Preventive Medicine 62 (2014) 155–160

Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

Pneumococcal vaccination of the elderly during visits to acute care providers: Who are vaccinated?

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ARTICLE INFO

Available online 16 November 2013

Keywords:
Vaccination
Immunization
Elderly
Pneumococcal infections
Pneumococcal vaccines
Health services
Public health

ABSTRACT

Objective. Many elderly remain unvaccinated against invasive pneumococcal disease yet frequently visit acute care providers where they have an opportunity to receive the pneumococcal vaccine. We describe factors associated with pneumococcal vaccination in adults aged 65 years and older during visits to acute care providers.

Method. The study included all elderly aged 65 years of age and older enrolled in a health insurance registry in a large Canadian city in 2009. Pneumococcal vaccination status was determined using a vaccination administrative database. Unvaccinated elderly were linked to ambulatory and inpatient care databases to determine acute care visits. Logistic regression was used to determine odds ratios for vaccination during a first visit to an acute care provider in 2009.

Results. Of 53,249 unvaccinated elderly, 23,574 presented to at least one acute care provider in 2009. Acute care visits were significantly associated with receipt of pneumococcal vaccine (11.0% vs. 7.8%, risk adjusted odds ratio [OR] = 1.53; 95% confidence interval [CI] = 1.44,1.62), particularly ambulatory care visits during influenza season (OR = 4.36; 95% CI = 2.86,6.66) and inpatient visits with lengths of stay >14 days (OR = 7.71, 95% CI = 4.41,13.47).

Conclusion. Acute care visits were associated with greater pneumococcal vaccine uptake for the elderly during the annual influenza season and long hospital stays.

Introduction

Invasive pneumococcal disease (IPD) remains a significant cause of morbidity and mortality among the elderly. In North America there remains an estimated 21 to 43 annual cases of IPD per 100,000 persons 65 years of age and older (Costa et al., 2011; Public Health Agency of Canada, 2010). Moreover case fatality is high, ranging from 16% for elderly 65 to 80 years of age to greater than 20% for elderly over the age of 80, despite the availability of effective antibiotic treatment and intensive care support (Kupronis et al., 2003; Robinson et al., 2001). With a growing proportion of individuals 65 years of age and older predicted in coming years and the emergence of drug-resistant pneumococcal strains (Dagan, 2009; Lynch and Zhanel, 2010), vaccination of the elderly against IPD remains a public health priority.

A single lifetime dose of 23-valent pneumococcal polysaccharide vaccine (PPV) has been recommended in the United States and Canada since the late 1990s for all persons 65 years of age and older to protect against IPD (Centers for Disease Control and Prevention, 2010; Public Health Agency of Canada, 2006). Unfortunately, despite public health's promotion of this safe, effective and economical vaccine (Moberley et al., 2008; Musher et al., 2010; Ogilvie et al., 2009) for over a decade, uptake of PPV vaccination among the elderly remains in the 40% to 60% range (Environics Research Group, 2006; Lu and Nuorti, 2010). This coverage rate is well below the United States' *Healthy People 2020* target of 90% for all persons 65 years of age and older and Canadian *National Consensus Conference* targets of 80% for all persons 65 years of age and older and 95% for residents of long-term care facilities (Centers for Disease Control and Prevention, 2012, 2008).

Previous studies have identified frequent missed opportunities to vaccinate elderly with PPV during visits to acute care settings (Centers for Disease Control and Prevention, 1997; Kyaw et al., 2006; Parsons et al., 2007). Unfortunately, these studies have had limited generalizability to the general population 65 years of age and older due to their reliance on medical records and retrospective assessment of PPV vaccination among IPD patients. Receipt of PPV is likely underestimated because vaccination may not be completely documented in medical charts (Mac Donald et al., 1999). IPD patients may represent higher-risk elderly with characteristics that differ from the general population 65 years of age and older.

Since 1998, a single lifetime dose of pneumococcal polysaccharide vaccine has been publicly funded in the province of Alberta, Canada for

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0091-7435/$ – see front matter © 2013 Published by Elsevier Inc.
http://dx.doi.org/10.1016/j.ypmed.2013.11.009

all adults 65 years of age and older (Kellner et al., 2009). PPV vaccination is administered by the Alberta Health Services for the city of Calgary, Alberta, a metropolitan center with a population of 1.2 million.

The purpose of this study is to use Alberta's population-based administrative data sources to determine the number of unvaccinated elderly 65 years of age and older accessing acute care services in Calgary and to describe the factors associated with PPV vaccination in these acute care settings. Understanding the factors associated with PPV vaccination for all elderly presenting to acute care will help target interventions to bring coverage rates closer to national targets.

Methods

Study population

A retrospective cohort design was conducted in 2012 linking Alberta's health care insurance registry, ambulatory care database and hospital discharge abstract database for fiscal year 2009 (April 1, 2009 to March 31, 2010) with public health vaccination data for the city of Calgary (January 1, 1998 to March 31, 2012) via unique personal health numbers. Canada has a government-financed universal health care insurance system resulting in a low opt-out rate for Alberta's provincial health care insurance registry (<1%). The study population was all adults in the registry who were 65 years of age and older and living in the city of Calgary on April 1, 2009. Three percent of the population was excluded due to patient death or migration out of Alberta during the study period.

The study population was linked to public health vaccination records to determine elderly 65 years of age and older with and without PPV vaccination prior to 2009 (no documented PPV for the period 1998 to 2008). As a publicly-funded resource, supply of PPV to community and acute care providers in Calgary is tightly controlled by public health and contingent on accurate reporting of vaccine use. All administered doses of PPV must be reported to public health including client identification and date of vaccination. As a result, public health vaccination records for the city of Calgary are complete and representative of PPV usage.

Exposure: Acute care visit

Unvaccinated elderly were linked to ambulatory and inpatient care data and stratified into individuals with no visits versus ≥1 visits to an acute care provider in 2009. Acute care visits were classified into ambulatory care only versus inpatient stays. Data for both the ambulatory care and hospital discharge abstract databases is extracted from patient charts by coders using a uniform protocol. The ambulatory care database includes all visits to government-funded facilities in Alberta including emergency departments, outpatient clinics operated from acute care facilities and day procedure facilities, and excludes visits to family physicians in the community. The hospital discharge abstract database contains information on all inpatient stays in Alberta.

Outcome: PPV vaccination

Unvaccinated elderly in both the no visits and ≥1 visits groups were stratified into those that received and did not receive PPV in 2009. Those that received PPV and had at least one visit to an acute care provider in 2009 were further stratified by whether they received the vaccine during their first visit in 2009. Recommendations to receive PPV can be made in an acute care setting without immediate administration of the vaccine when insufficient vaccine supply or clinical priorities necessitate a post-visit vaccination referral to primary care or public health in the community. In Calgary, a 10-minute PPV vaccination appointment with community public health has wait times consistently less than 2 weeks and sensitivity analysis for window periods of 7, 14 and 28 days showed no disproportionate effects on PPV vaccination rate estimates (4.4% vaccinated during 1st visit or within 7-days post-visit, 1.7% vaccinated between 8 and 14 days post-visit, 3.6% vaccinated between 15 and 28 days post-visit). Therefore PPV administered during a visit, or within a 14-day window period, was attributed to a PPV recommendation made in acute care and equivalent to receiving the vaccine in the acute care setting.

Statistical analysis

Logistic regression was used to build a model of the odds of PPV vaccination in 2009 among elderly with and without visits to acute care. Age (65–74, 75–84, 85+), sex and aboriginal status from the insurance registry and household median income (quartiles) from the 2006 Statistics Canada census (Statistics Canada, 2006), were adjusted for as potential confounders.

A second logistic regression model was fitted to determine the factors associated with PPV vaccination during a first visit to acute care in 2009. Independent variables were age, sex, household median income, occurrence of first visit (during vs. not during influenza season), Charlson comorbidities (Charlson et al., 1987) (none, 1, >1), ICD-10 mental health diagnosis (no, yes), health service facility (tertiary vs. non-tertiary care) and inpatient length of stay (≤14 days vs. >14 days, the 75th percentile for length of stay) from the ambulatory and inpatient care databases. Charlson comorbidities measuring health status and potential risk factors for healthcare services use include myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, peptic ulcer disease, renal disease, hemiplegia or paraplegia, cancer, liver disease, diabetes and AIDS. Mental health could be a potential barrier to vaccination consent. We followed a step-wise approach beginning with age and sex as independent variables. Additional variables were introduced in stages and retained if the resulting model was significantly different using the likelihood ratio test. Univariate and multivariate data analyses were performed using Stata/SE version 11.0 (StataCorp LP, College Station TX, 2009).

Results

A total of 106,053 elderly 65 years of age and older were identified in the city of Calgary as of April 1, 2009. The prevalence of previous PPV vaccination between 1998 and 2008 for this population was 49.8% (Fig. 1). Of the 53,249 unvaccinated elderly, 23,574 individuals presented to at least one acute care provider in 2009 but 89.0% remained unvaccinated at the end of 2009 and only 6.1% (n = 159) received PPV in association with their first visit. The vaccination rate for the no visit group was 7.8%.

Compared to elderly vaccinated with PPV prior to 2009, unvaccinated elderly were younger while both groups had a higher proportion of females (Table 1). Vaccination rates were higher in older age groups, reaching 68.5% for elderly over the age of 85, the highest risk age group for acquiring IPD. A reverse socioeconomic gradient was noted as vaccination rates were lower for higher household income quartiles. A higher percentage of females vs. males (52.0% vs. 47.0%) and non-Aboriginals vs. Aboriginals (49.8% vs. 40.2%) were vaccinated prior to 2009.

Ambulatory or inpatient visits to an acute care provider in 2009 were associated with higher likelihood of PPV vaccination compared to no visits (risk adjusted odds ratio [OR] = 1.53; 95% confidence interval [95% CI] = 1.44,1.62) (Table 2). Elderly were more likely to be vaccinated in 2009 with increasing household income (4th quartile OR = 1.44; 95% CI = 1.32,1.56). Despite age being a major risk factor for IPD, there was a lower odds ratio for PPV vaccination in 2009 in the 75–84 age group (OR = 0.48; 95% CI = 0.44,0.52) and 85 and older age group (OR = 0.63; 95% CI = 0.55,0.71) compared to the 65–74 age group.

For elderly with a first visit to ambulatory care in 2009 without admission to a hospital, individuals 75–84 years of age were less likely to receive PPV (OR = 0.47; 95% CI = 0.26,0.85) compared to elderly 65–74 years of age (Table 3). Elderly receiving ambulatory care at one of Calgary's three tertiary care centers were more likely to receive PPV (OR = 1.81; 95% CI = 1.04,3.14) than those attending non-tertiary care facilities. Finally, there was a strong association between receipt of PPV at a first ambulatory care visit during the fall influenza season (October to March) (OR = 4.36; 95% CI = 2.86,6.66) compared to the remainder of the year.

For elderly with a first visit to acute care in 2009 involving admission to hospital, females were less likely than males to receive PPV (OR = 0.52; 95% CI = 0.32,0.84). Notably, a median length of inpatient stay greater than 14 days was strongly associated with PPV vaccination (OR = 7.71; 95% CI = 4.41,13.47).

Discussion

We found that half of all elderly 65 years and older in Calgary, a large metropolitan center, were unvaccinated with PPV which is consistent