ORIGINAL RESEARCH

Primary Care Physicians' Struggle with Current Adult Pneumococcal Vaccine Recommendations

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Introduction: **In 2012, the Advisory Committee on Immunization Practices recommended 13-valent pneumococcal conjugate vaccine (PCV13) in series with 23-valent pneumococcal polysaccharide vaccine (PPSV23) for at-risk adults ≥19; in 2014, it expanded this recommendation to adults ≥65. Primary care physicians' practice, knowledge, attitudes, and beliefs regarding these recommendations are unknown.**

Methods: **Primary care physicians throughout the U.S. were surveyed by E-mail and post from December 2015 to January 2016.**

Results: **Response rate was 66% (617 of 935). Over 95% of respondents reported routinely assessing adults' vaccination status and recommending both vaccines. A majority found the current recommendations to be clear (50% "very clear," 38% "somewhat clear"). Twenty percent found the upfront cost of purchasing PCV13, lack of insurance coverage, inadequate reimbursement, and difficulty determining vaccination history to be "major barriers" to giving these vaccines. Knowledge of recommendations varied, with 83% identifying the PCV13 recommendation for adults ≥65 and only 21% identifying the recommended interval between PCV13 and PPSV23 in an individual <65 at increased risk.**

Conclusions: **Almost all surveyed physicians reported recommending both pneumococcal vaccines, but a disconnect seems to exist between perceived clarity and knowledge of the recommendations. Optimal implementation of these recommendations will require addressing knowledge gaps and reported barriers. (J Am Board Fam Med 2018;31:94–104.)**

Keywords: **Family Physicians, Insurance Coverage, Pneumococcal Vaccines, Primary Care Physicians, Vaccination**

In the United States, *Streptococcus pneumoniae* bacteria causes an estimated 445,000 hospitalizations annually.[1] In 2015 it caused approximately 29,500 cases of invasive pneumococcal disease and 3,350 deaths.[2] Adult pneumococcal disease is a major source of pneumococcal disease–related health care utilization and costs.[1]

Vaccines are an effective way to prevent pneumococcal disease and thereby reduce the burden and cost of pneumococcal disease. In the United States, the

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23-valent pneumococcal polysaccharide vaccine (PPSV23) has been recommended since 1984 for adults aged ≥65 years and adults with high-risk conditions.[3] These recommendations have been revised[4–6], expanding indications for the vaccination and introducing revaccination for some high-risk groups and for adults aged ≥65 years who received their first dose of PPSV23 before age 65. However, PPSV23 remained the only available product for pneumococcal disease prevention among adults through 2011. In terms of efficacy, strong evidence demonstrates that PPSV23 protects against invasive pneumococcal disease; however, PPSV23 does not consistently protect against pneumonia.[7]

In 2011 the pneumococcal conjugate vaccine (PCV13) was approved by the US Food and Drug Administration for use among adults aged ≥50 years.[8] In 2012, the Advisory Committee on Immunization Practices (ACIP) recommended PCV13 in a series with PPSV23 for high-risk adults aged ≥19 years.[9] In 2014, based on data demonstrating vaccine-preventable disease burden and on results of the CAPITA trial[10], which show the efficacy of PCV13 to prevent nonbacteremic pneumonia and invasive pneumococcal disease caused by vaccine serotypes in adults aged ≥65 years, ACIP expanded recommendations for the use of PCV13 to include recommending PCV13 in series with PPSV23 for all adults aged ≥65 years.[11] In June 2015 ACIP revised the recommended intervals between PCV13 and PPSV23 for adults aged ≥65 years from 6 months to 1 year.[12] Adults are recommended to receive both types of pneumococcal vaccine because PCV13 offers some protection against pneumonia, and a large portion of invasive pneumococcal disease in the United States is a result of serotypes unique to PPSV23.[13] A complete timeline of adult pneumococcal vaccine recommendations is presented in Table 1.

Despite longstanding ACIP recommendations for PPSV23 in adults, recent vaccination coverage was 64% among adults aged ≥65 years and only 23% among high-risk adults aged 19 to 64 years[14]—both well below HealthyPeople 2020 goals. Physician perceptions of these changes to the adult pneumococcal vaccine recommendations is unknown. Because physician recommendation is so important to patients' receipt of vaccines[15–18], we sought to describe the current practice, knowledge, attitudes, and beliefs of primary care physicians regarding the current adult pneumococcal vaccine recommendations.

Methods

Study Setting

From December 2015 to January 2016 we administered a survey to a national network of physicians who spent at least half their time practicing primary care. The human subjects review board at the University of Colorado Denver approved this study as exempt research that did not require written informed consent.

Study Population

The Vaccine Policy Collaborative Initiative[19], a survey mechanism to assess physician attitudes about vaccine issues, in collaboration with the Centers for Disease Control and Prevention (CDC), conducted the survey. We developed a network of primary care physicians by recruiting general internists (GIMs) and family physicians (FPs) from the memberships of the American College of Physicians and the American Academy of Family Physicians. We performed quota sampling[20] to ensure that networks of physicians were similar to the American College of Physicians and American Academy of Family Physicians memberships with respect to region, urban/rural locations, and practice setting. We previously demonstrated that survey responses from network physicians compared with those of physicians randomly sampled from American Medical Association physician databases were similar with respect to reported demographic characteristics, practice attributes, and attitudes about vaccination issues.[20]

Survey Design

We developed the survey collaboratively with the CDC. The survey asked about physician practices regarding assessing the need for, recommending, and stocking PCV13 and PPSV23 vaccines, and whether physicians referred patients for either vaccine if the vaccine(s) was not stocked. We used 4-point Likert scales to assess physician perceptions of the clarity of ("very clear" to "very unclear"), ease of implementation of ("very easy" to "very difficult"), and barriers to following ("not a barrier" to "major barrier") the 2015 ACIP adult pneumococcal vaccine recommendations. Physicians were

Table 1. Timeline of Advisory Committee on Immunization Practices Adult Pneumococcal Vaccination Recommendations*

Year	Adult Pneumococcal ACIP Recommendations	References
1984	PPSV23 recommended for adults aged ≥65 years	3
1989	In addition to adults ≥65, PPSV23 also recommended for- • Adults aged 19 to 64 years with chronic illness, including cardiovascular disease, pulmonary disease, diabetes mellitus, alcoholism, cirrhosis, CSF leaks • Adults aged 19 to 64 years with immunocompromising conditions, including splenic dysfunction, anatomic asplenia, Hodgkin disease, lymphoma, multiple myeloma, chronic renal failure, nephrotic syndrome, organ transplantation, HIV	4
1997	Added specificity to previous indications: • Cardiovascular disease to include congestive heart failure and cardiomyopathies • Chronic pulmonary disease to include chronic obstructive pulmonary disease and emphysema, but *not* asthma Added PPSV23 recommendation for adults aged 19 to 64 years who • live in an environment in which the risk of invasive pneumococcal disease or its complications is increased (eg, Alaskan Natives and certain American Indian populations, and patients in nursing homes) • have generalized malignancy • receive immunosuppressive chemotherapy Added recommendation for revaccination with PPSV23 in 5 years for adults aged 19 to 64 years with immunocompromising conditions Added the concept of revaccinating adults ≥65 years who had received a dose of PPSV23 at an age <65 as long as 5 years have elapsed since the first vaccination	5
2010	PPSV23 recommended for adults aged 19 to 64 years who • have asthma • smoke cigarettes PPSV23 no longer recommended for Alaskan Natives or American Indians unless another indication for PPSV23 is present	6
2012	PCV13 recommended in series with PPSV23 for high-risk adults aged ≥19 years (those with immunocompromising conditions, functional or anatomic asplenia, CSF leaks, or cochlear implants) • Pneumococcal vaccine–naïve persons should receive PCV13 first, followed by PPSV23 8 weeks later • If previously vaccinated with PPSV23, should receive PCV13 dose ≥1 year after PPSV23 dose • No changes to previously recommended doses of PPSV23	9
2014	PCV13 recommended in series with PPSV23 for all adults aged ≥65 years • Pneumococcal vaccine–naïve persons should receive PCV13 first, followed by PPSV23 6 to 12 months later • If previously vaccinated with PPSV23, give PCV13 ≥1 year after receipt of the most recent PPSV23 dose	11
2015	Changes to recommended intervals between PCV13 and PPSV23 • 1-year interval recommended between PCV13 and PPSV23, regardless of which vaccine given first, for immunocompetent adults aged ≥65	12

*Numerical references relate to the numerical references at the end of the manuscript.
ACIP, Advisory Committee on Immunization Practices; CSF, cerebrospinal fluid; PCV13, 13-valent pneumococcal conjugate vaccine; PPSV23, 23-valent pneumococcal polysaccharide vaccine.

asked what type of resources would help clarify the recommendations and whether they had a computerized way to identify adults <65 years old who needed either pneumococcal vaccine. Physicians were presented a series of case scenarios and asked questions aimed to assess knowledge of specific elements of the ACIP adult pneumococcal vaccine recommendations (Table 2). To encourage them to answer these questions without referring to other sources, "I would need to look this up" was an available response option. A national advisory panel of GIMs (n = 6) and FPs (n = 7) pretested the survey, which we modified based on their feedback. We pilot-tested the survey among 50 GIMs and 23 FPs nationally and further modified it based on their feedback.

Survey Administration

Based on physician preference, we sent the survey over the internet (Vovici Feedback; Verint Systems Inc., Melville, NY) or through US post. We sent the internet group an initial E-mail with up to 8 E-mail reminders, and we sent the post group an initial mailing and up to 2 additional reminders. Nonrespondents in the internet group were also sent by post up to 2 surveys in case of problems with E-mail correspondence. We patterned the

Table 2. Case-Based Questions Aimed to Assess Knowledge of Advisory Committee on Immunization Practices Adult Pneumococcal Vaccine Recommendations

Question	Answer Options*
1. A 65-year-old healthy woman with no history of prior pneumococcal vaccination sees you for an annual wellness visit. Which, if any, pneumococcal vaccine(s) should be administered at this visit?	• PPSV23 • **PCV13** • None • Both • I would need to look this up
2. A 24-year-old man sees you for a routine office visit. He has asthma and has not previously received any pneumococcal vaccines. Which, if any, pneumococcal vaccine(s) should be administered at this visit?	• **PPSV23** • PCV13 • None • Both • I would need to look this up
3. A 28-year-old woman with HIV infection sees you for a routine visit. She received 1 dose of PPSV23 1 year ago. Which, if any, pneumococcal vaccine(s) should be administered at this visit?	• PPSV23 • **PCV13** • None • Both • I would need to look this up
4. A 42-year-old man with nephrotic syndrome sees you for a routine visit. He has not previously received any pneumococcal vaccines. Which, if any, pneumococcal vaccine(s) should be administered at this visit?	• PPSV23 • **PCV13** • None • Both • I would need to look this up
5. A 66-year-old man with chronic heart disease sees you for a routine visit. He received 1 dose of PPSV23 at age 64. At what age, if at all, should he receive another dose of PPSV23?	• 66 • 67 • **69** • 75 • I would need to look this up
6. A 42-year-old man with cochlear implants sees you for a routine visit. He had received a PCV13 vaccine at his otolaryngologist's office the day before. When should a PPSV23 vaccine be administered?	• Never; the patient does not need a PPSV23 • **At least 8 weeks after the PCV13 vaccine** • At least 1 year after the PCV13 vaccine • At least 5 years after the PCV13 vaccine • I would need to look this up
7. A 67-year-old man with hypertension presents for a medication refill. You notice he received a PCV13 vaccine 6 months ago but has not received a PPSV23 vaccine. When should he receive the PPSV23 vaccine?	• Never; he does not need to receive PPSV23 • Today • **In 6 months** • Five years after he received the PCV13 vaccine • I would need to look this up
8. A 45-year-old woman with a history of idiopathic thrombocytopenic purpura was vaccinated with PPSV23 vaccine before her splenectomy at age 43, and with the PCV13 vaccine last year. When should this patient receive her next dose of PPSV23 vaccine?	• Never; she does not need another dose of PPSV23 • **Five years after her first dose of PPSV23 vaccine** • Today • When she is 65 years old • I would need to look this up

*Correct answers are boldface.
PCV13, 13-valent pneumococcal conjugate vaccine; PPSV23, 23-valent pneumococcal polysaccharide vaccine.

mail protocol on the tailored design method described by Dillman et al.[21]

Statistical Analysis

Analyses were conducted January 2016 through September 2016. We pooled internet and post surveys for analyses because other studies have found that physician attitudes are similar when obtained through either method.[21–23] We compared respondents with nonrespondents on all available characteristics using *t* tests, χ^2, and Mantel-Haenszel χ^2 analyses; characteristics of nonrespondents were obtained from the recruitment survey for the sentinel networks. Results were very similar for GIMs and FPs and are therefore presented together. After excluding physicians who responded that they were not familiar with the recommendations (n = 5), we used χ^2 analysis to compare physicians who perceived the recommendations as "very clear" or "somewhat clear" versus those who perceived them

Table 3. Demographic and Practice Characteristics of Survey Respondents in a Study of Physicians' Perspectives on Adult Pneumococcal Vaccine Recommendations, United States, 2016

Characteristics	Respondents (n = 617)	Nonrespondents (n = 318)
Age (years), mean (SD)*	53.5 (8.6)	55.3 (8.3)
Male*	54.1	63.1
Specialty		
Family physician	47.5	50.9
General internist	52.5	49.1
Region*		
Midwest	27.1	21.7
Northeast	18.2	19.8
South	31.4	39.9
West	23.3	18.6
Location of practice		
Urban	47.2	44.7
Suburban	48.1	49.7
Rural	4.7	5.7
Setting		
Private practice	71.5	78.9
Hospital/clinic	22.2	14.5
HMO	6.3	6.6
No. of providers in the practice		
1	12.4	18.3
2–4	25.1	27.7
5–10	32.3	30.9
≥10	30.2	23.2
Physicians providing vaccines to adults	97.6	N/A
Practice uses an EMR/EHR	93.6	N/A
Proportion of patients aged ≥65		
<10%	5.0	N/A
10–24%	17.4	N/A
25–49%	38.7	N/A
≥50%	38.9	N/A
Practice accepts Medicare	94.8	N/A
Practice accepts Medicaid	71.9	N/A

Data are percentages unless otherwise indicated.
*$P < .05$ for sex, practice setting, region of country, number of providers, and mean age between respondents and nonrespondents (χ^2, Mantel-Haenszel χ^2, and t tests were used).
EHR, electronic health record; EMR, electronic medical record; HMO, health maintenance organization; N/A, not applicable; SD, standard deviation.

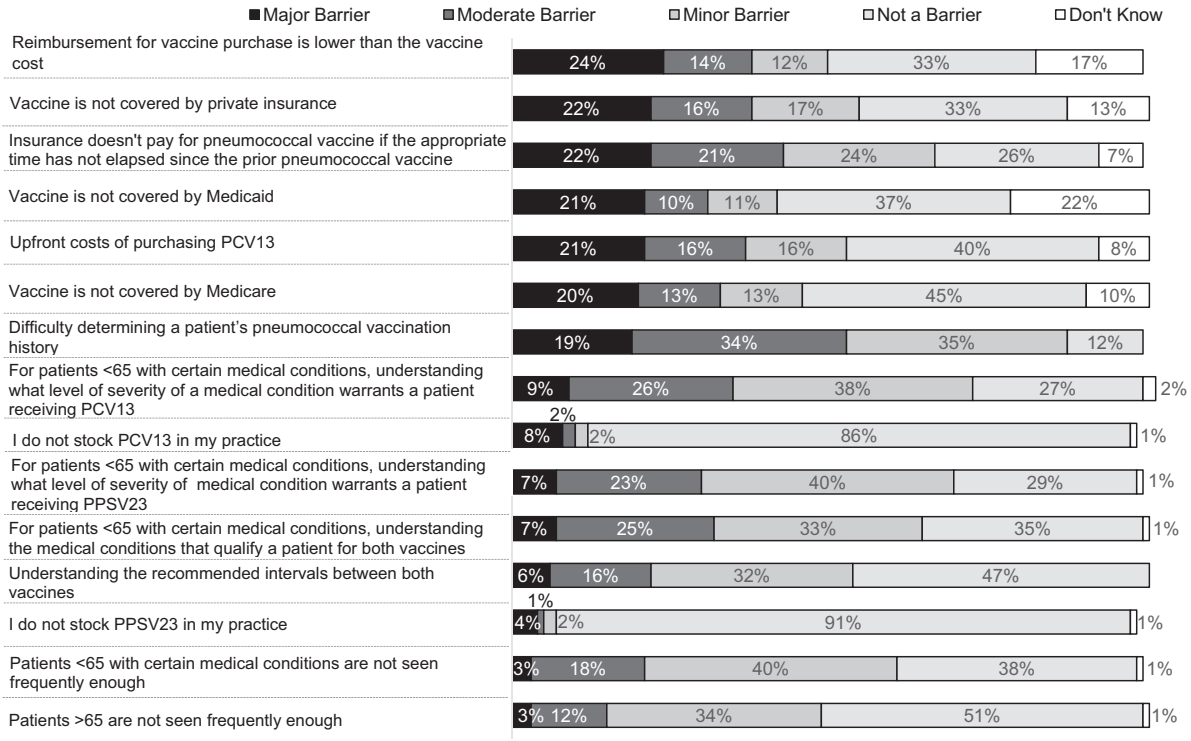
as "somewhat unclear" or "very unclear" in terms of what resources they reported would help clarify the recommendations. All analyses were performed using SAS version 9.4 (SAS Institute, Cary, NC).

Results

Survey Responses and Respondent Characteristics

The overall response rate was 66% (617 of 935). Respondents and nonrespondents did not differ significantly by census location (urban, suburban, or rural). Male and older physicians, and physicians from private practices or practicing in the South, were less likely to respond, whereas physicians from the Midwest or larger practices were more likely to respond. Characteristics of respondents and nonrespondents and other characteristics of respondents' practices and patient populations are shown in Table 3. Of those who responded, 15 reported they do not give immunizations to adult patients and were excluded from further analysis, leaving a final cohort of 602 physicians.

Figure 1. Physician-reported barriers to following Advisory Committee on Immunization Practices recommendations for giving pneumococcal conjugate vaccine (PCV13) and pneumococcal polysaccharide vaccine (PPSV23) in series, United States, 2016 (n = 602).



Current Pneumococcal Vaccination Practices

Nearly all respondents reported assessing the need for (96%) and recommending (95%) PCV13; 86% reported stocking it. Almost all respondents reported assessing the need for (98%) and recommending (97%) PPSV23; 92% reported stocking it. A total of 31% and 38% reported having a computer-based way to identify adults aged <65 who needed PCV13 or PPSV23, respectively. Of those physicians who reported not stocking PCV13 (n = 72) or PPSV23 (n = 49), 81% and 72%, respectively, referred patients elsewhere for the vaccine.

Perceptions of ACIP Adult Pneumococcal Vaccine Recommendations

The majority of respondents reported that the recommendations were clear (50% "very clear" and 38% "somewhat clear"); 11% reported that they are "somewhat unclear" or "very unclear," and 1% said they were not familiar with the recommendations. Most also reported the recommendations were easy to implement in practice (48% "very easy," 34% "somewhat easy"); 17% reported it was "somewhat difficult" or "very difficult" to implement the recommendations. Physicians reported that the following resources would help clarify the recommendations: a simplified fact sheet/flow diagram with patient scenarios (82%); an electronic medical record prompt (81%); an online self-paced continuing medical education course (56%); an interactive, patient-specific mobile app (45%); or an online webinar (36%). We found no statistical difference in responses to what resources would help clarify the recommendations between physicians who perceived the recommendations as clear versus those who perceived them as unclear. Figure 1 shows the perceived barriers to giving PCV13 and PPSV23 in series.

Knowledge of ACIP's Adult Pneumococcal Vaccine Recommendations

Table 4 shows respondent results for the series of case-based questions we used to evaluate respondents' knowledge of the ACIP's adult pneumococcal vaccine recommendations. We identified variability in the proportion of correct responses. Physicians were most knowledgeable about which pneumococcal vaccine to give first to adults aged

Table 4. Physician Knowledge of Adult Pneumococcal Vaccine Recommendation, United States, 2016 (n = 602)

Knowledge Concept	Correct (%)	Incorrect (%)	Would Need to Look This up (%)
Which pneumococcal vaccine should be given first to adults aged ≥65?	83	14	3
Qualifying conditions for PCV13 for patients aged <65 (HIV)	75	11	14
Interval between PCV13 and PPSV23 in immunocompetent adults aged ≥65	65	29	6
Interval between 2 PPSV23 doses when received at age <65 and patient is now aged ≥65	64	25	11
Which pneumococcal vaccine should be given first to a patient aged <65 with a qualifying condition (nephrotic syndrome)	54	30	16
Qualifying condition for PPSV23 in a patient aged <65 (asthma)	47	42	11
Interval between 2 PPSV23 doses in a patient aged <65 and who has a qualifying condition (splenectomy)	46	40	15
Interval between PCV13 and PPSV23 in patients aged <65 who have a qualifying condition (cochlear implant)	22	58	20

Some percentages do not add up to 100% because of rounding.
PCV13, 13-valent pneumococcal conjugate vaccine; PPSV23, 23-valent pneumococcal polysaccharide vaccine.

≥65 and least knowledgeable about the recommended interval between PCV13 and PPSV23 vaccines in patients <65 who are at high risk; respondents often (54%) provided the correct response for the interval recommended for adults ≥65 years old. Despite being given the option to say they would need to look the answer up, approximately a third or more of physicians answered half of the questions incorrectly.

Discussion

Almost all physicians reported assessing the need for, recommending, and stocking both pneumococcal vaccines and, if they did not stock pneumococcal vaccines, referring patients to receive them elsewhere. While most physicians reported that the recommendations were clear, we identified several knowledge gaps regarding the recommendations. Physicians reported that prompts in the electronic medical record would help clarify the recommendations, and the majority reported not having them in place. The top reported barriers to giving pneumococcal vaccines in series were financial concerns and difficulty determining a patient's pneumococcal vaccination history.

In previous surveys, physicians have reported financial barriers to providing adult vaccines[24,25]—primarily that they are inadequately reimbursed.[26] The specific barriers reported in this study about Medicare not covering the pneumococcal vaccines in series and insurance not paying for pneumococcal vaccines if the appropriate time had not elapsed may be rooted in initial disparities between Medicare policy and the recommendations. ACIP recommended both pneumococcal vaccines to be given in series to adults aged ≥65 years in August 2014, and while the Centers for Medicare and Medicaid Services responded swiftly to change regulations to allow coverage of the series in February 2015, months went by when the recommendations and Medicare policy were not aligned. In addition, even though the ACIP initially recommended different intervals between the 2 pneumococcal vaccines depending on which was given first, Centers for Medicare and Medicaid Services would only pay for both vaccines if a year elapsed between administration of the 2 vaccines, regardless of which vaccine had been given first. ACIP subsequently reevaluated their adult pneumococcal recommendations and in September 2015 recommended a year interval between the vaccines regardless of which vaccine was given first. The main reason for this change was to simplify the recommendation; the evidence supported the

longer interval for immunocompetent adults, but part of the rationale was to coordinate the ACIP recommendations with Medicare payment. Both vaccines are covered under Medicare Part B, and >90% of Medicare beneficiaries have Medicare Part B.[27] That physicians still reported these barriers to giving pneumococcal vaccines in series in 2016 suggests a need to evaluate why physicians perceive this and to investigate how to better communicate policy changes.[28,29]

Physicians also reported private insurance and Medicaid not covering pneumococcal vaccines as barriers to giving these vaccines in series. Most private insurance companies should be covering these vaccines because the Affordable Care Act (ACA) mandates that ACIP-recommended vaccines be covered with no cost-sharing in nongrandfathered insurance plans. The perception that these vaccines are not covered by private insurance may have a couple of explanations. Because pneumococcal vaccine recommendations for high-risk adults younger than 65 and for adults older than 65 are relatively new, there may have been a lag between ACIP making these recommendations and private insurance companies covering them. In addition, some private insurance plans are "grandfathered" and do not have to adhere to the ACA mandate that all ACIP-recommended vaccines be covered; 23% of employer-based insurance met these criteria in 2017.[30] State Medicaid agencies variably cover PPSV23 for adults, and this might partially explain several physicians reporting that Medicaid does not cover these vaccines in series. Medicaid provider reimbursement for adult immunizations in 2012 found that at least 3 state Medicaid agencies did not cover PPSV23[31]; state Medicaid coverage of PCV13 is not published but may presumably be lower given how much more expensive PCV13 is than PPSV23.[32] The ACA did not affect physicians' vaccine purchasing costs, so it is not surprising that physicians found the up-front costs of purchasing pneumococcal vaccines to be a deterrent to giving these vaccines in series.

Aside from financial barriers, the most common barrier was difficulty determining vaccination history; a similar finding to that of a survey of GIMs concerning PPSV23.[33] Giving unnecessary vaccines leads to unwarranted expense and denial of insurance claims; although the risk of severe adverse events from PCV13 and PPSV23 is low, it also exposes patients to potential vaccine-related adverse events. Adults may receive pneumococcal vaccines at various locations, including primary care physicians' and subspecialists' offices and retail pharmacies. Pharmacies in all states have jurisdiction to administer the pneumococcal vaccine to adults.[34] Adults also move around and do not necessarily keep good vaccination records. These factors combine to complicate determining patients' pneumococcal vaccination history. Immunization information systems (IISs) are confidential computerized systems that collect and consolidate vaccination data from multiple vaccine providers; broad use of IISs could partially address this identified barrier.[35,36] Although the National Vaccine Advisory Committee standards and Community Preventive Services Task Force guideline encourage IIS use[37], 72% of FPs and only 27% of GIMs who administer vaccines use them.[38]

While physicians did not generally report confusion about pneumococcal vaccines as a major barrier to giving these vaccines in series, their responses to knowledge questions tell a different story. Physicians were most knowledgeable about the recommendation to give PCV13 first to adults aged ≥65. This is possibly related to age-based recommendations being easier to understand and/or media campaigns specifically targeting seniors. Physicians were less knowledgeable about other adult PCV13 recommendations, and this is possibly attributable to the newness of the recommendations and the complexity of the risk-based recommendations. The confusion about the timing between PCV13 and PPSV23 in adults aged ≥65 may be due to the recommendation changes that occurred in a short time.[11,12] Physicians were least knowledgeable about the recommended interval between PCV13 and PPSV23 for high-risk adults <65 years old, yet they often gave the correct response for adults aged ≥65, suggesting a lack of recognition of the differences in the recommendations for these 2 populations. Knowledge gaps were not limited to the new pneumococcal vaccine recommendations. Physicians were also confused about asthma being a qualifying condition for PPSV23 and the timing between PPSV23 doses for high-risk adults <65 years old, and for adults ≥65 when the first dose of PPSV23 was received before age 65. PPSV23 has been recommended since 2010 for patients with asthma,[6] and the recommended revaccination intervals between doses of PPSV23 have not been changed since 1997.[5]

Another notable issue with the knowledge questions is that large percentages of physicians (11% to 58%) still answered questions incorrectly despite being offered the response option of needing to look the answer up. This may indicate that they feel confident in their incorrect answers and would not use resources that would need to be sought out to guide their decisions.[39] This has implications on optimal vaccine delivery and possibly contributes to the low observed rates for pneumococcal vaccine coverage among adults.[14]

The confusion identified here suggests that having an active clinical decision support system (CDSS) to identify adult patients who need pneumococcal vaccines at a visit, and not relying on physician knowledge, could help implement pneumococcal vaccine recommendations. Electronic health record (EHR) technology makes CDSSs possible. Over 90% of physicians reported using an EHR, but only approximately a third indicated having a computerized way to identify high-risk patients who need either pneumococcal vaccine. However, the majority (81%) indicated that prompts in the EHR would help clarify the recommendations. Because of the challenge of interpreting clinically written ACIP recommendations, current CDSS engine outputs often vary and are inconsistent in accurately reflecting ACIP recommendations.[40] The CDC created and continues to work on CDSS resources that can be integrated into EHRs to capture ACIP recommendations and could prove useful to adult pneumococcal vaccination efforts.[40]

Our study has strengths and limitations. Results were generated from primary care physicians from across the nation, and we achieved an excellent response rate for a physician survey.[41,42] Although our sample was designed to be representative of American College of Physicians and the American Academy of Family Physicians memberships, the attitudes, experiences, and practices of sentinel physicians may not be fully generalizable. Nonrespondents may have held different views than respondents. The survey relied on self-report of practice rather than observation of practice.

The practices reported by primary care physicians with regard to stocking and recommending pneumococcal vaccines suggest a positive outlook for implementation of the ACIP recommendations. However, realizing optimal implementation will require ensuring coverage for these vaccines, making physicians aware of this coverage, and addressing knowledge gaps regarding these recommendations. Our data support harnessing EHR capability to create accurate CDSSs for these complex recommendations that would actively prompt physicians to accurately apply ACIP pneumococcal recommendations, as opposed to looking up information they think they know.

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