Implementation of Pneumonia/Influenza Vaccination Educational Brochure Among COPD Patients in a Primary Care Setting

Yasmin Rafiuddin

Rutgers, the State University of New Jersey- School of Nursing

DNP Chair: Dr. Ann D. Bagchi, Ph.D., DNP, FNP-C, APN

DNP Team Member: Dr. Mercedes E. Camacho, RN, DNP, APN, FNP-BC

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Abstract

Chronic obstructive pulmonary disease (COPD) is the third leading cause of death. COPD causes weakness in the immune and respiratory systems, exposing those living with the disease to higher risk for flu and pneumonia (Restrepo et al., 2018). Pneumonia and flu, combined, rank as the eighth leading cause of death in the United States (Restrepo et al., 2018; Nace et al., 2011). Vaccination is one the most cost-effective ways of preventing pneumonia and flu related illness and hospitalization in COPD patients. Despite numerous studies supporting the need for pneumonia and flu vaccination among COPD patients, national rates still fall below the target. An educational brochure was designed using the most current vaccination guidelines from the Global Initiative for Chronic Obstructive Lung Disease (GOLD), the Centers for Disease Control and Prevention (CDC) and the Immunization Action Coalition for COPD patients. The pamphlet also addresses the most common barriers to vaccination based on the literature. A pre-educational survey developed by the World Health Organization (WHO) Strategic Advisory Group on Experts (SAGE) on Immunization was used to assess for specific barriers to vaccination in the project setting. A pre/post-test quiz based on the information from the pamphlet was implemented to assess for improved understanding of the education provided. The theoretical framework guiding this project was the Model for Improvement: Plan-Do-Study-Act (PDSA) Cycle.

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Introduction

Chronic obstructive pulmonary disease (COPD) is a group of irreversible diseases that obstruct the lungs, making it difficult to breathe. Because COPD weakens the respiratory systems, patients are more vulnerable to respiratory infections such as pneumonia and influenza. These illnesses often lead to an acute exacerbation of COPD (AECOPD), which is a worsening of symptoms, such as coughing, wheezing, and shortness of breath. Typically, these episodes result in hospitalization and, in worst cases, death (Restrepo, Sibila, and Anzueto, 2018).

The Centers for Disease Control and Prevention (CDC) (2016) strongly recommends those living with chronic respiratory diseases (CRDs), such as COPD, to get vaccinated for influenza and pneumonia. However, due to various barriers discussed below, vaccination rates remain low. As a result, hospitalizations continue to rise, contributing to increasing health care costs (Restrepo et al., 2018). While incredible efforts have already been made by health care associations (i.e., CDC, World Health Organization [WHO] and the American Lung Association) to address this issue, many patients with COPD continue to endure severe illness each year. To improve vaccination rates and patient outcomes, tremendous efforts are necessary by both clinicians and patients. The first aim of this project was to review the literature to identify common barriers to vaccination. Based on this information, the DNP student implemented an educational vaccination brochure in a primary care setting, with the end goals being to improve COPD patients' understanding of the significance of immunity and, ultimately, to improve vaccination rates.

Background and Significance

COPD is currently the third leading cause of death in the United States (U.S.). This group of debilitating illnesses encompasses bronchitis and emphysema, which are both chronic and cause poorly reversible airflow (Calverley, 2008). The obstruction in airflow results in symptoms such as wheezing, shortness of breath, coughing, and increased sputum production (WHO, 2017). Living with this disease is not as easy as one may imagine. Simple daily activities such as climbing stairs, grocery shopping or walking the dog can tire a person living with COPD very easily. Despite this, COPD can be managed with a variety of medications, oxygen therapy, deep breathing exercises, and pulmonary rehabilitation. Illness usually develops between the ages of 40 to 50 and is typically caused by years of smoking or exposure to outdoor/indoor pollution (WHO, 2017).

According to the COPD Foundation (2019), flare-ups, known as acute exacerbations are a significant complication of living with COPD. They typically result in severe shortness of breath and frequently requires hospitalization. Although allergens, stress, and change of weather may trigger an acute exacerbation, respiratory infections, especially pneumonia and influenza, are mainly to blame. Due to the fact that the respiratory system is weak, the lungs are unable to protect the body from infections and are therefore more vulnerable to viruses and bacteria (COPD Foundation, 2019).

Influenza (flu) & COPD

Influenza is a virus that infects the respiratory tract and can lead to a variety of illnesses, ranging from symptomless infection to primary viral and secondary bacterial pneumonia (Mallia and Johnston, 2007). Influenza exists in several different strains, some of which are stronger and cause more harm than others. Along with pneumonia, the flu is the 8th leading cause of death in

the U.S. and contributes 40% to 60% of COPD exacerbations. Symptoms of the flu typically start out as fever and aches but can lead to headache, a sore throat, and a dry cough. It usually lasts one to three days in healthy patients (Wesseling, 2007). For the immunocompromised, elderly, and those living COPD, hospitalization can last several weeks to months due to concurrent bacterial infections, such as those caused by Streptococcus pneumoniae, Haemophilus influenza, or Staphylococcus aureus (Wesseling, 2007).

Pneumonia & COPD

Pneumonia is defined as an infection (bacterial or viral) that causes inflammation of one, or more lobes of the lung (COPD Foundation, 2019). Organisms tend to settle in the lungs' air sacs (alveoli) and can proliferate, leading to the development of pus and fluid. It is reported that patients with COPD are 16 times more likely to get pneumonia compared to those without. As mentioned, in patients with weaker immune or respiratory systems, illness can be much more severe, leading to an increase in hospitalizations and worse outcomes. Additionally, there have been studies indicating that, in patients with COPD, inhaled corticosteroid use may also suppress the immune system, which enhances the susceptibility to respiratory infections (Restrepo et al., 2018). According to Restrepo et al. (2018), pneumonia resulted in more than 1.1 million hospitalizations and nearly 50,000 deaths in 2016.

Vaccinations and COPD

Based on what is known about the correlation between COPD and flu/pneumonia, major health agencies such as the CDC and WHO strongly recommend vaccination for both illnesses (Restrepo et al., 2018). The genetic makeup of the influenza virus is continually changing, indicating the need for annual vaccination. Some studies suggests that the flu and pneumonia vaccine are ineffective in preventing illness in patients with COPD. For example, there are

studies reporting that the efficacy in PPSV23 against community-acquired pneumonia has been inconsistent in at-risk populations (Froes, Roche, and Blasi, 2017). However, there is also data indicating otherwise (Mallia & Johnston, 2007). For example, based on a large cohort study done on 150,000 elderly patients, vaccination for influenza resulted in a 32% reduction of hospitalization for all respiratory conditions. Additionally, among patients with chronic lung diseases vaccination resulted in a 52% reduction in hospitalization and a 70% decrease in death rates during flu season (Wesseling 2007).

While the pneumonia vaccine is not required yearly, there are two different types of pneumonia vaccine available: Pneumovax (PPSV23) and Prevnar (PCV13). PPSV23 protects against 23 types of pneumonia bacteria while PCV13 protects against 13 strains (CDC, 2016). For patients who are younger than 65 years old and have COPD, it is recommended to get vaccinated with one dose of (PPSV23) and a one-time dose of PCV13 if they have not received it previously. Patients aged 65 or older need a dose of PCV13 (if not received it previously), and a second dose of PPSV23, provided at least five years have passed since the first dose (Immunization Action Coalition, 2018).

Although studies showing the efficacy of the vaccine in COPD patients are limited, there is information indicating that it does prevent illness. A study analyzing 58 patients for community-acquired pneumonia indicated that the pneumonia vaccine was effective in preventing pneumonia among patients less than 65 years old and living with COPD (Alfageme et al., 2005). Similarly, a three-year cohort study by Ventola (2016) demonstrated that there was a 63.8% reduction in all incidences of pneumococcal pneumonia in patients over the age of 50. Additionally, according to Restrepo et al. (2018), the pneumonia vaccine reduces the likelihood of COPD exacerbation, ultimately benefiting the patient with COPD.

Despite this significant amount of research, influenza and pneumococcal vaccination rates are below the target in the U.S. Studies and surveys have found that there are numerous barriers to vaccination. For those who have chronic illnesses, the main obstacles include patient visit priority, difficulty identifying patient vaccination status, and challenges recommending vaccination/revaccination (Ventola, 2016). Another troubling finding is that low coverage rates may be due to the fact that health care providers (i.e., physicians, nurse practitioners, nurses, etc.) are not encouraging patients to get vaccinated (National Foundation for Infectious Disease, 2015). Miscellaneous reasons also include, but are not limited to, cost, lack of knowledge/ awareness, and lack of accessibility (i.e., transportation problems, language barriers, cognitive issues) (Ventola, 2016).

Vaccine-preventable disease not only affects the well-being of patients living with COPD, it also takes a massive toll on our health care system. According to the American Lung Association (2015), in 2013 the U.S. spent more than $19.9 billion on pneumonia- and influenza-related health care (i.e., home treatment, prescriptions, emergency room treatment, inpatient hospitalization, outpatient/office visit). While pneumonia expenses were responsible for 81% ($16.2 billion) of this total, influenza accounted for the remaining $3.7 billion.

Prior studies have addressed the issue of poor vaccination. In a study done on community-dwelling adults, researchers utilized various methods to improve flu and pneumococcal vaccination rates. Interventions included financial incentives, audit and feedback, clinician reminders, clinician financial incentives, clinician education, and case management. Results showed that all interventions are highly effective, especially personal patient outreach via direct patient contacts, clinician education, and case management services (Lau et al., 2012).

Research relating to the efficacy of interventions and the barriers experienced by patients and our health care system suggest that the easiest and most cost-effective interventions would focus on improving clinicians' delivery of vaccine education and increasing the receptivity of patients. The goal of this project is to educate patients using a pamphlet that provides information geared towards those living with COPD and how influenza/pneumonia impacts their health. Implementation will occur via telephone calls or in-person clinical site visit and will take place in two primary care offices located in Essex County over a four-month period. Evaluation of the success or failure of the intervention will be based on the ability of the patient to demonstrate improvement in understanding of pamphlet education using a pre/post educational quiz and the patient's decision to receive one or both vaccines.

Needs Assessment

Global

There are nearly 251 million people living with COPD internationally (WHO, 2017). According to WHO (2018), COPD and lower respiratory tract infections ranked as the third and fourth leading causes of death internationally. While COPD claimed the lives of 3 million people worldwide, lower respiratory tract infections remain the deadliest communicable disease and were also the cause of 3 million deaths internationally in 2016 (WHO 2018). Outside of the U.S., influenza and pneumonia vaccination rates vary significantly across each continent due to a variety of barriers.

Like the U.S., many developed countries have adequate access to vaccines. Despite this, the vaccination rate for influenza for 2017 in the European Union (EU) was just 41.8%, and in other developed countries, rates approached at least 70% or more (Dinerstein, 2018). While more precise details on vaccination rates among COPD patients were difficult to locate, several

countries reported on the staggering hospitalization rates for COPD exacerbation due to flu and pneumonia. According to one study done in Germany, viruses were detected in 56% of cases of COPD exacerbation-related hospitalizations, compared with only 19% of stable COPD patients in the control group (Mallia and Johnston, 2007). Similarly, in Singapore, in a study of 14 patients admitted for COPD exacerbation, in 64% of the cases, viruses were detected. The most common infection was influenza, with 36% of cases reportedly not having received the influenza vaccine (Mallia and Johnston, 2007).

In a study conducted in Denmark, researchers examined hospitalizations for COPD exacerbation in the presence of and without pneumonia between 2006 and 2012. They concluded that pneumonia was a frequent finding in patients with COPD exacerbation and that it is in fact "associated with increased health care utilization and higher mortality" (Søgaard et al., 2016, p 455). Among the 179,759 people hospitalized, pneumonic COPD exacerbation increased by 20% from 0.92 per 1000 population in 2006 to 1.10 per 1000 population in 2012 (Søgaard et al. 2016).

It is worth mentioning that although there are millions living with COPD in underdeveloped countries, the barriers to vaccination are primarily due to a shortage of, or slow introduction to vaccines. While flu vaccine availability has increased dramatically over the past ten years, the WHO reports that supply still falls short of global demand. While 95% of the vaccines manufactured are used in North America, Europe, and the western Pacific, the remaining 5% goes to the underdeveloped parts of the world mentioned above, which makes up 48.5% of the global population (Dinerstein, 2018).

National

COPD is currently the third leading cause of death in the United States, with nearly 20 million people living with this chronic illness, many of whom are undiagnosed. As mentioned

earlier, much of the mortality and morbidity affiliated with COPD are due to acute exacerbations. In the U.S. COPD is responsible for 1.4 million emergency room visits and nearly 662,000 hospitalizations (Mallia & Johnston, 2007). According to Rest repo et al. (2018), COPD-related hospitalizations have contributed to roughly $10 billion in health care costs. While it was reported that among patients living with COPD vaccination for both illnesses were higher than those without COPD (American Lung Association, 2015). According to the American Lung Association (2015) only 82 % of COPD patients received the vaccination for pneumonia, and only 64% got the flu vaccine in 2014.

State & Local

Among all citizens living in New Jersey only 34.6% of residents received the flu vaccine in 2014 and 64.1% received the pneumonia vaccine (American Lung Association, 2015). There is no specific information regarding how many patients living with COPD received either vaccine. Based on a community health assessment done at a 342 bed acute care facility located in Essex County, COPD was among the top ten reasons for an emergency room visit in 2014. Flu and pneumonia were also the ninth leading causes of death in Essex County (RWJBarnabas Health, 2016).

Problem/Purpose Statement

Even though there are numerous studies showing the efficacy of vaccination for flu and pneumonia in COPD patients, vaccination rates still remain low (Dinerstein, 2018; Mallia and Johnston, 2007; Søgaard et al., 2016). Due to various modifiable barriers, thousands of preventable deaths occur each year. As mentioned, this issue is not only a local battle but also a global threat. Low rates of vaccination not only result in preventable hospitalizations and health care costs but also excess deaths. In order overcome this issue, action needs to continue in small

steps. Sharing an educational pamphlet in a local primary care setting among patients with COPD, clinicians had the opportunity to provide concise information for a specific group.

Clinical Question

Does the implementation of an education pamphlet on the dangers of pneumonia/flu among patients living with COPD and the benefits of vaccination improve patient understanding and rates of vaccine uptake?

Aims & Objectives

This project aimed to improve the rates of flu and pneumonia vaccination among COPD patients in a primary care setting. Through sharing information from an educational pamphlet, patients were expected to gain an increase in knowledge of why they are more susceptible to illness due to their history of COPD. The DNP student educated patients in-person and via telephone calls on how vaccination has been shown to help reduce morbidity and mortality among people living with COPD. Patients who were contacted via telephone were given the opportunity to schedule an appointment for vaccination, while those seen in the office were offered vaccines on site.

The object of this project was to give patients a better opportunity to control their health. Through education, they were expected to gain a powerful tool in decision-making, as opposed to relying only on the opinions of others. Outcome measures included a knowledge increase, as measured through a pre/post educational quiz, and increases in post-education vaccination rates. The goal was to improve evidence-based practice consistent with established clinical guidelines.

Review of the Literature

The DNP student completed a comprehensive review of the literature in March of 2019 focusing on effective/cost-effective interventions for improving vaccination rates as well as the relationship between flu/pneumonia and COPD. The search used the following databases:

PubMed, CINHAL, Medline, Joanna Briggs (JBI), Cochrane Library, and Google Scholar. Key search terms/phrases included *pneumonia, influenza* OR *flu, immunization* OR *vaccination, educational brochure* OR *pamphlet, vaccination education, barriers to vaccination, increasing* OR *improving vaccination rates, effective, efficacy, cost-effective, COPD* OR *Chronic Obstructive Pulmonary Disease*. Searches of all the databases used the advanced filter of 5 years except for classical studies and followed the PRISMA guidelines for data extraction.

The search of the CINHAL and Medline databases used a combination of the following terms/phrases: *COPD* OR *Chronic obstructive pulmonary disease, influenza/flu, pneumonia, vaccine* OR *immunization, improving vaccination rates, education, barriers, and educational brochure* yielded 3960 results. Five of these studies are included in the final literature review.

Using the Joanna Briggs Institute (JBI) database and the individual search terms mentioned above yielded 833 results. The combination *of pneumonia, influenza/flu* AND vaccine/immunization AND *COPD* yielded six results. The combination of search terms *educational brochure/program,* AND *vaccine/immunization* yielded three results. One study was used in the final evidence table.

Using PubMed and the combination of the terms/phrases *pneumonia, influenza/flu, vaccine, vaccination rates, improving vaccination rates, barriers to vaccination,* and *COPD* yielded 1,797 results, four of which were used in the final literature review.

Lastly, using the following combination of terms on the Google Scholar Search engine: *effective, interventions/methods, education, flu/pneumonia vaccine, COPD* yielded more than 30,000 results. Two articles were used in the final review. The Cochrane library search yielded two results, both of which were used in the final review. In total, the final literature review included 14 studies.

Burden of Influenza/ Pneumonia on COPD

COPD is responsible for thousands of hospitalizations each year and currently ranks as the third leading cause of death among male and females in the U.S. (Restrepo et al., 2018). Influenza and pneumonia, together, rank as the fourth leading cause of death, and the leading cause of vaccine-preventable illness in the U.S. (Nace et al., 2011). Since people living with COPD are at a higher risk for flu and pneumonia, the literature consistently documents recommendations for vaccination within this patient population. People living with COPD face a significant risk for acute exacerbations of symptoms (severe coughing, wheezing, and shortness of breath) if they contract flu or pneumonia. This can lead to higher hospitalization rates and health care costs (Bekkat-Berkani et al. 2017; Sanei and Wilkinson, 2016).

The 2017-2018 flu season was one of the worst seasons yet (Roshel, 2018). There were 12,000 to 56000 flu-related deaths, 140,000 to 710,000 hospitalizations, and between 9.2 and 36 million cases of flu in the U.S. in 2017 (Roshel, 2018). In approximately 70% of COPD exacerbation hospitalizations, nearly 30% are due to viruses (Bekkat-Berkani et al. 2017). These statistics highlight how important it is for COPD patients to avoid the flu as much as possible. The public is continuously educated on the prevention of spreading germs through proper hand hygiene, avoiding coughing/sneezing on others, and staying at home when sick (CDC, 2018). However, proper hygiene interventions can only do so much for those who have COPD and weak respiratory systems. Through a thorough examination of the evidence, vaccination has proven to be effective in protecting patients with COPD (CDC, 2018; Schembri, Morant, Winter and MacDonald, 2009; Bekkat-Berkani et al., 2017).

Pneumonia is an infection of the lungs and causes severe illness in COPD patients. According to Fores, Roche, and Blasi (2017), there are an estimated 3.37 million cases of

pneumonia annually, one-third of which require hospitalization. The risk of pneumonia, in the U.S., is 2.7 times higher in adults older than 65, compared to adults 50 to 60 years old and is a 7.7 times higher in persons with COPD compared to those without comorbidities (Fores, Roche, and Blasi, 2017). What places COPD patients at a higher risk for pneumonia is the "impaired mucociliary clearance mechanisms, and production of the specific cell adhesion molecules that mediate attachment of bacteria and viruses is increased in the airway," (Fores, Roche, and Blasi, 2017, p 3459). The number one recommended intervention for preventing pneumonia among high-risk adults is vaccination (Fores, Roche, and Blasi, 2017).

Efficacy of Vaccination

A Cochrane Review indicated that the inactivated influenza vaccine decreased exacerbations of COPD related to the influenza virus (Kopsaftis, Wood-Baker, and Poole, 2018). The review consisted of six studies and included 2469 patients with COPD and 4281 older or high-risk patients living with chronic lung disease (Kopsftis, Wood-Baker, and Poole, 2018). Similarly, several studies have also concluded that the influenza vaccine was affiliated with a decrease in all-cause mortality and supported a positive benefit-risk ratio in COPD patients (Bekkat-Berkani et al., 2017; Schembri, Morant, Winter and MacDonald, 2009). The evidence from these studies supports the efficacy of vaccination and suggests that patients with COPD should follow current guidelines and recommendations for receipt of annual vaccinations.

Guidelines strongly recommend that all adults over the age of 65 and all adults between the ages 19 to 65 years old who are living with a chronic illness obtain vaccine PPSV23 (Froes, Roche, and Blasi, 2017). Additionally, it is recommended that PCV13 be administered before PPSV23 because it offers improved protection in older adults and those living with COPD. A recent Cochrane Review found that the pneumonia vaccine reduces the incidence of acute

exacerbations of COPD and offers protection against community-acquired pneumonia (Walters, Tang, Poole and Wood-Baker, 2017). Another study showed that when PPSV23 is given along with the influenza vaccine, exacerbation frequency was dramatically lower than when either vaccine was given alone. The current evidence strongly supports the efficacy of both vaccines, especially when given at the same time (Froes, Roche, and Blasi, 2017). Simultaneous administration of both vaccinations, helps patients with COPD to develop stronger immune and respiratory defense, leading to less frequent exacerbations, fewer flu- and pneumonia- related hospitalizations, reduced health care costs, and lower mortality rates.

Limitations and Gaps

Despite strong support for the current vaccination recommendations, there are many limitations and a lack of statistically significant evidence indicating efficacy (Pamaiahgari, 2018; Walters, Tang, Poole, & Wood-Baker 2017). According to a JBI systematic review, while there is strong support for the influenza vaccine in COPD patients, there is a lack of statistically significant evidence of reduced rates of hospitalization and mechanical ventilation following flu vaccination (Pamaiahgari, 2018). Another study also suggested that while there is overall evidence to support the administration of the flu vaccine there is little research on the "individual benefit of administering TIV (trivalent influenza vaccine) as a prophylactic treatment in patients with COPD," (Sanei & Wilkinson, 2016, p 362). However, these authors note that efficacy of the vaccine could be complicated by the timing of vaccination, co-administration of other vaccines, and severity of COPD or the presence of other chronic illnesses (2016). The lack of clear evidence may lead researchers and patients to question the vaccine's efficacy.

Similarly, for the pneumonia vaccine, there is minimal definitive information on whether the vaccine prevents illness on an individual basis (Walters, Tang, Poole, & Wood-Baker 2017).

While research has shown vaccination to be beneficial in a group, studies have not examined efficacy at the individual level. The study by Walters et al. (2017) found that those who are vaccinated are less likely to experience COPD exacerbations. Their data suggests that at least eight people (95% CI 15 to 74) would have to be vaccinated to prevent one episode of an exacerbation and 21 people (95% CI 5 to 58) would have to be vaccinated to prevent one episode of pneumonia. In both cases, the type of vaccination was insignificant (Walters, Tang, Poole, & Wood-Baker 2017). While there is much more research to be done on the individual efficacy of both influenza and pneumonia vaccines in COPD patients. The literature supports current recommendations for influenza and pneumonia vaccine in COPD patients.

Barriers to Vaccination

There are many barriers to vaccination. Based on the literature, the barriers affiliated with pneumonia and flu vaccine include misconceptions/inadequate education on how vaccines are made and possible side effects, poor documentation of immunization status by the health care providers, inadequate provider-patient communication, and poor accessibility due to vaccine costs, language barriers, travelling distances etc. (Ventola, 2016; Madigan & Kenneley, 2015). Religious or cultural views may also impede vaccine uptake. Beliefs that vaccines can cause illness and disease stem from false beliefs and poor education regarding the risk and benefits of immunizations.

Additionally, some patients believe immunizations are no longer necessary in adulthood and are only need as children (Ventola, 2016). Other education barriers can originate with health care providers. Clinicians may offer vaccines, but may be quick to document a refusal rather than spend additional time educating patients to convince them to change their mind. Given the limited time available in an office visit, vaccines are not always a top priority (Ventola, 2016).

These missed opportunities may not be an issue for those living without CRDs but poses a significant hazard for those who do.

Limitations in Assessing for Vaccination Hesitancy

In general, assessing for vaccine hesitancy has been a challenge throughout the years. According to WHO (2014), up until 2014, vaccine hesitancy did not have an official definition, which is:

"The delay in acceptance or refusal of vaccination despite availability of vaccination services. Vaccine hesitancy is complex and context specific, varying across time, place and vaccines. It is influenced by factors such as complacency, convenience and, confidence" (p. 7).

While health care has come a long way in identifying barriers to vaccination, literature also suggests there are limited tools used to identify barriers across the globe (Larson et al., 2015). According to Larson et al. (2015) "tools are needed to assess the scope and scale of hesitancy issues by vaccine and setting. Ideally, a common survey tool than can be used globally would allow comparability across countries," (p 4165). In efforts to tackle this issue, the WHO Strategic Advisory Group of Experts (SAGE) on Immunization developed a list of survey questions known as the Vaccine Hesitancy Scale (VHS).

The VHS assessment questions stem from a broad review of the literature assessing the common barriers to vaccination from all types of settings and populations. Questions can be adjusted based on the type of vaccine being given or on the population being assessed (adult versus child) (Larson et al., 2015). Questions are broken down into three different types of barriers: (1) contextual influences (media/social media, religion, political leaders, historical influences), (2) individual/group influences (past vaccine experiences, cultural/personal beliefs, trust in health care system, perceived risk versus benefit, social norms), and (3) vaccine-specific

issues (risk versus benefit based on scientific evidence, mode of administration, introduction of new vaccines, design of vaccination mode of delivery, reliability of vaccine supply, vaccine schedule) (Larson et al., 2015). The VHS incorporates three question types: open ended, 5-point Likert scale, and close-ended survey questions (yes/no) (Larson et al., 2015).

Although the WHO SAGE VHS is relatively new, it is a major first step in developing a universal approach for assessing vaccine hesitancy (Domek et al., 2018). While more work is needed to assess the validity and reliability of the Likert scale questions, there have not been any documented limitations using the closed-ended questions. However, more information and research is needed using the VHS (Domek et al., 2018).

Interventions to Improve Vaccination Rates

Despite efforts already made, overcoming the low vaccination rates for pneumonia and flu has proven to be a challenge. Interventions that have been successful in increasing vaccination rates include education, outreach programs, follow up phone calls/reminders, and visual reminders (Sadaf, Richards, Glanz, Salmon, & Omer, 2011; Ventola 2016; Lau et al. 2012). Each of these interventions require clinicians to take their time with patients and to address the specific barriers patients face. For example, to address language barriers, education materials can be printed in several different languages. Rather than just distributing the information, brief brochures can easily be discussed in person during office visits (Lau et al. 2012, Coenen, et al. 2017).

Coenen et al. (2017) reported on a quality improvement study designed to increase vaccinations rates (including flu and pneumonia) among those living with inflammatory bowel disease. The researchers of this study divided patients into two groups. One group received educational information, including brochures and flyers regarding the significance of vaccination

among this patient population. The other group did not receive more information beyond what is typically discussed with the clinician in a regular office visit. Although results showed that education had a statistically significant impact on vaccination compliance, questions remained regarding whether these interventions alone can optimize vaccination rates (Conene, 2017).

Theoretical/Conceptual Framework

The model guiding the implementation of this project was the Model for Improvement, developed by the Associates in Process Improvement and used by the Institute for Healthcare Improvement (IHI) (Moran, Burson, & Conrad, 2017). This model focuses on three questions: (1) What are we trying to accomplish? (2) How will we know that a change is an improvement? and (3) What changes can we make that will result in improvement? (Moran, Burson, Conrad, 2017). Answering these questions allows the researcher/organization to develop aims, establish measures, and select the type of change needed. The goals for this project were to increase COPD patients' knowledge of the significance of vaccination and improve vaccination rates. Return education and an increase in vaccination compliance were considered indicators of whether the change was effective. Sharing of an educational brochure during office visits or via telephone call will be the change in how patients were educated about their COPD diagnosis and influenza/pneumonia.

As part of the Model of Improvement, the Plan Do Study Act (PDSA) cycle (see figure 1, Appendix B) tests changes on a smaller scale in a safe, timely, effective, efficient, equitable, and cost-effective manner (Reed & Card, 2016). PDSA consists of the following four steps: (1) Plan a test or observation, including a plan for collecting data; (2) Do-try out the test on a small scale; (3) Study-analyze the data and study the results; and (4) Act-refine the change based on what was learned from the test (Institute for Healthcare Improvement, 2019).

Methodology

Design of Project

The research project was a quality improvement study with a pre/post-test design. The design was an appropriate fit as it aligned with the project's aims and objectives. First, patients received a verbal survey assessing vaccination hesitancy. The literature has suggested the success of written materials inimproving immunization rates and changing vaccination behaviors (Lau et al., 2012; Sadaf et al. 2014). The intervention allowed the DNP student to examine how an educational brochure influenced vaccine decisions in patients who had not previously been vaccinated for flu and/or pneumonia. The success of the intervention was based on whether the patients could demonstrate understanding through return education, in addition to vaccination compliance.

Setting

This project took place in one internal medicine practice located in New Jersey in two of its four office locations. There are four clinicians working at this multi-location practice, which serves a diverse patient population with a variety of medical needs.

Study Population/Subject Recruitment

The project population was all adults living with COPD who had previously not been vaccinated for influenza and/or pneumonia. The project aimed to recruit a minimum of sixty patients. The patients, regardless of gender, race, and education level, were recruited through a chart audit via the electronic medical record. Inclusion criteria were all English-speaking adult patients, with a diagnosis of COPD, who had not received recommended vaccination for the flu and/or pneumonia. Exclusion criteria included adults with other chronic conditions, including other CRDs, adults who had already received the flu/pneumonia vaccine, and non-English speaking patients.

Consent Procedure

Because a signed consent would be the only link to subject identifiers and the principal risk to the subject would be due to a breach of confidentiality, a waiver of signed consent was requested for all study activities. Yasmin Rafiuddin is currently a DNP student at Rutgers University's School of Nursing and had the responsibility for conducting the proposed research project. With the waiver of signed consent, Ms. Rafiuddin selected participants after a chart audit based on the inclusion criteria from the EMR. Based on this chart audit, participants who were scheduled for routine primary care visits, or those who attended walk-in appointments were asked if they would like to participate in the proposed study. Oral consent was obtained from all participants. In efforts to meet sample size requirements, patients who also met the inclusion criteria, but were not scheduled for an appointment were also asked to participate via a telephone call by the primary care clinicians employed at the medical care practice. No personally identifiable information was collected from patients; therefore, all participants remained anonymous in the analytic data file.

Risks/Harms/Ethics

This study posed no more than the average risk of harm to the study participants. The only foreseeable risks were those associated with routine vaccine administration (i.e., redness and swelling at the injection site, temporary muscle pain associated with injections, etc. [CDC, 2018]). There were no other physical, psychological, or emotional risks or harms through this study. Data were collected using the EMR. The DNP student was the only individual who had access in the office using a login and password provided by the office manager. Minimum non-identifiable data were collected including patient diagnosis, demographic characteristics, and immunization status. This minimum information remained in the office and was locked in a

cabinet for the student to use in the office only. The student was the only individual with a key to the cabinet. The student interviewed and educated patients over the telephone in the office only. It was unnecessary to collect any identifiable information such as patient name, phone number, date of birth or account number.

Costs and Compensation

There was no financial incentive for participants to take part in this research study. The staff did not participate in the activities of this study. The student used her own resources to design and print the educational pamphlets. A telephone, paper, and writing utensils were provided in the study setting. There were no other costs associated with this study.

Study Intervention

The DNP student assessed for vaccine hesitancy using select questions from the WHO SAGE VHS. Sixteen dichotomous (yes/no) questions were included, all of which assessed for the most common barriers to vaccination for pneumonia and flu vaccine (see Appendix C). Some questions were adjusted to address the adult study population.

The DNP student designed an educational brochure outlining the current vaccine recommendations made by GOLD, the CDC and the Immunization Action Coalition (see Appendix D). The information presented gave a brief overview of the importance of immunizations for adults living with COPD and offered explanations to common barriers associated with vaccination based on the literature review. The information was discussed in detail via telephone call for the patients who were not in the office and in-person during office visits. The information was distributed in English only.

Prior to and after the information was given, the patients completed an educational quiz that consisted of 9 dichotomous (true/false) questions (see Appendix E). The quiz allowed the

DNP student to assess for whether there were improvements in the patients' understanding of vaccination importance.

Outcome Measures

A chart review was conducted prior to the project implementation. Currently, at the project setting, an assessment for vaccination is done for both pneumonia and flu, including refusal reason and whether or not education was given. Based on this existing practice, the chart review focused on all adults living with COPD, with no documented history of flu and/or pneumonia vaccine. After project implementation, another chart review was conducted on the same participants who were given information. Vaccination compliance, education compliance, and refusal were measured for success. The pre/post-educational quiz allowed the student to measure improvement in patient education. No patient identifiers (i.e., name, account number, DOB) were recorded in the data analytic file. The collected information mentioned helped to identify whether or not the educational material improved understanding of vaccine significance and rates of uptake.

Project Timeline

Assembly of the DNP team took place over seven days, starting in January 2019. Consent from the project implementation site was obtained on April 8, 2019. Planning for the project also began in January 2019, and was completed in May of 2019. The proposal was finalized, presented and approved by the DNP team in May of 2019. The proposal was then submitted to the IRB for approval in August 2019 and received in October of 2019. The project was then implemented from October 2019 through January 2020. Findings and results were analyzed in January 2020. The final project will be presented in April 2020. Graduation is anticipated in May of 2020.

Evaluation Plan

Data Maintenance and Security

The data collected were obtained from the EMR. Minimum non-identifiable data were collected including patient diagnosis, demographic data, and immunization status. This minimum information remained in the office and was locked in a cabinet for the student to use in the office only. The student possessed the only key to the cabinet. The student interviewed and educated patients over the telephone in the office only. Now that the project is completed, the collected written information will stored in a locked cabinet in the office of the PI, who will be the only individual with access. The information documented in the EMR regarding updated vaccination status and education will remain in the EMR and will continue to benefit the primary care clinician for future reference.

Data Analysis Plan

Patient demographics and survey responses were analyzed using descriptive statistics. Using the SPSS software, the pre/post-intervention vaccination compliance rates were measured using the Paired t-test. Evaluation of patient understanding of information was evaluated through the implementation of a pre/post quiz, which covered all of the information that was provided through the educational brochure. The paired t-test was also used to compare results before and after the information was given to ensure patients' understanding.

Discussion of Anticipated Findings

It was anticipated that the information presented in the educational pamphlet clarified any information on the flu and pneumonia vaccine. The information was customized to patients living with COPD and was designed to help them understand that they are at a higher risk for developing both illnesses than those without COPD. If patients were able to demonstrate better

understanding of information and if they agreed to vaccinations it would indicate that education played a significant role in compliance. These results would also indicate that the primary care setting continues to play a significant role in preventing COPD exacerbation and hospitalization.

Plans for Dissemination and Professional Reporting

After project completion, the goal is to provide more education in different primary care settings about vaccinations and COPD patients. Considering that COPD is one of the leading causes of death in the U.S., it is significant to prevent hospitalizations, and there is no better place to start than with the primary care provider (Restrepo et al., 2018). The student will draft a manuscript based on the study's findings for submission to the *Journal of the American Association of Nurse Practitioners*. Findings will also be presented at Rutgers' School of Nursing DNP Poster day.

Results

The implementation of this project took place from October 2019 throughout January 2020. The chart review conducted through the facility's EMR yielded 300 patients with a documented diagnosis of COPD and a lack of flu or pneumonia vaccination. Forty-five subjects met inclusion criteria. The DNP student obtained verbal consent prior to conducting study procedures and used SPSS software to analyze all collected data.

Demographics

The statistical analysis on demographic characteristics indicates participants were from several different racial backgrounds, with majority of Hispanic (33.3%) and African American (53.3%) descent (Table 1). Additionally, most of the patients were female (55.6%). The ages of all participants ranged between 40 and 70 years old, most of whom had a high school (35.6%) and college (37.8%) education level.

Results of VHS Survey

The barriers that patients cited reflected a range of factors, some easily amendable to intervention and others of a more practical nature (Table 2). The most common barriers related to physical discomforts with shots, lack of knowledge and inconvenience associated with medical visits. Specifically, the most common barriers were fear of needles (58.7%), pain affiliated with vaccines (63.0%), lack of knowledge of how vaccines work (40.0%), lack of knowledge of which vaccines they should receive (55.6%), and a wait time of more than 1 hour to receive a vaccine (60.0%).

Pre/Post-Educational Quiz Scores and Vaccination Rates

All 45 participants completed the pre/post-educational quiz containing nine dichotomous (true/false) questions. Before education, the mean score among the participants was 66.8%, and after education, the mean score was 100%. Scores were analyzed using the Paired t-test, which indicated that education had a statistically significant impact on test scores ($t_{(44)}$= 9.284, p<0.001).

Using the Paired t-test for flu and pneumonia vaccination before and after education indicated that education did not significantly influence vaccination choices. There were no statistically significant differences in intention to receive either vaccination after patients reviewed the educational brochure. Before education, 57.8% of patients intended to receive the flu vaccine, with only a small percentage (66.7%) actually agreeing to getting the vaccine after reviewing the pamphlet scores ($t_{(44)}$= 1.000, p=0.323). Similarly, before education, only 8.9% intended to receive the pneumonia vaccine and only 17.8% agreed to vaccination after ($t_{(44)}$= 1.274, p=0.209).

Discussion

VHS Survey

After analyzing the results of the VHS survey, many of the barriers to vaccination are similar to those discussed by Ventola (2016) and Mandigan & Kenneley (2015). Another concern mentioned in the literature was inadequate documentation of vaccination status by the health care provider (Ventola, 2016; Madigan & Kennely 2015). During the chart review conducted in this study, not only were vaccinations poorly documented, but the diagnosis for COPD was inaccurate for many patients. During the recruitment process, each subject was required to confirm their diagnosis of COPD and whether they received the flu or pneumonia vaccine in the past.

Based on the feedback, many patients had received either one or both of the vaccinations previously. In most cases, they reported getting the vaccines from their local pharmacy, explaining that it was more convenient, especially since the provider does not carry the pneumonia vaccine in the office. In rare cases, where some patients were inconsistent in the information they were providing, it is also possible that they were not entirely sure what vaccines they received in the past. In both cases, there is a possibility patients either did not disclose or provide written proof of vaccination to the provider or the provider did not ask/follow up with patients to keep the chart updated. Despite the reason for inconsistent documentation, this was a major limitation to the study. This study can serve as a learning opportunity to improve communication between patient and provider, thus resulting in accurate documentation.

As mentioned before, the chart review yielded a total of 300 patients with a documented diagnosis of COPD. However, only 45 patients confirmed their diagnosis, except for patients who spoke a different language. Possible reasons for this could be that patients are not aware of their diagnosis, the diagnosis was not confirmed through pulmonary function tests, or the

patients lack knowledge of what COPD is. Regardless of the case, this limited the sample size of the study, but more importantly, it prevents necessary care for patients who may have COPD.

As demonstrated through the survey, a lack of knowledge plays a significant role in vaccinations. The educational pamphlet distributed covered all of the barriers addressed in the survey and 9 had a positive impact on improving patient knowledge of COPD, flu/pneumonia and vaccinations. Moreover, spending time with the patients discussing the information in the pamphlet and clarifying the information played a role in increasing patient knowledge as discussed in the literature review (Lau et al. 2012, Coenen, et al. 2017). The use of a pre/post-educational quiz helped to examine whether or not the pamphlet was sufficient, and in this case, it was in terms of improving knowledge. Even though many patients did not disclose their education level, that factor did not seem to limit the improvement of quiz scores among the group. Unfortunately, the improvement of knowledge had no impact on vaccination rates. Despite taking the time to explain and review the pamphlet, the majority of the group opted not to get the flu or pneumonia vaccine. While a few patients verbalized they would come back to get the vaccine, others stated they would get it from their local pharmacy when they have time. A majority, however, stated personal reasons continue to hold them back from the vaccines. These responses once again play a role in inadequate documentation of vaccine and poor follow-up by the health care provider.

Another limitation to this study was denying patients who are non-English speaking an opportunity to take part. As discussed previously, the PDSA Cycle was the theoretical framework for this study. Step 4, which is Act, is to refine the change based on what was learned from the test (Institute for Healthcare Improvement, 2019). Following the framework, allowing all patients to participate in this type of quality improvement activity would improve vaccination

rates among the patients in the facility. While this requires the staff to have the pamphlet printed in several languages, it could make a difference in the care of the community.

Overall, the VHS survey was successful in identifying main vaccination barriers among patients, and the pamphlet improved patient knowledge of COPD and how it relates to flu and pneumonia. Unfortunately, vaccination rates did not improve. However, the study provides essential information to the facilities should they decide to implement additional interventions to improve vaccination rates.

Implications

Clinical Practice

The overall goal of this project was to improve the rates of flu and pneumonia vaccination among patients living with COPD. While the goal of increasing rates was not met due to various reasons, the success of the intervention was indicated through improved pre/post quiz results. Giving patients a chance to discuss the information in the pamphlet resulted in many verbalizing a better understanding of COPD and how it relates to flu/pneumonia. Based on the study's findings, there is a strong possibility of improving the intervention in the future. Once these results have been presented to the primary care site, the aim is to continue educating patients and distributing pamphlets. As mentioned before, printing pamphlets in several languages and educating the staff on the information will help improve education among the patient population. The most common barriers to vaccination in this study are worth addressing by the clinicians in order to improve vaccination rates.

In order to overcome the barrier of pain affiliated with vaccination, whether it be pain with needles or from the vaccine, Taddio et al. (2015) recommend using a combination of techniques to reduce pain during vaccinations. Administering the most painful injection first,

allowing the patient to sit up during the vaccine, providing education of what to expect, and refraining from aspirating during intramuscular vaccines are all strongly recommended for pain reduction in adults (Taddio et al., 2015). The with the documentation and publishing of this study, other primary care offices will also distribute written education to patients living with COPD and avoid increased hospitalization and worsening of illness.

Healthcare Policy

With the completion of this project and obtaining a doctoral degree, the DNP student has the skills to influence healthcare policy. After thorough research of COPD and the impact of flu and pneumonia, the DNP student understands the essential steps to conduct a research project and therefore find ways that would improve future practice. While master's degree programs allow nurse practitioners to become competent clinical practitioners, DNP programs allow the practitioner to influence all levels of policy change including state, national and international (Doctor of Nursing Practice, 2019). DNP graduates have opportunities to meet with legislators and discuss health care proposals or sit in on staff meetings to discuss health care issues. Using this project as an example, the student can sit with local legislators or policymakers to discuss the local need for improved vaccination rates to decrease local hospitalizations (Doctor of Nursing Practice, 2019).

Recommendations for policy changes, in this case, are organizational and national. Although the vaccination results were not statistically significant, the intervention did improve knowledge as evident by the quiz results. With the staff at the organization educated and the materials printed in several languages, the information could continue to be distributed to patients during office visits. Additionally, the staff and clinicians can address barriers their patients face, such as reducing pain affiliated with vaccines. With continuous reminders, along

with the inclusion of non-English speaking patients, and addressing barriers, this intervention has the potential to improve rates in the future.

Quality and Safety

Through the distribution of printed educational materials using evidence-based information from government websites, this project did not threaten the safety of patients. Government websites such as the CDC and the American Lung Association were used to create the educational pamphlet. Information also included how the flu and pneumonia affect patients living with COPD and how life-threatening those illnesses could be (Centers for Disease Control and Prevention, 2016).

During this study implementation process, no identifiable information was collected. Therefore, there was minimal risk of breach of confidentiality. Educational materials were offered to patients to take part in the study, and if patients refused to take part, then the DNP student abided by the subjects' wish. All non-identifiable information collected was locked in a cabinet to which only the DNP student had access. Once the project is complete and information has been stored in the primary investigator's office for six years in a closed cabinet, the information will be shredded appropriately.

Education

The intervention used in this study offers education to patients that is current and considered the standard of care in preventing worsening of COPD and hospitalization. Not only does the information presented in the pamphlet benefit the patient population, it keeps primary care providers updated on the necessary information to give to patients. This study will also educate new care providers on what is essential in primary care. With more patients being hospitalized for COPD exacerbation each year, it is necessary to take action in primary to

prevent hospitalization. Once published, this study could also provide further insight to practitioners across the country and state, reinforcing the notion that printed materials are indeed successful in improving vaccination rates.

Economic

Discussed previously, much of the mortality and morbidity affiliated with COPD are due to acute exacerbations. In the U.S., COPD is responsible for 1.4 million emergency room visits and nearly 662,000 hospitalizations (Mallia & Johnston, 2007). According to Rest repo et al. (2018), COPD-related hospitalizations have contributed to roughly $10 billion in health care costs. Distributing printed materials and taking time to discuss vaccination with patients in the primary care setting is one of the most cost-effective ways of preventing further hospitalization and worsening of illness. While it is important to remember that this is not a complete guarantee for improvement, printed materials could help the process in a costly manner. “The goal of printing and disseminating educational materials is to improve awareness, knowledge, attitudes, skills, and professional practice of health care providers (process outcomes), and also to improve patient health outcomes,” (Farmer, 2008, p. 2).

Plans for Future Scholarship

The next step is to present the final project to the DNP team for approval in March 2020. Overall the goal is to provide more education in different primary care settings about the importance of flu/pneumonia vaccinations and to improve the knowledge of all patients living with COPD. As discussed previously, educating all staff on the pamphlet and encouraging providers to take the time to educate all patients is vital in the sustainability of this intervention. Eventually, it is also a goal for the student to draft a manuscript based on the study’s findings for

submission to the *Journal of the American Association of Nurse Practitioners*. Findings will also be presented at Rutgers' School of Nursing DNP Poster day.

Summary

Considering that COPD is one of the leading causes of death in the U.S., it is significant to prevent hospitalizations, and there is no better place to start than with the primary care provider (Restrepo et al., 2018). This project aimed to improve the rates of pneumonia and flu vaccination among patients living with COPD. Both of these illnesses are life-threatening to those living with COPD and it is essential to continue educating patients and care providers. Overall this study suggests that education is effective in improving knowledge but may be insufficient in improving vaccination rates. A review of the study's findings suggests that some ways to enhance the intervention for future implementation. With these changes, it may be possible to improve vaccination rates among patients living with COPD. Through the results of this project, providers may agree to distribute printed materials in the primary care setting as a way to improve patient education.

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Table 1.

Demographic Characteristics of Participants

Baseline Characteristics	n	%
Sex		
Male	20	44.4
Female	25	55.6
Age		
40s	19	42.2
50s	17	37.8
60s	8	17.8
70s	1	2.0
Race		
African American	24	53.3
Hispanic	15	33.3
Caucasian	3	6.7
Asian/Indian	3	6.7
Education Level		
High School	16	35.6
College	17	37.8
Refused	12	26.7

Table 2.

Results of VHS Survey

Barriers to Vaccination	n	%
Knowledge		
Confusion about which vaccine to receive	25	55.6
Lack of knowledge of how vaccines work	18	40.0
Vaccine Schedule	2	62.2
Feel there are better methods of prevention	22	48.9
Feel Vaccines are not safe	14	31.1
Pain/Safety		
Fear of Needles	27	58.7
Pain after Vaccine	29	63.0
Access		
Inconvenient	13	28.9
Wait time of >1hr	27	60.0
Cost	22	48.9
Insurance (feel vaccines should be covered)	31	68.9
Location/Distance	15	33.3
Culture Religion	14	31.1
Past Vaccination Experience	23	51.1
Provider		
Lack of Trust for Correct Information	16	35.6
Poor Recommendation (for vaccines)	19	42.2

Appendix A

Table of Evidence

Article #	Author & Date	Evidence Type	Sample, Sample Size, Setting	Study findings that help answer the EBP Question	Limitations	Evidence Level & Quality
1	Bekkat-Berkani, 2017	Systematic review: RCTs and observational studies	17 articles, 13 studies	4 RCTs + 1 observational study demonstrates flu vaccine is immunogenic in pts with COPD Two studies found no increased risk of AECOPD after vaccination. 6/7 studies indicate longterm benefits of flu vaccine such as reduced exacerbation and reduced hospitalizations	More information/ regarding pneumonia vaccine is needed to prove definitive efficacy	Level III Good quality
2	Coenen et al. 2017	Quality Improvement	505 patients w/ IBD, Outpatient Clinic	Educational methods were statistically significant (P=0.001)in improving vaccination compliance. At baseline, only 32 % of all patients were compliant with vaccinations. Post education, 33% of the control group vs only 6% of the non-control group were compliant with vaccines.	Further education is needed as post eduction surveys were incomplete, patients did not	Level V
3	Froes, Roche, Blasi, 2017	Expert Opinion	NA	Overall there is evidence for the efficacy of PPV23 in older adults. PCV13 prevents CAP in older	Data is inconclusive for PPV23 protection in all	Level V Good Quality

				adults AND pts with chronic illnesses. Both influenza and pneumonia vaccines help prevent AECOPD	adults with CRDs	
4	Kopsaftis Z, Wood-Baker R, Poole P, 2018	Systematic Review	Six studies 2469 participants with COPD, five studies with 4281 older or high-risk participants	Vaccination decreased flare-ups of AECOPD; inactivated vaccine DOES NOT cause illness	Two studies evaluating mortality for influenza vaccine versus placebo were too small to have detected any effect on mortality	Level III High Quality
5	Lau et al., 2012	Systematic review and meta-analysis	77 studies Consisting of RCTs, Quasi RCTs, and observational studies	Interventions to improve flu and pneumonia vaccine rates: clinician reminders, patient outreach, clinician education	Study design limitations	Level III High Quality
6	Madigan And Kenneley, 2015	Multi-case study	Five agency case study	Barriers to vaccination mostly include poor education among clinician and patients	Participation rates, opinions/views of barriers differed, findings cannot officially be applied to other agencies	Level V Good quality
7	Nace et al., 2011	Quality Improvement	6 LTC facilities examined	Education does have an overall impact on increasing vaccination rates in a long	Staff turnover was a barrier to optimizing	Level V High quality

				term care facility	results	
8	Pamaiahgari, 2018	Systematic Review	2 RCT systematic reviews, two prospective cohort studies, two retrospective cohort studies, Systematic review with metanalysis, ecological study	Influenza vaccine has an overall risk-benefit ratio for COPD patients	Not enough information proving the efficacy of vaccine specifically in COPD patient due to lack of studies	Level III Good quality
9	Roshel, 2018	Quality Improvement Study	Unidentified sample number, medical clinic	Education plays a role in vaccination rates	Limitations related to the researcher's intervention, which is irrelevant to this study	Level V
10	Sadaf et al., 2013	Systematic Review	Thirty studies consisting of RCTs, Evaluation studies and NRCTs	Information/educational based interventions (i.e., powerpoints, flyers, and pamphlets)proved statistically significant positive impact on vaccination rates/patient education	More evidence is needed on proving how educational interventions can change patient perception and behaviors	Level III High Quality
11	Sanei & Wilkinson, 2016	Systematic review	9 RCTS	Overall there is a reduced mortality rate with Trivalent influenza vaccine	Impact of the vaccine on exacerbation unclear, more	Level III Good quality

					studies needed	
12	Schembri, Moran, Winter, MacDonald, 2009	Cohort study, Nonexperimental	120 patients with COPD	Influenza vaccine is associated with reduced all-cause mortality in COPD patients	Misclassification in documentation (possible false positive dx for COPD)	Level III Good quality
13	Ventola, 2016	Peer- Review	N/A	Barriers to vaccination mostly include poor education. Interventions to improve rates include spending time with patients and providing through education	NA	Level IV High Quality
14	Walters, Tang, Poole, Wood-Baker, 2017	Systematic Review, RCTS	12 studies with 2171 participants with COPD	Participants who were vaccinated were less likely to experience an episode of CAP 21 participants would need vaccination to prevent one episode of pneumonia Eight people would have to be vaccinated to prevent one person from having an episode of AECOPD	N/A	Level III, high quality

Appendix B

Figure 1. Institute for Health Care Improvement. (2019). Science of Improvement: Testing Changes

Model for Improvement: Plan-Do-Study-Act (PDSA) Cycles. Retrieved from http://www.ihi.org/resources/Pages/HowtoImprove/ScienceofImprovementTestingChanges.aspx

Appendix C

Vaccination Hesitancy Survey
Please answer yes or no to the following questions:

1. Have reports you heard/read in the media/social media made you reconsider the choice to have yourself vaccinated?
   YES NO
2. Do leaders (religious, political, teachers, health care workers) in your community support vaccines?
   YES NO
3. Do you remember any events in the past that would discourage you from getting a vaccine for yourself?
   YES NO
4. Does your religion/philosophy/culture recommend against (a certain) vaccination?
   YES NO
5. Has the distance, timing of clinic, time needed to get to clinic or wait time at clinic and/or cost in getting to clinic prevented you from getting vaccinated?
   YES NO
6. Have you or someone you know ever had a bad reaction to a vaccine which made you reconsider vaccines?
   YES NO
7. Do you believe there are other (better ways) to prevent diseases which can be prevented by vaccine?
   YES NO
8. Do you feel you know which vaccines you should get for yourself?
   YES NO
9. Do you feel you get enough information about vaccines and their safety?
   YES NO
10. Do you think vaccines are still needed even when the disease is no longer prevalent?
    YES NO
11. Do you think it is important to get a vaccine to protect those that cannot get vaccinated?
    YES NO
12. Do you believe vaccines are safe for yourself?
    YES NO
13. Do you fear the pain to you or fear the needles when receiving a vaccine make you hesitate to be immunized?
    YES NO
14. Has pain following immunization ever made you reconsider to have yourself vaccinated?
    YES NO
15. Would you rather receive a vaccine as conveniently as possible?
    YES NO
16. Do you consider all important vaccines provided/covered by your health insurance/health care plan/ health care provider?
    YES NO

Figure 2. Pretest Vaccination Hesitancy Survey

Appendix D

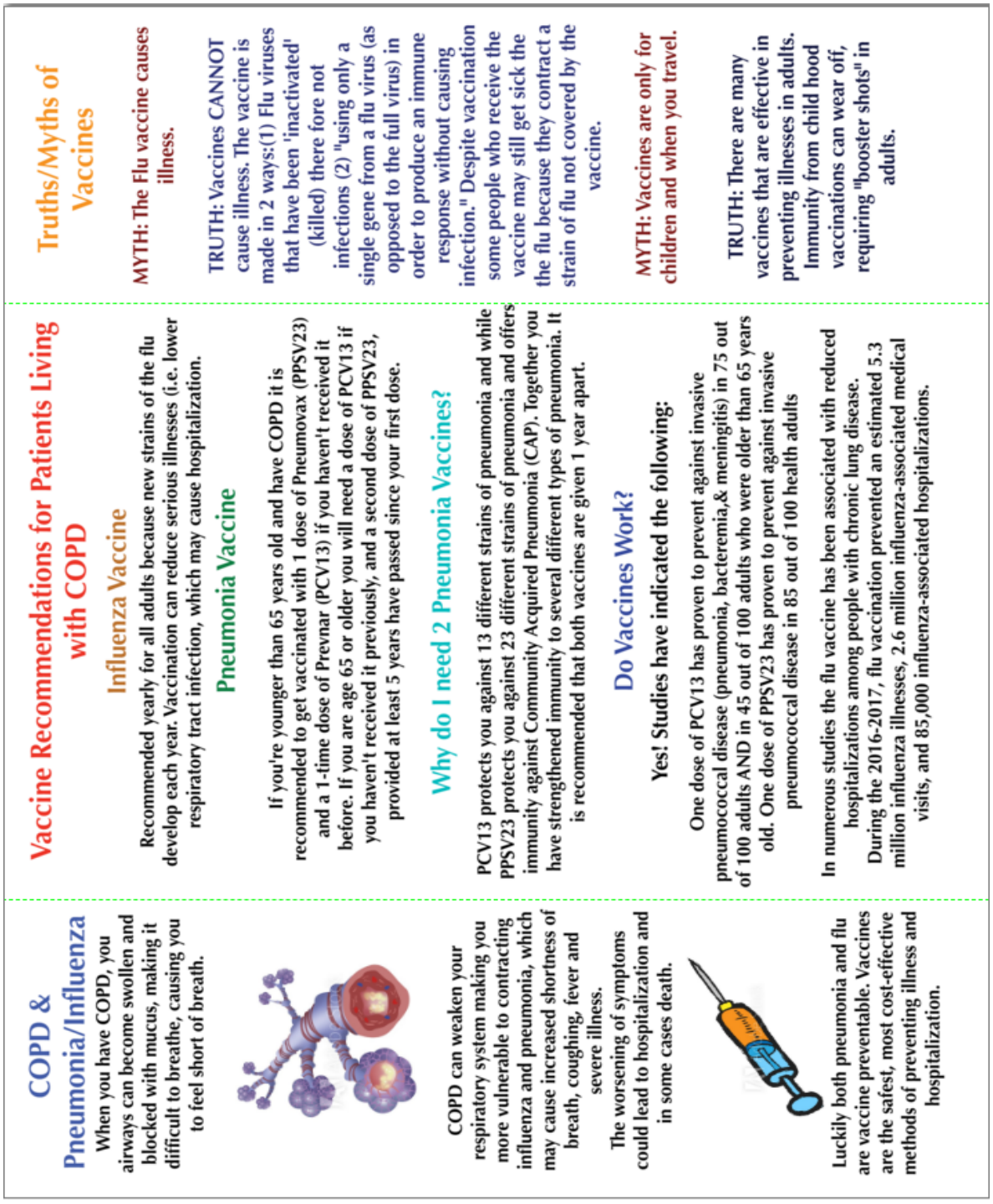
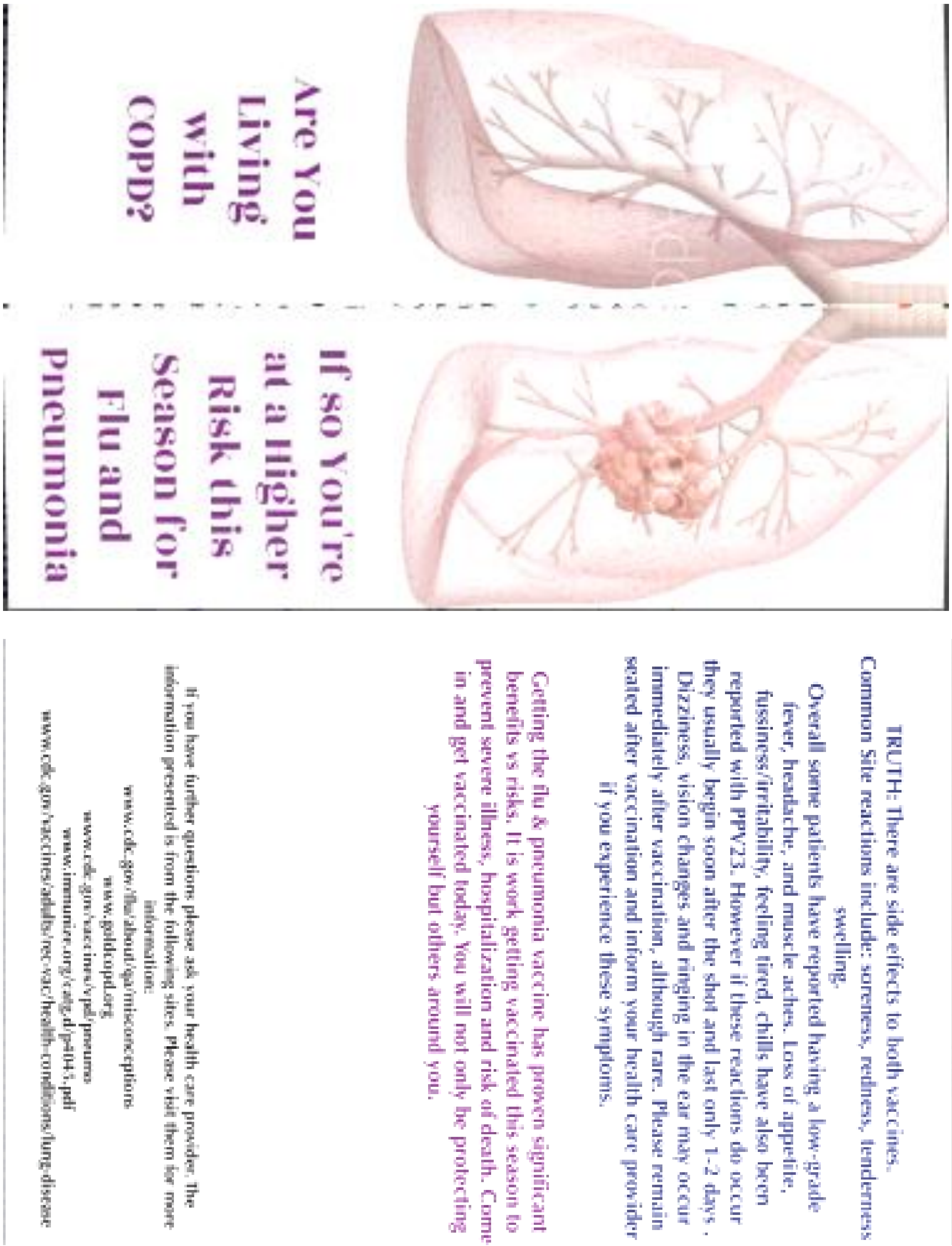


Figure 4. Educational Brochure (Inside)



Are You Living with COPD?

If so You're at a Higher Risk this Season for Flu and Pneumonia

TRUTH: There are side effects to both vaccines.
Common Site reactions include: soreness, redness, tenderness swelling.
Overall some patients have reported having a low-grade fever, headache, and muscle aches. Loss of appetite, fussiness/irritability, feeling tired, chills have also been reported with PPV23. However if these reactions do occur they usually begin soon after the shot and last only 1-2 days . Dizziness, vision changes and ringing in the ear may occur immediately after vaccination, although rare. Please remain seated after vaccination and inform your health care provider if you experience these symptoms.

Getting the flu & pneumonia vaccine has proven significant benefits vs risks. It is work getting vaccinated this season to prevent severe illness, hospitalization and risk of death. Come in and get vaccinated today. You will not only be protecting yourself but others around you.

If you have further questions please ask your health care provider. The information presented is from the following sites. Please visit them for more information:
www.cdc.gov/flu/about/qa/misconceptions
www.goldcopd.org
www.cdc.gov/vaccines/vpd/pneumo
www.immunize.org/catg.d/p4043.pdf
www.cdc.gov/vaccines/adults/rec-vac/health-conditions/lung-disease

Figure 5. Educational Brochure (Front and Back)

Appendix E

Post Education Quiz

Please answer true or false to the following statements:

1. Living with COPD puts me at a higher risk for pneumonia and flu
   TRUE FALSE
2. Influenza and pneumonia can worse my COPD symptoms (coughing, shortness of breath), which can result in hospitalization and severe illness.
   TRUE FALSE
3. Vaccines are only for children or when traveling outside the country.
   TRUE FALSE
4. Vaccines can cause illness.
   TRUE FALSE
5. The following vaccines are recommended for patients living with COPD, and younger than 65 years old.
   a) Flu vaccine (yearly)
   b) Pneumonia (PPSV23)
   c) Prevnar PCV13 (one dose)
   TRUE FALSE
6. The following vaccines are recommended for patients living with COPD, and aged 65 and above.
   a) Flu vaccine (yearly)
   b) Pneumonia (PPSV23), if you have not received it in the past year
   d) Prevnar PCV13, onetime dose if you have not received it before
   TRUE FALSE
7. The following are common **site reactions** of vaccines:
   a) Redness
   b) Swelling
   c) Tenderness
   d) Soreness
   TRUE FALSE
8. The following are **general side effects** of flu and pneumonia vaccines
   a) Low-grade fever
   b) Headache
   c) Muscle aches
   d) Loss of appetite
   e) Fussiness (irritability)
   f) Feeling tired
   g) Chills
   TRUE FALSE
9. Dizziness, vision changes, and ringing in the ear may occur immediately after vaccination, although rare. Remaining seated after vaccination and informing care provider of symptoms is important.
   TRUE FALSE

Figure 6. Pre/Post Education Quiz