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Primary Care Physicians' Perspective on Current Adult Pneumococcal Vaccine Recommendations

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Abstract

Introduction—In 2012, ACIP recommended 13-valent pneumococcal conjugate vaccine (PCV13) in series with 23-valent pneumococcal polysaccharide vaccine (PPSV23) for adults ≥19 at risk, and, in 2014, expanded this recommendation to adults ≥65. Primary care physicians' practice, knowledge, attitudes and beliefs regarding these recommendations are unknown.

Methods—General internists (GIM) and family physicians (FP) throughout the U.S. were surveyed by email and mail from December 2015 to January 2016. Multivariable analysis examined characteristics associated with knowledge of the recommendations (January 2016-September 2016).

Results—Response rate was 66% (617/935). Over 95% reported routinely assessing adults' vaccination status and recommending both vaccines. A majority found the current

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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 in series. Knowledge of recommendations was variable 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. Characteristics associated with greater knowledge included GIM vs. FP specialty (adjusted RR=1.45; 95% CI 1.09–1.88), younger vs. older age (adjusted RR=1.41; 95% CI 1.04–1.88), and perceiving the recommendations to be ‘very clear’ vs. other perceptions (adjusted RR=1.50; 95% CI=1.15–1.96).

Conclusions—Almost all surveyed physicians reported recommending both pneumococcal vaccines, but there appears to be a disconnect between perceived clarity and knowledge of the recommendations. Optimal implementation of these recommendations will require addressing knowledge gaps and reported barriers.

Introduction

In the U.S., *Streptococcus pneumoniae* bacteria cause an estimated 445,000 hospitalizations annually[1] and, in 2014, caused approximately 29,100 cases of invasive pneumococcal disease (IPD) and 3,250 deaths.[2] Adult pneumococcal disease is the major source of pneumococcal disease-related healthcare 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 U.S., the 23-valent pneumococcal polysaccharide vaccine (PPSV23) has been recommended for adults ≥ 65 and adults with high-risk conditions since 1984.[4] These recommendations have been revised,[5–7] expanding indications for the vaccination and introducing revaccination for some high-risk groups and for adults ≥ 65 who received their first dose of PPSV23 before age 65, but PPSV23 remained the only available product for pneumococcal disease prevention among adults through 2011.

In 2011, pneumococcal conjugate vaccine (PCV13) was approved by the FDA for use among adults ≥50.[8] The following year, ACIP recommended PCV13 in a series with PPSV23 for high-risk adults ≥19.[9] In 2014, based on data demonstrating vaccine-preventable disease burden and on results of the CAPITA trial[10] showing efficacy of PCV13 at preventing non-bacteremic pneumonia and invasive pneumococcal disease caused by vaccine serotypes in adults ≥ 65, ACIP expanded recommendations for the use of PCV13 to include recommending PCV13 in series with PPSV23 for all adults ≥65 years.[11] In June 2015, ACIP revised the recommended intervals between PCV13 and PPSV23 for adults ≥ 65 from 6 months to 1 year.[12]

Despite longstanding ACIP recommendations for PPSV23 in adults, recent vaccination coverage among adults ≥ 65 years was 61% and among high-risk adults 19–64 was only 20%,[13] both well below Healthy People 2020 goals. Physician perception of these changes to the adult pneumococcal vaccine recommendations is unknown. Since physician recommendation is so important to patients’ receipt of vaccines,[14–18] we sought to describe

current practice, knowledge, attitudes and beliefs of family physicians (FP) and general internists (GIM) 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 not requiring 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 (GIM) and family physicians (FP) from the memberships of the American College of Physicians (ACP) and the American Academy of Family Physicians (AAFP). We performed quota sampling[20] to ensure that networks of physicians were similar to the ACP and AAFP memberships with respect to region, urban versus rural location, and practice setting. We previously demonstrated that survey responses from network physicians compared to 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 CDC. The survey asked about physician practices regarding assessing need for, recommending, and stocking PCV13 and PPSV23 vaccines and whether physicians referred patients out for either vaccine if the vaccine(s) were not stocked. We used 4-point Likert scales for assessing physician perception 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 asked what type of resources would help clarify the recommendations and whether they had a computerized way to identify adults <65 who needed either pneumococcal vaccine. Physicians were presented a series of case scenarios and asked questions aimed to assess knowledge of specific elements of ACIP adult pneumococcal vaccine recommendations (Appendix Table 1). To encourage them to answer these questions without referring to other sources, ‘I would need to look this up’ was one available response option. A national advisory panel of GIM (n=6) and FP (n=7) pre-tested the survey, which we modified based on their feedback. We pilot-tested the survey among 50 GIM and 23 FP nationally and further modified based on their feedback.

Survey Administration

Based on physician preference, we sent the survey over the Internet[21] or through U.S. mail. We sent the Internet group an initial e-mail with up to 8 e-mail reminders, and we sent the mail group an initial mailing and up to 2 additional reminders. Non-respondents in the

Internet group were also sent up to 2 mail surveys in case of problems with e-mail correspondence. We patterned the mail protocol on Dillman's Tailored Design Method.[22]

Statistical analysis

Analyses were conducted January 2016 through September 2016. We pooled Internet and mail surveys for analyses because other studies have found that physician attitudes are similar when obtained by either method.[14,22,23] We compared respondents with non-respondents on all available characteristics using t-test and Mantel-Haenszel chi-square analyses; characteristics of non-respondents were obtained from the recruitment survey for the sentinel networks. We compared GIM and FP responses using Mantel-Haenszel and Pearson's chi-square tests. Results were very similar for GIM and FP physicians, and, are therefore, presented together with any differences highlighted in the text. After excluding physicians who responded that they were not familiar with the recommendations (n=5), we used chi-square analysis to compare physicians who perceived the recommendations as 'very clear' or 'somewhat clear' versus those who perceived them as 'somewhat unclear' or 'very unclear' in terms what resources they reported would help clarify the recommendations. Multivariable analysis was conducted with the dependent variable being respondents who answered six to eight out of eight knowledge questions (the top quartile of respondents) pertaining to current ACIP adult pneumococcal vaccine recommendations correctly. Independent variables included physician characteristics and practice characteristics and whether the practice had a computer-based way to identify patients <65 who need either PCV13 and/or PPSV23. Characteristics significant at $p \leq 0.25$ in bivariate analyses were tested in multivariable models using backwards elimination resulting in retention of only those factors that were significant at $p<0.05$ in the final model. Risk ratios were calculated because of the tendency of odds ratios to overestimate effect sizes when outcomes are common. Calculation of adjusted risk ratios was conducted using log-binomial models (SAS PROC GENMOD). All analyses were performed using SAS, version 9.4 (SAS Institute, Cary, North Carolina).

Results

Survey response and characteristics of respondents

Response rates were 68% for GIM (324/480) and 64% for FP (293/455). Respondents and non-respondents did not differ significantly by census location (urban, suburban or rural). Among GIM physicians, older physicians and physicians working in private and smaller practices were less likely to respond ($p=<0.01$). Among FP, male physicians and physicians from the South were less likely to respond and physicians from the Midwest were more likely respond ($p\leq0.05$). Characteristics of respondents and non-respondents and further characteristics of respondents' practices and patient populations are shown in Table 1. Of those who responded, 15 (7 GIM and 8 FP) reported they do not give immunizations to adult patients and were excluded from further analysis leaving a final cohort of 602 (317 GIM, 285 FP).

Current Pneumococcal Vaccination Practices

Nearly all respondents reported assessing need for (96%) and recommending (95%) PCV13; 86% reported stocking it. Almost all respondents reported assessing need for (98%) and recommending (97%) PPSV23; 92% reported stocking it. Thirty-one and 38% reported having a computer-based way to identify adults <65 who needed PCV13 or PPSV23, respectively. Of those physicians who reported not stocking PCV13 (n=72) or PPSV23 (n=49), 81% and 72%, correspondingly, 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’ or ‘very’ unclear, and 1% said they weren’t 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’ or ‘very difficult’ to implement the recommendations. Physicians reported 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 on-line 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 2 shows results of a series of case-based questions evaluating respondent knowledge of 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 ≥ 65 and least knowledgeable about the recommended interval between PCV13 and PPSV23 vaccines in patients <65 at high-risk, often providing the correct response for the interval recommended for adults ≥ 65 (54%). 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.

Physician Characteristics Associated with Knowledge of ACIP’s Adult Pneumococcal Vaccine Recommendations

As shown in Table 3, FP specialty and increasing age were significantly associated with lower knowledge scores regarding the recommendations, whereas physician perception of the recommendations as ‘very clear’ was associated with higher knowledge scores. Having an automated, computer-based way to identify patients <65 years who needed PCV13 or PPSV23 was not predictive of higher scores.

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 the recommendations were clear, several knowledge gaps regarding the recommendations were identified. Physicians reported electronic medical prompts 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 reported barriers 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 ≥ 65 in August 2014, and while the Centers for Medicare and Medicaid (CMS) responded swiftly to change regulations to allow series' coverage in February 2015, there were months where the recommendations and Medicare policy were not aligned. Also, even though ACIP initially recommended different intervals between the two pneumococcal vaccines depending on which was given first, CMS would only pay for both vaccines if a year elapsed between the administration of the two vaccines, regardless of which vaccine had been given first. ACIP subsequently re-evaluated 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 because the evidence supported the longer interval for immunocompetent adults, but part of the rationale was to coordinate ACIP recommendations with Medicare payment. Both vaccines are covered under Medicare Part B and over 90% of Medicare beneficiaries have Medicare Part B.[27] The fact that physicians are still reporting 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 being barriers to giving these vaccines in series. Most private insurance companies should be covering these vaccines since the Affordable Care Act mandates that ACIP recommended vaccines be covered with no cost-share in non-grandfathered insurance plans. The perception that these vaccines are not covered by private insurance may have a couple of explanations. Since pneumococcal vaccine recommendations for high-risk adults under 65 and for adults ≥ 65 are relatively new, there may have been a lag between ACIP making these recommendations and private insurance companies covering them. Also, some private insurance plans are "grand-fathered" and do not have to adhere to the Affordable Care Act (ACA) mandate that all ACIP recommended vaccines be covered; 23% of employer-based insurance met this criteria in 2016.[30] State Medicaid agencies cover PPSV23 variably 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[31] found that at least three state Medicaid agencies did not cover the PPSV23; state Medicaid coverage of PCV13 is not published, but may be presumably lower given how much more expensive PCV13 is compared to PPSV23.[32] The ACA did not affect

physicians' vaccine purchasing costs so unsurprisingly physicians found 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 a general internist's survey concerning PPSV23.[33] Giving unnecessary vaccines leads to unwarranted expense, denial of insurance claims, and, 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 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 and 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 family physicians, but only 27% of general internists are using them.[38]

While physicians did not generally report ignorance about pneumococcal vaccines was 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 ≥ 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 complexity of the risk-based recommendations. The confusion about the timing between PCV13 and PPSV23 in adults ≥ 65 may be due to the recommendation changes that occurred in a brief interval[11,12] Physicians were least knowledgeable about the recommended interval between PCV13 and PPSV23 for high-risk adults <65, yet often gave the correct response for adults ≥ 65, suggesting a lack of recognition of the differences in the recommendations for these two 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 <65 and for adults ≥ 65 when the first dose of PPSV23 was received before age 65. PPSV23 has been recommended for patients with asthma since 2010[7] and the recommended revaccination intervals between doses of PPSV23 have not been changed since 1997.[6]

Another notable issue with the knowledge questions is that large percentages of physicians (11–58%) still answered questions incorrectly despite being offered the response option of needing to look the answer up. This may indicate 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 adult coverage rates for pneumococcal vaccines that have been observed.[13] Family physicians and older physicians were less knowledgeable about the recommendations. Family physicians may tend to see younger patients than general internists[40] (Table 1) and

fewer patients with chronic medical conditions[40] which might explain these findings. Since there have been several pneumococcal vaccine recommendation iterations, older physicians may be more familiar with earlier versions.

The confusion identified suggests having an active clinical decision support system (CDSS) to identify adult patients needing pneumococcal vaccines at a visit, and not relying on physician knowledge, could help pneumococcal vaccine recommendation implementation. Electronic Health Record (EHR) technology makes CDSSs possible. Over ninety percent of physicians reported using an EHR, but only approximately a third indicated having a computerized way to identify high-risk patients needing either pneumococcal vaccines. However, the majority (81%) indicated electronic medical prompts would help clarify the recommendations. Due to the challenge of interpreting clinically-written ACIP recommendations, current CDSS engine outputs often vary and are inconsistent in accurately reflecting ACIP recommendations.[41] The CDC created and continues to work on CDSS resources that can be integrated into EHRs that capture ACIP recommendations and could prove useful to adult pneumococcal vaccination efforts.[41]

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.[42,43] Although our sample was designed to be representative of ACP and AAFP memberships, the attitudes, experiences, and practices of sentinel physicians may not be fully generalizable. Non-respondents may have held different views than respondents. The survey relied on self-report of practice rather than observation of practice.

Primary care physicians' reported stocking and recommending pneumococcal vaccine practices suggest a positive outlook for implementation of ACIP recommendations. However, realizing optimal implementation will require ensuring coverage for these vaccines, physician awareness 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.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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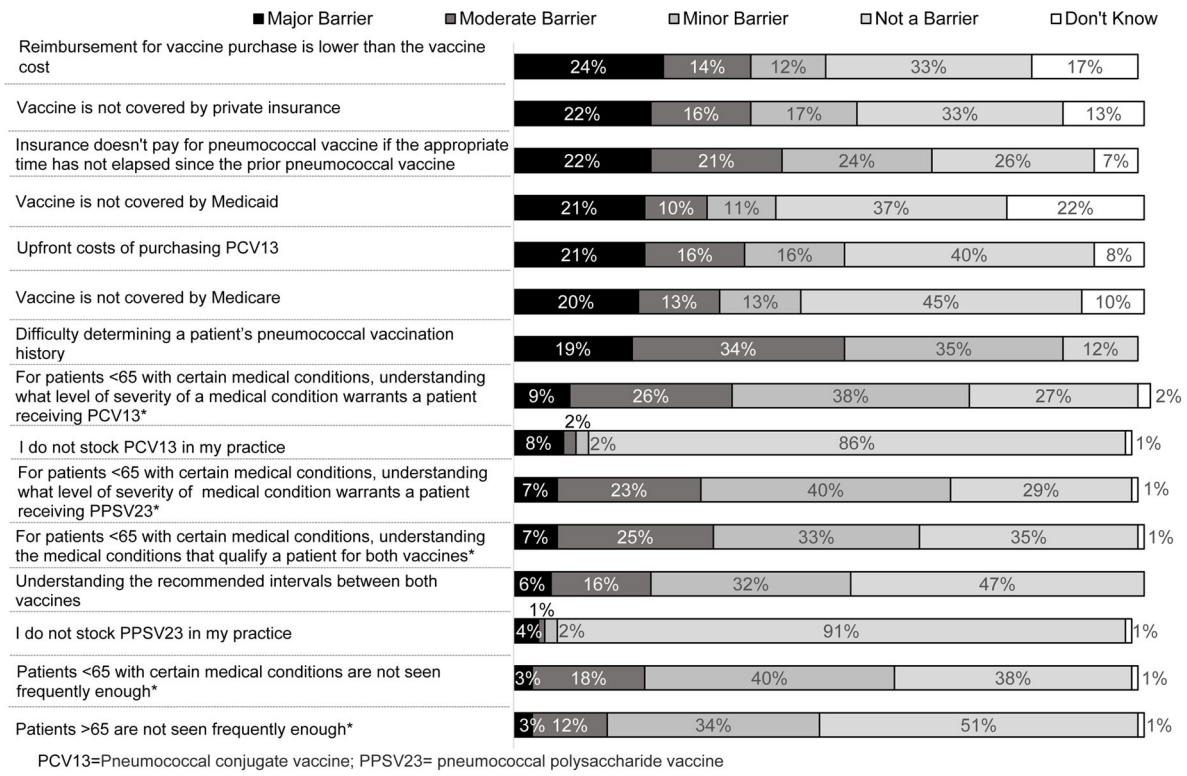

Figure 1. Barriers to Following ACIP Recommendations for giving PCV13 and PPSV23 in series

*FP significantly more likely than GIM to report this barrier, $p<0.05$

Table 1

Respondent and Non-Respondent Characteristics

Characteristic	GIM		FP	
	Respondents(n=324)	Non-Respondents (n=156)	Respondents (n=293)	Non-Respondents (n=162)
Age in years, mean (SD) †	52.9 (9.2)	55.8 (8.2)	54.3 (7.8)	54.8 (8.3)
Male, % *	56	62	52	64
Region, % *				
Midwest	22	21	32	22
Northeast	24	24	12	16
South	30	37	33	43
West	24	18	23	19
Location of Practice, %				
Urban	56	53	37	37
Suburban	43	46	54	54
Rural	1	2	9	9
Setting, % †				
Private practice	75	87	68	71
Hospital/clinic	21	11	23	18
HMO	4	2	9	11
# of providers in your practice, % †				
1	13	25	12	13
2–4	25	24	26	31
5–10	28	27	37	34
≥10	34	25	26	22
Physicians providing vaccines to adults, %	98	N/A	97	N/A
Practice uses an EMR/EHR, %	94	N/A	93	N/A
Proportion of patients ≥ 65,%				
<10%	3	N/A	7	N/A
10–24%	10	N/A	25	N/A
25–49%	34	N/A	44	N/A

Characteristic	GIM		FP	
	Respondents(n=324)	Non-Respondents (n=156)	Respondents (n=293)	Non-Respondents (n=162)
≥50%	53	N/A	23	N/A
Practice accepts Medicare, %	94	N/A	96	N/A
Practice accepts Medicaid, %	64	N/A	80	N/A

* p<0.05 for comparison of respondents and non-respondents within FP

† p<0.05 for comparison of respondents and non-respondents within GIM

Table 2

Physician Knowledge of Adult Pneumococcal Vaccine Recommendation (n=588)

Knowledge Concept	Correct (%)	Incorrect (%)	Would need to look this up(%)
Which pneumococcal vaccine should be given first to adults ≥65	83	14	3
Qualifying conditions for PCV13 for patient <65 (HIV)	75	11	14
Interval between PCV13 and PPSV23 in immunocompetent adults ≥ 65	65	29	6
Interval two PPSV23 doses when received < 65 and patient now ≥ 65	64	25	11
Which pneumococcal vaccine should be given first to <65 with qualifying condition (Nephrotic syndrome) *	54	30	16
Qualifying condition for PPSV23 <65 (Asthma)	47	42	11
Interval between two PPSV23 doses in patient with qualifying condition (Splenectomy) <65 *	46	40	15
Interval between PCV13 and PPSV23 in patients < 65 with qualifying condition (Cochlear implant)	22	58	20

* GIM significantly more likely to answer correctly than FP, p≤0.05.

Some percentages do not add up to 100% due to rounding.

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Table 3

Characteristics Associated with Knowledge of Adult Pneumococcal Vaccine Recommendations (n=588)

Variable	Answered 0–5 correctly Row % (n) n=424 (72%)	Answered 6–8 correctly Row % (n) n=164 (28%)	Bivariate RR* (95% CI)	Bivariate p value	Multivariable RR* (95% CI)
Specialty					
FP	78 (217)	22 (61)	0.66 (0.50–0.87)		0.69 (0.53–0.91)
GIM	67 (207)	33 (103)	Ref.	0.002	Ref.
Gender					
Male	75 (240)	25 (79)	Ref.		
Female	68 (184)	32 (85)	1.28 (0.98–1.65)	0.07	
Age group					
Less than 50	64 (130)	36 (74)	Ref.		Ref.
50–59	76 (158)	24 (51)	0.67 (0.50–0.91)		0.71 (0.53–0.96)
60 or more	77 (133)	23 (39)	0.63 (0.45–0.87)	0.005	0.65 (0.47–0.90)
Setting					
Private practice	72 (301)	28 (117)	Ref.		
Hospital or clinic	70 (93)	30 (39)	1.06 (0.78–1.43)		
HMO	79 (30)	21 (8)	0.75 (0.40–1.42)	0.57	
Census Location					
Urban	69 (193)	31 (85)	1.21 (0.93–1.59)		
Suburban	75 (211)	25 (71)	Ref.		
Rural	71 (20)	29 (8)	1.13 (0.61–2.11)	0.36	
Region					
Midwest	74 (121)	26 (42)	0.81 (0.58–1.13)		
Northeast	72 (76)	28 (30)	0.89 (0.61–1.29)		
South	68 (124)	32 (58)	Ref.		
West	75 (103)	25 (34)	0.78 (0.54–1.12)	0.49	

Variable	Answered 0–5 correctly Row % (n) n=424 (72%)	Answered 6–8 correctly Row % (n) n=164 (28%)	Bivariate RR* (95% CI)	Bivariate p value	Multivariable RR* (95% CI)
Current ACIP recommendations for pneumococcal vaccinations for adults are Very Clear					
Yes	65 (188)	35 (100)	1.57 (1.20–2.06)		1.50 (1.15–1.96)
No	78 (226)	22 (64)	Ref.	0.0007	Ref.
Automated, computer-based way to identify adults <65 who need PCV13 based on their medical conditions					
Yes	77 (138)	23 (42)	0.76 (0.56–1.03)		
No	69 (277)	31 (122)	Ref.	0.07	
Automated, computer-based way to identify adults <65 who need PPSV23 based on their medical conditions					
Yes	74 (165)	26 (57)	0.86 (0.65–1.13)		
No	70 (250)	30 (107)	Ref.	0.26	

*RR=risk ratio