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Chart Audit and Educational Provider Feedback Intervention to Improve Appropriate Use of Spirometry in Patients with Chronic Obstructive Pulmonary Disease

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CHART AUDIT AND EDUCATIONAL PROVIDER FEEDBACK INTERVENTION TO IMPROVE APPROPRIATE USE OF SPIROMETRY IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

A Scholarly Project

Submitted to the

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In partial fulfillment of

The requirements for the degree

Of Doctor of Nursing Practice

By

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ABSTRACT

Despite being a GOLD guideline and having documented benefits, confirming a COPD diagnosis with spirometry is not routinely done. The purpose of this project was to increase patient referrals for spirometry to confirm COPD diagnosis. A quasi-experimental design was incorporated in a primary care office. A retrospective pre-intervention chart audit and two post-chart audits, 30-days apart, compared the frequency of documented spirometry to confirm a COPD diagnosis. An educational intervention with a pre and post-survey examined provider behavior intention to order spirometry to confirm a COPD diagnosis. The pre-chart audit revealed that 27/50 (54%) of patients had spirometry documented to confirm a COPD diagnosis. Thirty-day post chart audit and feedback intervention revealed 33/50 (66%) and sixty-day post chart audit and feedback intervention revealed 31/50 (62%) of patients had spirometry documented to confirm a COPD diagnosis. The Z-test at 30 days revealed the P-value corresponding to z-1.225 is 0.112. The Z-test from the pre-chart audit to the 60-day post-chart audit revealed the P-value corresponding to z-0.8104 is 0.2088. The post-survey of 6 providers revealed a behavior intention increase from 63.4% to 86.6%, a 23.3% increase in behavior intention. Although there was not a statistically significant increase in the number of spirometry referrals, there was a clinically significant increase. After implementing a chart audit and educational intervention, the provider's behavior intention also increased. Hence, a chart audit and educational intervention may be helpful to improve primary care provider's behavior intention for specific clinical practice guidelines.

Keywords: Spirometry, COPD, primary care, chart audit.

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Table of Contents

List of Tables

List of Figures

List of Abbreviations

American Thoracic Society (ATS)

Appraisal of Guidelines Research & Evaluation II tool (AGREE)

Centers for Disease Control and Prevention (CDC)

Centers for Medicare and Medicaid (CMS)

Chronic Obstructive Pulmonary Disease (COPD)

Collaborative Institutional Training Initiative (CITI)

European Respiratory Society (ERS)

Evidenced-Based Practice (EBP)

Forced Expiratory Volume (FEV)

Forced Vital Capacity (FVC)

Global Initiative for Chronic Obstructive Lung Disease (GOLD)

Lower Limit of Normal (LLN)

Nurse Practitioner (NP)

Physician Assistant (PA)

Primary Care Providers (PCP)

Probability Value (P-value)

Randomized Controlled Trial (RCT)

Risk Difference (RD)

Scottish Intercollegiate Guidelines Network (SIGN)

United States

Veterans Affairs

Introduction

Chronic obstructive pulmonary disease (COPD) is a common, progressive, and debilitating disease that affects many people worldwide on a daily basis. COPD is characterized by an airway chronic inflammatory reaction from factors such as respiratory gases, especially tobacco smoke (Ghattas et al., 2013). COPD is prevalent and imposes a major fiscal burden on our global healthcare system. In 2010, COPD incurred approximately $50 billion from direct and indirect expenses (Guarascio, Ray, Finch, & Self, 2013). COPD affects approximately 6.3% of people in the United States, or 15 million adults (CDC, 2012). Current practice recommendations by the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines identify the significance of confirming a COPD diagnosis using spirometry (GOLD, 2017). Use of spirometry helps avoid misdiagnoses, determine prognosis, and guide treatment (GOLD, 2017). Healthcare providers have a weighty responsibility to properly diagnose and treat patients and must strongly consider the recommendations by reputable sources such as the GOLD standards (GOLD, 2017).

Spirometry is an objective, readily available, and noninvasive method to confirm the diagnosis of COPD (GOLD, 2017). Utilizing spirometry aids in avoiding misdiagnosing COPD, indirectly reduces COPD readmissions, improves patient outcomes and safety concerns, improves quality of life, is fiscally beneficial, and may ultimately reduce the global burden COPD has on the health care system. Chart audit and performance feedback is an efficient method to improve provider's compliance with evidenced-based practice guidelines, such as the usage of spirometry to confirm COPD diagnosis (Ivers et al., 2013). The purpose of this project is to determine the effectiveness of using a chart audit and feedback method to educate primary care providers on confirming COPD diagnosis with spirometry.

Background

Epidemiology of COPD

COPD is a common disease, characterized by its chronic and progressive nature. It is a major cause of morbidity and mortality around the world. It is the fourth leading cause of mortality, and by 2020 is suspected to increase to the third main cause of death (GOLD, 2017). The prevalence of COPD still continues to be high in the United States. Approximately 6.3% of people in the United States, or 15 million adults suffer from COPD (CDC, 2012). COPD also impacts morbidity and is associated with many co-morbid conditions. A large cross-sectional study examined COPD and its co-morbidities in the primary care setting. These co-morbidities include anxiety, depression, hypertension, and many others (Chetty et al., 2017). This study concluded that patients with COPD are much more likely to have many physical and mental co-morbidities that coincide with this disease than those who do not have COPD (Chetty et al., 2017). Within the fiscal perspective, COPD causes a large burden on the global healthcare system. In 2010, the amount of both direct and indirect expenses that COPD incurred summated approximately $50 billion (Guarascio et al., 2013).

COPD Diagnosis

Providers have a responsibility to correctly diagnose and treat their patients to prevent long-term complications and to delay the progression of a disease (Wood, 2014). Since COPD is chronic and progressive, the earlier that an accurate diagnosis is made, the better the outcome (Wood, 2014). In order to understand the importance of spirometry, COPD in general needs to be briefly examined regarding risk factors, etiology, diagnosis, and clinical manifestations.

Tobacco smoke is the most common identified risk factor for developing COPD (GOLD, 2017). Other risk factors include being exposed to occupational and other air pollutants.

Although nonsmokers can also develop COPD, the pathophysiology behind COPD involves a conglomeration of exposure to harmful gases and specific host susceptibilities. These specific host considerations include genetic components, asthma, history of pulmonary infections, advanced age, female gender, and lower socioeconomic status (GOLD, 2017).

Signs and symptoms of COPD include chronic dyspnea, cough, and sputum production (GOLD, 2017). The dyspnea is considered progressive in nature, is often exacerbated with exercise, and persists (GOLD, 2017). A chronic cough of someone with COPD may be either productive or non-productive in nature (GOLD, 2017). A patient who is suspected to have COPD based on their symptoms of the chronic cough, dyspnea, and/or sputum production with known risk factors are good candidates for spirometry evaluation to confirm the COPD diagnosis (GOLD, 2017).

Spirometry, is considered the gold standard for diagnosing COPD (GOLD, 2017). Spirometry is non-invasive and measures many aspects of one's pulmonary capabilities including capacity, lung volume, the rate of flow, and gas exchange, which helps the provider in differentiating between multiple differential diagnoses (John Hopkins Medicine, n.d). Spirometry specifically differentiates between an obstructive and a restrictive breathing pattern based on the results of the testing (John Hopkins, n.d.). Spirometry measures various values to determine these results including tidal volume, total lung capacity, forced vital capacity (FVC), and forced expiratory volume (FEV), with the last two being most important to the diagnosis of COPD (John Hopkins Medicine, n.d.). Spirometry is considered the gold standard for several reasons including its non-invasive characteristics, feasibility, that it is readily available, highly sensitive, reproducible, and objective (GOLD, 2017). Therefore, the 2017 guidelines identify spirometry as essential in diagnosing COPD (GOLD, 2017).

The cost of spirometry needs to be examined if it is recommended that primary care providers should order them. According to the Centers for Medicare and Medicaid (CMS), insurance coverage for spirometry will be provided if it is generally indicated (CMS, n.d.). These indications include documentation that supports signs, symptoms, abnormal laboratory testing, examination for preoperative risks, the patient's prognosis, and/or the impact specific diseases have on their pulmonary system (CMS, n.d.).

Spirometry usage benefits. Utilizing spirometry to confirm the diagnosis of COPD in the primary care setting has many documented benefits. Some of these benefits include spirometry assistance in avoiding misdiagnosing COPD, cost saving approaches, and reducing the considerable burden COPD has on the healthcare system (Walters et al., 2011 & Fortis et al., 2016). It also helps prevent COPD readmissions and improve the patient's quality of life/outcomes (Guerriero et al., 2015).

Despite all of the recommendations and positive characteristics, spirometry is still widely underutilized in diagnosing COPD. This results in patients often being misdiagnosed with COPD (Walters et al., 2011). In 2011, a cross-sectional study examined 341 patients in Australia who were diagnosed with COPD (Walters et al., 2011). The 341 patients in the study were examined using spirometry and the results identified 107 of those patients (31%), who did not have COPD even though they were diagnosed based on their symptoms and had been prescribed several inhalers (Walters et al., 2017). The study concluded that diagnosing COPD solely on symptoms is unreliable in the primary care setting and that these patients need spirometry to confirm their COPD diagnoses (Walters et al., 2017).

Incorrectly diagnosing a patient with COPD also impacts patient safety, results in financial waste, and burdens the global healthcare system. A longitudinal population study that

was conducted from 2005 to 2012 in Canada examined charts from patients who had been diagnosed with COPD. The article identified 68,898 patients with COPD and noted that only 41.2% of these patients received spirometry (Gershon et al., 2017). The analyses concluded those COPD patients who received spirometry were 9% less likely to be admitted to the hospital for a COPD cause, or die for any reason, than those patients with COPD who did not have spirometry completed (Gershon et al., 2017). Therefore, it appears that the number of primary care patients who receive spirometry prior to their COPD diagnosis needs to be increased in order to reduce morbidity and mortality as well as improve patient safety.

Spirometry also assists the provider in properly determining the severity of the patient's COPD. Without completing spirometry, the provider is likely to underestimate the severity of their patient's COPD (Mapel, Dalal, Johnson, Becker, & Hunter, 2015). A multicultural, cross-sectional, observational study in the United States examined 899 patients who had COPD and their providers, in order to determine whether the provider's impressions of the severity of their patients changed before and after spirometry (Mapel et al., 2015). Disease severity was realized to be more severe than what had been thought in 17% and less severe in 5% of the patients after spirometry testing resulted ($p<0.05$). Also, the treatment for about one-third of these patients changed after they received spirometry since the understanding of their severity had also changed (Mapel et al., 2105). Therefore, spirometry is important not only to diagnose COPD, but also to assist in treatment to improve patient safety and subsequently reduce costs.

COPD is a very common disease that impacts not only morbidity and mortality, but also has significant effects on reimbursement rates and hospital readmissions in the United States (U.S.). In 2010, the amount of both direct and indirect expenses that COPD incurred summated approximately $50 billion (Guarascio et al., 2013). COPD is also a common cause of

preventable readmissions to the hospital in the United States (U.S. Department of Health and Human Services, 2015). If a higher number of patients with COPD was accurately diagnosed with spirometry, then the number of inaccurately diagnosed "COPD" readmissions would be indirectly decreased (Spero et al., 2017). The U.S. Centers for Medicare and Medicaid (CMS) has imposed financial disincentives to hospitals with an "unacceptably" high COPD readmission rate (CMS, n.d.). Therefore, spirometry may potentially save local hospitals monetary revenue in COPD reimbursement rates.

Chart audit and Provider Feedback

The purpose of a chart audit is to identify whether certain factors can be improved upon. Provider feedback refers to giving guidance to the provider on ways to improve the area being audited. Evidence within the literature identifies the chart audit and feedback method as successful in improving healthcare provider performance measures with compliance to guidelines (Ivers et al., 2012). One such manuscript by Ospina et al., 2017 intended to review the success of COPD discharge care bundles, in which documenting spirometry was a component. The chart audit and feedback method was one strategy utilized, which ultimately resulted in reduced readmission rates (Ospina et al., 2017). In a chart audit and provider feedback study, McClellan et al (2003) identified that a chart feedback and education method regarding A1C levels resulted in improved treatment for diabetic Medicare patients. This chart audit and feedback method was similarly utilized to educate primary care providers on the need for spirometry to confirm a COPD diagnosis. Hence, a chart audit and feedback system has been proven through various studies to be an effective intervention to improve provider compliance and was used in this project to improve provider compliance with ordering spirometry.

Problem Statement

Despite the 2017 GOLD guidelines and a plethora of other quality literature, approximately 30% of patients are misdiagnosed with COPD due to a lack of utilization of spirometry in the primary care setting (Walters et al., 2011). The 2017 GOLD guidelines recommend utilizing spirometry to confirm the diagnosis of COPD. Utilizing spirometry for COPD diagnosis has been shown to reduce COPD misdiagnoses, assist in cost saving approaches, reduce the considerable burden COPD has on the healthcare system, prevent COPD readmissions, and improve quality of life/outcomes.

Purpose of the Project

The purpose of this scholarly project is to implement a chart audit and feedback method aimed at educating primary care providers to increase the appropriate ordering of spirometry. Utilizing a chart audit and feedback method has been shown to be successful in improving healthcare provider compliance with evidenced-based practice guidelines (Ivers et al., 2012).

Clinical Question

Does a chart audit and feedback method improve the number of primary care providers who appropriately order spirometry to confirm the diagnosis of COPD?

Population: Primary care providers.

Intervention: Chart audit and educational feedback.

Comparison: Standard practice.

Outcomes: Increase appropriate use of spirometry to confirm the COPD diagnosis.

Literature Review and Synthesis

A comprehensive electronic database search was completed using ProQuest, CINAHL, and the Cochrane Library. Search terms included spirometry, COPD, gold standard, providers,

quality of care, chart audit and feedback. No limits were placed on the type of article or published date. The search was limited to the English language with full text. A total of approximately 800 articles with published dates ranging from 2001 to 2017 were identified. Narrowing down the search based on the quality of the literature, relevance, published date, and type of study, ultimately yielded 21 articles for the literature review.

Quality Critical Appraisal

A single reviewer examined the quality of each study and the guidelines were appraised according to the Appraisal of Guidelines Research & Evaluation II tool (AGREE, 2013). The systematic reviews and other clinical trials were appraised according to the Scottish Intercollegiate Guidelines Network (SIGN, 2015). The team leader examined each article for the level of evidence according to Melnyk's system of hierarchy (University of Michigan Library, 2015). The quality of each study is provided in Appendix A.

Systematic Reviews

A strong systematic review of randomized controlled trials reveals the impact audit and feedback has on healthcare professionals practice and patient outcomes (Ivers et al., 2012). In addition, the purpose of the systematic review was to examine some causes of the differences between the effectiveness of various audit and feedback opportunities (Ivers et al., 2012).

The systematic review analyzed 140 randomized controlled trials, and only trials which utilized the audit and feedback system as a core component of their intervention were considered as part of the systematic review (Ivers et al., 2012). Two independent reviewers examined these trials after eliminating trials with a considerably high risk of bias, 82 comparisons from 49 studies, and those displaying dichotomous outcomes (Ivers et al., 2012). The weighted median adjusted risk difference (RD) was a 4.3% increase in healthcare providers' compliance with an

interquartile range of 0.5% to 16% absolute increase after utilizing audit and feedback (Ivers et al., 2012). Multivariable meta-regression determined feedback is more effective when the prior performance level is considered low, when the feedback was presented by a supervisor or colleague, when the feedback is presented more than once, if it is presented in verbal and written methods, and when it incorporates explicit targets and an action plan (Ivers et al., 2012). Finally, the magnitude of impact was altered by the clinical behavior designed by the intervention (Ivers et al., 2012).

The main strength of this systematic review was the large sample size of 140 randomized controlled trials that were analyzed and the RD being 4.3% (Ivers et al., 2012). Another strength of this systematic review was the utilization of two independent authors, who initially reviewed the literature and further screened the articles according to the inclusion criteria (Ivers et al., 2012). Two weaknesses identified from this review were eliminating studies which did not contain baseline calculations and limiting the examination for certain factors based on practical use of abstracts (Ivers et al., 2012).

Ospina et al., 2017 organized a systematic review regarding the validity of utilizing COPD discharge care bundles when patients with COPD are discharged from the hospital. An information specialist conducted an electronic database search, which was based on specific search criteria including COPD and discharge care bundles, in which documenting spirometry is a component (Ospina et al., 2017). Two independent examiners reviewed the results and identified 5,863 studies. A total of 14 different studies in 21 publications were included in the systematic review after removing duplicate studies, excluding records, excluding articles for other indications such as the bundle not being conducted at discharge, and removing multiple publications (Ospina et al., 2017). Of the 14 studies, five were clinical trials, seven were

uncontrolled trials, and two were interrupted time series (Ospina et al., 2017). A random effects meta-analyses was performed of the clinical trials for readmission, mortality, and quality of life (Ospina et al., 2017).

Ospina et al., examined a total of 14 studies with 26 different elements of care. Four main trials revealed that these bundles reduced readmissions to the hospital, one of which included documenting spirometry. One of the strategies identified in implementing this bundle was the chart audit and feedback. Four of the clinical trials with moderate to high bias revealed that COPD discharge bundles lowered hospital readmissions with a pooled risk ratio of 0.80 with a 95% confidence interval and ranging from 0.65 to 0.99 (Ospina et al., 2017). Although insufficient data was not able to reveal whether COPD discharge care bundles had a significant impact on long-term mortality or quality of life, the bundles likely reduced COPD exacerbated readmissions (Ospina et al., 2017). The systematic review aspect of this manuscript was a major strength as well as its utilization of a meta-analysis (Ospina et al., 2017). One weakness is the resulting smaller sample size being 14 studies and possible bias due to a lack of similarity and blinding (Ospina et al., 2017).

Clinical Practice Guidelines

Global Initiative for Chronic Obstructive Lung Disease. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2017 guideline is a worldwide “strategy document” with the purpose to assist health care providers in diagnosing, managing, and preventing COPD (GOLD, 2017). The GOLD program was initiated in 1998 and was developed to provide the best scientific information. The first GOLD guideline was available in 2001. Revisions have been made over the years with 2017 being the most recent version. The purpose of the 2017 report was to provide a non-biased, well-researched review of the provided evidence for

assessing, diagnosing, and treating patients with COPD. A PubMed search was utilized by the GOLD science committee. Search fields included: COPD, all-fields, adult, at least 19 years old, abstracts included, analyses, clinical trial, and human. The literature update for this edition was published between 2015 and 2016. The revised guidelines were distributed to 10 experts externally from the GOLD members. The guidelines were revised based on these experts' recommendations.

The levels of evidence were designated to certain recommendations and ranged from A to D. A were those randomized controlled trials with at least two trials with a large sample size. B also consisted of randomized controlled trials, but with some limitations such as a smaller sample size or flaws. C indicated nonrandomized controlled trials or observational studies. D were opinions of a panel. According to the GOLD guidelines, one significant recommendation was provided which is valuable to this project; spirometry is necessary to confirm the diagnosis of COPD. Spirometry continues to be vital in the diagnosis, determining the prognosis and nonpharmacological treatment of COPD. Spirometry is the most objective and reproducible way to determine airflow limitation. It is noninvasive and readily available in many areas. Spirometry should be utilized to assist in the confirmation process for the diagnosis of COPD.

One strength of this guideline is its expert committee members, who are known leaders with expert research and clinical experience with COPD. Two independent committee members analyzed each abstract and recommendations made by these reviewers were discussed by the committee biannually. One weakness of this guideline is the lack of documentation of the number of abstracts reviewed for the 2017 revision.

Randomized Controlled Trials

McClellan et al., 2003 developed a randomized controlled trial, with the purpose of determining whether an intervention involving a chart audit and feedback of hemoglobin A1C would cause more frequent monitoring. Patients who met the diabetes criteria for the study were assigned to a randomized trial of randomly selected physicians in a southern American state (McClellan, Millman, Presley, Couzins, & Flanders, 2003). The patient sample was about 23,000 people and the physicians were about 477 in 123 counties (McClellan et al., 2003). After assigning patients to physicians, each county was placed in alphabetical order and randomly assigned a number, which was used to assign to either the intervention or control group (McClellan et al., 2003). The intervention utilized a claims-based feedback (McClellan et al., 2003). The researcher found that rates for the quality indicators increased as well as the rate of A1C testing from 13.0% to 16.8% (McClellan et al, 2003). Therefore, chart audit feedback with education regarding A1C levels resulted in improved treatment for diabetic Medicare patients (McClellan et al., 2003). This quality research study reveals the successful nature of chart audit and feedback, which is significant to this project. The strength of this study was the randomized aspect as well as the large sample size (23,000 patients, 477 physicians, 123 counties) (McClellan et al., 2003). Limitations include a possible over or underestimation, since indicators were initially assigned to the patients and then the providers (McClellan et al., 2003). Another limitation is that the study occurred only within rural counties in a single state.

Thomas et al., 2007 conducted a randomized controlled trial with the purpose to examine the impact an audit, feedback, and patient reminder system would have on diabetes care. The randomized controlled trial incorporated a total of 78 subjects to which 39 residents received the instructions, chart audit, feedback, and letter (Thomas et al., 2007). Another 39 were in the

control group (Thomas et al., 2007). Patients that were treated by the intervention group had an improved adherence to the A1C recommendations compared to the control group (Thomas et al., 2007). Therefore, using a chart audit and feedback system with providers improved diabetes care processes, although it did not necessarily impact the intermediate clinical results (Thomas et al., 2007). The RCT aspect of this study was a major strength. The inability to have binding because of the intervention was a limitation to this study (Thomas et al., 2007).

A total of 1,236 subjects who were diagnosed with COPD were included in one randomized controlled study (Guerriero et al., 2015). The aim of this study was to evaluate the prevalence of COPD in Northern Italy utilizing the GOLD and ERS/ATS criteria (Guerriero et al., 2015). This randomized controlled study sent 5,000 invitation letters and 1,236 subjects were included based on reply and ability to perform spirometry (Guerriero et al., 2015). The study utilized spirometry and physician assessment (Guerriero et al., 2015). A total of 26.7% of subjects experienced daily pulmonary symptoms and only 30.7% had previously received spirometry (Guerriero et al., 2015). The COPD prevalence depended on the criteria utilized: 11.7% with the GOLD criteria, 9.1% LLN, and 6.8% physician diagnosis (Guerriero et al., 2015). Of the subjects previously diagnosed, 48.8% never received spirometry (Guerriero et al., 2015). Based on the prevalence of patients with COPD, an underdiagnosis/misdiagnosis of COPD occurs if spirometry was underutilized (Guerriero et al., 2015). This may affect quality of life and fiscal means, that may be preventable if spirometry were utilized (Guerriero et al., 2015). The random aspect of this study is one main strength as well as the population size (Guerriero et al., 2015). Also, the study utilized different criterion, which was more thorough. One limitation was that the prevalence studied was confined to one specific area, which could limit the generalizability.

Quasi-experimental Trials

Walters et al., 2011 was a cross-sectional quasi-experimental trial, which was conducted with the purpose of quantifying the number of patients with COPD who were misclassified in primary care, and to identify the causes correlated with the misdiagnoses (Walters et al., 2011). A cross-sectional study was completed in 31 different practices in Australia (Walters et al., 2011). A total of 341 patients were eligible for the study based on their COPD diagnosis or prescription for Tiotropium (Walters et al., 2011). The subjects were given spirometry testing and the results concluded that of the 341 patients with a COPD diagnosis/Tiotropium usage, 107 were misclassified (Walters et al., 2011). Misclassification was shown to be increased with overweight/obese patients and those that have reported allergic rhinitis (Walters et al., 2011). Basing a COPD diagnosis on symptoms in primary care may be inaccurate, especially with overweight patients (Walters et al., 2011). The study highlighted the importance of utilizing spirometry to prevent improper management (Walters et al., 2011). One strength of this study was that the intervention occurred across many different practices (Walters et al., 2011). A main limitation was that the study examined patients with COPD in primary care only, and not an ambulatory setting (Walters et al., 2011).

One study examined if gender bias affected the diagnosis of COPD (Chapman, Tashkin, & Pye, 2001). A random sample of 192 primary care physicians completed a hypothetical case study and follow-up interview (Chapman et al., 2001). A hypothetical case study and interview was provided to the PCP's and the outcome revealed that COPD was a more likely diagnosis to be given to a male by 16% (Chapman et al., 2001). Primary care physicians underdiagnose COPD, especially with their female patients (Chapman et al., 2001). Spirometry is underused and may ultimately reduce COPD under diagnosis along with gender bias (Chapman et al.,

2001). The random sampling method of selecting physicians was a strength (Chapman et al., 2001). A limitation included the lack of studying real encounters with patients, and the physicians background/training was not examined (Chapman et al., 2001).

Other Evidence

13 other articles were analyzed for quality of data to provide further evidence for the need to use spirometry to confirm the diagnosis of COPD. Each article had its own strengths and purpose and most limitations were related to having a lower level of evidence.

Synthesis

Misdiagnosed COPD. Utilizing spirometry to confirm the diagnosis of chronic obstructive pulmonary disease (COPD) in the primary care setting is vital. When a spirometry is not utilized in diagnosing COPD, inaccurate diagnoses are common. One study utilized a cross-sectional investigation to examine 341 patients in Australia who had a COPD diagnosis or were prescribed tiotropium with a general practitioner recognition (Walters et al., 2011). Of the 341 patients who were given spirometry, it was found that 31% (107) had been misclassified with COPD (Walters et al., 2011). This study recognized the importance of using spirometry to diagnose COPD and also highlighted the unreliable nature of diagnosing a patient with COPD based on reported symptoms alone (Walters et al., 2011).

Spirometry also assists in avoiding a delay in treatment by not misdiagnosing COPD. Jagana, 2015, examined the cause of the delays in treating COPD (Jagana, Bartter, & Joshi, 2015). The study concluded that underutilizing spirometry in primary care was linked to COPD misdiagnosis (Jagana et al., 2015). One interesting point discussed was that although the use of spirometry was available to 52% of subjects, only 31% actually utilized spirometry to confirm all of their COPD diagnoses and provide timely and appropriate treatment (Jagana et al., 2015).

Therefore, it is important to educate providers on the importance of utilizing the gold standard of spirometry to diagnose and not misdiagnose COPD (Jagana et al., 2015). This study is of significant interest to this project because the main intervention of the project will be to educate primary care providers in the office setting to increase the usage of spirometry as the gold standard in diagnosing COPD. This mirrors the Jagana study, which was to reduce the delay in diagnosing and treating COPD in primary care (Jagana et al., 2015).

COPD is not only unreliably diagnosed based on symptoms, but it is also often underdiagnosed based on patient identifying factors, such as gender. One particular study examined 192 primary care physicians, to identify whether there was a correlation between diagnosing COPD and gender bias (Chapman, Tashkin, & Pye, 2001). The study used a sample of primary care physicians and concluded that these providers were more likely to diagnose a male patient with COPD than a female (Chapman, Tashkin, & Pye, 2001). The article also concluded that initially, only 22% of these physicians were likely to utilize spirometry to diagnose COPD (Chapman, Tashkin, & Pye, 2001). Again the need for spirometry was confirmed in order to assist in a reliable diagnosis of COPD, but also to assist in avoiding identifying factors such as gender bias when diagnosing COPD.

Gender bias is not the only identifying factor that is associated with the lack of spirometry. One study examined the correlation of patient and physician factors when ordering spirometry to confirm the diagnosis of COPD (Gershon, Hwee, Croxford, Aaron, & To, 2014). The population study examined 491,754 patients in Ontario, Canada (Gershon, et al., 2014). It was concluded that only 35.9% of these patients who were newly diagnosed with COPD ever received a spirometry test (Gershon, 2014). Therefore, spirometry is still underutilized in many areas, including Canada. The article also highlighted a correlation between patient age,

comorbidity, and physician factors with the use of spirometry (Gershon, 2014). Regardless of the factors associated with the lack of spirometry usage, it is clear that primary care providers need to increase their usage of spirometry to diagnose COPD.

The need for spirometry avoids empirically diagnosing or treating patients with COPD while concurrently misdiagnosing these patients. One study examined patient safety concerns when providers empirically diagnose and treat patients regardless of spirometry results (Fortis, Corazalla, Jacobs, & Kim, 2016). The article concluded that although only 7% of patients were empirically diagnosed with COPD, 82% of these patients were also empirically treated (Fortis et al., 2016). The study highlighted the importance of primary care providers avoiding this improper treatment as it increases unnecessary costs of treatment as well as possibly resulting in avoidable adverse reactions (Fortis et al., 2016). Therefore, although this project is attempting to increase spirometry, it is still important to consider that some providers may continue to empirically treat patients regardless of their spirometry results.

Avoiding misdiagnosing patients with COPD by utilizing spirometry, especially on those patients who are frequent exacerbators, is necessary. One study was unique in that it explored the misclassifications among COPD and asthma patients that are prone to having frequent exacerbations (Jain et al., 2015). 333 patients were selected, who have had frequent exacerbations of either asthma or COPD and a retrospective chart review ensued (Jain et al., 2015). The article concluded that objectively confirming airway obstruction, especially among those with frequent exacerbations, was necessary compared to clinically diagnosing patients based on symptoms (Jain et al., 2015). Spirometry was shown to greatly reduce the risk of misdiagnosing COPD or asthma (Jain et al., 2015). This article further highlights the vital importance of confirming a COPD diagnosis with objective testing, such as with spirometry.

Another study was conducted in Latin America that examined the degree to which COPD was under or misdiagnosed in the primary care setting (Casas Herrera et al., 2016). The article confirmed the need for spirometry to be increasingly utilized in primary care to avoid underdiagnosing and misdiagnosing COPD (Casas Herrera et al., 2016).

Spirometry is also necessary because a high percentage of patients are over diagnosed with COPD based on lack of use of spirometry. One study examined the frequency of COPD overdiagnosis among underserved patients with a government qualified organization (Ghattas, Dai, Gemmel, & Awad, 2013). A descriptive retrospective cohort study included 80 patients who were either previously diagnosed with COPD or receiving anticholinergic inhalers without a COPD diagnosis (Ghattas et al., 2013). These patients were given spirometry testing and concluded that about 42.5% of these patients had no obstruction and 22.5% had a reversible form of obstruction (Ghattas et al., 2013). Therefore, a high percentage of these underserved patients who were either treated for COPD or diagnosed as COPD did not objectively have COPD based on spirometry (Ghattas et al., 2013). This study is helpful for this project, as it provides further evidence of the importance of ordering spirometry to confirm the diagnosis of COPD.

Spirometry also needs to be performed before patients are misdiagnosed with COPD, and/or admitted/readmitted. Spero, 2017, examined the frequency of COPD overdiagnosis, but specifically analyzed patients in the hospital setting (Spero, Bayasi, Beaudry, Barber, & Khorfan, 2017). The purpose of the study was to examine the percentage of hospital COPD patients that received confirmatory testing with spirometry and to examine the accuracy of the diagnosis (Spero et al., 2017). The study examined 6,018 patients with COPD in the hospital, of which 504 had completed spirometry during their hospital stay (Spero et al., 2017). Of the 504 subjects, COPD was confirmed in 69.2%, 26.6% had a restrictive lung disease, and 4.2% had

normal spirometry (Spero et al., 2017). One strength of this study was that it was conducted at a teaching hospital, which reflecting real-life scenarios with COPD (Spero et al., 2017). This study highlights the necessity to diagnose COPD patients with spirometry in the primary care office setting before they become admitted and treated inaccurately due to a lack of objective COPD confirmation (Spero et al., 2017).

Appropriate use of Spirometry. Utilizing spirometry appropriately avoids the discharged patients from becoming "readmitted" incorrectly with COPD, which is of interest as it impacts cost savings and the considerable burden COPD has on the global healthcare system. Without spirometric confirmation of COPD, hospitalizations, readmissions, and utilization of COPD resources will be wasted. One study examined patient safety concerns when providers applied the discharge diagnosis of COPD when spirometry was not utilized to confirm the diagnosis (Wu, Wise, & Medinger, 2017). The study examined 826 patients in the Veterans Affairs (VA) health system after discharge with a COPD diagnosis (Wu, et al., 2017). About 21% of these patients had no spirometry measurements documented (Wu et al., 2017). The study emphasized the need for providers to take caution when patients are discharged with a diagnosis of COPD, mainly if they had not received spirometry (Wu et al., 2017). Without spirometric confirmation of COPD, COPD hospitalizations, COPD readmissions, and utilization of COPD resources will be wasted (Wu et al., 2017). For example, if a COPD diagnosis is not confirmed with spirometry, they may become inaccurately readmitted with COPD negatively impacting cost savings for the hospital and placing a burden on the global health care system.

Appropriately utilizing spirometry avoids the underdiagnosis of COPD and helps identify those patients with COPD to allow for proper treatment and improve the quality of care provided. One study examined the need for primary care providers to increase their usage of

spirometry to diagnose COPD (Mapel, Dalal, Johnson, Becker, & Hunter, 2015). A multicenter, cross-sectional, observational study examined patients with COPD and estimated the physicians' impressions and severity of the patient's COPD (Mapel et al., 2015). After completion of spirometry, the results concluded that without ordering spirometry, the primary care physicians were underestimating the disease severity of their patients with COPD (Mapel et al., 2015). This negatively impacted quality of care provided for these patients (Mapel et al., 2015). The use of spirometry for these patients changed the physician's impressions of the severity of the disease for about one-third of these patients, further demonstrating the beneficial use of spirometry in diagnosing and treating patients with COPD (Mapel et al., 2015).

Lacking spirometry usage negatively impacts cost and quality of life issues. A randomized cross-sectional study examined 1,236 subjects who were diagnosed with COPD (Guerriero et al., 2015). Only approximately 48.8% of patients had completed spirometry prior to the initiation of the study (Guerriero et al., 2015). The lack of spirometry use was associated with COPD misdiagnosis and especially underdiagnosis of COPD, which both lead to quality of life concerns as well as fiscal irresponsibility (Guerriero et al., 2015). Since COPD is a progressive disease, to slow the progression one must diagnose promptly, and properly treat this disease (Guerriero et al., 2015). Hence, mis/underdiagnosing COPD may lead to a lack of work and social quality of life (Guerriero et al., 2015). The direct and indirect costs of treating COPD in stage one or two compared to severe COPD is a difference of about twice the cost (Guerriero et al., 2015). Therefore, by diagnosing COPD early with spirometry, a cost savings can be recognized (Guerriero et al., 2015).

Improved outcomes with appropriate spirometry usage. Appropriately utilizing spirometry improves quality of life, patient safety, and cost savings. One study examined 68,898

patients who were diagnosed with COPD and discovered an interesting correlation (Gershon, et al., 2017). Confirming the diagnoses of COPD utilizing spirometry is correlated with a decreased risk of mortality as well as admissions to the hospital for COPD (Gershon et al., 2017). This study utilized a longitudinal population analysis between 2005 and 2012 (Gershon et al., 2017). Although some bias and confounding factors may have been identified, this study highlights the importance of improving quality of care and patient safety by confirming a diagnosis of COPD with spirometry (Gershon et al., 2017).

Adhering to GOLD standards increases quality of life and provides cost savings. One particular study investigated the clinical as well as cost saving benefits that resulted from adhering to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) recommendations (Asche et al., 2012). A retrospective cohort study design examined 364 subjects and concluded that adhering to the GOLD recommendations not only had clinical benefits, but also provided cost savings (Asche et al., 2012). This study is relevant to this project because it confirms evidence that staging COPD with spirometry as well as adhering to the GOLD recommendations not only increases quality of care, but also provides benefits with cost savings (Asche et al., 2012).

Improved outcomes with appropriate spirometry usage allows for proper treatment of those patients with COPD. Walker, 2006 validated the need for spirometry to confirm a COPD diagnosis specifically in the primary care setting (Walker, Mitchell, Diamantea, Warburton, & Davies, 2006). The study utilized a retrospective method to analyze if the use of spirometry in primary care ultimately increased the number of patients diagnosed with COPD (Walker et al., 2006). The study examined 1,508 subjects that were referred for spirometry, for which 235 patients had post-bronchodilator obstruction (Walker et al., 2006). Of the 235 patients, 130 of

them received a new diagnosis, mainly COPD (Walker et al., 2006). The study concluded that a large portion of patients were undertreated before being referred for spirometry (Walker et al., 2006). Also, the use of spirometry increased the number of COPD patients who received proper treatment (Walker et al., 2006).

Chart audit and provider feedback. Evidence from one strong systematic review (Ivers et al., 2012), one moderate systematic review (Ospina et al., 2017), one strong randomized controlled trial (McClellan et al., 2003), and one moderate randomized controlled trial (Thomas et al., 2007) supports the use of chart audit and feedback focused on improving provider adherence with confirming a COPD diagnosis with spirometry.

Ivers et al., 2012 identified chart audit and feedback as a successful method of improving healthcare provider compliance with evidenced-based practice. Ospina et al., 2017 intended to review the success of COPD discharge care bundles, in which documenting spirometry is a component. One strategy utilized was the chart audit and feedback method, which ultimately resulted in reduced readmission rates (Ospina et al., 2017). Just as the chart audit and feedback system aided in improved results, an audit and feedback system was utilized in this project to improve provider compliance with ordering spirometry. McClellan et al., 2003 identified a chart feedback and education, regarding A1C levels, resulted in improved treatment for diabetic Medicare patients. This chart audit and feedback method can similarly be utilized to educate primary care providers on the need for spirometry to confirm a COPD diagnosis. Thomas et al., 2007 examined the impact a chart audit, feedback system, and patient reminder had on diabetes care. The audit and feedback ultimately improved diabetes care processes (Thomas et al., 2007). Hence, a chart audit and feedback system has been proven through various studies to be an effective intervention to improve provider compliance.

Conceptual Framework

The conceptual framework utilized for this scholarly project is the Iowa model. The Iowa model was designed to assist clinicians in the evidenced-based practice (EBP) process to pursue a methodical approach in conducting and establishing an intended project (Iowa Model Collaborative, 2017). The six main components of the Iowa model are: identifying a trigger, determining organizational priority, formulating a team, examining the evidence, implementing the change into practice, and analyzing the outcomes (Iowa Model Collaborative, 2017). Permission was provided by the University of Iowa, Department of Nursing to utilize the Iowa Model to initiate quality improvement for this scholarly project (Appendix C).

Identifying the trigger. Identifying the trigger is the first step in promoting evidenced-based practice (Iowa Model Collaborative, 2017). Triggers may be problem or knowledge focused (Iowa Model Collaborative, 2017). In this project, the problem focused trigger focuses on the idea that despite the 2017 GOLD guidelines and a plethora of other quality literature, approximately 30% of patients are misdiagnosed with COPD due to a lack of utilization of spirometry in the primary care setting.

Organizational priority. The next step in the Iowa model is to decide if the topic is a priority (Iowa Model Collaborative, 2017). As discussed in the literature review, a lack of spirometry usage to confirm COPD diagnosis has many negative ramifications. These include insufficient quality of care, patient safety concerns, fiscal irresponsibility of the provider, and it causes a poor reflection on the organization.

It is vital for this scholarly project to align with the mission and values of the organizational site. If a gap exists between the project purpose/design and the organization, then the project must be re-formatted. The organizational site determined for this scholarly project is

a primary care site in the state of Virginia. Both the mission and vision of the site align closely with the intended scholarly project. Focusing on quality care, while encouraging evidenced-based practice through excellence, is foundational to the implementation of this scholarly project.

Formulating a team. The next step in the Iowa model is to formulate a team and seamlessly collaborate through teamwork (Iowa Model Collaborative, 2017). Teamwork is necessary to implement an evidenced-based practice change to proficiently provide the quality improvement needs. The team members include the team leader who organized the project, implemented the educational feedback method, and completed the chart audits. The committee chair provided mentorship, guidance, and feedback with the on-going process. Also, a measurement consultant formulated and analyzed statistical results.

Examine the evidence. The next step in the Iowa model is to examine the evidence (Iowa Model Collaborative, 2017). An extensive literature review process occurred and was reviewed by the project chair. The evidence has also been discussed with administration of the organizational site and will continue to be shared with the various team members as well as the providers who are to receive the educational intervention.

Implement the change into practice. The next step in the Iowa Model is to develop and pilot the practice change of educating primary care providers on the importance of ordering spirometry to confirm a COPD diagnosis (Iowa Model Collaborative, 2017). Ivers et al., 2012 identified chart audit and feedback as a successful method of improving healthcare provider compliance with evidenced-based practice. Providing regular feedback to providers regarding their adherence to the GOLD guidelines is essential in providing quality care.

The pre-intervention process was established through completing a chart audit that identified patients with a primary or secondary diagnosis of COPD who visited the primary care

office within the last 30 days. This was the baseline chart audit and required a measurement of the patients diagnosed with COPD who had spirometry as well as the number of patients diagnosed with COPD who never had spirometry completed. The intervention portion was planned and conducted, which was an educational presentation delivered to the providers in the primary care office setting on the importance and benefits of ordering spirometry to confirm the diagnosis of COPD. The presentation highlighted the average percentage of patients that are often misdiagnosed without using spirometry and the GOLD standard of ordering spirometry to confirm the diagnosis of COPD. A survey was given to the providers before and after the presentation. Another designing and implementation step was to provide a handout in the office setting to encourage the providers to continue to order spirometry prior to diagnosing COPD.

Analyze outcomes. The last main step was to implement the evaluation plan, which involved a post-intervention chart audit. A 30-day and 30 to 60-day post intervention chart audit was conducted. The rationale is that much improvement may not be seen at the 30-day, but may at the 60-day audit. If only one audit occurred, and there was no improvement at the 30-day, but there was improvement at the 60-day, an average of both the 30 and 60-day post intervention may be negatively skewed. The chart audit examined the number of patients diagnosed with COPD who had spirometry or were referred for spirometry as well as the number of patients diagnosed with COPD who did not have a spirometry referral.

Once the implementation process was completed, a determination of whether the change would be appropriate for adoption in the primary care setting needed to occur (Iowa Model Collaborative, 2017). A sustainable method for the project would be to focus on engaging specific staff personnel, such as administration, nurses, and providers, to continue to follow the GOLD recommendations with ordering spirometry. This could be done by keeping visual

reminders in the office setting, such as small posters or notices (GOLD, 2017). Also, another chart audit in the future could continue to measure the impact the presentation and reminders had on increasing spirometry in the primary care office site as time elapses.

The final step in the Iowa model is to disseminate the results (Iowa Model Collaborative, 2017). Dissemination will occur by discussing the results of this project with key stakeholders including the Medical Director and other providers with the primary care site. Conducting another presentation to discuss the results of the post chart audit would be beneficial for the providers in the office site to illustrate the benefits of the project and identify further inquiry needs. Publishing the results in a journal as well as creating a poster for appropriate conferences to improve the number of COPD patients who are diagnosed with spirometry confirmation is another planned component of the dissemination plan.

Summary

The purpose of this literature review was to identify the clinical problem, identify a successful intervention, provide beneficial goals and objectives, and provide outcome measurements. The critical appraisal of data provides strong evidence with apparent quality. The strong systematic review (Ivers et al., 2012) provides evidence of the success a chart review and feedback has on provider compliance with evidenced-based practice. The GOLD guidelines recommend utilizing spirometry to confirm the diagnosis of COPD. Utilizing spirometry to confirm the diagnosis of COPD assists in preventing misdiagnoses, avoids “readmissions” with COPD, improves outcomes and patient safety concerns, improves quality of life, is fiscally beneficial, and reduces the global burden COPD has on our health care system. This literature review supports the need for this project, which is to increase the number of COPD patients

diagnosed with spirometry by utilizing a chart audit and feedback system with primary care providers.

Methodology

Design

The purpose of this scholarly project was to implement a chart audit and feedback method aimed at educating primary care providers to increase the ordering of spirometry to confirm the diagnosis of COPD. The goal of this project was to promote an EBP change in primary care to improve the quality of care provided. The project design was conducted based on evidence and structure of the Iowa model. The trigger and organizational priority have been identified and a team has been formulated. The team members include the team leader, the committee chair, assistance from the measurement consultant, and support from various administration.

The team leader audited charts for a total of 150 patients with COPD as one of their diagnoses. These patients must have had visited the primary care office in the last 30 days and charts were scanned for spirometry. This was completed prior to the educational intervention. An aggregate group performance data was measured and provided to the participants during the educational piece. During the educational feedback method, the providers were educated on the 2017 GOLD guidelines, focusing on the recommendations of the importance of appropriately ordering spirometry to confirm the diagnosis of COPD. Before and after the educational intervention, a survey was provided to examine if the behavior intention of the providers had changed. Two handouts were given after the educational intervention to the providers in the office. A 30-day and 30 to 60-day post intervention chart audit was subsequently completed to

examine whether an increased number of patients diagnosed with COPD received an order for spirometry.

Measurable Outcomes

1. After completion of the educational feedback, providers in a primary care setting will demonstrate a behavior intention change of the guidelines for ordering spirometry to confirm the diagnosis of COPD. This will be evidenced by an increased average in the Likert score for all four questions.
2. After completion of the chart audit and feedback method, providers in a primary care setting will improve their usage of EBP guidelines as evidenced by an increase number of documented spirometry to confirm the diagnosis of COPD.

Setting, Population, Sample

A primary care office setting in Virginia was chosen as the site for the prospective scholarly project. The office providers include physicians, nurse practitioners (NP's), and physician assistants (PA's). The Medical Director of the organization has provided a letter of support for the site (Appendix F). The sample comprises of two different populations: (1) primary care providers (physicians, nurse practitioners, and physician assistants), (2) adult patients with COPD as one of their diagnoses.

The inclusion criteria for the first population includes physicians, NP's, and PA's practicing in the primary care setting. The exclusion criteria for the first population includes non-providers and those who choose not to participate. A total of 6 providers were included in the project. The inclusion criteria for the second population includes patients with COPD as one of their diagnoses, age ≥ 18 years old, and <90 years old. The exclusion criteria for the second population includes patients who do not have COPD as one of their diagnoses, <18 years old, ≥

90 years old, or under the care of palliative or hospice service. All of the primary care providers and patients with COPD who meet the inclusion criteria, without exclusion criteria, were candidates for the scholarly project. However, a cap of 50 patient charts was incorporated for each audit.

Ethical Considerations

All members of the project team have completed research ethics training to ensure the protection of human rights. A copy of the Collaborative Institutional Training Initiative (CITI) certificate is provided in Appendix B. A submission of the final project to the Institutional Review Board (IRB) of the University was approved by the chair. The project was also submitted to the organization's IRB for approval as well. Appendix H and I, respectively display the University's and the organization's approvals. The project leader conducted the chart audit. A total of 50 charts for the pre and 50 for the post intervention audits were examined. A master code book was created, which contained each charts' medical record number, date of service, and the chart identification assigned code. The master code book was created in an Excel spreadsheet and saved as a password-protected document and saved on a password-protected, health information and portability accountability act (HIPAA) compliant computer. De-identified data was kept separate on a password protected computer. Data documented with the chart audit tool, survey, and data analysis documents was de-identified of any patient and provider information. The data collector maintained the master code book set as a password protected document on a password protected HIPAA compliant computer for 3 years after completion of the scholarly project. No copies will be made of the master code book and it will be eliminated from the computer after 3 years. No patient or primary care provider identifying information associated with any presentation or publication of this project will be done.

Intervention, Tool, Data Collection

A baseline pre-chart audit was conducted through the electronic medical record system at the organization to identify patients who have COPD as one of their diagnoses and visited the office within the prior 30 days. Also, any existing spirometry documentation was examined. A non-random sampling, purposive, method was utilized for this project. The sample size included up to 50 charts per audit that contained the inclusion without the exclusion criteria. The data was entered into Microsoft excel and analyzed with the help of a measurement consultant.

An educational feedback method was conducted by the team leader, which reviewed the objectives, background, benefits, 2017 GOLD guidelines, the problem, aggregate group performance data, with a main focus on the necessity to confirm the diagnosis with spirometry, and implications for practice. A survey was provided before and after the educational intervention to examine if the behavior intention of the providers changed. The survey was adapted and modified with permission as shown in Appendix D from the article titled *Barriers to Adherence to COPD Guidelines Among Primary Care Providers* (Perez, Wisnivesky, Lurslurchachai, Kleinman, & Kronish, 2012). The survey was utilized in the project to examine the behavior intention of the providers based on COPD and the GOLD guidelines (Perez et al., 2012). Completed in writing, the survey only took about 2-4 minutes. The survey was answered with a Likert scale from 1-5 with 1 being strongly disagree, 3 neutral, and 5 strongly agree (Appendix G). The scored ranged from 1-5 with the low score of 1 reflecting the provider's lack of intention for change and a high score of 5 reflecting an intention for change. A calculated average for the pre and post-intervention examined if a behavior intention change has occurred. The data was entered into Microsoft excel and analyzed. After the educational intervention, a handout was implemented to the primary care providers to remind providers of some of the

GOLD guidelines, particularly spirometry testing. A 30-day and 30 to 60-day post intervention chart audit occurred to examine if an increase number of patients diagnosed with COPD received spirometry ordering.

Timeline of project stages.

Preparation.

Aligning with the Iowa Model, the team leader already identified the problem focused trigger, determined it was a topic priority for the organization, created a team, formulated research and reviewed the available literature, and decided there was a sufficient research base. The following steps were executed based on the proposed timeline:

- By February 9th: Complete primary defense with chair
- By February 16th: Submit proposal to University's IRB
- By February 27th: Submit proposal and Universities IRB acceptance letter to site's IRB

Implementation.

Aligning with the Iowa Model, the evidenced-based practice project was implemented into practice. The following steps were executed based on the proposed timeline:

- By March 30th: Conduct pre-intervention chart audit (Retrospectively from February 28th-March 28th)
- March 30th: Conduct educational feedback method with primary care providers in the office, and survey was provided before and after education.
- May 2nd: Conduct 30-day post-intervention chart audit (Retrospectively from April 1st-May 1st)
- June 2nd: Conduct 60-day post-intervention chart audit (Retrospectively from May 1st-June 1st)

***Evaluation*.**

Aligning with the Iowa Model, the evidenced-based practice project was evaluated. The following steps are in the process of being executed based on the proposed timeline:

- By June 16th: Post-intervention chart audits analyzed
- By July 16th: The written scholarly project finished editing and sent to the editor
- By July 23rd: Editor will return paper with recommendations
- By August 3rd: Final defense will be conducted with chair
- By August 10th: Final revisions will be made and project posted to the Digital Commons
- By August 10th: Disseminate to key stakeholders

Feasibility Analysis

A feasibility analysis was performed and includes examination of personnel, resources/technology, and a cost-benefit analysis was completed.

Personnel.

- Team leader
- Scholarly project chair
- Administration/Primary care providers
- Statistical Consultant

Resources/Technology.

- Electronic medical record (EMR) system
- Provider feedback survey
- Computer
- Excel

Other.

- Lunch budget

Cost-Benefit Analysis

The cost of this project reflects mainly the budget for lunch and the editor. The benefits of this project include possible reduced COPD readmissions, improved patient outcomes and safety concerns, improved quality of life, fiscal benefits, and that it may ultimately help in reducing the global burden COPD has on the health care system. The cost of this project is seemingly low, but the benefits as discussed are relatively high. Therefore, the benefits outweigh the cost of this project.

Evaluation/Data Analysis

Objectives:

1. After completion of the educational feedback, providers in a primary care setting will demonstrate a behavior change with the guidelines for ordering spirometry to confirm the diagnosis of COPD. This will be evidenced by an increased average in the Likert score for all four questions.
2. After completion of the chart audit and feedback method, providers in a primary care setting will improve their usage of EBP guidelines as evidenced by an increase number of documented spirometry to confirm the diagnosis of COPD.

Objective 1: Impact behavior intention for primary care providers.

Method and design.

A quasi-experimental, one group pre-test/posttest design was completed to examine the impact an educational interventional feedback method has had on the behavior intention of primary care providers with guidelines for ordering spirometry to confirm the diagnosis of COPD.

Sample.

The sample comprised of primary care providers (physicians, NP's, PA's). A nonrandom, purposive, convenient sampling is suggested for the primary sample method. A total of 6 providers were employed at the primary care office. A total of 18 providers in the office were sent a recruitment email (Appendix E). The inclusion criteria for the first population includes physicians, NPs, and PAs practicing in the primary care setting. The exclusion criteria for the first population includes non-providers and those who choose not to participate.

Data Collection/Tool.

The survey is adapted and modified with permission as shown in Appendix D from the article titled *Barriers to Adherence to COPD Guidelines Among Primary Care Providers* (Perez et al., 2012). The survey only took about 2-4 minutes and was completed in writing. The survey was answered with a Likert scale from 1-5 with 1 being strongly disagree, 3 neutral, and 5 strongly agree. The average was calculated for the pre and post-intervention to examine if the behavior intention of the providers has changed. During the educational feedback method, the providers were educated on the 2017 GOLD guidelines, focusing on the recommendations of the importance of appropriately ordering spirometry to confirm the diagnosis of COPD.

Statistical Analysis.

The dependent variable of interest (provider behavior intention) is presented with a Likert scale from 1-5 with 1 being strongly disagree, 3 neutral, and 5 strongly agree (Appendix G). The average was calculated for the pre and post-intervention examining if a behavior intention change has occurred. The data was entered into Microsoft excel and analyzed. Descriptive statistics and analysis (mean) was conducted to examine provider behavior intention with the GOLD guidelines for spirometry ordering (Appendix G).

Objective 2: Primary care providers will increase the number of documented spirometry to confirm the diagnosis of COPD.

Method and design.

A quasi-experimental, one group pre-test/posttest design was utilized to examine the impact a chart audit and educational feedback method has had on the primary care providers' usage of EBP guidelines as evidenced by an increase number of documented spirometry to confirm the diagnosis of COPD.

Sample.

The sample populations were adult patients with COPD as one of their diagnoses (J 44). The inclusion criteria included patients with COPD as one of their diagnoses, age ≥ 18 years old, and < 90 years old. The exclusion criteria included patients who did not have COPD as their diagnosis, <18 years old, ≥ 90 years old, or under the care of palliative or hospice service. The number of patients who met the inclusion criteria for the chart audit was 50 charts per chart audit. Therefore, a maximum of 50 charts for the pre chart audit, 50 charts for the 30-day post chart audit, and 50 charts for the 30 to 60-day post chart audit was analyzed.

Data Collection/Tool.

A 30-day retrospective chart review was implemented for pre-intervention information and a 30-day and 60-day post intervention audit. Data collection proceeded as follows:

1. A chart search method for population identification was performed by the assistants and the project leader reviewed the identified patients for inclusion and exclusion criteria.
    a) Searched medical record for patients with COPD as a diagnosis (J 44)
    b) Narrow search by visited date range (previous 30-day period)
    c) Narrow search by patient age in years (18 years or older)

d) Narrow search to by patient in years (89 years or younger)

2. The project leader evaluated the chart to examine if spirometry was documented. The post chart audit was conducted in the same way as the pre chart audit, with the modification of changing the search visited date range to the previous 30-day and 60-day.
3. A master code book was created, which contained each chart's medical record number, date of service, and the chart identification assigned code. The master code book was created in an Excel spreadsheet and saved as a password-protected document and saved on a password-protected, health information and portability accountability act (HIPAA) compliant computer. De-identified data was kept separately on a password protected computer. Data documented with the chart audit tool, survey, and data analysis documents was de-identified of any patient and provider information.
4. The data collector will maintain the master code book set as a password protected document on a password protected HIPAA compliant computer for 3 years after completion of the scholarly project. No copies will be made of the master code book and it will be eliminated from the computer after 3 years. No patient or primary care provider identifying information associated with any presentation or publication of this project will be done.

Statistical Analysis.

Statistical analysis was conducted in two phases: pre and post intervention. One statistical method, a statistical z-test, comparing the percentages of each sample was used to evaluate objective 2. The percentages reflect the number of patients who have had spirometry documented from the whole sample of COPD patients. This test was used for the pre and post intervention to compare the number of spirometry tests documented pre and post intervention.

Results

A total of 18 providers were invited to participate in this scholarly project with 6 providers actually participating who met the inclusion criteria without the exclusion criteria. A total of 150 charts were audited, with 50 charts for the pre, 50 for the 30-day, and 50 for the 60-day post-intervention chart audits. The various demographics of the primary care providers, sample size, assumptions, significant findings, and a summary of the results is provided.

Demographics

Sample size. A total of 6 providers who participated in this scholarly project (n=6). The pre and post survey were collected on all 6 providers. The chart audits included a total of 150 (n=150), with 50 being the pre chart, 50 for the 30-day, and 50 for the 60-day post-intervention audit.

Years of experience. Of the 6 providers who participated, 1 had less than 5 years of experience, 1 had 5-10 years of experience, 2 had 11-20 years of experience, 2 had greater than 20 years of experience; see figure 1.

Figure 1. Years of Provider's Experience.

Type of healthcare profession. There was a total of 3 physicians, 2 nurse practitioners, and one physician assistant who participated in this scholarly project; see figure 2.

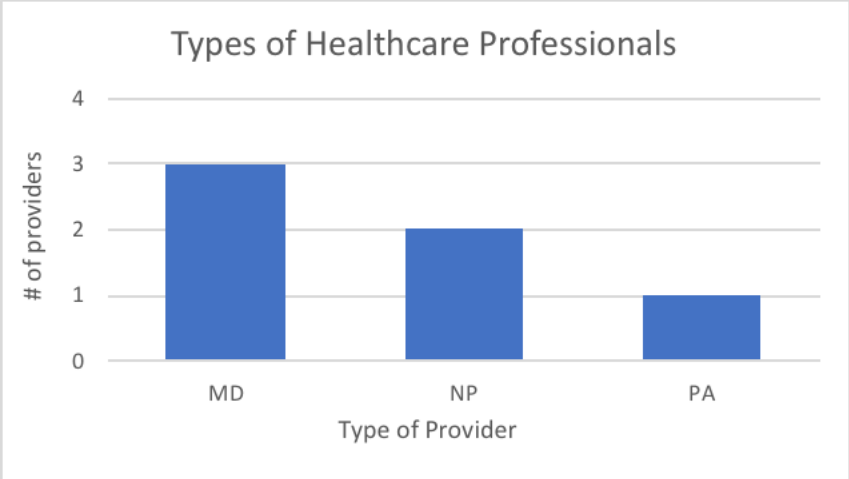

Figure 2. Type of Provider Healthcare Profession.

Assumptions

There were two main assumptions made during this scholarly project. The first assumption was that the participants answered the questions honestly and not as they thought they should answer the questions. The second assumption was that the providers ordered spirometry to confirm a COPD diagnosis, rather than for other reasons.

Main Findings

A total of 50 patients diagnosed with COPD who visited the primary care office within the prior thirty days were included in the pre-chart audit. A total of 50 patients for the 30-day and 50 patients for the 60-day post-chart audits were included. The pre-chart audit revealed that 27/50 (54%) of patients had previously had spirometry documented to confirm a COPD diagnosis. Thirty-day post chart audit and feedback intervention 33/50 (66%) and sixty-day post chart audit and feedback intervention revealed 31/50 (62%) of patients had spirometry documented to confirm a COPD diagnosis (see table 1 and figure 3).

Table 1
Documented Spirometry Rate

Stage	Documented Spirometry
Pre-chart Audit	27
30-day Post	33
60-day post	31

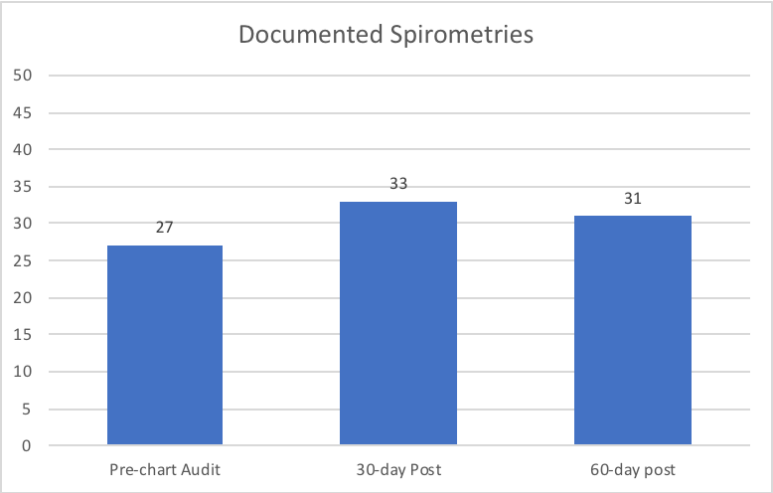

Figure 3. Documented Spirometry Rate.

During the three chart audits, spirometry ordering trends were also analyzed based on the dates that the spirometry tests had been ordered (see table 2 and figure 4). Those ordered less than 30 days prior revealed an increase from the pre to 30-day and a slight increase from pre to 60-day post-chart audit. The 30-day to 6 months was about the same with a 3, 3, and 2 result. The 6 months to 1-year period was a 2, 3, 2. The 1 to 2-year period was a 5, 4, 1. Finally, greater than 2 years was a 17, 18, 24 results. This suggests no obvious spirometry referral trend. However, further research maybe able to examine for a lengthier and larger sample size trend.

Table 2

Spirometry Referral Trend

Stage	<30d	30d-6m	6m-1y	1y-2y	>2y
Pre	0	3	2	5	17
30-day post	5	3	3	4	18
60-day post	2	2	2	1	24

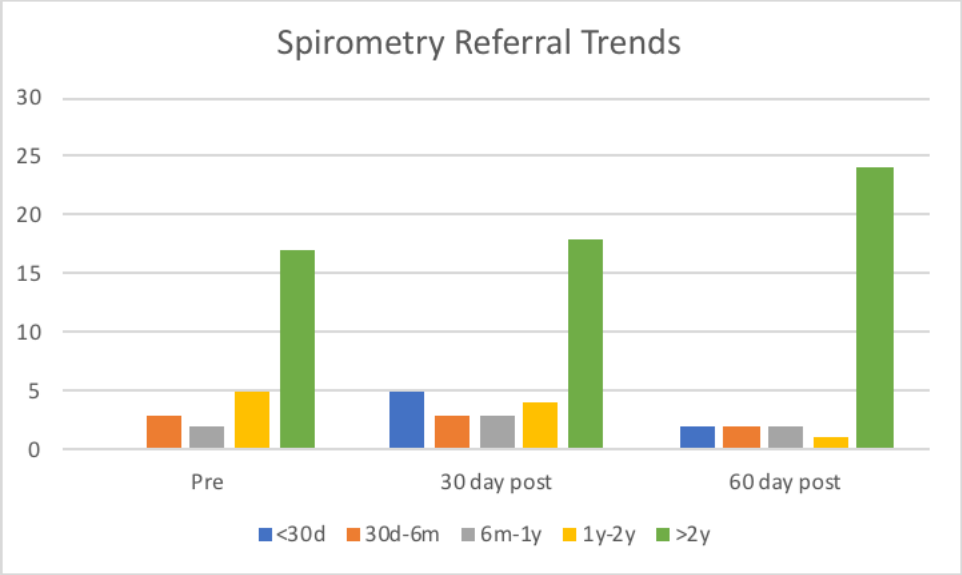

Figure 4. Spirometry Referral Trend.

The survey was conducted before and after the providers were educated on the importance of ordering spirometry to confirm the diagnosis of COPD (Appendix A). The survey took about 2-4 minutes and was completed by providers in writing. The survey is answered with a Likert scale from 1-5 with 1 being strongly disagree, 3 neutral, and 5 strongly agree. The average was calculated for the pre and post-intervention and examined whether a behavioral intention has occurred. The score reflected behavioral intention; the higher the score, the more

likely the provider was to order spirometry to confirm a COPD diagnosis. The pre-survey average totaled 3.17/5. The post survey average totaled 4.33/5. The pre to post-intervention survey of 6 providers revealed an increase behavior intention from 63.4% to 86.6%, which is a 23.3% increase in behavior intention. Therefore, there is a 23.3% increased likelihood that the providers will order spirometry to confirm their COPD diagnosis.

Two-proportions Z-test. A two-proportions Z-test was conducted with $\alpha = 0.05$. The Z-test at 30 days revealed the P-value corresponding to z-1.225 is 0.112. The Z-test from the pre-chart audit to the 60-day post-chart audit revealed the P-value corresponding to z-0.8104 is 0.2088.

Summary of Results

The outcomes for this scholarly project were measured as follows: (1) increased primary care provider behavior intention to order spirometry to confirm a COPD diagnosis and (2) increased number of documented spirometry referrals.

Outcome 1. Increased primary care provider behavior intention to order spirometry to confirm a COPD diagnosis. As identified by the post survey, the primary care providers were more likely to order spirometry to confirm the diagnosis of COPD following the intervention. These results were identified as the average of the pre to post-intervention survey of 6 providers revealed an increase behavior intention from 63.4% to 86.6%, which is a 23.3% increase in behavior intention. Therefore, there is a 23.3% increased likelihood that the providers will order spirometry to confirm their COPD diagnosis.

Outcome 2. Increased number of documented spirometry referrals. As the two-proportions Z-test revealed, which was conducted with $\alpha = 0.05$, the Z-test at 30 days revealed the P-value corresponding to z-1.225 is 0.112. The Z-test from the pre-chart audit to the 60-day

post-chart audit revealed the P-value corresponding to z-0.8104 is 0.2088. Therefore, although there is not significant statistical evidence for either Z-test, there is a clinically significant increase in spirometry referrals documented.

Discussion

The purpose of this scholarly project was to determine the effectiveness of using a chart audit and feedback method to educate primary care providers on confirming COPD diagnosis with spirometry. The results of this project show that although there is not significant statistical evidence for either Z-test, there is clinical significance. Despite the fact that the results did not reveal statistical significance in increasing the number of patients who received spirometry, there are a number of positive outcomes. The literature review documented a plethora of research, clinical guidelines, and documented benefits concerning the significance of ordering spirometry to confirm the diagnosis of COPD. The limitations and clinical implications of this project need to be considered for any further exploration of the need for spirometry to confirm the diagnosis of COPD.

Strengths

Strengths of this project include the following: (1) cost effectiveness, (2) multiple methods of data collection, and (3) the swift rate of collecting data. The cost of this project was minimal and required no outside fiscal assistance. The multiple methods of data collection included the surveys as well as the chart audits, thereby yielding a well-rounded project and reducing bias. Finally, obtaining outcomes in a short time frame assisted in completing and obtaining results quickly.

Limitations

Limitations to this project include the following: (1) time, (2) chart sample (3) provider sample size (4) manual process of locating spirometry results in the charts, and (5) repeat patients from one audit to another. Auditing charts for only 60 days after the educational intervention was not long enough to reveal a trend towards increasing spirometry referrals. Further studies could lengthen the timeline in order to examine for a trend towards ordering spirometry to confirm a COPD diagnosis. In addition, a larger sample size of audited charts being only 50 patients is not quite ideal for this project. A larger sample size of both charts and providers would have more accurately reflected the population of COPD patients and primary care providers as a whole.

The manual process of locating spirometry results in the charts was a definite limitation. Because of the amount of information that needed to be manually examined in each chart, it was possible to miss spirometry documentation. If spirometry were to be succinctly documented in the medical record, the results would be more definitive. Finally, some patients who visited the office during the pre-chart audit time frame may have also visited the office during the 30 or 60-day post chart audit period. Hence, some results may have been slightly impacted due to this occurrence. Additional use of electronic medical record analysis may be one solution to this difficulty.

Implications for Practice

Although there was no statistical significance of this project, one of the purposes was to increase the awareness of the primary care providers of the importance of ordering spirometry to confirm the diagnosis of COPD. The results of this scholarly project indicate that there was clinical significance, as an increase in the number of spirometry ordering and a slight trend

towards more spirometry ordering can be assumed. Therefore, a chart audit and educational feedback method is clinically beneficial in assisting providers in the primary care setting to incorporate spirometry to confirm the diagnosis of COPD. The results also indicate that a chart audit and feedback method can be utilized in the primary care setting to enact and promote an evidenced-based practice.

Utilizing spirometry to confirm the diagnosis of COPD is a GOLD guideline and is considered vital (GOLD, 2017). The multiple benefits can be appreciated including its assistance in avoiding misdiagnosing COPD, cost saving approaches, and reducing the considerable burden COPD has on the healthcare system (Walters et al., 2011 & Fortis et al., 2016). It also helps prevent inaccurate COPD readmissions and improve the patient's quality of life/outcomes (Guerriero et al., 2015). These benefits, a plethora of other literature, and the findings of this EBP project encourage the use of a chart audit and educational intervention method to promote the use of spirometry to confirm the diagnosis of COPD.

As literature and this project reflect, many primary care providers, including this primary care site, have not been utilizing spirometry and its multitude of benefits to confirm the diagnosis of COPD. This problem needs to continue to be addressed in clinical practice in the primary care setting to promote the benefits and prevent the issues of not utilizing spirometry in this manner. Since COPD continues to be one of the greater causes of readmissions in the United States according to the U.S. Centers for Medicare and Medicaid (CMS), the more promptly and accurately the diagnosis is made, the sooner patient safety and quality of care can be improved (CMS, n.d.).

Implications for Research

Further research is recommended to be completed on a greater scale, with a larger sample size, and longer period of time to more accurately examine whether a chart audit and feedback method is beneficial in impacting EBP projects such as this project. More research should be conducted to observe the direct benefits of utilizing spirometry to confirm the diagnosis of COPD including the fiscal aspect, patient quality of care, and morbidity and mortality rates. Also, readmissions and a cost savings approach in this manner should be considered and examined.

More research can also be examined in regards to this particular project as further chart audits could be completed in 3 months, 6 months, and 1 year to determine if a trend is occurring. Finally, another survey could be completed to examine whether the primary care site's providers could identify benefits or challenges in ordering spirometry according to the GOLD guidelines.

Dissemination plan

The dissemination plan needs to be addressed as this is vital to spread the findings of this project to the target audience as well as educate providers on the importance of ordering spirometry to confirm a COPD diagnosis. The goals of the dissemination plan are as follows:

1. Educate primary care providers about the importance of ordering spirometry to confirm the diagnosis of COPD.
2. Encourage the primary care providers at the site to continue to order spirometry to confirm their diagnoses of COPD.
3. Educate the public about the benefits of utilizing a chart audit and feedback method to promote evidenced-based practice.

4. Educate the public regarding the benefits of ordering spirometry to confirm the diagnosis of COPD.

The dissemination plan will be conducted by the project leader. The first step of the dissemination plan is to share the findings with the providers at the primary care site as well as the medical director. A presentation will be provided over email, which will include bar graphs and tables to demonstrate the results. Dissemination of the project will also be planned through a submission of a poster presentation to be presented at a conference in New York state. This will ultimately have a target audience of clinical professionals including nurses, nurse practitioners, physician assistants, or physicians. This project will also be submitted to the Digital Commons to reach a broader audience. Finally, a manuscript submission to a journal will be completed.

Conclusion

Despite being a GOLD guideline and having documented benefits, confirming a COPD diagnosis with spirometry is not routinely done in the primary care setting (Walters et al., 2011). The purpose of this project was to increase referrals for spirometry to confirm COPD diagnosis and to determine the effectiveness of using a chart audit and feedback method to educate primary care providers on confirming COPD diagnosis with spirometry. A quasi-experimental design was incorporated in a primary care office. A retrospective pre-intervention chart audit and two post-chart audits, at 30 and 60 days compared the frequency of documented spirometry to confirm a COPD diagnosis. An educational intervention with a pre and post-survey examined whether the intervention changed provider behavior intention to order spirometry to confirm a COPD diagnosis. Although there was not a statistically significant increase in the number of spirometry referrals, there was a clinically significant increase. After implementing a chart audit

and educational intervention, the provider's behavior intention also increased. Hence, a chart audit and educational intervention is helpful to improve primary care provider's behavior intention for specific clinical practice guidelines as well as a clinical increase in the evidenced-based practice goal. Further research is necessary to determine if other settings would have similar results.

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Appendix A

Literature Matrix Review.

Author (year)	**Study Purpose/ Objective(s)**	**Design, Sampling Method, & Subjects**	**LOE**	**Intervention & Outcomes**	**Results**	**Study Strengths & Limitations**
Global Initiative for Chronic Obstructive Lung Disease (GOLD) (2017).	The purpose of this report is to provide non-biased, well-researched review of the provided evidence for assessing, diagnosing, and treating patients with COPD.	A PubMed search was utilized by the GOLD science committee. The search fields included: COPD, all-fields, adult, at least 19 years old, abstracts included, analyses, clinical trial,	I	Spirometry is necessary to diagnose COPD.	Spirometry continues to be the key in diagnosis, determining prognosis, and nonpharmacological treatment.	Strengths include the consistent treatment objectives and the simplicity of the COPD severity classifications. A study limitation was not identified in this evidenced-based clinical guideline.

		human. The literature update for this edition was published between 2015 and 2016. s				
Ivers, Jamtvedt, Flottorp, Young, Odgaard-Jensen, French, … Oxman (2012).	The purpose of this systematic review was to examine the impact audit and feedback has on healthcare professionals' practice and patient outcomes. The aim is also to examine the cause of the differences between the	A systematic review of 140 randomized controlled trials were examined, which utilized audit and feedback with healthcare professionals. A multivariate meta-regression was utilized to evaluate the	I	A weighted mean risk difference of 0.5% to 16% increase in provider compliance resulted. 26 comparisons with 21 studies revealed a weighted median change to control was 1.3%.	Although small, chart audit and feedback is effective in improving healthcare needs. The effectiveness is impacted by baseline performance and the system of feedback.	The strength of this study was the nature of it being a systematic review of 140 studies. One main limitation was that some lack of documentation may have caused some reporting bias.

	effectiveness of various chart audit and feedback.	differences between the effectiveness of chart audit and feedback.				
Ospina, Mrklas, Deuchar, Rowe, Leigh, Bhutani, & Stickland (2017).	The purpose of this systematic review was to examine the efficiency of a discharge COPD care bundle.	This meta-analysis systematic review identified studies that examined care bundles for discharged patients with COPD. One of which included documenting spirometry.	I	A total of 14 studies were examined with 26 different elements of care. Four main trials revealed that these bundles reduced readmissions to the hospital. One of the strategies identified in implementing this bundle was the chart audit and feedback.	These discharge bundles led to less readmissions, but not necessarily any reduced mortality or improved quality of life.	The meta-analysis aspect is a major strength. Limitations include barriers and promotors of the bundle, which were not examined. Also, possible bias due to a lack of similarity and blinding may have been present.

McClellan, Millman, Presley, Couzins, & Flanders (2003).	The aim of this study was to determine if an intervention involving chart feedback of A1C causes more frequent monitoring.	A randomized trial of randomly selected physicians in a southern American state were assigned to patients who met the diabetes criteria for the study. The patients sample were about 23,000 and the physicians were about 477 and 123 counties. After	II	Claims-based feedback was involved in the intervention. Rates for the quality indicators increased as well as the rate of A1C testing from 13.0% to 16.8%.	Chart feedback and education regarding A1C levels resulted in improved treatment for diabetic Medicare patients.	The strength was the randomized aspect as well as the large sample size. An over or underestimation may have occurred since indicators were initially assigned to the patients and then the providers. Another limitation is that the study occurred only with rural counties in a single state.

		assigning patients to physicians, each county was placed in alphabetical order and randomly assigned a number, which was used to assign to either the intervention or control group.				
Thomas, Thomas, Stroebel, Mcdonald, Hanson, Naessens, . . . Kolars (2007).	The purpose of this study was to examine the impact an audit, feedback, and patient reminder	A total of 78 subjects were included in a randomized controlled trial to which 39 residents	II	Patients that were treated by the intervention group had an improved adherence to the A1C	Using a chart audit and feedback system with providers improved diabetes care processes, but	The RCT aspect of this study was a strength. The incomplete participation of residents, the inability to

	system had on diabetes care.	received the instructions, chart audit, feedback, and letter and 39 were in the control group.		recommendations compared to the control group.	did not necessarily impact the intermediate clinical results.	calculate the impact of interventional components, and the inability to have binding because of the intervention were all limitations with the study.
Guerriero, Caminati, Viegi, Senna, Cesana, & Pomari (2015).	The aim of this study was to evaluate the prevalence of COPD in Northern Italy utilizing the GOLD and ERS/ATS criteria.	A randomized cross-sectional study sent 5,000 invitation letters and 1,236 subjects were included based on reply and ability to perform	II	Pulmonary symptoms were experienced daily by 26.7% and only 30.7% had previously received spirometry. The COPD prevalence depended on the criteria utilized: 11.7% with the	Based on the prevalence of patients with COPD, an underdiagnosis/ misdiagnosis of COPD occurs if underutilizing spirometry. This may affect quality of life and fiscal	The random aspect of this study is one main strength as well as the population size. Also, the study utilized different criterion, which is more thorough. One

		spirometry. Spirometry and physician assessment were completed		GOLD criteria, 9.1% LLN, and 6.8% physician diagnosis. Of the subjects previously diagnosed, 48.8% never received spirometry.	means that may be preventable if spirometry was utilized.	limitation is that the prevalence is confined to one specific area, which could limit the generalizability.
Chapman, Tashkin, & Pye (2001).	The objective of the study was to examine if gender bias affected the diagnosis of COPD.	A random sample of 192 primary care physicians completed a hypothetical case study and follow-up interview.	III	A hypothetical case study and interview was provided to the PCP's and the outcome revealed that COPD was a more likely diagnosis to be given to a male by 16%.	Primary care physicians underdiagnose COPD, especially with their female patients. Spirometry is underused and may ultimately reduce COPD	The random sampling method of choosing physicians was a strength. A limitation included the lack of studying real encounters with patients

					underdiagnosis as well as gender bias.	and the physicians background/training was not examined.
Walters, Walters, Nelson, Robinson, Scott, Turner, & Wood-Baker (2011).	The purpose of this study was to quantify the number of patients with COPD who were misclassified in primary care and to identify the causes correlated with the misdiagnoses.	A cross-sectional study was completed in 31 different practices in Australia. A total of 341 patients were eligible for the study based on their COPD diagnosis or prescription for Tiotropium.	III	The subjects were given spirometry and the results concluded that of the 341 patients with a COPD diagnosis/Tiotropium usage, 107 were misclassified. Misclassification was shown to be increased with overweight/obese patients and those that have reported allergic rhinitis.	Basing a COPD diagnosis on symptoms in primary care may be inaccurate, especially with overweight patients. The study highlighted the importance of utilizing spirometry to prevent improper management.	One strength of this study was that the intervention occurred across many different practices. A main limitation was that the study examined patients with COPD in primary care and not an ambulatory setting.

Jain, Allison, Andrews, Mejia, Mills, & Peterson (2015).	The purpose of this study was to examine the misdiagnosis of asthma/COPD and its factors in frequent exacerbators.	A retrospective chart review with total of 333 patients were enrolled in the study based on inclusion and exclusion criteria. Patients received various diagnostic testing and two pulmonologists made the final diagnoses.	IV	Of the total 333 subjects who are considered to be frequent exacerbators, misdiagnosis was identified in 26% of patients. Risk factors for misdiagnosis include underusing spirometry and smoking pack years.	Objective confirmation is necessary to avoid misdiagnosis of frequent asthma/COPD exacerbations. Employing spirometry is helpful is reducing misdiagnoses.	The retrospective chart study is the main limitation. Also, post-bronchodilator spirometry was not done in about 15% of patients and may have skewed the results. The strength of this study was its incorporation of frequent exacerbators.

Gershon, Hwee, Croxford, Aaron, & To (2014).	This study examined the correlation of patient and physician factors with ordering spirometry to confirm the diagnosis of COPD.	A chart review population study examined 491,754 patients that were 35 years of age and older and newly diagnosed with COPD between 2000 and 2010.	IV	Only 35.9% of the patients newly diagnosed with COPD had spirometry completed.	Only about one-third of patients newly diagnosed with COPD received spirometry. The age, various co-morbidities, and specific physician factors have been shown to impact the use of spirometry.	The strength of this study is the large population size. Limitations include the lack of certainty of when the spirometry was completed as well as a lack of indication if the spirometry was diagnostic in nature.
Gershon, Mecredy, Croxford, To, Stanbrook, & Aaron (2017).	The purpose of this study was to determine if completing spirometry to confirm a COPD diagnosis was correlated with	A longitudinal population study between 2005 and 2012 included 68,898 patients who had COPD	IV	Patients with COPD who received spirometry had a 9% lower risk of mortality and hospital	Confirming the diagnoses of COPD utilizing spirometry is correlated with a decreased risk of mortality as well as admissions to	A strength to this study was the large population size, but limitations include misclassificatio n, bias, and

	improved health outcomes.	and were older than 42 years old.		admission rate for COPD.	the hospital for COPD.	confounding factors. Also, an association between spirometry and patient outcomes may not necessarily indicate causation.
Wu, Wise, Medinger, (2017).	The purpose of this study was to examine the frequency that patients are discharged with a COPD diagnosis that was confirmed by spirometry at the Veterans Affairs (VA) system.	A retrospective longitudinal study between 2005 and 2015 examined 826 patients hospitalized for COPD at the VA.	IV	Of the 826 subjects, 21% never had spirometry completed and only 56% had obstruction identified through spirometry.	Without spirometric confirmation of COPD, issues with hospitalizations, readmissions, quality of care, and resource waste will be negatively impacted.	One specific limitation is that of the 826 patients, 12% of the patients who received the spirometry were unable to complete the breathing maneuvers accurately.

Mapel, Dalal, Johnson, Becker, & Hunter (2015).	The purpose of this study was to examine primary care physicians' impressions of the severity level of their patients with COPD. The study also attempted to examine if spirometry results impacted the physicians' viewpoint and treatment choices.	A randomized, multicenter, cross-sectional, observational study recruited 899 patients with COPD in 89 practices.	IV	The subjects received a questionnaire and spirometry. The primary care physicians completed a questionnaire and case study forms. The physician's impressions of severity for their patients were only 30% accurate with 41% of the severities being underestimated. About 30% of patients received a change in their severity after spirometry, and 37% of treatments	The study concluded that without spirometry, underestimations of COPD severity occur. Also, about one-third of these patients with COPD received treatment changes after they received spirometry. Therefore, spirometry is a helpful tool in primary care for diagnosing and accurately treating COPD.	The strength of this study was that the design as randomized multicenter. The limitations of this study include it being observational and recruiting physician's with a previous interest in COPD and experience treating COPD. Also, the terminology of the severity of COPD is considered subjective in nature, which

				were changed by physicians based on the severity levels.		may have skewed the results.
Fortis, Corazalla, Jacobs, & Hyun (2016).	The purpose of this study was to determine the number of people who receive a persistent empirical COPD diagnosis and treatment as well as identify factors that contributed to the empiric diagnosis and treatment of COPD despite spirometry and	A retrospective chart review ensued including 1,805 subjects with Spirometry.	IV	About 7% of these patients had an empiric COPD diagnosis and 24% had an empiric treatment.	Persistent COPD empiric diagnosis and treatment still occurs despite spirometry results indicating no obstruction.	Limitations include the retrospective aspect as well as being operated in only one healthcare system. Despite the limitations, the overdiagnosis and overtreatment of COPD needs to be further evaluated and managed.

	lung volume measurements.					
Asche, Leader, Plauschinat, Raparla, Yan, & Young (2012).	The purpose of this study was to measure the potential fiscal savings for adhering to GOLD standards to treat COPD.	An observational, retrospective, cohort study ensued with 761 subjects who were chosen based on inclusion criteria.	IV	Adhering to the GOLD standards showed an average fiscal savings of $5,889 for LAMA + LABA treatment group, $3,330 for LABA + ICS group, and $10,217 for LAMA + LABA ICS group.	Staging of COPD utilizing spirometry and adhering to the GOLD standards was correlated with more fiscal savings with moderate to severe staged COPD. Appropriately prescribing inhalers impacts not only clinical, but also fiscal responsibility.	Measuring the fiscal aspect of this study was a strength. The main limitations include possible discrepancies with gathering information from the EMR. Therefore, the true cost of treatment may be higher than reported. Secondly, the inclusion/exclusion criteria resulted in a relatively small

						number of subjects.
Spero, Bayasi, Beaudry, Barber, & Khorfan (2017).	The purpose of this study was to examine the prevalence of spirometry usage and to assess the accuracy of the diagnosis of patients hospitalized for COPD.	A total of 6,018 patients were examined through a retrospective chart based on their age being greater than 18 and having a COPD	IV	Spirometry confirmed the COPD diagnosis for 69.2% of patients. Restrictive lung disease was identified in 26.6% and 4.2% were normal. Factors correlated with obstruction	Up to one-third of patients admitted with COPD to the hospital may be misdiagnosed based on spirometry results. Factors correlated with misdiagnosing COPD include	The main limitation of this study was that it was conducted in one center and it was retrospective in nature. The main strength of this study was that it was

		diagnosis. Of these patients, a total of 390 had adequate spirometry based on ATS-ERS criteria. Other data of the patients were collected including their smoking status and BMI.		include smoking status as well as an elevated pack-year history. Patient factors correlated with misdiagnosing COPD include an elevated BMI and other co-morbidities.	an elevated BMI, other co-morbidities, and a lower pack-year smoking history.	conducted with real-world situations in a local community teaching hospital.
Walker, Mitchell, Diamantea, Warburton, & Davies (2006).	The purpose of this study was to examine if spirometry usage in primary care to diagnose COPD would	A retrospective review examined a total of 1,508 subjects who were referred for open-	IV	Of the 1,508 patients referred, 130 received a new diagnosis, most of which was COPD. These patients with COPD were	Spirometry increases the rate of COPD diagnosis and also results in improved treatment.	Limitations include its retrospective review. An important strength was the random

	improve management.	access spirometry. Exclusions for referral include <40 years of age and no history of smoking.		found to be undertreated and spirometry resulted in an increase in using pharmacologic treatment for these patients.		selection of practices.
Casas Herrera, Montes de Oca, López Varela, Aguirre, Schiavi, & Jardim (2016).	The aim of this study was to examine COPD under/misdiagnosis rates in primary care. Also, the aim was to determine factors correlated with COPD underdiagnosis.	This multicenter, international study was conducted in Latin America, in which subjects were included in the study if they were >40 years and at risk for COPD. A	IV	Spirometry was initiated with these patients and the results examined. COPD underdiagnosis was 65.8% and misdiagnosis was 26.4%.	COPD underdiagnosis is a major issue in primary care. Spirometry usage should be encouraged and available to primary care patients to reduce underdiagnosis.	Limitations include the possible overestimation of COPD underdiagnosis in the study. Also, the results obtained may not pertain to all countries in Latin America. However, one particular strength is its

		total of 1,540 subjects were included in the study.				international aspect.
Ghattas, Dai, Gemmel, & Awad **(**2013).	The purpose of this study was to identify the patients that are over diagnosed with COPD and subsequently mistreated.	A retrospective descriptive cohort study examined 80 patients who were previously diagnosed with COPD or prescribed an anticholinergic inhaler without a COPD diagnosis. Patients were referred for spirometry to	IV	Of the 80 subjects, spirometry showed 42.5% had no obstruction, 22.5% had a reversible obstruction, and 35% had non-reversible obstruction.	Without spirometry, COPD overdiagnosis occurs at a high rate. Confirming a COPD diagnosis with spirometry is necessary to prevent mistreatment, prevent using incorrect medications with possible side effects, and avoid unnecessary	Some limitations include patient recall bias, data input error, and the low number of subjects. One main strength is that the spirometry was completed based on recommendations of the American Thoracic Society.

		confirm their COPD diagnosis or assess severity of diagnosis.			costs, especially in populations with fewer health resources.	
Jagana, Bartter, & Joshi (2015).	The purpose of this article was to identify the causes and solutions for the delay in COPD diagnosis.	This article examined several studies and literature regarding COPD diagnosis delays.	V	Ironically, COPD is both under and over diagnosed.	The early diagnosis of COPD needs to be examined further and requires a culture change in primary care. Respiratory symptoms in a smoker over the age of 40 should be emphasized in that they need spirometric evaluation.	Its limitation is that it is only a level V evidence, but one strength is that it examined multiple studies to make conclusions about COPD and its diagnosis delay.

Appendix B

CITI Certificate.

CITI PROGRAM

Completion Date 15-Oct-2017
Expiration Date 14-Oct-2020
Record ID 20098079

This is to certify that:

Ruth Demetros

Has completed the following CITI Program course:

Human subject - Basic (Curriculum Group)
Nursing (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Liberty University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w0a9536b2-1c30-4d0b-ab3a-bd43827c3835-20098079

Appendix C

Permission to Use the Iowa Model.

Permission to Use The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care

K [redacted] - University of Iowa Hospitals and Clinics < [redacted] >

Tue 10/31/2017, 12:30 PM

Demetros, Ruth Evangeline

Reply all

DNP folder

Flag for follow up. Start by Tuesday, February 06, 2018. Due by Tuesday, February 06, 2018.

Action Items

You have permission, as requested today, to review and/or reproduce *The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care.* Click the link below to open.

The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care

Copyright is retained by University of Iowa Hospitals and Clinics. **Permission is not granted for placing on the internet.**

Citation: Iowa Model Collaborative. (2017). Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing, 14(3), 175-182. doi:10.1111/wvn.12223*

In written material, please add the following statement:
Used/reprinted with permission from the University of Iowa Hospitals and Clinics, copyright 2015. For permission to use or reproduce, please contact the University of Iowa Hospitals and Clinics at [redacted]

Please contact [redacted] or [redacted] with questions.

Appendix D

Permission to Modify Survey.

Hi Ruth,

No problem. Please go ahead and modify the survey as works best for your research. And thanks for citing our work!

Best.

[redacted]

[redacted]

From: "Demetros, Ruth Evangeline" < [redacted] >
Da [redacted]
To [redacted]
Subject: Modify your survey

Greetings!

My name is Ruth Demetros and I am a doctor of nursing practice (DNP)/family nurse practitioner (FNP) student [redacted] I am contacting you because I would like to ask permission to modify your survey in my scholarly project from your article titled "Barriers to adherence to COPD guidelines among primary care providers." I would like to modify the seven questions to ensure it closely reflects the 2017 version of the GOLD guidelines and focus more on spirometry usage as well, and add a few provider sociodemographic questions. After defending my scholarly project, my program requires me to submit it for publication in [redacted] open-access institutional repository, the Digital Commons, and in the Proquest thesis and dissertation subscription research database. If you allow this, I will provide a citation of your work as follows: (Perez et al., 2012) and Perez, X., Wisnivesky, J. P., Lurslurchachai, L., Kleinman, L. C., & Kronish, I. M. (2012). Barriers to adherence to COPD guidelines among primary care providers. *Respiratory Medicine, 106*(3), 374-81.

Thank you for your consideration in this matter,

Ruth Demetros

Appendix E

Recruitment email.

Dear [redacted] provider:

As a graduate student in the doctorate of nursing practice (DNP) program at [redacted], I am conducting a scholarly project as part of the requirements for a DNP degree. The purpose of my scholarly project is to implement a chart audit and feedback method aimed at educating primary care providers to increase the appropriate ordering of spirometry and I am writing to invite you to participate in my project.

If you are a provider (physician, physician assistant, or nurse practitioner) in the primary care setting and are willing to participate, you will be asked to attend an educational feedback presentation and complete a pre- and post-intervention survey. A lunch will be provided to those attendees, and the session should take approximately 30 minutes. Your participation is completely voluntary, and participating/not participating does not impact employment. Data that is collected will be de-identified before data analysis or dissemination. The chart audits for provider performance will be analyzed as an aggregate, and no individual performance metrics will be analyzed or published.

To participate in this process improvement project, please reply to confirm your attendance.

Sincerely,

Ruth Demetros

RN, BSN, DNP/FNP student with [redacted]

Appendix F

Letter of Support.

[redacted] [redacted]

February 2nd, 2018

Attention: IRB

[redacted]

IRB Members:

Ms. Ruth Demetr[redacted]of Nursing Practice Student (Principal Investigator) and [redacted]sistant Professor of Nursing, and DNP Scholarly Project Chair (Faculty Chair) have proposed to conduct Ms. Demetros' Doctor of Nursing Practice Scholarly Project: Chart Audit and Educational Provider Feedback Intervention to Improve Appropriate Use of Spirometry in Patients with Chronic Obstructive Pulmonary

[redacted] is committed to providing excellent, comprehensive care for our patients, facilitated by the pursuit of quality improvement. Ms. Demetros' Doctor of Nursing Practice Scholarly Project reflects our commitment that every patient receives optimal quality health care.

[redacted]s pleased to support Ms. Demetros' Scholarly project: Chart Audit and Educational Provider Feedback Intervention to Improve Appropriate Use of Spirometry in Patients with Chronic Obstructive Pulmonary Disease.

Feel free to contact me if I can be of further assistance.

[redacted]

z

Appendix G

Pre/Post Intervention Survey.

Participation in this survey is voluntary, not required, and does not impact employment. De-identified results may be published.

In years, how many years have you been working in your profession? _____

Your degree:

- ☐ Nurse practitioner (NP)
- ☐ Physician Assistant (PA)
- ☐ Physician

Answer the following on a Likert scale of 1-5 with 1-strongly disagree; 2-somewhat disagree; 3-neutral; 4-somewhat agree; 5-strongly agree:

1. You would routinely order spirometry or pulmonary function testing to confirm the diagnosis of COPD in your patients who smoke and complain of shortness of breath.

   1 2 3 4 5

2. For a new patient coming in to the office having been discharged from the hospital with a COPD diagnosis, you would routinely check to see if spirometry or a pulmonary function test was ordered and performed.

   1 2 3 4 5

3. A patient comes to your office from another practice with a COPD diagnosis, you would routinely check to see if spirometry or a pulmonary function test was ordered and performed.

   1 2 3 4 5

4. The time involved to search a patient's history for spirometry or a pulmonary function test would be cost effective.

   1 2 3 4 5

This survey was modified with permission (Perez et al., 2012)

Appendix H

University IRB Approval.

[redacted]

March 13, 2018

Ruth Demetros
IRB Application 3176: Chart Audit and Educational Provider Feedback Intervention to Improve Appropriate Use of Spirometry in Patients with Chronic Obstructive Pulmonary Disease

Dear Ruth Demetros,

The [redacted] Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study does not classify as human subjects research. This means you may begin your research with the data safeguarding methods mentioned in your IRB application.

Your study does not classify as human subjects research because evidence-based practice projects are considered quality improvement activities, which are not considered "research" according to 45 CFR 46.102(d).

Please note that this decision only applies to your current research application, and any changes to your protocol must be reported to the [redacted] for verification of continued non-human subjects research status. You may report those changes by submitting a new application to the IRB and referencing the above IRB Application number.

If you have any questions about this determination or need assistance in identifying whether possible changes to your protocol would change your application's status, please email us at [redacted]

Sincerely,

[redacted]

Appendix I

Organization IRB Approval.

Appendix H

[redacted]

Institutional Review Board

[redacted]

EXEMPT RESEARCH CHECKLIST

Version 3, 21APR2015

Date: 2/19/18

RECEIVED 2/27/18

[redacted]

Principal Investigator: Ruth Demetros [redacted] DNP/FNP student

Email address:

Phone number

EXEMPT Date: 3/12/18

Title of Research Project/Study Title: Chart Audit and Educational Provider Feedback Intervention to Improve Appropriate Use of Spirometry in Patients with Chronic Obstructive Pulmonary Disease.

Attach documents related to the study.

Checklist Statements	True	Not True
Category 1 – For Educational Settings		
1. The research will only be conducted in established or commonly-accepted educational settings including but not limited to schools and colleges. (May include other sites where educational activities regularly occur.)		
2. The research will involve only normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or		