

# Prevalence and Predictors of Influenza and Pneumococcal Vaccine Uptake in Patients with Diabetes

U Clancy, J Moran, A Tuthill  
Cork University Hospital, Wilton, Cork

## Abstract

The Irish Immunisation Guidelines recommend that people with diabetes mellitus receive the seasonal influenza and pneumococcal vaccines. We aimed to gather data on seasonal influenza vaccine uptake over the previous twelve months, to determine pneumococcal vaccine uptake over a lifetime, and to identify predictors that may influence likelihood of vaccine uptake. A combination of retrospective medical record review and patient questionnaire was undertaken over a three-month period in a diabetes outpatient clinic. Two hundred patients, 28.5% (n=57) with type 1 and 70.5% (n=141) with type 2 diabetes were questioned. Uptake of seasonal influenza vaccine in the previous year was 64.5%. Reported lifetime uptake rate of pneumococcal vaccine was 22%. Increasing age, increasing duration of diabetes and history of recent GP visits significantly increased frequency of influenza vaccination over a five-year period. Significant predictors of influenza vaccination over the previous 12 months included those receiving GP recommendation [OR 10.6 (95% CI 4.3-26.4)] and those aged over 65 [OR 2.8 (1.008-7.8)]. Significant predictors of pneumococcal vaccine uptake included GP recommendation [OR=63 (10-388)] and chronic kidney disease [OR=22 (1.5-312)]. Increased uptake of vaccines is desirable and may be improved by general practices targeting subsets of the population and annual auditing.

## Introduction

The reported prevalence of diabetes mellitus in Ireland is 4.7%, though the actual figure is higher due to the number of undiagnosed cases. People with diabetes have a higher susceptibility to morbidity, mortality and hospitalizations due to influenza and pneumococcal disease compared to the general population. Accordingly, diabetes is prioritised as a high risk condition in Ireland and many other countries, with vaccination recommended against these diseases under national guidelines. The Immunisation Guidelines for Ireland and the American Diabetes Association (ADA) recommend that people with diabetes receive the seasonal influenza and pneumococcal vaccines. The influenza vaccine is recommended annually, while the pneumococcal vaccine is recommended at least once over a patient's lifetime. 3,4

Uptake rates of the seasonal influenza vaccine among diabetic patients range vary widely in the international literature, with quoted figures in different studies ranging from 43.5% to 67.6%.<sup>5,6</sup> With regard to the pneumococcal vaccine, uptake rates are quite low across the board, ranging from 16.1% to 43.5%.<sup>7,8</sup> The most salient characteristics featured in international studies as predictors of vaccination are increasing age and chronic comorbidity, increased frequency of physician visits, previous vaccination, male patients, increasing duration of diabetes and receipt of insulin therapy. Many studies cite missed opportunities as a reason for low uptake - conversely, of every ten vaccines offered, eight will be accepted. This finding, along with the positive results of interventional trials, demonstrates the huge potential for physician-mediated efforts in increasing vaccine uptake rates. 13

## Methods

This cross-sectional study was a combination of medical record review and patient questionnaire. A mixed quantitative-qualitative, 58-item questionnaire was self-designed based on variables identified in a literature review. Criteria for inclusion in the study were adults with a diagnosis of diabetes who were attending the mixed public/private diabetes outpatient clinic at Cork University Hospital. The following exclusion criteria were used for the study: patients diagnosed with diabetes after the onset of the previous influenza season (less than eight months prior to the study); women with gestational diabetes mellitus (this wasn't regarded as an at risk condition at the time); and patients with documented cognitive impairment. The study was conducted over a period of three months, after the influenza season of 2009/2010 had ended. Medical records for each patient were checked prior to questioning in order to assess whether the inclusion criteria were fulfilled. The total response rate was 98%.

Six pieces of data recorded from the chart were confirmed as correct by the patient prior to completing the questionnaire: age, gender, type of diabetes, number of years elapsed since diagnosis of diabetes, insulin status, and presence of at risk comorbidities indicated for vaccination - defined as per the Immunisation Guidelines for Ireland. Data collected in the questionnaire included health perception, medical card status, number of weeks elapsed since last G.P. visit, seasonal influenza vaccine receipt in the previous 12 months as well as the frequency of receipt in the previous 5 years. Reported receipt of the pneumococcal vaccine over a lifetime was also recorded. With regard to both vaccines, a history of vaccine refusal and/or adverse experiences was sought.

Statistical analysis was carried out using PASW version 18. Investigations into the normality of continuous variable distributions found that they did not display a normal curve and therefore they were summarised using median and interquartile ranges (IQR), and analysed using non-parametric tests. Mann-Whitney U and Kruskal-Wallis tests were used to test associations of two or more non-parametric variables, respectively. Correlations between variables were examined using Spearman's rank correlation coefficient. In testing associations for categorical variables, Pearson's chi-square tests for independence and logistic regression analysis were performed. For some analyses, a split file function was used to separately assess patients who were and weren't aware of the pneumococcal vaccine. A probability value of <0.05 was considered statistically significant.

## Results

### Population Characteristics

Two hundred patients, 28.5% (n=57) with type 1 diabetes and 70.5% (n=141) with type 2 diabetes, were studied. The study population was found to have a median age (IQR) of 60 (48.2-70) years and a median of 10 (6-17) years since diagnosis of diabetes. Table 1 summarises other population characteristics.

### *Vaccine uptake rates*

The influenza vaccine uptake rate for the previous influenza season in patients with diabetes was 64.5% (n=129). The median number of seasonal influenza vaccines received in the past five years was three times (IQR 0-5). Regarding the pneumococcal vaccine, reported vaccine uptake over patients' lifetimes was 22% (n=44). Of the entire study population, 78% were either a) not aware or b) had not received the pneumococcal vaccine. More patients were able to cite the H1N1/swine flu vaccine (12.5%) than the pneumococcal vaccine (4.5%) as being recommended for people with diabetes.

### *Vaccine advisors*

88.6% of patients had been advised to get the seasonal influenza vaccine by a healthcare professional (HCP) in the past, while 22% of patients had received a recommendation to get the pneumococcal vaccine. Distribution across various sources of advice is shown in Figure 1.

### *Vaccine refusal and opinions*

Thirteen per cent of the study population had declined the seasonal influenza vaccine in the past (n=26). The commonest reasons cited were a past history of side effects and fear of side effects. Nine per cent of patients reported an adverse experience with the seasonal influenza vaccine. 1.5% (n=3) had declined the pneumococcal vaccine in the past.

Figure 1: Percentage of patients in receipt of advice regarding seasonal influenza and pneumococcal vaccines from various sources

### *Predictors of vaccine uptake*

Spearman's rank order correlation testing found that increasing age ( $\rho=0.233$ ) and a longer duration since diagnosis of diabetes ( $\rho=0.254$ ) were significantly associated with an increase in vaccination frequency over 5 years, with significance set at two-tailed,  $p<0.01$ . There was also a negative, small but significant correlation between duration since last GP visit and vaccination frequency, i.e. higher frequencies were associated with more recent GP visits ( $\rho=-0.22$ ). After controlling for the influence of age, these three measures still explained an additional 7.1% of the variance in vaccine frequency when examined with hierarchical multiple regression: R squared change = .071, F change (3, 184) = 4.99,  $p<0.05$ .

Pearson's chi square tests for independence were carried out in order to detect associations between receipt of seasonal influenza vaccination last year and other categorical variables. Statistically significant associations are shown. With regard to reported pneumococcal vaccine receipt, recommendation from any source to get the vaccine was positively associated with vaccine uptake over a patient's lifetime, as was being a medical card holder. In contrast to influenza vaccination, chronic renal or lung disease were found to be statistically significant contributors. Age was not a statistically significant predictor for pneumococcal vaccine uptake.

### *Logistic Regression Analysis*

Direct logistic regression was performed to assess the impact of a number of factors on the likelihood that respondents were likely to have received either vaccine.

## **Discussion**

The uptake rates of seasonal influenza (64.5%) and pneumococcal (22%) vaccines reported in this study are consistent with figures reported in international studies; however pneumococcal vaccine uptake is notably lower than influenza. Vaccine uptake was influenced by a variety of factors, with a previous GP recommendation being the strongest positive predictor identified in this study. This is reflected by the finding that 74.5% of patients received GP advice regarding the seasonal influenza vaccine and 21% received GP advice regarding the pneumococcal vaccine. GPs were significantly more likely to advise vaccination if patients were medical card holders; this is a new finding. Patients who had seen their GP for any reason in the last fortnight were likely to have received the seasonal influenza vaccine more frequently over the last five years. Poor awareness played a part in vaccine non-uptake, and many patients were unable to cite the vaccines that are currently recommended for people with diabetes. Awareness in this study was poorer than that documented in the literature. It is interesting to note that despite the national immunisation guidelines, patients aged over 65 were significantly more likely to have received the seasonal influenza vaccine but not the pneumococcal vaccine. Similarly, patients with concomitant chronic kidney and lung disease were more likely to receive the pneumococcal vaccine but not the influenza vaccine. 36.5% of the study population had one or more chronic comorbidity which fell into the 'at risk' category for vaccination. Twelve per cent of patients recalled recommendations from hospital doctors to receive the influenza vaccine. There is perhaps further scope for exploring the role of hospital doctors in relation to vaccine uptake among high-risk groups.

The limitations of this study include possible recall bias given the historical nature of the study in terms of investigating patient vaccination patterns. A selection bias was also present in this study for several reasons. Firstly, specialist referral of patients with type 2 diabetes is recommended for those who have complicated disease or poor glucose control. Additionally, the proportion of subjects with type one diabetes was much higher than that found in the general population. This was also true for medical card holders. Ideally, a study of this kind should be carried out in a general practice setting, generating results that would be more generalisable to the rest of the population and reducing recall bias. When interpreting the uptake rate for seasonal influenza vaccine, it is important to note that these figures may have been inflated for the season of 2009/2010 due to the introduction of the H1N1/swine flu vaccine. Indeed, upon analysing the data, 7.8% of respondents who received the seasonal influenza vaccine last year had reported that they had not received it any other time in the preceding four years, which may suggest that the swine flu vaccine had a role in increasing seasonal influenza vaccine uptake during this season.

This study is the first to establish seasonal influenza and pneumococcal vaccine uptake rates among patients with diabetes in an Irish setting. Intervention is evidently warranted due to low uptake of the pneumococcal vaccine, in particular. As one or two pneumococcal vaccinations cover most individuals for life, an effective campaign promoting this vaccine would yield longstanding results. Given this study's finding of the strength of a simple GP recommendation, an opportunistic but targeted approach is perhaps the most feasible and inexpensive one. This can be used to full advantage in targeting subsets of the population identified by this study, including those that do not own a medical card and patients who have declined an influenza vaccine in the past. In relation to pneumococcal vaccine uptake, males and patients over 65 years of age should be advised regarding same. Ideally, a campaign would be conducted as part of a wider management strategy for diabetes, given the sheer number of interventions required for these patients. The evolution of chronic disease registries (nationally e.g., in Sweden, locally e.g. Diabetes Interest Group Cork and within individual practices) allows regular auditing with easier identification and targeting of non-vaccinees. These simple measures can contribute to better management of this complex chronic disease.

Correspondence: U Clancy  
Mercy University Hospital, Grenville Place, Cork  
Email: [u.p.clancy@umail.ucc.ie](mailto:u.p.clancy@umail.ucc.ie)

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