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Physicians' Use of Evidence-Based Strategies to Increase Adult Vaccination Uptake

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Abstract

Introduction: The objectives were to assess among primary care physicians 1) use of evidence-based strategies to improve adult vaccination rates 2) the number of strategies employed simultaneously and characteristics associated with assessing adult vaccinations at each visit.

Methods: Internet and mail survey between December 2015 and January 2016 of primary care physicians designed to be representative of the American College of Physician's and American Academy of Family Physician's memberships.

Results: Response rate was 66% (617/935); 94% reported using electronic health records. Standing orders (84%), and electronic provider reminders at a visit (61%) were the most common strategies reported for influenza vaccine. Electronic provider reminders at a visit (53%) and recording a vaccination in an immunization registry (32%) were the most common strategies reported for all non-influenza vaccines. Most physicians reported using ≥ 2 strategies although this was more common for influenza (74%) than non-influenza (62%) vaccines. In multivariable analysis, physicians who reported assessing adult vaccinations at every patient visit were more likely to work in practices where decisions about purchasing and handling vaccines were made at a

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larger system level [Relative Risk (RR) 1.20, 95% Confidence Interval (CI) 1.04–1.40], and report using electronic provider reminders [RR 1.38, 95% CI 1.15–1.69] and standing orders [RR 1.45, 95% CI 1.21–1.75] for all non-influenza adult vaccines.

Conclusions: Several strategies are being used, particularly for influenza vaccine. Investing in implementing standing orders and electronic clinical decision support for all routine adult vaccinations could support assessment of adult vaccinations at each visit and potentially improve adult vaccination rates.

Introduction

Many adults in the U.S. do not receive routinely recommended vaccinations. To give two examples, as of 2017, the U.S was falling well short of meeting Healthy People 2020 goals of vaccinating 70% of adults annually against seasonal influenza and 90% of adults ≥ 65 years against pneumococcal disease with only 45% and 69% of adults receiving these vaccines, respectively.[1,2] The Centers for Disease Control and Prevention (CDC) and Immunization Action Coalition believe broader implementation of evidence-based strategies to improve vaccination rates might address this problem[2,3] and could act synergistically with the current standards for adult immunization[3] calling for every provider who sees adult patients to assess, recommend, and administer or refer for needed vaccines at every visit, to increase rates of vaccination.

Several evidence-based strategies are recommended by the US Community Preventive Services Task Force.[4] Five examples include 1) client reminder/recall (R/R), 2) assessment and feedback where vaccine providers are given information about their performance delivering a vaccine or vaccines to a patient population, 3) provider reminders to deliver vaccines at the time of a visit, 4) use of immunization information systems (IIS) and 5) standing orders[4] to permit non-physician staff to prescribe and administer vaccinations. IIS are confidential, population-based, computerized databases that record all immunization doses administered by participating vaccine providers to persons residing within a given geopolitical area.[5]

Little is known about provider use of these strategies in adult care. Previous studies, primarily focusing on one strategy at a time, have indicated that client reminder/recall,[6] standing orders[7,8] and IIS[9,10] are underutilized. No prior studies have quantified the use of evidence-based strategies to improve vaccinations more comprehensively both in terms of breadth of strategies utilized and vaccinations targeted.

The objectives in this study were to assess among primary care physicians, including general internists (GIM) and family physicians (FP): 1) use of evidence-based strategies to improve adult vaccination rates; 2) the number of strategies being employed simultaneously; and 3) characteristics associated with assessing adult vaccination status at each visit, which is one of the proposed standards for adult immunization for all healthcare professionals.[3]

Methods

Study Population

The Vaccine Policy Collaborative Initiative, a survey entity to assess physician practice and attitudes about vaccines and vaccine policy, in collaboration with the CDC, designed and conducted the survey among physician networks intended to be representative of the American College of Physicians and the American Academy of Family Physician memberships.[11–12] These physician networks are similar to physicians randomly sampled from the American Medical Association Masterfile with respect to demographics and attitudes regarding vaccines.[11] Census location for each physician is determined based on self-reported zip code that is then matched with most recent Census location results. The human subjects review board at the University of Colorado Anschutz Medical Campus approved this study as exempt research.

Study Design

The survey assessed use of the following five evidence-based strategies: 1) client reminder/recall, 2) standing orders, 3) assessment and feedback, 4) use of an IIS to assess and/or record vaccinations, and 5) provider reminders in the form of electronic clinical decision support. Physicians were asked about evidence-based strategies used for influenza and non-influenza vaccinations separately as there may be different approaches for an annually recommended vaccine vs. other routinely recommended vaccines. The response options for whether a strategy was being used for influenza vaccination were ‘yes’ or ‘no,’ whereas for the other routine vaccinations the response options were ‘yes for all,’ ‘yes for some,’ or ‘No.’ The survey was pretested by a physician advisory board and piloted among a national sample of primary care physicians.

Survey Administration

Based on physician preference, the survey was sent over the Internet or through U.S. mail. The Internet group was sent an initial E-mail with up to 8 E-mail reminders, and the post group was sent 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. The mail protocol was patterned on Dillman’s Tailored Design Method.[13] The survey was administered from December 2015 to January 2016.

Statistical analysis

Analyses were conducted April through October 2019. Results were similar by specialty so are presented together. Respondents and nonrespondents were compared on all available characteristics using t-tests, chi-squared tests, and Wilcoxon tests, as appropriate. In quantifying the number of evidence-based strategies a physician used, it was counted as one strategy if a physician reminded all patients or just high-risk groups to be vaccinated, if a physician received lists of all patients needing a vaccine or just high-risk groups, and if they used an IIS to assess or to document vaccination information. A multivariable regression was conducted where the dependent variable was assessing vaccination status at every visit, including acute care. Independent variables included physician age and gender, practice

specialty, number of providers in practice, practice location (urban/rural) and setting, region, decision-making capacity regarding the purchasing and handling of vaccines, and reported use of evidence-based strategies to improve non-influenza routinely recommended adult vaccines.

Respondents were excluded from the multivariable model who did not answer the outcome variable question, reported not using an electronic health record (EHR) and answered fewer than six of the eight questions that were asked about using evidence-based methods. Because the outcome was common, log-binomial (SAS PROC GENMOD) was used to generate risk ratios instead of odds ratios because odds ratios overestimate effect size for common outcomes. A cutoff of $P < 0.25$ was used in bivariate analysis for including variables in the model. A backward elimination procedure was used in which the least significant predictor in the model was eliminated sequentially. At each step, estimates were checked to make sure other variables were not affected by dropping the least significant variable. The final model retained only variables that that were significant at $P < 0.05$. All analyses were performed using SAS, version 9.4 (SAS Institute, Cary, North Carolina).

Results

The overall response rate was 66% (617/935); 64% (293/455) for FP and 68% (324/480) for GIM. Characteristics of respondents and non-respondents are shown in Table 1. Respondents and non-respondents did not differ 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. This data are very similar to national estimates of practice setting for primary care physicians[14]. Fifteen respondents reported not administering adult vaccinations and were excluded from further analysis, leaving a final cohort of 602.

Standing orders and provider reminders at the time of the visit in the form of electronic clinical decision support were the most common strategies reported for seasonal influenza vaccination (Table 2). Use of an electronic clinical decision support system and recording vaccinations in an IIS were the most common strategies reported for all non-influenza vaccinations. More physicians reported using reminder/recall and standing orders for influenza than for non-influenza routinely recommended vaccines. Five percent of physicians reported not using any strategies to increase rates for both routinely administered influenza and non-influenza vaccinations combined (data not shown).

Seventy-four percent and 62% of respondents reported employing ≥ 2 strategies to increase influenza and non-influenza vaccination rates, respectively (Figure 1). Almost 20% of respondents reported using 4 or more strategies for both influenza and non-influenza vaccinations.

The results of the multivariable analysis are presented in Table 3. Seventy-four respondents were not included in the model as they did not meet pre-specified criteria. Physicians who reported assessing adult vaccination status at each visit were more likely to work in practices where decisions about purchasing and handling vaccines were made at a larger system

level [Relative Risk (RR) 1.20, 95% Confidence Interval (CI) 1.04–1.40], and report using electronic clinical decision support [RR 1.38, 95% CI 1.15–1.69] and standing orders [RR 1.45, 95% CI 1.21–1.75] for all non-influenza adult vaccines.

Discussion

This is one of few studies to assess physician use of evidence-based strategies to improve adult vaccination, including influenza and other adult vaccines. The vast majority of physicians reported using standing orders to help deliver influenza vaccine to their adult patients. Slightly more than half reported using electronic provider reminders at the time of the visit for influenza and all other routinely recommended adult vaccines. The majority of physicians reported using at least two strategies to aid adult vaccination efforts, but many reported not using certain evidence-based strategies, including IIS.

Few prior studies have reported physician use of evidence-based strategies to improve adult vaccination. A national survey of primary care physicians sampled from the AMA Masterfile and conducted in 2009 found 23% used standing orders for both influenza and pneumococcal vaccine and 20% used them for influenza vaccine only; use of standing orders for other routinely recommended vaccines was not assessed.[7] In this study, 84% of respondents reported using standing orders for influenza, quadruple what was previously observed. A notable difference between this study and that of Albert and colleagues is that the latter study investigated consistency of using standing orders and credited physicians only for using standing orders if they were used consistently. This present study investigated whether standing orders were used and therefore likely obtained a less conservative estimate of standing order use. Standing order use for the non-influenza vaccines was not as extensive as for influenza vaccine in this study, with 57% using standing orders for some or all non-influenza vaccines, possibly because many non-influenza vaccine recommendations for adults are risk-based (e.g., hepatitis B vaccine and pneumococcal for adults age 19–64 years) or have different preferred venues of vaccination (medical home vs. the pharmacy) based on insurance coverage (zoster vaccine being covered by Medicare Part D for Medicare beneficiaries) making it more difficult to implement a standing order.

This study showed similarly low rates of IIS use for assessing and recording adult vaccination information compared to a survey focused on IIS use among pediatricians, family physicians and general internists using the same methodology.[10] It also expands on earlier literature because questions were asked about types of vaccines for which the IIS is used. There were no differences in use of IIS for influenza and non-influenza vaccines despite an IIS being a potential useful tool to identify vaccines delivered outside the medical home, as often occurs for influenza vaccine,[15] since many EHRs are not yet linked to IIS.

Very few physicians reported using client reminder/recall systems either for all patients or for high-risk patients, but approximately twice the number of physicians reported using these systems for influenza than for non-influenza vaccines. Previous work has demonstrated client reminder/recall has been underused for pediatric patients (16% of pediatricians reported using)[16] and adolescents (24% of pediatricians 18% of family physicians reported using)[17] in national studies; use of client reminder/recall among general

internists has not been previously documented. There were no data to compare this study's data to regarding the use of assessment and feedback and electronic provider reminders for adult vaccination.

Most physicians in in this study were using at least two strategies and nearly 20% were using four or more suggesting that despite low national rates, there is substantial effort going into vaccinating adults. Most of the evidence demonstrating efficacy of these strategies is now decades old and the healthcare landscape has changed dramatically with the wide adoption of electronic health records (EHRs). In 2012, recognizing the importance of provider's recommendation and offer of vaccine at the same visit[18,19] and wanting to provide a pathway for improving adult vaccination rates, the National Vaccine Advisory Committee published Standards for Adult Immunization Practice.[3] One of the recommended standards is to incorporate immunization needs assessment into every clinical encounter.[3] The multivariable analysis offers a window into what strategies might be most useful to adhere to this standard. Using standing orders and electronic clinical decision support were both associated with checking adult vaccination status at each visit. Prior work has demonstrated the impact of provider reminders (a proxy for electronic clinical decision support), in that they alone can independently increase vaccinations for influenza, PPSV23 and hepatitis B in high-risk adults, whereas other strategies must be combined to improve vaccination rates.[20] Similarly, electronic health record prompts specifically have been shown to improve HPV vaccination in adolescents and young adults[21] and hepatitis B vaccination initiation and completion in diabetic patients 19 to 59 years.[22] Physicians from systems where decisions about purchasing and handling vaccines are made at a larger system level may have been more likely to assess vaccinations at each visit because these systems may use robust EHRs with technical capabilities to develop the programming required to build standing orders and provider alerts into electronic medical records to support adult vaccination efforts. This practice may also reflect greater motivation within these systems to seek payments by insurance companies for improving quality metrics.

This study has both strengths and limitations. The survey methodology results in nationally representative samples of primary care physicians who care for adults in the United States and the response rate was high. Males, older physicians and physicians from smaller, private practices where decisions are made independently or practicing in the South are somewhat underrepresented in these findings. Also, these data represent reported and not observed practice. In some cases, practices might use strategies that physicians within the practice are not aware of and thus some strategies could be under-reported. It is not known whether physicians who have electronic reminders for vaccinations in the EHR act on them. Also, this study did not measure immunization rates and therefore cannot link use of these strategies to better vaccination coverage.

Conclusion

Primary care physicians are using evidence-based strategies to deliver adult vaccines. However, to improve low adult vaccination rates and better adhere to the standards for adult immunization, they may need to prioritize capturing the capabilities of their EHRs to build standing orders and electronic clinic decision support, not just for influenza, but

all non-influenza routine adult vaccinations. It would be particularly advantageous if these efforts could occur in parallel with broader bidirectional information exchange between electronic medical records and IIS so vaccination history necessary for building standing orders and electronic clinical decision support would be more complete.

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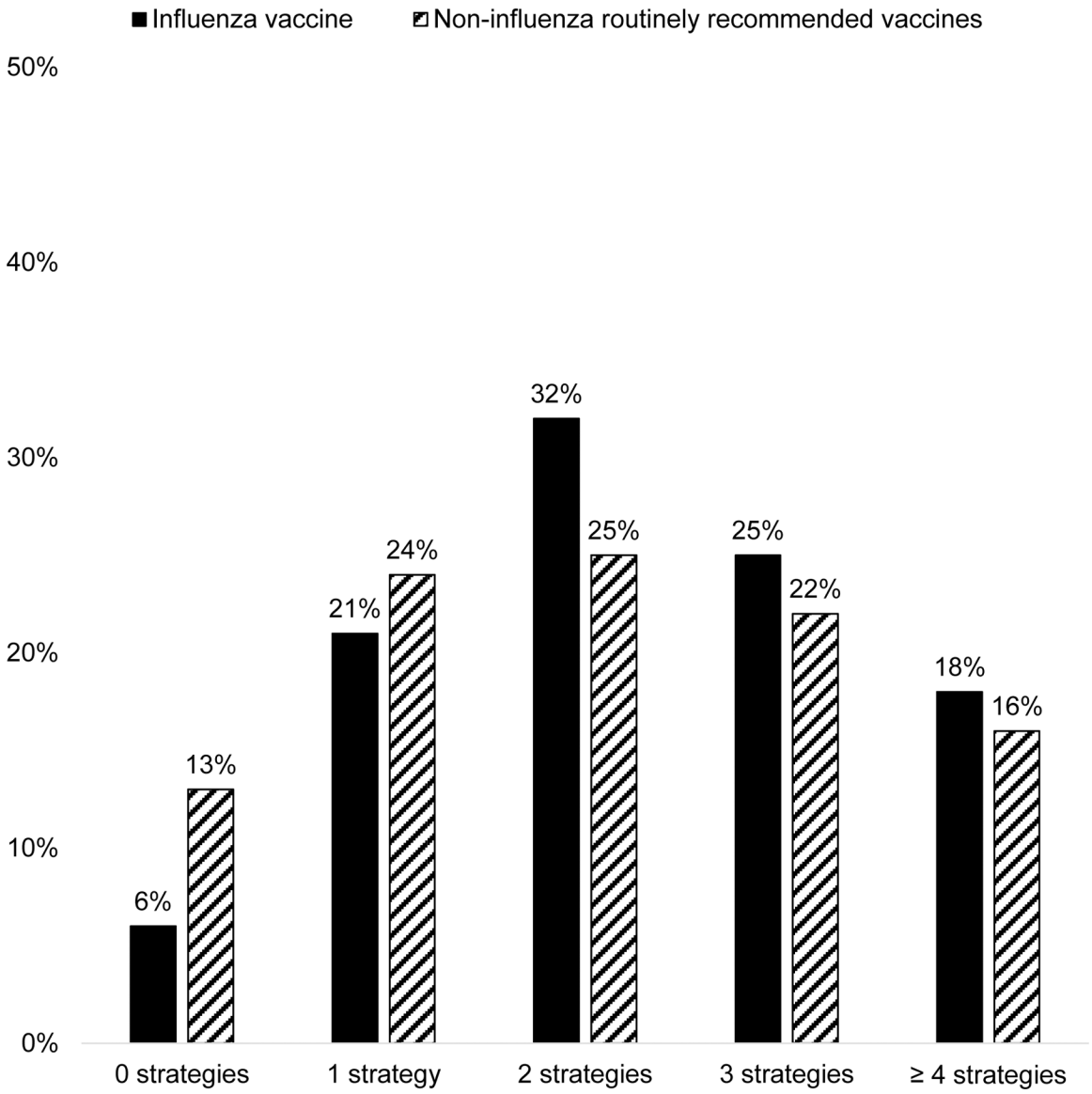

Figure 1:

Reported number of strategies[a] used to improve influenza and non-influenza adult vaccine rates, United States, 2016 n=602[b]

[a]Strategies included client reminder/recall, standing orders, assessment and feedback, use of an IIS to assess and/or record vaccinations, and provider reminders

[b] Percentages may not add to 100% due to rounding

Table 1.

Demographic and practice characteristics of survey respondents, United States, 2016

Characteristic	Respondents (n=617)	Non-Respondents (n=318)	P-Value
Mean (sd [a]) age of provider in years	53.5 (8.6)	55.3 (8.3)	**0.003** [b]
Male, %	54	63	**0.01** [b]
Specialty			
FP[c]	47	51	0.32
GIM[d]	53	49	
Region, % [e]			
Midwest	27	22	**0.03** [b]
Northeast	18	20	
South	31	40	
West	23	19	
Location of Practice, % [e]			
Urban	47	45	0.68
Suburban	48	50	
Rural	5	6	
Practice Setting, % [e]			
Private practice	71	79	**0.02** [b]
Hospital/clinic	22	14	
HMO[f]	6	7	
Median (IQR [g]) number of providers in your practice	6 (3–12)	5 (2–10)	**0.002**[b,h]
Decisions are made about purchasing and handling vaccines, %			
Independently	55	63	**0.02** [b]
At a larger system level	45	37	
Physicians providing vaccines to adults, %	98	N/A	
When do you or when does someone in your practice usually assess an adult patient's vaccination status?			
Initial visit	90	N/A	
Annual visit	95		
Every visit	56		
Practice uses an EMR/EHR [i], %	94	N/A	

[a] sd= standard deviation

[b] Bold values indicate statistical significance p<0.05 between respondents and non-respondents

[c] FP= Family physicians

[d] GIM= General internists

[e] Percentages may not add to 100% due to rounding

[f] HMO= Health maintenance organization

[g] IQR= Interquartile range

[h] Wilcoxon test used

[i] EMR/EHR= Electronic medical record/Electronic health record

Table 2.

Physician Reported Use of Strategies to Improve Adult Vaccination, United States 2016, n=602

Evidence-based Strategy				
Strategies to Increase Patient Demand for Vaccine	**Influenza Vaccine (%)**	**All non-influenza routinely recommended adult vaccines (%)**	**Some of the non-influenza routinely recommended adult vaccines (%)**	**None of the non-influenza routinely recommended adult vaccines (%)**
Written, telephone, or email vaccination reminders are sent to all adult patients in the practice who are due for vaccine(s)[a]	23	9	11	80
Written, telephone, or email vaccination reminders are sent to sub-groups of high risk adult patients in the practice who are due for vaccine(s)[a]	23	10	13	77
Strategies Directed at the Provider or Healthcare System				
Standing orders (i.e., non-physician staff use a protocol to prescribe and deliver vaccinations to Patients)	84	16	41	43
Physicians are provided a list showing them when all of their adult patients are due or overdue for vaccination(s)[b]	16	12	8	80
Physicians are provided a list showing them when sub-groups of high-risk adult patients in the practice are due for vaccination(s)[b]	16	10	9	81
A state or regional Immunization Information System (IIS) is used to assess an adult patient's vaccination status	26	25	8	67
A state or regional IIS is used to record vaccination(s) an adult patient receives in your practice	32	32	3	64
An electronic clinical decision support system is used to help determine if an adult patient needs a vaccine(s) at the time of the visit[c]	61	53	12	36

[a] Client reminder/recall

[b] Assessment and feedback

[c] Provider reminder

Table 3.

Characteristics of Physicians Who Reported Assessing Adult Vaccination Status at Each Visit (n=528)

		Assess Adult Vaccination Status at Every Visit		Bivariate	RR[a] (95% CI[b])
Variable	**Category**	**No (N=230)**	**Yes (N=298)**	**P-value**	
Mean (sd[c]) age of provider in years		53.2 (9.0)	53.0 (8.3)	0.79	
Gender	Female	45% (103)	48% (144)	0.42	
	Male	55% (127)	52% (154)		
Practice Specialty	FP[d]	48% (111)	45% (134)	0.45	
	GIM[e]	52% (119)	55% (164)		
Practice Setting	Univ/Hosp/Public/Other	17% (38)	26% (77)	**0.002**[f]	
	HMO[g]	4% (10)	9% (26)		
	Private practice	79% (182)	65% (195)		
Census location	Rural	6% (13)	4% (13)	0.15	
	Urban-Non-Inner City	52% (120)	45% (134)		
	Urban-Inner City	42% (97)	51% (151)		
Region	Midwest	26% (59)	29% (86)	0.23	
	Northeast	18% (41)	18% (53)		
	South	36% (83)	28% (84)		
	West	20% (47)	25% (75)		
Median (IQR[h]) # of providers in your practice		6.0 (3.0–12.5)	7.0 (4.0–15.0)	**0.009**[f,i]	
Decisions are made about purchasing and handling vaccines	Independently	60% (136)	46% (135)	**0.001**[f]	Ref.
	At a larger system level	40% (92)	54% (161)		1.20 (1.04–1.40)
A state or regional Immunization Information System (IIS) is used to assess an adult patient's vaccination status	Yes for all non-influenza adult vaccines	24% (55)	28% (81)	0.26	
	Yes for some non-influenza adult vaccines	10% (23)	7% (19)		
	No	65% (148)	66% (191)		

		Assess Adult Vaccination Status at Every Visit		Bivariate	RR[a] (95% CI[b])
Variable	**Category**	**No (N=230)**	**Yes (N=298)**	**P-value**	
A state or regional IIS is used to record vaccination(s) an adult patient receives in your practice	Yes for all non-influenza adult vaccines	33% (72)	34% (101)	0.39	
	Yes for some non-influenza adult vaccines	5% (11)	3% (8)		
	No	62% (137)	63% (187)		
An electronic clinical decision support system is used to help determine if an adult patient needs a vaccine(s) at the time of the visit	Yes for all non-influenza adult vaccines	45% (100)	64% (189)	**<0.001** [f]	1.38 (1.15–1.69)
	Yes for some non-influenza adult vaccines	14% (31)	12% (34)		1.09 (0.80–1.43)
	No	42% (93)	24% (71)		Ref.
Written, telephone, or email vaccination reminders are sent to all adult patients in the practice who are due for vaccine(s)	Yes for all non-influenza adult vaccines	4% (8)	14% (40)	**<0.001** [f]	
	Yes for some non-influenza adult vaccines	10% (22)	12% (36)		
	No	87% (198)	74% (218)		
Written, telephone, or email vaccination reminders are sent to sub-groups of high risk adult patients in the practice who are due for vaccine(s)	Yes for all non-influenza adult vaccines	6% (14)	14% (39)	**0.017** [f]	
	Yes for some non-influenza adult vaccines	13% (29)	15% (43)		
	No	81% (183)	72% (210)		
Physicians are provided a list showing them when all of their adult patients are due or overdue for vaccination(s)	Yes for all non-influenza adult vaccines	6% (13)	16% (47)	**<0.001** [f]	
	Yes for some non-influenza adult vaccines	7% (17)	9% (25)		
	No	87% (197)	75% (218)		
Physicians are provided a list showing them when sub-groups of high-risk adult patients in the practice are due for vaccination(s)	Yes for all non-influenza adult vaccines	5% (11)	14% (41)	**0.002** [f]	
	Yes for some non-influenza adult vaccines	9% (21)	10% (29)		
	No	86% (196)	76% (221)		
Standing orders (i.e., non-physician staff use a protocol to prescribe and deliver vaccinations to patients)	Yes for all non-influenza adult vaccines	10% (24)	22% (65)	**<0.001** [f]	1.45 (1.21–1.75)
	Yes for some non-influenza adult vaccines	39% (90)	43% (126)		1.19 (1.00–1.42)
	No	50% (115)	35% (104)		Ref.

[a]RR= relative risk from multivariable regression model

[b]CI= confidence interval

[c]sd= standard deviation

[d]FP= family physicians

[e]GIM= general internists

[f]Bold values indicate statistical significance ($p<0.05$)

[g]HMO= Health maintenance organization

[h]IQR= interquartile range

[i]Wilcoxon test used