Implementation of a Pneumococcal Initiative in a Primary Care Community Clinic

Ann Berdugo

Johns Hopkins School of Nursing

Project Advisor: Jaime McDermott, DNP, RN, ACNP-BC, CV-BC, CCRN, CHFN

Organizational Mentor: Grace Floutsis, MD

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Abstract

Background: There is a low marginal uptake of the pneumococcal vaccine amongst type 2 diabetics (T2DM) globally despite highly supported health organizational recommendations. Persons with T2DM are immunocompromised and at higher risk of complications, including death, if infected with a pneumococcal infection. There is low guideline adherence of pneumococcal vaccination globally in community clinics.

Purpose: The purpose of the Pneumococcal Initiative is to evaluate current strategies to help increase the marginal uptake of the pneumococcal vaccine in community clinics.

Method: This study takes place at a primary care community clinic and employs a pre- and post-intervention design to assess the effects of independent variables (an educational toolkit accompanied by a pre- and post-quiz, diabetic order set (DOS), and point-of-care patient handout) on dependent variables (provider knowledge, provider screening, and patient adherence to the vaccine), relatively. Providers (adult primary care physicians and nurse practitioners) and adult diabetic patients are participants to their correlating aim.

Findings: Statistical significance (p=0.38) was seen in improving provider knowledge (n = 5), and provider satisfaction with the intervention was high. However, there was no significant relationship between provider adherence to the DOS (p=0.098) and type of visit (p=0.788). Despite this, the patient pneumococcal vaccine adherence (n=345) rate increased by 37.7% at the end of the 12-week intervention.

Conclusion: This study improved provider knowledge and increased patient vaccine adherence despite low provider adherence to the new order set. Educational sessions can enhance provider knowledge and satisfaction. Engaging providers and patients can increase vaccine acceptance and adherence. Vaccine education methods may vary by clinic. Implications highlight the need
for ongoing efforts to improve vaccination rates among at-risk populations, like those with T2DM.

**Key Words:** type 2 diabetes, T2DM, pneumococcal vaccines, PCV13, PPV23, Pneumovax, Prevnar20, PCV20
Implementation Of A Pneumococcal Initiative In A Primary Care Community Clinic

Introduction

Pneumococcal infections are particularly important to address for adults, ages 19 to 64 years, with chronic conditions like type 2 diabetes mellitus (T2DM) as they increase the risk for severe health complications and outcomes (Goeijenbier et al., 2017). Patients with T2DM are three times more unlikely to survive pneumococcal infections than those without T2DM (Chen, 2018). Therefore, pneumococcal vaccination is a crucial aspect of preventative healthcare for T2DM adults. Despite the recognized importance of pneumococcal vaccination among T2DM, with guidelines set by distinguished national and worldwide health organizations such as the Center of Disease and Control (CDC) and World Health Organization (WHO), studies have shown that vaccination rates among this adult population remains low (CDC, 2019). This disparity highlights the need for continued efforts to increase awareness and access an important preventative measure.

Background

T2DM is a growing global problem with approximately 463 million T2DM adults ages 20 to 79 years currently diagnosed, with anticipation to rise to 700 million adults by 2045 (International Diabetes Federation [IDF], 2019). Due to their immunocompromised status, patient with T2DM are at risk for major complications including pneumococcal pneumonia, which is the seventh leading cause of death in the United States and primary leading cause of hospitalization globally every year (Centers of Disease Control and
Prevention [CDC], 2021; The World Health Organization [WHO], 2021). Likewise, T2DM patients are more prone to slower infection recovery rates, three times more likely not to survive pneumonia disease, due to their suppressed immune system (CDC, n.d.). When compared to their vaccinated counterparts, unvaccinated patients are at higher risk for death (Goeijenbier et al., 2017). Death caused by pneumococcal disease in persons greater than 50 years old was estimated to be more than 0.6 million cumulative deaths (Morgan et al., 2022). Despite evidence-based research and current guidelines supporting the administration of the pneumococcal vaccine to help reduce hospitalizations and mortality rates among the T2DM population, vaccination rates are drastically below goal worldwide (CDC, 2019; Chen, 2018). Healthy People 2020 reported a goal of greater than or equal to 90% pneumococcal vaccination rates among adults (Nace et al., 2017). However, the last reported pneumococcal vaccination rate is 24.5% in the United States by the CDC 2017 National Health Survey (CDC, 2019). Locally in Los Angeles County, mortality rates for T2DM and pneumonia remain as top ten causes of death (LAPDH, 2019). The project site is an underserved primary care clinic that currently holds a pneumococcal vaccination rate of below ten percent.

The CDC recently updated its guidelines for administering pneumococcal vaccinations to individuals aged 19 to 64 years with type 2 diabetes who have not been vaccinated or have received previous vaccinations. For diabetic individuals before the age of 65 years, the updated recommendation is to receive either the Prevnar 20 (PCV20) alone or Prevnar 15 (PCV15), followed by Pneumovax (PPV23) one year later, instead of the Prevnar 13 (PCV13) and/or Pneumovax series (CDC, 2023).
The frontline of pneumococcal vaccination is seen within community primary care clinics (Gottlieb & Dols, 2018). In a recent study, 13.3% of patients disclosed a lack of vaccination recommendation from their provider (Isik et al., 2020). Low vaccination uptake is the result of a lack of patient awareness of vaccination and a lack of provider knowledge and/or adherence to current guidelines (Isik et al., 2020; Geneev et al, 2018; Gottlieb & Dols, 2018; Sacco et al., 2019; Sidani et al., 2015; Wilson et al., 2016). Providing education to both patients and healthcare providers and improving systems for access may improve uptake of pneumococcal vaccination.

**Problem Statement**

T2DM is a globally increasing health disease that continues to be one of the leading causes of death from various health complications (CDC, 2021). As such, it is imperative to increase pneumococcal vaccination rates amongst adults diabetics ages 19 to 64 years to reduce negative patient outcomes (CDC, n.d.). Standard of care guideline noncompliance, knowledge deficiency among providers, and lack of patient awareness equally contribute to marginal administration of the pneumococcal vaccine. Providing provider and patient education and improving standardized vaccination screening may aid in increasing vaccination rates among T2DM patients.

**Purpose**

The purpose of this evidence-based, 12-week quality improvement project, is to determine whether a point-of-care patient educational handout for T2DM patients ages 19 to 64 years old at a primary care clinic and improving provider vaccine knowledge and screening will improve pneumococcal vaccine acceptance among T2DM patients.
Project Aims

The aims of this project are:

1. To improve knowledge about pneumococcal vaccination in providers at a primary care clinic over 12-weeks.
2. To increase pneumococcal vaccination screening among T2DM patients by 55% with provider utilization of CDSS in eClinicalWorks over 12-weeks.
3. To increase diabetic patient adherence and vaccination acceptance of the pneumococcal vaccine by 18% by the end of 12-weeks.

Review of the Literature

Vaccination has shown to be one of the most effective preventative methods to help protect individuals and communities from disease (Morgan et al., 2022). Numerous strategies have been assessed to enhance general vaccination rates and to maximize incremental increases. This pilot study addressed provider knowledge, electronic health record (EHR) tools, and patient education to increase pneumococcal vaccination rates.

Provider Knowledge

An evidence-based intervention that shows high effectiveness is provider knowledge reinforcing recommendation of the vaccine to patients, especially against vaccine hesitancy (Chaudhry et al, 2022; Rutten et al., 2021; Sozen et al., 2021). Rutten and colleagues (2021) discuss that providers are an entrusted source that have documented higher vaccination rates after discussion with patients. However, to ensure readiness and strong vaccination recommendations, providers must have adequate
knowledge, such as vaccine efficacy, safety, and reactiogenicity of the vaccine to foster entrusting communication (Rutten et al., 2021).

Wilson and colleagues (2016) identified knowledge deficiency among resident physicians regarding the pneumococcal vaccine. After implementing an educational toolkit, provider knowledge improved from 31.2% to 87.5% (Wilson et al., 2016). Information sessions updating and or refreshing provider education regarding the pneumococcal vaccination showed a positive increase in vaccination rates up to 53% in diabetic patients (Chaudhry et al., 2022).

**Electronic Health Record (EHR) Tool**

Another intervention that has been identified to increase pneumococcal rates include integrating HER tools into the provider or clinician workflow (Buenger & Weber, 2020; Rutten et al., 2021; Zupa et al., 2021). Buenger and Weber (2020) were able to drastically improve vaccination rates, by 20 times the number of eligible patients, in an Emergency Department using an EHR alert/tool. Integration of an EHR tool into the provider’s workflow deemed as efficient and convenient (Buenger & Weber, 2020). Organizational-level EHR tool utilization has been found to help provider work flow, such as the availability of standing orders accessible by nurses, order sets, reminder/recall systems (Rutten et al., 2021).

**Patient Education**

Patient education in combination with other evidence-based interventions like improving provider knowledge, serves as a reliable method to help increase pneumococcal vaccination rates (Fischer et al., 2008; Geneev et al., 2018; Gottlieb &
Dols, 2018; Strine et al., 2005). Diabetic visits with allotted time for vaccine education are associated with increased vaccination when compared to those that do not receive education (Fischer et al., 2008; Geneev et al., 2018; Gottlieb & Dols, 2018; Strine et al., 2005). Sozen and colleagues (2021) highlighted that 24% of originally unenthusiastic patients ended up receiving the pneumococcal vaccination after patient education. Another study revealed that 76% of diabetic patients that received discussion and or printed education were administered all recommended vaccines versus a 20% of non-educated diabetic patients receiving recommended vaccines (Gottlieb & Dols, 2019).

Another evidence-based research strong predictor to improve vaccination rates was the time allocated for patient education by medical staff, whether face-to-face or via telephone visits, engaged patients into understanding the importance and need for the vaccine (Chaudhry et al, 2022; Fischer et al., 2008; Geneev et al., 2018; Gottlieb & Dols, 2018; Strine et al., 2005).

### Evidence Based Practice Model

To help translate the evidence-based knowledge of pneumococcal vaccination into practice, the Rosswurm and Larabee’s Model for Evidence-Based Practice (EBP) served well as a framework to guide the clinical project within the institution. The Rosswurm and Larabee’s Model for EBP (1999) is derived from a traditional and institutionally driven practice to fit an acute care or primary care setting (White et al., 2019). The model (refer to the adapted Figure 1 in Appendix A) is a linear progression of six components – assess, link, synthesize, design, implement and evaluate, and integrate and maintain (White et al., 2019). The first step assessed the clinical problem by
evaluating the internal data with the external data; the second step linked the clinical issue with interventions and outcomes; the next step was to synthesize highly supported research and contextual evidence; fourthly, the implementation in practice was outlined; fifthly, needed changes after evaluating outcomes was implemented and revised; and Lastly, findings were communicated and integrated into practice.

The Rosswurm and Larabee’s framework aligned with the current clinical problem of addressing the low uptake of the pneumococcal vaccine in the primary care setting because it helped sustain an evidence-based clinical guideline. With less than 10% of T2DM patients vaccinated in the primary care setting, a problem was identified with a need for change. The project began with identifying all stakeholders involved in the change, such as patients, providers, nursing staff, and the community. Potential interventions were synthesized and evaluated to be implemented during the 12-week period. Within this clinical project, point-of-care patient education was utilized during visits that helped increase vaccination rates as supported by literature (Fischer et al., 2008; Geneev et al., 2018; Gottlieb & Dols, 2018; Strine et al., 2005). To further promote the pneumococcal vaccine, including the new Prevnar 20, a follow-up telephonic visit was implemented if the patient is either undecided, requesting more education, or to confirm vaccine administration (Gottlieb & Dols, 2019). After the 12-week implementation of patient education to all new or existing type 2 diabetic patients as proposed, PPV23 vaccination rates before intervention and after the project period time was used as the outcome indicator.
Proposed change emphasized the use of medical staff, such as the provider to educate the patient about the importance of the pneumococcal vaccine. This was feasible with a team consisting of a medical assistant, licensed nurse, and provider to help communicate the importance of the vaccine. A cohesive and communicable team was imperative to the success of the project (Sims et al., 2015). However, the abbreviated visits and potential vaccine cost continuously pose as barriers to the intervention (Clancy et al., 2012; Geneev et al., 2018; Strine et al., 2005). Similar as discussed earlier, the 12-week intervention assessed pre- and post-intervention vaccine data.

Recommendations derived from data analysis was then discussed with stakeholders to hopefully become a part of clinical integration.

Methods

Design

This project utilizes data pre- and post-intervention design. Testing of dependent variables (provider knowledge, provider screening, and patient adherence to the vaccine) before and after intervention with the independent variables (an educational toolkit, diabetic order set, and point-of-care handout) will best gage directionality of the QI project.

Setting

This QI project will be conducted in an underserved community primary care clinical setting in a large urban city. The community clinic is composed of three specialties – adult and pediatric primary care, and women’s health. This clinic patient
population continues to grow and currently serves approximately 1,000 adults per year; with approximately 600 adult patients diagnosed with T2DM.

Sample

Two samples were collected to address the project’s aims. The first sample included five adult primary care providers to address provider knowledge and the use of a diabetes order set. The second sample included adult diabetic patients to evaluate pneumococcal vaccination adherence and acceptance.

Inclusion/Exclusion Criteria. Any adult patients currently receiving care at the clinic aged 18 to 64 years old with T2DM (defined as glycated hemoglobin (A1c) > 5.7%) were included. Exclusion criteria included type 1 DM patients; patient ages less than 18 years old or older than 64 years; and pregnant persons. Meanwhile, all five adult primary care providers employed at the clinic participated.

Recruitment

The clinic consisted of five adult primary care providers whom all were enrolled by default. Providers were informed via email about participation in the QI project implementation, unless expressing declination.

Patient participants of the project were automatically enrolled if seen by a primary care provider in the clinic within the 12-week implementation period and met inclusion criteria.

Instruments/Measures

To measure the first aim, a Pneumococcal Vaccine Quiz and educational toolkit (Refer to Appendix C) was utilized for provider pneumococcal vaccine knowledge
measurement. Dr. Wilson and his team developed a Pneumococcal Vaccine Quiz to measure internal medicine residents' knowledge (Wilson et al., 2016). The quiz consisted of eight clinical vignettes and was administered pre- and post- an educational toolkit. The quiz had nominal measurement and a resulted higher score indicated greater knowledge. A five-item survey was also conducted post educational toolkit and quiz to gauge provider knowledge and confidence. The quiz revealed a knowledge deficiency among the residents. While the quiz's reliability has not been evaluated, it was developed by experts and showed content validity. 101 residents participated, and the study plans to redistribute the quiz and survey for further insight. The author has granted permission to use this tool for this project.

To measure the second aim, a retrospective EHR review was performed. To determine provider adherence to the diabetic order set, the QI project leader manually conducted a retrospective review of diabetic patient encounters/charts every two weeks. The use of the diabetic order set was identified through a specific electronic health record pre-set labeling that indicated a vaccine order from the diabetic set. The vaccine was labeled as "PCV20" when ordered, instead of "Prevnar20". Once determined the vaccine was ordered via the DOS, the relevant data was collected for analysis.

To assess the third aim, a manual retrospective chart review was also conducted every two weeks. The charts selected for review included adult diabetic patient encounters during the 12-week implementation period. Each chart was carefully scrutinized to ascertain the patient's pneumococcal vaccination status prior to that particular encounter. This was done by accessing the clinic's electronic health record
(EHR) vaccine data or the Los Angeles County's vaccine database, CAIR, where possible. If no data was available or accessible, the patient was presumed to be unvaccinated, and the discussion of the vaccine was expected to have occurred during that visit. Any documentation of vaccine prescription or administration during the encounter was identified and the relevant data was collected for analysis. In the absence of such documentation, the previous vaccination status data was collected for analysis. If the patient had subsequent visits after their first encounter during the 12-week implementation period, their charts were reviewed to identify any changes in vaccination status, if relevant.

Demographic data for the first two aims only included the level of provider – physician or nurse practitioner. Meanwhile, patient demographic information collected included categorical data such as patient age, vaccination status, and diagnosis of T2DM.

**Intervention**

**Pre-Intervention.** To address provider knowledge, revision of the CDC updated clinical guidelines took place 12 weeks prior to the start of intervention. The educational toolkit included a pocket guide for pneumococcal vaccine guidelines and pneumococcal vaccine quiz. Providers created a de-identified provider code using a combination of a favorite color and animal (i.e. BlueMonkey). A one-hour meeting session was scheduled to initiate the administration of the pre-quiz, educational review/toolkit, post-quiz, and post-quiz survey was scheduled two weeks prior to the start of the QI project.

For provider screening, a meeting with IT was scheduled two weeks before project implementation to discuss and create a diabetic screening tool. The tool was then
created through the EMR’s clinical decision support system (CDSS) and reviewed with the organizational mentor for approval one week before QI implementation. The finalized screening tool was created one week prior to QI implementation. Once the diabetic order was established, a 30-minute meeting one week prior to implementation with medical assistants and providers took place to discuss use of screening tool for all diabetic visits will be scheduled.

To prepare for patient intervention, a meeting with the Quality Improvement Champion was scheduled to first obtain a baseline percentage of pneumococcal vaccinations among diabetics using Azara one week prior to QI implementation. Meanwhile, a pneumococcal initiative point-of-care handout with guidance from CDC was created and completed three weeks before QI implementation. A stakeholder 30-minute stakeholder meeting (same time as discussing screening tool) was scheduled one week prior to start of intervention. A hard copy and electronic access was readily available for review to all stakeholders immediately after the meeting.

Biweekly meetings for providers and involved medical staff – RN, MAs, LVNs was scheduled once the QI project was initiated.

**Intervention.** The provider educational toolkit was conducted during a single 1-hour session, 1 week before start of the Pneumococcal Initiative project. The toolkit provided consisted of a pneumococcal vaccine pocket QR code card, CDC vaccine indication table, 8 quiz questions, and a post-quiz Likert survey.

At the beginning of the meeting, participating providers was asked to create a de-identifying code name (combination of their favorite color and animal) to write on their
quizzes. A hard copy of the pneumococcal vaccine quiz was administered at the beginning of the meeting, followed by a brief educational review session, and a repeat quiz administered after. Providers was offered to keep the educational toolkit.

Regarding provider screening, a diabetic order set created during the pre-intervention phase was readily available to use for visits with diabetic patients over the 12-week implementation period. Baseline screening began at zero percent considering the order set was newly created. The order set consisted of screening for the pneumococcal vaccine, Tdap vaccine, hemoglobin A1c, lipid, basic metabolic panel, microalbumin UA, podiatry, and optometry. The order set was uploaded under the CDSS (Clinical Decision Support System) tab. This order set was available for utilization in the chart once a patient checked in for their visit. Providers had to update each diabetic health indicator, as needed, to proceed.

A rolling chart review using Azara and eClinicalWorks occurred every 2 weeks on Fridays to evaluate use of the diabetic order set over the course of the project.

The Pneumococcal Initiative patient intervention was a point-of-care diabetic handout given at the beginning of the allotted 15-minute visit by the medical assistant. Handouts were also poster in the patient room. The medical assistant offered the pneumococcal vaccine to the patient, in addition to provider inquiry during visit.

**Post-intervention.** Post-interventions evaluated outcome measures of each aim. For provider knowledge, pre- and post-educational review quizzes were collected to compare scores. A post-quiz Likert type survey was used to evaluate provider confidence after the pneumococcal educational toolkit. To evaluate provider screening
and patient adherence to the pneumococcal vaccine, a rolling review every 2 weeks in conjunction to telephonic patient follow-up calls were done to collect corresponding vaccine data.

**Data Collection/Procedures**

Provider knowledge was measured by administering a pneumococcal quiz before and after a brief educational session that included handouts. The quiz was composed of eight clinical vignette selected-response items, and the comparison of scores between the pre- and post-education quiz was evaluated to determine knowledge deficiency and improvement. The score was calculated by dividing the number of correctly answered questions by eight, resulting in a percentage. Furthermore, a post-quiz Likert-type survey was conducted to measure the provider's confidence. The tool was developed by pulmonologists and had been previously used in various settings, which ensured its content validity.

Provider screening was monitored through the use of a diabetic order set created for this purpose. Using manual reconciliation of data in eCW, the electronic health software, the overall percentage of screening was determined by assessing the number of order sets used for screening relative to the number of diabetic visits that took place over the 12-week implementation period. This analytic data was collected biweekly. The same method was applied to patient vaccination, where the baseline percentage of vaccinated patients was compared to the updated vaccination rate provided by Azara.

To measure patient vaccination adherence to the project protocol, reported vaccination status in the eClinicalWorks charting software was used. The immunization
acceptance rate reflected a positive outcome. Patient identity or demographics were not needed for this project.

**Ethical Review**

Ethical review approval for this quality improvement project will be obtained from Johns Hopkins School of Nursing Project Ethical Review Committee and the Institutional Review Board at the project site.

No informed consents are necessary as California does not require consents for adult vaccinations, the PPV23 vaccine is FDA approved, and PPV23 vaccination is an established public health guideline amongst diabetics (CDC, 2019; CDPH, 2021).

**Data Analysis**

SPSS version 27 was used for statistical analysis. Descriptive statistics were used for demographics using categorical data including age, vaccination status, and diagnosis of T2DM.

**Aim 1:** To improve knowledge about pneumococcal vaccination in providers at a primary care clinic over 12-weeks.

**Analyses:** A pre- and post-test intervention design with a dependent variable (provider knowledge) that was normally distributed and a sample size of 5. A sensitivity analysis was done by inputting different effect size values. However, a small provider participation group acted as a limiting factor, underpowering the study. Overall, this aim was analyzed using a Wilcoxon signed-ranked test. The p-value was reported to determine statistical significance and the median and interquartile range to interpret the direction of the relationship.
Aim 2: To increase pneumococcal vaccination screening among T2DM patients by 55% with provider utilization of CDSS in eClinicalWorks over 12-weeks.

Analyses: A frequency analysis was used post-intervention to calculate the percentage of pneumococcal vaccination screening by providers. An EHR retrospective rolling chart review was in place biweekly during the intervention period. A Chi-Square analyses was also used to evaluate the relationship between the use of provider adherence to the orderset and the type of visit that occurred, with a p-value to determine significance.

Aim 3: To increase diabetic patient adherence and vaccination acceptance of the pneumococcal vaccine by 18% by the end of 12-weeks.

Analyses: An intervention and control group design was used with a dependent variable (patients vaccinated) that was categorical and a sample size greater than 30. Therefore, this aim was analyzed using a Chi-square. The p-value was reported to determine statistical significance and the cell counts and percentages to interpret the direction of the relationship.

Results

Results of the Pneumococcal Iniative addressed three aims –provider knowledge, provider adherence to a diabetes order set, and patient acceptance and adherence to the pneumococcal vaccine.

Provider Knowledge

This aim was directed towards improving pneumococcal vaccination knowledge among primary care providers (n = 5) through the use of an educational toolkit and pre- and post- quiz. Pre-intervention mean score was 5.20 (M = 5.20, SD = 0.837); and post-
intervention mean score was 6.60 (M = 6.60, SD = 0.548) (Appendix D, Table 1). A statistical significance (a <= 0.05) using the Wilcoxon Signed Rank Test was seen with a p-value of 0.38 (Appendix D; Table 2). The post-intervention knowledge quiz resulted in a positive provider satisfaction (intervention effectiveness) with predominantly either 60% “Agree” or 40% “Strongly Agree” (Appendix D, Table 3 and 4, Figure 1).

**Provider Adherence to DOS**

Aim two assessed the provider use to the newly created Diabetes Order Set (DOS) to help screen for vaccination status during diabetic patient visits. Baseline use of the DOS pre-intervention was at 0% use. After a frequency analysis of diabetic encounters (n = 345), 12.8% (n = 44) of charts utilized the DOS (Appendix D, Table 5 and 6). A Chi-Square analyses was also employed to evaluate the relationship between provider adherence to the DOS and the type of visit (in-person versus telehealth; and diabetes/physical exam versus other/sick visit). There was no significant relationship between provider adherence with in-person versus telehealth (p = 0.788) and or if it was a diabetes/physical exam versus other/sick visit (p = 0.098) (Appendix D, Table 7 to 10, Figure 2).

**Patient Acceptance and Adherence**

Lastly, aim three evaluated diabetic patient acceptance and adherence of the pneumococcal vaccine after intervention. Average age of the T2DM patient was 52.50 years old (M = 52.50, SD = 12.542). Patients consisted of females (n = 234; 67.9%) and males (n = 111; 32.2%). Prior to the Pneumococcal Initiative, documented pneumococcal vaccination rates at the project site was at 8.6%. Findings revealed an increase of
pneumococcal vaccination prescriptions by 15.1%. Meanwhile, documented administration (whether in the clinic or at a pharmacy) of the pneumococcal vaccines – PCV13, PPV23, and PCV20 – increased by 1.4%, 7.5%, and 13.6% respectively from the start of intervention. Overall, there is increased patient pneumococcal vaccine adherence rate of 37.7% at the end of the 12-week intervention.

Discussion

Diabetes and pneumonia can increase mortality rates when occurring together. Recent studies show that persons with diabetes are almost twice as likely to die from pneumonia than those without diabetes, and in some cases, the rate is three times higher. The Pneumococcal Initiative 12-week intervention was effective in improving provider knowledge and confidence regarding pneumococcal vaccination. It also led to an overall increase in patient acceptance and adherence rates, which is particularly noteworthy given the some challenges such as vaccine hesitancy and insurance coverage. Although provider adherence to the Diabetic Order Set (DOS) did not show statistical significance, identifying and addressing electronic health record mapping flaws could ultimately lead to increased vaccine uptake rates.

The results of the Pneumococcal Initiative 12-week intervention are encouraging, as they demonstrate the importance of provider education and engagement in improving vaccine uptake rates among patients. The finding of electronic health record mapping flaws that impacted provider adherence to the DOS highlights the potential for broader implications in improving healthcare delivery. The project results are consistent with previous literature findings that the involvement of medical staff, such as providers, can
improve patient vaccine uptake. However, the unsuitability of the DOS with the clinic’s current electronic workflow raises the need for tailored interventions that consider the varying types of implemented electronic health records across practices. Overall, the study underscores the importance of targeted educational interventions and provider engagement in improving patient vaccine uptake rates, especially in the context of comorbidities such as diabetes and pneumonia.

Additional findings evaluated the type of visit occurring during the provider and patient interaction. It was seen that the DOS was most utilized during in-person encounters versus encounters done via telehealth. In relation to in-person visits, the DOS was utilized marginally higher during diabetic and or physical exam visits than other non-diabetic or physical related visits. Although medicine has greatly transitioned to accommodate a telehealth platform, in-person engagement appears to be more effective for both provider and patient involvement (Reed et al., 2021).

Overall, the project results are consistent with other previous literature findings in that involvement of medical staff such as providers will produce improve patient vaccine uptake (Chaudhry et al, 2022; Rutten et al., 2021; Sozen et al., 2021). Uniquely, the project found that the DOS was most utilized during in-person encounters, particularly diabetic and physical exam visits, compared to encounters done via telehealth. The statement underscores the persistent difficulties of adjusting to a telehealth system and stresses the significance of face-to-face interactions in achieving productive involvement between healthcare providers and patients.
Limitations to the study include the lack of proper electronic software mapping/infrastructure challenges is a significant limitation, as it indicates that the intervention may not have been fully implemented as intended. The small provider sample size is also a limitation, as it may limit the generalizability of the findings. Additionally, vaccine cost/insurance coverage and hesitancy are important factors that may affect vaccine uptake rates, but they were not directly addressed in the intervention. Overall, the Pneumococcal Initiative 12-week evidence-based intervention shows promising results in improving provider knowledge and patient acceptance and adherence rates for pneumococcal vaccination. Addressing the limitations of the intervention and building upon its strengths could lead to further improvements in vaccine uptake rates and overall healthcare delivery.

Conclusion

The Pneumococcal Initiative aimed to improve pneumococcal vaccination knowledge among primary care providers and increase pneumococcal vaccination rates among adults aged 19-64 years with T2DM. Evidence—based literature supported improving provider knowledge with implementing educational sessions followed by a quiz to help reinforce knowledge; the use of order sets to help improve provider vaccine adherence; and provider and patient vaccine engagement to increase patient acceptance and adherence. The study found that the intervention was effective in improving provider knowledge, with positive provider satisfaction. However, provider adherence to the newly created Diabetes Order Set (DOS) was low, with no significant relationship found between provider adherence and the type of visit (in-person versus telehealth) or
diabetes/physical exam versus non-diabetes/other visit. Despite this, the intervention resulted in a significant increase in pneumococcal vaccination prescriptions and documented administration of the pneumococcal vaccines, with an overall increase in patient pneumococcal vaccine adherence rate of 37.7% at the end of the 12-week intervention.

**Dissemination**

The results of this study hold significant implications for healthcare providers and policymakers seeking to address the low vaccination rates among adults with T2DM. As such, these findings will be presented to administrative stakeholders at the collaborating organization to facilitate informed decision-making. Furthermore, this pilot study is intended for publication on social media, specifically the LinkedIn page of the California Primary Care Association and the Diabetes Education Network, to disseminate these results to a wider audience of healthcare professionals and stakeholders.

**Sustainability**

The success of the Pneumococcal Initiative in increasing pneumococcal vaccination rates among adults with T2DM highlights the importance of sustainable practices in healthcare. By implementing evidence-based strategies to improve provider knowledge, enhance vaccine adherence, and engage patients, the initiative was able to achieve a significant increase in patient vaccine adherence rates. It is hoped that this project will continue to increase pneumococcal vaccination rates in the next 10 years to meet Healthy People goals. Continued support from collaborated provider and nursing staff is necessary to provide patient education and encourage discussion about the
vaccine. Stakeholders, including administrative leadership, IT, providers, and nursing staff, will continue to play a vital role in sustaining this project. Additional staff to administer educational sessions, toolkits, and quizzes will be required, but the financial cost is relatively low. Partnering with primary care community clinic organizations can continue to help improve quality improvement projects. The positive provider satisfaction with the educational sessions and engagement strategies suggests that such sustainable practices can be readily adopted and integrated into routine healthcare practices for long-term benefits. Overall, the Pneumococcal Initiative serves as an example of how sustainable healthcare practices can lead to significant improvements in patient health outcomes and contribute to a more effective and efficient healthcare system.
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Appendix

(Align Appendices sequentially from first inclusion in narrative through last inclusion.

Start each new Appendix item on separate page in your actual work)

## Appendix A

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<td>vaccination and</td>
<td>educational</td>
<td>education and vaccine</td>
<td></td>
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<td>LA Care, Alliance</td>
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<td>diabetics</td>
<td>flyer regarding</td>
<td>vaccine adherence</td>
<td></td>
</tr>
<tr>
<td>IPA,</td>
<td></td>
<td></td>
<td>PPV23 to qualified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MediCare/Medicaid,</td>
<td></td>
<td></td>
<td>diabetics with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MHLA</td>
<td></td>
<td></td>
<td>supplemental</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal data with</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>AzaraHealth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Software Program:
Collect PPV23 vaccination rates amongst type 2 diabetics under 65 years
• External data: CDC, WHO PPV23 vaccination rates for type 2 diabetics under 65 years
• Identify problem:
Low vaccination rate of PPV23 amongst type 2 diabetics

- Outcome indicators:
  Vaccination rates

- Evidence using integrative review
  • Synthesize best evidence:
    one-on-one patient education in person or over the phone
  • Feasibility on clinical site: good

direct patient education in person or over the phone
• Needed resources:
  CDC vaccination information, medical staff training
• Plan implementation process
• Outcomes:
  Improved PPV23 vaccination rates amongst type 2 diabetics 65 years and under

- Decide to adapt, adopt, or reject practice change
**Figure 1.** Model for Change for Low PPV23 Uptake in Type 2 Diabetics Adapted from the Rosswurm and Larabee’s Model for Change to Evidence-Based Practice

---

**Appendix B**

**Timeline**

**Table 1**

*Simplified Project Timeline* (yours will have more Task Headers and will be more detailed)

<table>
<thead>
<tr>
<th>Task</th>
<th>October</th>
<th>November</th>
<th>December</th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
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</thead>
<tbody>
<tr>
<td>Recruitment of eligible participants</td>
<td>X</td>
<td>continued</td>
<td>?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention; Evaluation; Toolkit</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Post-test and</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Appendix C. Pneumococcal Educational Toolkit (Unmodified)

1. Pocket card

---

**What's my risk of pneumococcal disease?**

<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>- Invasive pneumococcal disease&lt;br&gt;- Respiratory failure&lt;br&gt;- Severe sepsis&lt;br&gt;- HIC&lt;br&gt;- Chronic lung disease&lt;br&gt;- Diabetes (non-insulin-dependent)</td>
</tr>
<tr>
<td>INTERMID.</td>
<td>- Pneumonia&lt;br&gt;- Influenza pneumonia&lt;br&gt;- COPD&lt;br&gt;- Asthma&lt;br&gt;- BMI &gt; 30&lt;br&gt;- Chronic heart disease</td>
</tr>
<tr>
<td>LOW</td>
<td>- None of the above</td>
</tr>
</tbody>
</table>

Adult, Age 19-64

- BOTH PCV13 and PPSV23
- PPSV23 Only
- Not needed

- Scan card if PCV13 only
- Last scan if PPSV23 only

---

**Have I already received the PPSV23?**

<table>
<thead>
<tr>
<th>Question</th>
<th>Adult, Age 65+</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>BOTH PCV13 and PPSV23</td>
</tr>
<tr>
<td>YES, before I turned 65</td>
<td>BOTH PCV13 and PPSV23</td>
</tr>
<tr>
<td>YES, after I turned 65</td>
<td>PCV13 Only</td>
</tr>
</tbody>
</table>

- Scan card if PCV13 only
- Last scan if BOTH PCV13 and PPSV23

---

http://www.cdc.gov/vaccines/hcp/acip-recs/sr Vent-pneumococcal.html
2. **Pneumococcal Vaccination Quiz with answers**

**Introduction:**

The purpose of this quiz is to assess knowledge from current internal medicine residents regarding pneumococcal vaccination guidelines. Please select the single best answer.

**Questions:**

1. Of the following, which is the most common manifestation of invasive pneumococcal disease in the adult population?

   1. A) Meningitis
   2. B) Septic arthritis
   3. C) **Bacteremia**
   4. D) Endocarditis

   **Rationale:** Identify the manifestations of invasive pneumococcal disease and understand their relative frequency.

1. A 63 year old woman presents to your clinic for routine examination. Her medical problems include osteoarthritis and hypothyroidism. Which of the following pneumococcal immunization regimens is most appropriate?

   1. A) Administer PCV-13 (Prevnar) now
   2. B) Administer PCV-13 (Prevnar) now and follow with PPSV-23 (Pneumovax) in approximately 8 weeks afterward
3. C) Administer PCV-13 (Prevnar) at 65 years of age and follow with PPSV-23 (Pneumovax) in approximately 8 weeks afterward.

4. D) Administer PCV-13 (Prevnar) at 65 years of age and follow with PPSV-23 (Pneumovax) in 12 months afterward.

Rationale: Identify the vaccination schedule for adult patients under the age of 65 without significant risk factors.

1. A 68 year old man has CHF and CAD. He received a dose of PPSV-23 (Pneumovax) at age 55 and no other pneumococcal vaccines thereafter. What should the provider do next?

1. A) No further action is needed

2. B) Administer PCV-13 (Prevnar) now

3. C) Administer PCV-13 (Prevnar) now and follow with PPSV-23 (Pneumovax) in approximately 8 weeks afterward

4. D) Administer PCV-13 (Prevnar) now and follow with PPSV-23 (Pneumovax) in 12 months afterward

Rationale: Identify the vaccination schedule for patients over the age of 65 with a history of previous pneumococcal vaccination.

1. A 59 year old man is evaluated during a routine examination in October. He was recently diagnosed with COPD. His COPD is controlled with tiotropium and albuterol. He receives an influenza vaccination yearly. He
has never received the pneumococcal vaccination. Which of the following is the best immunization regimen for this patient?

1. A) Influenza vaccine now

2. B) **Influenza and PPSV-23 (Pneumovax) vaccines now**

3. C) Influenza vaccine now and PPSV-23 (Pneumovax) vaccine at the next routine visit

4. D) Influenza vaccine now and PPSV-23 (Pneumovax) vaccine at age 65 years

Rationale: Identify the vaccination schedule for patients under the age of 65 with significant co-morbid medical conditions.

1. A 55 year old male presents to your clinic for a hospital follow up visit after recent admission for congestive heart failure exacerbation. The patient initially presented with dyspnea on exertion and increased lower extremity edema. After aggressive IV diuresis, the patient returned to baseline functional and volume status and was discharged from the hospital. Current medications include aspirin, furosemide, carvedilol, and lisinopril. The patient has never received any form of pneumococcal vaccine. In terms of immunizations, what is the most appropriate for the patient?

1. **Administer PPSV-23 (Pneumovax) now**

2. Administer PCV-13 (Prevnar) now; follow this with PPSV-23 (Pneumovax) in 8 weeks

3. Administer both PCV-13 (Prevnar) and PPSV-23 (Pneumovax) now
4. Pneumococcal vaccine should be not be given immediately following hospitalization

   Rationale: Identify the vaccination schedule for patients under the age of 65 with significant co-morbid medical conditions.

   1. A 74 year old female presents for routine physical examination. Her medical problems include essential hypertension, gout, and diet-controlled diabetes mellitus type 2. The vital signs and physical examination are unremarkable. The patient reports receiving PPSV-23 (Pneumovax) at the age of 66. What is the most appropriate care for the patient?

   1. Administer PCV-13 (Prevnar) now

   2. Administer PCV-13 (Prevnar) now; follow this with PPSV-23 (Pneumovax) in 8 weeks

   3. Administer both PCV-13 (Prevnar) and PPSV-23 (Pneumovax) now

   4. The patient does not need additional vaccinations

   Rationale: Understand the need for additional vaccination with PCV-13 for patients over age 65 that have previously received the PPSV-23 vaccine.

7. A 35 year old female was recently diagnosed with HIV after complaining of fatigue and malaise for 3 months. In addition to beginning antiretroviral therapy, which pneumococcal immunization(s) are indicated at this time?

   1. Pneumococcal vaccines should only be given after 3 months of antiretroviral therapy
2. Administer PCV-13 (Prevnar) now and follow with PPSV-23 (Pneumovax) in 12 months afterward

3. Administer PPSV-23 (Pneumovax) now; PCV-13 (Prevnar) is not indicated until age 65

4. **Administer PCV-13 (Prevnar) now and follow with PPSV-23 (Pneumovax) in approximately 8 weeks afterward**

Rationale: Identify the vaccination schedule for patients under the age of 65 with immunocompromising conditions.

8. Which most accurately describes the vaccine classification for PCV-13 (Prevnar)?

   1. A) Live attenuated
   2. B) Recombinant vector
   C) **Conjugate**
   D) Toxoid

Rationale: Identify the composition and unique features of the PCV-13 vaccine.

---

3. **Post-quiz survey**

   **Pneumococcal Vaccine Education - Effectiveness Survey**

   Please indicate your agreement with the following statement:

   1) Overall, this education was effective in improving my understanding and implementation of current pneumococcal vaccine guidelines for adults. (This education included a brief video, a pocket card, posters in clinic workrooms, and a PDF.)
      - Strongly agree  ○ Agree  ○ Neither agree nor disagree  ○ Disagree  ○ Strongly disagree

   2) Please provide any additional comments regarding the effectiveness of the pneumonia vaccine education.
4. CDC Guidelines

**Pneumococcal Vaccine Timing for Adults**

Make sure your patients are up to date with pneumococcal vaccination.

**CDC recommends pneumococcal vaccination for**

- Adults 65 years old and older
- Adults 19 through 64 years old with certain underlying medical conditions or other risk factors:
  - Alcoholism
  - Cerebrospinal fluid leak
  - Chronic heart/liver/lung disease
  - Chronic renal failure
  - Cigarette smoking
  - Cocaine/Heroin use
  - Congenital or acquired asplenia
  - Congenital or acquired immunodeficiencies
  - Diabetes
  - Generalized malignancy
  - HIV infection
  - Hodgkin disease
  - Iatrogenic immunosuppression
  - Leukemia
  - Lymphoma
  - Multiple myeloma
  - Nephrotic syndrome
  - Sickle cell disease or other hemoglobinopathies
  - Solid organ transplants
* Considered an immunocompromising condition

**For those who have never received a pneumococcal vaccine or those with unknown vaccination history**

Administer one dose of PCV15 or PCV20.

If PCV20 is used, their pneumococcal vaccinations are complete.

If PCV15 is used, follow with one dose of PPV23.

- The recommended interval is at least 1 year.
- The minimum interval is 8 weeks and can be considered in adults with an immunocompromising condition, cochlear implant, or cerebrospinal fluid leak.
- Their pneumococcal vaccinations are complete.

**For those who previously received PPV23 but who have not received any pneumococcal conjugate vaccine (e.g., PCV13, PCV15, PCV20)**

You may administer one dose of PCV15 or PCV20.

Regardless of which vaccine is used (PCV15 or PCV20):
- The minimum interval is at least 1 year.
- Their pneumococcal vaccinations are complete.

**Pneumococcal vaccines**

- PCV13: 13-valent pneumococcal conjugate vaccine (Prevnar 13®)
- PCV15: 15-valent pneumococcal conjugate vaccine (Prevnar 15®)
- PCV20: 20-valent pneumococcal conjugate vaccine (Prevnar 20®)
- PPV23: 23-valent pneumococcal polysaccharide vaccine (Pneumovax®)

www.cdc.gov/pneumococcal/vaccination.html
Appendix D

Results

Table 1.

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<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
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<th>Maximum</th>
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Table 2.

Test Statistics*  

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Table 3.

Provider Satisfaction

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<tr>
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<tr>
<td>Type</td>
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<tr>
<td>1</td>
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<td>0.0%</td>
</tr>
<tr>
<td>2</td>
<td>Disagree</td>
<td>0</td>
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<tr>
<td>3</td>
<td>Neither agree or disagree</td>
<td>0</td>
<td>0.0%</td>
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<tr>
<td>4</td>
<td>Agree</td>
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Table 4.
**Primary Care Pneumococcal Initiative**

**Descriptive Statistics**

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</table>

**Figure 1.**

**Table 5.**

**Provider adherence to Diabetes Order Set during visit prior to 12-week implementation**

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
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<tr>
<td>Valid did not use DOS pre</td>
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<td>100.0</td>
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**Table 6.**
### Provider adherence to Diabetes Order Set during visit after 12 week implementation

<table>
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<tr>
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<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
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<td>used DOS post</td>
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<td>Total</td>
<td>345</td>
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Table 7.

### Type of visit was Diabetic visit or Physical Exam

<table>
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<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Not Diabetic/Physical Exam Visit</td>
<td>219</td>
<td>63.5</td>
<td>63.5</td>
<td>63.5</td>
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<td>Diabetic/Physical Exam Visit</td>
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<td>Total</td>
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Table 8.

### Type of visit was telehealth visit

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<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Not Telehealth Visit</td>
<td>237</td>
<td>68.7</td>
<td>68.7</td>
<td>68.7</td>
</tr>
<tr>
<td>Telehealth Visit</td>
<td>108</td>
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<td>Total</td>
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Table 9.
### Provider adherence to Diabetes Order Set during visit after 12-week implementation * Type of visit was Diabetic visit or Physical Exam

Crosstabulation

<table>
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<tr>
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<th>Type of visit was Diabetic visit or Physical Exam</th>
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<th></th>
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<tr>
<td></td>
<td>Not Diabetic/Physical Exam Visit</td>
<td>196</td>
<td>105</td>
<td>301</td>
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<tr>
<td>Provider adherence to Diabetes Order Set during visit after 12-week implementation</td>
<td>used DOS post</td>
<td>23</td>
<td>21</td>
<td>44</td>
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<tr>
<td>Total</td>
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<td>219</td>
<td>126</td>
<td>345</td>
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Table 10.

### Provider adherence to Diabetes Order Set during visit after 12-week implementation * Type of visit was telehealth visit Crosstabulation

Crosstabulation

<table>
<thead>
<tr>
<th></th>
<th>Type of visit was telehealth visit</th>
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<td>206</td>
<td>95</td>
<td>301</td>
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<td>13</td>
<td>44</td>
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<tr>
<td>Total</td>
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<td>237</td>
<td>108</td>
<td>345</td>
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</table>

Figure 2.
Table 11.

<table>
<thead>
<tr>
<th>Age of patient</th>
<th>Statistic</th>
<th>Std. Error</th>
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<tr>
<td>Mean</td>
<td>52.50</td>
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<td>95% Confidence Interval for Mean</td>
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<td>5% Trimmed Mean</td>
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<td>Kurtosis</td>
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Table 12.
Table 13.
### Patient history of pneumococcal vaccine

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<th>Valid Percent</th>
<th>Cumulative Percent</th>
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<td>49.9</td>
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<td>Previously Vaccinated WPV</td>
<td>173</td>
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<td><strong>Total</strong></td>
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</table>

### Patient adherence to vaccine before implementation; previously vaccinated with PCV13

<table>
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<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
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<td>98.8</td>
<td>98.8</td>
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<td>1.2</td>
<td>1.2</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>345</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
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</table>

### Patient adherence to vaccine before implementation; previously vaccinated with PPV23

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Not Previously Vaccinated WPPV23</td>
<td>255</td>
<td>73.9</td>
<td>73.9</td>
<td>73.9</td>
</tr>
<tr>
<td>Previously Vaccinated WPPV23</td>
<td>90</td>
<td>26.1</td>
<td>26.1</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>345</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
### Patient adherence to vaccine before implementation; previously vaccinated with both PCV13 and PPV23

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Not Previously Vaccinated Wboth</td>
<td>328</td>
<td>95.1</td>
<td>95.1</td>
<td>95.1</td>
</tr>
<tr>
<td>Previously Vaccinated Wboth</td>
<td>17</td>
<td>4.9</td>
<td>4.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>345</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

### Patient adherence to vaccine before implementation; previously vaccinated with PCV20

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Not Previously Vaccinated WPCV20</td>
<td>337</td>
<td>97.7</td>
<td>97.7</td>
<td>97.7</td>
</tr>
<tr>
<td>Previously Vaccinated WPCV20</td>
<td>8</td>
<td>2.3</td>
<td>2.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>345</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 14.

### Patient acceptance of pneumococcal vaccination; Agrees to vaccine prescription

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid declines Vaccine Prescription</td>
<td>293</td>
<td>84.9</td>
<td>84.9</td>
<td>84.9</td>
</tr>
<tr>
<td>Agrees Vaccine Prescription</td>
<td>52</td>
<td>15.1</td>
<td>15.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>345</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
### Patient acceptance of pneumococcal vaccination with administered PCV13 vaccine

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid has not received UPV</td>
<td>340</td>
<td>98.6</td>
<td>98.6</td>
<td>98.6</td>
</tr>
<tr>
<td>given updated PCV13</td>
<td>5</td>
<td>1.4</td>
<td>1.4</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>345</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

### Patient acceptance of pneumococcal vaccination with administered PPV23 vaccine

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid has not received UPV</td>
<td>319</td>
<td>92.5</td>
<td>92.5</td>
<td>92.5</td>
</tr>
<tr>
<td>given updated PPV23</td>
<td>26</td>
<td>7.5</td>
<td>7.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>345</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

### Patient acceptance of pneumococcal vaccination with administered PCV20 vaccine

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid has not received UPV</td>
<td>298</td>
<td>86.4</td>
<td>86.4</td>
<td>86.4</td>
</tr>
<tr>
<td>given updated PCV20</td>
<td>47</td>
<td>13.6</td>
<td>13.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>345</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>