

## **Addressing Educational and Coordination Barriers for Adult Pneumococcal Disease Prevention in Rhode Island**

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## **Abstract**

### **Background**

A significant challenge with adult immunizations, as opposed to childhood vaccinations, is improving adult vaccination awareness and guideline implementation among immunization providers. Here we describe our academic detailing intervention and community outreach efforts.

### **Methods**

A clinical pathway was developed to educate immunization providers about appropriate indications and administration schedules, and frequently asked questions for the two pneumococcal vaccines. Community outreach activities included radio ads, as well as distribution of patient handouts and wallet cards at community events. Using case report and hospital discharge data, we assessed differences in pneumococcal disease using chi-square, Fisher's exact, or Wilcoxon Rank Sum tests.

### **Results**

From November 2013 through July 2015, our academic detailers visited 121 of 177 RI community pharmacies and distributed our vaccination pathway materials to 50% of adult RI hospitals. Every immunization provider who received a vaccination pathway also received a six question survey. Of the 413 surveys completed, 92% agreed that their knowledge of the PCV13 and PPSV23 vaccines had improved. We attended 116 public health events impacting approximately 9,415 Rhode Islanders. Our radio ad aired 227 times on 6 radio stations in RI with an estimated audience of 368,895. Vaccination increased non-significantly during the intervention period from 72% to 75% among older adults in RI. Pneumococcal pneumonia decreased significantly between the pre-intervention (01/2013-10/2013) and intervention periods (11/2013-07/2015) by 2.4 per 10,000 discharges, and by 4.5 discharges between the

intervention and post-intervention periods (08/2015-09/2015). A decrease in invasive pneumococcal disease and increase in vaccination was observed over the study period, however these changes were non-significant.

### **Conclusions**

Our statewide educational outreach program for pneumococcal vaccination was effective in increasing patient and provider knowledge and awareness, with sustained decreases in pneumococcal disease.

## Introduction

Greater than half of all cases of pneumococcal disease in older adults occur in non-vaccinated patients with an indication for pneumococcal vaccination and an estimated 67 million at-risk individuals in the United States (US) have not been vaccinated.<sup>1,2</sup> This is extremely concerning, because patients with Advisory Committee on Immunization Practices (ACIP) indications for pneumococcal vaccination are twice as likely to die as those without indications if they develop invasive pneumococcal disease.<sup>3</sup> Despite this grave reality, and efforts to improve national pneumococcal vaccination rates among populations which should be vaccinated, vaccination rates rarely reach 75%.<sup>4-6</sup> Pneumococcal vaccination in adults aged 65 years and older has remained relatively stable over the past several years, however it is still well below the Health People 2020 goal of 90%.<sup>4</sup> The most recent estimates of vaccination coverage in older adults ranges from 61% percent (National Health Interview Survey, 2014) to 70% (Behavioral Risk Factor Surveillance System, 2014).<sup>5,6</sup>

Indications for pneumococcal vaccines have expanded significantly in the last few years, which may in part account for vaccination rates that are below the Health People 2020 goal. In 2008, ACIP recommended patients aged 19-64 years with asthma or current smokers receive a one-time dose of the polysaccharide pneumococcal vaccine (PPSV23).<sup>7</sup> After the approval of the pneumococcal conjugate vaccine (PCV13) in children, it was then extended to include those 50 and older at risk for invasive disease in 2011. In 2014, the recommendation for a one-time dose of PCV13 in addition to PPSV23 for adults 65 years and older also dramatically increased the populations in which vaccination is recommended.<sup>8</sup>

The most significant challenge with adult vaccinations, as opposed to childhood vaccinations, is adult vaccination awareness among immunization providers, including pharmacists, physicians, physician assistants, and nurse practitioners. Currently, vaccine status assessment in adults by

healthcare providers is not routine.<sup>9-12</sup> Moreover, a major concern with adult vaccination is that patients often receive care at multiple locations, which may not always be coordinated.<sup>9</sup> Additionally, patients may be unaware of their immunization status and eligibility to receive pneumococcal vaccination. As such, we developed a statewide education campaign utilizing academic detailing and patient outreach to improve adult pneumococcal rates by increasing knowledge and awareness of pneumococcal immunization recommendations. Academic detailing is “university or non-commercial-based educational outreach which involves face-to-face education to prescribers by trained health care professionals”.<sup>13,14</sup> The goal of academic detailing is to provide education consistent with medical evidence and guidance documents.<sup>13,14</sup> To assess the effectiveness of our approach for improving pneumococcal vaccination in Rhode Island (RI) through education, we evaluated a range of outcomes, including changes in vaccination rates, invasive pneumococcal infections, and pneumococcal pneumonia, as well as provider feedback on academic detailing.

## **Methods**

This project was reviewed and approved by the Institutional Review Board of the University of Rhode Island.

### Pathway and educational materials

The grant team developed a vaccination pathway designed to address the complex pneumococcal vaccine administration schedules and corresponding indications which served as a central component for immunization provider education. The pathway was developed using national guidance from the Advisory Committee on Immunization Practices (ACIP) adult pneumococcal vaccination recommendations, the Center for Disease Control and Prevention, and the Infectious Disease Society of America (IDSA), along with information from the Immunization Action Coalition and prescribing information for both types of adult pneumococcal

vaccinations (PPSV23 and PCV13). After initial pathway development, local infectious disease specialists were asked to provide critical analysis and design feedback to help ensure the final pathway provided complete information in an easy-to-follow format. As new national guidance became available, the pathway was updated to reflect the most current guideline recommendations. The vaccination pathway was reviewed and approved by the RI department of Health and copyrighted by the University of Rhode Island Office of Intellectual Property and Economic Development.

The four page pathway document was laminated and held together by a corner ring for durability and accessibility in the clinical setting. The pathway included the adult pneumococcal vaccination recommendations and schedule for both PPSV23 and PCV13, medical conditions requiring pneumococcal vaccination, facts about pneumococcal disease, frequently asked questions about pneumococcal vaccination, package insert information on both types of pneumococcal vaccinations, as well as contraindications, side effects, and precautions. Contact information for the major insurance carriers in RI was also provided.

A patient vaccination wallet card and pneumococcal vaccination patient information handout were also created. The wallet card included vaccination status for multiple adult immunizations and important medical information. A wallet card sleeve was incorporated to protect the wallet card and a reminder to “please carry this with you and show to your healthcare professional”. The wallet card was approved by the RI Department of Health and the Ocean State Adult Immunization Coalition. An educational patient handout was developed and included information on the dangers of pneumococcal disease, who should be vaccinated, and prompted patients to contact their immunization provider to get vaccinated. The handout was developed using resources from the Immunization Action Coalition, the National Foundation for Infectious Diseases, and scholarly articles. The wallet card, wallet card sleeve, and patient handout were

all printed in English and in the 5 most common foreign languages spoken in RI since 5.7% of households in RI are linguistically isolated.

### Academic detailing

#### *Implementation, immunization providers*

In an effort to introduce our vaccination pathway to immunization providers throughout the state, our team attended 22 events with pharmacist, physician, and nurse attendees from August 2013 through May 2015. Presentations on our vaccination pathway were made to the RI Department of Health Flu Task Force, RI Certified Diabetes Outpatient Educators, Ocean State Adult Immunization Coalition, Wellness Company Nurses Protocol Meeting, Seminar by the Sea Northeast Regional Continuing Education Conference for Pharmacists, RI Pharmacists Foundation, Coastal Medical of Rhode Island, RI Department of Health Nurses Conference, and Economic Burden of Vaccine Preventable Diseases in RI. Additionally, we mailed copies of our vaccination pathway to hospitals and clinics in both RI and surrounding states. Events and mailings were either planned based on outreach efforts by the project team or by request of the event host or facility.

All materials distributed during our statewide academic detailing and community outreach campaign were made available for download from the [URI Drug Information Services](#) website to ensure continued access to the vaccination pathway and patient handouts and to make the materials available to a wider audience. A mass email with the link to the website was sent to immunization providers in the state.

#### *Implementation, community pharmacies*

A list of all CVS, Rite Aid, Target, and Walgreens pharmacies in RI was compiled. The URI College of Pharmacy has full-time faculty, adjunct faculty, and preceptors with clinical practice

sites in community pharmacies across the state. The College's relationships with these pharmacists enabled us to present our pneumococcal vaccination pathway and academically detail 121 of the 177 RI pharmacies from November 2013 through July 2015. The academic detailers included faculty and a community pharmacy resident. Various academic detailing methods were used to reach as many immunization providers as possible in the state. A 1-to-1, face-to-face approach was utilized at all of the CVS, Rite Aid, and Target pharmacy sites visited. Sessions lasted approximately 15 minutes, and each participant was provided education on how to use the pneumococcal vaccination pathway, which patient populations should be vaccinated, and the recommended schedule of vaccination. Academic detailing for Walgreens pharmacies consisted of a 20-minute presentation at the Walgreens District meeting of 70 pharmacy managers. Academic detailing sessions also occurred during Rite Aid district meetings.

#### *Immunization provider survey*

After all academic detailing sessions, each participant was requested to take an anonymous 6 question survey about the effectiveness of their detailing session. Surveys were either submitted electronically via Survey Monkey on an iPad, or paper surveys were collected in a sealed envelope, depending on immunization provider preference. Domains of survey measurement included content understanding, educational material ease of use, satisfaction with the academic detailing session, confidence in applying the new knowledge in practice, and intention to utilize the pathway and change vaccination practices. Each question followed a 5-point Likert scale, from strongly disagree = 1 to strongly agree = 5. We assessed the percent agreeing with each question (5 = strongly agree, 4 = agree). Health profession and setting were collected in the survey and question responses were compared between groups using the chi-square or Fisher's exact tests as appropriate.

#### Patient outreach



To further improve communication and coordination between patients and their immunization providers, a Public Service Announcement (PSA) was developed in collaboration with the RI Department of Health and Ocean State Adult Immunization Coalition, which aired in English and Spanish on RI radio stations: *“Do you have diabetes or asthma? Do you smoke? Are you over 65 years of age? If you answered yes to even one of these questions, you are at increased risk for bacterial pneumonia. Bacterial pneumonia is an infection of the lungs. It’s a dangerous disease that could send you to the hospital. In some cases, it can even be deadly. The good news is that you can protect yourself. Ask your doctor or pharmacist about the vaccine that protects against bacterial pneumonia. Vaccination - it’s your best defense. Sponsored by the University of Rhode Island College of Pharmacy and the Rhode Island Department of Health”*. Our target audience for the PSA was adults 65 years and older, and based on demographics provided by the advertising company, six radio stations were chosen. The PSA aired a total of 227 times in December 2014.

To reach patients of diverse backgrounds throughout RI, the study team and the URI Pharmacy Outreach Program attended 89 public health events from September 2013 through July 2015. Events included public health fairs, such as the Feed 1,000 Rhode Islanders event for two consecutive years, brown bag events, support groups, and educational programs held at senior centers, senior housing, and community centers. Wallet cards, patient handouts, and chap sticks promoting pneumococcal vaccination were distributed to attendees. At several events, formal presentation about pneumococcal disease and pneumococcal vaccination were made to attendees.

### Pneumococcal vaccination and infections

#### *Vaccination*

Pneumococcal vaccination was determined from the BRFSS based on the percentage of adult respondents 65 years and older who have ever had a pneumonia vaccination in RI and the US.

#### *Invasive pneumococcal disease, case reports*

The goal of vaccination is to prevent morbidity and mortality, particularly invasive disease. As such, we assessed changes in the incidence of invasive pneumococcal disease in RI. Invasive pneumococcal disease is a reportable disease nationally. Invasive disease is confirmed by isolation of pneumococcus from blood, cerebrospinal fluid, pericardial fluid, pleural fluid, peritoneal fluid, joint fluid, or another normally sterile site. In RI, public health regulations require that invasive pneumococcal disease must be reported within 4 days of recognition. Changes in incidence between the pre-intervention (January 2013 - October 2013) and intervention periods (November 2013 - July 2015) were assessed, as were changes between the intervention and post-intervention periods (August 2015 - December 2015) were evaluated. Additionally, we assessed differences in patient characteristics between the study periods from case report data.

#### *Pneumococcal disease, hospital discharge data*

We assessed pneumococcal disease from hospital discharge data collected by the state. Discharge data is captured from 5 teaching hospitals providing general acute care, 6 other general acute-care hospitals, 2 psychiatric teaching hospitals, and 1 rehabilitation hospital. International Classification of Disease, 9<sup>th</sup> revision (ICD-9) diagnosis codes were used to identify pneumococcal disease: pneumonia 481, bacteremia 038.2, meningitis 320.1.

#### *Statistical analysis*

Discharge rates per 10,000 discharges and per 10,000 bed days were calculated. Incidence of invasive disease was calculated per 100,000 population. We generated descriptive statistics,

including the number, percentage, median, and interquartile range to describe characteristics of patients with pneumococcal disease. Rate differences and differences in patient characteristics between the study periods were evaluated with chi-square, Fisher's exact, or Wilcoxon Rank Sum tests, as appropriate, with OpenEpi ([www.OpenEpi.com](http://www.OpenEpi.com)).

## **Results**

At the start of our grant efforts, the number of licensed immunization providers in RI was obtained from the Rhode Island Department of Health website. It is estimated that out of 7,200 licensed physicians, pharmacists, nurses in the state of Rhode Island, we have impacted 2,179 with our grant efforts. It is estimated that we have had over 1,143,914 citizen-encounters.

### Academic detailing

Academic detailing was assessed with surveys of licensed immunization providers. Overall, immunization providers found the academic detailing sessions to be effective with easy to understand materials (Figures 1 and 2). Most immunization providers agreed or strongly agreed (92%) that their knowledge of identifying which patient populations require PCV13 or PPVSV23 improved. Providers intended to apply the knowledge in their clinical practice (83%), and expected their vaccination practices to change as a result of the academic detailing and education materials (73%). Almost 90% of immunization providers found the educational materials easy to understand, with providers from the community and ambulatory care settings having greater agreement than the hospital or free clinic settings (Figure 1;  $p < 0.05$  for hospital compared to community setting). In comparing between settings, both median scores and percent agreement were significantly lower among hospital respondents than community respondents (Figure 1) and among nurses compared to pharmacists (Figure 2).

Of the 74 respondents that provided additional comments, 62% gave positive feedback

regarding the detailer and/or materials, such as “Great flow chart, easy to read, very informative” and “[Academic detailer] did a great job explaining all the information! I feel that I am able to really put this new information into good practice.” Of those providing positive feedback, 78% were pharmacists. A quarter of the respondents providing additional comments found the pathway and/or detailing session to be confusing, complicated, or lacking information (18/73), such as “Difficult to follow and had to flip back and forth” and “I would like a better description on the 2 indications for Prevnar”. Of those that found the material or session confusing, 72% were nurses. Other respondents noted that they do not vaccinate (3%) or were already implementing the pneumococcal vaccination recommendations (4%).

### Pneumococcal vaccination and infections

#### *Vaccination*

In the US, the percentage of adults 65 years and older who had ever received pneumococcal vaccination increased from 69.5% in 2013 to 70.3% in 2014. In RI, pneumococcal vaccination increased from 72.4% (95% confidence interval 69.7-75.1%) in 2013 to 75.2% (95% CI 72.8%-77.6%) in 2014. Though the 2.8% increase in pneumococcal vaccination in RI was non-significant, it was greater than the increase in the US (0.8%).

#### *Pneumococcal disease in Rhode Island*

Pneumococcal pneumonia decreased significantly between the pre-intervention (January 2013 - October 2013) and intervention periods (November 2013 - July 2015) by 2.4 per 10,000 discharges (95% CI 0.1-4.8; p=0.032), and also decreased significantly by 4.5 discharges per 10,000 discharges between the intervention and post-intervention periods (August 2015 - December 2015; 95% CI 1.6-7.4; p=0.030). Significant rate differences were not observed in the overall pneumococcal or pneumococcal bacteremia discharge rates (Table 1). While invasive pneumococcal disease remained stable between the pre-intervention and intervention

periods, the rate decreased non-significantly by 0.43 cases per 100,000 population between the intervention and post-intervention periods (95% CI -0.1-9.5; p=0.179).

There were 136 pneumococcal disease discharges in RI during the pre-intervention period (86.0% pneumonia, 24.3% bacteremia, 2.2% meningitis, 12.5% with multiple infection types). A similar distribution was observed during the intervention period (n=238, 75.5% pneumonia, 34.0% bacteremia, 8.7% meningitis, 14.7% with multiple infection types). Overall, patients were similar in the pre-intervention and intervention periods (Table 2). Diabetes (31.6% vs 24.8%) and chronic obstructive pulmonary disease (39.0% vs 31.5%) were less common among patient in the intervention period, although these differences were non-significant. Inpatient mortality was significantly lower in the intervention period compared to the pre-intervention period (8.8% vs 3.8%, p=0.042).

Characteristics of patients with invasive pneumococcal disease during the pre-intervention (n=56), intervention (n=139), and post-intervention (n=16) periods can be found in Table 3. Underlying conditions were significantly less common in the intervention period compared to the pre-intervention period (92.9% vs 77.0%, p=0.010). Coronary artery disease (57.1% vs 18.7%, p<0.001) and polysaccharide vaccination (14.3% vs 4.3%, p=0.027) were also significantly less common between the pre-intervention and intervention periods. Diabetes was significantly more common in the post-intervention period compared to the intervention period (10.8% vs 31.3%, p=0.037).

## **Discussion**

To our knowledge, this is the first statewide pharmacist-driven academic detailing and community outreach campaign to promote adult vaccination. With the complexity of recommendations for pneumococcal vaccination, development of an easy-to-understand

pathway and corresponding educational materials served as the backbone for our academic detailing efforts. Prior to pathway development, implementation of the ACIP recommendations was difficult due to a lack of public and provider knowledge, electronic medical record systems that did not automatically recommend the correct vaccine, and perceived and actual financial/reimbursement limitations, mainly from the primary payer for older adults, Medicare. Statewide academic detailing efforts along with the supporting pathway and educational materials impacted the immunization providers' knowledge about pneumococcal vaccination. Our survey results demonstrated that the academic detailing efforts increased immunization providers' ability to identify patients eligible for pneumococcal vaccination and many providers indicated that the new knowledge would be incorporated into their clinical practice. Provider survey results suggests the education through academic detailing with supporting materials was effective for immunization providers in community settings but that improvements could be made in regards to hospital and nurse education.

Pharmacists noted consistently upon academic detailing the pneumococcal pathway materials assisted them and clarified questions they had regarding recommendations for which patient populations should receive the PPSV23 and PCV13 and the administration schedules. Individual 1-to-1 approaches were mainly implemented to reach as many pharmacists as possible in their practice settings. The academic detailers remarked on the difficulties in providing consistent academic detailing at community pharmacies. Academic detailing in this setting is often challenging because of constraints on the pharmacists' time to step away from the workflow and this is dependent on prescription volume as well as additional professional staffing at the pharmacy. A large group meeting of pharmacy managers proved to be an efficient forum, allowing pharmacists the time to adequately review the materials and pose questions of the detailer.

Though vaccination increased non-significantly, we observed other signals which infer increased vaccination, including a 5% decline in inpatient mortality among patient with pneumococcal disease and fewer patients with underlying conditions.<sup>15-17</sup> Additionally, we observed significant decreases in pneumococcal disease during our statewide academic detailing and community outreach campaign, specifically pneumococcal pneumonia, which were sustained after the campaign ended. In RI, invasive pneumococcal disease was similar between the pre-intervention and intervention periods, but then dropped by 0.43 cases per 100,000 population between the intervention and post-intervention periods, however this decline was non-significant. It should be noted that during the same time periods, different patterns were observed in New England and the US. Invasive pneumococcal disease increased significantly between the pre-intervention and intervention periods in New England and the US and while subsequent decreases were observed in both groups, their rates were still higher than RI (US: 0.39 cases per month per 100,000 population; New England: 0.54; RI: 0.15).<sup>18</sup>

### Limitations

First, as updates to vaccination recommendations over the study period meant outdated materials were in circulation, academic detailing was repeated in the community pharmacies which added considerable time to the project and effort from the academic detailers. The vaccination pathway did include the [URI Drug Information Services](#) website so that immunization providers could access and download the most recent version of the pathway. Second, though community pharmacies received two academic detailing sessions, different pharmacists may have participated in the detailing sessions, and as such, we were not able to follow-up with immunization providers to determine use of the academic detailing material in the practice or whether the pathways changed their immunization practices. Third, as hospital discharge data was not yet available for the last quarter of 2015, changes in patient characteristics could not be assessed between the intervention and post-intervention periods.

Lastly, we attempted to collect vaccination data from several sources, other than BRFSS, however we were not able to obtain these data. Additionally, BRFSS data was only available through 2014, which limited our ability to determine change in vaccination rates.

## **Conclusions**

Our statewide pharmacist-driven campaign to increase adult pneumococcal vaccination through academic detailing to immunization providers and community outreach efforts resulted in increased provider knowledge regarding the pneumococcal vaccine, as well as decreases in pneumococcal pneumonia in RI.



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Table 1. Rates of pneumococcal disease

	Pre-intervention	Intervention	Post-intervention
Rhode Island, pneumococcal disease per 10,000 discharges	12.8	10.8	3.6
Pneumonia	10.6	<b>8.1<sup>a</sup></b>	<b>3.6<sup>b</sup></b>
Bacteremia	2.0	2.0	0
Rhode Island, pneumococcal disease per 10,000 bed days	2.6	2.2	<b>0.8<sup>b</sup></b>
Pneumonia	2.1	<b>1.6<sup>a</sup></b>	<b>0.8<sup>b</sup></b>
Bacteremia	0.4	0.4	0
Rhode Island, monthly incidence of invasive pneumococcal disease per 100,000 population	0.53	0.59	0.15
New England, monthly incidence of invasive pneumococcal disease per 100,000 population	0.34	<b>0.80<sup>a</sup></b>	<b>0.54<sup>b</sup></b>
United States, monthly incidence of invasive pneumococcal disease per 100,000 population	0.37	<b>0.42<sup>a</sup></b>	0.39

Periods: pre-intervention January-October 2013, intervention November 2013-July 2015, post-intervention for discharges August-September 2015, post-intervention for invasive disease August 2015-May 2016.

<sup>a</sup> Indicates significantly ( $p < 0.05$ ) different from pre-intervention period.

<sup>b</sup> Indicates significantly ( $p < 0.05$ ) different from intervention period.

Table 2. Pneumococcal disease, hospital discharges, Rhode Island

	Pre-intervention (n=136)	Intervention (n=238)
Primary diagnosis	71 (52.2%)	136 (57.1%)
Age group		
<18	6 (4.4%)	14 (5.9%)
18-54	32 (23.5%)	63 (26.5%)
55-64	21 (15.4%)	52 (21.8%)
65-74	28 (20.6%)	38 (16.0%)
75-84	25 (18.4%)	31 (13.0%)
85+	24 (17.6%)	40 (16.8%)
Male gender	60 (44.1%)	114 (47.9%)
White race	111 (80.4%)	205 (86.1%)
Hispanic	12 (8.8.2%)	13 (5.4.6%)
County		
Bristol	0 (0%)	6 (2.5%)
Kent	25 (18.4%)	52 (21.8%)
Newport	10 (7.4%)	18 (7.7%)
Providence	91 (66.9%)	141 (59.2%)
Washington	10 (7.4%)	21 (8.8%)
Comorbidity		
Diabetes	43 (31.6%)	59 (24.8%)
Chronic obstructive		

pulmonary disease	53 (39.0%)	75 (31.5%)
Asthma	18 (13.2%)	32 (13.4%)
Chronic respiratory disease	71 (52.2%)	110 (46.2%)
Chronic kidney disease	17 (12.5%)	34 (14.3%)
Liver disease	10 (7.4%)	21 (8.8%)
Cancer	11 (8.1%)	33 (13.9%)
Congestive heart failure	28 (20.6)	59 (24.8%)
Hypertension	70 (51.5%)	140 (58.8%)
Rheumatoid arthritis	8 (5.8%)	10 (4.2%)
Immune disorder	0 (0%)	5 (2.1%)
Inpatient mortality	12 (8.8%)	<b>9 (3.8%)<sup>a</sup></b>

Periods: pre-intervention January-October 2013, intervention November 2013-July 2015.

Data are n (%).

<sup>a</sup> Indicates significantly (p<0.05) different from pre-intervention period.

Table 3. Invasive pneumococcal disease, case reports, Rhode Island

	Pre- Intervention (N = 56)	Intervention (N = 139)	Post- Intervention (N = 16)
Age, median (interquartile range)	68 (53-80)	61 (46-76)	61 (47-70)
Male gender	28 (50.0%)	72 (51.8%)	12 (75.0%)
White race	43 (76.8%)	114 (82.0%)	13 (81.3%)
Hispanic	<5	5 (3.6%)	<5
County			
Bristol	<5	5 (3.6%)	<5
Kent	15 (26.8%)	30 (21.6%)	<5
Newport	9 (16.1%)	18 (13.0%)	<5
Providence	27 (48.2%)	75 (54.0%)	11 (68.8%)
Washington	<5	11 (7.9%)	<5
Underlying conditions	52 (92.9%)	<b>107 (77.0%)<sup>a</sup></b>	12 (75.0%)
Alcohol abuse	7 (12.5%)	<b>&lt;5<sup>a</sup></b>	<5
Cancer	9 (16.1%)	28 (20.1%)	<5
Chronic obstructive pulmonary disease	14 (25.0%)	26 (18.7%)	<5
Coronary artery disease	32 (57.1%)	<b>26 (18.7%)<sup>a</sup></b>	<5
Current smoker	11 (19.6%)	16 (11.5%)	<5
Diabetes	9 (16.1%)	15 (10.8%)	<b>5 (31.3%)<sup>b</sup></b>
Immunosuppressive therapy	6 (10.7%)	13 (9.4%)	<5
Other prior illness	13 (23.2%)	35 (25.2%)	<5
Vaccination	9 (16.1%)	15 (10.8%)	<5
Conjugated	<5	9 (6.5%)	<5
Polysaccharide	8 (14.3%)	<b>6 (4.3%)<sup>a</sup></b>	<5
Hospitalized	51 (91.1%)	132 (95.0%)	16 (100%)
Length of stay	6 (4-8)	6 (3-9)	9 (5-17)
Died from this illness	<5	20 (14.4%)	<5
Sterile site blood	55 (98.2%)	134 (96.4%)	16 (100%)

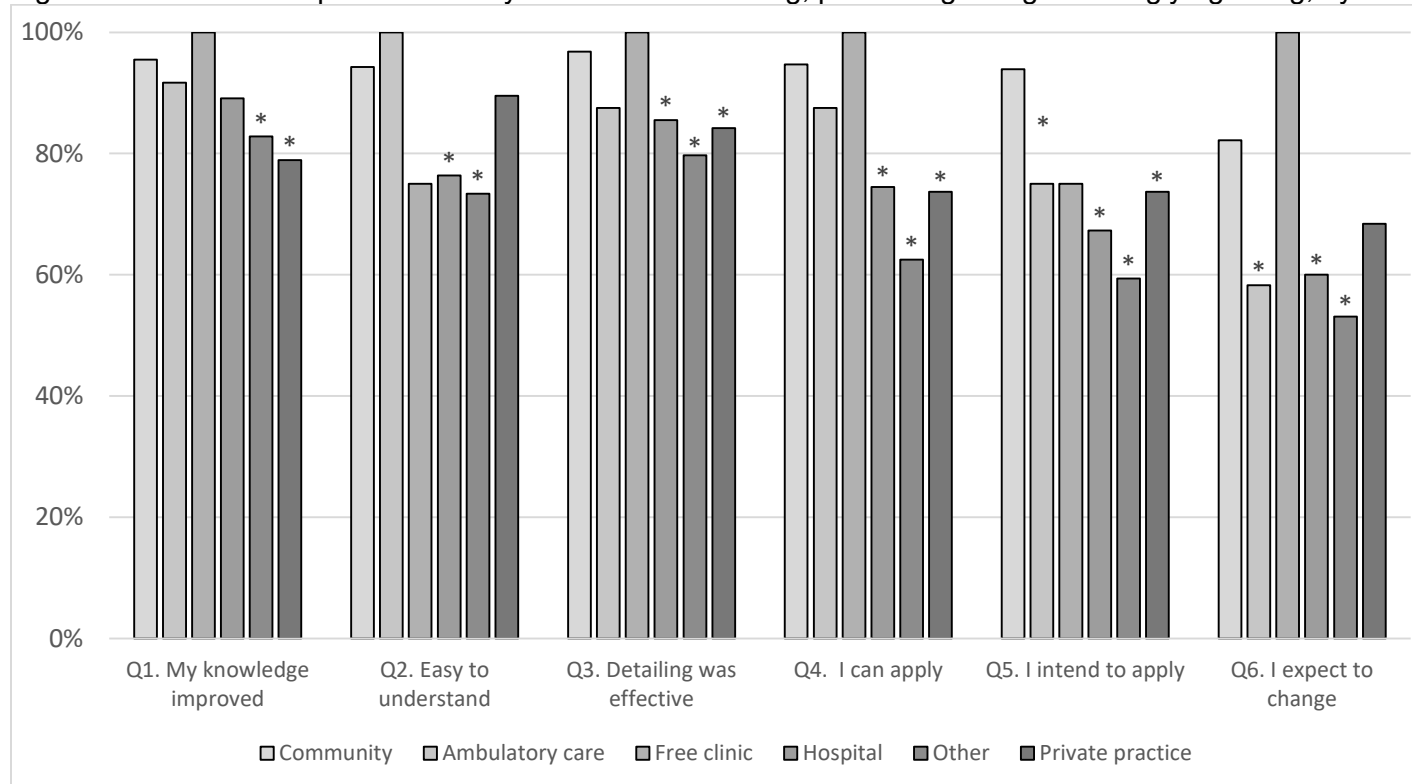
Periods: pre-intervention January-October 2013, intervention November 2013-July 2015, post-intervention August-December 2015.

Data are n (%), unless otherwise indicated.

<sup>a</sup> Indicates significantly (p<0.05) different from pre-intervention period.

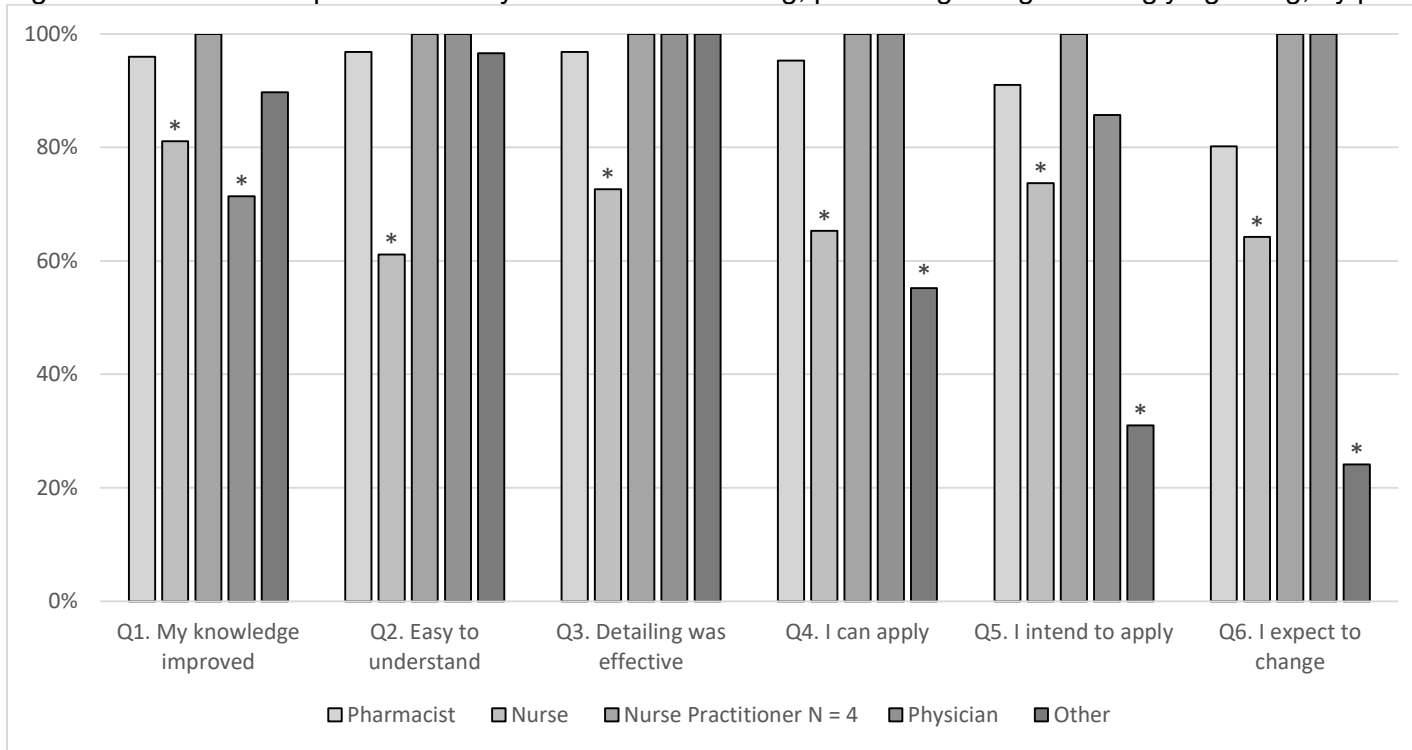
<sup>b</sup> Indicates significantly (p<0.05) different from intervention period.

Figure 1. Immunization provider survey of academic detailing, percent agreeing or strongly agreeing, by setting



\* Significant ( $p < 0.05$ ) differences as compared to community setting.

Figure 2. Immunization provider survey of academic detailing, percent agreeing or strongly agreeing, by provider



\* Significant (p<0.05) differences as compared to pharmacists.