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The Effect of Pharmacist Intervention on Herpes Zoster Vaccination in Community Pharmacies

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Abstract

OBJECTIVE—To evaluate the effectiveness of community pharmacy-based interventions in increasing vaccination rates for the herpes zoster vaccine.

DESIGN—Prospective intervention study with a pre-post design.

SETTING—Three independent community pharmacies in Tennessee.

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PATIENTS—Patients whose pharmacy profiles indicated they were eligible for the vaccine and patients presenting to receive the vaccine at study sites.

INTERVENTIONS—Interventions initiated by pharmacists to promote the herpes zoster vaccine included a press release published in local newspapers, a flyer accompanying each prescription dispensed at participating pharmacies, and a personalized letter mailed to patients whose pharmacy profiles indicated they were eligible for the vaccine.

MAIN OUTCOME MEASURES—Comparison of vaccination rates for the herpes zoster vaccine during the control period and intervention period and patients' indication for their sources of education and influence in receiving the vaccine.

RESULTS—Vaccination rates increased from 0.37% (n=59/16121) during the control period to 1.20% (n=193/16062) during the intervention period ($P<0.0001$). Cochran-Armitage Trend analyses including the months before and after the interventions confirmed a significantly higher vaccination rate during the intervention month than other months analyzed. More patients indicated that they were educated about the herpes zoster vaccine by one of the pharmacist-driven interventions than by a physician, family/friend, or other source during the intervention period ($P<0.0001$ for all comparisons). Also, more patients were influenced to receive the vaccination as a result of one of the pharmacist-driven interventions rather than a physician ($P=0.0260$) or other source ($P<0.0001$). No difference in the effectiveness of patient influence was found when the pharmacy interventions were compared with family/friends ($P=0.1025$).

CONCLUSION—The three pharmacist-driven interventions were effective in increasing vaccination rates for the herpes zoster vaccine.

Keywords

Herpes zoster vaccine; interventional research; community pharmacy-based interventions; vaccination rate; pharmacist role

Introduction

Shingles (herpes zoster) is a disease caused by reactivation of the varicella zoster virus, which has been stored in sensory ganglia after having chickenpox (varicella).[1–3] Shingles usually presents as a vesicular eruption limited to a dermatome or specific enervation segment of the spinal cord. After initial inflammation, the reactivated virus travels down the nerve and causes pain and inflammation that can persist from weeks to years, a condition called postherpetic neuralgia. The risk of postherpetic neuralgia increases with advanced age, and 50% of patients over the age of 60 develop this complication. Secondary complications of shingles also include scarring, palsies, ocular complications, hearing loss, motor deficits, pneumonia, encephalitis, bacterial superinfection, and death.[1–3]

The herpes zoster vaccine (Zostavax- Merck & Co., Inc.) was approved for use by the FDA in May 2006.[4] The herpes zoster vaccine induces varicella zoster virus-specific immunity, hence conveying protection against zoster and its complications. The vaccine is indicated to prevent herpes zoster in adults aged 50 years and older and is not indicated to treat herpes zoster or postherpetic neuralgia.[4] The Centers for Disease Control Advisory Committee on Immunization Practices (CDC ACIP) recommends that all patients aged 60 or older receive a single dose of herpes zoster vaccine, regardless of previous shingles episodes.[5] A recent study reported that the national vaccination rate for herpes zoster vaccine was only 6.7% in 2008 among those aged 60 and older.[6]

While pharmacists have been giving vaccines for years, recognition of pharmacists as immunizers began in the early 1990s.[7] Since November 1996, when the American

Pharmacists Association (APhA) began a nationally recognized vaccination training program, the number of certified pharmacist and pharmacy student immunizers has grown to over 150,000, and administering vaccinations is now widely accepted to be within the scope of pharmacy practice.[8] Pharmacists can act as educators, advocates, facilitators, and immunizers in the movement to vaccinate more Americans against vaccine-preventable diseases.[8]

Pharmacies have served as alternative settings for administering vaccines to a wide variety of patient populations. The most common vaccines for pharmacists to administer include influenza, pneumococcal, and hepatitis.[9] Past studies have assessed the rate of pharmacist administration of vaccines, as well as physician perception, patient perception and satisfaction, demographic areas of greatest impact, and methods of vaccination program implementation, as detailed below.[10–19] Pharmacist involvement in vaccination programs and education has been associated with significant increases in the rates of vaccination, patient satisfaction, and vaccination of underserved populations. [10–19] For example, Grabenstein and colleagues found that vaccine delivery by pharmacists was associated with an increased rate of influenza vaccines in a state allowing pharmacists to immunize versus a state that did not.[10] Weitzel and Goode observed that, upon implementing a pharmacy-based vaccination program with an intervention aimed at increasing awareness of pharmacy vaccination services, the number of vaccines administered rose from almost 6,000 in 1998 to almost 20,000 in 1999.[11] Bearden et al. concluded that pharmacists tend to immunize patients who would be unlikely to receive vaccinations elsewhere.[12] Ernst and colleagues discovered that patients were supportive of pharmacists as nontraditional vaccination providers, especially adults living in smaller towns and rural areas.[13] In addition, patients who have been vaccinated by a community pharmacist describe the experience as satisfactory and would recommend the option to others.[14] Pharmacists have the potential to be influential public health advocates as well; 50–94% of people accept recommendations from pharmacists to be immunized.[15] Indeed, vaccination services have become successful practices in community pharmacies and have continued to expand over time.[20]

For herpes zoster vaccine, there is also an opportunity for community pharmacist to identify potential vaccine recipients, educate them about the vaccine, and administer vaccinations. The herpes zoster vaccine must be stored frozen, reconstituted immediately upon removal from the freezer, and administered within 30 min of reconstitution.[4] Most community pharmacies are well equipped to accommodate these conditions. Moreover, a recent study by Wood et al. demonstrated that a herpes zoster vaccination program is also able to generate a profit in the independent community pharmacy setting.[21] However, there is a lack of studies of innovative herpes zoster vaccination services in the community pharmacy setting, specifically studies that evaluate the effectiveness of community pharmacy-based programs in increasing awareness of the vaccine and getting candidates to receive the vaccine.

Objective

This study was designed to investigate whether interventions by community pharmacists promoting the herpes zoster vaccination would result in an increased rate of herpes zoster vaccination.

Methods

This study was a prospective interventional study with a pre-post design. Study sites included three independent pharmacies across the state of Tennessee. According to census measures, these three pharmacies serve populations that represent suburban, semirural and

rural demographics.[22] The study sites followed different vaccination protocols; two of the pharmacies operated under collaborative agreements with a local physician, and one pharmacy required a prescription for all vaccinations.

This study used a control period in February 2008 and an intervention period in March 2008, each 4 weeks long. During the control period, patients were recruited to the study when they voluntarily presented to pharmacy study sites requesting herpes zoster vaccination. During their pharmacy visit, participants were given a vaccine information sheet, screened for vaccine contraindications, provided with the vaccine, and asked to complete a study survey after they received the vaccine. The survey was designed to capture demographic information, assess patients' comfort levels with pharmacists administering the vaccine, and elicit sources of education about the vaccine and sources of influence for receiving the vaccine. Respondents were allowed to choose more than one source when responding to questions assessing sources that provided education about the herpes zoster vaccine or influenced them to receive the vaccine. Specifically, regarding sources of education about the vaccine, patients were asked, "How did you hear about the Shingles vaccine?" They were asked to select from the following options: doctor, family/friend, pharmacist, flyer from your pharmacy, newspaper, letter in the mail from pharmacy and other. Regarding sources of influence, patients were asked, "Why did you decide to get vaccinated against shingles?" They were given the following options: (1) family member or friend suffered from shingles; (2) doctor told me I need to get the vaccine; (3) pharmacist/pharmacy told me I need to get the vaccine; and (4) other. The survey was developed by pharmacy residents and was discussed among the investigators. Participation in the study did not affect provision of vaccinations, counseling, or information.

On the first day of the intervention period, three pharmacist-driven interventions were initiated. First, a one-time newspaper press release regarding the vaccine was published as a news item in local community newspapers. The newspaper press release contained information about herpes zoster infection and the herpes zoster vaccination including indications, adverse effects, and contraindications. Second, every prescription dispensed during the intervention period at any study-site pharmacy contained a flyer advertisement. The flyer contained identical information as in the press release. Third, all current pharmacy profiles of patients with CDC ACIP-recommended indications for herpes zoster vaccination were identified as potential recipients of the vaccine; these patients received a one-time personalized letter via mail. The personalized letter contained identical information as in the press release and the flyer. During the intervention period, an identical procedure was followed as in the control period for patient screening, education, vaccination, and survey completion. Specifically, as in the control period, subjects were recruited from voluntary self-presentation to the pharmacies for routine herpes zoster vaccination during the intervention period. Subjects were given a vaccine information sheet, screened for vaccine contraindications, provided with the vaccine, and asked to complete a study survey after they received the vaccine. The survey used for the intervention period was the same survey as for the control period.

Inclusion criterion for patients consisted of men and women aged 60 or older. Exclusion criteria included contraindications for the herpes zoster vaccination including an allergy to neomycin, gelatin, or any other component of the vaccine; pregnancy; patients with weakened immune systems such as those receiving radiation, corticosteroids, or those with HIV/AIDS; cancer; patients previously receiving herpes zoster vaccination; and patients receiving another live vaccine within the 4 weeks prior to herpes zoster vaccination. Patients were vaccinated if they met the inclusion criterion and did not have contraindications. Patients were still given the vaccine if they previously had suffered from herpes zoster to prevent the recurrence of the condition per CDC ACIP recommendations.[5] Although the

shortage of herpes zoster vaccine has been reported,[23] the vaccine shortage did not affect the supply of vaccine for this study.

The primary outcome for this study was the change in vaccination rates from the control period to the intervention period. A sample size of fewer than 5000 should be adequate to detect a significant change in herpes zoster vaccination rate. For example, 4,835 patients would be required to detect a significant change from 7% to 9% in the proportions of patients receiving herpes zoster vaccinations due to the interventions with a significance level of 0.05 and a power of 0.80.[24] An estimate on the prevalence of herpes zoster vaccination was not available at the time of the study design. However, because of the possible low herpes zoster vaccination rate, a prevalence under 10% and an increase of two percentage points were used in this conservative example for sample size calculation. Due to the large sizes of the patient population at three study sites, it was deemed very unlikely the investigators would not have sufficient sample size to detect significant effects of the intervention strategies.

The primary data analysis compared vaccination rates in the control and intervention periods using a chi-square test. This test assessed whether the probability of vaccination was the same for the control and intervention periods. We identified patients initially eligible for the vaccine and followed them in the control period and the intervention period. When calculating the vaccination rate for the control period, the numerator included all individuals in the pharmacy databases who were vaccinated during the control period; the denominator included all individuals in the pharmacy databases who met the inclusion criterion. For the intervention period, the numerator included all individuals in the pharmacy databases who were vaccinated during the intervention period; the denominator included all individuals in the pharmacy databases who met the inclusion criterion and were not vaccinated during the control period. In both periods, no patients who requested the vaccine had contraindications for the vaccine.

Patient characteristics, such as patient age, could be important factors to consider when examining the effect of interventional strategies on vaccination rates. However, the investigators could not obtain age distribution of the patient population because of concerns related to the Health Insurance Portability and Accountability Act. Furthermore, patient gender was not adjusted because patient gender distributions were very similar between control and intervention periods..

Additionally, the investigators attempted to assess time trends: differences in vaccination rates between the control and intervention period were compared to an average change in the vaccination rates of the immediate previous 3 months with the use of the Cochran-Armitage Trend Test. The effect of time needed to be assessed because of the limitation of a pre-post design: the possibility of naturally occurring increase in vaccination rates from the control period to intervention period needed to be ruled out. The investigators also wanted to determine whether the effects of the intervention persisted over time. Therefore, the intervention period was compared to the three months in the postintervention period by using the Cochran-Armitage Trend Test. This part of the analysis was conducted for the aggregate study as well as for each individual study site.

Secondary outcomes included evaluating of the relative efficacy of the pharmacy interventions in two areas: educating patients about the vaccine and influencing patients to receive the vaccine. In addition patient satisfaction with the pharmacist as an immunizer was measured. The proportion of individuals who learned about or were influenced to receive the herpes zoster vaccine from a pharmacist-driven intervention was compared to the proportion of individuals who learned about or were influenced to receive the vaccine from other

sources such as friends and family or a physician. In addition, each of the pharmacy-driven interventions was compared against other pharmacy-driven interventions. For example, the number of individuals who cited the flyer as the dominant factor in influencing them to receive the herpes zoster vaccine was compared to the number of individuals who cited the newspaper release as the dominant factor in influencing them. Consequently, the McNemar's chi-square test was used for evaluating these responses. McNemar's test is one type of chi-square test for a 2 × 2 contingency table with matched pairs of subjects. Hence, in the example given above, individuals who cited both the flyer and newspaper release as influencing factors for them were not included in the calculation of the McNemar's test, neither were the individuals who did not select either one as a influencing factor; rather, only those people who cited only one of these two factors were included in the calculation. This part of the analysis was conducted for the whole study and for each study site and used survey data only from the intervention period but not the control period.

The investigators evaluated patient attitudes to determine how comfortable individuals were with a pharmacist administering the vaccine. A Likert scale was used with five levels: very comfortable, somewhat comfortable, unsure, uncomfortable, and very uncomfortable. The number of patients who were at least somewhat comfortable with a pharmacist administering the vaccine was compared between the control and the intervention periods. This was conducted using a Fisher's Exact test because 50% of the cells had expected counts less than 5. Information needed for this part of the analysis was obtained from the study survey.

SAS® 9.2 (SAS Institute Inc., Cary, NC) was used for the statistical analysis. The statistical significance level was set a priori at α=0.05. This study was approved by the University of Tennessee IRB Office, and informed consent was received from all survey participants.

Results

While not many demographic characteristics of the study sample were available to the investigators, the gender distribution could be analyzed. During the control period, 57.42% were female among total individuals eligible for the vaccine during the control period. During the intervention period, the proportion of females was 57.38% among total individuals eligible for the vaccine. The gender distribution of each site was similar to the overall population. For example, during the control period, 58.15% were female among individuals eligible for the vaccine at one site. During the intervention period, the proportion of females was 58.07% among individuals eligible for the vaccine at the same site.

The vaccination rates significantly increased after implementing the pharmacist-driven interventions. Specifically, vaccination rates increased from 0.37% (or 59/16,121) during the control period to 1.20% (or 193/16,062) during the intervention period (P<0.0001). When data from each individual pharmacy site were similarly analyzed for changes in vaccination rates, the investigators found a significant increase in vaccination rates at each site independent of others' data: one site experienced an increase from 0.39% (or 10/2,533) to 2.93% (or 74/2523; P<0.0001); the second site had an increase from 0.58% (or 26/4,453) to 1.72% (76/4,427; P<0.0001); and the third site experienced an increase from 0.25% (or 23/9,135) to 0.47% (43/9,112; P=0.01).

Vaccination rates in the 3 months prior to the intervention were analyzed with a Cochran-Armitage Trend Test Z-statistic to assess the effect of time (Table 1); no significant rate changes were found in the 3 months preceding intervention for the individual pharmacies or the overall population (P=0.43). During the 4 months following the initiation of pharmacist-driven interventions, vaccination rates decreased significantly (Table 2; P<0.0001);

however, when the intervention month was excluded from the analysis, no significant changes in vaccination rates were found (Z statistic=−1.67; P=0.10). Analyses in each community pharmacy produced similar patterns.

Regarding the survey respondents, the number of survey respondents was 46 while 59 individuals in pharmacy databases received the vaccine during the control period, giving a response rate close to 80%. Among survey respondents during the control period, the average age was 71.15 (standard deviation=6.54, minimum=60, maximum=89). The majority of the population was female (72.34%) and White (97.87%) and had Medicare Part D (59.57%). The number of survey respondents was 158 while 193 individuals in pharmacy databases received the vaccine during the intervention period, giving a response rate over 80%. Survey respondents during the intervention period had similar characteristics as did the survey respondents from the control period. Among these individuals, the average age was 71.90 (standard deviation=7.05, minimum=60, maximum=90). The majority of this population was female (63.92%) and White (96.82%), and had Medicare Part D (72.15%).

The investigators used survey results from the intervention period to determine the main educational sources about the herpes zoster vaccine for patients. This was based on patient answers to the question, “How did you hear about the Shingles vaccine?” Patients were asked to select from the following options: doctor, family/friend, pharmacist, flyer from your pharmacy, newspaper, letter in the mail from pharmacy and other. This analysis used the McNemar’s chi-square test (Table 3). Patients were more likely to be educated about the vaccine by one of the pharmacy-driven interventions than by a physician (P<0.0001), family/friend source (P<0.0001), or other source (P<0.0001). Upon comparing each of the pharmacy-based interventions, the personalized letter was significantly more effective than every other intervention (Table 3). For example, when comparing the personalized letter to the newspaper, 21 patients chose the newspaper as the sole source of information about the herpes zoster vaccine, while 43 patients indicated that the personalized letter was the sole source of information (Table 3). All other patients either selected both of these interventions as sources of information or did not select either one. Comparisons between the flyer and newspaper did not produce significant differences. Site-specific analysis showed more heterogeneous effects, particularly with respect to newspapers and flyers. None of the other pharmacy-driven interventions was more effective than the personalized letter in any instance. However, at one site, the newspaper was more effective than was the flyer; and at another site, the flyer was more effective than was the newspaper in informing patients of the vaccine.

Patient influence was also assessed via analysis of the survey results from the intervention period by using McNemar’s chi-square test (Table 4). This was based on patient answers to the question, “Why did you decide to get vaccinated against shingles?” They were given the following options: (1) family member or friend suffered from shingles; (2) doctor told me I need to get the vaccine; (3) pharmacist/pharmacy told me I need to get the vaccine; and (4) other. Patients were more likely to be influenced to receive the herpes zoster vaccination as a result of one of the pharmacist-driven interventions rather than a physician (P=0.0260) or other source (P<0.0001). However, there was no statistical difference when pharmacy-based sources and family/friends were compared (P=0.1025). The relative efficacy of pharmacist-driven interventions in influencing patients to receive the vaccine was also compared (Table 4). Of the pharmacy-driven interventions, the personalized letter was more effective than all of the other interventions in influencing patients to receive the herpes zoster vaccine. For example, when comparing the flyer to the personalized letter, six people indicated that the flyer was the sole factor in influencing them to receive the vaccine as opposed to 42 patients who indicated that the personalized letter was the dominant factor in their receiving the vaccine (Table 4). All other patients indicated that neither of these interventions was

instrumental in influencing their decision to obtain the vaccine or that both interventions played a part in their choosing to get vaccinated. When analyzing the results according to each specific site, the letter was more effective than was the flyer and newspaper at two of the three sites.

Finally, of the 205 patients who filled out a survey during the study, 204 (99.5%) reported being either very comfortable or somewhat comfortable with the pharmacist administering the vaccine. There was no significant difference between the control period (97.8% among 46 respondents) and the intervention period (100% among 158 respondents) in the rates of patients reporting being comfortable with pharmacists administering vaccine (P=0.2255).

Discussion

In this study, the researchers reported a change in vaccination rates from 0.37% to 1.20% from the control period to the intervention period. Although this may not represent a substantial change in terms of absolute percentage points, this change represents an increase of over 200%. This result suggests that pharmacists' interventions had an effect of increasing the overall rate of vaccination against herpes zoster. These findings are consistent with previous study findings of the effects of pharmacists-driven vaccination programs. Loughlin and colleagues found that a pharmacist-managed influenza vaccination program in a large, multispecialty, group practice increased the vaccination rates among patients from 39% to 76% or almost double the vaccination rate before implementing the vaccination program.[16] Van Amburgh and colleagues evaluated a pharmacist-managed vaccination campaign that resulted in an increase in influenza vaccination rates from 28% before the campaign to 54% after the program initiation.[17]

Pharmacy sources were generally statistically more effective than were all other sources in educating people about the vaccine and influencing patients to receive the herpes zoster vaccination. The only exception was that there was no difference in efficacy of pharmacy sources and family members or friends in influencing patients to receive the vaccine. A personalized letter sent to targeted patient populations was the most effective pharmacist-driven intervention for both educating patients about the vaccine and influencing them to receive the vaccine. Previous studies comparing the effects of various interventions in increasing vaccination rates are rare. However, various strategies have been used by pharmacists to increase the awareness of pharmacy vaccination services. Strategies have included letters and chart stickers to patients' physicians,[11] partnership with a physician to establish the vaccination protocol,[11] flyer,[15] and mailings to high-risk patients.[17] These strategies can be classified into two categories: those to general population (in this study, newspaper and flyer), and those targeting specific individuals needing the service (personalized letter). The findings that personalized letter was more effective than the other two strategies are consistent with our expectation because a targeted marketing campaign is typically more effective than a campaign to the general public.[25]

An interesting statistic emerged when analyzing vaccination rates in the 4 months following the intervention initiation; vaccination rates dropped significantly when data from the intervention month were included while vaccination rates did not change significantly when data from the intervention month were excluded. This indicates that effective pharmacist-driven interventions may need ongoing reinforcement to achieve continued effects.

There was no difference between the control and intervention groups in patient comfort levels with pharmacists administering vaccinations, and 99.5% of patients were comfortable with the experience. The survey was conducted after the vaccination. Survey respondents were likely to be at least somewhat comfortable with pharmacists administering the vaccine

before they approached pharmacists for the vaccine. Therefore, finding a high comfort levels with pharmacists administering vaccinations is not surprising. However, this finding is also consistent with the previous literature on patient perception of pharmacists administering vaccines. When Bounthavong and colleagues asked about the experience with a Pharmacy Specialty Immunization Clinic (PSIC), 86.9% of patients agreed or strongly agreed about their overall satisfaction; 98.9% of patients agreed that pharmacists in the PSIC administered vaccinations appropriately.[18] According to a nationwide survey, Taitel and colleagues reported that 97% of patients were satisfied with their experience receiving flu shots at a chain pharmacy.[19]

The study methods were designed specifically so that the interventions could be implemented in the course of usual practice in a community pharmacy setting. Therefore, the methodology of this study will be relatively easy to replicate by pharmacists in a similar community pharmacy setting. In addition, because each of the three study sites was unique regarding population demographics, it may be possible that pharmacist-driven study interventions will be equally effective in a variety of communities. Previous studies have reported that pharmacy involvement in vaccination programs and education has been associated with significant increases in the rates of vaccination in various settings, particularly among underserved populations.[10–19]

Limitations

Limitations in this study included a lack of documentation of patient barriers to receiving the vaccine. Cost may be a significant barrier, as many insurance companies do not cover the vaccine on their formularies. Although patient barriers were not study outcomes, documenting patient barriers may have provided further insight into the effects of the interventions on patient education and patient influence. Future research should examine patient barriers to receiving the vaccine. Additionally, month or time of the year of the intervention may have had an impact on the effectiveness of the intervention. However, because the Cochran-Armitage Trend analyses for the months before and after the interventions confirmed a significantly higher vaccination rate during the intervention month than during other months analyzed, the effect of the time of the year may not have had significant effect on study findings.

Additionally, it is theoretically possible that some event outside the experiment also affected patients' decision in getting vaccinated. Without a true control group, the authors could not completely rule out that possibility. However, that situation is not likely to have happened based on the investigators' interactions with patients. Furthermore, without access to full medical history of patients the authors may not be aware if some patients had received herpes zoster vaccines elsewhere. If this was the case the authors' may have overestimated the eligible individuals for both the intervention and control periods. However, this should not be a major issue because the overall sample size was large and number of individuals that had received the herpes zoster vaccines should be small thanks to the low herpes zoster vaccination rate at the baseline. On a related note, it is also possible that patients received the vaccine elsewhere after receiving the intervention. In that case, the effect of the intervention may have even been underestimated in this study.

One further limitation was that comparison analyses could not be conducted between survey respondents and nonrespondents. However, because the survey response rate was relatively high, the study findings based on survey responses should be reasonably reliable. Finally, the results may have been confounded because of differing vaccination protocols across the study sites. Specifically, two of the pharmacies operated under collaborative agreements with a local physician, and one pharmacy required a prescription for all vaccinations.

However, the vaccination rates increased in both types of settings during the intervention period, suggesting that the interventions may be effective in pharmacies operating under collaborative practice agreements, as well as in those requiring a prescription to administer the vaccine.

Another limitation of this study is that the survey questionnaire was not extensively pre-tested. However, the study findings do exhibit face validity which mitigates this important study limitation. Additionally, it would be interesting to compare the return on investment for the interventional strategies. However, that is beyond the scope of this study.

Conclusion

This study found that a combination of the three pharmacist-driven interventions may have led to an increase in vaccination rates of herpes zoster vaccine. Specifically, a personalized letter detailing the disease and related vaccine seemed to be the most effective form of pharmacist intervention. Community pharmacies may be able to use information gathered from this research to improve their own vaccination programs with a reasonable certainty of success. Further community-based research in the area of pharmacist-managed vaccination programs is warranted to verify the results of this study and investigate the effect of the growing role of pharmacists in community care.

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Table 1

Trend analysis for the herpes zoster vaccination rate in the 3 months before initiating pharmacy-driven interventions

Months	Number Vaccinated	Vaccination Rate (%)	Number Eligible
December, 2007	69	0.42	16,274
January, 2008	84	0.52	16,205
February, 2008	59	0.37	16,121

Z statistic=−0.7835, P=0.4333; Intervention month was March 2008.

Table 2

Trend analysis for the herpes zoster vaccination rate in the intervention month and following 3 months

Months	Number Vaccinated	Vaccination Rate (%)	Number Eligible
March, 2008	193	1.20	16,062
April, 2008	82	0.52	15,869
May, 2008	97	0.61	15,787
June, 2008	60	0.38	15,690

Z statistic=−8.0513, $P<0.0001$; Intervention month was March 2008.

Table 3

Comparison of different sources in educating patients about vaccination

Source 1	Source 2	No/No Number (%)	No 1/Yes 2 Number (%)	Yes 1/No 2 Number (%)	Yes/Yes Number (%)	*P* Value
Pharmacist	Doctor	18 (11.39)	26 (16.46)	106 (67.09)	8 (5.06)	<0.0001
Pharmacist	Friend/Family	31 (19.62)	13 (8.23)	111 (70.25)	3 (1.90)	<0.0001
Pharmacist	Other	34 (21.52)	10 (6.33)	111 (70.25)	3 (1.90)	<0.0001
Flyer	Letter	84 (53.16)	47 (29.75)	25 (15.82)	2 (1.27)	0.0095
Flyer	Newspaper	105 (66.46)	26 (16.46)	26 (16.46)	1 (0.63)	>0.9999
Letter	Newspaper	88 (55.70)	21 (13.29)	43 (27.22)	6 (3.80)	0.0060

Total sample size=158; Percentages may not add up to 100% in each row due to rounding. Percentages of individuals selecting the following sources: 72.15% for pharmacy, 21.52% for doctor's office, 10.13% for family/friend, 8.23% for other, 17.09% for flyer, 31.02% for letter, 17.09% for newspaper.

Table 4

Comparison of different sources in influencing patients to receive vaccination

Source 1	Source 2	No/No Number (%)	No 1/Yes 2 Number (%)	Yes 1/No 2 Number (%)	Yes/Yes Number (%)	*P* Value
Pharmacist	Doctor	59 (37.34)	34 (21.52)	55 (34.81)	10 (6.33)	0.0260
Pharmacist	Friend/Family	37 (23.42)	56 (35.44)	40 (25.32)	25 (15.82)	0.1025
Pharmacist	Other	77 (48.73)	16 (10.13)	65 (41.14)	0 (0.00)	<0.0001
Flyer	Letter	109 (68.99)	42 (26.58)	6 (3.80)	1 (0.63)	<0.0001
Flyer	Newspaper	139 (87.97)	12 (7.59)	7 (4.43)	0 (0.00)	0.2513
Letter	Newspaper	106 (67.09)	9 (5.70)	40 (25.32)	3 (1.90)	<0.0001

Total sample size=158; Percentages in each row may not add up to 100% in each row due to rounding. Percentages of individuals selecting the following sources: 41.14% for pharmacy, 27.85% for doctor's office, 51.26% for family/friend, 10.13% for other, 4.43% for flyer, 27.21% for letter, 7.59% for newspaper.