

# Influenza Vaccination Coverage Level at a Cystic Fibrosis Center

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**ABSTRACT.** *Background.* Influenza causes substantial morbidity and mortality, particularly in vulnerable populations. Annual vaccination is the most effective means to prevent or attenuate this illness. The vaccine is recommended for patients with cystic fibrosis (CF) older than 6 months, but the degree of adherence with this recommendation is unknown.

*Objectives.* To determine 1) the vaccination coverage level for the 1997–1998 influenza season in a population of CF patients, and 2) the factors associated with nonadherence with vaccination.

*Design.* Retrospective chart review, a mailed survey, and telephone interviews.

*Setting.* Intermountain CF Center. This center, accredited by the CF Foundation, delivers health care to affected individuals throughout the Intermountain West. Care of children and adults is based at Primary Children's Medical Center and the University of Utah Hospital, respectively. The adjacent hospitals are comprehensive, tertiary care medical centers on the University of Utah campus in Salt Lake City. Approximately one third of the center's patient population lives in southern Idaho. There are 2 affiliate centers in Idaho, one based in Pocatello/Idaho Falls and the other in Boise.

*Patients.* All patients over 6 months of age on the center's roster.

*Results.* We found documentation of influenza vaccination status in the medical records of 99 patients; 98 who received the vaccine and 1 who did not because of an allergy to egg products. Through the mailed surveys and telephone interviews, we collected data on 236 additional patients. Thus, we report data on 335 (92.5%) of 362 patients on the center's roster. A total of 256 (76.4%) of 335 patients received the influenza vaccine before the 1997–1998 flu season, including 181 (79.4%) of 228 children (<18 years of age) and 75 (70.1%) of 107 adult patients (≥18 years of age). We also analyzed the data assigning all patients to their major site of care, either the Salt Lake parent center or one of the Idaho affiliates. We found no difference in the vaccination rate when comparing parent center to affiliates: 179 (78.2%) of 229 patients at the parent center were vaccinated versus 77 (72.6%) of 106 patients at the affiliates. For the 79 patients who did not obtain the influenza vaccine, the major reasons were: "forgot," "too healthy," "too busy," "worried about the side effects," or "too sick at the time." The

unvaccinated group had fewer clinic visits, fewer CF-related hospitalizations, and lived further from the care center than the vaccinated group. To further explore the association between contact with the center and vaccination status, we categorized patients into those who were evaluated in the outpatient clinic and/or hospitalized in 1997 and those who were not. We found that 80.8% of the 281 patients who actually received care at the center during 1997 were vaccinated as compared with only 59.5% of the 42 patients who did not receive care during that year. The timing of clinic visits also appears to be a critical factor. We found that 87.1% of patients who had a visit during the fourth quarter of the year had the vaccination as compared with 64.9% of patients who did not have a fourth quarter visit. A fourth quarter visit remained highly associated with vaccination in a logistic regression analysis, whereas number of clinic visits did not.

*Conclusions.* The vaccination coverage level in this vulnerable population is higher than other high-risk groups of comparable age. Nonetheless, there is room for improvement. Strategies aimed at increasing patient contact with the CF center, particularly during the fourth quarter of the calendar year, may result in improved vaccination rates. Additional data encompassing a cross-section of CF centers would be helpful in ensuring that influenza vaccination is receiving adequate attention in this patient population. Systematic monitoring of influenza vaccination rates at a national level should be considered as a means of encouraging compliance with this important preventive measure. *Pediatrics* 2002;109(5). URL: <http://www.pediatrics.org/cgi/content/full/109/5/e80>; cystic fibrosis, influenza, vaccination, health care delivery.

ABBREVIATION. CF, cystic fibrosis.

Influenza remains a substantial cause of morbidity and mortality, resulting in hundreds of thousands of excess hospitalizations, tens of thousands of excess deaths, and billions of dollars in health care costs each year.<sup>1,2</sup> Influenza vaccination is the most effective means to prevent or attenuate this illness.<sup>3–5</sup> Unfortunately, this simple, cost-effective preventive measure is underutilized.<sup>3</sup>

Annual vaccination of high-risk groups is a major ongoing public health initiative. A national health objective for the year 2000 was to increase influenza vaccinations to greater than 60% for persons at high risk for influenza disease (objective 20.1).<sup>6</sup> Children and young adults with chronic pulmonary conditions such as cystic fibrosis (CF) are a high-risk group. Indeed, influenza infection has been associated with severe pulmonary exacerbations in CF pa-

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tients.<sup>7-9</sup> Of note, evidence suggests that influenza vaccination elicits an antibody response in this patient population that would be expected to provide protection from the disease.<sup>10,11</sup>

The CF Foundation Clinical Practice Guidelines<sup>12</sup> recommend that all CF patients older than 6 months be vaccinated against influenza annually; however, there is no data available concerning vaccination coverage level in this population. To determine the influenza vaccination rate for the 1997-1998 influenza season in the patient population of the Intermountain CF Center, we conducted a chart review, mailed survey, and telephone interviews. Relevant patients were asked to identify the major reason for not obtaining the vaccine. To define the patient characteristics associated with failure to obtain the vaccine, we compared the vaccinated and unvaccinated groups with respect to demographic and disease-related parameters.

## METHODS

The study was approved by the Institutional Review Board of the University of Utah Health Sciences Center. All patients on the Intermountain CF Center patient roster over 6 months of age were included in the study. The Intermountain CF Center, accredited by the CF Foundation, delivers health care to affected individuals throughout the Intermountain West. Care of children and adults is based at Primary Children's Medical Center and the University of Utah Hospital, respectively. The adjacent hospitals are comprehensive, tertiary care medical centers on the University of Utah campus in Salt Lake City. Approximately two thirds of the patients reside along the Wasatch Front in Utah, and one-third live in Southern Idaho. There are 2 affiliate centers in Idaho. One is based in Pocatello/Idaho Falls and cares primarily for pediatric patients. This region of Idaho is within a 3- to 4-hour drive from Salt Lake City, so a number of these patients come to the parent center for a portion to their care. The other affiliate is based in Boise. Approximately a third of the patients at this site are  $\geq 18$  years of age, similar to the age distribution of the Utah patient population. Typically these patients come to the parent center only for tertiary care issues, because the Boise area is approximately a 7-hour drive from Salt Lake City.

Our CF Center does not have an immunization registry in place for annual reminders to patients, nor do we use the Vaccines for Children Program. However, at the time of this study, we sponsored an annual fall "flu shot" party for CF patients and their families. All patients on the center's patient roster (including patients cared for at the affiliate centers) were sent a postcard invitation. Essentially, this served as a reminder that the influenza vaccine was available and the center endorsed this intervention.

We first did a retrospective review of the medical records for influenza vaccination status. A survey (Appendix) was mailed to each patient (or their parents if they were  $< 18$  years of age) whose vaccination status was not clearly documented in the medical record. The surveys were coded to track their return and facilitate a second mailing to nonrespondents. A telephone interview was attempted for those who did not respond to a second mailed survey.

For each patient, we estimated the distance between home and the site where they received the majority of their care (ie, parent or affiliate center) with Mapquest (<http://www.mapquest.com>) by using the zip codes of their residence and the care center. Comparisons between the vaccinated and unvaccinated groups were performed with 2 sample *t* tests. Where the assumptions for the *t* test were not met, the Mann-Whitney *U* test was used. Categorical variables were analyzed with a  $\chi^2$  test. Logistic regression analysis was performed with influenza vaccination status as the dependent variable and number of clinic visits and fourth quarter clinic visit (yes or no) as covariates.

## RESULTS

We found documentation of influenza vaccination status in the medical records of 99 patients; 98 who

received the vaccine and 1 who did not because of an allergy to egg products. Through the mailed surveys and telephone interviews, we collected data on 236 additional patients. Thus, we report data on 335 (92.5%) of 362 patients on the center's roster. The nonresponders did not differ from responders in age, forced expiratory volume in 1 second predicted, forced vital capacity predicted, height-for-age percentile, weight-for-age percentile, CF-related hospitalizations, clinic visits, or distance from the care center (data not shown).

We found that 256 (76.4%) of 335 patients received the flu vaccine during the fall of 1997, including 181 (79.4%) of 228 children ( $< 18$  years of age) and 75 (70.1%) of 107 adult patients ( $\geq 18$  years of age;  $P = .084$  by  $\chi^2$  analysis). We also analyzed the data assigning all patients to their major site of care, either the Salt Lake parent center or one of the Idaho affiliates. We found no difference in vaccination rate when comparing parent center with affiliates: 179 (78.2%) of 229 patients at the parent center were vaccinated versus 77 (72.6%) of 106 patients at the affiliates ( $P = .33$  by  $\chi^2$  analysis). For the 79 patients who did not obtain the influenza vaccine, the major reasons were: "forgot," "too healthy," "too busy," "worried about side effects," or "too sick at the time" (Table 1).

The vaccinated and unvaccinated groups were compared with respect to demographic and disease-related parameters for 1997 (Table 2). Data were available on 323 of the 335 patients for whom vaccination status was determined. The mean age of the unvaccinated group was greater than the vaccinated group, reflecting the greater proportion of adults in the unvaccinated group. The unvaccinated group had greater height-for-age percentile than the vaccinated group, probably related to the age difference in the 2 groups, with a survivor bias emerging in the older, unvaccinated group. There was no significant difference in pulmonary function between the 2 groups.

The unvaccinated group had fewer clinic visits, fewer CF-related hospitalizations, and lived further from the care center than the vaccinated group (Table 2). To further explore the association between contact with the center and vaccination status, we

**TABLE 1.** Patients' Reasons for Not Obtaining the Influenza Vaccination

Reason	Number of Patients ( $< 18$ Years Old)	Number of Patients ( $\geq 18$ Years Old)
Forgot	8	8
Too busy	5	7
Too healthy	7	4
Worried about side effects	6	2
Too sick at the time	5	3
Too expensive or not covered by insurance	3	2
Does not work for me	3	0
Afraid of needles	1	1
Allergic to eggs	0	1
Other or several reasons	9	4
Total	47	32

**TABLE 2.** Comparison of Vaccinated and Unvaccinated Groups

Parameter	Vaccination Status		P Value
	Mean (SD)		
	Yes	No	
Age (y)	14.8 (10.1)	18.1 (11.3)	.019*
FEV <sub>1</sub> % predicted	82.8 (27.0)	78.4 (25.7)	.313*
FVC % predicted	91.6 (21.9)	90.1 (20.2)	.676*
Height-for-age percentile	27.9 (24.4)	39.8 (28.7)	.003†
Weight-for-age percentile	26.2 (23.4)	27.7 (24.1)	.513†
CF-related hospitalizations	0.67 (0.96)	0.44 (0.71)	.082†
Clinic visits	3.7 (2.9)	2.9 (3.8)	<.001†
Distance from center (miles)	54.3 (67.4)	74.8 (93.9)	.097†

SD indicates standard deviation; FEV<sub>1</sub>, forced expiratory volume in 1 second; FVC, forced vital capacity.

\* 2-tailed *t* test.

† Mann-Whitney *U* test.

categorized patients into those that were evaluated in the outpatient clinic and/or hospitalized in 1997 and those that were not. We found that 80.8% of the 281 patients who actually received care at the center during 1997 were vaccinated as compared with only 59.5% of the 42 patients who did not receive care during that year ( $P = .004$  by  $\chi^2$  analysis). The timing of clinic visits also seems to be a critical factor. We found that 87.1% of patients who had a visit during the fourth quarter of the year had the vaccination as compared with 64.9% of patients who did not have a fourth quarter visit. ( $P < .001$  by  $\chi^2$  analysis). A fourth quarter visit remained highly associated with vaccination in the logistic regression analysis, whereas number of clinic visits did not.

## DISCUSSION

Our study, the first of its kind in this particular high-risk population, indicates that a majority (76.4%) of patients cared for at a relatively large, accredited CF center received an influenza vaccination before the 1997–1998 influenza season. Even if one assumes that all of the nonrespondents were not immunized, the vaccination rate for this population still exceeds the national objective for the year 2000. We found no significant difference in vaccination rate at the pediatric care center and adult care centers and no significant difference between the parent and affiliate centers.

The vaccination coverage level in this CF population exceeds that reported for other high-risk populations <65 years of age. For example, recent reports indicate that only 25% of children with moderate-to-severe asthma<sup>13</sup> and 27.7% of young adults (18–44 years of age) with diabetes mellitus<sup>14</sup> were immunized against influenza. The retrospective nature of our study introduces some potential recall and reporting biases that may result in an overestimation of the influenza vaccination rate. In particular, these biases may influence the quality of data obtained from parents about their chronically ill children. However, previous reports suggest that retrospective surveys of influenza vaccination status provide highly accurate data.<sup>15,16</sup>

Although it is reassuring that a majority of our patients received the influenza vaccine, our data in-

dicating that there is room for improvement. Individuals volunteered a number of reasons why they did not obtain the influenza vaccination. A number of these reasons would seem to be remediable with specific strategies aimed at increasing compliance such as timely reminder cards.<sup>17</sup>

The most notable difference between the vaccinated and unvaccinated groups was in patient contact with the care center. Patients that were evaluated at the center during 1997 were much more likely to have received the flu vaccination. Timing of the contact with the center was also an important factor. A clinic visit during the fourth quarter of the calendar year was strongly associated with influenza vaccination.

Taken together, our results suggest a tangible benefit to patient contact with the CF center. Indeed, the CF Foundation Clinical Practice Guidelines<sup>12</sup> recommend quarterly clinic evaluations. Strategies aimed at increasing patient contact with the center, particularly during the fourth quarter of the calendar year, may result in an improved influenza vaccination rate.

The execution of this study resulted in a reorganization of our medical records. We were surprised by the relatively poor documentation of influenza vaccination status in our clinic records. As noted, this important piece of information could not be readily found in the majority of our clinic charts. We have subsequently reorganized our clinic records to display influenza vaccination status along with the problem list, medications and allergies. This has permitted us to target educational efforts and reminders to those that have not received the vaccine and to efficiently identify patients who may benefit from chemoprophylactic therapy during the influenza epidemic season. For this past influenza season, we found an increase in the vaccination rate in adults; 93 (83.8%) of 111 for the 2000–2001 flu season as compared with 75 (70.1%) of 107 reported herein for the 1997–1998 influenza season ( $P = .025$  by  $\chi^2$  analysis). Documentation of vaccination status will become increasingly relevant as new therapeutic options for influenza and influenza prevention become available.<sup>18,19</sup>

## CONCLUSION

A majority of patients cared for at our relatively large, accredited CF center received an annual influenza vaccination. The most important difference between vaccinated and unvaccinated patients was in whether they had a clinic visit during the fourth quarter of the calendar year. Additional data encompassing a cross-section of CF centers would be helpful in ensuring that influenza vaccination is receiving adequate attention in this patient population. Systematic monitoring of influenza vaccination rates at a national level should be considered as a means of encouraging compliance with this important preventive measure.

## ACKNOWLEDGMENT

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**APPENDIX**  
**FLU SHOT QUESTIONNAIRE**

Did you receive the flu shot for this season (September–December 1997)?

Yes  No

If you answered yes to question 1, when, and where (ie, at what hospital, clinic or other facility) did you receive the vaccination? Please be as specific as possible.

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If you answered no to question 1, why did you decide not to get the vaccine? Please choose only 1 answer that best describes your reason.

- |   |  |
|---|--|
| <input type="radio"/> Allergic to egg products              | <input type="radio"/> Too sick at the time       |
| <input type="radio"/> Too healthy; didn't think I'd need it | <input type="radio"/> Afraid of needles          |
| <input type="radio"/> Forgot                                | <input type="radio"/> Worried about side effects |
| <input type="radio"/> Too expensive                         | <input type="radio"/> Insurance doesn't cover    |
| <input type="radio"/> Too busy                              | <input type="radio"/> Other_____                 |
| <input type="radio"/> Don't think they work for me          |  |

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