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RESEARCH

Impact of the RxVaccinate program for pharmacy-based pneumococcal immunization: A cluster-randomized controlled trial

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ABSTRACT

Objectives: To evaluate the impact of the RxVaccinate program on the structure, process, and outcome measures and to assess team leaders' perceptions of the program.
Design: Cluster-randomized experimental design.
Setting: Community pharmacies.
Participants: Community pharmacists.
Interventions: The RxVaccinate program consisted of (a) two self-directed training webinars and practice development and implementation tools and (b) expert and peer coaching sessions through an in-person 4-hour workshop and optional e-community and monthly teleconferences. One group received only the self-directed training (self-directed learning group), and the other group received both self-directed training and coaching sessions (coaching group).
Main outcome measures: Both groups provided data on (a) completion of structure and process indicators at 3, 6, and 9 months after the in-person workshop, (b) number of pneumococcal vaccinations administered in pharmacy during the 12-month period preceding and following the in-person coaching workshop, and (c) team leaders' perceptions of the RxVaccinate program.
Results: Greater proportions of pharmacies in the coaching group completed structure and process indicators than pharmacies in the self-directed learning group. Both groups showed an increase in the number of pneumococcal vaccinations administered ($P < 0.001$). The increase was significantly greater among pharmacies in the coaching group than among pharmacies in the self-directed training ($P = 0.032$). Team leaders in both groups were generally satisfied with the RxVaccinate program.
Conclusion: Although significant increases in the number of pharmacist-administered pneumococcal vaccinations were observed in both groups, the increase was greater in the group receiving both self-directed training and expert and peer coaching than the group without the coaching strategy. This could be because pharmacies in the coaching group were more likely to complete structure and process indicators than their counterparts. Future studies should examine key structure and process indicators affecting the success of pneumococcal vaccinations.

Pneumococcal disease is a leading cause of death in the United States.[1] Pneumococcal disease is caused by *Streptococcus pneumoniae*, a common type of bacteria also known as pneumococcus.[2] Pneumococcal pneumonia is the most common form of pneumococcal disease in adults; it is estimated that there are 900,000 annual cases of pneumococcal pneumonia and as many as 175,000 hospitalizations each year.[2] Of those, 5%–7% died, and the mortality rate is estimated to be even higher in adults aged 65 years and older.[3] Further, in

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Key Points

Background:

- Despite the generally wide availability of pneumococcal vaccines, the pneumococcal immunization rate for adults remains below Healthy People 2020 targets.
- Increasing the level of pharmacy-based pneumococcal immunization activities can be an important way to promote patients' health.
- The RxVaccinate program was designed to provide pharmacists with the knowledge, skills, and practice implementation tools to work with patients and establish collaborative agreements with prescribers via two training strategies: self-directed learning and coaching.

Findings:

- The RxVaccinate program was effective in increasing the number of pneumococcal vaccine doses among participating pharmacies.
- Increases in vaccine doses were greater among pharmacies that received coaching guidance in addition to the self-directed training.

2013, an estimated 13,500 cases of invasive pneumococcal disease (IPD) occurred among adults aged 65 years and older.[4] Before September 2014, the Advisory Committee on Immunization Practices (ACIP) recommended a single dose of pneumococcal polysaccharide (PPSV23) for high-risk adults younger than 65 years and another single dose for all adults 65 years or older, which offers protection against IPD in a general elderly population with a vaccine efficacy of 65%.[5] Recently, the Community-Acquired Pneumonia Immunization Trial in Adults has reported the efficacy of pneumococcal conjugate vaccine (PCV13); among approximately 85,000 adults 65 years or older, PCV13 demonstrated 45% efficacy against vaccine-type community-acquired pneumococcal pneumonia and 75% efficacy against vaccine-type IPD.[6] Because of protection against noninvasive pneumococcal pneumonia, in September 2014 ACIP updated their recommendation for adults to include PCV13. Specifically, PCV13 and PPSV23 should be administered routinely in a series to all adults aged 65 years and older. As for adults younger than 65 years, selection of PCV13 or PPSV23 depends on their risk factors or conditions.[4,7]

A pneumococcal immunization rate for adults remains below the Healthy People 2020 targets.[8] The pneumococcal immunization rate for high-risk adults younger than 65 years is 21.2% (compared with the 60% target) and 59.7% among people aged 65 years and older (compared with the 90% target).[9] These rates remain unchanged from 2011 and 2012.[10,11] Multiple reasons for not being vaccinated include: lack of knowledge or lack of doctor recommendation, efficacy and safety concerns, and lack of time.[12-14] Because pharmacists are easily accessible, community pharmacies can identify high-risk patients and recommend and administer the vaccine(s).

Although the pneumococcal vaccine is generally available in most community pharmacies,[15,16] it is not frequently administered in pharmacies, and there is a clear need to increase pharmacy engagement in pneumococcal vaccination services. For example, community pharmacies in Washington State that have been offering immunization services for several years reported administering 42 PPV23 doses per pharmacy per year.[16] The numbers were smaller (24 PPV23 doses) among pharmacies that recently started their immunization services.[16] Several studies have used various strategies to help increase the number of pneumococcal vaccination activities in pharmacies, including the use of pharmacy students, a motivational interviewing technique, and proactively screening for high-risk patients.[17-19] Although these strategies were effective in increasing vaccination activities, these studies were limited in scope, such as conducting studies in one state, enrolling a small number of patients, or including only one chain pharmacy. Therefore, the generalizability of these studies' results should be regarded with caution.

The primary goal of the present study was to assess the impact of the RxVaccinate program on pneumococcal vaccinations in community pharmacies. To accomplish this goal, participating community pharmacies were divided into two groups: (a) those with pharmacists who attended two self-directed basic training and had access to practice development and implementation tools and (b) those with pharmacists who completed the self-directed basic training, had access to practice development and implementation tools, and participated in the in-person coaching workshop and subsequent coaching sessions via teleconferences and e-learning community. These two groups of pharmacies are referred to as the “self-directed learning” group and the “coaching” group, respectively.

Objectives

1. Compare the completion of structure and process indicators between pharmacies in the self-directed learning group and in the coaching group at 3, 6, and 9 months after the delivery of the in-person coaching workshop.
2. Compare changes in the number of pneumococcal vaccinations from the 12-month period preceding to the 12-month period following the in-person coaching workshop between pharmacies in the self-directed learning group and in the coaching group.
3. Assess team leaders' perceptions of the RxVaccinate program.

Methods

RxVaccinate program

The RxVaccinate Program was designed, developed and implemented by the American Pharmacists Association (APhA), and the research protocol involving the use of deidentified data received an exempt status by the lead investigator's Institutional Review Board. The RxVaccinate program consisted of two phases: (a) two self-directed basic training webinars and practice implementation tools and (b) expert and peer coaching sessions to facilitate engagement

among pharmacists through an in-person workshop and optional e-community and monthly teleconferences. The content of the RxVaccinate program and its assessment tools were designed by the advisory panel, which consisted of the lead investigator (the primary author of this report), several nationally recognized immunization experts, a representative from the Immunization Action Coalition, and representatives from APhA. Strategies used were based on the Community Preventive Services Task Force's recommendations through rigorous systematic reviews. Interventions with "strong evidence" were incorporated into our program.[20] Because virtually none of the reviewed studies were conducted in community pharmacies, a key contribution of the present study is to translate the recommended interventions for application in the community pharmacy context. Strategies include provider interventions (provider education and feedback), system intervention (use of an immunization protocol), and patient interventions (education and reminder). Details about the RxVaccinate program and its learning objectives are listed in Supplemental Table 1 (available online).

The first 1-hour continuing pharmacist education webinar focused on current pneumococcal immunization recommendations and benefits and barriers of obtaining pneumococcal immunizations. The second 1.5-hour continuing pharmacist education webinar focused on professional collaboration principles and pharmacist strategies for community, patient, health system, and provider engagement. In addition, all pharmacists who participated in the second webinar also received various practice development tools related to pneumococcal immunizations. For example, pharmacists learned how to identify high-risk patients and counsel them on the importance of pneumococcal vaccine. These two webinars were delivered on June 26 and August 8, 2013, respectively, and they were made available online to any pharmacist that had already completed APhA's immunization certificate training program. The invitations to join these webinars were made via multiple emails to APhA members and on the APhA website. The second phase of the RxVaccinate program was a 4-hour in-person coaching workshop designed to help pharmacists outline an action plan and use the practice development and implementation tools. This workshop, facilitated by four immunization expert faculty, was held in Dallas, TX, on January 7, 2014. In addition to the workshop, the coaching sessions were offered for the next 12 months after the workshop, as the workshop participants were encouraged to use an e-learning community web platform to interact, exchange information, and call in for monthly teleconferences. Both e-community and teleconference used expert and peer coaching strategies that were designed to allow all participants to discuss experiences, gauge progress, foster friendly competition, and facilitate group problem solving.[21] During the 12 months following the in-person workshop, it was up to participating pharmacies to use the knowledge and skills learned from the RxVaccinate program in their pharmacies to identify high-risk patients, market the services, and so on. The RxVaccinate program concluded in December 2014.

Recruitment of participating community pharmacies

The number of pneumococcal vaccinations administered in pharmacy was the primary outcome. With the use of the G-Power software, version 3.1.9.2,[22] to estimate a desired sample size with alpha = 5% (two-sided) and power = 80% and an anticipated difference of approximately 25 pneumococcal vaccine doses between groups,[16] it was determined that a minimum number of 36 pharmacies in each group was needed to detect the difference. To account for potential dropouts, we recruited approximately 45 to 50 pharmacies in each group.

To recruit pharmacies into the second phase of RxVaccinate, community pharmacists who participated in the two previously discussed webinars were invited to participate. To apply, pharmacists were required to (a) fill out the application form which included questions about pharmacy characteristics, (b) submit a letter of agreement signed by a pharmacy management official at their practice site, and (c) agree to submit claims records on pneumococcal vaccines for a 12-month period preceding and 12-month period following the in-person workshop (regardless of whether they participated in the workshop or not), and (d) complete three quarterly reports on immunization activities. The questions about pharmacy characteristics and quarterly surveys were written by immunization experts and approved by the advisory team, which demonstrated face validity of the instruments. They were not pilot tested, however. A total of $1,000 was given to each participating pharmacy that submitted both before and after claims reports, and pharmacists who traveled to the workshop were reimbursed for their travel expenses up to $750 per participant.

Of the 126 community pharmacy sites that expressed their interests in participating in the second part of the RxVaccinate program, 96 community pharmacy sites were selected to be geographically representative and diverse in pharmacy ownership types. Each one was subsequently randomized into one of the two groups (48 in each group). To reduce cross-contamination between groups, pharmacy sites from the same corporation within the same region were assigned to the same group. Once the random assignment of corporate-owned pharmacies (in clusters) was completed, independent pharmacies were then randomly assigned to groups. No additional factors were used as criteria for random assignment. Owing to unforeseen reasons, several pharmacists in the coaching group could not attend the in-person coaching workshop. These pharmacies were later reallocated to the self-directed learning group, resulting in a total of 53 and 43 pharmacies in the self-directed learning and coaching groups, respectively.

Measures

Community pharmacies in both the self-directed learning group and the coaching group provided data for the following measures.

Pharmacy characteristics

Pharmacy characteristics, gathered during the application process, included pharmacy location, ownership type, prescription volume, pharmacist and technician hours, number of medication therapy management encounters, number of influenza and pneumococcal vaccines administered, and types of clinical services offered. This information was used to identify differences between community pharmacies in the self-directed learning group and those in the coaching group at baseline.

Structure and process indicators

These indicators were designed to lead to success in service development and implementation. Figures 1 and 2 provide a complete list of the indicators. Structure indicators included pharmacy capability and readiness to provide pneumococcal services, such as having a protocol in place and having a contract with payers. Process indicators included routine activities that would enhance the immunization program such as proactively targeting high-risk patients and mass marketing activities. To assess whether these indicators were completed or implemented, team leaders in both groups received three identical quarterly surveys at 3, 6, and 9 months after the in-person coaching workshop.

Number of pneumococcal vaccinations

Each pharmacy in both groups was requested to submit claims reports on the number of pneumococcal vaccinations administered in the 12-month periods preceding and following the in-person workshop. If a claims report submitted to the research team included less than or more than a 12-month period, the research team prorated the number of vaccines to 365 days. Because ACIP changed their recommendations to include PCV13 in September 2014, it is possible that during the last quarter of data collection, the number of pneumococcal vaccinations reported included both PCV13 and PPSV23 doses.

Team leaders' perceptions

At the end of 12 months after the in-person workshop, both groups received an online survey to assess team leaders' perceptions of the RxVaccinate program. Because each pharmacy may have multiple team leaders for reasons including sharing responsibilities or turnovers, all team leaders' perceptions were included in the analysis. The survey used four response categories that included strongly disagree, somewhat disagree, somewhat agree, and strongly agree.

Data analysis

Data were deidentified by APhA before they were sent to the lead investigator and her team for data analyses. Data were analyzed with the use of SPSS, version 19. Descriptive statistics were used to describe characteristics of participating pharmacies and pharmacy leaders' perceptions. Differences in pharmacy characteristics between the self-directed learning and coaching groups were explored with the use of one-way analysis of variance (ANOVA) for continuous variables and Pearson chi-square analysis and Fisher exact test for categoric variables. Repeated-measures ANOVA was used to assess the change in the number of pneumococcal vaccines administered in pharmacies within and between groups; outliers beyond 1.5 times the interquartile range were excluded to meet the assumptions. In addition, chi-square analyses were used to explore differences regarding structure and process indicators completion between the two groups at 3, 6, and 9 months after the in-person coaching workshop. All statistical analyses were based on a significance level of 0.05. Data analyses were conducted independently from APhA.

Results

Table 1 compares pharmacy characteristics between community pharmacies in the self-directed learning and coaching groups. The differences were not statistically significant between groups for all characteristics. Figures 1 and 2 show the proportion of pharmacies in the self-directed learning and coaching groups that reported completion or implementation of the structure and process indicators at 3, 6, and 9 months after

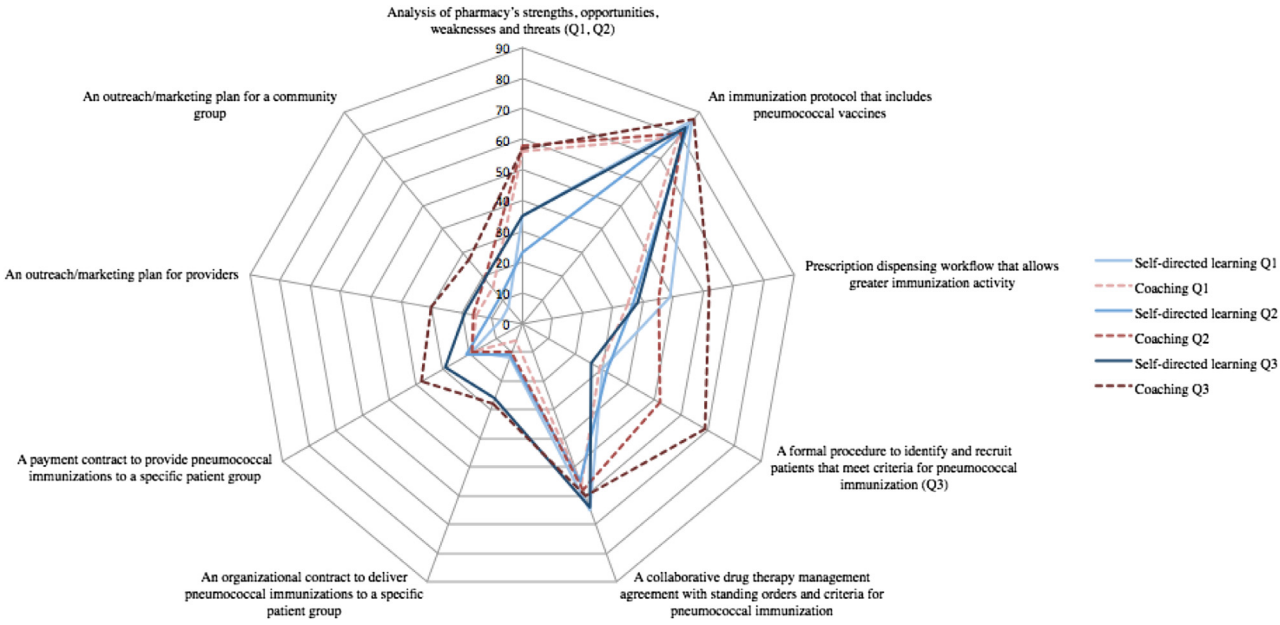

Figure 1. Percentage of community pharmacies within their respective groups that reported completing the structure indicators for pneumococcal immunization services at quarters (Q) 1, 2, and 3. Quarter(s) listed in parentheses after a structure indicator indicates significant differences between the groups.

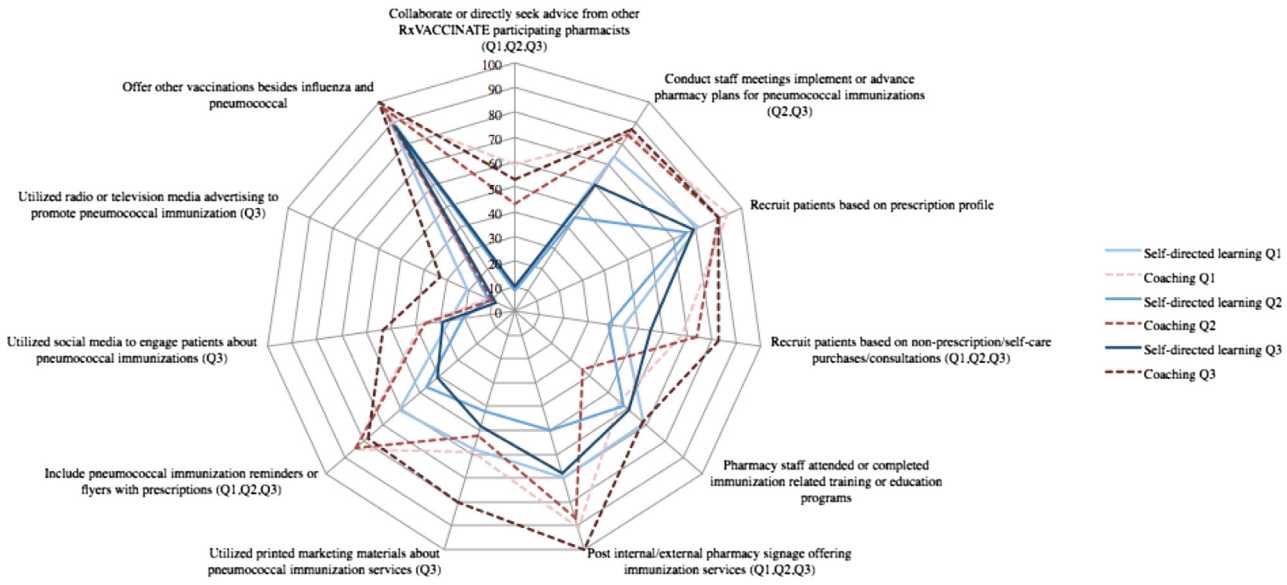

Figure 2. Percentage of community pharmacies within their respective groups that reported implementing the process indicators for pneumococcal immunization services at quarters (Q) 1, 2, and 3. Quarter(s) listed in parentheses after a process indicator indicates significant differences between the groups.

the in-person workshop. Significant differences were found in quarter 1 (35% of self-directed group vs. 56% of coaching group) and quarter 2 (23% vs. 58%) for the "assessing strengths, opportunities, weaknesses and threats" indicator and in quarter 3 (26% vs. 69%) for the "establishing a procedure to identify and recruit patients" indicator (Figure 1). That is, a greater proportion of pharmacies in the coaching group than in the self-directed learning group completed these two indicators. Similarly, several process indicators were more likely to be completed by pharmacies in the coaching group than by pharmacies in the self-directed learning group (Figure 2). Significant differences were found between groups in all three quarters for the following activities: collaborating with or seeking advice from other pharmacists, recruiting patients based on self-care purchases and consultations, posting pharmacy signage about immunization services, and including flyers with prescriptions.

Table 2 compares the change in number of pneumococcal vaccinations in the 12-month periods preceding and following the in-person workshop. Of the 42 pharmacies in the self-directed learning group and 36 pharmacies in the coaching group that reported numbers of pneumococcal vaccinations for both periods, only 37 self-directed learning and 32 coaching pharmacies were included in the repeated-measures analysis of variance after excluding outliers. Results show a significant improvement in the number of pneumococcal vaccinations in both groups (P <0.001). Specifically, the self-directed learning pharmacies had an average increase of 13.3 (SD 35.3) doses and the coaching pharmacies had an average increase of 32.9 (SD 38.7) doses. In addition, the increase in the number of vaccinations administered was significantly greater in the coaching group compared with the self-directed learning group (P < 0.032). To ensure that our results were robust, we tested them with the use of an intention-to-treat analytic approach, in which we replaced the missing value for the post-workshop period with the pre-workshop value. This analysis yielded consistent results (n = 88); the change in the number of pneumococcal vaccinations between the two periods was significant for both groups (P <0.001) and the increase was significantly greater in the coaching group (P = 0.024).

Table 3 presents team leaders' perceptions of the RxVaccinate program and their suggestions regarding future training programs. A total of 92 team leaders, representing 73 pharmacies, contributed to the survey. In general, almost all team leaders agreed that the participation fee paid to the pharmacy was adequate (97.4%) and that the project was helpful in increasing their pharmacy's pneumococcal immunization activity (86.3%). However, nearly 60% of respondents felt that their pneumococcal immunization services would have increased without participation in the project. When asked about the education and training webinars, the vast majority agreed that the provided content was new information (93.5%), helped with understanding the project (95.0%), and helped their pharmacy to advance immunization services (83.4%). When asked about coaching sessions, the vast majority (>90%) of participants in the coaching group viewed the in-person workshop as helpful in identifying implementation strategies and were therefore able to carry out many of the strategies and ideas discussed during the workshop when returning to their pharmacy. However, not as many participants (75.0%) found the monthly calls to be helpful.

Discussion

This study has several strengths. First, research assessing the effectiveness of pharmacy-based vaccination interventions is limited. Therefore, there was a need for the RxVaccinate program to translate the recommended interventions for application in the community pharmacy context. One component of the RxVaccinate program was similar to a study published by Taitel et al.,[17] in which pharmacists were recommended to routinely identify high-risk patients, which yielded an increase in vaccination activity. Although the Taitel

Table 1
Comparison of pharmacy characteristics at baseline between community pharmacies in self-directed learning and coaching groups, n (%)

Variable	Self-directed learning (n = 53)	Coaching[a] (n = 43)	*P* value[b]
Pharmacy region			0.057
Northeast	4 (7.5)	7 (16.3)	
Midwest	22 (41.5)	8 (18.6)	
South	19 (35.8)	23 (53.5)	
West	8 (15.1)	5 (11.6)	
Pharmacy type			0.666
Corporate owned	27 (50.9)	20 (46.5)	
Independent	26 (49.1)	23 (53.5)	
Pharmacy scripts per day			0.892
<100	7 (13.2)	6 (14.0)	
101–250	21 (39.6)	15 (34.9)	
>250	25 (47.2)	22 (51.2)	
Pharmacist hours per week			0.871
<80	15 (28.3)	14 (32.6)	
81–120	22 (41.5)	18 (41.9)	
121–160	8 (15.1)	4 (9.3)	
>160	8 (15.1)	7 (16.3)	
Technician hours per week			0.980
<80	11 (20.8)	9 (20.9)	
81–120	13 (24.5)	9 (20.9)	
121–160	8 (15.1)	7 (16.3)	
>160	21 (39.6)	18 (41.9)	
Number of medication therapy management encounters			0.487
<50	26 (49.1)	26 (60.5)	
51–100	14 (26.4)	10 (23.3)	
>100	13 (24.5)	7 (16.3)	
Self-reported influenza vaccine administered in the past 12 months			0.668
None	5 (9.4)	3 (7.0)	
<100	3 (5.7)	4 (9.3)	
101–250	8 (15.1)	5 (11.6)	
251–500	13 (24.5)	9 (20.9)	
501–1,000	9 (17.0)	13 (30.2)	
>1,000	15 (28.3)	9 (20.9)	
Self-reported pneumococcal vaccine administered in the past 12 months			0.929
None	7 (13.2)	7 (16.3)	
<100	43 (81.1)	33 (76.7)	
101–500	3 (5.7)	3 (7.0)	
Types of clinical services offered, mean (SD)	4.2 (1.9)	3.5 (1.7)	0.096

[a] Coaching group included webinars, in-person coaching workshop, and optional e-community and monthly teleconferences.
[b] Comparisons between groups with the use of chi-square or Fisher exact test for categoric data and analysis of variance for continuous data.

et al. study was an observational study, it is very informative because it included extensive data from a large national chain pharmacy. Second, this study was among few studies that used an experimental design to evaluate the impact of an educational program on pneumococcal vaccination services in community pharmacies and that involved several ownership types spanning numerous regions across the US, which increases the generalizability of the study findings. And third, in addition to the number of pneumococcal vaccine doses, this study also measured the completion of structure and process indicators. By comparing the structure and process indicators between groups, key areas that may have led to successful outcomes could be identified. In fact, the majority of the differences were related to process indicators, which stresses the need to integrate vaccination services into routine practice.[23]

Table 2
Comparison of number of pneumococcal vaccinations in the 12-month periods preceding and following the in-person coaching workshop between self-directed learning and coaching groups,[a] mean (SD)

12-month period	Self-directed learning (n = 37)	Coaching (n = 32)
Before the in-person workshop	28.9 (25.1)	20.4 (17.6)
After the in-person workshop	42.3 (39.0)	53.2 (40.4)
Mean difference within group	13.3 (35.3)	32.9 (38.7)

[a]Repeated-measures general linear model shows that the change in the number of pneumococcal vaccinations between the periods before and after the in-person workshop was significant (P <0.001) and that the interaction between time and group also was significant (P = 0.032).

The results show that the increase in the number of pneumococcal vaccinations was greater in the coaching group than in the self-directed learning group. Coaches play an important role in the change process and organizational development, because they provide guidance on behavior changes and help to set the desired goals.[21] Furthermore, coaches provide feedback on achievements, suggestions, encouragement, and advice that are relevant and meaningful to the organizational context.[24,25] It is argued that merely giving the tools to practitioners may not be sufficient in helping them to implement new strategies to enhance performance.[26] In the present study, the self-directed learning group did not receive coaching advice or feedback on their performance, and therefore they may have had some difficulty applying the concepts and tools to their practice. In contrast, pharmacists in the coaching group received guidance regarding how to use the tools and positive reinforcements from expert and peer coaches. This process may have made them feel more confident in their capabilities and reassured them of their progress toward increasing pneumococcal vaccination services. Because of that, they continued to engage in various vaccination activities and were able to increase the number of pneumococcal vaccinations.

Overall, the RxVaccinate program was perceived by participating team leaders as being helpful toward advancing pharmacies' pneumococcal vaccination services. This perception was substantiated by the fact that both groups had a significant increase in the number of pneumococcal vaccinations compared with the time before participating in the program. Because the content provided by the APhA was highly regarded, team leaders from both groups expressed an obvious demand for similar future content. It is important to recognize that participants in the coaching group were compensated by the grant for their travel to participate in the coaching workshop. In the future, it may be important to design and evaluate an alternate mode to deliver the coaching program, such as an online synchronous or asynchronous program instead of face-to-face workshops. Whether it is presented as an online webinar or as a live workshop, respondents suggested that the APhA should continue to develop and provide continuing education offerings that stimulate the advancement of their practices.

Limitations

Several limitations should be recognized. Owing to the fact that we did not have a true control group, increased vaccination activities could be due to external factors in the

Table 3
Team leaders' perceptions of the RxVaccinate program, n (%) (N = 92)[a]

Parameter	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
General perceptions of RxVaccinate				
The fee paid to the pharmacy for participation was adequate.	1 (1.3)	1 (1.3)	20 (26.7)	53 (70.7)
Participation in the project was helpful in increasing our pharmacy's pneumococcal immunization activity.	4 (5.0)	7 (8.8)	27 (33.8)	42 (52.5)
Our pneumococcal immunization services would have increased without participation in the RxVaccinate project.	12 (15.0)	21 (26.2)	33 (41.2)	14 (17.5)
Perceptions of education and training webinars				
The education and training webinars provided by APhA at the start of the project provided new information.	2 (2.6)	3 (3.9)	24 (31.2)	48 (62.3)
The education and training webinars provided by APhA helped me understand the project.	2 (2.5)	2 (2.5)	16 (20.3)	59 (74.7)
The education and training webinars provided by APhA at the start of the project helped our pharmacy advance our pneumococcal immunization services.	4 (5.1)	9 (11.4)	20 (25.3)	46 (58.2)
Perceptions of coaching strategies[b]				
I participated in three or more monthly intervention group teleconferences.	3 (8.8)	3 (8.8)	0 (0.0)	28 (82.4)
The live workshop was helpful in identifying strategies to implement after returning to my pharmacy.	1 (2.9)	1 (2.9)	4 (11.8)	28 (82.4)
I was able to implement many of the strategies and ideas discussed during the workshop when returning to my pharmacy.	1 (2.9)	2 (5.9)	7 (20.6)	24 (70.6)
I found the monthly calls helpful in identifying new strategies for increasing our pharmacy's pneumococcal immunization activity.	2 (6.5)	6 (19.4)	8 (25.8)	15 (48.4)
Perceptions of future development programs				
Our pharmacy would benefit from participating in future APhA practice demonstration projects similar to RxVaccinate.	1 (1.2)	2 (2.5)	14 (17.3)	64 (79.0)
APhA should develop more continuing education offerings that include online webinar workshops to help pharmacists advance their practice.	1 (1.2)	0 (0.0)	12 (15.0)	67 (83.8)
APhA should develop more continuing education offerings that include live workshops to help pharmacists advance their practice.	2 (2.5)	2 (2.5)	10 (12.7)	65 (82.3)
APhA should develop more continuing education offerings that include regularly scheduled support teleconferences to help pharmacists advance their practice.	1 (1.3)	7 (8.9)	19 (24.1)	52 (65.8)

[a] Total for each item may not add up to 92 owing to missing data.
[b] Applicable only to team leaders in the coaching group.

environment rather than the RxVaccinate program. Another limitation is the selection bias; pharmacists who participated in this study may have been highly motivated to make positive changes. It is also possible that monetary incentive influenced their motivation. Therefore, they may not be representative of the general pharmacist and pharmacy population. In addition, observational bias may have influenced participants' behaviors, which may have led them to be more involved in immunization activities compared with the general pharmacist and pharmacy population. It is also possible that participating pharmacies implemented other immunization-related programs concurrently with the study period and therefore that the observed differences in vaccine doses could be a result of other programs and not necessarily the RxVaccinate program. We observed an increase in the number of vaccinations administered in the self-directed learning group. In addition to the effect of the webinars and the tools, this increase could be partially due to the effect of the quarterly surveys, which may serve as a self-directed prompt or reminder to pharmacists to make changes. In addition, we did not capture who participated and the extent of participation in the teleconference calls and e-learning communities. This study prorated the number of vaccine doses to 365 days for a comparison between and within groups to be made. But there could be fluctuations in the number of vaccinations across months that this study could not capture. This study did not ask participants to report doses for specific vaccines. It is likely that the majority of vaccine doses reported were PPSV23. But because the vaccine recommendations were changed in September 2014 to include PCV13 for adults, it is possible that PCV13 doses were included during the last quarter of 2014. There could be other factors affecting the increase of vaccine doses that we did not control for, such as participants' characteristics, law and regulations, extent of participation in coaching sessions, number of immunizing pharmacists, corporation policies, and patient mix. The proportions of engagement in structure and process indicators were calculated based on self-reported information of those who completed the quarterly surveys, and therefore we could not capture the engagement level among nonrespondents. Finally, the change in September 2014 (9 months after the in-person workshop) of the recommendations for the pneumococcal vaccine may have contributed to an increase in the number of pneumococcal vaccinations administered in pharmacies after October 2014.

Conclusion

Pharmacies in both the self-directed learning group and the coaching group showed a significant increase in the number of pharmacist-administered pneumococcal vaccinations. Because the increase in the number of vaccine doses was greater in the group receiving both self-directed training with practice development and implementation tools and expert and peer coaching than the group without the coaching strategy, we conclude that the coaching strategy was important in assisting pharmacists to implement the tools in actual practice. Several structure and process indicators were identified as potential indicators for successful implementation. Future studies might

explore the effect of coaching by peers versus coaching by experts as well as assess the cost-effectiveness of self-directed prompts through e-mails or text messages versus the coaching approach. We recommend that return on investment of each strategy be compared.[27] This information would be helpful in informing community pharmacies that decide to internally offer a similar program to their staff pharmacists. Finally, we recommend that future studies should examine which structure and process indicators are key to enhancing the success of pneumococcal vaccination activities.

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Supplemental Table 1
RxVACCINATE program and learning objectives and components

	RxVACCINATE	Learning Objectives/Components
Coaching; Self-Directed Learning	Webinar 1: Pneumococcal Vaccination Update	1. Recall the current CDC recommendations for pneumococcal vaccinations 2. Discuss the benefits and risks associated with pneumococcal vaccinations 3. Answer the most frequent questions posed by patients and prescribers
Coaching; Self-Directed Learning	Webinar 2: Pharmacist Pneumococcal Immunization Services	1. Evaluate current practice capability/readiness to provide service 2. Identify required service components and implementation steps 3. Outline a process for identifying and securing collaborative partners 4. Describe several strategies for promoting and marketing the service 5. Recall third-party payment and reimbursement requirements for pneumococcal immunizations.
Coaching; Self-Directed Learning	Practice Development and Implementation Tools (Available for pharmacists who participated in Webinar 2)	1. Practice capability/readiness assessment tool to identify operational gaps that may hinder pneumococcal immunization delivery 2. Immunization service development and expansion action plan 3. Pneumococcal immunization service budget planning worksheet 4. Immunization service tracking form 5. Standing orders and protocols—necessary elements 6. Pneumococcal immunization collaborative drug therapy management agreement template 7. Immunization encounter form
Coaching	In-person Coaching Workshop[a]	1. Complete a practice capability/readiness assessment for initiating or improving pneumococcal immunization services and seeking collaborative partners 2. Create a plan for identifying and modifying existing pharmacy operations required to effectively and efficiently offer pneumococcal immunizations 3. Outline a pharmacy fact sheet detailing pneumococcal immunization services and benefits to patients, providers, and the community 4. Develop a marketing and promotion plan to increase the number of pneumococcal immunizations requested and administered at the pharmacist practice site or collaborative partner care location 5. Provide interactive learning and discussion through case based learning and role play

[a] Participants in the coaching workshop could also participate in optional e-community and monthly group teleconferences.