

Parental support for healthy behaviors and prior emergency department visits are associated with increased influenza vaccine uptake

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Abstract

Background: Influenza causes significant morbidity and mortality in children. Even though vaccination remains the best available tool for preventing infection, uptake rates are still low.

Objective: To identify factors associated with influenza vaccine uptake among children from Eastern Brooklyn, NY.

Methods: This cross-sectional study surveyed caregivers of children who received routine medical care at Brookdale Medical Center's pediatric ambulatory clinics from June 2017 to February 2018. Caregivers were asked to complete a questionnaire that self-reported influenza vaccine uptake in the past 12 months, support for healthy behaviors (i.e. physical activity, healthy eating, dental care and influenza vaccine) and sociodemographic factors (i.e. child's age, household income, parent's birthplace, education, etc.) Missed health supervision visits and emergency room (ER) visits within the past 12 months, as well as comorbidities, were retrieved from electronic medical records (EMR). Multiple logistic regression analyses were performed to determine the factors associated with influenza vaccine uptake.

Results: From the 213 caregivers with 268 children who answered the survey, 173 (64.5%) reported having received influenza vaccine. EMR review revealed that 106 (39.5%) missed appointments and 132 (49.3%) visited the ER in the past 12 months. Children who received influenza vaccine are more likely to have comorbidities (72% vs. 28%, $p = 0.01$) and have parental support for healthy behaviors (83.5% vs. 16.5%, $p < 0.01$). Results from multiple regression analysis showed parental support for healthy behaviors (aOR = 3.94, 95% CI: 2.07, 7.52) and prior ER visits (aOR = 2.3, 95% CI: 1.21, 4.39) were associated with increased influenza vaccine uptake. In contrast, missed appointments (aOR = 0.38, 95% CI: 0.2, 0.73) were associated with decreased uptake.

Conclusion: Parental support for healthy behaviors and prior ER visits are associated with increased influenza vaccine uptake, whereas missed appointments are associated with decreased uptake. Encouraging the practice of healthy behaviors and attending appointments may improve influenza vaccine uptake rates.

Abbreviations: AAP: American Academy of Pediatrics; AICP: Advisory Committee on Immunization Practices; BUHMC: Brookdale University Hospital and Medical Center; EMR: Electronic Medical Record; ER: Emergency Room

Introduction

Influenza is a major cause of illness and death in the United States, accounting for approximately 226,000 hospitalizations [1] and 24,000 deaths per year [2]. Up to 40% of all children in the US are infected with the influenza virus each year [3]. Since vaccination is the best way to prevent influenza infection, annual vaccination was universally recommended by the Advisory Committee on Immunization Practices (ACIP) in 2010 for all persons aged ≥ 6 months without contraindications to vaccination [4]. In addition, the Healthy People 2020 goals for seasonal influenza vaccine uptake aim for a target of 70% attainment (from a baseline of 46.9% in 2010-2011) [5]. Annually, influenza leads to missed school days [6], missed working days and wages for parents and caregivers [7,8], more emergency room (ER) visits and hospitalizations [9] and extra healthcare and childcare costs [10].

The 2017-2018 influenza season was considered of high severity due to high levels of outpatient clinic and ER visits for influenza-like

illness, and high influenza-related hospitalization rates. It was also one of the deadliest with 183 influenza-associated pediatric deaths (highest since 2009-2010 with 288 pediatric deaths) [11]. In New York City, influenza vaccine coverage was only 49% for children 6 months old through 18 years old [12].

Brookdale University Hospital and Medical Center (BUHMC) is a community hospital that serves Eastern Brooklyn, New York, an area with high rates of poverty, crime and substance use [13]. According to the NYC's Citywide Immunization Registry Up-To-Date reports (unpublished data), Brookdale's 2017-2018 pediatric influenza vaccination rates were 32% for 6-59-month-olds, 29% for 5-10-year-olds, and 28% for 11-18-year-olds. Similarly, all NYC medical facilities showed influenza vaccination rates of 30.3% for 6-59-month-olds, 33.8% for 5-10-year-olds, and 33.2% for 11-18-year-olds.

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Key words: influenza vaccine, health behaviors support, emergency room visits

Received: May 15, 2019; **Accepted:** July 30, 2019; **Published:** August 05, 2019

Few studies have identified modifiable barriers to influenza vaccination such as decreased access to medical services, misconceptions regarding vaccine safety and decreased insurance coverage [14-17]. Therefore, the purpose of this study is to identify factors affecting influenza vaccine uptake among children from Eastern Brooklyn, NY.

Methods

This cross-sectional study with a convenience sample surveyed parents/guardian of patients who received routine medical care at the four BUHMC's pediatric ambulatory clinics. Researchers approached parents/caregivers either before or after their visit with the pediatrician. After informed consent was obtained, a member of the team verbally administered the questionnaire. If a participant was Spanish-speaking, a native Spanish-speaking researcher provided interpreter services. Eligibility criteria were:

1. Child(ren) aged 18 years old or younger who were brought by parents/caregivers to the clinics.
2. Established patients who received health care at our clinics.
3. Parents/caregivers who are English or Spanish speaking.
4. Parents/caregivers who provided informed consent to participate in the study.

Sociodemographic and socioeconomic variables

Parents/guardians were asked to complete a questionnaire which included sociodemographic factors: child's age (years), child's gender (male vs. female), caregiver's age (years), caregiver born in the US (yes vs. no), single parent (yes vs. no). Socioeconomic factors: caregiver's education level (high school or less), employment status (yes vs. no), household income (yearly before taxes and deductions), and health insurance coverage (yes vs. no).

Comorbidities

Chronic medical conditions such as asthma and obesity in our participants were identified through EMR review, as defined by ICD-10.

Parental support for healthy behaviors

Four questions were developed according to AAP guidelines [18-20] to evaluate the caregiver's support for healthy behaviors ("Do you think children should receive the flu vaccine?", "Do you think children should drink fewer sugary soft drinks?", "Do you think children should be involved with at least 60 minutes of moderate to vigorous physical activity a day?", "Do you think children should brush their teeth as early as the first tooth comes out?") Parents/caregivers were determined to have support for healthy behaviors if they answered "yes" to all four health behaviors questions.

ER visits

ER visits were defined as an ER visit within the past 12 months to either BUHMC's ER (obtained from our hospital's EMR) or a self-reported ER visit if the child visited the ER at another institution outside of our system.

Non-adherence to health supervision visits

Non-adherence to health supervision visits was defined as at least one missed preventive pediatric health care appointment within the past 12 months, as recommended by the AAP Bright Futures Guidelines [21].

Statistical analysis

Groups of children who received influenza vaccination within the past 12 months vs. children who did not receive the influenza vaccine were compared through student T-test or Chi-square on sociodemographics, comorbidities, length of knowing provider, parental support for healthy behaviors, ER visits within the past 12 months and non-adherence to health supervision visits.

Variables that were associated ($p < 0.20$) with influenza vaccination in bivariable logistic regression models were considered as covariates for multivariable analyses. A final multiple logistic regression analysis was done to identify the factors associated with influenza vaccination when controlling for confounders. Statistical analysis was performed using SPSS software, version 24 (SPSS Inc, Chicago, IL).

Sample size calculation: As multiple logistic regression analysis is the main statistical model in this study, 5-10 participants were needed for each predictor. Therefore, we estimated a requirement of 150 participants for the study. Our target sample size of 268 participants was determined to have sufficient statistical power.

Ethical review

The clinical research study was approved by the BUHMC's institutional review board.

Results

From the 268 participants, 173 children (64.6%) received the influenza vaccine within the past 12 months. These children were on average older than their unvaccinated counterparts (8.26 vs. 6.42 years old, $p < 0.01$), had comorbidities (72% vs. 28%, $p = 0.01$), had known their pediatrician for more than a year (70.5% vs. 29.5%, $p = 0.01$), had fewer missed health supervision visits (16.5% vs. 83.5%, $p \leq 0.01$), and had parents who provided support for healthy behaviors (83.5% vs. 16.5%, $p < 0.01$) (Table 1).

Results from the multiple logistic regression analysis (Table 2) suggest that parental support for healthy behaviors (aOR = 3.94, 95% CI: 2.07, 7.52) and ER visits within the past 12 months (aOR = 2.3, 95% CI: 1.21, 4.39) were associated with increased influenza vaccine uptake, after adjusting for covariates. On the other hand, missed health supervision visits (aOR = 0.38, 95% CI: 0.2, 0.73) were associated with decreased influenza vaccine uptake. Other factors such as child's age, comorbidities, length of knowing pediatrician and parental birthplace were not significantly associated with either increased or decreased influenza vaccine uptake.

Discussion

Our study suggests that parental support for healthy behaviors and prior ER visits are positively associated with influenza vaccination. Conversely, missed health supervision visits are associated with decreased influenza vaccination.

We asked four health behavior questions related to parental support for healthy behaviors. In our study, it was shown that parental support for healthy behaviors carried the strongest association for increased influenza vaccine uptake. Parents who provide this type of support may place more focus on healthy practices, adhere to their pediatrician's recommendations and follow AAP's recommended vaccine schedule for their children.

Prior ER visits were also found to be positively associated with influenza vaccination. Even though the cross-sectional nature of the

Table 1. Demographic of children and caregiver sample (N = 268)

Variables	Total N = 268 (%)	Unvaccinated N = 95 (%)	Vaccinated N = 173 (%)	P value
Child age yrs. (mean, SD)	7.61 (5.20)	6.42 (5.21)	8.26 (5.10)	< 0.01*
Caregiver				
Age (< 40 yrs.)	189 (70.5)	69 (72.6)	120 (69.4)	0.58
Born out of America	103 (38.4)	31 (32.6)	72 (41.6)	0.11
Single parent	106 (39.6)	39 (41.1)	67 (38.7)	0.71
Unemployed	116 (43.4)	39 (41.1)	77 (44.5)	0.59
Household Income (less than 20,000)	150 (56.0)	52 (54.7)	98 (56.6)	0.76
Education (high school or less)	179 (66.8)	61 (64.2)	118 (68.2)	0.51
Healthy behavior	115 (42.9)	19 (20.0)	96 (55.5)	< 0.01*
Child with comorbidity	132 (49.3)	37 (38.9)	95 (54.9)	0.01*
Length of knowing your doctor				< 0.01*
Less than 1 year	61 (22.7)	34 (35.8)	27 (15.6)	
1-3 years	43 (16.0)	17 (17.9)	26 (15.0)	
4-5 years	16 (6.0)	6 (6.3)	12 (6.9)	
6-10 years	60 (22.3)	22 (23.2)	38 (22.0)	
11 years or more	88 (32.8)	18 (18.9)	70 (40.5)	
Non-adherence supervision visit	106 (39.5)	79 (83.5)	27 (15.6)	< 0.01*
ER visit in past 12 months	132 (49.3)	39 (41.1)	93 (53.2)	0.13

*P < 0.05

Table 2. Univariate and multivariate modeling of predictors to receiving flu vaccine

	Univariate (OR, 95%CI)	P value	Multivariate (aOR, 95%CI)	P value
Child age	1.07 (1.02, 1.13)	0.01*	1.04 (0.98, 1.11)	0.23
Caregiver				
Age (< 40 yrs.)	1.17 (0.67, 2.05)	0.58		
Born out of American	1.62 (0.96, 2.73)	0.07	0.61 (0.33, 1.13)	0.12
Unemployed	1.15 (0.69, 1.91)	0.59		
Income less than 20,000	1.08 (0.65, 1.79)	0.76		
Education (high school or less)	1.20 (0.71, 2.03)	0.51		
Healthy behavior	4.99 (2.78, 8.96)	< 0.01*	3.94 (2.07, 7.52)	< 0.01*
Child with comorbidity	1.91 (1.15, 3.18)	0.01*	1.68 (0.90, 3.16)	0.11
Length of knowing doctor	1.41 (1.20, 1.65)	< 0.01*	1.17 (0.96, 1.44)	0.12
Non-adherence supervision visit	0.35 (0.21, 0.89)	< 0.01*	0.38 (0.20, 0.73)	0.01*
ER visit in past 12 months	1.49 (0.89, 2.52)	0.13	2.30 (1.21, 4.39)	0.01*

*P < 0.05

study does not allow us to provide a temporal association (whether vaccination took place before or after ER visit), this finding suggests that parents who have sought medical attention for their children at the ER may be more aware of the importance of illness prevention practices. Therefore, they may be more adherent to the recommendations given by ER providers and pediatricians. In addition, these parents may be more cognizant of the costs surrounding frequent ER visits such as lost wages, transportation, medications, and additional childcare if other children are also present in the household [8].

Missed health supervision appointments were found to be associated with decreased influenza vaccine uptake. Missing these appointments translates to decreased contact with the pediatrician and other healthcare providers, missed opportunities to vaccinate, answer questions, and dispel any misconceptions regarding the influenza vaccine [22]. It is also a missed opportunity to counsel the families on the importance of practicing healthy habits such as adhering to the vaccination schedule.

There are some limitations noted in this study. First, with self-reported surveys, parents may be unable to recall whether their children received the influenza vaccine, missed supervision appointments or visited the ER within the past 12 months. On the other hand,

influenza vaccination could also be over reported [23]. Even though we supplemented this information with a detailed EMR search in order to increase the accuracy of our data, information was not available if the parent accessed care at another institution outside of the BUHMC system. In addition, the reason and level of acuity of the ER visit (i.e. high acuity vs. low acuity) were not analyzed in this study. This would have allowed us to further characterize the relationship of the type of ER visit on influenza vaccine acquisition. Second, participants were recruited exclusively through our ambulatory clinics. This leads to unavoidable selection bias as our participants in this convenience sample may have better health behaviors, greater influenza vaccination rates (64.6% in our sample vs. 28-33.8% in BUHMC and other NYC institutions), and fewer rates of missed medical appointments. Also, due to the survey-based methodology of the study, covering across two influenza seasons (by asking whether the child received the influenza vaccine in the past 12 months instead of asking about the specific influenza vaccine season) may have led to the reporting of higher influenza vaccine coverage rates in our study. Similar high influenza vaccination rates in NYC were encountered by the National Immunization Survey, a survey-based source of influenza vaccine coverage [24]. Third, our 4-item health behavior questionnaire has not been validated. However, it could be a measure that reflects healthy behavior according to AAP guidelines.

Future studies may focus on other possible factors that affect influenza vaccine acquisition such as reasons for vaccine refusal (whether these are related to health beliefs, uncertainty about the indication for vaccination, etc.) [25,26] as this could influence future interventions that address gaps in coverage [27]. Development and validation of health behavior questionnaires may be useful to assess parental attitudes towards influenza vaccine uptake.

Our study echoes research stating that the length of knowing the provider has a positive influence on parental choices [28]. The pediatrician's recommendations and parent's trust in their advice could have an important role in improving influenza vaccination uptake rates [29].

From a health systems perspective, it has been shown that mass vaccination programs are associated with a reduction in morbidity and school absence rates [30-32]. Influenza vaccination interventions, whether carried out at schools, ERs or clinics, seek to bridge the gaps and address missed opportunities for vaccination [33,34]. However, these must take into consideration the community's needs and risk factors for influenza vaccine uptake such as the ones discussed in this study.

Conclusion

Parental support for healthy behaviors and prior ER visits are associated with increased influenza vaccine uptake, whereas non-adherence to health supervision appointments are associated with decreased uptake. Encouraging the practice of healthy behaviors and decreasing the rates of missed health supervision appointments may help improve influenza vaccine uptake rates.

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