Frequency and Consequences of Influenza Vaccination in Adults With Congenital Heart Disease

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Immunization against influenza is a critical, but perhaps underappreciated prevention of morbidity and mortality in the cardiac population. The purpose of the present study is to examine influenza vaccination rates in adults with congenital heart disease (ACHD). A secondary purpose is to explore whether there is an association between demographic, medical, and behavioral variables and receipt of the influenza vaccination. Of the 183 consecutive ACHD patients who were contacted, 123 responded to our telephone survey. Mean age was 38.4 ± 14.7, with the most common type of lesion complexity being moderate (65.3%), followed by simple (21.0%) and severe (13.7%). Overall, 53 respondents reported undergoing influenza vaccination in the previous season. Fifty-two percent of all subjects claimed they were notified of the benefits of vaccination by their physician. Univariate analysis revealed that older age (p = 0.006), female gender (p = 0.027), perceived susceptibility to influenza illness (p <0.001), perceived severity of the influenza illness (p <0.001), perceived benefits of the influenza vaccination (p <0.001), side effects from previous immunization (p = 0.006), and physician recommendation (p = 0.008) were predictors of receipt of influenza vaccination. On multivariate analyses, however, only side effects from previous immunization was a predictor (odds ratio = 0.34 [95% confidence interval 0.13 to 0.91]), whereas physician recommendation was numerically, but not statistically, significant (odds ratio 2.01 [95% confidence interval 0.85 to 4.78]). Our study demonstrated that less than 50% of ACHD population receives influenza vaccination. We believe educating both the patients about the side effects of vaccination and the physicians about their role in counseling ACHD patients will increase the vaccination rates in this high-risk population. **(Am J Cardiol 2017;■■:■■–■■)**

Influenza is estimated to cause >36,000 deaths and 225,000 excess hospitalizations in the United States every year.[1] Influenza-related death is more common among patients with cardiovascular disease than among patients with any other chronic disease. Recognizing this, the American College of Cardiology and the American Heart Association (ACC/AHA) now recommends influenza vaccination as part of the comprehensive secondary prevention in children and adults with cardiovascular disease.[2] Adults with congenital heart disease (ACHD) represent the fastest growing cohort of patients with unique set of cardiovascular concerns.[3] There is an accelerated rate of growth in the number of hospital admissions for ACHD,[4] increasing cardiovascular comorbidities,[5] and increasing health-care costs.[6] There are currently limited data on rates of immunization in this patient population. Furthermore, to our knowledge, no study has been conducted attempting to understand why ACHD do, or do not, receive the influenza vaccine annually. Here, we report the first studies to quantify the rate of influenza vaccination in an ACHD clinic. The primary objective of the present study is to examine influenza vaccination rates in ACHD in our clinic. A secondary objective is to explore whether there is an association between demographic, medical, and behavioral variables and receipt of the influenza vaccination. We hypothesized that ACHD receive the influenza vaccinations less frequently than the general cardiac population.

Methods

Ethical approval for this study was granted by the Regina Qu'Appelle Health Region Ethics Board. This study utilized a population-based sample. Eligibility criteria included all adults who have a diagnosis of congenital heart disease and attend the ACHD clinic in Regina, SK. We contacted, telephonically, every patient seen at our clinic from March 1, 2016 to February 28, 2017 (n = 183).

Demographic variables were assessed by self-report and included age, gender (male vs female), race (White, First-Nation, African-American, Asian, and Other), and years of postsecondary education, if any. Medical variables were also assessed by self-report and included severity of congenital heart disease (simple, moderately complex, and great complexity), last immunization, and number of physician appointments in the last year.

Attitudes and beliefs surrounding the influenza vaccination were assessed using items from the Health Belief Model.[7]

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Three components of the Health Belief Model (perceived susceptibility to influenza, perceived severity of the influenza, and perceived benefits of the influenza) were measured and assessed using the 5-point Likert scale of qualitative expressions. Answers ranged from "Yes, I am extremely concerned" (measured as 1 on the Likert scale) to "No, I am not concerned at all" (measured as 5 on the Likert scale). We asked 3 additional behavioral questions in our attempt to further understand vaccination uptake, namely, (1) concern about unknown contents in the influenza vaccine; (2) awareness of the benefits of influenza vaccine in patients with heart disease; and (3) previous perceived side effects from the influenza vaccine. Concern about vaccination content was measured with a single item, "Are you concerned there may be something in the flu shot that you do not know about?" Awareness of the benefits was also measured with a single item, "Has your physician ever told you about the benefits of the influenza vaccine in patients with heart disease?" Likewise, previous side effects was also measured with a single item, "Have you had any side effects that you perceive to be from the vaccine?"

All analyses were conducted using SPSS version 22 (SPSS Inc, IBM Corp, Armonk, New York). Independent *t* tests and chi-square tests were used to examine the association between the categorical demographic, medical, and behavioral variables and the immunized and not immunized question. Continuous variables or variables with more than 2 categories were dichotomized using dummy variables for the logistic regression analyses based on the optimal comparison. Likert-scaled responses were analyzed as dichotomous (e.g., extremely/very/slightly vs not at all). The significance level was set at an alpha of 0.05, and all tests were 2-sided.

Results

We successfully contacted 68% of the eligible subjects. Demographic and medical correlates of influenza immunization are presented in Table 1. The final sample had a mean age of 38.4 and was predominately white. Overall, 43% of respondents reported undergoing influenza vaccination in the previous season. ACHD were more likely to receive the influenza vaccination if they were older, female, and told about the benefits of the vaccine by their physician.

Behavioral correlates of influenza immunization are presented in Table 2. ACHD were more likely to receive the influenza vaccine if they were more concerned they would contact influenza without the vaccine, were more concerned about the severity of the influenza illness, believed the vaccination would benefit them and had not previously experienced side effects from previous influenza vaccinations.

The 7 significant correlates from univariate analysis (i.e., age, sex, physician recommendation, and each component of the health belief model) were included in a logistic regression analysis as shown in Table 3. Demographic, medical, and behavioral variables with more than 2 categories were dichotomized. The logistic regression model was statistically significant, chi-square (7) = 36.55, $p < 0.001$, and explained 26.4% of the variance in receipt of immunization in ACHD. Older age was 2.11 times more likely to be associated with receipt of vaccination, and this almost met statistical significance ($p = 0.087$, CI 0.90 to 4.98). Likewise, physician recommendation was 2.01 times more likely to be associated with receipt of the vaccine, and this almost met statistical significance ($p = 0.11$, CI 0.85 to 4.78). Perceived vaccine-related side effects from the influenza vaccination ($p = 0.032$, odds ratio = 0.34, CI 0.13 to 0.91) was a statistically significant negative predictor of receiving influenza vaccination.

To examine the representativeness of our sample, we compared responders (n = 124) and nonresponders (n = 59) on the limited demographic and medical information available from the registry. We found our sample of responders was similar in age (38.4 ± 14.7 vs 37.6 ± 17.4 years; $p = 0.75$) and type of lesion ($p = 0.63$).

Discussion

The aim of our study was to explore influenza vaccination rates in ACHD patients and examine their attitudes toward the vaccine. Our results showed that 43% of ACHD reported receiving the influenza vaccination. The pattern of correlates suggests that older patients, those who have never experienced side effects and those who have been educated about the benefits of the vaccine in patients with heart disease are more likely to receive the influenza vaccine. The complexity of the congenital lesion, patient's education level, and

Table 1
Demographic and medical correlates of influenza immunization in adults with congenital heart disease in Southern Saskatchewan (N = 124)

Variable	All subjects (N = 124)	Immunized (N = 53)	Not Immunized (N = 71)	p-Value
Sociodemographic variables				
Age (Years)	38.4 ± 14.7	42.6 ± 15.9	35.20 ± 12.9	0.006
Women	63 (51%)	30 (24%)	33 (27%)	0.027
White	114 (92%)	47 (38%)	67 (54%)	0.13
Post-secondary education	51 (41%)	25 (20%)	26 (21%)	0.24
Years of post-secondary education	3.1 ± 1.8	3.2 ± 1.9	3.2 ± 1.8	0.96
Anatomy Complexity				
Simple	26 (21%)	9 (7%)	17 (14%)	
Moderate	81 (65%)	37 (30%)	44 (36%)	
Complex	17 (14%)	7 (6%)	10 (8%)	0.61
Physician visits in the last year				
0–5	59 (48%)	24 (28%)	35 (19%)	
6–10	36 (29%)	12 (10%)	24 (19%)	
11–15	15 (12%)	8 (7%)	7 (6%)	
16+	14 (11%)	9 (7%)	5 (4%)	0.19