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Survey of vaccination knowledge and acceptance among adults admitted to an urban emergency department

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ABSTRACT

Background: Adult vaccination rates in the United States have fallen below national target levels and may be exacerbated by lack of access to a primary care physician. We assessed patient knowledge of and attitudes towards vaccines in an urban emergency department population and analyzed the feasibility of using this setting as a vaccine delivery site from a patient perspective.
Methods: In-person interviewers administered surveys to 250 adult patients presenting to the Detroit Receiving Hospital emergency department in Detroit, Michigan. Respondents were asked about vaccination status, preferences, and willingness to accept vaccination reminders via text messaging. Odds ratios and 95% Wald confidence intervals assessing differences between vaccinated and non-vaccinated individuals were generated with univariate logistic regression.
Results: Vaccinated adults were more likely to have a primary care provider than non-vaccinated adults (OR 1.94, 95% CI: 1.09–3.45). Non-vaccinated adults were significantly more likely to have unvaccinated adult relatives (OR8.64, 95% CI: 4.10–18.22). Nearly all respondents used a cell phone, and 75.8% of unvaccinated adults were willing to receive text messages reminders about vaccines.
Conclusions: Although less likely to have a primary care access point than vaccinated participants, non-vaccinated respondents reported interest in receiving vaccinations. Emergency departments could serve as vaccination hubs for patients and unvaccinated accompanying family members. Text message reminders offer a potential source of additional vaccine prompts and education.

1. Introduction

The United States Centers for Disease Control and Prevention recommends vaccination of adults aged 19 years and older for vaccine-preventable diseases, including seasonal influenza, tetanus, diphtheria, pertussis, shingles, meningitis, and human papillomavirus [1]. Recommendations are based on age, previous childhood vaccination histories, and individual factors such as immune suppression. Although national approximations of adult vaccination coverage vary, all estimates fall below vaccination target levels of 90% for persons ⩾65 years, 60% for high-risk populations 19–64 years [2,3], and 70% for influenza vaccination for persons 18 years of age and older [4]. Vaccination coverage has seen little improvement in recent years; between 2011 and 2015, adult influenza vaccination coverage ranged from a low of 38.8% in the 2011–2012 influenza season to a high of 43.6% for the 2014–2015 influenza season [5]. Challenges in achieving widespread vaccine coverage in the United States may stem from barriers in reaching adults who do not seek regular preventative care through a primary care physician.

Emergency departments in the United States were visited 136.3 million times in 2011; of those visits, 20.4 million were by adults age 65 or older [6]. In total, 10–20% of the adult population makes at least one visit to the Emergency Department (ED) annually [7,8] Previous studies have identified 69% of the patient population in EDs as high-risk for influenza and 45% as high-risk for pneumococcal disease, but less than 20% of that high-risk population has been vaccinated [7]. Despite the American College of Emergency Physicians' recommendation that EDs participate in routine immunization programs [9], 93% of vaccinations given in the ED are for tetanus [2].

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In this study, we assessed patient knowledge of and attitudes towards vaccines among adults at least 18 years of age who were attending an urban ED. We further analyzed the feasibility of utilizing this setting as a vaccine delivery site from a patient's perspective. We evaluated healthcare barriers to vaccination and explored the potential use of text messaging for delivery of vaccination reminders and education.

2. Methods

Recruitment occurred at the Detroit Receiving Hospital ED in Detroit, Michigan from June to September 2012. Eligibility criteria included the following: adults ⩾18 years of age, English-speaking, triaged for care to the fast-track unit of the ED, which typically sees patients with lower acuity. Prisoners and cognitively impaired/-mentally disabled individuals were excluded. The study was approved by the Wayne State University Institutional Review Board. Subjects were not compensated for their participation.

In-person interviews were conducted and recorded by trained interviewers using a standard questionnaire (Supplementary Material). Patients were asked to participate when they were in a private area and no active care was taking place. Demographic information collected included sex, age, zip code, race (American Indian/Alaskan Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, White, or Other), vaccination history, and vaccination history of other adults in the household. Fourteen questions collected information on participant's knowledge of influenza, pneumococcal disease, pertussis, tetanus, shingles, hepatitis A and meningococcal vaccinations in adults. To determine participant vaccine knowledge, respondents were asked if they had heard of the vaccine in question (yes, no, or don't know), at what age the vaccine should be administered (free response), and whether they believed vaccines for adults were safe (yes, no, or don't know).

Respondents were asked if they or a family member had been diagnosed with a chronic illness, defined as heart disease, chronic lung disease, chronic liver disease, asplenia, kidney failure/end-stage renal failure, diabetes, or having an immunocompromising condition.

Participants were classified as 'vaccinated' if they reported receiving at least one of the following vaccines at any time as an adult: seasonal influenza, pneumococcal, pertussis, tetanus, shingles, hepatitis A, meningitis. For inference, logistic regression analysis was applied to all demographics and access to healthcare variables to generate univariate odds ratios and 95% confidence intervals. A pooled student's T-test was used for the continuous age variable. A multivariate logistic regression model was created using backward selection to determine the best-fit predictors of vaccine uptake. Analyses were performed in SAS software version 9.4 (Cary, NC) and R 3.3.2 using the caret package for model fitting and performance assessment.

3. Results

A total of 250 participants completed the survey, seventy-five percent of who reported living in a zip code within Detroit, MI. Sixty-six respondents (26.4%) self-reported that they had never received a vaccination as an adult (Table 1). Of the 184 adults who reported receipt of at least one vaccination as an adult, vaccination uptake varied by vaccine type, ranging from a high of 78.8% (n = 145) for the tetanus vaccine to a low of 12.5% (n = 23) for the meningococcal vaccine (Table 1).

Non-vaccinated participants (n = 66) were less likely to have a primary care physician than vaccinated participants (OR: 0.52 95% CI: 0.29–0.91) were less likely to go to a doctor's office for primary healthcare visits (OR 0.53, 95% CI: 0.28–0.98) and less likely to identify with any primary source of healthcare (OR 0.33, 95% CI: 0.12–0.92) (Table 2). However, non-vaccinated participants did not display a clear preference when asked where they would prefer to receive a vaccine. Of those without vaccination as an adult, 36.4% (n = 24) said they would prefer to receive vaccinations in the emergency room, 34.9% (n = 23) preferred a doctor's office or clinic, and 24.2% (n = 16) did not have a preference. There was no difference in the likelihood of having received a vaccine between individuals living with a chronic disease and those without (OR 1.29, 95% CI: 0.70–2.36).

Participants reporting past receipt of at least one adult vaccine were more likely than unvaccinated participants to have heard of

Table 1
Vaccine coverage by vaccination type.

Vaccine	Percentage of respondents self-reporting vaccination (n = 250)	Percentage of respondents' family members (n = 250)
Influenza	46.8 (117)	45.2 (112)
Pneumococcal disease	15.2 (38)	24.7 (160)
Pertussis	5.20 (13)	12.2 (30)
Tetanus	58.0 (145)	42.5 (105)
Shingles	4.00 (10)	14.2 (35)
Hepatitis A	20.8 (52)	23.9 (29)
Meningitis	9.20 (23)	17.0 (42)

Note. Data are% (no.).

Table 2
Population demographics and access to healthcare among vaccinated adults compared to unvaccinated adults.

Characteristics		Study participants		
		Vaccinated (n = 184)[a]	Unvaccinated (n = 66)	OR (95% CI)
Gender	Male	87 (47.3)	33 (52.7)	0.90 (0.51, 1.57)
Race	Black	156 (84.8)	59 (89.4)	0.66 (0.27, 1.60)
	White	15 (8.2)	4 (6.1)	1.37 (0.44, 4.30)
	Other	13 (7.1)	3 (4.6)	1.60 (0.44, 5.78)
Age, years	Mean (SD)	38.3 (13.7)	36.0 (13.2)	1.01 (0.99, 1.04)
Has a primary care physician	Yes	101 (55.8)	26 (39.4)	1.94 (1.09, 3.45)
Principal healthcare access point	Doctor's office	88 (50.0)	20 (34.5)	1.90 (1.03, 3.52)
	Urgent care	18 (10.2)	9 (15.5)	0.62 (0.26, 1.47)
	Hospital	70 (3.8)	29 (50.0)	0.66 (0.36, 1.20)
	Don't know	8 (4.4)	8 (12.1)	0.33 (0.12, 0.92)
At least one other vaccinated adult family member	Yes	128 (86.5)	20 (42.6)	8.64 (4.10, 18.22)
Diagnosed with chronic disease[b]	Yes	66 (35.9)	20 (30.33)	1.29 (0.70, 2.36)

Note. Data are no. (%), unless otherwise indicated. All% represent the proportion excluding missing values.
[a] Vaccinated defined as having received at least one adult vaccine at the time of study participation.
[b] Chronic disease includes: heart disease, lung disease, liver disease, asplenia, kidney failure, diabetes, or immunocompromising condition.

Table 3
Multivariate logistic regression model predicting vaccination.

Predictors	OR	95% CI
Principal healthcare access point – urgent care	0.34	(0.12, 0.98)
Principal healthcare access point – Hospital	0.60	(0.28, 1.26)
Principal healthcare access point – Don't Know	0.19	(0.06, 0.64)
Principal healthcare access point – Doctor's Office	Ref	Ref
At least one other vaccinated adult family member	6.92	(3.48, 14.18)
Model performance metrics		
Accuracy (95% CI)	0.875 (0.68, 0.97)	
Sensitivity	0.94	
Specificity	0.67	
Positive predictive value	0.89	
Negative predictive value	0.80	

Table 4
Potential approaches for interventions to increase vaccination rates through utilization of emergency departments.

Characteristics		Vaccinated (n = 184)	Unvaccinated (n = 66)
Where would you prefer to receive a vaccine?	Emergency department	52 (28.3)	24 (36.4)
	Doctor's office/clinic	87 (47.3)	23 (34.9)
	Local pharmacy	8 (4.35)	2 (3.03)
	Multiple locations	8 (4.35)	1 (1.52)
	Other/don't know	23 (12.5)	16 (24.2)
	Does not want vaccine	1 (0.54)	0 (0.0)
Do you use a cell or mobile phone?	Yes	176 (95.7)	65 (98.5)
Would you be open to receiving text message reminders about vaccines?	Yes	122 (67.8)	50 (78.1)

Note. Data are no. (%). All% represent the proportion excluding missing values.

all vaccines except hepatitis A and meningococcal; they were more likely to report familiarity with influenza (OR 7.45, 95% CI: 3.31–16.72) and pertussis vaccines (OR 2.04, 95% CI: 1.13–3.67) regardless of whether or not they had received the vaccine being asked about. Of the vaccinated population, 69.6% (n = 128) had at least one other adult family member who had received at least one vaccination, while only 30.3% (n = 20) of the unvaccinated population had at least one other vaccinated adult family member (OR 8.64, 95% CI: 4.10–18.22).Overall, in a multivariate logistic regression model, receiving principal health care from urgent care settings, or being unaware of ones' primary care location was significantly associated with lower vaccination uptake; conversely, having vaccinated family members was significantly associated with increased vaccination uptake (Table 3).

Cell phones were used by 96.4% (n = 241) of all respondents and by 98.5% (n = 65) of unvaccinated respondents. 66.3% (n = 122) of vaccinated participants and 75.8% (n = 50) of unvaccinated participants stated they would be willing to receive text message reminders about adult vaccination (Table 4). Unvaccinated adults more often indicated a willingness to receive text-message reminders about vaccination than their unvaccinated counterparts (OR 1.70, 95% CI: 0.87–3.32).

Although vaccination was not offered as part of the survey, participants were asked by surveyors about their willingness to be vaccinated if vaccine to become available at that location. Of 250 respondents, one participant wished not to be vaccinated.

4. Discussion

This study identifies lack of education and lack of vaccination opportunities as potential contributors to low vaccine coverage in an urban United States adult population. Our finding that the greatest vaccine awareness existed in previously vaccinated adults suggests that strategies to improve communication about adult vaccination opportunities could help achieve increased coverage. We found that significantly higher numbers of unvaccinated adults lack a primary care physician, indicating a need for an alternative location for vaccine availability. Our results are similar to observations from New York City, where access to routine care was found to be a significant predictor of influenza vaccination receipt [10] Nearly 40% of the unvaccinated population expressed an active preference to be vaccinated in the ED, again comparable to the 51% reported by Bryant et al. [10]. These factors highlight the potential of the ED to provide routine vaccinations, such as the seasonal influenza vaccine, and reach a large number of unvaccinated adults, including high-risk populations. High-risk adults presenting to the ED were no more likely that those without chronic diseases to be vaccinated.

This study also identifies a patient's family members as a secondary population potentially eligible for vaccination. Unvaccinated respondents were significantly more likely to have unvaccinated adult family members; family members accompanying the primary patient could thus represent a secondary unvaccinated population. Offering vaccines and vaccine information to this secondary population could further increase coverage and disseminate knowledge of vaccines.

This study population was composed largely of urban residents, with the majority of respondents residing within the city of Detroit. Previous research has identified disparities in vaccination coverage in urban areas [10,11]. Estimated vaccination rates may be imprecise due to recall bias: respondents who had not previously heard of a vaccine may have erroneously assumed no other family members received the vaccine in question. Data collection utilized convenience sampling and, similarly to other ED-based vaccination studies [7,10,12] relied on self-reporting of vaccination histories and medical conditions; studies comparing medical records to self-reporting have suggested self-reporting leads to inflated vaccination coverage estimates [13]. Obtaining verification of vaccination history in adults beyond self-report is an ongoing challenge given the wide variability of state-by-state immunization registry practices [14]. Furthermore, our study was unable to directly assess the impact of vaccine delivery on clinical flow and cost of care. Finally, acceptance of text-based reminders may have been impacted by social desirability bias.

Despite these limitations, our findings have potential implications for vaccination policies in EDs. Emergency Departments that begin offering vaccinations may be able to improve vaccine coverage in high-risk populations, provide better immunization data for state registries, and potentially reduce long-term costs through this preventative health care measure. EDs already possess the necessary infrastructure to offer vaccine options to waiting patients: between 1992 and 2000, they administered over 27 million vaccinations, largely tetanus [2]. Ample time exists to provide vaccines while waiting in the ED: on an average visit, patients spent 47.4 min waiting to see a physician, while receiving an influenza vaccine took an average of only 4 min [8,15].

Previous research demonstrates the feasibility of ED vaccination [16,17]. In a 2004 intervention, Pappano et al. offered a test group of pediatric patients in the ED the influenza vaccination and offered a control group education about vaccinations [16]. Although both groups saw increased vaccination rates from baseline, the increase was greatest in the test group. The vaccination rate of accompanying family members also increased, indicating the plausibility of extending vaccination efforts to patient escorts.

Offering vaccines in the ED does require additional personnel commitments, as staff need to be available to screen for vaccine eligibility, educate patients and patient escorts about vaccine options, and administer vaccinations. Vaccination efforts could

also be complicated due to lack of comprehensive medical records, particularly for the large segment of patients lacking primary care providers. However, even if an ED deems itself unable to offer vaccinations, they can easily enroll patients in text message programs that provide reminders and identify local sources of vaccines, without requiring a medical history or significantly increased staffing. Using text messaging to refer patients to local vaccine providers such as pharmacies may be less invasive than appointment prompts and may be particularly warranted for administration of multi-dose series such as the meningococcal B vaccine. Cell phones were ubiquitous among both vaccinated and unvaccinated participants, and three-fourths of unvaccinated respondents indicated a desire to learn more about vaccines through text messaging. Vaccination reminders via text messaging can be undertaken by other non-primary care health settings, such as urgent care centers or minute clinics in drugstores, and offer potential for expansion into a variety of healthcare initiatives.

Future efforts are needed to assess the feasibility of ED-based vaccination programs in terms of staffing, time, and potential cost savings to the hospital. Additional directions could also examine the ease of using ED vaccination information for surveillance purposes and measure efficacy of text-based interventions for primary healthcare interventions.

Through this study, we build on knowledge of vaccine uptake among adults in an urban center by demonstrating the population demand for ED vaccine options and the need for increased options for adult vaccination.

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Conflict of interest statement

None.

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.vaccine.2017.01.014.

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