

Louis Stokes Cleveland Department of Veterans Affairs Medical Center

Reducing disparities in pneumococcal vaccinations related to geography and to provider performance within the Veterans Health Administration of Ohio

Pfizer Learning and Change Grants: Disparities in Adult Immunizations

Abstract

The Advisory Committee on Immunization Practices (ACIP) now recommends using the 13-valent polysaccharide-protein conjugate vaccine (PCV13) for adults with immune suppression. ACIP continues to recommend the 23-valent un-conjugated polysaccharide vaccine (PPSV23) for people with chronic illness or age ≥ 65 . The Veterans Administration (VA) responded to this new element of complexity in pneumococcal vaccination by developing a national electronic clinical reminder geared towards outpatient clinic encounters.

The **overall goal** for this project is to support effective implementation and use of the electronic clinical reminder to increase pneumococcal immunizations among eligible veterans within the Veterans Integrated Service Network (VISN)-10.

The **target population** is healthcare personnel in primary care and medical specialty clinics.

The **key objectives for the project** are:

1. To quantify disparities in pneumococcal vaccination rates within VISN-10.
2. To determine barriers to use of the pneumococcal vaccine electronic clinical reminder within Northeast Ohio.
3. To optimize the impact of the pneumococcal vaccine electronic clinical reminder through an educational intervention for providers in Northeast Ohio

Outcomes evaluation includes measuring pneumococcal immunization rates for Ohio veterans, assessing barriers to use of the electronic clinical reminder as reported by healthcare providers and developing an educational intervention that will permit providers to overcome those barriers. This application aligns with the focus of the Pfizer Learning and Change Grants on increasing immunization against pneumococcal diseases and supports the VA's goal to deliver the highest quality health care to our nation's veterans, including through disease prevention.

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Reducing disparities in pneumococcal vaccinations related to geography and to provider performance within the Veterans Health Administration of Ohio

Overall Goal & Objectives

The Advisory Committee on Immunization Practices (ACIP) recently modified pneumococcal vaccination strategies, recommending the novel, more immunogenic polysaccharide-protein conjugate vaccine against 13 pneumococcal serotypes (PCV13) for adults with immune suppression. ACIP continues to recommend the un-conjugated polysaccharide vaccine against 23 pneumococcal serotypes (PPSV23) for people with chronic illness or age ≥ 65 .

The Veterans Health Administration (VA), the largest integrated healthcare system in the United States, responded to this new element of complexity in pneumococcal vaccination by developing a **national electronic clinical reminder** geared towards outpatient clinic encounters. The reminder will deploy throughout the Veterans Integrated Service Network (VISN)-10, which serves most of Ohio, by the fall of 2014. VISN-10 contains 31 community-based outpatient clinics (CBOCs) which offer primary care in predominantly rural settings while 4 medical centers and 2 multi-specialty outpatient clinics offer both primary and specialty care clinics in predominantly urban settings. In each of these clinics, providers with different levels of training (physicians, advanced practice nurses, physician assistants, pharmacists, registered nurses and licensed practical nurses) may be responsible for distinct aspects of patient care. Northeast Ohio, which **serves 105,000 unique veterans** from 24 counties each year, is home to 13 CBOCs including 1 multi-specialty outpatient clinic and the Louis Stokes Cleveland VA Medical Center, a tertiary-care hospital.

The overall goal for this project is to support implementation and use of the electronic clinical reminder as a means to increase immunizations against pneumococcal disease among eligible veterans. Our key objectives to achieve this goal are:

1. To quantify disparities in pneumococcal vaccination rates for veterans in VISN-10 by where they reside (rural or urban setting) and by the clinical services they use (primary care, specialty care or both).
2. To determine barriers to using pneumococcal vaccine clinical reminder within Northeast Ohio by geographic setting, services offered and providers' type of training.
3. To optimize the impact of the pneumococcal vaccine electronic clinical reminder through an educational intervention for providers in Northeast Ohio.

The goal of this application aligns with the focus of the Pfizer Learning and Change Grants on increasing immunization against pneumococcal diseases in the at-risk adult population. It also contributes to the VA's goal to deliver the highest quality and safest health care to our nation's veterans, including through disease prevention. Finally, the outcomes from the key objectives proposed here may be widely disseminated to support effective use of the pneumococcal immunization electronic clinical reminder throughout the VA health care system.

Technical Approach

A. Current Assessment of Need

i. Baseline Data Summary

Pneumococcal Vaccination Rates for Veterans in VISN-10

We examined vaccination rates for outpatients served within VISN-10 using data accessed from the Data Warehouse, a data repository regularly updated with information from the Computerized Patient Record System (CPRS), the VA's long-standing and robust electronic medical record system. To estimate the overall rate of vaccination, we calculated the number of individuals who received any pneumococcal vaccination among those veterans who had at least 1 outpatient visit in the 10-year span between 2004 and 2013. While this estimation does not consider the eligibility of the individual veterans, it does offer a **crude estimate of an overall pneumococcal vaccination rate within VISN-10 of about 21%**. There is little variation among the 4 VA medical centers (VAMCs) or Columbus outpatient clinics .

PPSV23 represents virtually all of the pneumococcal vaccinations administered during this time (99.7%). For those veterans who received a second dose of PPSV23 between 2004 – 2013 (n = 6588), the time between those doses met the recommended guidelines (>5 years) for only ~50% of cases. For those who received their PPSV23 dose early, the mean duration between doses was ~2 years (interquartile range of 92 – 1283 days). Even prior to the advent of PCV13, the **majority of veterans administered a 2nd dose of PPSV23 did not receive that dose in accordance with the recommended pneumococcal vaccine schedule.**

In October 2012, ACIP recommended routine use of PCV13 for adults aged ≥ 19 years with an array of immune compromising conditions. In response to this change, the VA initiated development of an electronic clinical reminder that incorporated both PPSV23 and PCV13 with the intent to offer guidance given the complexity of the recommendations as well as of the VA patient population. The electronic clinical reminder identifies those veterans who are eligible for PCV13, including in that cohort those who are immunocompromised, those who receive chemotherapy, immunosuppressive medications or long-term steroids and those with a cochlear implant or cerebrospinal fluid leak. It also evaluates for administration of PPSV23 in

the previous year and contraindications to PCV13. For those who have already received or are not eligible for PCV13, the electronic clinical reminder assesses their eligibility for PPSV23 using similar parameters and also accounts for administration of a second dose based on patients' age and medical diagnoses.

The Dayton VAMC became a test site for the pneumococcal vaccine electronic clinical reminder, the first version of which was released in July 2013. Subsequently, the rate of individuals who received pneumococcal vaccines at the Dayton VAMC nearly doubled, increasing **from 4.6% to 8.3%**, while remaining unchanged in the other VAMCs within VISN-10.

These data demonstrate the effectiveness of using the electronic medical record as a means to improve provider performance and patient vaccination rates.

Pneumococcal Vaccination Rates for HIV-Positive Veterans in VISN-10

In addition to examining the overall pneumococcal vaccination rates at each medical center, we also examined the proportion of pneumococcal vaccination among veterans with HIV, who access the majority of their routine medical care through an Infectious Disease specialty clinic. The proportion of those who received any pneumococcal vaccination among veterans with HIV who had at least 1 outpatient visit in the 10-year span between 2004 and 2013 is 40%. Following inclusion of PCV13 in the VA Formulary in April, 2013, the rate of immunizations for HIV-positive veterans increased nearly 2-fold at the Cleveland VAMC (17% to 30%) and over 3-fold at the Cincinnati VAMC (23% to 78%). For both institutions, PCV13 administration, consistent with the ACIP recommendations, drove this increase. Interestingly, the rate of vaccination for HIV-positive veterans at the Dayton VAMC did not change.

These data illustrate 3 points. First, despite being a test site for the electronic clinical reminder, rates of pneumococcal immunization among HIV patients at the Dayton VAMC remain suboptimal. Indeed, in 2013, of the 164 HIV patients who had an ambulatory visit with their provider in Dayton VAMC, none received PCV13. Second, there is marked geographic variation in the rates of pneumococcal vaccination for HIV patients between the 4 VAMCs and outpatient specialty clinics in Columbus, despite these all being VA facilities within a single VISN. Finally, the overall rate of pneumococcal vaccination among VISN-10 veterans living with HIV is quite low. This is especially alarming given that HIV providers are usually attuned to encouraging vaccinations, particularly among immunocompromised adults. **These findings underscore a need to educate providers in specialty clinics to use the electronic clinical reminder as a means to improve pneumococcal vaccination coverage among our more vulnerable veterans.**

ii. Target Audience & Beneficiaries

Our initial evaluation of disparities in pneumococcal vaccination will include the 4 VAMCs, their affiliated CBOCs and the Columbus outpatient clinics. To assess barriers to using the pneumococcal vaccine clinical reminder, we will target the multi-disciplinary group of providers (physicians, advanced practice nurses, physicians assistants, pharmacists and registered nurses) who serve the 105,000 veterans within the Northeast Ohio region that comprises the catchment area for the Louis Stokes Cleveland VAMC. We will include providers from primary care clinics in rural (n = 8) and urban (n = 5) settings as well as those from specialty clinics at the Parma CBOC and at the main campus of the Cleveland VAMC. Providers targeted to receive education and training in the electronic clinical reminder will come from this cohort.

We anticipate that both the providers and especially the veterans from Northeast Ohio will be immediate beneficiaries of the work proposed. Specifically, as providers' knowledge and familiarity with pneumococcal vaccination strategies increases, their patients will benefit from pneumococcal vaccine administration. Furthermore, the outcomes of the work proposed here will be shared with other facilities within VISN-10 as well as with the Veterans Health Administration National Center for Health Promotion and Disease Prevention. This will support further refinements in the electronic clinical reminder for pneumococcal vaccination. It may also offer specific strategies for targeted education and training of providers throughout the VA Healthcare system.

B. Project Design and Methods

Overview: The overall goal for this project is to support implementation and use of the electronic clinical reminder as a means to increase immunizations against pneumococcal disease among eligible veterans. To achieve this, we propose first to determine which veteran populations were most underserved prior to implementation of the electronic clinical reminder (Key Objective 1). We will also ascertain perceptions regarding use of the electronic clinical reminder by providers caring for veterans in Northeast Ohio (Key Objective 2). The outcomes from Key Objective 2 will inform the development of an educational intervention designed to optimize use of the electronic clinical reminder. Outcomes from Key Objective 1 will identify the type and location of clinics that would most benefit from implementation of the educational intervention. Design and implementation of the educational intervention comprise Key Objective 3 (**Figure 3**).

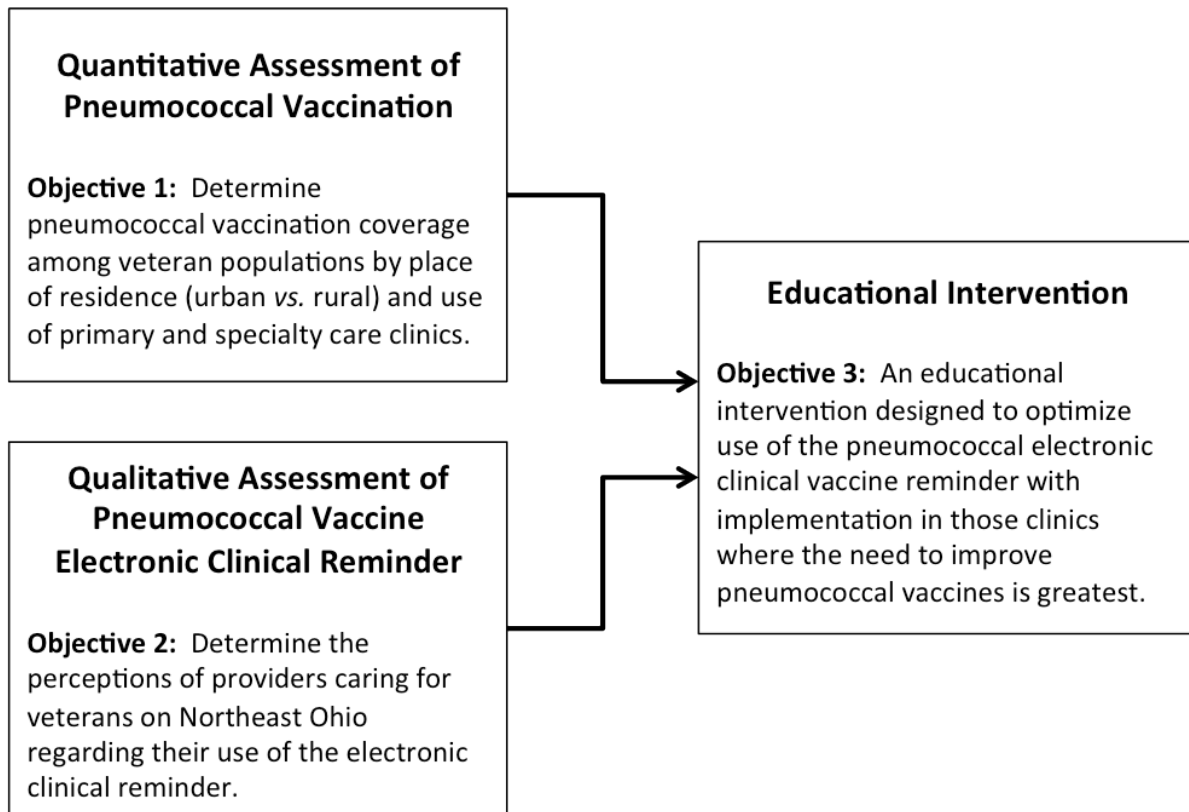


Figure 3: Conceptual Model demonstrating the relationship between Key Objectives 1-3.

Key Objective 1: To quantify disparities in pneumococcal vaccination rates for veterans in VISN-10 by where they reside (rural or urban setting) and by the clinical services they use (primary care, specialty care or both).

Purpose/Hypothesis: To access primary care within the VA healthcare system, veterans usually attend the CBOC most convenient to their home, which may be in an urban or rural setting. **We hypothesize that veterans within VISN-10 who attend primary care clinics in rural areas have lower pneumococcal vaccination rates than veterans attending clinics in urban areas.** Furthermore, veterans with chronic health conditions, such as HIV-infection, rheumatoid arthritis or cancer may supplant primary care in favor of a specialty clinic, regardless of whether they live in an urban or rural setting. As they focus on patients’ chronic health problems, specialty providers may overlook health maintenance, including routine immunizations. **We further hypothesize that veterans seen mostly by primary care providers have higher pneumococcal vaccination rates than veterans seen mostly by specialist providers (e.g., infectious diseases, rheumatology, oncology etc.).**

Methods: To test our hypotheses, we will conduct a retrospective cohort study on the veterans with VISN-10 who had at least one outpatient clinic visit per year for two consecutive years between 2004 and 2013. We will quantify pneumococcal vaccination rates based on

- (i) whether veterans reside in an urban or rural setting and,
- (ii) whether the veteran receives the majority of their care from a primary care provider, specialist or both.

Data Collection & Analysis: We will obtain data from the VISN-10 Data Warehouse searchable under a structured query language (SQL) environment. Updated from the Computerized Patient Record System (CPRS) each night, the Data Warehouse maintains up-to-date and valid data. Patients eligible for immunization with PPSV23 and PCV13 will be identified according to age (>65) and ICD-9 codes designating chronic illnesses and immune suppressive conditions. Additional data will include patient demographics, county of residence, diagnoses by ICD-9 code, the number of outpatient visits/year categorized by types of services accessed and immunization history.

We will characterize patients eligible for PCV13 and PPSV23 vaccines and establish the rates of vaccination in those groups. The primary independent variables will be patients' residence in an urban vs. rural county (determined using the National Center for Health Statistic 2013 Urban-Rural classification scheme ¹) and patients' utilization of primary care and medical specialty clinics. We will use multivariable logistic regression to determine associations between pneumococcal vaccination status and the independent variables after adjusting for the potentially confounding effects of covariates.

Anticipated Outcomes: We anticipate that just as with the general population, veterans living in rural environments will have lower vaccination rates compared to those living in urban areas. We further anticipate that the overall rate of vaccination among those eligible based on chronic health conditions will be lower among those eligible based upon age. We also expect that, regardless of their use of specialty clinics, veterans who have less than 1 primary care visit each year (averaged over 5 years) will have reduced pneumococcal vaccination coverage.

Pitfalls and Limitations: Some veterans choose to access medical care outside of the VA system. Should they receive pneumococcal immunizations by a non-VA provider, it will not be reflected in CPRS and we may underestimate pneumococcal coverage in our population.

The need addressed Objective 1 is to quantify disparities in vaccine administration between rural and urban locations, and between primary care and specialty providers, by comparing vaccination rates among those groups. The desired results will be obtained by utilizing the rich, detailed and comprehensive data set available at the VA, and by determining associations and controlling for important covariates. These results will identify locations and types of providers where barriers to the use of the electronic clinical reminder are critical, and that would most benefit most from an intervention to optimize its use.

Key Objective 2: To determine barriers to use of the pneumococcal vaccine electronic clinical reminder within Northeast Ohio, by geographic setting, services offered, and providers' type of training.

Purpose/Hypothesis: The purpose of this work is to evaluate the barriers perceived to the implementation of the electronic clinical reminder perceived by healthcare providers. As summarized in this grant's request for applications, known barriers to pneumococcal vaccination among healthcare providers include lack of awareness about ACIP guidelines, not eliciting an immunization history, skepticism towards vaccinations, not considering it their responsibility and lack of continuity. Systems barriers include lack of a structure ensuring vaccination and inadequate supplies. It is unclear, however, what barriers may limit the use of electronic clinical reminders intended to improve vaccination practices. **We hypothesize that there are barriers to pneumococcal vaccination that specifically arise from the design and content of the VA's electronic clinical reminder.**

Methods: The electronic clinical reminder is forecast for dissemination throughout VISN-10 in October, 2014. Beginning in January 2015, we will administer an anonymous **electronic survey** to healthcare providers staffing the 5 urban and 8 rural CBOCS (community based outpatient clinics) in Northeast Ohio as well as those who work in primary care and medical specialty clinics at the Cleveland VA medical center. The providers surveyed will include physicians, advanced practice nurses, physician assistants, pharmacists, registered nurses and licensed practical nurses. The survey questions will address participants' knowledge, attitudes and beliefs regarding the efficacy, indications and contraindications to and perceived barriers to pneumococcal vaccination. The survey will also query their perceptions and experience with the pneumococcal vaccine electronic clinical reminder. Answers will conform to a Likert-like scale.

Drawing from this same population, we will also apply a mixed-methods approach, and invite healthcare providers to participate in **semi-structured interviews**. The primary goal of the interviews will be to elicit the perspective of healthcare providers on the acceptability and usefulness of the pneumococcal vaccine electronic clinical reminder. Secondary goals will assess participants' knowledge, attitudes and beliefs regarding: pneumococcal disease burden; vaccine indications, contraindications and efficacy; potential adverse effects; and barriers to pneumococcal vaccination. Interviews will be recorded (audio only).

Data Collection and Analysis: We will compare outcomes of the electronic survey based on the respondents' practice setting (urban or rural), type of training (physician, advanced practice nurse, physician assistant, pharmacist, registered nurse and licensed practical nurse) and type of clinic (primary care or medical specialty) using an analysis of variance (ANOVA).

Interviews will be conducted between January and June of 2015 at the participant's site of practice. Reoccurring ideas expressed by the participants will be grouped into themes; associations between themes will also be identified.

Anticipated Outcomes: From the electronic survey, we anticipate that, compared to subspecialists, primary care physicians and advanced practice nurses will have higher scores regarding knowledge of pneumococcal vaccine benefits and recent ACIP recommendations regarding PCV13. Furthermore, we expect that compared to registered nurses and license practical nurses, physicians and advance practice nurses will report greater barriers to use of the electronic clinical reminder, citing both time and patient complexity. We do not foresee notable differences based on the clinic setting (urban or rural) or type of care offered (primary care or medical specialty).

Pitfalls and Limitations: Decreased participation by specific groups of providers (based on their practice location, service or type) may limit interpretation of some aspects of the results.

The need addressed by Objective 2 is to identify barriers to the use of the pneumococcal vaccine electronic clinical reminder. The desired results will be obtained by utilizing qualitative analyses through surveys and interviews of healthcare providers. The information obtained will facilitate the design of an educational intervention intended to improve the use of the electronic clinical reminder.

Key Objective 3: To optimize the impact of the pneumococcal vaccine electronic clinical reminder through an educational intervention for providers in Northeast Ohio.

Purpose/Hypothesis: The purpose of these activities is to implement an educational intervention directed towards healthcare workers that complements and supports the use of the electronic medical reminder. Our hypothesis is that an educational intervention tailored to address the barriers identified in Objective 2, will increase the impact of an electronic clinical reminder on pneumococcal vaccination rates. We will target this intervention clinics in Northeast Ohio that serve the veteran population most in need of improved pneumococcal vaccine coverage, as determine in Objective 1.

Methods: An in-service training module will be developed and delivered to VA primary care or medical specialty clinics in Northeast Ohio serving veteran populations that fall into the lowest quartile of pneumococcal vaccination rates (Objective 1). The training will be provided during a monthly staff meeting and will include instructions on how to use the electronic clinical reminder, describe ACIP immunization recommendations, and present providers with an overview of pneumococcal disease and its burden. Importantly, the training module will specifically seek to overcome barriers to pneumococcal vaccination identified by Objective 2. The training module will emphasize content that addresses deficits in knowledge regarding pneumococcal vaccines, will acknowledge beliefs that lead providers and veterans to avoid pneumococcal vaccination, and will attempt to counter practices that lead to poor adherence to ACIP recommendations and decreased immunization rates. Participants will be encouraged to complete an electronic survey, similar to the survey described in Objective 2, which also solicits directed feedback about the effectiveness of the educational intervention.

Data collection and analysis: Quantitative evaluation of the impact of the educational intervention will employ a pre-/post-intervention design, measuring changes in vaccination rates in the clinic before and after the intervention. Data will be obtained from the VISN-10 Data Warehouse accessible through SQL queries, as described in Objective 1. Also, changes in vaccination rates and use of the clinical reminder that occur in the clinics that receive the education and training module can be compared to those for clinics that did not receive the educational intervention. Scores obtained in the computer-based survey before and after the intervention will also be compared, for individual participants using paired t-test, as well as aggregate scores for participating clinics.

Anticipated outcomes: We anticipate that the clinics involved with the educational intervention will demonstrate a significant increase in pneumococcal vaccination rates, compared to rates in the same clinic before the intervention, and to clinics that do not receive the intervention. We also anticipate a change in the knowledge, beliefs, and attitudes towards the electronic clinical reminder and pneumococcal vaccination among providers that receive the educational intervention. Training healthcare providers on the use of the electronic clinical reminder will also offer the opportunity to provide up-to-date information about immunization rates within VISN-10 as well as their particular unit. We predict that this direct feedback will empower healthcare providers to commit to improving their clinic's performance for pneumococcal vaccination.

Limitations and pitfalls: The results of the intervention will largely depend on the participation of healthcare providers. Substantial modifications to the electronic clinical reminder itself, to increase its functionality and acceptability, are not anticipated at this stage.

The need addressed by Objective 3 is to support the use of the electronic clinical reminder with a tailored educational intervention. The desired results will be obtained by incorporating providers' perceived barriers to pneumococcal vaccination and the electronic clinical reminder into an educational intervention targeted to those clinics serving veteran populations that fall into the lowest quartile of pneumococcal vaccination coverage.

C. Evaluation Design

Table 3: Evaluation Design of Outcomes from Key Objectives 1-3

Key Objective	Gap Addressed	Data Source	Data Collection	Analysis
<p>1 <i>To quantify disparities in pneumococcal vaccination rates for veterans in VISN-10 by where they reside and by the clinical services they use</i></p>	<p>Who needs the program and how great is the need</p>	<p>VISN-10 Data Warehouse</p>	<p>SQL Queries</p>	<p>Vaccine eligibility Rates of vaccination Residence in an urban vs. rural county Utilization of primary care or medical specialty clinics Multivariable logistic regression analysis</p>
<p>2 <i>To determine barriers to using pneumococcal vaccine clinical reminder within Northeast Ohio by geographic setting, services offered and providers' type of training</i></p>	<p>Target population's opinions, knowledge, attitudes and beliefs and perception of barriers</p>	<p>Guided interviews Survey of healthcare providers</p>	<p>Interview Web-based survey</p>	<p>Systematic analysis of content, conclusion drawing and verification Scores in web-based survey and associations with location and type of practice ANOVA</p>
<p>3 <i>To optimize the impact of the pneumococcal vaccine electronic clinical reminder through an educational intervention for providers in Northeast Ohio</i></p>	<p>To what extent is the program achieving its outcomes</p>	<p>VISN-10 Data Warehouse Survey of healthcare providers</p>	<p>SQL Queries Web-based survey</p>	<p>Rates of vaccination Survey scores and associations with location and type of practice Pre- and post-intervention comparison; one group participates in program, other does not</p>

Quantification of change: We anticipate that the target audience will improve their perception pneumococcal vaccination and of the electronic clinical reminder by 30%. We anticipate that the immunization rates in clinics that receive the intervention will increase by at least 30%, based on the experience at Dayton VA.

Target audience engagement: We will have 1:1 contact with providers in the clinics selected for the education and training intervention. We plan to administer a post-intervention survey and assess their response and engagement.

Dissemination of outcomes: We intend to report our findings to the leaders in VSIN-10 and VHA Central Office. We plan to submit to a peer review journal a manuscript describing barriers to the use of the electronic clinical reminder and disparities in pneumococcal vaccination rates.

Detailed Work Plan and Deliverables Schedule

Objective 1: The work proposed is to quantify the rates of pneumococcal vaccination for veterans within VISN-10 over the 10-year span from 2004 – 2013. This data already exists in the Data Warehouse. The specific tasks involved in achieving Objective 1 are detailed below, including the anticipated start and stop dates.

07/14 – 09/14 Extract data from the VISN-10 Data
10/14 – 12/14 Data cleaning and validation
01/15 – 06/15 Analysis of vaccination rates by county & clinic type

Objective 2: The goals are to conduct a qualitative assessment of health care providers' experiences with the electronic clinical reminder, which is slated for implementation across VISN-10 by October, 2014. We intend for health care personnel to have at least 3 months experience with the electronic clinical reminder before initiating surveys about those experiences.

11/14 – 02/15 Develop semi-structured interview and electronic survey
03/15 – 06/15 Enroll and conduct interviews
Launch electronic survey
07/15 – 12/15 Data analysis, identify recurring ideas, themes
Analyze data from electronic survey

Objective 3: The goals are to improve the use of the electronic clinical reminder through an educational intervention. The outcomes from Aim 2 will inform the content of the education regarding the electronic clinical reminder while the outcomes from Aim 1 will inform the clinics enrolled.

01/16 – 06/16 Develop, pilot test the educational intervention
07/16 – 12/16 Implement the educational intervention
01/17 – 12/17 *Measure changes in pneumococcal coverage in clinics that participated in educational intervention.

*This analysis will extend beyond the proposed funding period.

Table 4: Detailed Work Plan with Schedule for Deliverables and Estimated Costs (based on salary support of involved personnel)

Deliverables	year		2014				2015				2016				2017		Personnel ^a	Estimated Cost
	quarter		3	4	1	2	3	4	1	2	3	4	1	2	3	4		
Key Objective 1: Quantitative Assessment of Pneumococcal Vaccination in VISN-10																		
Pneumococcal coverage by urban vs. rural setting																		
Pneumococcal coverage by use of primary vs. specialty care clinics																		
Key Objective 2: Qualitative Assessment of Pneumococcal Vaccine Electronic Clinical Reminder																		
Survey of personnel working in primary care clinics																		
Survey of personnel working in medical specialty clinics																		
Key Objective 3: Educational Intervention																		
Develop educational intervention																		
Implement intervention																		
Study effects of intervention																		