Vaccine xxx (2018) xxx–xxx

Contents lists available at ScienceDirect

Vaccine

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

Association of provider recommendation and offer and influenza vaccination among adults aged ≥18 years – United States

Peng-jun Lu [a,*], Anup Srivastav [a,b], Ashley Amaya [c], Jill A. Dever [c], Jessica Roycroft [c], Marshica Stanley Kurtz [c], Alissa O'Halloran [a,b], Walter W. Williams [a]

[a] Immunization Services Division, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, 1600 Clifton Road, NE, Atlanta, GA 30333, United States
[b] Leidos Inc., Atlanta, GA, United States
[c] RTI International, Research Triangle Park, NC, United States

ARTICLE INFO

Article history:
Received 29 August 2017
Received in revised form 4 December 2017
Accepted 6 December 2017
Available online xxxx

Keywords:
Provider recommendation
Influenza
Influenza vaccine
Vaccination
Coverage
Adult
National Internet Flu Survey (NIFS)
The Advisory Committee on Immunization Practices

ABSTRACT

Background: Influenza vaccination has been recommended for all persons aged ≥6 months since 2010.
Methods: Data from the 2016 National Internet Flu Survey were analyzed to assess provider vaccination recommendations and early influenza vaccination during the 2016–17 season among adults aged ≥18 years. Predictive marginals from a multivariable logistic regression model were used to identify factors independently associated with early vaccine uptake by provider vaccination recommendation status.
Results: Overall, 24.0% visited a provider who both recommended and offered influenza vaccination, 9.0% visited a provider who only recommended but did not offer, 25.1% visited a provider who neither recommended nor offered, and 41.9% did not visit a doctor from July 1 through date of interview. Adults who reported that a provider both recommended and offered vaccine had significantly higher vaccination coverage (66.6%) compared with those who reported that a provider only recommended but did not offer (48.4%), those who neither received recommendation nor offer (32.0%), and those who did not visit a doctor during the vaccination period (28.8%). Results of multivariable logistic regression indicated that having received a provider recommendation, with or without an offer for vaccination, was significantly associated with higher vaccination coverage after controlling for demographic and access-to-care factors.
Conclusions: Provider recommendation was significantly associated with influenza vaccination. However, overall, 67.0% of adults did not visit a doctor during the vaccination period or did visit a doctor but did not receive a provider recommendation. Evidence-based strategies such as client reminder/recall, standing orders, provider reminders, or health systems interventions in combination should be undertaken to improve provider recommendation and influenza vaccination coverage. Other factors significantly associated with a higher level of influenza vaccination included age ≥50 years, being Hispanic, having a college or higher education, having a usual place for medical care, and having public health insurance.
Published by Elsevier Ltd.

1. Introduction

Seasonal influenza is associated with substantial morbidity and mortality in the United States [1–4]. Annual epidemics of influenza typically occur during the late fall through early spring in the United States. During the 2015–16 influenza season, hospitalization rates associated with influenza ranged from 20.3 per 100,000 to 321.1 per 100,000 persons depending on age group with an estimated 310,000 hospitalizations. About 50% of these hospitalizations occurred among adults aged 65 years and older, although this age group accounted for only 15% of the U.S. population [2]. Rates of serious illness and death are higher among adults aged ≥65 years, children younger than 2 years, pregnant women, and persons of any age who have medical conditions that place them at increased risk for complications from influenza [1]. Influenza illness burden among healthy adults 18–49 years is an important cause of outpatient medical visits and loss of workdays [5,6]. Influenza vaccination has been shown to be a cost-effective tool for reducing morbidity and mortality associated with influenza among adults [5,7–19].

* Corresponding author at: National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, 1600 Clifton Road, NE, Mail Stop A–19, Atlanta, GA 30333, United States.
E-mail address: plu@cdc.gov (P.-j. Lu).

https://doi.org/10.1016/j.vaccine.2017.12.016
0264-410X/Published by Elsevier Ltd.

Since the 2010–11 influenza season, the Advisory Committee on Immunization Practices has recommended annual influenza vaccination for all persons 6 months of age and older [1]. Influenza vaccination is the most effective strategy for preventing influenza and its complications; however, vaccination coverage has been suboptimal [1,20–22]. Studies have indicated that doctor's recommendations and referrals for vaccination are associated with influenza vaccination uptake among pregnant women, but comprehensive assessment of the impact of these recommendations and referrals on vaccination coverage among the general population is limited [23–25].

This study uses data from the 2016 National Internet Flu Survey (NIFS) to assess the association of early-season influenza vaccination coverage with receipt of recommendations and offers of influenza vaccination by provider. The findings can be used to modify strategies and interventions to improve influenza vaccination among adult populations.

2. Methods

The NIFS is an annual survey which collects information about early-season influenza vaccination, and provider recommendation/offer status, knowledge, attitudes, behaviors, and barriers related to influenza vaccination in the non-institutionalized U.S. adult population. Information such as demographic and access-to-care characteristics of respondents are also collected. The 2016 NIFS was conducted for Centers for Diseases Control and Prevention (CDC) by RTI International and Gesellschaft für Konsumforschung (GfK) Custom Research, LLC during October 27–November 9, 2016. The survey was conducted on a random sample of participants in the GfK KnowledgePanel®, a probability-based Internet panel designed to be representative of the non-institutionalized U.S. population aged ≥18 years [26]. The NIFS self-administered interview was conducted in English only.

For this ongoing GfK panel, participants are initially chosen by a random selection of telephone numbers and residential addresses. Persons in selected households are then invited by telephone or mail to participate in the web-enabled KnowledgePanel®. For those who agree to participate but do not already have Internet access, GfK provides both a laptop and Internet access at no cost. People who already have computers and Internet service participate using their own equipment. Panelists receive unique login information for accessing surveys online, and are sent e-mails on an ongoing basis, inviting them to participate in surveys. The KnowledgePanel® recruitment response rate was approximately 13% using the American Association for Public Opinion Research response rate 3 formula [27].

The 2016 NIFS survey invitation was sent to a random sample of 7014 panel members. A total of 4305 completed the NIFS questionnaire, with an unweighted completion rate of 61.4%, and a weighted completion rate of 61.1%. All NIFS estimates were weighted to reflect the non-institutionalized U.S. population aged ≥18 years. Influenza vaccination coverage estimates represent approximately the cumulative proportion of persons vaccinated by October 28, 2016 (the weighted median of the interview date) [21].

Provider recommendation/offer status was assessed by asking respondents: "Since July 1, 2016, have you visited a doctor or other health professional about your own health at a doctor's office, hospital, clinic, or some other place?"; "During any visits to your primary care doctor, family doctor, general practitioner, or internal medicine doctor, your OB/GYN, an urgent care center, an emergency room, an inpatient in a hospital, and another specialist or medical place since July 1, 2016, did a doctor, nurse, or other medical professional recommend that you get a flu vaccination or talk to you about the importance of flu vaccination?"; and, "During any of these visits to your primary care doctor, family doctor, general practitioner, or internal medicine doctor, your OB/GYN, an urgent care center, an emergency room, an inpatient in a hospital, and another specialist or medical place since July 1, 2016, did a doctor, nurse, or other medical professional offer to give you a flu vaccination?".

To determine influenza vaccination coverage, respondents were asked: "*Since July 1, 2016, have you had flu vaccination?*" Individuals were considered to have received an influenza vaccination if they reported having received the vaccine since July 1, 2016, considered in this study as the beginning date for the vaccination period.

Covariates were selected to measure associations with influenza vaccination coverage, including: status of receiving provider offer/recommendation for influenza vaccination, age group, gender, race/ethnicity, marital status, educational level, income, employment status, region of residence, knowledge or awareness of the recommendation for influenza vaccination, metropolitan statistical area (MSA) status, having children in the household, high-risk medical condition status, having a usual place for medical care, and health insurance status.

SAS release 9.4 (SAS Inc. Cary, NC, USA) and SUDAAN 11.0 (Research Triangle Institute, Research Triangle Park, NC, USA) were used to calculate point estimates and 95% confidence intervals for early-season influenza vaccination coverage. All analyses were weighted to the U.S. population of non-institutionalized adults using the 2016 March Supplement of the Current Population Survey estimates after adjusting the NIFS base weights for nonresponse. *T*-tests were used to test for vaccination coverage differences by status of receiving provider offer/recommendation for influenza vaccination, and vaccination coverage differences among covariates within each variable category. A two-sided significance level of 0.05 was adopted for all statistical tests. A multivariable logistic regression model with predictive marginals was used to identify factors independently associated with influenza vaccination coverage among adult populations, and multicollinearity was assessed using condition indices. All variables that were used in the bi-variable analysis were included in the final regression model except knowledge and awareness of influenza vaccination recommendation variable which were excluded from the model since we could not tell if level of knowledge and awareness of influenza vaccination recommendation increased likelihood of vaccination, or the process of recommendation, offer, and vaccination led to increased knowledge and awareness of recommendation, inclusion of this variable in the multivariable models could bias estimates of association for other variables. Thus, this variable was excluded from the models.

3. Results

Sociodemographic and access-to-care characteristics of the study population are shown in Table 1. Of the 4305 participants who completed the survey, the majority of participants had not received influenza vaccination (59.4%), did not indicate correct knowledge of the influenza vaccination recommendation (78.4%) but indicated awareness of the recommendation (62.6%), did not have children aged ≤5 years in the household (93.1%), did not have a high-risk medical condition (67.4%), had a usual place for medical care (86.1%), and had private health insurance (60.8%). Overall, 24.0% reported that a provider both recommended and offered influenza vaccination, 9.0% reported that a provider only recommended but did not offer, 25.1% received neither a recommendation nor offer, and 41.9% did not visit a doctor since July 2016 (those with no provider visit were not asked about provider recommendation and offer). The percentage of respondents reporting

Please cite this article in press as: Lu P-j et al. Association of provider recommendation and offer and influenza vaccination among adults aged ≥18 years – United States. Vaccine (2018), https://doi.org/10.1016/j.vaccine.2017.12.016