)
44. Chiasson AM, Rowe P. Flu vaccine in the ED: Administering influenza vaccine in a Canadian emergency department: Is there a role? Can J Emerg Med 2000;2:90-4.
45. Mullooly JP BW, Nolan TF Jr. Risk of acute respiratory disease among pregnant women during influenza A epidemics. Pub Health Rep 1986;101:205-11.
46. Neuzil KM, Reed GW, Mitchel EF, Simonsen L, Griffin MR. Impact of influenza on acute cardiopulmonary hospitalization in pregnant women. Am J Epidemiol 1998;148:1094-102.
47. Naleway AL, Smith WJ, Mullooly JP. Deliviering influenza vaccine to pregnant women. Epidemiol Rev 2006;28:47-53.
48. Gonik B, Jones T, Contreras D, Fasano N, Roberts C. The obstetrician-gynecologist's role in vaccine preventable diseases and immunization. Obstet Gynecol 2000;96:81-4.
49. Fernandez W, Oyama L, Mitchell P, Edwards EM, St George J, et al. Attitudes and practices regarding influenza vaccination among emergency department personnel. J Emerg Med 2009;36:201-6.
50. Influenza virus vaccine 2009-2010 season. 2009. (Accessed April 27, 2009, at http://www.fda.gov/Cber/flu/flu2009.htm.)
51. Glezen WP. Prevention and treatment of seasonal influenza. N Engl J Med 2008;359:2579-85.

Figures and Tables

Figure 1. Summary of recommendations for annual seasonal influenza vaccinations adapted from the Advisory Committee on Immunization Practices (ACIP) guidelines, 2009[8]

- Any adult wishing to decrease his/her risk of influenza-related illness and/or transmitting that illness to others
- All children 6-months to 18-years of age
- All persons at increased risk for complications related to influenza:
    - Adults ≥50 years of age
    - Children 6-months to 4-years of age
    - Females who will be pregnant during the influenza season
    - Individuals with chronic pulmonary (including asthma), cardiovascular (not including hypertension), kidney, liver, blood or metabolic (including diabetes mellitus) disease
    - Immunosuppressed individuals (including those with human immunodeficiency virus, or medication-related immunosuppresion)
    - Individuals with disorders that place them at increased risk of aspiration
    - Individuals living in chronic care facilities
    - Children being treated with chronic aspirin therapy
- All adults in close contact with persons at increased risk for complications of the flu, including:
    - Health-care workers
    - Household contacts and caregivers of children younger than five years-old and adults ages 50 years or older
    - Close contacts of children younger than six-months old
    - Household contacts and caregivers of individuals at increased risk for severe complications of influenza secondary to medical conditions

The above guidelines are taken directly from the ACIP published guidelines, and are used to evaluate patient risk for complications of the flu.

Table 1: Summary of influenza vaccination trials for high-risk patients in the Emergency Department

Authors (publication year)	Study period	Location	% at high-risk	Up To Date Vaccine Status	% of high risk patients willing to accept an influenza vaccine in ED, % actually receiving the vaccine*	Barriers to vaccine acceptability
Cassidy W, et al. (2009)[40]	Dec 5, 2005 – March 5, 2006	Louisiana State University, Baton Rouge, LA, USA	76%	25%	54% accepted, 39% vaccinated	
Rimple D, et al. (2006)[39]	Dec 1-21, 2003	University of New Mexico, Albuquerque, NM, USA	69%	16%	66% accepted, 66% vaccinated	• Perceived lack of need
Pearson E, et al. (2005)[38]	Nov 1-30, 2001	Sir Mortimer B Davis Jewish Hospital (McGill), Montreal, Quebec, Canada	36%	35%	71% accepted, 65% vaccinated	• Questions about vaccine benefits • Concern of side effects • Want to discuss with their PMD
Kapur A, Tenenbein M (2000)[41]	March 1996 (one week/ED)	4 EDs in Winnipeg, Manitoba, Canada	64.5%	45%	59.3% accepted (Not vaccinated)	• 72% perceived lack of need • 60% concern of side effects • 22% want to discuss with their PMD
Chiasson AM, Rowe P (2000)[44]	Nov 6 – Dec 10, 1997	Prince George Regional Hospital, Prince George, BC, Canada	27.6%	47.2%	43% vaccinated	
Slobodkin D, et al. (1998)[37]	Oct 21, 1996 – Dec 2, 1996	Cook County Hospital, Chicago, IL, USA	29.9%	21%	71% accepted, 62% vaccinated	• 39% perceived lack of need • 29% concern of adverse reaction • 14% believe it will cause the flu/pneumonia • 8% believe the vaccine does not work • 7% want to receive the vaccine elsewhere • 3% want further advice • 16.6% other

Wrenn K, et al. (1994)[42]	1994	Vanderbilt University, Nashville, TN, USA	Not reported	57%	54% accepted (Not vaccinated)	• Never informed of need for vaccine • History of adverse reaction
Rodriguez RM, Baraff LJ (1993)[36]	Mid Oct– Mid Dec, 1992	UCLA, Los Angeles, CA, USA	Not reported	36.8%	53.6% accepted, 50% vaccinated	• 34% wanted to discuss with their PMD • 22% believe the vaccine does not work • 15% concern of adverse reaction
Polis, MA, et al (1987)[35]	Aug-Dec 1986	George Washington University Medical Center, Washington D.C., USA	Not reported	47.8% (ever vaccinated)	59.3% accepted (Not vaccinated)	• 27% concern of side effects • History of flu-like symptoms after prior vaccine

*Among patients without contraindications to the vaccine

This table represents all prior studies of influenza vaccinations in the emergency department, all of which were focused on the vaccination of individuals at high risk for complications of the flu. Studies were conducted in both Canada and the United States, with varying rates of high-risk patients (27.6-76%) and up-to-date annual vaccinations (16-47.2%). The acceptance rates for the vaccine varied from 54% to 71%, and while not all studies actually administered the vaccine, actual ED vaccination rates ranged from 43-65%.

Figure 2: Study survey on Seasonal Influenza Vaccinations

Survey for Seasonal Influenza Vaccination Study in the Emergency Department

General Information:

1. Age ____
2. Self-identified Race/Ethnicity
   ☐Hispanic/Latino ☐Black/African-American (non-Hispanic) ☐White(non-Hispanic)
   ☐Asian ☐Other______________________
3. Male or Female?
4. **Yes No** Are you able to read and understand English at a 4^{th} or 5^{th} grade level?
   If no, what is your primary language? __________________________
5. What is the highest level of education you have completed?
   ☐Never attended high school ☐Grades 9 -11 (some high school)
   ☐Grade 12 or GED ☐College 1 to 3 years (some college or technical school)
   ☐College 4 years or more (4-year college graduate)
6. For your health insurance, are you covered by any of the following?
   ☐Private insurance ☐Medicare ☐Medicaid ☐SAGA ☐No insurance
7. **Yes No** Have you received the seasonal flu shot this season (since September 2009)?
   If no, why? ☐No vaccine available ☐Do not want vaccine ☐Other_______________
8. **Yes No** Have you received the seasonal flu shot in previous years?
9. **Yes No** Do you have a primary care physician?
   If yes, when was the last time you saw him/her for medical care? ___________________________
10. **Yes No** Do you think you should receive the seasonal flu shot this year?
    Why/Why not? ____
11. **Yes No** Would you accept a flu shot today if it was available in the ED?
    If you answered "No," Why?
    ☐"I do not think I am at risk for the flu"
    ☐"I think I am healthy enough to fight off the flu"
    ☐"I am concerned about side effects of the vaccine"
    ☐"The flu shot will make me sick"
    ☐"I would rather receive the flu shot elsewhere"
    ☐"I would like to consult my primary care doctor first"
    ☐Other ____

13. **Yes No** Do you have other plans to get the flu shot this season?

Risk factors for complications with influenza infection

1. **Yes No** Are you pregnant or hoping to be pregnant during the next 6 months?
2. Please circle any of the following medical problems you may have:

☐Diabetes ☐Asthma/other lung disease ☐Heart disease (other than high blood pressure)
☐Kidney disease ☐Liver disease ☐Blood problems
☐Cancer ☐Problems with immune system ☐Other chronic illness:____________________

3. **Yes No** Are you in close contact with anyone with serious chronic medical conditions, such as those listed above?

12. **Yes No** Do you work in the health care field?
13. **Yes No** Are you in close contact with any children younger than 5 years old, or adults older than 50 years old?
14. **Yes No** Do you have close contact with children <6 months old?

Contraindications:

1. **Yes No** Are you allergic to eggs, egg products or thiomerosal?
2. **Yes No** Have you had a bad reaction to the flu vaccine in the past? If yes, what?

The survey distributed to and completed by patients in the Urgent Care section of the Yale-New Haven Hospital Emergency Department.

Table 2: Summary of survey responses

	Total, N=349	% of Total
Age (years) –Mean 36 years, SD 12.4		
18-29	131	37.5
30-49	161	46.3
50-64	51	14.6
65+	6	1.7
Younger than 50	292	83.7
50 and older	57	16.3
Sex		
Male	197	56.4
Female	152	43.6
Race/Ethnicity		
White (non-Hispanic)	107	30.7
Black (non-Hispanic)	126	36.1
Hispanic/Latino	95	27.2
Other	11	3.2
Non-white	232	66.5
Insurance Status		
Private Insurance	93	26.6
State/Government (Public)	160	46.8
Any health insurance	253	72.4
None	84	24.1
Education level		
Non-high school graduate	83	23.8
High school graduate/GED	193	55.5
College graduate	73	20.9
All high school graduates/GED	266	76.2
Vaccination status		
Received vaccine this year	69	19.8
Vaccinated in previous years	158	45.3
History of adverse reaction following influenza vaccinations in the past (100% reported "flu" or flu-like symptoms)	20	12.6
Never vaccinated	180	51.6
Think they should be Vaccinated (of n=280 unvaccinated)	166	59.3
Have plans to be vaccinated this year (of n=280 unvaccinated)	107	38.2
Would accept vaccine in ED (of n=280 unvaccinated)	179	**63.9**
Have a primary medical doctor	180	51.6
Medical indications for vaccination		
Pregnant	11	3.2
Chronic medical condition	101	28.9
Healthcare worker	34	9.8
Close contact with at risk person(s) below	256	73.4
Chronically ill person	81	23.5
At risk age group (<5 years, >50 years)	237	68.1
<6 month old	59	16.9

The above table summarizes the data obtained from patient-completed surveys, including demographic breakdown, vaccination status, medical indications for annual vaccination, and close contact with people at high risk for complications of influenza.

Table 3: Vaccination rates over time

Dates	Number surveyed	Number reporting vaccination this year (%)
November 2-15	203	33 **(16%)**
November 16-30	149	36 **(24%)**

Vaccination rates increased over the course of this study, from 16% during the first half to 24% during the second.

Table 4: Vaccination beliefs/practices of patients who have never been vaccinated (N=180)

	Total, N=180	% of Total
Thoughts on vaccination		
Think they should be Vaccinated	92	51.1
Have plans to be vaccinated this year	55	30.6
Would accept vaccine in ED	108	60.0
Medical indications for vaccination		
Pregnant	6	3.4
Chronic medical condition	49	27.2
Healthcare worker	13	7.3
Close contact with at risk person(s) below	121	67.2
Chronically ill person	30	16.9
At risk age group (<5 years, >50 years)	112	62.2
<6 month old	29	16.1

This table summarizes the vaccination status and interests of patients who have never been vaccinated. Also includes data on traditional indications for influenza vaccination among these patients.

Table 5: Previous vaccination status compared to current vaccination beliefs and practices

	Vaccinated in previous years (%), n= 158	**P-value**	**Odds Ratio (95% Confidence Interval)**	**Never vaccinated (%), n=180**	**p-value**	**Odds Ratio (95% Confidence Interval)**
Vaccinated this year, n=69	58 (84.1)	**<0.01**	**9.49** (4.49,20.06)			
Not vaccinated, but believe they should be, n=166	74 (44.6)	**<0.01**	**2.72** (1.57,4.71)	92 (55.4)	**<0.01**	**0.37** (0.21,0.64)
Not vaccinated, but have plans to receive vaccine, n=	52 (48.6)	**<0.01**	**2.46** (1.47,4.13)	55 (51.4)	**<0.01**	**0.41** (0.24,0.68)
Not vaccinated, but would accept vaccine in ED, n=179	71 (39.7)	0.07	1.63 (0.96,2.77)	108 (60.3)	0.07	**0.61** (0.36,1.04)

Patients' current vaccination practices and beliefs were measured in relation to their vaccination history. The first three columns show that patients vaccinated this year, those who believe they should be vaccinated, those with plans to be vaccinated, and those willing to accept a vaccine in the emergency department were all likely to have been vaccinated in previous years. The second three columns show that those same patient groups were unlikely to have never been vaccinated. Because the "never vaccinated" group excludes all patients vaccinated this year, that data has been omitted. Overall, history of previous vaccination did affect the odds that a patient would respond favorably to vaccination now.

Table 6: Age and vaccination status

Age (years)	Vaccinated this year (%) n=69	p-value	Odds Ratio (95% Confidence interval)	Vaccinated in previous years (%) n=158	p-value	Odds Ratio (95% Confidence Interval)	Never vaccinated (%) n=180	p-value	Odds Ratio (95% Confidence Interval)
18-29, n=131	17 (12.9)	**0.01**	**0.48** (0.26,0.87)	50 (38.2)	**0.04**	**0.63** (0.40,0.98)	78 (59.5)	**0.02**	**1.67** (1.07,2.61)
30-49, n=161	28 (17.4)	0.29	0.75 (0.44,1.28)	68 (42.2)	0.32	0.81 (0.53,1.23)	86 (53.4)	0.56	1.13 (0.74,1.73)
50-64, n=51	21 (41.2)	**<0.01**	**3.65** (1.89,7.02)	35 (68.6)	**<0.01**	**3.11** (1.63,5.95)	15 (29.4)	**<0.01**	**0.34** (0.17,0.65)
≥65, n=6	3 (50)	0.06	4.20 (0.82,21.5)	5 (83.3)	0.06	6.21 (0.71,54.5)	1 (16.7)	0.08	0.18 (0.02,1.60)
18-49, n=292	45 (15.4)	**<0.01**	**0.25** (0.13,0.47)	118 (40.4)	**<0.01**	**0.29** (0.15,0.54)	164 (56.2)	**<0.01**	**3.28** (1.74,6.21)
≥50, n=57	24 (42.1)	**<0.01**	**3.99** (2.12,7.53)	40 (70.2)	**<0.01**	**3.47** (1.85,6.52)	16 (28.1)	**<0.01**	**0.30** (0.16,0.58)

The likelihood of vaccination among various age groups is demonstrated here. The first three columns show the number and percent of patients vaccinated this year in the given age groups, as well as the p-values and odds ratios with 95% confidence intervals demonstrating the significance of the likelihood of vaccination in these age groups. The second and third sets of columns demonstrate the same information in relation to vaccination in previous years and never being vaccinated, respectively.

Table 7: Age and vaccination beliefs/practices among patients who have not been vaccinated this year (N=280)

Age (years)	Believe they should be vaccinated (%), n=166	p-value	Odds Ratio (95% Confidence Interval)	Plans to be vaccinated (%), n=107	p-value	Odds Ratio (95% Confidence Interval)	Would accept a vaccine in the ED (%), n=179	p-value	Odds Ratio (95% Confidence Interval)
18-29, n=114	72 (63.2)	0.28	1.31 (0.80,2.15)	49 (43.0)	0.17	1.40 (0.86,2.29)	82 (71.9)	**0.02**	**1.82** (1.09,3.06)
30-49, n=133	73 (54.9)	0.17	0.71 (0.44,1.16)	44 (32.1)	0.11	0.67 (0.41,1.09)	76 (57.1)	**0.03**	**0.58** (0.35,0.95)
50-64, n=30	20 (66.7)	0.38	1.42 (0.64,3.18)	13 (43.3)	0.54	1.27 (0.59,2.74)	21 (70.0)	0.46	1.36 (0.60,3.10)
65+, n=3	1 (33.3)	0.36	0.34 (0.03,3.82)	1 (33.3)	0.86	0.81 (0.07,9.04)	0 (0)	**0.02**	0
18-49, n=247	145 (58.7)	0.59	0.81 (0.38,1.73)	93 (37.7)	0.60	0.82 (0.39,1.71)	158 (64.0)	0.97	1.01 (0.48,2.16)
≥50, n=33	21 (63.6)	0.59	1.23 (0.58,2.61)	14 (42.4)	0.60	1.22 (0.58,2.55)	21 (63.6)	0.97	0.99 (0.46,2.10)

Among patients who were not vaccinated this year, the likelihood of interest in vaccination in various age groups is demonstrated here. The first three columns show the number and percent of patients believing they should be vaccinated in the given age groups, as well as the p-values and odds ratios with 95% confidence intervals demonstrating the significance of the likelihood of vaccination in these age groups. The second and third sets of columns demonstrate the same information in relation to plans to be vaccinated this year and willingness to accept a vaccine in the emergency department, respectively.

Table 8: Race/Ethnicity and vaccination status

Race/ Ethnicity	Vaccinated this year (%), n=69	p-value	Odds Ratio (95% Confidence interval)	Vaccinated in previous years (%), n=158	p-value	Odds Ratio (95% Confidence Interval)	Never vaccinated (%), n=180	p-value	Odds Ratio (95% Confidence Interval)
White n=107	17 (15.9)	0.23	0.69 (0.38,1.26)	55 (51.4)	0.13	1.43 (0.90,2.26)	47 (43.9)	0.06	0.64 (0.40,1.01)
Black n=126	27 (21.4)	0.56	1.18 (0.68,2.02)	55 (43.7)	0.65	0.91 (0.58,1.40)	68 (54.0)	0.50	1.16 (0.75,1.80)
Latino/ Hispanic n=95	20 (21.1)	0.71	1.11 (0.62,2.00)	40 (42.1)	0.47	0.84 (0.52,1.35)	53 (55.8)	0.34	1.26 (0.78,2.03)
Other n=11	2 (18.2)	0.89	0.90 (0.19,4.27)	3 (27.3)	0.22	0.44 (0.12,1.71)	8 (72.7)	0.15	2.57 (0.67,9.93)
All non-white, n=232	49 (21.1)	0.37	1.30 (0.73,2.31)	98 (42.2)	0.11	0.69 (0.44,1.08)	129 (55.6)	**0.03**	**1.62** (1.03,2.55)

The likelihood of vaccination among various race/ethnic groups is demonstrated here. The first three columns show the number and percent of patients vaccinated this year in the given race/ethnic groups, as well as the p-values and odds ratios with 95% confidence intervals demonstrating the significance of the likelihood of vaccination in these groups. The second and third sets of columns demonstrate the same information in relation to vaccination in previous years and never being vaccinated, respectively.

Table 9: Race/Ethnicity and vaccination beliefs/practices among patients who have not been vaccinated this year (N=280)

Race/ Ethnicity	Believe they should be vaccinated (%), n=166	p-value	Odds Ratio (95% Confidence Interval)	Plans to be vaccinated (%), n=107	p-value	Odds Ratio (95% Confidence Interval)	Would accept a vaccine in the ED (%), n=179	p-value	Odds Ratio (95% Confidence Interval)
White n=90	49 (54.4)	0.26	0.75 (0.45,1.24)	32 (35.6)	0.53	0.85 (0.50,1.43)	57 (63.3)	0.89	0.96 (0.57,1.62)
Black n=99	54 (54.5)	0.23	0.74 (0.45,1.22)	37 (37.4)	0.83	0.95 (0.57,1.57)	55 (55.6)	**0.03**	**0.57** (0.34,0.96)
Latino/ Hispanic n=75	56 (74.7)	**<0.01**	2.55 (1.39,4.64)	34 (45.3)	0.14	1.50 (0.87,2.57)	60 (80.0)	**<0.01**	**2.89** (1.52,5.51)
Other n=9	3 (33.3)	0.11	0.33 (0.08,1.37)	1 (11.1)	0.09	0.19 (0.02,1.60)	3 (33.3)	0.05	0.27 (0.07,1.12)
All non-white n=183	113 (61.7)	0.25	1.34 (0.81,2.21)	72 (39.3)	0.59	1.15 (0.69,1.91)	118 (64.5)	0.79	1.07 (0.64,1.79)

Among patients who were not vaccinated this year, the likelihood of interest in vaccination for various race/ethnic groups is demonstrated here. The first three columns show the number and percent of individuals of various race/ethnic groups patients believing they should be vaccinated, as well as the p-values and odds ratios with 95% confidence intervals demonstrating the likelihood of vaccination. The second and third sets of columns demonstrate the same information in relation to plans to be vaccinated this year and willingness to accept a vaccine in the emergency department, respectively.

Table 10: Insurance status and vaccination status

Insurance status	Vaccinated this year (%), n=69	p-value	Odds Ratio (95% Confidence interval)	Vaccinated in previous years (%), n=158	p-value	Odds Ratio (95% Confidence Interval)	Never vaccinated (%), n=180	p-value	Odds Ratio (95% Confidence Interval)
Private, n=93	21 (22.6)	0.43	1.26 (0.71,2.26)	45 (48.4)	0.48	1.19 (0.74,1.91)	45 (48.3)	0.47	0.84 (0.52,1.35)
Public, n=160	37 (23.1)	0.16	1.46 (0.86,2.48)	78 (48.8)	0.23	1.30 (0.85,1.99)	77 (48.1)	0.23	0.77 (0.51,1.18)
None, n=84	11 (13.1)	0.08	0.54 (0.27,1.08)	31 (36.9)	0.08	0.64 (0.38,1.06)	50 (59.5)	0.09	1.53 (0.93,2.52)
Any insurance, n=253	58 (22.9)	**0.02**	**2.29** (1.14,4.63)	123 (48.6)	**0.04**	**1.65** (1.01,2.68)	122 (48.2)	**0.04**	**0.61** (0.38,0.99)

The likelihood of vaccination among individuals with various levels of health insurance is demonstrated here. The first three columns show the number and percent of patients vaccinated this year in the given insurance status groups, as well as the p-values and odds ratios with 95% confidence intervals demonstrating the significance of the likelihood of vaccination in these groups. The second and third sets of columns demonstrate the same information in relation to vaccination in previous years and never being vaccinated, respectively.

Table 11: Insurance status and vaccination beliefs/practices among patients who have not been vaccinated this year (N=280)

Insurance status	Believe they should be vaccinated (%), n=166	p-value	Odds Ratio (95% Confidence Interval)	Plans to be vaccinated (%), n=107	p-value	Odds Ratio (95% Confidence Interval)	Would accept a vaccine in the ED (%) n=179	p-value	Odds Ratio (95% Confidence Interval)
Private, n=72	34 (47.2)	**0.02**	**0.52** (0.30,0.89)	21 (29.2)	0.07	0.58 (0.33,1.05)	40 (55.6)	0.09	0.62 (0.36,1.08)
Public, n=123	80 (65.0)	0.07	1.57 (0.96,2.57)	61 (49.6)	**<0.01**	**2.48** (1.49,4.13)	84 (68.3)	0.15	1.44 (0.87,2.37)
None, n=73	46 (63.0)	0.45	1.24 (0.71,2.14)	22 (30.1)	0.10	0.62 (0.34,1.10)	45 (61.6)	0.64	0.88 (0.50,1.52)
Any insurance, n=195	114 (58.5)	0.67	0.89 (0.53,1.51)	82 (42.1)	**0.05**	**1.74** (1.00,3.02)	124 (63.6)	0.86	0.95 (0.56,1.62)

Among patients who were not vaccinated this year, the likelihood of interest in vaccination among individuals with various levels insurance is demonstrated here. The first three columns show the number and percent these patients who believe they should be vaccinated, as well as the p-values and odds ratios with 95% confidence intervals demonstrating the likelihood of vaccination. The second and third sets of columns demonstrate the same information in relation to plans to be vaccinated this year and willingness to accept a vaccine in the emergency department, respectively.

Table 12: Access to primary care and vaccination status

Have a PMD?	Vaccinated this year (%), n=69	p-value	Odds Ratio (95% Confidence interval)	Vaccinated in previous years (%), n=158	p-value	Odds Ratio (95% Confidence Interval)	Never vaccinated (%), n=180	p-value	Odds Ratio (95% Confidence Interval)
Yes n=180	48 (26.7)	**<0.01**	**2.56** (1.44,4.55)	96 (53.3)	**<0.01**	**1.97** (1.28,3.04)	80 (44.4)	**<0.01**	**0.55** (0.36,0.85)
No n=169	21 (12.4)	**<0.01**	**0.39** (0.22,0.69)	62 (36.7)	**<0.01**	**0.51** (0.33,0.78)	100 (59.2)	**<0.01**	**1.81** (1.18,2.79)

The likelihood of vaccination among individuals with and without primary care physicians is demonstrated here. The first three columns show the number and percent of patients with and without PMDs who were vaccinated this year, as well as the p-values and odds ratios with 95% confidence intervals demonstrating the significance of the likelihood of vaccination in these groups. The second and third sets of columns demonstrate the same information in relation to vaccination in previous years and never being vaccinated, respectively.

Table 13: Last visit with a primary care physician (N= 149 responses of 180 individuals reporting to have primary medical doctors [83%])

Last visit to PMD	Number of patients (% of 149 total responding)	Number vaccinated this year (%)	p-value	Odds Ratio (95% Confidence Interval)
<2 months ago	69 (46%)	24 (34.8%)	**<0.01**	**2.79** (1.53,5.08)
2-6 months	44 (30%)	12 (27.3%)	0.18	1.63 (0.79,3.37)
6-12 months	11 (7%)	1 (9.1%)	0.37	0.40 (0.05,3.17)
>1 year	25 (17%)	0 (0%)	0.01	0

Of the 180 patients with primary care doctors, 149 (83%) provided information on their last visit with that physician. 69 (49%) of these patients had seen their primary care doctor within the last two months, and 24 (35%) of them had been vaccinated. This corresponded with a 2.79 odds ratio (95% CI=1.53-5.08, $p<0.01$) for vaccination among patients who visited their PMD within the last two months. The odds of vaccination decreased as patients were further temporally removed from their last medical visit.

Table 14: Access to primary care and vaccination beliefs/practices among patients who have not been vaccinated this year (N=280)

Have a PMD?	Believe they should be vaccinated (%), n=166	p-value	Odds Ratio (95% Confidence Interval)	Plans to be vaccinated (%), n=107	p-value	Odds Ratio (95% Confidence Interval)	Would accept a vaccine in the ED (%), n=179	p-value	Odds Ratio (95% Confidence Interval)
Yes n=132	83 (62.9)	0.25	1.33 (0.82,2.15)	68 (51.5)	**<0.01**	**2.97** (1.77,4.99)	83 (62.9)	0.73	0.92 (0.56,1.50)
No n=148	83 (56.1)	0.25	0.75 (0.47,1.22)	39 (26.4)	**<0.01**	**0.34** (0.20,0.57)	96 (64.9)	0.73	1.09 (0.67,1.78)

Among patients who were not vaccinated this year, the likelihood of interest in vaccination for individuals with and without primary care physicians is demonstrated here. The first three columns show the number and percent of these patients believing they should be vaccinated, as well as the p-values and odds ratios with 95% confidence intervals demonstrating the likelihood of vaccination. The second and third sets of columns demonstrate the same information in relation to plans to be vaccinated this year and willingness to accept a vaccine in the emergency department, respectively.

Table 15: Patients with medical indications for vaccination and vaccination status

Medical indication	Vaccinated this year (%), n=69	p-value	Odds Ratio (95% Confidence interval)	Vaccinated in previous years (%), n=158	p-value	Odds Ratio (95% Confidence Interval)	Never vaccinated (%), n=180	p-value	Odds Ratio (95% Confidence Interval)
Pregnant n=11	2 (18.2)	0.90	0.90 (0.19, 4.29)						
Chronic medical illness, n=101	26 (26.7)	**0.04**	**1.79** (1.03, 3.12)	49 (48.5)	0.44	1.20 (0.75,1.91)	49 (48.5%)	0.47	0.84 (0.53,1.33)
No medical indications n=245	42 (17.1)	0.06	0.59 (0.34, 1.03)	109 (44.5)	0.65	0.90 (0.57,1.43)	128 (52.2)	0.70	1.09 (0.69,1.73)

The likelihood of vaccination among individuals with medical conditions that place them at increased risk of complication from influenza infection is demonstrated here. The first three columns show the number and percent of patients vaccinated this year in the each group with specified medical indications for vaccination, as well as the p-values and odds ratios with 95% confidence intervals demonstrating the significance of the likelihood of vaccination in these age groups. The second and third sets of columns demonstrate the same information in relation to vaccination in previous years and never being vaccinated, respectively.

Table 16: Patients with medical indications for seasonal influenza vaccination and vaccination beliefs/practices among patients who have not been vaccinated this year (N=280)

Medical Indication	Believe they should be vaccinated (%), n=166	p-value	Odds Ratio (95% Confidence Interval)	Plans to be vaccinated (%), n=107	p-value	Odds Ratio (95% Confidence Interval)	Would accept a vaccine in the ED (%), n=179	p-value	Odds Ratio (95% Confidence Interval)
Pregnant, n=9	7 (77.8)	0.25	2.47 (0.50,12.2)	5 (55.6)	0.27	2.10 (0.55,8.05)	8 (88.9)	0.12	4.61 (0.56,37.9)
Chronic medical illness, n=74	49 (66.2)	0.16	1.49 (0.85,2.60)	29 (39.2)	0.84	1.06 (0.61,1.83)	49 (67.6)	0.45	1.24 (0.71,2.19)
No medical indications n=203	115 (56.7)	0.15	0.67 (0.38,1.16)	77 (37.9)	0.87	0.96 (0.56,1.64)	126 (62.1)	0.29	0.74 (0.42,1.30)

Among patients who were not vaccinated this year, the likelihood of interest in vaccination for individuals with medical conditions placing them at increased risk for complications of the flu is demonstrated here. The first three columns show the number and percent of these patients believing they should be vaccinated, as well as the p-values and odds ratios with 95% confidence intervals demonstrating the likelihood of vaccination. The second and third sets of columns demonstrate the same information in relation to plans to be vaccinated this year and willingness to accept a vaccine in the emergency department, respectively.

Table 17: Contact with high-risk individuals and vaccination status

High-risk contacts	Vaccinated this year (%), n=69	p-value	Odds Ratio (95% Confidence interval)	Vaccinated in previous years (%) n=158	p-value	Odds Ratio (95% Confidence Interval)	Never vaccinated (%), n=180	p-value	Odds Ratio (95% Confidence Interval)
Close contact with chronic disease, n=81	22 (27.2)	0.05	1.77 (0.98, 3.18)	48 (59.3)	**<0.01**	2.10 (1.26,3.51)	30 (37.0)	**<0.01**	0.46 (0.27,0.78)
Close contact <5yrs or >50yrs, n=237	52 (21.9)	0.15	1.55 (0.85, 2.84)	116 (48.9)	**0.04**	1.64 (1.03,2.61)	116 (48.9)	**0.02**	0.57 (0.36,0.90)
Close contact <6mo, n=59	12 (20.3)	0.90	1.04 (0.52, 2.10)						
Work in health care n=34	7 (20.6)	0.92	1.05 (0.44, 2.51)	20 (58.8)	0.11	1.80 (0.87,3.71)	13 (38.2)	0.11	0.56 (0.27,1.16)
All contacts of high-risk individuals n=256	56 (21.9)	0.10	1.72 (0.89, 3.33)	126 (49.2)	**0.01**	1.85 (1.12,3.04)	121 (47.3)	**<0.01**	0.52 (0.32,0.85)
No high-risk contacts n=93	13 (14.0)	0.10	0.58 (0.30, 1.12)	32 (34.4)	**0.01**	0.54 (0.33,0.89)	59 (63.4)	**<0.01**	1.94 (1.18,3.17)

The likelihood of vaccination among of individuals in contact with people at increased risk for complications of influenza is demonstrated here. The first three columns show the number and percent of patients vaccinated this year in the contact groups, as well as the p-values and odds ratios with 95% confidence intervals demonstrating the significance of the likelihood of vaccination in these groups. The second and third sets of columns demonstrate the same information in relation to vaccination in previous years and never being vaccinated, respectively. Because contact with babies younger than 6 months old was not necessarily known for prior vaccination season, the columns related to previous vaccination histories were omitted for this variable.

Table 18: Contact with high-risk individuals for patients who have not been vaccinated this year (N=280)

High-risk contacts	Believe they should be vaccinated (%), n=166	p-value	Odds Ratio (95% Confidence Interval)	Plans to be vaccinated (%), n=107	p-value	Odds Ratio (95% Confidence Interval)	Would accept a vaccine in the ED (%), n=179	p-value	Odds Ratio (95% Confidence Interval)
Close contact with chronic disease, n=59	38 (64.4)	0.33	1.35 (0.74,2.45)	25 (42.4)	0.43	1.27 (0.71,2.28)	40 (67.8)	0.44	1.27 (0.69,2.34)
Close contact <5yrs or >50yrs, n=185	117 (63.2)	0.05	1.65 (0.99,2.74)	79 (42.7)	**0.02**	**1.85** (1.08,3.17)	130 (70.3)	**<0.01**	2.27 (1.34,3.82)
Close contact <6mo, n=47	30 (63.8)	0.49	1.26 (0.66,2.41)	22 (46.8)	0.18	1.53 (0.81,2.89)	34 (72.3)	0.19	1.59 (0.79,3.18)
Work in health care n=27	12 (44.4)	0.11	0.52 (0.23,1.17)	8 (29.6)	0.33	0.65 (0.27,1.55)	13 (48.1)	0.08	0.50 (0.22,1.11)
All contacts of high-risk individuals n=200	127 (63.5)	**0.02**	1.83 (1.08,3.11)	85 (42.5)	**0.02**	1.95 (1.10,3.45)	139 (69.5)	**<0.01**	2.28 (1.33,3.92)
No high-risk contacts n=80	39 (48.8)	**0.02**	0.55 (0.32,0.93)	22 (27.5)	**0.02**	0.51 (0.29,0.91)	40 (50.0)	**<0.01**	0.44 (0.26,0.75)

Among patients who were not vaccinated this year, the likelihood of interest in vaccination for individuals in contact with people at high risk for complication is demonstrated here. The first three columns show the number and percent of these patients believing they should be vaccinated, as well as the p-values and odds ratios with 95% confidence intervals demonstrating the likelihood of vaccination. The second and third sets of columns demonstrate the same information in relation to plans to be vaccinated this year and willingness to accept a vaccine in the emergency department, respectively.

Table 19: Reasons for vaccine refusal (N=97)

Reasons for Vaccine Refusal	N (%)
"The flu shot will make me sick"	22 (25.3%)
"I do not think I am at risk for the flu"	21 (24.1%)
"I think I am healthy enough to fight off the flu"	16 (18.4%)
"I am concerned about side effects of the vaccine"	12 (13.8%)
Other: Fear of needles	7 (8.1%)
"I would like to consult my primary care doctor first"	6 (6.9%)
Other: "Do not trust any vaccines"	2 (2.3%)
Other: I don not think the flu shot works	1 (1.1%)
"I would rather receive the flu shot elsewhere"	0

Of the 101 unvaccinated patients who would not accept a seasonal influenza vaccine in the emergency department, 97 (96%) provided reasons for their refusal. This table demonstrates the number of people providing each response as a reason for refusal, and the percent of all respondents providing the same response.