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The Effect of Provider Education on COPD Screening Rates in the Primary Care Setting

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Abstract

BACKGROUND: Chronic Obstructive Pulmonary Disease is one of the leading causes of morbidity and mortality in the United States. With early detection, COPD is a treatable disease, highlighting the need for an effective screening measure. The COPD Population Screener Questionnaire (COPD-PS) is a valid, accurate questionnaire that can identify individuals likely to have COPD.

PURPOSE: The purpose of this study was to evaluate the impact of a provider-based educational intervention on the knowledge, attitudes, self-efficacy and screening rates of COPD using the COPD-PS screening tool among primary care providers.

METHODS: This study was a single-center, pre/post implementation study to evaluate provider screening rates for COPD, provider knowledge, attitudes and self-efficacy regarding COPD screening and utilization of the COPD-PS screening tool. Phase one of the study was a baseline chart review and provider pre-implementation survey. Phase two was a provider educational intervention covering COPD and COPD-PS screening tool. Third phase study was a post-implementation chart review and provider post-implementation survey.

RESULTS: There was an increase in overall means from the baseline to the posttest scores, but these changes were not statistically significant: provider knowledge (pre=6.75, post=7.00, *p=.391),* attitude (pre=4.12, post=4.93, *p=.090),* or self-efficacy (pre=4.12, post=5.00, *p=.133).* There was a statistically significant increase in provider practice for COPD screening using surveys *(p=.003),* performing COPD-PS screening tool *(p=.001),* documentation of COPD-PS *(p=.001)* and spirometry ordered *(p=.001)* from the pre- to post-intervention period.

CONCLUSION: Utilization of a questionnaire-based screening tool, such as the COPD-PS can increase COPD screening rates and identify at risk patients who may benefit from diagnostic spirometry.

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Dedication

I dedicate my work to my father Gary, who passed away this past semester after battling cancer. This project is dedicated to the dad who taught me to follow my dreams, never give up and be thankful for the life and time God has given me. I will forever follow his words of encouragement and strive to make him proud.

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Introduction

Chronic obstructive pulmonary disease (COPD) is a common, preventable and progressive respiratory condition limiting an individual's ability to breathe (Global Initiative for Chronic Obstructive Lung Disease (GOLD), 2019). COPD is a leading cause of morbidity and mortality in the United States and is projected to be the third leading cause of death globally by 2020 (GOLD, 2019). In 2014, an estimated 13.7 million individuals in the United States were diagnosed with COPD and an additional 24 million were undiagnosed or misdiagnosed (CDC, 2018). The slow progression of COPD means that its early symptoms are often unrecognized by both patients and providers despite having significant clinical deterioration in health status, quality of life and increased risk of morbidity and mortality (Yawn, et al., 2014). The hallmark symptoms of COPD are exertional dyspnea, increased sputum production, and chronic cough (GOLD, 2019). Numerous risk factors are associated with a diagnosis of COPD, however exposure to cigarette smoke and other noxious particles are the best studied risk factors for COPD (GOLD, 2019). COPD not only affects individual health but it has become a financial burden for the healthcare system. Healthcare expenditures due to hospital admissions and co-morbidities associated with COPD alone are estimated at 50 billion dollars (Schwab, et al., 2017). Without addressing early screening for COPD in at risk individuals, an increased number of individuals will have a missed diagnosis of COPD, resulting in no treatment while the disease progresses and worsens a patient's quality of life and overall health status.

Early detection of COPD in the primary care setting through screening at risk individuals can improve short-and long-term patient outcomes, increase quality of life, decrease co-morbidities, mortality, and reduce costs related to underdiagnosed COPD (Schwab, et al., 2017). Recent studies have found that one out of every three adults age 40 years and older who are diagnosed as having asthma actually have COPD and one in five adults age 40 years and older who smoke have undiagnosed COPD (Anzueto, Heijdra, & Hurst, 2015). Primary care providers play a pivotal role in early recognition of COPD by recommending diagnostic testing based on screening eligible patients. However, early screening may not be performed on a regular basis in the primary care setting due to lack of provider knowledge about available screening tools for COPD. Awareness of COPD screening needs to be heightened in both patients and providers, as poor knowledge and expertise are significant barriers to diagnosis of COPD (Weiss et al., 2014).

While spirometry remains the gold standard for detecting and quantifying airflow obstruction in COPD, it is not feasible or cost-effective for routine screening in the primary care setting (Johns, Walters, & Walters, 2014). Therefore, it is important to determine feasible, cost-effective ways of evaluation patients at risk for airflow obstruction. The COPD Population Screener Questionnaire (COPD-PS) is a tool recommended as an evidence-based solution to assist in early diagnosis and diagnostic testing for COPD in at risk patients by primary care providers (Martinez, et al., 2008). Patients that receive a positive score of five or higher on the COPD-PS screening tool are advised to have spirometry performed to confirm a diagnosis of COPD (COPD Foundation, 2019; Martinez, et al., 2008).

The purpose of this project was to determine the effectiveness of a provider-based educational intervention on the knowledge, attitude, self-efficacy, and screening rates of COPD using the COPD-PS screening tool among primary care providers in one primary care office.

Background

COPD is the fourth most common cause of mortality and disability in the US, with higher incidences in Kentucky than the majority of other states (Croft, et al., 2018). As of 2017, for every 100,000 people, 62.8 people have died from COPD in Kentucky, making Kentucky the state with the highest rates of deaths related to COPD (CDC, 2018). COPD is a significant independent risk factor for deaths related to other causes such as lung cancer, diabetes and heart disease (Anzueto, Heijdra, & Hurst, 2015). In Kentucky, there are estimates of diagnostic rates of COPD at 11.3% compared to the overall national average of 6.3% with prevalence of COPD significantly higher among women (13.3%) compared to men (9.4%) (KyBRBS, 2016). In addition, COPD rates are projected to continue rising, as the population continues to age. It is estimated that 1.1 billion people in the world smoke, resulting in an estimated 328 million people who are diagnosed with COPD (Anzueto, Heijdra, & Hurst, 2015). Along with increased smoking rates and an aging population, the forecasted increase in COPD is projected to become a worldwide problem by 2020 (CDC, 2017). The incidence of emergency department visits due to COPD complications is 5.6%, however this number could be higher (CDC, 2017), since 63% of adults with evidence of impaired lung function have never been diagnosed with a lung disease (Han, et al., 2015). Therefore, it is essential to screen at risk patients for COPD in order to accurately diagnose patients in the early phase of the disease when more treatment options are available for better patient outcomes.

Screening Recommendations

The United States Preventive Services Task Force (USPSTF) recommends against routine screening for COPD in asymptomatic adults. This recommendation, however, applies only to asymptomatic adults who do not report respiratory symptoms such as chronic cough, sputum productions, dyspnea or wheezing to their primary care provider (USPSTF, 2017). The American College of Physicians (ACP), American College of Chest Physicians (ACCP), American Thoracic Society (ATS), and European Respiratory Society (ERS) recommend that spirometry should be obtained to diagnose airflow obstruction in patients with respiratory symptoms (Grade: strong recommendation, moderate-quality evidence) and spirometry should not be used to screen for airflow obstruction in individuals without respiratory symptoms (Grade: strong recommendation, moderate-quality evidence) (Qaseem, et al., 2011). The USPSTF has identified 3 externally validated questionnaires based on risk factors, symptoms, or both: They are: the COPD Diagnostic Questionnaire, the Lung Function Questionnaire, and the COPD Population Screener (COPD-PS; 2017). Utilizing a COPD questionnaire is a feasible method to identify symptomatic patients at risk of COPD who could benefit from diagnostic spirometry (Yawn, et al., 2014). In addition, the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines recommend considering a diagnosis of COPD and perform spirometry, if any of the following indicators are present in an individual over age 40: 1.) dyspnea: that is progressive over time, characteristically worse with exercise or persistent; 2.) chronic cough: that may be intermittent and may be unproductive; 3.) recurrent wheeze; 4.) chronic sputum production; 5.) recurrent lower respiratory tract infections; 6.) history of risk/host factors such as (genetic factors, congenital/developmental abnormalities), tobacco smoke, smoke from home cooking and heating fuels and occupational dusts, vapors, fumes, gases and other chemicals; and, 7.) family history of COPD and/or childhood respiratory infections. Patients that meet screening requirements are to be referred to spirometry to confirm COPD diagnosis (GOLD, 2019).

Screening Tools

GOLD guidelines recommend using the mMRC (Modified Medical Research Council) Dyspnea Scale, The COPD Control Questionnaire (The CCQ) and the COPD Assessment Test (CAT) to quantify the impact of COPD symptoms on patients' overall health, guide treatment interventions in patients already diagnosed with COPD and predict future mortality risk (GOLD, 2019; Perez, et al., 2015). Although GOLD guidelines recommend the use of mMRC, the CCQ

and CAT are recommended for measuring the progression of COPD once it has been diagnosed. However, none of these instruments have specifically attempted to identify previously undiagnosed individuals with clinically significant COPD or who are at high risk of developing COPD (Han, et al., 2015). Therefore, utilization of a screening questionnaire, such as the COPD-PS in undiagnosed, symptomatic patients in the primary care setting could aid in diagnosis of COPD.

COPD-PS

The COPD Population Screener Questionnaire (COPD-PS) is a first-line screening tool recommended as an evidenced-based solution to aid in early diagnosis and diagnostic testing of COPD in at risk patients by primary care providers (Martinez, et al., 2008). The COPD-PS was developed by five pulmonologists, four primary care physicians and one respiratory therapy professor. The tool was developed to facilitate communication between healthcare providers and patients about their respiratory symptoms with their healthcare providers. The COPD-PS is a simple, self-administered and self-scored five-item questionnaire that measures the presence, frequency, duration, or quality of symptoms by asking 5 questions related to: a) dyspnea; b) cough; c) functional impact; d) smoking; and e) age. Patients that meet screening requirements for COPD-PS and receive a score of five or higher should be referred for diagnostic spirometry to confirm a diagnosis of COPD (COPD Foundation, 2019). See Appendix A for COPD-PS Screen questionnaire

Review of Literature

Screening using the COPD-PS has been shown to be effective as an alternative approach to early and accurate diagnosis of COPD in the primary care setting due to the simplicity of questions that can cross a range of all literacy levels in the general population (Martinex, et al., 2008; Spyratos, Haidich, Chloros, Michaelopoulou, & Sichletidis, 2017; Tsukuya, et al., 2015; Yawn, et al., 2014). Screening using the COPD-PS tool has also been shown to increase motivational levels to quit smoking among patients who identify as current smokers (Kaplan & Thomas, 2017).

The COPD-PS screening tool is highly sensitive and specific for diagnosis of COPD following spirometry confirmation (Duvall & Frank, 2010; Martinez, et al., 2008; Spyratos, Haidich, Chloros, Michaelopoulou, & Sichletidis, 2017;). For instance, a COPD-PS score cut point of 5 or more out of a possible 10, predicted COPD with a sensitivity of 84.4% and

specificity of 60.7% (Martinez, et al., 2008), while Tsukuya, et al's., study resulted in a sensitivity of 67.1% and specificity of 72.9% (2015).

Individuals with higher COPD-PS scores are more likely to have increased airway obstruction, which is associated with a diagnosis of COPD (Martinez, et al., 2008; Spyratos, Haidich, Chloros, Michaelopoulou, & Sichletidis, 2017 & Tsukuya, et al., 2015). Martinez, et al, found that out of 295 patients with a positive (score of 5 or higher) COPD-PS screen who underwent spirometry, approximately 38% had COPD based on their spirometry results (2008). Likewise, Spyratos, Haidich, Chloros, Michaelopoulou, & Sichletidis (2017) found that out of 351 patients 10.9% had COPD based on spirometry results (2017).

The COPD-PS has been found to have a high positive predictive value (PPV) on accurately diagnosing COPD compared to other screening tools and is applicable to all primary care settings (Martinez, et al., 2008; Spyratos, Haidich, Chloros, Michaelopoulou, & Sichletidis, 2017). Furthermore, Martinez, et al's., (2008) results of a 68.4% PPV aligned with results from Spyratos, Haidich, Chloros, Michaelopoulou, & Sichletidis's, (2017) who found a 41% PPV in accurately diagnosing COPD with utilization of the COPD-PS tool. Previous studies have shown that the COPD-PS screening tool has a high negative predictive value ranging from 96% (Spyratos, Haidich, Chloros, Michaelopoulou, & Sichletidis (2017) to 97% (Tsukuya, et al., (2015), indicating that those who did not have a positive COPD-PS are truly not at risk for COPD.

Screening programs and ongoing education for providers to use simple screening tools, such as the COPD-PS among high-risk populations in primary care is a feasible way to reduce the percentage of underdiagnosed COPD (Martinez, et al., 2008; Spyratos, Haidich, Chloros, Michaelopoulou, & Sichletidis, 2017 & Tsukuya, et al., 2015). Furthermore, the 5-item COPD-PS screening tool that is based on presenting risk factors, signs and symptoms (Martinez, et al., 2008) is inexpensive and takes approximately 3-5 minutes for the healthcare provider to review results for further recommendations. Dissemination of this screening tool can assist providers in identifying patients who would need spirometric assessment to diagnose COPD. Implementation of the COPD-PS in the primary care setting is essential for early diagnosis and treatment of individuals at risk for development of COPD.

Theoretical Framework

Transformational Learning Theory by Mezirow guided the education intervention for providers in this project to teach primary care providers new knowledge and skills related to screening for COPD. The theory of transformational learning in adults is that new learning is actually created and circumscribed by a previous frame of reference, from an individual's previous point of view, which influences their new thinking, beliefs and actions (Hoggan, 2016). Transformational learning education involves challenging current beliefs and thought patterns on an existing topic, in order to awaken the learner to a new way of viewing and examining a problem or way of thinking (Mezirow, 1981). As healthcare continues to change, a provider's ability to learn new material in order to improve patient care is necessary, even if their current knowledge, beliefs and attitudes about a topic differ from the one being taught. Transformational learning theory was appropriate to use for this study because it focuses on changing and challenging providers' knowledge and attitudes about a topic for which they have a bias or strong opinions about (i.e., screening is not necessary for COPD). During the educational session providers were given the task of using the COPD-PS to screen at risk patients for COPD. Providers that chose to participate in the study used critical reflection to try a new method of primary prevention that was previously not used in their everyday practice.

Transformative learning facilitated providers to critically reflect on the validity of new evidence given to them during the educational session. Provider participation in the study demonstrates the provider's agreement to learning new knowledge and skills, which diverges from their current practice of performing patient care. Accomplishment of integrating this theory into this project is evident by provider participation, positive COPD-PS screening forms and increased rates of referral for spirometry testing.

Purpose

The purpose of this project was to evaluate the effect of a provider-based educational intervention on primary care providers' (a) knowledge of COPD screening and use of COPD-PS screening tool; (b) attitudes about screening for COPD and using COPD-PS; (c) self-efficacy of screening for COPD using COPD-PS screening tool (d) screening rates of COPD in at risk patients and (e) identify barriers and facilitators to screening.

Methods

Design

This study was based on a single center quasi-experimental pre-posttest design to assess provider screening rates for COPD, knowledge, attitudes and self-efficacy on screening for COPD and using the COPD-PS screening tool before and after an educational intervention. The study took place in three phases. Phase one of the study consisted of a pre-implementation chart review and a provider pre-implementation survey. Phase two of the study consisted of an educational intervention for providers. Finally, phase three consisted of a post-implementation chart review and post-implementation provider survey.

Setting

The study took place at one primary care office in Louisville Kentucky. This office primarily serves residents of the metropolitan area and Southern Indiana for comprehensive services, including preventive medicine, screening, wellness exams, care for chronic conditions, and acute medical visits. Approximately 200 patients with ages across the lifespan are seen each day in this office.

Sample

Providers

Provider inclusion criteria for this study sample included primary care providers (physicians and nurse practitioners) who attended the educational intervention and completed the pre-implementation survey on June 1, 2019. Exclusion criteria involved providers who did not attend the educational meeting and complete the pre-implementation survey.

This practice setting consisted of a total of ten providers, with two female and four male physicians and four female nurse practitioners. To recruit provider participation, flyers were posted around the office to inform providers of the survey and the upcoming educational session. Next, emails were sent to providers two weeks before the educational session to remind providers to take the survey prior to educational session. The email detailed the purpose of the study, as well as the risk and benefits for participating in the study.

Patients

Patients included in the study were from the primary care office that served as the study site. A total of 100 medical records were randomly selected by the data analysts within the healthcare system during the pre-intervention phase from patients who were seen in office prior

to the intervention between June 1, 2018 and August 31, 2018 who met the study inclusion criteria. Inclusion criteria were: patients seen by a provider who attended the educational intervention, patients male or female, age 40 years or older, current or history of smoking in their chart who present to the office with complaints of at least one of these variables: cough, dyspnea, shortness of breath or had a history of a lower respiratory tract infection and an ICD 10 code of at least one of the following, R05 (cough), R06.00 (dyspnea), R06.09 (other forms of dyspnea), R06.0 (dyspnea), R06.02 (shortness of breath), J22 (unspecified acute lower respiratory tract infection), F17 (nicotine dependence), F17.210 (nicotine dependence, cigarettes) and Z87.891 (personal history of nicotine dependence). Another 100 medical records were randomly selected from patients who were seen in office after the intervention between June 1, 2019 and August 31, 2019 who met the study inclusion criteria, which was identical from the pre-intervention inclusion criteria. Exclusion criteria for both the pre-post chart review included: patients less than forty years of age, current diagnosis of COPD or ICD code J44.9 in patients' medical chart, pregnant at time of the healthcare visit and provider did not attend the educational intervention. The research office at the healthcare system provided a report of patient medial record numbers based on patients who met the study inclusion criteria for the single site setting. A password protected electronic crosswalk table was assembled to simplify the data collection process.

Institutional Review Board Approval

The project received approval under the UK IRB, entitled The Effect of Provider Education on COPD Screening Rates in the Primary Care Setting (IRB#46940 ID#10440532).

Study Procedures

This study consisted of three phases.

Phase One: Consisted of a pre-implementation chart review and provider pre-implementation survey

Part 1: Part one of phase one consisted of a provider pre-implementation chart review to assess baseline screening for patients at risk for COPD using the COPD-PS screening tool and number of referrals for spirometry. This chart review took place from June 1, 2018 to August 31, 2018, and 100 randomly selected charts were reviewed to assess provider screening rates for COPD that met screening qualifications. An approved waiver of documentation of informed consent was obtained for this study.

Patients were asked to read a consent letter form, which described the purpose, potential risks and benefits of participating in the study. Patients that agreed to participate in the study filled out the screening form. Patients were informed that their information would be used only for this study and that the information they provided was secure and confidential.

Part 2: Part two of phase one consisted of a provider pre-implementation survey that was distributed via email using Qualtrics. The providers who participated and completed the survey were assigned a unique identifier to maintain anonymity. The pre-implementation survey was used to assess provider knowledge, attitude and self-efficacy of screening for COPD, as well as providers perceived barriers for screening and utilization of the COPD-PS screening tool (see Appendix B Survey Instrument Pre-Post Test). Providers that completed the pre-implementation survey, voluntarily consented to participate in the study. (see Appendix C for Provider Email Consent).

Phase Two: Consisted of an educational intervention for providers.

Phase two consisted of an educational intervention for providers that took place June 1, 2019. The intervention consisted of provider education about identifying patients at risk for COPD, implementation and documentation of the COPD-PS screening tool, as well as the next steps after a positive COPD-PS score. The educational intervention took place for 15 minutes during the monthly provider staff meeting. Copies of the COPD-PS screening tool and copies of patient consent forms that patients would review and sign for the study were provided and issued during the meeting for provider reference. Providers were educated on the screening tool and providers were asked to discuss where to document the screening tool after completion. During the meeting, all providers agreed to have nursing scan a copy of the screening tool into the Media tab on the patients electronic medical record(EMR) and for providers to document the score in the patient's chart. Since there is no current screening tool or tab in Epic for COPD, providers were asked for their preference for documenting and recording the tool. Scoring of the screening tool was discussed with the providers. Providers were educated that patients who met screening criteria and scored a 5 or great on the COPD-PS screening tool, warranted a referral for diagnostic spirometry. Providers were aware that they would need to place a referral for outpatient screening since there is currently no spirometry screening offered in the office. No incentive was rewarded for the providers who voluntarily participated in the study. Screening forms, hats and pins for patients who completed the screening tool were donated by the COPD

Foundation. Patients of providers that voluntarily agreed to participate in the study and who met the inclusion criteria for COPD screening were given an in-person COPD-PS screening form and were asked to complete the COPD-PS form during their office visit.

Patients

First, a patient survey cover letter was given to each patient prior to filling out the screening form. The survey cover letter described the study as well as the risks and benefits of participation. Then screening forms were given to patients that agreed to participate in the study. Patient completion of the COPD-PS screening form was used as a waiver of informed consent. (see Appendix D for Patient Survey Cover Letter). Patients that completed a screening form were offered a COPD hat or pen for participating in the study.

Providers

Nursing staff provided the cover letter and screening tool for patients to read and fill out. Nurses scanned the patient's completed COPD-PS in the media section in the patient's EMR and distributed a hat or pin to patients that participate in the study. Prior to starting the patient visit, nursing staff notified providers of both a positive and negative score. Provider's then discussed results with patients, and if a positive score was found, placed an outpatient referral for diagnostic spirometry. Patients were educated that they did not have to go for spirometry but that it was advised to confirm a diagnosis of COPD.

Phase 3: Consisted of a post-implementation chart review and post-implementation provider survey

Part 1: Consisted of a post-implementation chart review to assess the number of patients being screened for COPD using the COPD-PS screening tool and number of referrals for spirometry. A post-implementation chart review was performed during the months of June to August 2019, using 100 randomly selected charts for patients who met the screening criteria. Screening criteria was the same as in part one phase one of the study. Screening rates for COPD and referrals for spirometry were compared to the findings in part one phase one, to determine if an educational intervention increased screening rates and diagnosis of COPD. A waiver of documentation of informed consent was requested and approved.

Part 2: Consisted of a post-implementation provider survey via email using Qualtrics. Providers who completed the pre-implementation survey were the same providers who were asked to complete the post-implementation survey. The post-implementation survey was the

same as the pre-implementation survey that was used to assess provider knowledge, attitude and self-efficacy of screening for COPD, as well as providers perceived barriers for screening and utilization of the COPD-PS screening tool. Results of the survey for pre and post-data were evaluated by the unique identifier, and not the participant's name or email address. Findings of the post-implementation survey were compared to the pre-implementation survey to determine if provider knowledge, attitude, self-efficacy and screening rates increased after an educational intervention. (see Appendix B Survey Instrument Pre-Post Test).

Measures

A survey of knowledge, attitudes, self-efficacy and assessing barriers and facilitators of screening for COPD using the COPD-PS was created by the PI based on the GOLD guidelines and COPD Foundation COPD-PS screening tool (see Appendices A and B). The pre-implementation survey was distributed to the providers' emails for completion prior to the June educational meeting. The post-implementation survey was distributed during the last week of the intervention in August 2019. The survey was the same for both the pre- and post-test. The survey included seven multiple choice questions to test provider knowledge, eight Likert-style questions to assess their attitudes and self-efficacy, three questions to assess current screening practice, and two fill-in answer questions to assess barriers and facilitators related screening for COPD and use of the COPD-PS screening tool.

To assess provider screening for COPD using the COPD-PS screening tool, documentation of the screening tool and referral rates for spirometry, 100 randomly selected charts of patients seen in the office from the months of June-August 2018, and 100 randomly-selected charts of patients seen after the intervention from the months of June-August 2019 were selected, using the sample inclusion and exclusion criteria. The results were stored in a Microsoft Excel spreadsheet. See Table 1 for summary of variables.

Data Analysis

Statistical analysis was completed using IBM SPSS statistical software version 26. Descriptive statistical analysis using frequencies and means were used to describe the sample and a chi-square test was used to compare findings in the pre/post-implementation groups. Differences between variables in the samples before and after the intervention were assessed using chi-square analysis to assess patient age, gender, ethnicity, patient reported symptoms, ICD-10 codes in EHR, COPD-PS performed on eligible patients and documentation of COPD-

PS screening tool. Variances in the proportion of spirometry ordering rates before and after the intervention were assessed using chi-square analysis. Differences between variables in the samples before and after the intervention were assessed using paired sample t-tests to assess changes in provider knowledge, attitudes and self-efficacy. Provider's perception on barriers and facilitators in COPD screening in the primary care were described qualitatively.

Results

The study sample included 170 patients aged 40-62+ and four primary care providers from one primary care office setting. Appendix tables 2, 3, 4 and 5 demonstrate the detailed results from the study.

Provider

Of the ten primary care providers, only six primary care providers were in attendance at the meeting and four providers voluntarily participated in the study and completed both the pre- and post-test (67% participation rate). The identity of those four providers is anonymous. The ratio of male to female providers was even, with two physicians and two nurse practitioners and all providers had five or more years of experience. See Table 2 for provider demographics.

Patients

The primary investigator performed a chart review of 200 randomly selected patients who met all inclusion criteria and for whom screening was indicated during the pre-and-post intervention time frame. Of those 200 randomly selected patient charts, 30 patients were excluded in the post-intervention study because of a diagnosis of COPD in their chart, leaving a total sample of 170 patients. Of those 170 randomly selected charts, 100 charts were from pre and 70 from post-intervention who met inclusion criteria were reviewed in the pre-intervention group and 70 charts who met inclusion criteria were reviewed in the post-intervention group.

Most patients screened for COPD were age 51+. The pre-implementation group represented age group was 61+ (49%) and for the post-implementation group it was ages 51-61 (43%). The smallest groups for both pre and post was the 40-50 year old group (24% and 18.6% respectively). There were more female participants than male participants in the study. There was a statistically significant difference (*p= .007)* in the number of female participants in the pre (n=65, 65%) and post (n=30, 44.3%). The majority of patients for both pre and post were Caucasian (74% and 67.1% respectively). The most common symptom reported in patients in both the pre and post was a cough (52% and 42.9%). Similarly, since most patients were

presenting with cough, provider documentation of ICD-10 codes of patients presenting symptoms were highest with cough (R05) in both the pre and post group (81% and 48.6%), which was statistically significant, (*p=.001)*. See table 3 for demographic and clinical characteristics pre- and post-educational intervention.

Provider Knowledge

Seven knowledge-based questions on COPD and the COPD-PS screening tool were analyzed in both the pre- and post-tests. Two questions evaluated provider knowledge on COPD-PS screening tool and five questions tested provider knowledge on risk factors, prevalence, diagnostic testing, characteristics and symptoms of COPD. Each question had only one correct answer and was coded accordingly with the score of any incorrect answer as 0 and the correct answer as 1.0, which created a range of 0-7. Both the pre- and post-tests were distributed via survey to the providers email using Qualtrics.

A comparison of means of each knowledge domain question pre-test versus post-test is presented in Table 5. There was an increase in mean knowledge (pre and post means, respectively) though it was not significant (p=.390). scores but there was not a statistically significant difference between the pre- and post-study scores, (*p=.390*). The overall mean score of provider knowledge increased from 6.75 out of a possible 7 correct answers (SD=0.50) before the intervention to 7 out of 7 correct (SD=0.00) after the intervention. See Table 4 and Figure 1

Provider Attitudes

A comparison of means of provider attitudes towards COPD screening and the COPD-PS screening tool questions for the pre-test versus post-test is presented in Table 4 and Figure 2. Provider attitude mean scores in the pre-test was 4.12 out of a possible 5 points (SD=0.75) compared to the post-test of 4.93 (SD=0.12) Although, the overall change between pre- and post-tests mean scores for provider attitudes was not statistically significant.

Provider Self-Efficacy

A comparison of means of provider self-efficacy towards COPD screening and the COPD-PS screening tool questions for the pre-test versus post-test is presented in Table 4 and Figure 3. Provider self-efficacy mean scores in the pre-test was 4.12 out of a possible 5 points (SD=0.85) compared to the post-test of 5.00 (SD=0.00). Although, the overall change between pre- and post-tests mean scores for provider self-efficacy was not statistically significant

(p=0.133), is it worth noting that provider self-efficacy towards utilization of the COPD-PS screening tool and screening for COPD in the primary care improved..

Provider Current Screening Practice

Currently there is no standard screening process to identify patients for COPD in the primary care office at this organization. Providers were asked in the pre-and post-tests what methods they use to help facilitate screening for COPD. The providers scores were ranked from "Always (4) to Never (1)" on which tools they used to screen patients for COPD, both before and after the educational intervention. The method used most often to help aid in diagnosis of COPD in the pre-test was spirometry with a mean of 3.75 (SD=0.96) and in the post-test was surveys with a mean of 2.00 (SD=0.00), which was statistically significant (*p=.003)*. The least used method in both pre-and post-test was chest x-ray 3.00 (SD=0.82) and 2.00 (SD=0.00) respectively). The method providers chose to screen patients for COPD in the primary care office was statistically significant in the use of surveys. (see Table 4 and Figure 4).

Measurement of COPD-PS Screening Tool

Pre-Intervention

The PI performed a chart review of 100 randomly selected patients who met all inclusion criteria and for whom screening was indicated during the pre-intervention months of June through August 2018. Of those 100 patients, zero patients were screened for COPD using the COPD-PS screening tool and no documentation elsewhere of COPD screening for any patient was found in patient's charts. Although these patients were considered at risk for COPD, there was no documentation in patient's EHR of screening for COPD using the COPD-PS screening tool, spirometry or other screening tools. This finding indicates that patients who were not screened for COPD but met inclusion criteria could have been screened and diagnosed for COPD earlier in the disease process if regularly screening for COPD occurred in the primary care setting (see Table 3 and Figure 4).

Post- Intervention

The primary investigator performed a chart review of 70 randomly selected patients who met all inclusion criteria and for whom screening was indicated during the post-intervention months of June through August 2019. Of those 70 patients, 16 (22.9%) had the COPD-PS screening tool performed and scanned into the Media tab in the patients EHR and 54 (77.1%) did not have the screening tool performed. Provider documentation of the COPD-PS screening tool

score was documented 14 times (20.0%) at the end of the patient's assessment and plan in their office visit note. Provider documentation of COPD-PS may have not been recorded if provider did not see results of score, if paper copy was lost before being scanned into patient's EHR or if patient did not score high enough to warrant provider discussion and spirometry referral. See Table 3 and Figure 4 for comparison of COPD-PS screenings performed and documented pre- and post-intervention.

A chi-square test was used to analyze COPD-PS screening rates for patients who met screening requirements in the pre-and post-intervention periods. Analysis revealed that there was significant statistical differences in the COPD-PS screening tool being performed *(p=.001)* and documentation *(p=.001)* of COPD-PS from the pre-to-post intervention periods (see Table 3).

Increased Spirometry Screening Rates

Pre-Intervention

The primary investigator performed a chart review of 100 randomly selected patients who met all inclusion criteria and for whom screening for COPD was indicated during the pre-intervention months of June through August 2018. Of those 100 patients, two patients (2.0%) had spirometry ordered, while the other 98 patients (98.0%) did not. Reasons for not screening for COPD or ordering spirometry were not documented in the patient's EHR. Reasoning for spirometry not being ordered could be correlated with providers not using the COPD-PS screening tool for at risk patients. Provider documentation and screening for patients using the COPD-PS screening tool could have identified patients at risk for COPD, which would have led diagnostic spirometry testing.

Post-Intervention

The primary investigator performed a chart review of 70 randomly selected patients who met all inclusion criteria and for whom screening was indicated during the post-intervention months of June through August 2019. Of those 70 patients, 14 (20.%) had spirometry ordered and 56 (80.0%) did not. Reasons for not ordering spirometry was documented in four of the 56 patients charts, "patient COPD-PS score less than 5" from one provider. Of the 14 patients who had spirometry ordered, four patients did not follow through and get testing performed, two patients were hospitalized and spirometry testing was performed at the hospital and eight patients had spirometry performed. Of the eight patients who had spirometry orders placed during the post-intervention period, three patients' spirometry readings were normal and five indicated

airway obstruction, indicating a diagnosis of COPD. Physicians performing spirometry on the patients include comments such as "spirometry demonstrates severe airway obstruction FEV1/FVC 51, FEV1 37% of predicted"; lung volumes are consistent with moderate restrictive and obstructive lung disease"; "moderate airway obstruction"; "moderate obstruction, recommend full PFT."

A chi-square analysis was used to analyze spirometry ordering rates for patients in the pre-and post-intervention periods. Analysis revealed that the difference in spirometry ordering rates from the pre- to post-intervention periods was statistically significant *(p=.001)*. Patients that had spirometry ordered in the post-intervention were patients who had the COPD-PS screening tool completed. This finding is significant and supports the literature from Martinez, et al., 2008; Spyratos, Haidich, Chloros, Michaelopoulou, & Sichletidis, 2017 & Tsukuya, et al., 2015, that utilization of the COPD-PS can identify at risk patients for COPD, who would benefit from diagnostic spirometry. Utilization of the COPD-PS screening tool was able to aid in diagnosing five pre-undiagnosed patients with COPD, which may not have occurred without the COPD-PS. See Table 3 and Figure 5 for comparison of order rates pre and post-intervention.

Barriers and Facilitators Identified

At the end of the provider pre-and post-implementation survey, providers were asked if they felt there were barriers for screening for COPD in their setting and what facilitators were available to assist them in overcoming these barriers. By allowing providers to leave comments, the PI hoped to gain insight on the providers' perspective of barriers and identify potential solutions in order to increase screening rates for COPD.

Three out of the four providers provided comments about the barriers they perceived and what facilitators may help overcome these barriers. Provider comments on perceived barriers include "easier access to spirometry"; "time to screen patients and time to do spirometry" and "improve pay models since I won't get paid for taking extra time to do screen/test." Facilitators to screening include "more time with patients'; 'having nurses do screen and do spirometry" and "company have machine here and pay to compensate time spent." One provider stated that "nursing staff could be beneficial in overcoming these barriers by completing and documenting the screening tool in the patients chart and performing the spirometry if it was warranted for the patient."

Discussion

Patient Demographic and Clinical Characteristics

The findings from this study support findings from previous studies that the use of the COPD-PS screening tool is an effective way to identify patients at risk for COPD in the primary care setting. The findings in this study are similar to current studies in the literature (Martinez, et al., 2008; Spyratos, Haidich, Chloros, Michaelopoulou, & Sichletidis, 2017; Tsukuya, et al., 2015 & Yawn, et al., 2014). The results of this study are comparable to other studies that have also found higher incidences of COPD in Caucasian adult patients ages 51 + (Martinez, et al., 2008; Tsukuya, et al., 2015 & Yawn, et al., 2014). A study performed by Jenkins, et al., (2017) found that the prevalence of COPD is increasing more rapidly in woman than in men, which was also present in this study, ($p= .007$). This finding indicates the need for providers to equally screen both men and women who present to the office with COPD symptoms.

A study performed by Martinez, et al., (2008) used the COPD-PS screening tool to determine that patients who presented with symptoms of COPD (dyspnea, chronic cough, chronic sputum production, and a history of exposure to risk factors, such as smoking) and had a positive COPD-PS score were diagnosed with COPD after spirometry confirmation. This finding was also found in this study, which found five patients previously undiagnosed with COPD. Without utilization of the COPD-PS screening tool patients may have not been screened for COPD and referred for diagnostic spirometry to confirm a diagnosis of COPD.

Influencing Provider Knowledge, Attitudes, Self-Efficacy

A provider-based educational intervention improved provider, knowledge, attitudes and self-efficacy related to COPD screening and utilization of the COPD-PS screening tool in this study. There was not much variability in provider attitudes scores, since most providers agreed or strongly agreed with each statement in the pre/post survey. Though the overall means for provider knowledge, attitudes and self-efficacy increased from the pre- to post-implementation study, the change was not statistically significant. Provider knowledge, attitudes and self-efficacy was consistently positive and improved after education, indicating that providers are capable of identifying at risk patients for COPD as well as ordering spirometry for diagnostic testing.

Provider knowledge scores from the pre and post-study indicate that providers are underestimating the problem of COPD. One of the four providers in the pre-implementation survey missed one of the seven knowledge question. The question the provider missed was the

number of patients who are undiagnosed with COPD in the United States . All four providers got all seven knowledge questions correct in the post-implementation study, indicating that they are knowledge about COPD and the availability and process of screening for COPD using the tool. With an estimated 24 million Americans undiagnosed with COPD, it is essential for providers to screen patients for COPD (CDC, 2018). Although there are screening tools to aid in diagnosing COPD, providers may choose not to use one based on their personal instinct and assumptions of correctly identifying and diagnosing patients for COPD without a screening tool or diagnostic spirometry. By speculating a diagnosis of COPD but not testing for it, patients may remain undiagnosed with COPD or be diagnosed at a later stage in life. Therefore, a standardized screening tool is needed to accurately diagnose patients at the earliest sign of a possible COPD diagnosis.

Influencing Provider Spirometry Screening Rates

Provider screening rates for COPD utilizing the COPD-PS was statistically significant from the pre to post-implementation phase. Prior to the educational intervention providers were not using any form of screening tool to assess patients for COPD, therefore it is likely that the increased screening rates of COPD was due to provider education. Without performing a COPD screen on patients, five patients would still be undiagnosed with COPD. Providers that used the COPD-PS screening tool and received a positive score (5 or greater) placed a referral for spirometry. Of the 14 referrals, five patients with previously undiagnosed COPD were appropriately diagnosed with COPD and started on medications and three had normal spirometry results indicating no obstruction or diagnosis of COPD. There were an additional four patients that had the order in for spirometry but did not go.

Four patients that completed the COPD-PS screen scored less than five, which was not appropriate for spirometry referral. It would be of interest to see if patients who scored less than five were screened again in the winter months when symptoms are more apparent. The last two patients who had referrals for spirometry were hospitalized before spirometry was performed but had spirometry performed during their hospital admission.

By offering in-office spirometry providers would not have to refer patients out for screening, could ensure screening was performed during the office and could bill for the service and interpretation of results. Nursing staff is essential to the success of COPD screening and in-office spirometry. Nursing staff could screen patients for COPD as well as perform spirometry

on patients that meet screening requirements, which could decrease providers perceived barrier of limited time with patients and limited provider's time. A study performed by Ruppel, Carlin, Hart, & Doherty (2018), found that a formal questionnaire, such as the COP-PS can improve the efficacy and accuracy of a COPD diagnosis when used to select patients for diagnostic spirometry. Similarly, Mapel, Dalal, Johnson, Becker, & Hunter (2015), reported that COPD disease severity was underestimated in about 40% of subjects before spirometry and that treatment changes occurred in 37% of cases when the primary care practitioner had spirometry results. These findings are important for future studies, since they highlight the importance of screening at risk patients for COPD could lead to a diagnosis of COPD that could have been underdiagnosed in the past. In this study, there was a significant improvement in provider screening for COPD utilizing the COPD-PS screening tool, documentation and spirometry ordering following a positive COPD-PS score between the pre and post implementation phase.

Barriers to COPD Screening

During the chart review "lack of transportation" was cited for one of the four patient as the reason for why spirometry testing was not completed. The other three referrals for spirometry were open but the patient's never went for testing. A study performed by Yawn, Wollan, Textor, & Yawn (2016) reported provider perceptions of barriers for screening for COPD, which was consistent with findings in Han, et al (2015) and Dirven, et al's., (2013) studies that listed "lack of easy access to spirometry," time limitation," lack of expertise to interpret results of spirometry," "lack of reimbursement," and "lack of nursing staff" as barriers to in-office spirometry. Likewise, Enocson, et al., (2018) performed a study that examined patient perceptions on barriers for COPD screening. Participants suggested that screening activities for COPD should take place in a convenient place, such as their general practice, as it is "close to home and travel costs are minimal" (Enocson, et al., 2018). Enocson, et al., (2018) reported additional patient barriers to COPD screening which were, "too busy," depends on how long test would take because I take care of my disabled wife," "takes 3 months to see PCP for follow-up," and "limited time to be off work." Similarly, both providers and patients have similar barriers to COPD screening and diagnostic spirometry to confirm COPD in the primary care setting. Availability of in-office spirometry has led to increased use of spirometry and confirmation of a diagnosis of COPD in the primary care setting. In a study by Yawn, et al., availability of in-office spirometry confirmed diagnosis of COPD in more than 58.2% of the patients with a

positive COPD-PS score (2015). Likewise, Murphy, et al., (2016) found 29% of patient who had in-office spirometry performed, 69% were diagnosed with COPD. These findings are similar to this study, as they are patients who were previously undiagnosed with COPD, were diagnosed after spirometry confirmation.

The significance of this finding is that there is not only a need for early COPD screening but there is also a need for availability of in-office spirometry. Identification of patient barriers to spirometry was not asked of patients, however, in-office spirometry could save patients time, decrease transportation and prevent an additional co-pay (Martinez, et al., 2008; Yawn, et al., 2014). It would be interesting, however, to perform this same study again but with availability of in-office spirometry and all providers and nursing staff to receive the educational session.

Implications for Future Study

Providers who offered their written feedback in the pre- and post-intervention survey allowed for identification of barriers and possible solutions to increase COPD screening in the primary care setting. One way that providers could improve patient care is by screening patients for COPD and having spirometry on site in the primary care office. The study by Yawn, et al., (2014), revealed a strong association between office-based spirometry and a significant increase in COPD diagnosis in primary care providers ($p=.002$). Availability of spirometry in the office would be beneficial for patients as well as providers. Patients may be more likely to follow through with testing if it is offered at the same time of their office visit.

Another recommendation for future practice includes the use of a screening tab for COPD in the organizations computer system. Currently there is no established screening tool in the Epic computer system that is utilized by the study site to help providers remember to screen patients for COPD. The COPD-PS screening tool is currently the only evidence-based screening tool developed to aid in early diagnosis of patients with COPD (Martinez, et al., 2008). Integration of the COPD-PS screening tool in patients EHR can eliminate nursing from having patients to complete the paper form and then scan it into each patients EHR. This step will allow providers to know which patients have been screened and will allow providers to be able to order diagnostic testing and address results with patients easier. Integration of the screening tool in a computer system will allow for patient information to be safely kept in the patient's own EHR, thus eliminating potential patient privacy issues and loss of paper screening forms. Performing

screening tool in the computer would be instant and would not require for nursing staff to have to scan documents into the computer system, which would save time and protect patient privacy.

Another recommendation for future practice includes the use of educating nursing staff to screen at risk patients for COPD and perform spirometry in the office. All providers listed nurses as facilitators in overcoming barriers for screening patients for COPD. Utilizing nursing staff could potentially increase the number of patients being screened for COPD, increase availability of spirometry testing for those patients with limited transportation and increase provider billing.

It is worthwhile to note the potential impact of provider-based interventions on certain outcome measures. Since there was a statistically significant change in provider use and documentation of the COPD-PS as well as spirometry order rates, it may be beneficial to conduct another educational session for all providers and their nurses to attend. This finding is significant because it showcases that screening for COPD using the COPD-PS and provider referral for spirometry to diagnosis COPD is significant in identifying previously undiagnosed patients with COPD There would be two educational sessions, one for the nursing staff and one for the providers. Education would be provided to both on who to screen, how to document and what to do with a positive COPD-PS score. Handouts would be given to providers and nursing staff to review patient inclusion and exclusion criteria. With more providers and nursing staff screening patients for COPD, more patients would be diagnosed at an earlier stage of the disease progress, this leading to better patient outcomes.

Limitations

Limitations for this study include a small sample size of providers (n=4) at one primary care office with mostly Caucasian participants. Provider knowledge, attitudes, self-efficacy and screening practice was limited with the size of participants and only being conducted at one office. A larger sample size with more offices would have allowed for variances in pre-post interventions sample data. Additional risk factors such as family history of COPD, childhood respiratory infections, congenital/developmental abnormalities, occupational dusts, vapors, fumes, gases and other chemicals could be useful for inclusion criteria in future studies.
The timeframe for implementation was short (three months) and took place during the summer months, when COPD symptoms are not as prominent. Performing the study over 6 months and starting from October to March could be more beneficial in screening patients for COPD, since that is when exacerbations are most common. The reliability and validity of the pre- and post-

test has not been determined, as it was generated by the PI and not trialed prior to this study. Data collected from providers in the pre-and post-test may also involve bias opinions to the need for COPD screening in the primary care office.

Recommendations

Although this study did not show any statistical significant findings with provider knowledge, attitudes and self-efficacy with COPD screening, the need to determine the reliability and validity of the provider survey accessing these components is one important implication for further study, as the true reliability and validity remains unknown. If reliability and validity cannot be achieved, consideration of a different validated survey may be warranted for future studies. It may also be beneficial to extend the time frame of the study to determine whether knowledge, attitudes, and self-efficacy were sustained over time or became more relevant during the winter months when COPD exacerbations are more prominent. Lastly, implementation of this study in a multi-site office would be ideal to test replicability and generalizability of the study.

Conclusion

COPD is the fourth most common cause of mortality and disability in the US, with higher incidences in Kentucky than majority of other states (Croft, et al., 2018). Although there is no cure for COPD, earlier screening and detection can improve short-and long-term patient outcomes, increase quality of life, decrease co-morbidity and mortality, and reduce costs related to underdiagnosed COPD.

Utilization of a screening tool, such as the COPD-PS, could be instrumental in early identification and diagnosis of patients with COPD in the primary care setting. In this study a pre- and posttest revealed an overall increase in provider knowledge, attitudes and self-efficacy with utilization of the COPD-PS screening tool and COPD, however differences between these findings in the pre and posttest were not statistically significant. Pre and post-tests revealed an increase in provider documentation, screening for COPD using the COPD-PS screening tool and order referrals for spirometry, which was statically significant. It is important to note the significance of the barriers and facilitators providers noted for screening for COPD for future practice. Future propositions for practice change may involve implementing a documentation tab for COPD screening in the Epic computer system to help providers remember to screen patients, order spirometry and review results with patients. Future initiatives for COPD screening using

the COPD-PS screening tool and availability of in-office spirometry could increase earlier diagnosis of COPD and improve patient outcomes.

Appendix A. *COPD-PS Screening Tool*

This survey asks questions about you, your breathing and what you are able to do. To complete the survey, mark an X in the box that best describes your answer for each question below.

1. During the past 4 weeks, how much of the time did you feel short of breath?

None of the time	A little of the time	Some of the time	Most of the time	All of the time
☐ 0	☐ 0	☐ 1	☐ 2	☐ 2

2. Do you ever cough up any "stuff," such as mucus or phlegm?

No, never	Only with occasional colds or chest infections	Yes, a few days a month	Yes, most days a week	Yes, every day
☐ 0	☐ 0	☐ 1	☐ 1	☐ 2

3. Please select the answer that best describes you in the past 12 months. I do less than I used to because of my breathing problems.

Strongly disagree	Disagree	Unsure	Agree	Strongly agree
☐ 0	☐ 0	☐ 0	☐ 1	☐ 2

4. Have you smoked at least 100 cigarettes in your ENTIRE LIFE?

No	Yes	Don't know
☐ 0	☐ 2	☐ 0

5. How old are you?

Age 35 to 49	Age 50 to 59	Age 60 to 69	Age 70+
☐ 0	☐ 1	☐ 2	☐ 2

How to Score Your Screener: In the spaces below, write the number that is next to your answer for each of the questions. Add the number to get the total score. The total score can range from 0 to 10.

_____ + _____ + _____ + _____ + _____ = _____
(#1) (#2) (#3) (#4) (#5) TOTAL SCORE

If your total score is 5 or more, this means your breathing problems may be caused by chronic obstructive pulmonary disease (COPD). The higher your score, the more likely you are to have COPD. COPD is often referred to as chronic bronchitis and/or emphysema and is a serious lung disease that slowly gets worse over time. While COPD cannot be cured, it is treatable, so please share your answers to the five question screener with your healthcare professional (HCP).

If your total score is between 0 and 4, and you are experiencing problems with your breathing, please share your answers to the five-question screener with your HCP.

Only your HCP can decide if you have COPD. Your HCP can help evaluate your breathing problems by performing a breathing test, also known as spirometry. Don't wait. Call your HCP today to make an appointment to see if you may be at risk for COPD. Remember, when speaking to your HCP, be honest and open in describing your symptoms and explain how your breathing problems affect your activity level on a daily basis.

COPD88821CONS

Appendix B. *Provider Pre-Post Implementation Test Survey*

Start of Block: COPD Screening Survey

Your answers are anonymous. In order to match your pre-test and post-test, please select a random number with 3 or more digits. Remember this digit and copy it onto the post-test

Number:_____

What is your gender

- ○ Male (1)
- ○ Female (2)

What is your degree

- ○ NP (1)
- ○ MD (2)

Years of experience

- ○ Less than 5 years (1)
- ○ More than 5 years (2)

Q1 About how many patients are underdiagnosed with COPD in the United States?

- ○ 32 million (1)
- ○ 17 million (2)
- ○ 12 million (3)
- ○ 24 million (4)

Q2 At what age should screening for COPD be started?

- 40 (2)
- 55 (3)
- 60 (4)
- 65 (5)

Q3 What is the main risk factor for COPD?

- Air Pollution (1)
- Biomass Fuel Exposure (2)
- Asthma (3)
- Smoking (4)

Q4 What symptom is **not** characteristic of COPD?

- Chronic Cough (1)
- Bradycardia (2)
- Dyspnea (3)
- Productive Sputum (4)

Q5 What test is required by GOLD guidelines to establish a diagnosis of COPD?

- Chest X-Ray (1)
- Patient history (2)
- Family history (3)
- Spirometry (4)

Q6 How many questions is the COPD-PS?

- ○ 4 (1)
- ○ 5 (2)
- ○ 6 (3)
- ○ 7 (4)

Q7 What score on the COPD-PS screening tool is considered "high risk" for diagnosis of COPD and warrants further testing?

- ○ 0-4 (1)
- ○ 5-10 (2)
- ○ 10-20 (3)

Q8 What is your current practice for screening for COPD in the primary care setting? Do you use:

	Always (4)	Sometimes (3)	Rarely (2)	Never (1)
Chest X-Ray (1)	○	○	○	○
Screening Tools (2)	○	○	○	○
Spirometry (3)	○	○	○	○
Surveys (4)	○	○	○	○
Other (5)	○	○	○	○

Q9 Do you currently use any screening tools to help identify patients with COPD?

- ○ Yes (1)
- ○ No (2)

Q10 If yes, do you use

- ○ COPD Population Screener (COPD-PS) (1)
- ○ COPD Assessment Test (CAT) (2)
- ○ Chronic Respiratory Questionnaire (CCQ) (3)
- ○ Modified Medical Research Council (mMRC) (4)

Q11 Do you feel there are barriers in screening patients for COPD in your setting?

- ○ Yes (1)
- ○ No (2)

Q12 If yes, what could assist in reducing the barriers?

Q13 What facilitators are available to assist you in screening patients for COPD in your setting?

Q14 On a scale from Strongly agree to Strongly disagree, record your responses to screening for COPD using the COPD-PS screening tool

	Strongly agree (5)	Somewhat agree (4)	Neither agree nor disagree (3)	Somewhat disagree (2)	Strongly disagree (1)
I feel screening for COPD is important in the primary care setting (1)	○	○	○	○	○
I understand which patients are at risk for COPD (2)	○	○	○	○	○
Screening for COPD using the COPD-PS can earlier identify patients at risk for COPD (3)	○	○	○	○	○
I understand how to use the COPD-PS (4)	○	○	○	○	○
I am comfortable with screening for COPD using the COPD-PS (5)	○	○	○	○	○
The COPD-PS screening tool is easy to use (6)	○	○	○	○	○
Availability of in-office spirometry would increase patients I screen for COPD (7)	○	○	○	○	○

Appendix C. *Provider Email Consent*

Dear Providers at NCMA-Dixie,

You are being invited to participate in a research study, "The Effect of Educating Providers on How to Implement the COPD-PS tool on Screening Rates in the Primary Care Setting." The purpose of this study will be to assess baseline practice related to screening for Chronic Obstructive Pulmonary Disease (COPD) among adult patients at in one primary care setting. Furthermore, the purpose will be to educate providers about COPD and the COPD-PS screening tool and to evaluate subsequent changes in knowledge and screening rates.

The Principal Investigator is Kelli Craig a faculty member in the Doctor of Nursing Practice Program at the University of Kentucky College of Nursing and current employ at Norton Healthcare.

If you agree to participate in the study, you will be asked to complete an online survey on Qualtrics that asks you to provide answers to several question items, in the form of multiple score, Likert Scale and fill-in the blank. There is no risk to participation in the study, other than participants might remember a negative experience when completing the survey instrument.

The benefits that may be derived from this research include that with future improvement of COPD screening, individuals who have not been previously recognized or screened for COPD will be identified as screening process improvement takes place.

Your participation in this study is entirely voluntary. We hope to receive 11 completed questionnaires so your answers are important to us. Of course, you have a choice about whether or not to complete the survey/questionnaire, but if you do participate, you are free to skip any questions or discontinue at any time. The survey will take about 3 minutes to complete.

We make every effort to safeguard your data once received on our servers via Qualtrics. Given the nature of online surveys, as with anything involving the internet, we can never guarantee the confidentiality of data still en route to us. Qualtrics is a secure, web-based application designed exclusively to support data capture for research studies.

Your responses will be anonymous. Records of your participation in this study will be kept confidential to the extent permitted by law. Results of this research will be reported as summarized data and will not contain any identifiable individual data. For this study, survey respondents will not be ask to provide a name, email address or any identifying information.

Should you have any questions you may contact Kelli Case Craig, the Principal Investigator, at kaca268@uky.edu or per telephone at (812) 987-9557**.** If you have complaints, suggestions, or questions about your rights as a research volunteer, contact the staff in the University of Kentucky Office of Research Integrity at 859-257-9428 or toll-free at 1-866-400-9428.

Your completion of the survey will be considered your consent to participate in the study and as your agreement that you have been sufficiently informed of the purpose of the study and any risks and benefits. If you agree to participate in the study please click on the below link to access the survey.

SURVEY LINK WILL BE COPIED HERE

Thank you in advance for your assistance with this important project.

Sincerely,

Kelli Case Craig
College of Nursing, University of Kentucky

Appendix D. Patient Survey Cover Letter

To Patients of NCMA- Dixie

Researchers at the University of Kentucky are inviting you to take part in the CODP-PS questionnaire about risk for development of COPD in the greater Louisville area. You are receiving this survey because you are being seen for a routine physical in which health maintenance data, such as diet, exercise, and preventative screenings, such as the COPD-PS are going to be discussed.

Although you may not get personal benefit from taking part in this research study, your responses may help us understand more about properly screening for COPD. Some volunteers experience satisfaction from knowing they have contributed to research that may possibly benefit others in the future.

If you do not want to participate, simply do not fill out the five-question survey on the back of this form.

The questionnaire will take about 2 minutes to complete. Participants are asked to complete the survey while in the provider office.

Your response to the survey is anonymous which means no names will appear or be used on research documents, or be used in presentations or publications. The research team will not know that any information you provided came from you, nor even whether you participated in the study.
Your information collected for this study will NOT be used or shared for future research studies, even if we remove the identifiable information like your name, clinical record number, or date of birth.

There are no risks to participating in this study.

We hope to receive completed questionnaires from about 250 people, so your answers are important to us. Of course, you have a choice about whether or not to complete the survey/questionnaire, but if you do participate, you are free to skip any questions or discontinue at any time. While filling out the survey, if you experience any anxiety related to the questions being asked, you can skip the questions and consult with your provider. We understand that these questions could potentially lead to feelings of anxiety about the possibility of a diagnosis of COPD, therefore it is important to discuss with your provider your risks for COPD.

If you have questions about the study, please feel free to ask; my contact information is given below. If you have complaints, suggestions, or questions about your rights as a research volunteer, contact the staff in the University of Kentucky Office of Research Integrity at 859-257-9428 or toll-free at 1-866-400-9428.

If you have any questions about the study or need to speak with my faculty advisor, Elizabeth Tovar, PhD, APRN; her contact information is (859) 323-6611 or email egres2@uky.edu.

By filling out the questionnaire on the back of this consent, you consent to being a part of this study.

Thank you in advance for your assistance with this important project.
Sincerely,
Kelli Case Craig
College of Nursing- Graduate Studies, University of Kentucky
PHONE: 812-987-9557
E-MAIL: Kelli.Case@uky.edu

Table 1. *Summary of Variables*

Variable	**Scoring Measure**	**Time-point of Measure**	**Level of Measure**	**Data Source**
Age	40-50=1 51-61=2 62+=3	Pre and Post	Continuous	Electronic Health Record
Gender	Male=1 Female=2	Pre and Post	Nominal	Electronic Health Record
Ethnicity	African American=1 Caucasian=2 Hispanic=3 Other=4	Pre and Post	Nominal	Electronic Health Record
Symptoms	Dyspnea=1 Cough=2 Sputum=3	Pre and Post	Nominal	Electronic Health Record
ICD 10 Codes	Dyspnea=1 Cough=2 Sputum=3	Pre and Post	Nominal	Electronic Health Record
COPD-PS Screening Tool Performed	Yes=1 No=2	Pre and Post	Nominal	Electronic Health Record
COPD-PS Documented	Yes=1 No=2	Pre and Post	Nominal	Electronic Health Record
Spirometry Ordered	Yes=1 No=2	Pre and Post	Nominal	Electronic Health Record

Variable	**Scoring Measure**	**Time-point of Measure**	**Level of Measure**	**Data Source**

Knowledge of COPD-PS	1-7 based on # correct	Pre and Post	Scale	Survey
Attitudes about COPD-PS	Likert Scale	Pre and Post	Scale	Survey
Self-efficacy about COPD-PS	Likert Scale	Pre and Post	Scale	Survey
Current Practice COPD screening	Likert Scale	Pre and Post	Scale	Survey

Variable	**Scoring Measure**	**Time-point of Measure**	**Timeline**	**Data Source**
Gender	Male vs Female	Pre and Post	Baseline	Nominal
Degree	MD vs NP	Pre and Post	Baseline	Nominal
Experience	< 5 years vs >5 years	Pre and Post	Baseline	Nominal

Table 2. *Summary of Provider Demographics*

	n	**n(%)**
Providers in Attendance	6	54%
Surveys Completed	4	67%

Category	**n**	**n(%)**
Gender:		
Male	2	50%
Female	2	50%
Degree:		
NP:	2	50%
MD:	2	50%
Experience:		
<5 years	0	0%
>5 years	4	100%

Table 3. *Statistical Analysis of Demographic and Clinical Characteristics Pre- and Post-Educational Intervention (N =170)*

	Pre-intervention (N = 100) n (%)	**Post-intervention (N = 70) n (%)**	**p**
Age			
40-50	24 (24.0%)	13 (18.6%)	.100
51-61	27 (27.0%)	30 (42.9%)	
62+	49 (49.0%)	27 (38.6%)	
Gender			
Male	35 (35.0%)	39 (55.7%)	.007*
Female	65 (65.0%)	31 (44.3%)	
Ethnicity			
African American	23 (23.0%)	18 (25.7%)	.387
Caucasian	74 (74.0%)	47 (67.1%)	
Hispanic	0 (0.0%)	0 (0.0%)	
Other	3 (3.0%)	5 (7.1%)	
Symptoms			
Dyspnea	12 (12.0%)	10 (14.3%)	.170
Cough	52 (52.0%)	30 (42.9%)	
Sputum	0 (0.0%)	0 (0.0%)	
Dyspnea/Cough	16 (16.0%)	23 (32.9%)	
Dyspnea/Cough/Sputum	10 (10.0%)	7 (10.0%)	
Cough/Sputum	10 (10.0%)	0 (0.0%)	
ICD 10 Codes			
Dyspnea	14 (14.0%)	9 (12.9%)	.001*
Cough	81 (81.0%)	34 (48.6%)	
Dyspnea/Cough	4 (4.0%)	27 (38.6%)	
Cough/Sputum	1 (1.0%)	0 (0.0%)	

COPD-PS Screening Tool Performed			
Yes	0 (0.0%)	16 (22.9%)	.001*
No	100 (100.0%)	54 (77.1%)	
COPD-PS Documented			
Yes	0 (0.0%)	14 (20.0%)	.001*
No	100 (100.0%)	56 (80.0%)	
Spirometry Ordered			
Yes	2 (2.0%)	14 (20.0%)	.001*
No	98 (98.0%)	56 (80.0%)	

* denotes statistically significant data based on p-value <0.05

Table 4. *Statistical Analysis of Provider Knowledge, Attitudes, Self-Efficacy and Current Practice*

	Potential Range	**Pre-education *Mean* (SD)**	**Post-education *Mean* (SD)**	**P-value**
Knowledge	0-7	6.75 (0.50)	7.00 (0.00)	.391
Provider Attitudes	5-25	4.12 (0.75)	4.93 (0.12)	.090
Provider Self-Efficacy	5-25	4.12 (0.85)	5.00 (0.00)	.133
Current Practice for COPD Screening	1-4			
Chest X-ray		3.00 (0.82)	2.00 (0.00)	.092
Screening Tools		3.25 (0.96)	4.50 (0.58)	.080
Spirometry		3.75 (0.96)	4.50 (1.00)	.391
Surveys		2.00 (0.00)	4.25 (0.50)	.003*
Other		3.00 (1.41)	2.00 (0.00)	.252

* denotes statistically significant data based on p-value <0.05

Table 5. *Comparison of Provider Knowledge Questions*

Knowledge	**Pre-test (n=4)**	**Post-test (n=4)**
Q1 - About how many patients are underdiagnosed with COPD in the United States?	3.25	4.00
Q2 - At what age should screening for COPD be started?	4.00	4.00
Q3 - What is the main risk factor for COPD?	4.00	4.00
Q4 - What symptom is not characteristic of COPD?	4.00	4.00
Q5 - What test is required by GOLD guidelines to establish a diagnosis of COPD?	4.00	4.00
Q6 - How many questions is the COPD-PS?	4.00	4.00
Q7 - What score on the COPD-PS screening tool is considered "high risk" for diagnosis of COPD and warrants further testing?	4.00	4.00

Figure 1. *Percentage of Knowledge Questions Answered Correctly*

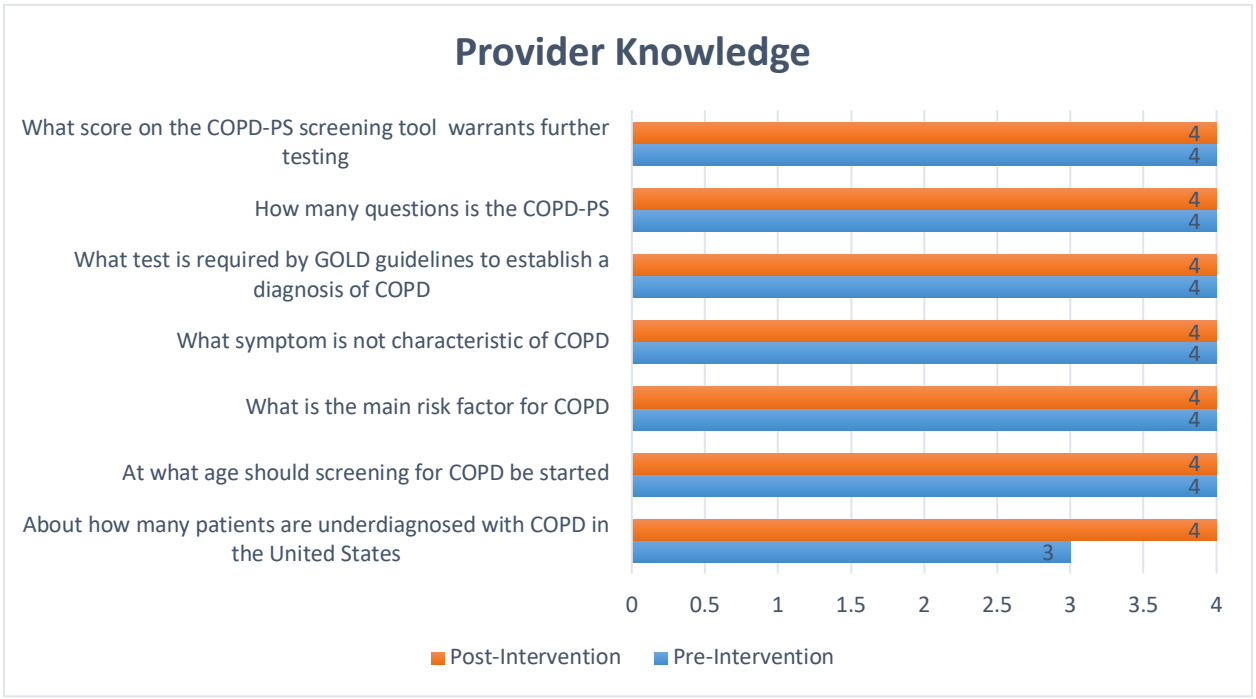


Figure 2. *Measurement of Provider Attitudes*

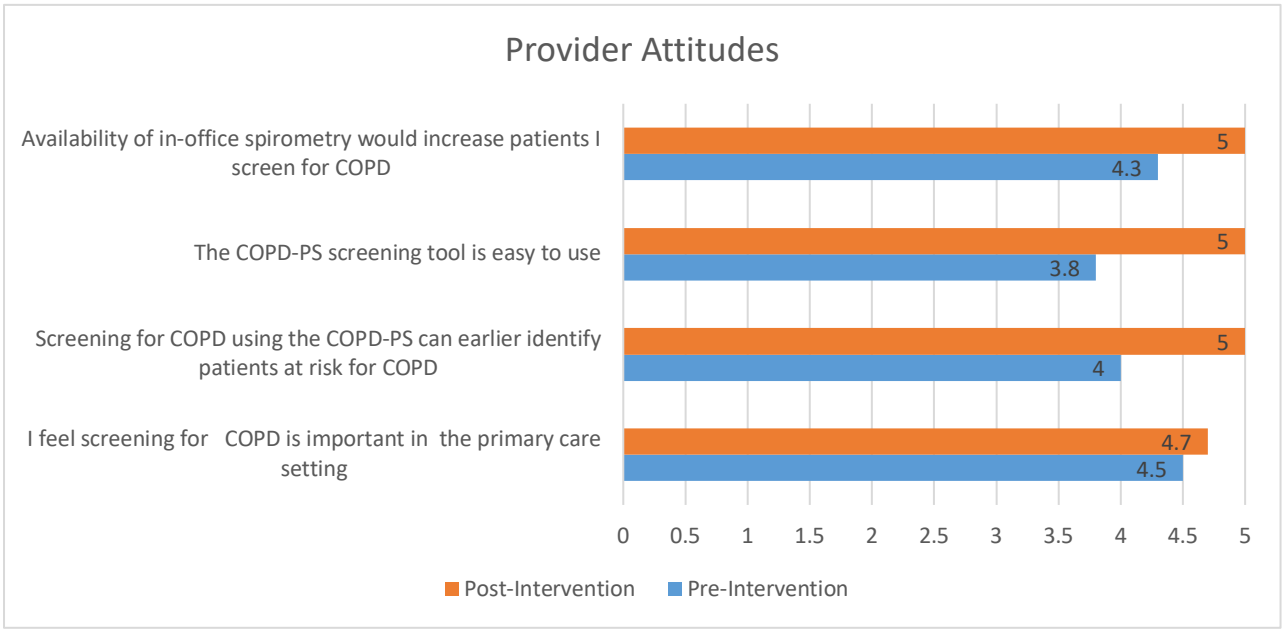


Figure 3. *Measurement of Provider Self-Efficacy*

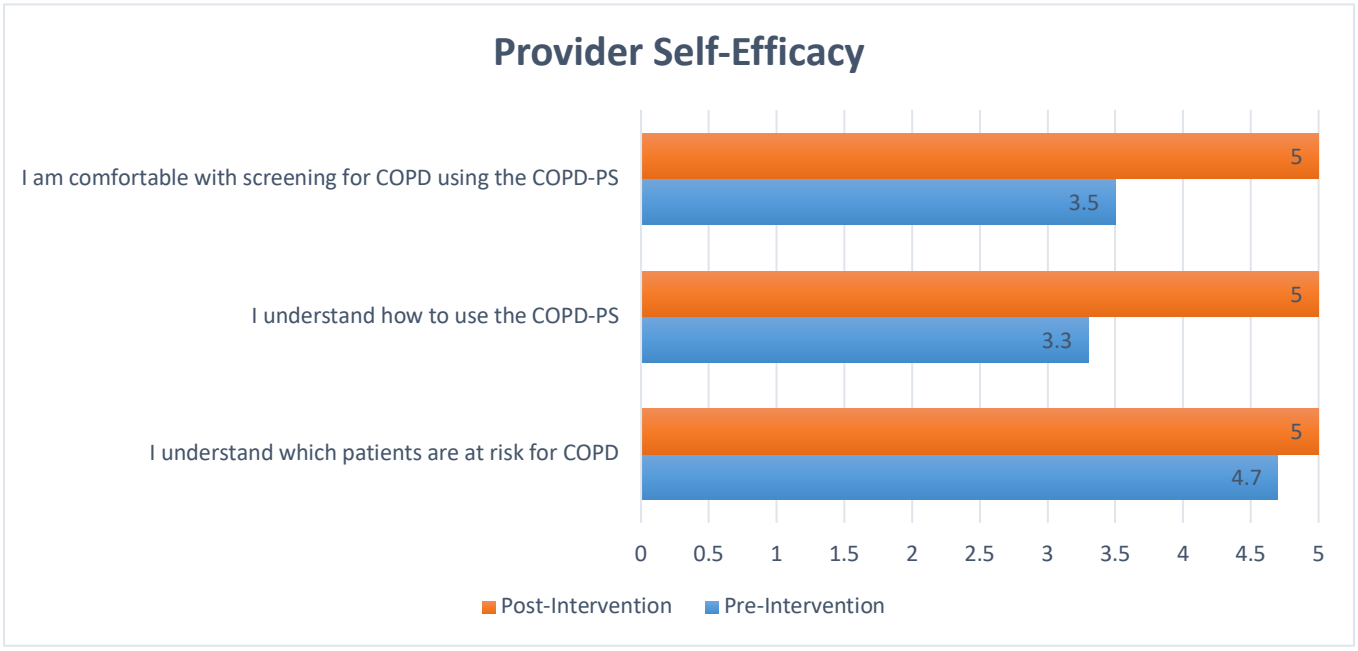


Figure 4. *Measurement of Provider Current Practice for COPD Screening*

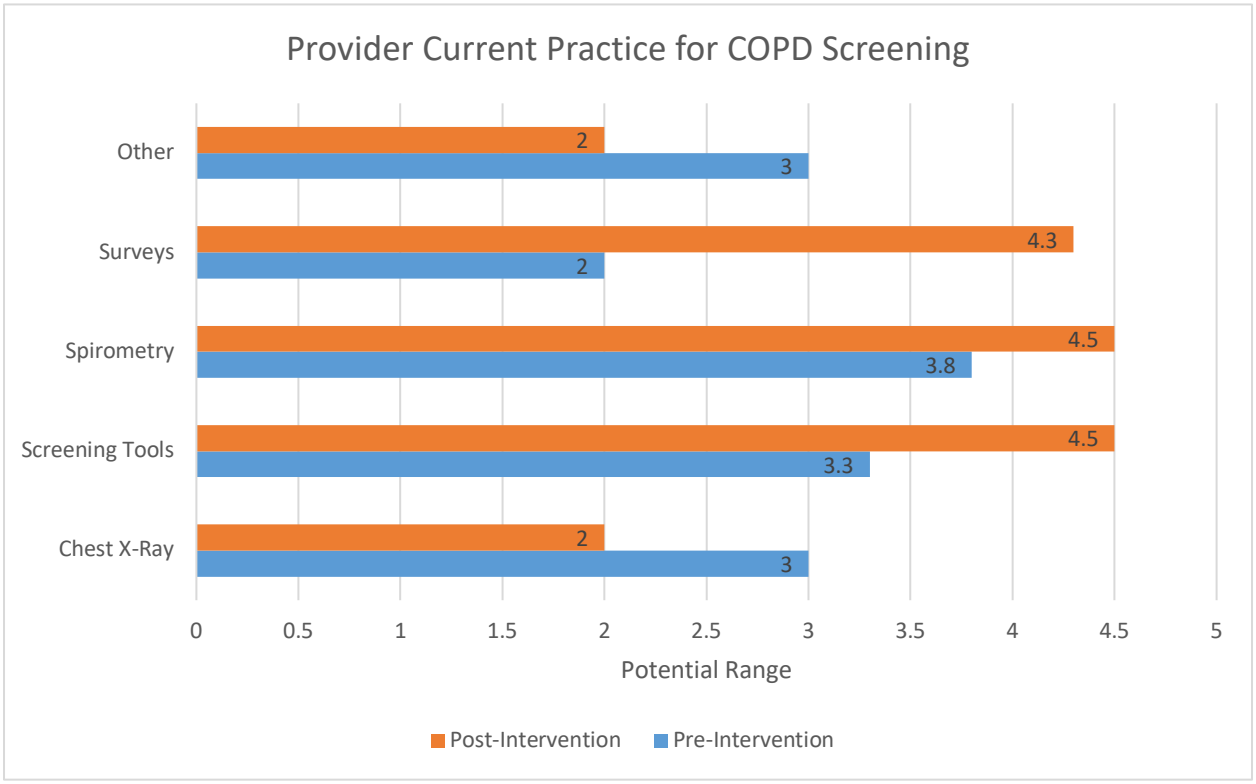


Figure 5. *Measurement of COPD-PS Screening Tool*

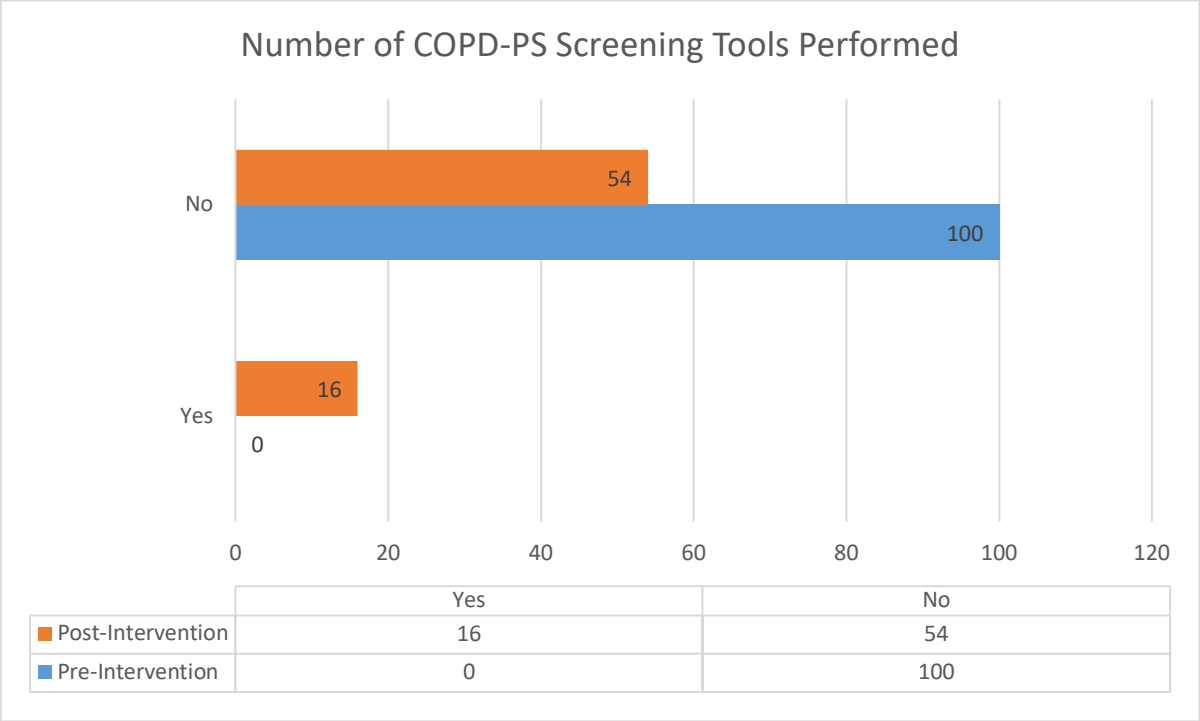
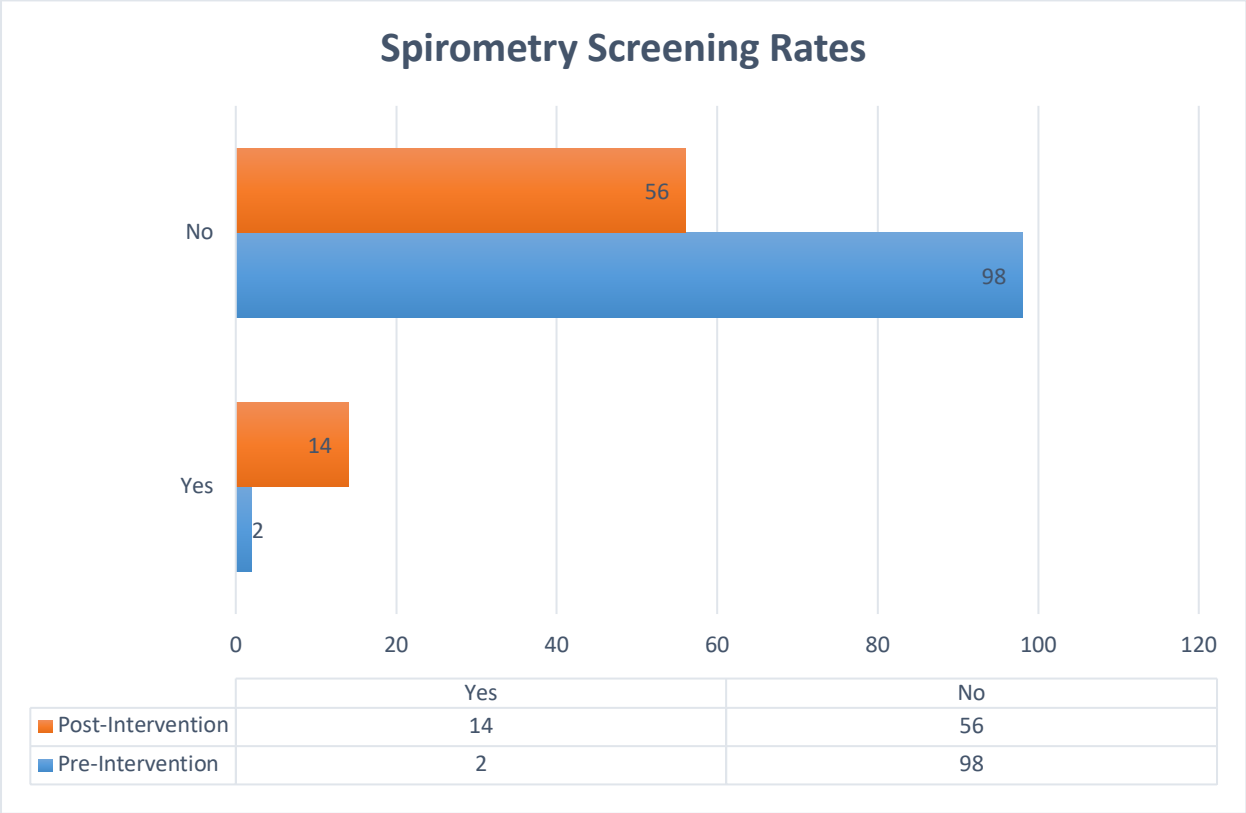


Figure 6. *Measurement of Increased Spirometry Rates*



References

Anzueto, A., Heijdra, Y., & Hurst, J. R. (2015). *Controversies in Copd: Ers Monograph*(1st ed., Vol. 69). Retrieved from https://books.google.com/books?hl=en&lr=&id=rHlxCgAAQBAJ&oi=fnd&pg=PA1&dq=COPDPSscreening&ots=zXy2Vv345D&sig=iQvYXfnbNfBeOPgSSLSlaJ3f8Iw#v=onepage&q=COPD-PS screening&f=false

Centers for Disease Control and Prevention (CDC). (2017, May 3). Chronic Obstructive Pulmonary Disease (COPD) Includes: Chronic Bronchitis and Emphysema. Retrieved from https://www.cdc.gov/nchs/fastats/copd.htm

Centers for Disease Control and Prevention (CDC). (2018, June 5). COPD Death Rates in the United Sates. Retrieved from https://www.cdc.gov/copd/data.html

Croft JB, Wheaton AG, Liu Y, et al. Urban-Rural County and State Differences in Chronic Obstructive Pulmonary Disease — United States, 2015. MMWR Morb Mortal Wkly Rep 2018;67:205–211. Accessed September 15, 2019

COPD Foundation (2013). COPD Population Screener. Retrieved from https://www.copdfoundation.org/Screener.aspx

Dirven, J. A., Tange, H. J., Muris, J. W., Haaren, K. M. V., Vink, G., & Schayck, O. C. V. (2013). Early detection of COPD in general practice: implementation, workload and socioeconomic status. A mixed methods observational study. *Primary Care Respiratory Journal*, *22*(3), 338–343. doi: 10.4104/pcrj.2013.00071

Duvall, K., & Frank, G. W. (2010). Identifying Chronic Obstructive Pulmonary Disease in Primary Care of Urban Underserved Patients: Tools, Applications, and Challenges. *Journal of the National Medical Association*,102(7), 570-578. doi:10.1016/s0027-9684(15)30623-4

Enocson, A., Jolly, K., Jordan, R., Fitzmaurice, D. A., Greenfield, S., & Adab, P. (2018). Case-finding for COPD in primary care: a qualitative study of patients' perspectives. *International Journal of Chronic Obstructive Pulmonary Disease*, *Volume 13*, 1623–1632. doi: 10.2147/copd.s147718

Global Initiative for Chronic Obstructive Lung Disease (GOLD). GOLD 2019 global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease, 2017 report. Retrieved from https://goldcopd.org/wp-content/uploads/2018/11/GOLD-2019-POCKET-GUIDE-FINAL_WMS.pdf. Accessed September 8, 2019.

Han, M., Steenrod, A., Bacci, E., Leidy, N., Mannino, D., Thomashow, B., … Martinez, F. (2015). Identifying Patients with Undiagnosed COPD in Primary Care Settings: Insight from Screening Tools and Epidemiologic Studies. *Chronic Obstructive Pulmonary Diseases: Journal of the COPD Foundation*, *2*(2), 103–121. doi: 10.15326/jcopdf.2.2.2014.0152

Hoggan, C. D. (2016). Transformative Learning as a Metatheory: Definition, Criteria, and Typology. Adult Education Quarterly, 66(1), 57–75. https://doi.org/10.1177/0741713615611216

Jenkins, C. R., Chapman, K. R., Donohue, J. F., Roche, N., Tsiligianni, I., & Han, M. K. (2017). Improving the Management of COPD in Women. *Chest*, *151*(3), 686–696. doi: 10.1016/j.chest.2016.10.031

Johns, J. P., Walters, J. A., & Walters, E. H. (2014). Diagnosis and early detection of COPD using spirometry. *Journal of Thoracic Disease*, *6*(11), 1557–1569. doi: 10.3978/j.issn.2072-1439.2014.08.18

Kentucky Behavioral Risk Factor Survey (KyBRBS).(2016). Retrieved from https://chfs.ky.gov/agencies/dph/dpqi/cdpb/Kentucky BRFSS Data Reports/2018 KyBRFS Annual Report.pdf

Mapel, D. W., Dalal, A. A., Johnson, P., Becker, L., & Hunter, A. G. (2015). A Clinical Study of COPD Severity Assessment by Primary Care Physicians and Their Patients Compared with Spirometry. *The American Journal of Medicine*, *128*(6), 629–637. doi: 10.1016/j.amjmed.2014.12.018

Mezirow, J. (1981). A Critical Theory of Adult Learning and Education. *Adult Education*, *32*(1), 3–24. Retrieved from https://journals-sagepub-com.ezproxy.uky.edu/doi/pdf/10.1177/074171368103200101

Murphy, T., Eikermann, S., Guzman, A., Vanderheiden, D., Khan, A., & Surani, S. (2016). Is Variation on Following the GOLD Guidelines Provider Dependent? *Chest*, *150*(4). doi: 10.1016/j.chest.2016.08.1177

Perez, T., Burgel, P. R., Paillasseur, J. L., Caillaud, D., Deslée, G., Chanez, P., & Roche, N. (2015). Modified Medical Research Council scale vs Baseline Dyspnea Index to evaluate dyspnea in chronic obstructive pulmonary disease. *International Journal of Chronic Obstructive Pulmonary Disease*, 1663. doi: 10.2147/copd.s82408

Ruppel, G. L., Carlin, B. W., Hart, M., & Doherty, D. E. (2018). Office Spirometry in Primary Care for the Diagnosis and Management of COPD: National Lung Health Education Program Update. *Respiratory Care*, *63*(2), 242–252. doi: 10.4187/respcare.05710

Qaseem, A., Wilt, T. J., Weinberger, S. J., Hanania, N. A., Criner, G., Marciniuk, D. D., … Wedzicha, W. (2011). Diagnosis and Management of Stable Chronic Obstructive Pulmonary Disease: A Clinical Practice Guideline Update from the American College of Physicians, American College of Chest Physicians, American Thoracic Society, and European Respiratory Society. *American College of Physicians*, *155*, 179–191. Retrieved from https://www.thoracic.org/statements/resources/copd/179full.pdf

Schwab, P., Dhamane, A.D., Hopson, S.D., Mortez, C., Annavarapu, S., Burslem, K., Renda, A.,… Kaila, S. (2017). Impact of comorbid conditions in COPD patients on health care resource utilization and costs in a predominantly Medicare population. *International Journal of Chronic Obstructive Pulmonary Disease*, 12(1),735-744. doi:10.2147/COPD.S112256

Spyratos, D., Haidich, A., Chloros, D., Michalopoulou, D., & Sichletidis, L. (2017). Comparison of Three Screening Questionnaires for Chronic Obstructive Pulmonary Disease in the Primary Care. Respiration,93(2), 83-89. doi:10.1159/000453586

Tsukuya, G., Matsumoto, K., Fukuyama, S., Crawford, B., Nakanishi, Y., Ichinose, M., . . . Inoue, H. (2015). Validation of a COPD screening questionnaire and establishment of diagnostic cut-points in a Japanese general population: The Hisayama study. *Allergology International*,64(1), 49-53. doi:10.1016/j.alit.2014.06.002

Weiss G, Steinacher I, Lamprecht B, et al. Detection of Chronic Obstructive Pulmonary Disease in Primary Care in Salzburg, Austria: Findings from the Real World. Respiration. 2014; 87(2): 136-143. https://doi.org/10.1159/000354796

Yawn, B. P., Duvall, K., Peabody, J., Albers, F., Iqbal, A., Paden, H., … Wadland, W. C. (2014). The Impact of Screening Tools on Diagnosis of Chronic Obstructive Pulmonary Disease in Primary Care. *American Journal of Preventive Medicine*, *47*(5). doi: 10.1016/s0749-3797(14)00522-4

Yawn, B., Wollan, P., Textor, K., & Yawn, R. (2016). Primary Care Physicians', Nurse Practitioners' and Physician Assistants' Knowledge, Attitudes and Beliefs Regarding COPD: 2007 to 2014. *Chronic Obstructive Pulmonary Diseases: Journal of the COPD Foundation*, *3*(3), 628–635. doi: 10.15326/jcopdf.3.3.2015.0168