The New Jersey Academy of Family Physicians (NJAFP) Final Report

Improving Pneumococcal Immunization Rates in New Jersey through Collaboration

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Acronyms

AHRQ	Agency for Healthcare Research and Quality
BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CMS	Centers for Medicare & Medicaid Services
CPC	Comprehensive Primary Care initiative
EHR	Electronic Health Record
IHI	Institute for Healthcare Improvement
NCQA	National Committee for Quality Assurance
NJAFP	New Jersey Academy of Family Physicians
PCMH	Patient-Centered Medical Home
PDSA	Plan-Do-Study-Act
QI	Quality Improvement

1. Structure Abstract

Purpose: The overall goal of this project was to increase the numbers of eligible New Jersey residents aged 19 or older who receive pneumococcal vaccinations.

Scope: Streptococcus pneumoniae is a major cause of illness and death in the United States. Pneumococcal disease is the 10th leading cause of death in New Jersey (1). The goal of this project was to address the obstacles that limit eligible adult patients from receiving pneumococcal vaccination, thereby increasing the number of eligible New Jersey residents that are vaccinated, and improving the health and well-being of those patients, and the public, while reducing healthcare costs through reductions in avoidable hospitalization and emergency department visits.

Methods: Baseline (pre-intervention) and remeasurement (post-intervention) data was collected from the 10 practices in the intervention group. This data comprised the total number of patients seen at the practice who were 19 years of age or older, and the number of patients in that age range that had received a pneumococcal vaccination during the defined period. NJAFP provided an educational curriculum aimed at reducing the perceived obstacles to offering and/or administering the available FDA-approved pneumococcal vaccinations. NJAFP also contracted with an independent review vendor to distribute surveys to a group of participating providers, as well as a nonparticipating (i.e., control) group. Quantitative analysis was used to determine the percent change in vaccination rates amongst eligible patients from the participating practices. Qualitative analysis was used to determine the impact that the educational interventions had on the overall mindset of participating providers, and any change in perceived obstacles to administering pneumococcal vaccinations, as well as the effect that access to community partners had practice on day-to-day practice administration related to pneumococcal vaccination.

Results: Increases were seen in pneumococcal vaccination rates for practices in the intervention group in both age groups: patients aged 19 to less than 65 and those 65 years or older. In the first age group, there were a total of 4,139 eligible patients receiving appropriate pneumococcal vaccinations – a growth of 1,273 patients over baseline (22.70% change from baseline). In the second age group, there were a total of 9,030 eligible patients receiving appropriate pneumococcal vaccinations – a growth of 3,386 patients over baseline (22.50% change from baseline).

Qualitative data analysis demonstrated overall improvement across project variables, including that participating providers were more likely than nonparticipants to: identify appropriate patients to receive a pneumococcal vaccine, be knowledgeable about recommended vaccination schedules, and communicate with other local healthcare providers to coordinate care related to pneumococcal vaccinations. In addition, providers responded that they were more consistent with vaccination documentation in their EHRs, in more frequent contact with community resources regarding vaccination of their patients, and more consistent about monitoring vaccination rates in their practice.

Key Words pneumococcal, immunization, New Jersey, NJAFP, Pfizer

2. Purpose (Objectives of Study)

The overall goal of this initiative was to increase the number of New Jersey residents aged 19 or older who receive pneumococcal vaccinations, thereby improving health and well-being, while reducing healthcare costs through reductions in avoidable hospitalization and emergency department visits.

The key objectives of the program were to: 1) increase adult pneumococcal immunizations by approximately 5% by implementing practice protocols to identify, address and overcome physician and patient barriers contributing to low immunization rates; 2) develop and expand activities across vaccine provider and healthcare settings to foster communication and coordination of adult pneumococcal immunization by creating a patient-centered medical community; 3) identify and implement interventions to address and overcome financial barriers related to adult pneumococcal vaccinations; and 4) disseminate educational information via publications, presentations and the development of an online Toolkit containing materials, resources and information to increase pneumococcal immunization rates.

3. Scope

3.1. Background

Streptococcus pneumoniae is a major cause of illness and death in the United States. Pneumococcal disease is the 10th leading cause of death in New Jersey (1). A Behavioral Risk Factor Surveillance System (BRFSS) report ranked New Jersey as the fourth worse state in the US based on an immunization rate of 64.3% (2).

3.2. Settings

Primary care (family medicine and internal medicine specialties) practice locations, included private/independent practices, systems/hospital-owned/employed practices, and residency programs.

3.3. Participants

Primary care teams (i.e., physicians, nurses, care coordinators, medical assistants, etc.) were the target audience for this project. Additional audiences targeted for select interventions included specialists (e.g., cardiologist, pulmonologists, endocrinologists, etc.) and community partners (e.g., local health departments, home care organizations, hospitals, and local pharmacies/pharmacists).

Practice Selection: For this project, NJAFP recruited 20 NCQA-recognized Patient-Centered Medical Home (PCMH) practices with electronic health record (EHR) systems. Interested practices completed a short application form for NJAFP review, which included key information about the practice. Recruitment was based on the number of patients aged 65 or older in the practice, and on practices in counties with a large number of adults aged 65 or older. Enrolled practices were assigned to either an intervention group or a control group. Both groups completed a Letter of Participation that was signed by the lead physician indicating and acknowledging the practice's commitment of time and resources for the project.

Panel Meeting: NJAFP convened a panel of experts to assist in the development of the educational materials and the deployment strategy for this project. The panel included

physicians, a public health professional and a pharmacist. In addition, one panel member served as faculty for an educational session during the project.

3.4. Incidence

Most incidences of pneumococcal disease occur in institutional settings and small, closed communities. When outbreaks of *S. pneumoniae* occur the common theme is over-crowding, which facilitates the transmission of the organism to susceptible populations. Over the last several years, the introduction of vaccines that address the most common serotypes for pneumococcal disease have resulted in a decrease in the incidence of the disease.

3.5. Prevalence

Streptococcus pneumoniae is a major cause of illness and death in the U.S. In 2010, *S. pneumoniae* was responsible for 39,750 cases of disease and 4,000 deaths. The highest incidence of the disease was among children and elderly adults aged 65 or older.

3.6. References

(1) New Jersey Department of Health. *Indicator profile of deaths due to influenza and pneumonia,* Indicator Reports 2011; Available from: http://www4.state.nj.us/dhss-shad/indicator/view/PneuFluDeath.Trend.html.

(2) Table 7_1_2_10_1.3 Adults age 65 and over who ever received pneumococcal vaccination, by State, 2001-2010. Centers for Disease Control and Prevention, Behavioral Risk Factor Surveillance System. http://nhqrnet.ahrq.gov/inhqrdr/data/submit. This report is no longer accessible online.

(3) IHI, The Breakthrough Series: IHI's collaborative model for achieving breakthrough improvement, in IHI Innovation Series white paper2003, Institute for Healthcare Improvement: Boston.

(4) Redfield JR, Wang TW. Improving pneumococcal rate: A three-step approach. *Fam Med*, 2000. 32(5): p. 338-341.

(5) Willis BC et al. Improving influenza, pneumococcal polysaccharide, and hepatitis B vaccination coverage among adults aged <65 years at high risk. *Morbidity and Mortality Weekly Report* 54(RR05) 2005 [cited 2012 July]; Available from: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5405a1.htm.

4. Methods

4.1. Study Design

Based on the intervention and educational model that NJAFP proposed, each participating practice was assigned to a matched practice; intervention group practices were matched with practices from the control group based on a pre-determined set of criteria. Initially, the intervention and control groups each comprised 10 practices; however, one practice was removed from the project.

Baseline data was collected from all enrolled practices for the pre-intervention/pre-education period (defined as January 1, 2012 – December 31, 2012). The intervention and education component of the study commenced in September of 2013 and concluded in September of 2014. Remeasurement data was collected beginning in January of 2015, and

comprised the data period January 1, 2014 – December 31, 2014. Baseline data sets were compared to remeasurement sets for both quantitative and qualitative analysis, as described below.

4.2. Data Sources/Collection

At the initiation of the project, and prior to the implementation of the educational program, NJAFP developed a tool for data collection and requested that each enrolled practice extract a specific data set from their EHR system, and return that data using the provided collection tool. This quantitative data set comprised the number of patients seen from January 01, 2012 through December 31, 2012, who were age 19 or older. The data was then segmented out into the age groups defined for this study (i.e., age 19 to less than age 65 and age 65 or older). This initial data set was used to establish a baseline for comparison at remeasurement, and to determine the number and percentage of patients that received a pneumococcal vaccination.

The Meaningful Use measure, Pneumonia Vaccination Status for Older Adults was one of the metrics used, and provided the percentage of patients 65 years of age or older who had ever received a pneumococcal vaccine at one of the enrolled practices (this measure was endorsed by NQF as measure 0043 and CMS PQRI 111). An additional measure was incorporated for this project, which provided pneumococcal vaccination rates for patients age 19 to less than 65 years who had ever received a pneumococcal vaccination at one of the enrolled practices.

The intervention and education period began in September 2013 and ended in September 2014. Beginning in January of 2015, NJAFP requested that the enrolled practices extract the same data variables that were requested at baseline, but for the following timeframe: January 1, 2014 – December 31, 2014. This data set would be used for remeasurement, and to calculate all change percentages.

The selection of two matched time frames (i.e., calendar years) allowed for the greatest opportunity to align the assessment timeframe from year-to-year. The two points of assessment, including data collected prior to and, following the education, with data collected through the use of one standardized data tool enabled comparative analysis to evaluate the impact of the program on pneumococcal immunization rates. In addition to the quantitative variables collected and analyzed for this study, NJAFP utilized two distinct qualitative measures. NJAFP collected qualitative responses at baseline and remeasurement to determine the impact that the interventions had on such areas as EHR monitoring, and the development of communication within a medical community to foster communication and coordination of adult pneumococcal immunizations. Impact was determined by measuring the percent change in provider response between baseline and remeasurement. Additionally, NJAFP contracted with an independent evaluation company (CE Outcomes) to determine the impact of the provider education component of this project by assessing the knowledge, practice, perceptions, and barriers of providers related to pneumococcal immunizations for adult patients. Efficacy was measured via a survey comprised of patient case-related practice questions and questions designed to evaluate the mindset of enrolled providers as they related to pneumococcal immunization. The responses were collected after the educational component of the project was completed, and were compared to a nonparticipating control group matched by

demographics. Quantitative and qualitative findings are presented in Section 5.1 and Appendix A: Qualitative Data and Analysis.

4.3. Interventions

This project was modeled after the Institute for Healthcare Improvement (IHI) Breakthrough Series model (3). The Breakthrough Series is a collaborative model that assists providers in engaging in rapid cycle Quality Improvement (QI) changes within their practice. The structure of the model provides extensive opportunities for practices to learn how to make identified improvements in practice from topic experts in specific fields while learning from each other, resulting in project outcomes that close the gap between what is known and what is done.

The model uses a short-term learning timeframe, typically six to 12 months, during which time all practice teams come together for three separate learning sessions. Learning sessions are typically attended by three practice team members. These team members then go back to the practice, and during the action period (defined as the time between learning sessions) work with the entire staff to introduce the intended changes through rapid plan-do-study-act (PDSA) cycles, to foster and ensure the implementation of the intended outcomes.

This change model provides an opportunity for practices to follow four actionable steps to bring about a desired change. In the "Plan" stage, practices work to develop the aims or goals of the intervention and the necessary processes that would be needed to drive the desired results. In the "Do" stage, the practice team deploys the plan and collects data to review in the next phase, the "Study" stage. During the Study Stage, the practice team reviews the data and determines if change is happening, and whether the change will bring about the desired outcomes. In the next stage, the "Act" stage, the practice uses the data from the Study Stage to either make corrective actions or continue on course to achieve the desired results.

Several studies foster this intervention strategy, including Redfield and Wang, who documented an increase in pneumococcal vaccination rates for persons aged 65 or older from 56.7% pre-intervention to 75.8% post-intervention (4). In addition, a *Morbidity and Mortality Weekly Report* stated that multiple interventions of this type had the most success in increasing pneumococcal immunization rates among patients who were less than 65 years of age and considered high-risk (5).

This project worked with practices to implement a three-step model of education, prompts and community partner involvement. It began with learning collaboratives comprised of the practice's healthcare team (physician, nurse, office manager, medical assistant). The learning collaborative participants came together in a series of learning sessions and subsequent action periods designed to facilitate increased immunization rates by addressing known patient, physician, and system barriers to immunization. There were a series of three learning sessions and three correlated action periods. The first session comprised NJAFP staff and experts providing the content; with the subsequent action periods and second session working towards the final session where the practice teams and community partners conducted presentations to foster sharing and the spread of best practices and lessons learned.

First Learning Session and Action Period: The first Learning Session provided an educational background on pneumococcal disease and the need to increase immunization rates; explanation of the standing orders for 23-valent pneumococcal polysaccharide vaccine (PPSV23) and 13-valent pneumococcal conjugate vaccine (PCV13); discussions of best practices to increase immunization rates; strategies for data collection and monitoring; and identification of the most appropriate community partners to work in collaboration with the practice. During the learning sessions, practice teams received change packets (i.e., an outline of best practice interventions that can be implemented to initiate desired outcomes). The packets provided access to evidence-based knowledge of proven tactics and methods to drive change and develop an improvement plan to take back to the practice for implementation during the action periods. To assist with development and initiation of the improvement plan, practices also received education regarding the PDSA cycles for rapid change.

In addition, during this session, practices began identifying community partners to invite along with the practice team to the second Learning Session. NJAFP staff conducted site visits during the Action Period to ensure the QI plans were put into action, assessed barriers and challenges being encountered, and assisted the practice in implementing interventions to increase immunization rates. NJAFP provided the practice with communication materials that they could use to engage local partners in immunization efforts, as well as use to invite these partners to future Learning Sessions.

Second Learning Session and Action Period: Due to the complex nature of the immunization recommendations for PCV13 and PPSV23 issued by the Centers for Disease Control and Prevention (CDC), the second Learning Session included a second expanded and enhanced introduction and explanation of the CDC's recommended immunization guidelines for pneumococcal and the NJAFP-developed Standing Orders for both vaccines, and the appropriate administration for both, as well as communication techniques and motivational interviewing training to assess and overcome patient barriers.

The attendees for Learning Session 2 expanded to include local community partners for each practice. The specific focus was on communications, partnerships, and expectations to building a community focused on increasing pneumococcal immunizations and the documentation and reporting of immunization among the local community partners. Communication and coordination across settings and specialties was also addressed; specifically the introduction of compacts between primary care, specialists and community partners. Compacts outline roles and responsibilities for primary care and the coordinating specialists or community partner, as well as communicate expectations and more. Specifically, compacts detail how the primary care practice and the specialist or community partner would work together to coordinate care and services, improve patient outcomes, and communicate and access key patient information.

In addition, best practices to mitigate financial barriers to immunization were discussed. NJAFP staff conducted site visits during the action period to ensure the plan was put into action, assessed barriers and challenges encountered, and assisted the practice in implementing interventions to increase immunization rates. This session addressed system, coordination, and economic barriers to meet key objectives 1, 2, and 3 (as described in Section 2).

Third Learning Session and Action Period: The final Learning Session focused on sharing and spreading best practices, lessons learned and sustaining new community relationships. All of the presentations were from practice teams - on sharing what worked, what did not, successes, materials, resources and sustaining engagement and activities beyond the initial project.

Toolkit: NJAFP developed a Toolkit of best practices and made it available on the NJAFP website as a way to support the continued education of the participating practices, and to increase the scope impact to practices not able to participate, thereby encouraging and fostering increasing pneumococcal immunization rates beyond initial project activities. Based on feedback from the intervention group practices, the practices indicated that the Standing Orders and communication materials provided in NJAFP's Change Packet were the most useful or helpful; therefore these are the materials that were compiled and posted to the NJAFP website.

4.4. Measures

Pre-intervention and post-intervention data sets were collected from all practices in the intervention group. This data included the total number of patients and the total number of patients who received a pneumococcal immunization. The results from this data set are in Table 1.

Measures to monitor and evaluate project activities and all training sessions were developed to serve as criteria to determine what constituted active provider/practice project involvement. Criteria included proxy measures to alert NJAFP staff to potential issues. NJAFP collected this qualitative and quantitative data via learning sessions (e.g., attendance, surveys), and site visits to the practices (e.g., observations, QI plan assessments). NJAFP worked with the practices to assist them in overcoming project participation barriers, when possible.

Case Vignette Assessment Instrument Design

CE Outcomes was contracted by NJAFP to conduct an independent evidence-based outcomes evaluation of provider performance associated with participation in this CME activity to determine its effectiveness.

For this qualitative assessment, participants are defined as the providers (physicians and nurse practitioners) enrolled in the intervention group. Nonparticipants are defined as providers that were not in the intervention group; however these nonparticipants may or may not have been in the control group of this project, and were matched to participating providers based on demographics.

For this facet of the project, case vignettes were designed to assess whether the diagnostic and therapeutic choices of participants were consistent with clinical evidence presented in the content of the educational activity. The case vignettes were also used to assess whether practice choices of participants were different from practice choices of nonparticipants. Additional survey items were included to assess attitudes and barriers associated with pneumococcal vaccination as well as confidence of participating healthcare providers.

Survey Implementation

All surveys were field tested with practicing members of the target audience community and revised based on field testing data prior to implementation. Surveys and data analysis were conducted in conjunction with a practicing expert physician in the therapeutic area of interest.

Survey instruments were distributed by CE Outcomes to educational participants at least 30 days after completing the activity.

The same survey instrument was distributed to a demographically similar group of clinicians who did not attend the CME program, randomly selected from a proprietary database. Surveys were distributed by email, and responses were collected and analyzed in comparison to the responses of the participant (intervention) group.

Analysis

Participant and nonparticipant samples were initially examined to ensure the following:

1. Activity participants were excluded from the nonparticipant sample
2. Non-practicing clinicians were excluded from the study sample

A statistical analysis package for the social sciences (IBM SPSS Statistics 20) was used in data management, extraction and transformation, and statistical analyses. For the case vignette questions, chi-square tests were conducted to detect significant differences between the responses of the participant and nonparticipant groups. T-tests were used to calculate differences between responses of scale questions (e.g., agreement, confidence, barriers). When the analysis involved the comparison of responses where one answer is evidence-based and thus preferred, the P value represents the level of significant difference between the participant groups in the selection of that response. When the analysis involved the comparison of responses where no response is preferred (e.g., in questions that assess confidence), the P value represents the difference in the distribution of response selection between the participant and nonparticipant groups. The level of statistical significance for analytical tests was set at $P \leq 0.10$.

5. Results

5.1. Principal Findings

Intervention Group Quantitative Results: Increases were seen in pneumococcal vaccination rates for practices in the intervention group in both age groups: patients aged 19 to less than 65 and those 65 years or older. In the first age group, there was an increase of 22.70% with a total of 4,139 eligible patients receiving appropriate pneumococcal vaccinations – a growth of 1,273 patients over baseline. In the second age group, there was an increase of 22.50%, with a total of 9,030 eligible patients receiving appropriate pneumococcal vaccinations – a growth of 3,386 patients over baseline.

Note: The post-intervention rate for patients in the group aged 19 to less than 65 years group was 22.70%. This change does not reflect the true improvement seen with this age group due to a limitation in how data was collected and extracted from EHR systems (see Section 5.3 for more detail).

Table 1: Intervention Group Results

	Baseline			Remeasurement			% Change
	# of patients in practices	# of patients with current pneumococcal vaccine	% of patients with current pneumococcal vaccine	# of patients in practices	# of patients with current pneumococcal vaccine	% of patients with current pneumococcal vaccine	
Age 19 to <65	38,556	2,866	7.4%	45,378	4,139	9.1%	22.70%
Age ≥65	12,554	5,644	45.0%	16,391	9,030	55.1%	22.50%

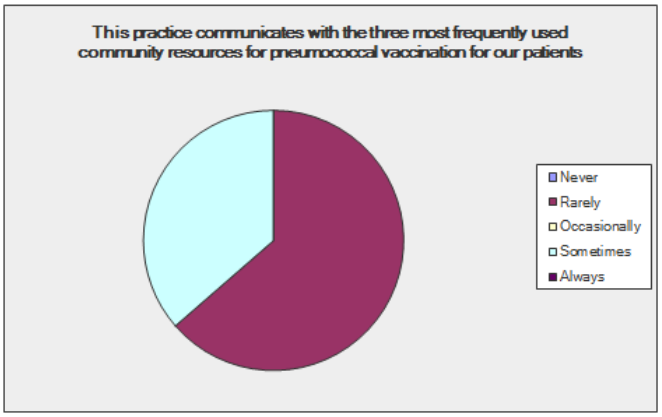
NJAFP Qualitative Assessment Results: A qualitative survey was distributed to practices pre- and post-intervention to assess the extent to which the practice had advanced from a patient-centered practice to a patient-centered community. This survey was also given to the control group practices for comparison. The qualitative survey assessed the practice's engagement and relationships with external partners, as well as systemic changes that may have been made in the practice. The analysis of this data provided an assessment regarding the practice's involvement with immunization coordination activities prior to intervention and after project completion. This survey also assessed the practice's communications with external partners (e.g., specialists, health departments, home care, hospitals and pharmacists) pre-and post-intervention. In addition, the survey assessed systems the practice had in place to monitor pneumococcal immunization rates for their patient population. NJAFP staff validated survey responses via on-site visits and review of communication documentation provided by the practice.

There was an expectation that improvement in the qualitative survey would also result in practice-wide changes, such as those practices that previously indicated "no to little involvement or engagement with community partners" would increase to "some or moderate involvement with community partners," and those that indicated "no to little monitoring of practice pneumococcal immunization rates" would increase to "sometimes or always monitor the practice's pneumococcal immunization rates" at the conclusion of the project.

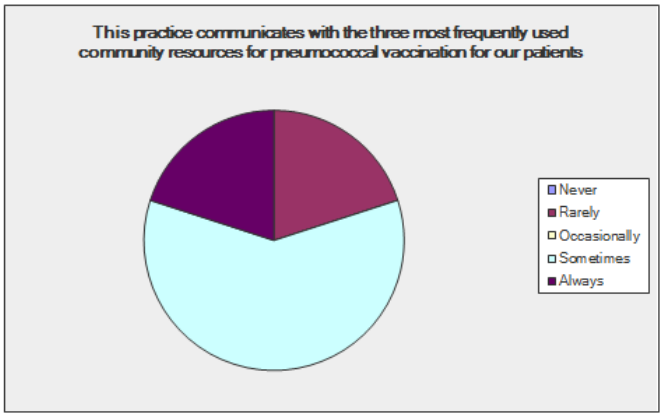
Improvements were seen across the board when pre-intervention responses were compared with post-intervention responses. The following demonstrate these improvements:

- "This practice monitors pneumococcal vaccination rates"
  - 100% increase in the number of providers who answered this statement "quarterly" at baseline
- "Pneumococcal vaccines provided in the community are consistently documented in the EHR"
  - 54% increase in the number of providers who answered this statement "always" at baseline

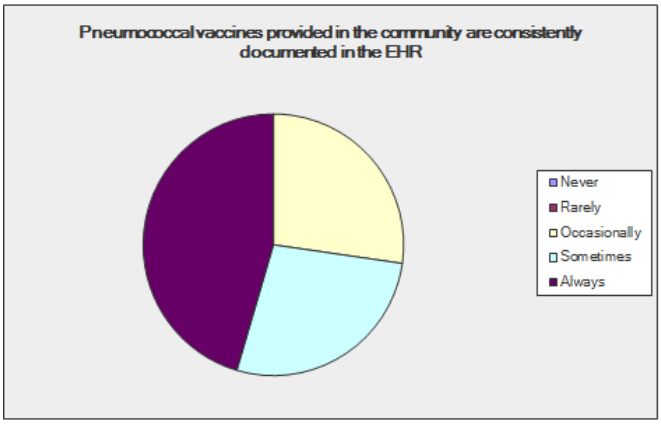
Pneumococcal Immunization Qualitative Assessment – Baseline	
This practice communicates with the three most frequently used community resources for pneumococcal vaccination for our patients	
Answer Options	**Response Percent**
Never	0.0%
Rarely	63.6%
Occasionally	0.0%
Sometimes	36.4%
Always	0.0%



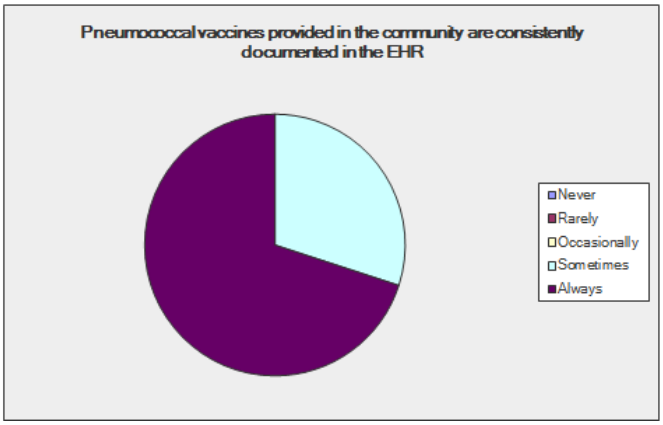
Pneumococcal Immunization Qualitative Assessment – Remeasurement	
This practice communicates with the three most frequently used community resources for pneumococcal vaccination for our patients	
Answer Options	**Response Percent**
Never	0.0%
Rarely	20.0%
Occasionally	0.0%
Sometimes	60.0%
Always	20.0%



Pneumococcal Immunization Qualitative Assessment – Baseline	
Pneumococcal vaccines provided in the community are consistently documented in the EHR	
Answer Options	**Response Percent**
Never	0.0%
Rarely	0.0%
Occasionally	27.3%
Sometimes	27.3%
Always	45.5%

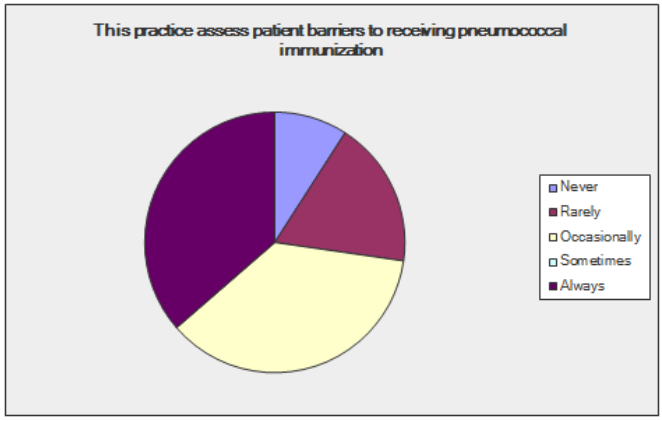


Pneumococcal Immunization Qualitative Assessment – Remeasurement	
Pneumococcal vaccines provided in the community are consistently documented in the EHR	
Answer Options	**Response Percent**
Never	0.0%
Rarely	0.0%
Occasionally	0.0%
Sometimes	30.0%
Always	70.0%



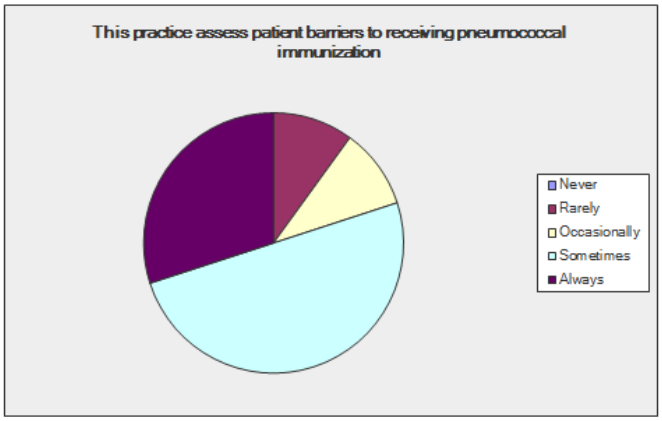
Pneumococcal Immunization Qualitative Assessment – Baseline

This practice assess patient barriers to receiving pneumococcal immunization	
Answer Options	**Response Percent**
Never	9.1%
Rarely	18.2%
Occasionally	36.4%
Sometimes	0.0%
Always	36.4%



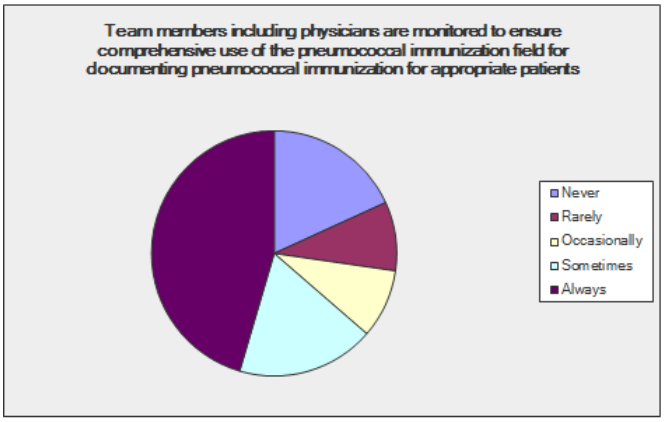
Pneumococcal Immunization Qualitative Assessment – Remeasurement

This practice assess patient barriers to receiving pneumococcal immunization	
Answer Options	**Response Percent**
Never	0.0%
Rarely	10.0%
Occasionally	10.0%
Sometimes	50.0%
Always	30.0%



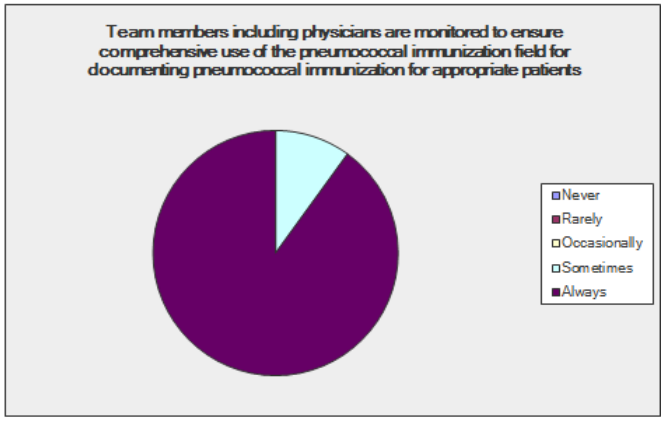
Pneumococcal Immunization Qualitative Assessment – Baseline

Team members including physicians are monitored to ensure comprehensive use of the pneumococcal immunization field for documenting pneumococcal immunization for appropriate patients	
Answer Options	**Response Percent**
Never	18.2%
Rarely	9.1%
Occasionally	9.1%
Sometimes	18.2%
Always	45.5%



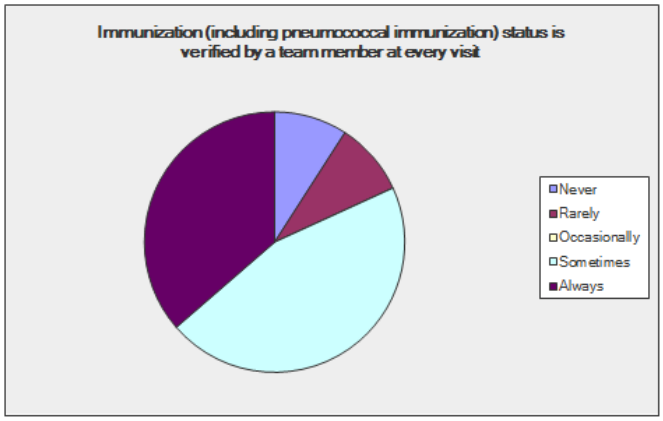
Pneumococcal Immunization Qualitative Assessment – Remeasurement

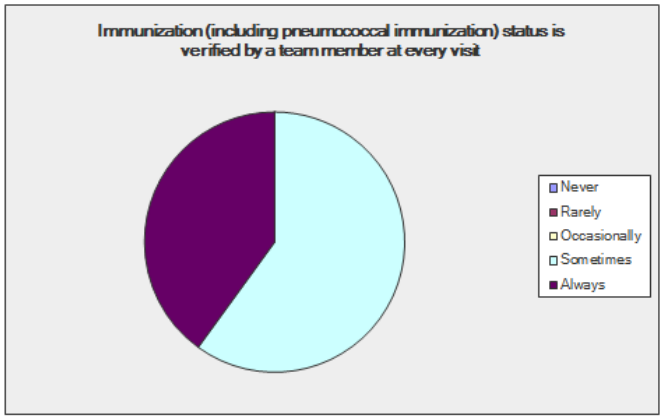
Team members including physicians are monitored to ensure comprehensive use of the pneumococcal immunization field for documenting pneumococcal immunization for appropriate patients	
Answer Options	**Response Percent**
Never	0.0%
Rarely	0.0%
Occasionally	0.0%
Sometimes	10.0%
Always	90.0%



Pneumococcal Immunization Qualitative Assessment - Baseline	
Immunization (including pneumococcal immunization) status is verified by a team member at every visit	
Answer Options	**Response Percent**
Never	9.1%
Rarely	9.1%
Occasionally	0.0%
Sometimes	45.5%
Always	36.4%

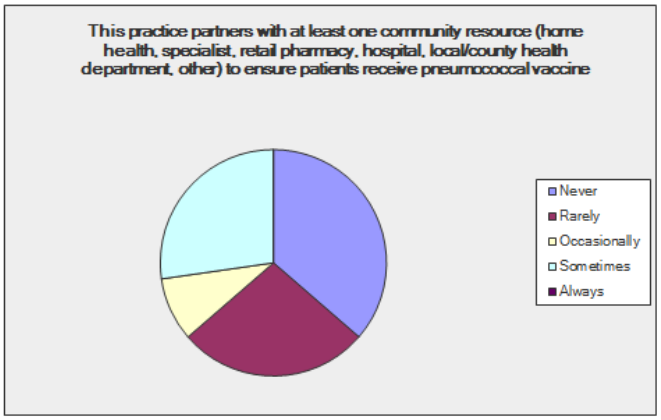
Pneumococcal Immunization Qualitative Assessment - Remeasurement	
Immunization (including pneumococcal immunization) status is verified by a team member at every visit	
Answer Options	**Response Percent**
Never	0.0%
Rarely	0.0%
Occasionally	0.0%
Sometimes	60.0%
Always	40.0%

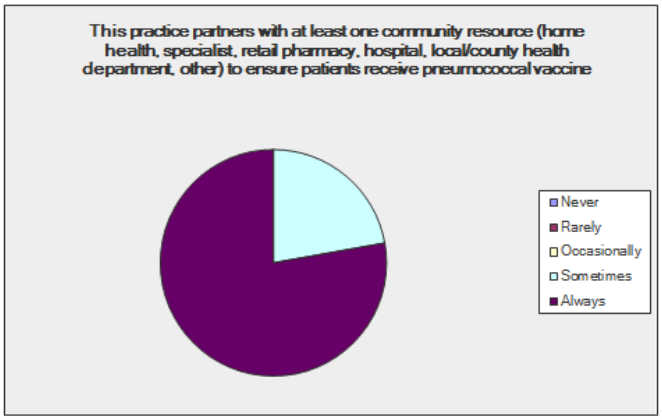




Pneumococcal Immunization Qualitative Assessment - Baseline	
This practice partners with at least one community resource (home health, specialist, retail pharmacy, hospital, local/county health department, other) to ensure patients receive pneumococcal vaccine	
Answer Options	**Response Percent**
Never	36.4%
Rarely	27.3%
Occasionally	9.1%
Sometimes	27.3%
Always	0.0%

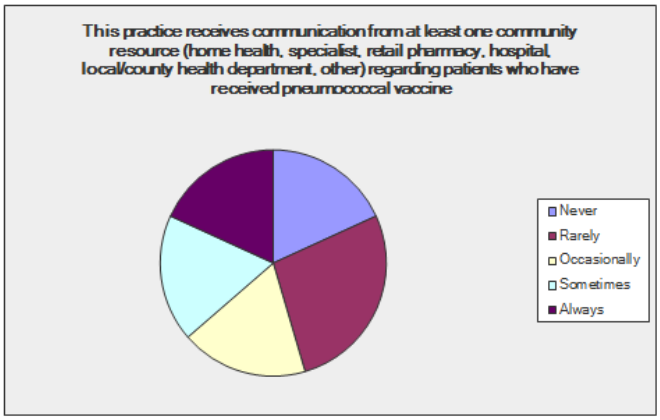
Pneumococcal Immunization Qualitative Assessment - Remeasurement	
This practice partners with at least one community resource (home health, specialist, retail pharmacy, hospital, local/county health department, other) to ensure patients receive pneumococcal vaccine	
Answer Options	**Response Percent**
Never	0.0%
Rarely	0.0%
Occasionally	0.0%
Sometimes	22.2%
Always	77.8%

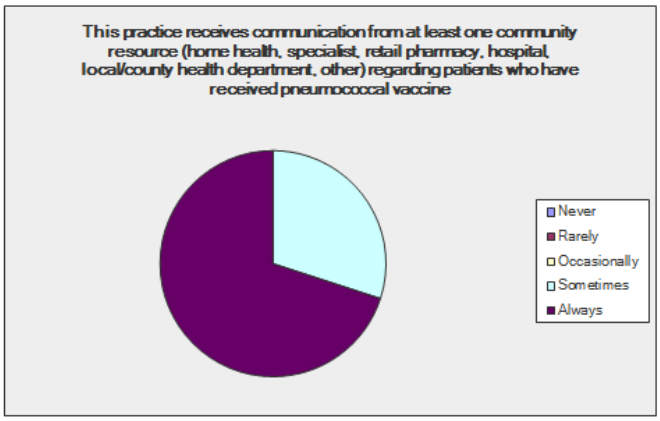




Pneumococcal Immunization Qualitative Assessment - Baseline	
This practice receives communication from at least one community resource (home health, specialist, retail pharmacy, hospital, local/county health department, other) regarding patients who have received pneumococcal vaccine	
Answer Options	**Response Percent**
Never	18.2%
Rarely	27.3%
Occasionally	18.2%
Sometimes	18.2%
Always	18.2%

Pneumococcal Immunization Qualitative Assessment - Remeasurement	
This practice receives communication from at least one community resource (home health, specialist, retail pharmacy, hospital, local/county health department, other) regarding patients who have received pneumococcal vaccine	
Answer Options	**Response Percent**
Never	0.0%
Rarely	0.0%
Occasionally	0.0%
Sometimes	30.0%
Always	70.0%

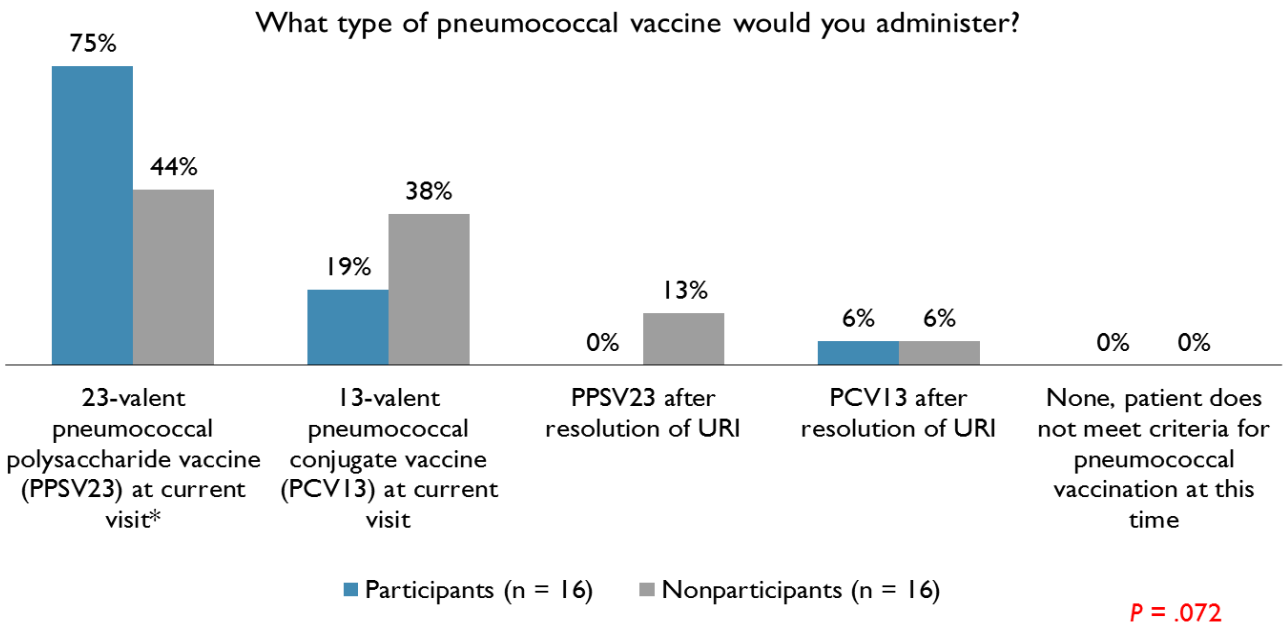




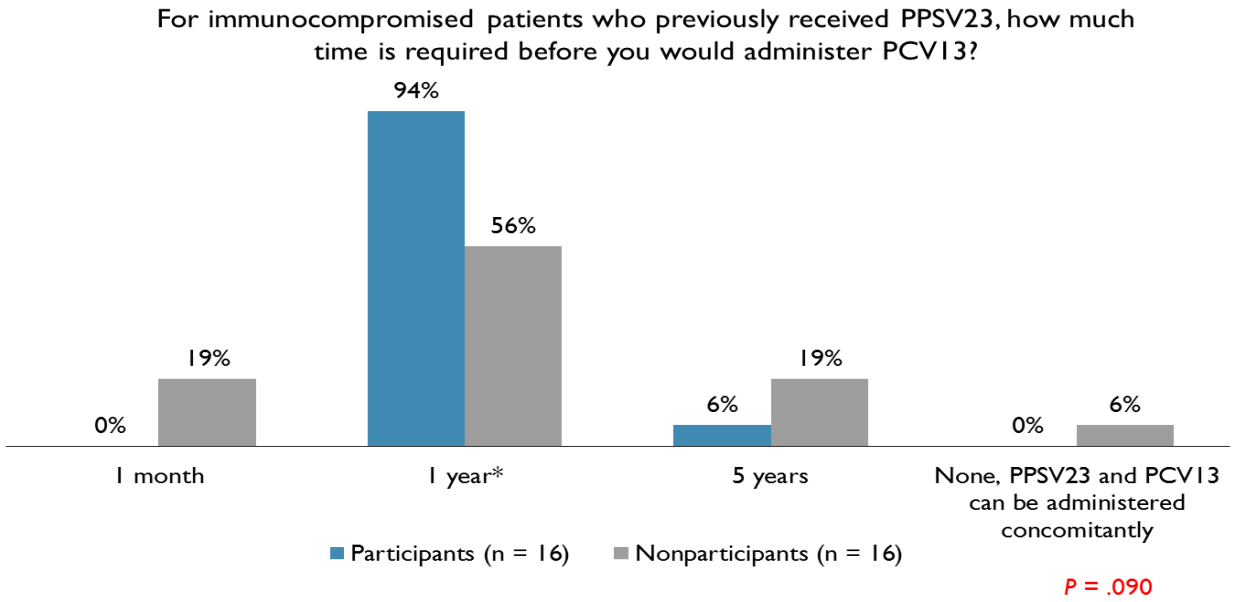
Qualitative Results – Participants vs. Nonparticipants: Based on the qualitative data analysis, CE Outcomes found that participating providers (as compared to nonparticipating providers' data) were more likely to:

- identify appropriate patients to receive a pneumococcal vaccine
- be knowledgeable about recommended vaccination schedules
- communicate with other local healthcare providers to coordinate care related to pneumococcal vaccinations
- agree that coordinating this care is an effective method of improving the quality of patient care
- be significantly more likely than nonparticipants to have reviewed practice data regarding pneumococcal vaccinations in the past three months. Following are some samples of the qualitative findings (all CE Outcomes qualitative data findings can be seen in Appendix A: Qualitative Data and Analysis).

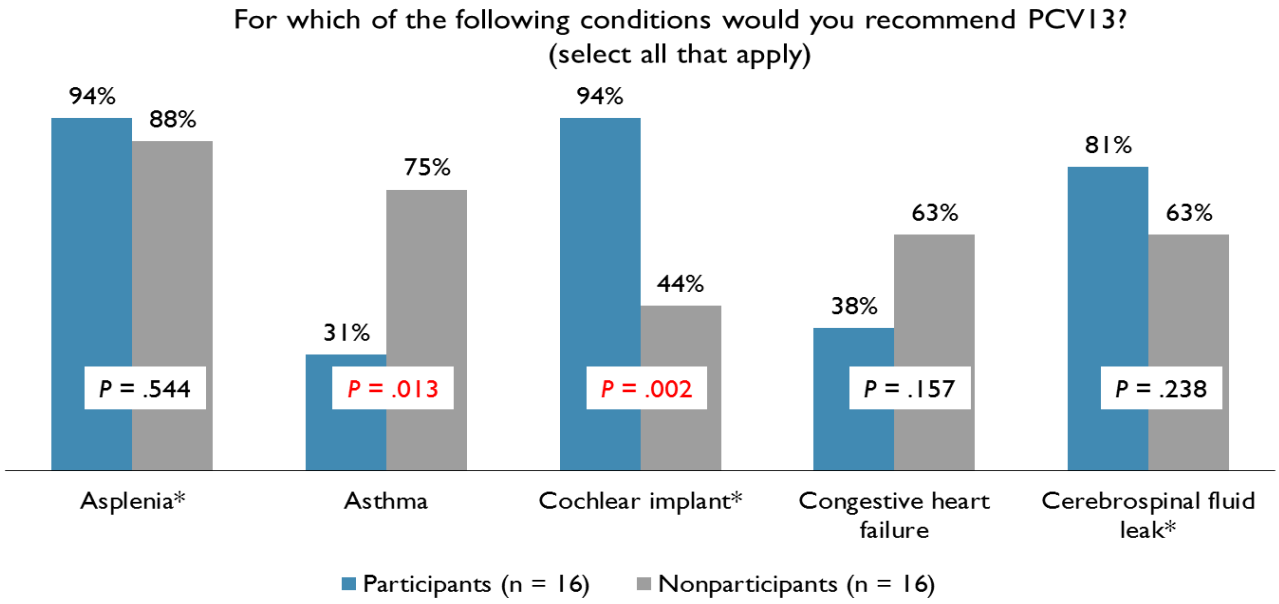
CASE: A 60-year-old man presents to you for a routine wellness examination. He states that he is recovering from an upper respiratory infection (URI) with resolving rhinorrhea but otherwise feels well. His medical history is significant for diabetes mellitus, currently controlled with metformin. He does not recall his vaccination history but states that his last immunization was likely his "childhood shots." On exam he is afebrile with mildly inflamed nasal mucosa. Otherwise the remainder of the exam was normal.



ANALYSIS: Three-fourths of participants, compared to under half of nonparticipants, would appropriately administer PPSV23 to a 60-year-old patient presenting with an unresolved respiratory infection (URI) with unknown vaccination history. The education clearly had an effect on the choice of clinicians, and nonparticipant survey results indicate that continued dissemination of vaccination guidelines is needed.

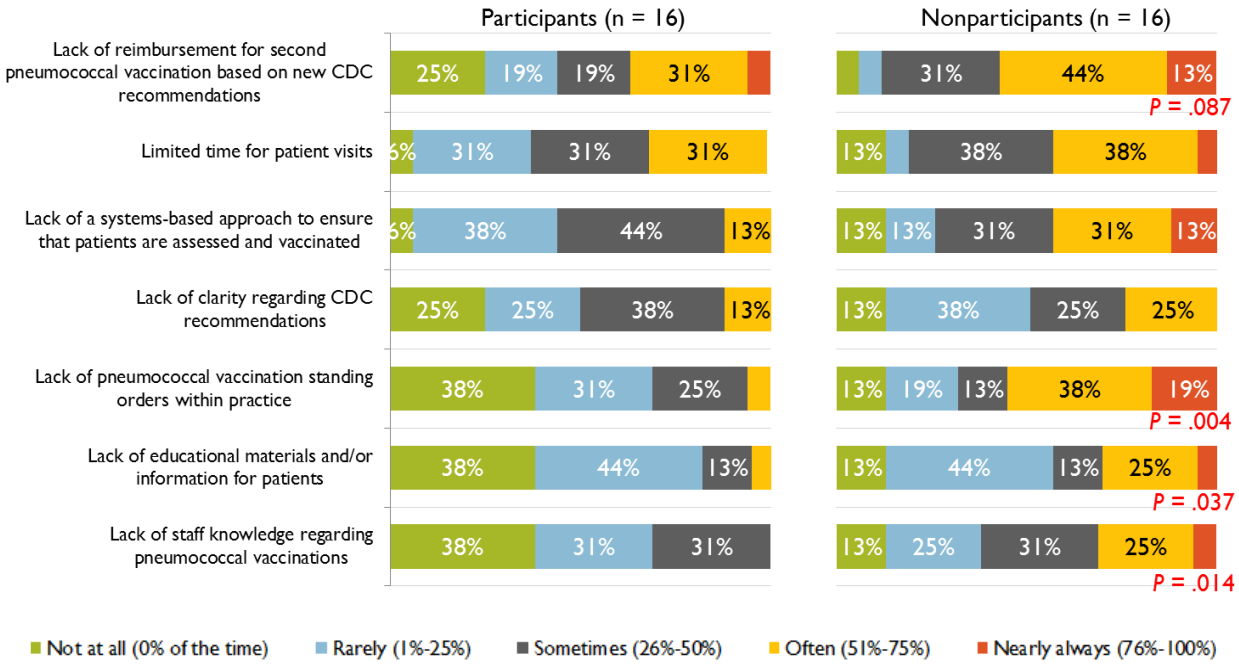


ANALYSIS: Participants were significantly more likely than nonparticipants to recognize that an interval of a year is required to administer PCV13 for an immunocompromised patient who previously received PPSV23. Again, the education was shown to be effective as nearly all participants recognized this timing requirement of PCV13, compared to just over half of nonparticipants.



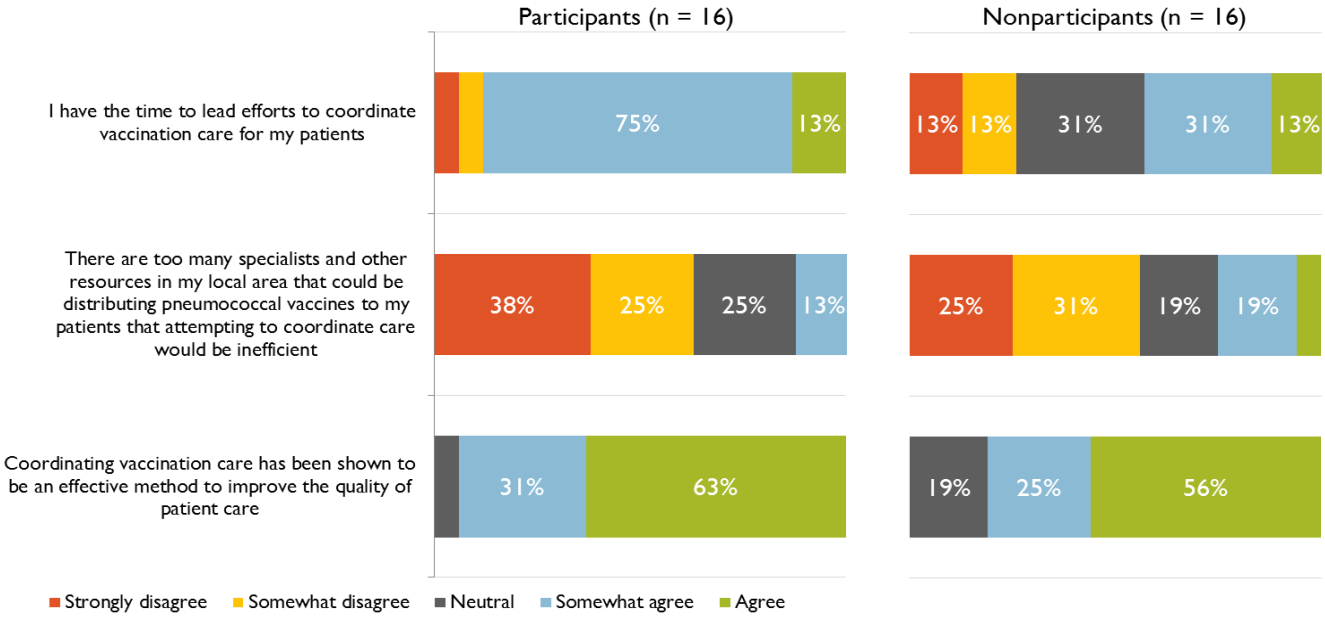
ANALYSIS: The majority of participants would recommend a PCV13 for patients with immunocompromising conditions, such as asplenia, cochlear implant, and cerebrospinal fluid leak. Compared to nonparticipants, participants were significantly more likely to indicate that they would give PCV13 to patients with a cochlear implant and significantly less likely to give it to patients with asthma. 44% of participants would recommend PCV13 to all 3 appropriate patients without giving it to any inappropriate patients (compared to 6% of nonparticipants, $P = .014$).

Please indicate how often the following barriers impede your ability to provide pneumococcal vaccinations to your patients:

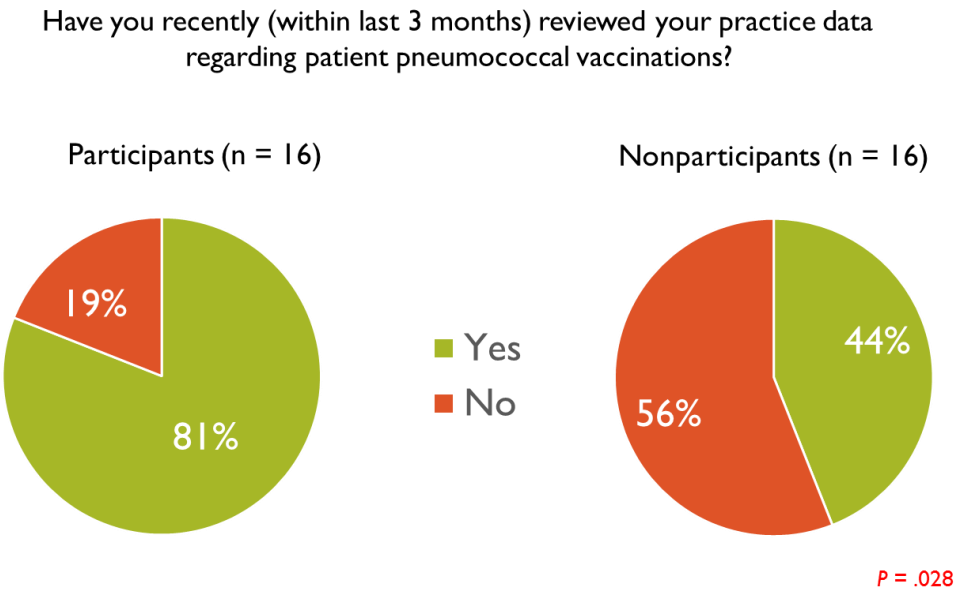


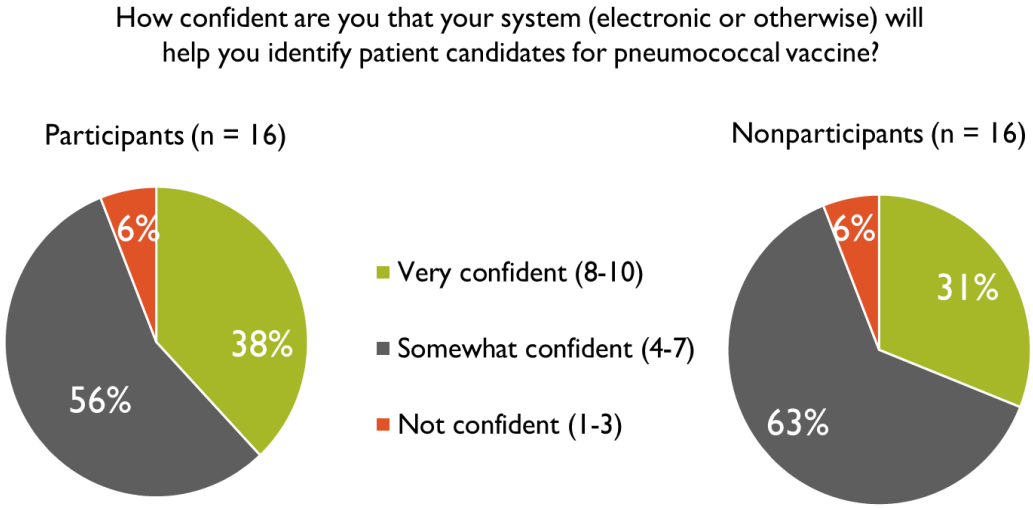
ANALYSIS: The main physician/system barriers to pneumococcal vaccination are lack of reimbursement and limited time. Participants are significantly less likely than nonparticipants to find lack of reimbursement, lack of standing orders, lack of educational materials, and lack of staff knowledge to be barriers to care.

Please indicate your agreement with the following issues regarding coordinating care for pneumococcal vaccinations?



ANALYSIS: Nearly all participants "agree" or "strongly agree" that they have the time to lead efforts to coordinate vaccination care and that coordinating care has been shown to be an effective method to improve the quality of patient care. Nonparticipants are more reluctant to indicate that they have time to do so, reflecting the effectiveness of the education. Participants and nonparticipants both appear unsure about how efficient coordinating care may be, which may indicate an opportunity for future educational efforts.





ANALYSIS: Participants are significantly more likely than nonparticipants to have reviewed practice data regarding pneumococcal vaccinations in the previous three months. Nonparticipant data indicates that future education should continue to focus on strategies and tools to review practice vaccination data.

Participants and nonparticipants are nearly identical in their confidence that their system will help them identify patient candidates for pneumococcal vaccinations.

5.2. Outcomes

Notable increases in pneumococcal vaccination rates appear to be a result of the QI activities developed by the Intervention Group, and the educational curriculum and assistance provided by the NJAFP team. The administration of pneumococcal vaccinations for patients in the age 19 to less than 65 group increased by 22.70%; and by 22.50% in the 65 years or older group. This initiative far exceeded the project goal of a 5% increase in the administration of pneumococcal vaccinations.

The intervention and educational aspects of this project occurred simultaneously. While our analysis does not include a method for demonstrating correlation or causation, our results demonstrate both a larger than anticipated increase in pneumococcal vaccinations rates for the eligible population, and a statistically significant improvement in the mindset and knowledge of participating providers. A reasonable conclusion can be made that the intervention and educational aspects of this project had a positive impact on the change in appropriate pneumococcal vaccination rates, as well as the mindset of participating providers regarding the administration of pneumococcal vaccinations.

5.3. Limitations

EHR Limitations: Initially, the timeframe for the baseline and remeasurement data sets was designed to be a three-month period comprising Quarter 4 of 2012 and Quarter 4 of 2014. Due to limitations with the extraction capabilities of the practices' EHR systems, this data could not be accurately pulled for a quarter. NJAFP modified the data set timeframes to comprise a year for both baseline and remeasurement. Baseline data sets included data pulled from January 1, 2012 through December 31, 2012; remeasurement data sets included data pulled from January 1, 2014 through December 31, 2014.

Due to limitations with EHR data collection and extraction functionality, data reports providing the total number of patients ages 19 and up that were eligible for a pneumococcal vaccination were not able to be generated. NJAFP modified the data set requirements to include all patients ages 19 and up that had been seen in the enrolled practices. We compensated for this alteration in study design by focusing on the percent change from baseline, rather than on actual number of patients vaccinated.

These flaws need to be addressed by EHR vendors, and possibly future QI initiatives.

Practice Retention Limitations: Following the baseline data collection from the 10 enrolled control group practices, NJAFP had to dis-enroll one practice out of the project. The 1:1 ratio of intervention practice to control practice was an important initial aspect of the study design. In addition, intervention and education processes were already underway. For these reasons, it was determined that our analysis would focus more on the improvement vaccination rates, and the likely connection between those improvements and the intervention and educational programs included in this project for the intervention group. While this shift from our initial study design changed the available methods for determining the statistical significance of the quantitative changes seen, the results still far exceeded the anticipated change percent in vaccination rates. As the statistical significance of the improvements seen in the qualitative data are demonstrable, we believe it is within reason to draw a conclusion that the improvement in appropriate vaccination rates was related (if not contingent upon) the education and intervention provided to the participants in the intervention group.

5.4. Discussion

Several audiences directly utilized and benefited from the project and its outcomes. First, patients received better care through increased immunizations, mitigating pneumococcal disease and pneumococcal complications. A total of 13,169 patients in both age groups received vaccinations, an increase of 4,659 patients over baseline. Second, the community benefited through increased herd immunity, improved community health, and potential

reduction of healthcare costs due to avoidable hospitalizations and emergency department use. Third, physicians, multi-disciplinary team members, health plans, health systems and community partners were positively affected by increasing pneumococcal immunizations through enhanced communications, and more efficient and effective use of resources. Communication and coordination of immunizations resulted in primary care staff spending less time and resources to determine patients' immunization status and outreaching to already immunized patients, as well as reducing duplication of immunizations. Practice staff benefited through the anticipated increase in utilization of standing orders to administer and increase pneumococcal immunization. Fourth, the overall health system directly benefited from the project outcomes via a reduction in costly hospital admissions and emergency department visits.

5.5. Conclusions

Based on both the quantitative and qualitative data analyses, the interventions and educational curriculum of this project yielded the desired result. The project resulted in an increase in pneumococcal vaccination rates that surpassed the anticipated project outcome of 5%.

The limitations encountered with the EHR system capabilities is a factor that may resolve with increased implementation and utilization of EHR systems, and is one that could be circumvented by having the practices work with the EHR vendor in advance to ensure that collection and extraction capabilities meet the requirements of the defined data set. The impact of this limitation in regards to the results of this project is undefinable, although it can be surmised that the immunization rate of the aged19 to less than 65 year old group would have been higher if the denominator had only included eligible patients.

The barriers introduced by the complexity of the CDC's immunization recommendations can be circumvented in a multitude of ways. First, NJAFP has developed a full set of standing orders for both PCV13 and PPSV23, which could be adopted for a future project, and would assist in interpreting the CDC's guidelines. Second, a future project could provide pre-recorded training sessions that could be made available online for repeated reference by enrolled practices. Third, additional on-hand education and reference materials could be developed and distributed for practices to access before or during patient visits. Reviewing the CDC guidelines during the second Learning Session was a necessary event for this project, but could be avoided in future initiatives by preparing more educational resources for practices to access.

6. List of Publications and Products

I. Miller, C. Using New Guidelines for Administering Pneumococcal Vaccinations in Adults. *Perspectives: A View of Fam Med in NJ*. 2015 Jun; 14 (1, 2): 15-6.

II. Miller, C. Primary Care Practices Take Steps to Increase Pneumococcal Vaccination in New Jersey. *Perspectives: A View of Fam Med in NJ*. 2015 Jun; 14 (1, 2): 18.

III. Cardea C, DiFerdinando G. Pneumococcal Immunization Updates and Standing Orders. 2015 Advanced Topics in Healthcare Delivery Symposium; 2015 Jun 11; Atlantic City, New Jersey: New Jersey Academy of Family Physicians.

IV. DiFerdinando G, Maffei M, Cardea C. Pneumococcal Immunization Update. 2015 Advanced Topics in Healthcare Delivery Symposium; 2015 Jun 12; Atlantic City, New Jersey: New Jersey Academy of Family Physicians.
V. DiFerdinando G. Use of 13-Valent Pneumococcal Conjugate Vaccine and 23-Valent Pneumococcal Polysaccharide Vaccine Among Adults Aged ≥ 65 Years: New Pneumococcal Vaccination Guidelines. Pneumococcal Immunization Project WebEx; 2014 Nov 11; Online: New Jersey Academy of Family Physicians.
VI. Pneumococcal Immunization Toolkit for Practices. New Jersey Academy of Family Physicians. Pfizer Grant No. 434 012. http://njafp.org/About%20NJAFP/Programs/Partnership/Pneumococcal%20Vaccination%20Quality%20Improvement%20Collaborative/Pneumoco. Accessed 2015 Aug 24.

Appendix A: Qualitative Data and Analysis

Demographics of Sample

		Participants (n = 16)	Nonparticipants (n = 16)
Degree, %	MD/DO	87%	100%
	NP	13%	0%
Years since graduation, mean (range)		20 (4-37)	29 (14-42)
Specialty	Internal medicine	13%	13%
	Family medicine	87%	87%
Gender	Male	69%	69%
	Female	31%	31%
Location of practice	Urban	0%	31%
	Suburban	100%	56%
	Rural	0%	13%
Practice setting	Solo	0%	25%
	Group	81%	63%
	Government	0%	6%
	Other*	19%	6%
Major professional activity	Direct patient care	81%	100%
	Medical education	19%	0%
Patients seen per week, mean (range)		78 (20-150)	93 (45-120)
Percent patients aged 65 or older?	1%-25%	19%	25%
	26%-50%	44%	38%
	51%-75%	31%	38%
	76%-100%	6%	0%
Using EHR system in practice, %		100%	75%

*Other practice setting includes: residency, hospital clinic, and free clinic

Analyses of responses to the survey questions are presented below. In the graphs below, percentages have been rounded to the nearest whole number and asterisks (*) indicate evidence-based responses where appropriate.

Asterisks indicate the content-based or evidence-based responses. P-values indicate significance of differences between the selections of education participants and control nonparticipants. For rating questions, the P values indicate the significance of the difference between the means.

CASE: A 60-year-old man presents to you for a routine wellness examination. He states that he is recovering from an upper respiratory infection with resolving rhinorrhea but otherwise feels well. His medical history is significant for diabetes mellitus, currently controlled with metformin.

He does not recall his vaccination history but states that his last immunization was likely his "childhood shots." On exam he is afebrile with mildly inflamed nasal mucosa. Otherwise the remainder of the exam was normal.

1. What type of pneumococcal vaccine would you administer? (select only one)

	Participant		Nonparticipant	
	N	%	N	%
23-valent pneumococcal polysaccharide vaccine (PPSV23) at current visit*	12	75%	7	44%
13-valent pneumococcal conjugate vaccine (PCV13) at current visit	3	19%	6	38%
PPSV23 after resolution of URI	0	0%	2	13%
PCV13 after resolution of URI	1	6%	1	6%
None, patient does not meet criteria for pneumococcal vaccination at this time	0	0%	0	0%
Total Respondents	16	100%	16	100%

P = .072

2. For which of the following conditions would you recommend PCV13? (select all that apply)

	Participant		Nonparticipant	
	N	%	N	%
Asplenia* (*P* = .544)	15	94%	14	88%
Asthma (*P* = .013)	5	31%	12	75%
Cochlear implant* (*P* = .002)	15	94%	7	44%
Congestive heart failure (*P* = .157)	6	38%	10	63%
Cerebrospinal fluid leak* (*P* = .238)	13	81%	10	63%
Total Respondents	16	100%	16	100%

Q2. For which of the following conditions would you recommend PCV13? (select all that apply)

	Participant		Nonparticipant	
	N	%	N	%
Chose inappropriate responses or not all appropriate responses	9	56%	15	94%
All appropriate responses, no inappropriate responses	7	44%	1	6%
Total Respondents	16	100%	16	100%

P = .014

3. For immunocompromised patients who previously received PPSV23, how much time is required before you would administer PCV13? (select only one)

	Participant		Nonparticipant	
	N	%	N	%
1 month	0	0%	3	19%
1 year*	15	94%	9	56%
5 years	1	6%	3	19%
None, PPSV23 and PCV13 can be administered concomitantly	0	0%	1	6%
Total Respondents	16	100%	16	100%

4. Have you recently (last 12 months) communicated with other local healthcare providers or clinics to coordinate care and information regarding patient pneumococcal vaccinations (ie, ensure patient history is accurate, ensure patients have access to vaccinations)? (select only one)

	Participant		Nonparticipant	
	N	%	N	%
Yes	12	75%	9	56%
No	4	25%	7	44%
Total Respondents	16	100%	16	100%

4a. [If yes] What have you done to coordinate care regarding patient pneumococcal vaccinations?

	Participant		Nonparticipant	
	N	%	N	%
	4	25%	7	44%
Call	0	0%	1	6%
call my local comm hospital	0	0%	1	6%
Called local hospitals and specialists office to check if my patient received pneumococcal vaccination at their site. Also logged into local hospital's electronic medical record system to check immunization status of patient.	1	6%	0	0%
Common EHR	1	6%	0	0%
Communication with local pharmacies and hospitals to ensure vaccination was performed.	1	6%	0	0%
Discussing current guidelines and insurance coverage	1	6%	0	0%
discuuse indicationns	1	6%	0	0%
enter updated accurate vaccination info in the EMR (which is seem by other offices outside of ours since we share the same EMR record across our medical group)	1	6%	0	0%

Get monthly updates from our hospital about which patients have received Pneumovax while in the hospital.	1	6%	0	0%
immunization recommendations regarding prevnar 13 and pneumovax should be separated by 8 weeks	0	0%	1	6%
Obtain records from other providers including physician practices and hospitals.	1	6%	0	0%
Obtaining previous records form prior physicians, hospitalizations and pharmacy records	1	6%	0	0%
Partnered with Medford Family Pharmacy in our medical building to ensure all eligible patients were vaccinated	1	6%	0	0%
request vaccine records	0	0%	1	6%
Reviewed requested immunization record	0	0%	1	6%
seminar	0	0%	1	6%
speak to patients	0	0%	1	6%
spoken with local home care agencies who visit my patients who are shut in's	0	0%	1	6%
The specialists will send me a message and remind the pts to see me for an immunization update via our EMR	0	0%	1	6%
To ensure office staff relays accurate and timely information regarding the new vaccine to eligible patients.	1	6%	0	0%
try to obtain records from hospital or outpt site where vaccine may have been given	1	6%	0	0%
Total Respondents	16	100%	16	100%

5. Please indicate your agreement with the following issues regarding coordinating care for pneumococcal vaccinations? (select one for each)

I have the time to lead efforts to coordinate vaccination care for my patients

	Participant		Nonparticipant	
	N	%	N	%
Strongly Disagree	1	6%	2	13%
Somewhat Disagree	1	6%	2	13%
Neutral	0	0%	5	31%
Somewhat Agree	12	75%	5	31%
Strongly Agree	2	13%	2	13%
Total Respondents	16	100%	16	100%

I have the time to lead efforts to coordinate vaccination care for my patients

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	3.81	16	3.19

P = .121

There are too many specialists and other resources in my local area that could be distributing pneumococcal vaccines to my patients that attempting to coordinate care would be inefficient

	Participant		Nonparticipant	
	N	%	N	%
Strongly Disagree	6	38%	4	25%
Somewhat Disagree	4	25%	5	31%
Neutral	4	25%	3	19%
Somewhat Agree	2	13%	3	19%
Strongly Agree	0	0%	1	6%
Total Respondents	16	100%	16	100%

There are too many specialists and other resources in my local area that could be distributing pneumococcal vaccines to my patients that attempting to coordinate care would be inefficient

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	2.13	16	2.50

P = .376

Coordinating vaccination care has been shown to be an effective method to improve the quality of patient care

	Participant		Nonparticipant	
	N	%	N	%
Strongly Disagree	0	0%	0	0%
Somewhat Disagree	0	0%	0	0%
Neutral	1	6%	3	19%
Somewhat Agree	5	31%	4	25%
Strongly Agree	10	63%	9	56%
Total Respondents	16	100%	16	100%

Coordinating vaccination care has been shown to be an effective method to improve the quality of patient care

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	4.56	16	4.38

P = .469

6. Have you recently (within last 3 months) reviewed your practice data regarding patient pneumococcal vaccinations? (select only one)

	Participant		Nonparticipant	
	N	%	N	%
Yes	13	81%	7	44%
No	3	19%	9	56%
Total Respondents	16	100%	16	100%

P = .028

7. Please indicate the significance of each of the following patient barriers in your practice regarding pneumococcal vaccinations? (select one for each)

Lack of patient understanding of the risks of preventable disease

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	6.06	16	5.94

P = .871

Lack of patient understanding of the risks of preventable disease

	Participant		Nonparticipant	
	N	%	N	%
Not significant (1-3)	2	13%	2	13%
Somewhat significant (4-7)	10	63%	10	63%
Very significant (8-10)	4	25%	4	25%
Total Respondents	16	100%	16	100%

Lack of patient knowledge of his or her own vaccination status

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	6.63	16	7.00

P = .565

Lack of patient knowledge of his or her own vaccination status

	Participant		Nonparticipant	
	N	%	N	%
Not significant (1-3)	1	6%	1	6%
Somewhat significant (4-7)	9	56%	7	44%
Very significant (8-10)	6	38%	8	50%
Total Respondents	16	100%	16	100%

Patient assumption that healthy individuals do not need vaccination

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	6.63	16	6.94

P = .705

Patient assumption that healthy individuals do not need vaccination

	Participant		Nonparticipant	
	N	%	N	%
Not significant (1-3)	2	13%	2	13%
Somewhat significant (4-7)	8	50%	6	38%
Very significant (8-10)	6	38%	8	50%
Total Respondents	16	100%	16	100%

Patient fear of safety of vaccination (ie, side effects, adverse events, can cause disease)

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	6.25	16	6.50

P = .700

Patient fear of safety of vaccination (ie, side effects, adverse events, can cause disease)

	Participant		Nonparticipant	
	N	%	N	%
Not significant (1-3)	1	6%	1	6%
Somewhat significant (4-7)	11	69%	7	44%
Very significant (8-10)	4	25%	8	50%
Total Respondents	16	100%	16	100%

Patient lack of access (ie, transportation, appointment scheduling)

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	3.13	16	5.25

P = .005

Patient lack of access (ie, transportation, appointment scheduling)

	Participant		Nonparticipant	
	N	%	N	%
Not significant (1-3)	12	75%	4	25%
Somewhat significant (4-7)	4	25%	10	63%
Very significant (8-10)	0	0%	2	13%
Total Respondents	16	100%	16	100%

Patient financial/cost/insurance issues

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	4.25	16	6.44

P = .018

Patient financial/cost/insurance issues

	Participant		Nonparticipant	
	N	%	N	%
Not significant (1-3)	6	38%	3	19%
Somewhat significant (4-7)	8	50%	7	44%
Very significant (8-10)	2	13%	6	38%
Total Respondents	16	100%	16	100%

8. Please indicate how often the following barriers impede your ability to provide pneumococcal vaccinations to your patients: (select one for each)

Lack of clarity regarding CDC recommendations

	Participant		Nonparticipant	
	N	%	N	%
Not at all (0% of the time)	4	25%	2	13%
Rarely (1%-25% of the time)	4	25%	6	38%
Sometimes (26%-50% of the time)	6	38%	4	25%
Often (51%-75% of the time)	2	13%	4	25%

Nearly always (76%-100% of the time)	0	0%	0	0%
Total Respondents	16	100%	16	100%

Lack of clarity regarding CDC recommendations

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	2.37	16	2.63

P = .495

Lack of a systems-based approach to ensure that patients are assessed and vaccinated

	Participant		Nonparticipant	
	N	%	N	%
Not at all (0% of the time)	1	6%	2	13%
Rarely (1%-25% of the time)	6	38%	2	13%
Sometimes (26%-50% of the time)	7	44%	5	31%
Often (51%-75% of the time)	2	13%	5	31%
Nearly always (76%-100% of the time)	0	0%	2	13%
Total Respondents	16	100%	16	100%

Lack of a systems-based approach to ensure that patients are assessed and vaccinated

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	2.63	16	3.19

P = .135

Limited time for patient visits

	Participant		Nonparticipant	
	N	%	N	%
Not at all (0% of the time)	1	6%	2	13%
Rarely (1%-25% of the time)	5	31%	1	6%
Sometimes (26%-50% of the time)	5	31%	6	38%
Often (51%-75% of the time)	5	31%	6	38%
Nearly always (76%-100% of the time)	0	0%	1	6%
Total Respondents	16	100%	16	100%

Limited time for patient visits

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	2.88	16	3.19

P = .400

Lack of pneumococcal vaccination standing orders within practice

	Participant		Nonparticipant	
	N	%	N	%
Not at all (0% of the time)	6	38%	2	13%
Rarely (1%-25% of the time)	5	31%	3	19%
Sometimes (26%-50% of the time)	4	25%	2	13%
Often (51%-75% of the time)	1	6%	6	38%
Nearly always (76%-100% of the time)	0	0%	3	19%
Total Respondents	16	100%	16	100%

Lack of pneumococcal vaccination standing orders within practice

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	2.00	16	3.31

P = .004

Lack of educational materials and/or information for patients

	Participant		Nonparticipant	
	N	%	N	%
Not at all (0% of the time)	6	38%	2	13%
Rarely (1%-25% of the time)	7	44%	7	44%
Sometimes (26%-50% of the time)	2	13%	2	13%
Often (51%-75% of the time)	1	6%	4	25%
Nearly always (76%-100% of the time)	0	0%	1	6%
Total Respondents	16	100%	16	100%

Lack of educational materials and/or information for patients

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	1.88	16	2.69

P = .037

Lack of staff knowledge regarding pneumococcal vaccinations

	Participant		Nonparticipant	
	N	%	N	%
Not at all (0% of the time)	6	38%	2	13%
Rarely (1%-25% of the time)	5	31%	4	25%
Sometimes (26%-50% of the time)	5	31%	5	31%
Often (51%-75% of the time)	0	0%	4	25%
Nearly always (76%-100% of the time)	0	0%	1	6%
Total Respondents	16	100%	16	100%

Lack of staff knowledge regarding pneumococcal vaccinations

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	1.94	16	2.88

P = .014

Lack of reimbursement for second pneumococcal vaccination based on new CDC recommendations

	Participant		Nonparticipant	
	N	%	N	%
Not at all (0% of the time)	4	25%	1	6%
Rarely (1%-25% of the time)	3	19%	1	6%
Sometimes (26%-50% of the time)	3	19%	5	31%
Often (51%-75% of the time)	5	31%	7	44%
Nearly always (76%-100% of the time)	1	6%	2	13%
Total Respondents	16	100%	16	100%

Lack of reimbursement for second pneumococcal vaccination based on new CDC recommendations

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	2.75	16	3.50

P = .087

9. Which of the following has your office implemented in the last 12 months to help counter these patient barriers? (select all that apply)

Increased emphasis on direct communication between physician and patient regarding importance of vaccinations

	Participant		Nonparticipant	
	N	%	N	%
Have not implemented	0	0%	4	25%
Started within the last 12 months	7	44%	9	56%
Started more than 12 months ago	9	56%	3	19%
Total Respondents	16	100%	16	100%

Educational handouts provided to patient

	Participant		Nonparticipant	
	N	%	N	%
Have not implemented	8	50%	6	38%
Started within the last 12 months	5	31%	5	31%
Started more than 12 months ago	3	19%	5	31%
Total Respondents	16	100%	16	100%

An "immunization champion" designated in the office to improve vaccination rates and lead office vaccine initiatives

	Participant		Nonparticipant	
	N	%	N	%
Have not implemented	6	38%	11	69%
Started within the last 12 months	7	44%	4	25%
Started more than 12 months ago	3	19%	1	6%
Total Respondents	16	100%	16	100%

Changes within practice system/records to identify patients in need of vaccinations

	Participant		Nonparticipant	
	N	%	N	%
Have not implemented	0	0%	4	25%

Started within the last 12 months	13	81%	11	69%
Started more than 12 months ago	3	19%	1	6%
Total Respondents	16	100%	16	100%

An "immunization coordinator" designated to organize workflow process, keep inventory, and train staff

	Participant		Nonparticipant	
	N	%	N	%
Have not implemented	6	38%	11	69%
Started within the last 12 months	6	38%	4	25%
Started more than 12 months ago	4	25%	1	6%
Total Respondents	16	100%	16	100%

Implemented standing orders for patients aged 65 or older

	Participant		Nonparticipant	
	N	%	N	%
Have not implemented	3	19%	10	63%
Started within the last 12 months	4	25%	3	19%
Started more than 12 months ago	9	56%	3	19%
Total Respondents	16	100%	16	100%

Implemented standing orders for patients aged 19 to 64

	Participant		Nonparticipant	
	N	%	N	%
Have not implemented	8	50%	11	69%
Started within the last 12 months	2	13%	3	19%
Started more than 12 months ago	6	38%	2	13%
Total Respondents	16	100%	16	100%

Increased emphasis on patient reminders (eg, telephone, postcards)

	Participant		Nonparticipant	
	N	%	N	%
Have not implemented	10	63%	8	50%
Started within the last 12 months	5	31%	4	25%
Started more than 12 months ago	1	6%	4	25%
Total Respondents	16	100%	16	100%

Vaccination clinics

	Participant		Nonparticipant	
	N	%	N	%
Have not implemented	13	81%	9	56%
Started within the last 12 months	0	0%	2	13%
Started more than 12 months ago	3	19%	5	31%
Total Respondents	16	100%	16	100%

Implemented population health management (ie, proactively identified patients who need vaccine)

	Participant		Nonparticipant	
	N	%	N	%
Have not implemented	2	13%	6	38%
Started within the last 12 months	8	50%	4	25%
Started more than 12 months ago	6	38%	6	38%
Total Respondents	16	100%	16	100%

Collaborated with local pharmacists and other allied health professionals to increase access to care

	Participant		Nonparticipant	
	N	%	N	%
Have not implemented	9	56%	8	50%
Started within the last 12 months	5	31%	3	19%
Started more than 12 months ago	2	13%	5	31%
Total Respondents	16	100%	16	100%

Other (please specify):

	Participant		Nonparticipant	
	N	%	N	%
Have not implemented	3	75%	4	67%
Started within the last 12 months	0	0%	0	0%
Started more than 12 months ago	1	25%	2	33%
Total Respondents	4	100%	6	100%

9. Which of the following has your office implemented in the last 12 months to help counter these patient barriers? (select all that apply)

	Participant		Nonparticipant	
	N	%	N	%
	12	75%	10	63%

Coordinate with local health clinic	0	0%	1	6%
immunization records check	0	0%	1	6%
n/a	1	6%	0	0%
N/a	0	0%	1	6%
none	1	6%	0	0%
Not applicable	1	6%	0	0%
nothing	0	0%	1	6%
Office Huddles to identify and communicate patients in need of vaccination	1	6%	0	0%
staff education	0	0%	1	6%
vaccinated	0	0%	1	6%
Total Respondents	16	100%	16	100%

10. How confident are you that your system (electronic or otherwise) will help you identify patient candidates for pneumococcal vaccine? (select only one)

	Participant		Nonparticipant	
	N	Mean	N	Mean
	16	6.88	16	6.38

P = .526

10. How confident are you that your system (electronic or otherwise) will help you identify patient candidates for pneumococcal vaccine? (select only one)

	Participant		Nonparticipant	
	N	%	N	%
Not confident (1-3)	1	6%	1	6%
Somewhat confident (4-7)	9	56%	10	63%
Very confident (8-10)	6	38%	5	31%
Total Respondents	16	100%	16	100%

11. Do you use an Electronic Health Records system in your practice? (select only one)

	Participant		Nonparticipant	
	N	%	N	%
Yes	16	100%	12	75%
No	0	0%	4	25%
Total Respondents	16	100%	16	100%

Approximately how many patients do you see each week?

	Participant		Nonparticipant	
	N	%	N	%
20	1	6%	0	0%
25	1	6%	0	0%
45	0	0%	1	6%
50	1	6%	0	0%
55	1	6%	0	0%
60	1	6%	1	6%
65	1	6%	0	0%
75	1	6%	1	6%
80	1	6%	2	13%
85	0	0%	1	6%
90	2	13%	1	6%
95	1	6%	0	0%
100	4	25%	5	31%
110	0	0%	1	6%
120	0	0%	3	19%
150	1	6%	0	0%
Total Respondents	16	100%	16	100%

Approximately how many patients do you see each week?

Participant						Nonparticipant					
N	Mean	Median	Mode	Range	Std. Deviation	N	Mean	Median	Mode	Range	Std. Deviation
16	78.44	85.00	100.00	130.00	32.34	16	92.81	100.00	100.00	75.00	21.37

P = .148

Please select which percentage of your patients are aged 65 or older?

	Participant		Nonparticipant	
	N	%	N	%
0%	0	0%	0	0%
1%-25%	3	19%	4	25%
26%-50%	7	44%	6	38%
51%-75%	5	31%	6	38%
76%-100%	1	6%	0	0%
Total Respondents	16	100%	16	100%

Degree

	Participant		Nonparticipant	
	N	%	N	%
MD	9	56%	14	88%
DO	5	31%	2	13%
NP	2	13%	0	0%
PA	0	0%	0	0%
Other	0	0%	0	0%
Total Respondents	16	100%	16	100%

Specialty

	Participant		Nonparticipant	
	N	%	N	%
Family Medicine	14	88%	14	88%
Internal Medicine	2	13%	2	13%
General Practice	0	0%	0	0%
Other:	0	0%	0	0%
Total Respondents	16	100%	16	100%

What year did you graduate from medical school?

Participant						Nonparticipant					
N	Mean	Median	Mode	Range	Std. Deviation	N	Mean	Median	Mode	Range	Std. Deviation
16	1995	1998	2001	33	9.81	16	1986	1986	1982	28	8.08

US trained

	Participant		Nonparticipant	
	N	%	N	%
Yes	15	94%	12	75%
No	1	6%	4	25%
Total Respondents	16	100%	16	100%

Gender

	Participant		Nonparticipant	
	N	%	N	%
Male	11	69%	11	69%
Female	5	31%	5	31%
Total Respondents	16	100%	16	100%

Practice location

	Participant		Nonparticipant	
	N	%	N	%
Urban	0	0%	5	31%
Suburban	16	100%	9	56%
Rural	0	0%	2	13%
Total Respondents	16	100%	16	100%

Present employment

	Participant		Nonparticipant	
	N	%	N	%
Solo practice	0	0%	4	25%
Group practice	13	81%	10	63%
Medical school	0	0%	0	0%
HMO	0	0%	0	0%
Non-government	0	0%	0	0%
Government	0	0%	1	6%
Other:	3	19%	1	6%
Total Respondents	16	100%	16	100%

Present employment

	Participant		Nonparticipant	
	N	%	N	%
	13	81%	15	94%
Free clinic for undocumented immigrants	0	0%	1	6%
Hospital clinic	1	6%	0	0%
residency	1	6%	0	0%
Residency practice	1	6%	0	0%
Total Respondents	16	100%	16	100%

Major professional activity

	Participant		Nonparticipant	
	N	%	N	%
Direct patient care activities	13	81%	16	100%
Administrative activities	0	0%	0	0%
Medical education	3	19%	0	0%
Medical research	0	0%	0	0%

Other:	0	0%	0	0%
Total Respondents	16	100%	16	100%