Implementing Spirometry-Driven Evidence-Based Asthma Care in a Primary Care Practice

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Implementing Spirometry-Driven Evidence-Based Asthma Care in a Primary Care Practice

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August 8, 2016
Dedication

To my three beautiful children who joined me for this journey: Luke, Jordan, and Adrianna.

May you live the vigorous life as you dare to dream. For those with asthma: may you breathe a little easier.
Acknowledgments

My gratitude and sincerest appreciation to:

God for my existence and, more importantly, the hope of an eternal life with Him through the blood of his son Jesus Christ.

My beautiful wife, Sarah, and her commitment and sacrifice on this journey.

My fabulous Project Advisory Committee for their patience, expertise, and support.

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J. V., NP, for sharing her DNP project experience with me.

K. G. for allowing this project to occur.

Dr. D. Z. from the GVSU statistics department for his expert counsel.

The makers of the various energy drinks I have sampled over the last four years, may I never consume another again.
Abstract

This project was a quality improvement initiative employing an educational intervention to increase the awareness and stress the importance of utilizing spirometry in the diagnosis, treatment, and management of asthma. Clinical support staff received training on how to perform spirometry and providers received education on the interpretation and utility of spirometry results to drive care to improve outcomes for clients with asthma. Project outcomes examined the self-rated confidence to perform and interpret spirometry before and after the intervention and the subsequent utilization pattern of office-based spirometry at the primary care clinic. For clinical support staff, the self-comfort level at performing spirometry increased by an average of 32.1% after the training session, and the average overall confidence level in ability to perform spirometry on clients in the imminent future was 74.8%. For providers, the self-reported comfort-level in their ability to interpret spirometry reports increased by an average of 30.8%. There was also an average overall 96.3% confidence in the providers’ perceptions of their ability to accurately interpret a spirogram in the imminent future following the educational session. In-office spirometry use from 2015 to 2016 increased by twofold. This primary care office utilized their spirometer as much during the one month following this project’s interventions than it did the entire 2015 fiscal year. Valuable experience was gained implementing this project and recommendations for future initiatives are explored. This document discusses the background information, problem statement, intervention, evaluation methods, outcomes, sustainability, and dissemination methods related to the project.

Keywords: Asthma, primary care, provider education, spirometry
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Executive Summary

Asthma is a complex respiratory disorder “characterized by variable and recurring symptoms, airflow obstruction, bronchial hyperresponsiveness, and an underlying inflammation” (National Heart, Lung, and Blood Institute, NHLBI, p. 9, 2007). The interplay between these features determines the clinical manifestations, severity, and ultimately the experience of individuals living with asthma. Asthma is a prevalent chronic disease which affects 7.3% of the United States population (Centers for Disease Control and Prevention, CDC, 2013) and confers significant cost burden and resource utilization on the health care industry (Sullivan & Ghushchyan, 2015). Michigan has both a higher prevalence of and hospitalization rate due to the effects of asthma compared to the United States Average (Michigan Department of Health and Human Services, MDHHS, 2016). Research has shown that asthma is an underdiagnosed and undertreated chronic disease in the state of Michigan and many opportunities exist to improve care delivery to this population in the primary care setting (Asthma Initiative of Michigan, AIM, 2014).

When planning care for clients with respiratory concerns, an objective measurement of lung function is vital, along with a detailed history and physical exam for optimal clinical decision making and to differentiate between different chronic respiratory diseases (Chavannes et al., 2004). Without an objective measurement of lung function clinicians and clients may overestimate the degree of asthma control (Nair, Daigle, DeCuir, Lapin & Schramm, 2005). Spirometry is the recommended objective measurement to diagnose asthma and monitor asthma control nationally (NHLBI, 2007) and is part of international primary care guidelines (Levy, Quanjer, Booker, Cooper, Holmes & Small, 2009). Despite the evidence and recommendations, the ability to provide high quality care may be inhibited by clinicians’ lack of confidence in their
ability to perform and interpret spirometric tests (Goeman et al., 2005). Office-based spirometry is evidence-based according to the national guidelines and is vital to the provision of high quality asthma care which in most cases can be effectively managed in the primary care setting (Yawn et al., 2007).

The literature confirms that spirometry is well-suited for use in primary care and can provide useful and reliable data to drive clinical decision making (Zanconato, Meneghelli, Bragas, Zacchello & Baraldi, 2005). Interventions designed to improve the quality and use of spirometry in the primary care setting are effective and well documented (Eaton, Withy, Garrett, Mercer, Whitlock & Rea, 1999; Lusuardi et al., 2006; Represas-Represas et al., 2013). In addition, the literature supports the efficacy of interventions designed to improve provider adherence to the national asthma guidelines and subsequently the care delivered to clients with asthma (Okelo et al., 2013; Dexheimer, Borycki, Chiu, Johnson & Aronsky, 2014). Despite the various barriers that can hinder the use of spirometry in the primary care setting, interventions show promise to drive evidence-based asthma care.

The purpose of this project was to educate the clinical staff at a primary care office in the performance and interpretation of spirometry reports with the goal of increasing office-based spirometry and finally to evaluate the outcomes. The objectives were: (a) to review and train the clinical support staff on the calibration of the spirometer, process of ordering and documenting spirometry in the electronic medical record (EMR), and coaching of the client during the spirometric maneuvers; (b) to revisit how to interpret spirometry reports with the providers and review the national asthma guidelines; and (c) to evaluate the effectiveness of the education and training on the clinical staff’s confidence in their ability to perform and interpret spirometry and to determine if this intervention increased the office’s utilization of spirometry.
A spirometry training session was conducted during a mandatory monthly all-clinical support staff meeting in which the calibration of the spirometer was reviewed, the steps to order and document spirometry in the EMR were outlined, and the process of how to properly coach a client through spirometry maneuvers was described. Job-aids in the form of an EMR workflow walk-through guide (Appendix F) were created and provided to all clinical support staff at this meeting and a voluntary anonymous post-education survey (Appendix E) was dispersed.

Next, two voluntary educational sessions for providers conducted by the author and a certified asthma educator which were held over the office’s lunch period on two consecutive days. During these educational sessions, the indications for and interpretation of spirometry was reviewed, the national asthma guidelines pertaining to the use of spirometry and its role in guiding asthma therapy were reviewed, and questions were answered. An evidence-based spirometry in primary care guide (Appendix I) was created and dispersed to all providers in attendance in addition to an Asthma Care Quick Reference guide (NHLBI, 2012), a spirometry bronchodilator study guide, and an asthma classification and severity guide. At the conclusion of each identical educational session a voluntary anonymous post-education survey (Appendix G) was distributed.

After the spirometry training session for the clinical support staff 10 participants returned completed surveys. The self-rated confidence level with performing spirometry increased by an average of 32.1% after the training session and the average overall confidence level in ability to perform spirometry on clients in the future was 74.8%. Disappointingly, only 3 (27.2%) of the providers in the office attended one of the lunch educational sessions. Only one of them had ordered in-office spirometry before. Despite the poor attendance overall, the providers confidence in their ability to interpret spirometry reports increased by an average of 30.8% and
there was an overall 96% confidence in ability to accurately interpret a spirogram in the imminent future following the educational session. The provider survey also revealed that providers were previously utilizing the national asthma guidelines 73.6% of the time and did value their utility (91.9% useful) in their personal practice.

Many barriers were encountered during the implementation of this project at the practice site. Ultimately, the decision of how to care for individuals with asthma lies with the provider. Providers make clinical decisions based on what he or she feels is in the best interest of the client. Having an asthma “champion” in the office who is able to promote best evidence-based practices and lead by example is one way to endorse the utility of office-based spirometry to drive asthma care.
Introduction and Background

Asthma is a prevalent chronic disease which affects 7.3% of the United States population (CDC, 2013) and confers significant cost burden and resource utilization on the health care industry (Sullivan & Ghushchyan, 2015). The financial impact of asthma is staggering; compared to individuals without asthma from 2008 to 2010, individuals with asthma incurred an additional $1,095 in annual healthcare expenditures. These individuals with asthma also were 1.43 times more likely to seek care in the emergency department, were 1.2 times likely to be admitted to the acute care setting, and were prescribed twice the number of prescription drugs. Morbidity related to asthma can have significant ramifications and is prevalent, as 55% of adults with asthma have uncontrolled disease (Peters, Jones, Haselkorn, Mink, Valacer & Weiss, 2007). The cost of managing severe asthma averages approximately $5,000 per year, with one in five individuals requiring emergency department care to stabilize their symptoms at least once annually (Nagar, Stanford & White, 2011). Overall, asthma in the United States contributes to over 50 billion dollars in total health care costs annually (Kamble & Bharma, 2009).

At the state level, Michigan has a higher percentage of adults and children with asthma and a higher hospitalization rate among residents with asthma compared to the United States average (MDHHS, 2016). Subsequently, Michigan is failing to meet federal targets for asthma control including asthma-related deaths and hospitalizations, as outlined by the Healthy People 2020 respiratory diseases goals (U.S. Department of Health and Human Services, 2010). In the two year period from 2011 to 2013, the asthma hospitalization rate in Michigan was 13.3 per 10,000 citizens with an average of 13,617 hospitalizations per year (Wisnieski, Anderson & Wahl, 2015). Although most asthma deaths are considered preventable and mortality rates are
Individuals with asthma may also suffer substantial morbidity from this condition, with 25.1% of adults and 11% of children reporting they had no asthma symptom-free days in the past two weeks (MDHHS, 2016). In 2011, a mere 42% of adults with asthma in Michigan reported that their disease was well controlled (Asthma Initiative of Michigan, (AIM), 2014) which translates into lost workplace productivity, school absenteeism, and increased burden on the health care system. Locally, asthma affects 9.8% of residents in one southwestern Michigan county with the highest prevalence among Black females (Fussman, 2015). Statewide, there continues to be economic, racial, and geographic disparities in the distribution and severity of asthma burden that must be addressed (AIM, 2014). To summarize, asthma is an underdiagnosed and undertreated chronic disease in the state of Michigan and there is ample opportunity for the primary care arena to transform the care delivered to this population (AIM, 2014).

Asthma is also an undermanaged chronic disease in Michigan which has led to severe consequences for many individuals with asthma and their support systems (AIM, 2014). The aforementioned statistics are inexcusable in the current age of increased access to care and support for individuals with asthma and their caregivers. Providers have significant variability in adhering to the current national asthma recommendations (Gipson, Millard, Kennerly & Bokovoy, 2000), set forth by the National Heart, Lung, and Blood Institute (NHLBI, 2007), known as the National Asthma Education and Prevention Program’s Expert Panel Report 3 (EPR-3). In Michigan, the aforementioned national objectives for asthma treatment are not being met, and current evidence-based guidelines have not improved adherence (AIM, 2014).
One specific guideline recommendation that is often overlooked is the importance of spirometry in diagnosing, treating, and managing asthma (Dostaler, Olajos-Clow, Sands, Licskai, Minard & Lougheed, 2011). The reasons clinicians fail to follow evidence-based guidelines is multifactorial, but even if clinicians are aware of current guidelines, the ability to provide high quality care may be limited by a lack of confidence to perform and interpret spirometric tests (Goeman et al., 2005). This report describes an intervention which implemented a spirometry training program for clinical staff and providers in a primary care office in an effort to improve asthma care to individuals with asthma age 5 and older.

**Problem Statement**

The selected primary care practice is located in Michigan and operated by a faith-based health system. The office is housed in a building owned and operated by the organization which includes many other services, including an emergency department, physical and occupational therapy suite, a pharmacy, a hand surgery clinic, and rotating space for specialty practices to utilize, including cardiology and gynecology.

The primary care office currently has a mix of providers comprised of physicians, nurse practitioners, and physician assistants. At the present time, the remaining members of the care team are comprised of clinical support staff, including medical assistants (MAs) and licensed practical nurses (LPNs) who typically operate as phone nurses, two secretarial personnel at the front desk, a referral specialist, at least two registered nurses who function as case managers, and the practice manager. This DNP student’s site mentor is a nurse practitioner who partners with her collaborating physician to provide care organized in a pod delivery format.

The impetus for this project originated from discussions between the nurse practitioner and collaborating physician. The physician who used to be the lead physician at the office identified the need to improve the care delivered to individuals with asthma at the primary care
office and in the health system at large. Aware of the nurse practitioners embedded role at a local university, the physician informally tasked this endeavor to the nurse practitioner partner. This DNP student was assigned a few clinical rotations with the nurse practitioner at the primary care clinic and while there began drafting the idea of an evidence-based quality improvement intervention to improve the asthma care the office provides.

It was observed that any client with asthma needing an objective measurement of lung function via spirometry was either referred to a pulmonologist for formal testing in a pulmonary function laboratory, or sent to the outpatient lab housed in the primary care clinic’s building across the hall. Either way there was an extensive gap between when the spirometry was ordered and when the provider had the results; either from a progress note from a pulmonary specialist, or a spirogram via the clinical inbox. During the clinical rotation this student discovered that the office owned a spirometer that was seldom used, and several staff members admitting they did not know the equipment existed much less where it was stored. A general sense of unease and unfamiliarity surrounded the spirometer when it came up in conversation among staff members.

In speaking with the practice manager and a few MAs and LPNs, it was determined that clinical support staff did have their spirometry performance minimally assessed annually via a skills test at a competency evaluation. However, if the providers they worked with never ordered spirometry, they never had any interaction with the equipment until the next annual assessment. During the organizational assessment of the office by the DNP student, one provider stated that use of spirometry in management of clients with asthma occurred, but when the spirometry calibration log was examined, the last entry was over two years before this. Spirometry is essential to the diagnosis, management and treatment of asthma, according to the EPR-3 (NHLBI, 2007) and, combined with medical review, has been shown to improve asthma control
compared to usual care or isolated spirometry (Oei et al., 2011). These gaps in care led to the genesis of this spirometry intervention.

The practice problem of interest was how to promote evidence-based guideline-recommended asthma care in the primary care setting utilizing spirometry education for providers and clinical staff. Spirometry is a valuable objective measurement of lung function which is easily performed in primary care offices, but is often underutilized for many reasons. Such barriers include a lack of instruction in educational programs, lack of equipment, and poor modeling by senior clinicians who are advocates of spirometry (Roberts, Smith & Partridge, 2011). After performing a search of the literature and assessment of the organization, it was determined that implementing an evidence-based asthma intervention based on spirometry and its interpretation would be a beneficial project and thus was conducted in the aforementioned primary care office.

The project addressed the problem of how to improve asthma care for clients at a primary care office while utilizing existing office resources to generate additional revenue. This project aligned with the organization’s mission to improve the health of the community (Mercy Health, 2016) as provider education programs similar to that of this project have actualized improved asthma care, decreased the frequency of days of asthma symptoms, and decreased emergency care utilization (Cabana et al., 2006).

**Evidence Based Initiative**

A literature search for spirometry use and interventions in relation to asthma care in the primary care setting was conducted using CINAHL, Google Scholar, the Grand Valley State University Library website, and PubMed, which resulted in a total of 560 articles. The search terms included: *asthma, asthma intervention, spirometry, provider education, asthma educator*
and primary care. Inclusion criteria for this search were: human studies; in the English language; from the year 1999 to the present, (to capture 8 years prior to the latest guidelines and recommendations set forth by the EPR-3 (NHLBI, 2007) and just over 8 years after) to the present. Studies involving both pediatric and adult populations were included because the need for quality spirometry and awareness of the national guidelines that informs clinical decision making is needed to drive interventions for all ages. Exclusion criteria for this search were: non-English language, studies utilizing non-human participants, articles that were not linked with full-text, and articles published prior to 1999.

The final sample of literature at the conclusion of this literature review included a total of 40 articles, including 5 systematic reviews. The key concepts from this literature review will be summarized and synthesized providing support for this spirometry intervention to drive asthma care in the primary care setting.

**Systematic Reviews**

No systematic reviews specifically addressed spirometry interventions; however, four systematic reviews were identified in the literature that addressed asthma interventions utilizing provider education, and one that focused on the effects of educational meetings on professional practice and health care outcomes. These will be discussed in chronological order.

The first systematic review was conducted by Stanford University and the University of San Francisco’s evidence-based practice center for the Agency for Healthcare Research and Quality (Bravata et al., 2007). These authors sought to evaluate the evidence regarding how quality improvement strategies such as patient education, self-monitoring or self-management, organizational change, provider education, and audit and feedback could impact care. The authors found that interventions were more successful if they were based on a theoretical
framework, consisted of multiple education sessions, had a long duration of influence, and if they used a variety of instructional modalities. Among the eleven studies implementing provider education interventions to general populations or adults, 55% of the studies demonstrated that providers improved their adherence to asthma management guidelines. The effect was less in relation to decreasing health services utilization (27%) or improving clinical outcomes (9%).

A second systematic review also conducted by Bravata et al. (2009) sought to evaluate if quality improvement strategies can improve the processes and outcomes of outpatient pediatric asthma care. This review demonstrated that provider education interventions yielded improvements in medication use; specifically, an increase in use of inhaled long-term control medications among the participants. Several studies also showed improvements in asthma symptoms and reductions in emergency department use. Due to the small number of studies and heterogeneity that exists between them the authors could not identify which specific provider education intervention was associated with improvements in clinical outcomes. This review emphasized the importance of having a conceptual framework and gap analysis of the intervention site in mind when crafting the format of the educational session, in order to tailor it optimally to the practice setting.

A third systematic review examining the effects of continuing education meetings and workshops on professional practice and health care outcomes showed the potential for improvements in both aspects (Forsetlund et al., 2012). Although not directly asthma-related, this review found that the effects of educational meetings are similar to other types of continuing medical education such as audit and feedback, and educational outreach visits. The authors suggested several optimizations to maximizing the effectiveness of educational meetings, including increasing attendance, using mixed interactive and didactic formats, and a focus on
improving outcomes that are perceived as serious and thus valued by the clinicians. This literature review supports educational interventions such as the one used in this project, providing the format and content of the education is tailored to the unique audience it serves.

Health care providers caring for clients with asthma often do not follow available clinical guidelines to drive the care they provide. A fourth systematic review assessing the effect of interventions to improve clinicians’ adherence to asthma guidelines on health care process and clinical outcomes was conducted by Okelo et al. (2013). The authors found 68 eligible studies conducted in pediatric populations, and examined their effects on the prescription of long-term control medications, self-management education and asthma action plans, acute care visits, and missed days of work or school. The types of intervention most likely to improve provider adherence to guidelines included decision support tools, feedback and audit, and clinical pharmacy support. The authors concluded that the decision to choose a particular intervention should consider the data on the effectiveness of the intervention, the feasibility of implementing the intervention in their practice setting, and the sustainability of the intervention.

A fifth systematic review of the implementation and impact of asthma protocols found that asthma guidelines improved provider performance and the care delivered to clients regardless of the manner of implementation (Dexheimer, Borycki, Chiu, Johnson & Aronsky, 2014). This study specifically examined protocol reminder systems to assist clinicians in utilizing evidence-based asthma guidelines to plan care for their clients. Many strategies exist to assist providers to provide the most efficacious care, and many more are developing as technology evolves. In relation to the intervention used in this project, the use of asthma guidelines is warranted and the literature supports such an educational intervention to bolster clinician’s knowledge and ability to utilize this expertise to improve care.
These five systematic reviews highlight the modest merit provider education interventions have in improving asthma care. Primary care providers must have sound knowledge of best care practices in order to adequately educate their clients and caregivers in disease management strategies. While the literature does not demonstrate direct drastic improvements in patient outcomes, two of the reviews showed an overall decrease in health services utilization, and two of the studies showed that the intervention conferred increased provider adherence to the national guidelines. Successful quality improvement interventions must begin with an assessment of gaps in the current care of individuals with asthma in order for the intervention to make a targeted impact on the areas with deficits. The use of a conceptual framework is also recommended to guide the design of the educational intervention and to promote optimal effectiveness and impact of the chosen intervention. This must occur after considering the specific nuances and organizational aspects of the practice site.

**Importance of Spirometry in Primary Care**

Spirometry is the recommended objective measurement to diagnose asthma and monitor asthma control nationally (NHLBI, 2007) and is part of international primary care guidelines (Levy, Quanjer, Booker, Cooper, Holmes & Small, 2009). For a variety of reasons spirometry is underutilized in primary care, and making an asthma diagnosis without an objective measurement of lung function has been implicated in misdiagnoses (Dostaler, Olajos-Clow, Sands, Licskai, Minard & Lougheed, 2011). It also has been shown that physician estimates of asthma severity appear to determine asthma care, leading to ineffective care less in line with national guidelines (Wolfenden, Diette, Krishnan, Skinner, Steinwachs & Wu, 2003).

In regards to the under-treatment of asthma, two different studies of children with asthma dwelling in urban areas demonstrated that one-third of the participants were reclassified into a
higher asthma severity category when spirometry was considered, in addition to symptom frequency (Stout et al., 2006). Not all individuals with asthma perceive their symptoms similarly, and an objective feature of severity classification is crucial. For example, Nair, Daigle, DeCuir, Lapin and Schramm (2005) found that without spirometry providers often overestimated the degree of asthma control, potentially leading to suboptimal therapy that may even endanger the client with asthma.

Concerning making an accurate diagnosis, Averame et al. (2009) found that 53% of clients in their pre-existing asthma group exhibited normal spirometry. This shows a need for regular spirometry in primary care to drive efficacious clinical decision-making, especially when initiating medication therapy. Equally concerning is that 66.4% of the previously diagnosed asthma clients had spirometry performed in a laboratory in the past, but the general practitioners (GPs) had no record regarding the specialized diagnostic testing.

Spirometry has the ability to impact GPs’ decision-making processes (Chavannes et al., 2004) and to assist them to distinguish between various chronic respiratory diseases. These researchers concluded that trained GPs were able to differentiate between normal versus obstructive versus restrictive disease patterns while patterns of rare or mixed pathology were often missed (Chavannes et al., 2004). The authors found that spirometry reduced diagnostic uncertainty among GPs, and increased the use of additional diagnostic testing and referral to specialist care, at least initially. This study was valuable in highlighting how a well-organized educational intervention can improve the diagnosis and affect the management decisions of clinicians.

Concerning the impact of spirometry on decision making and patient management by clinicians, Dales, Vandemheen, Clinch and Aaron (2005) found that the addition of spirometry to
the practice resulted in a new diagnosis of unsuspected airflow obstruction in 9% of clients. Ultimately, these authors concluded that in 15% of cases, the clinicians stated that they would change management based on the results of spirometry, especially when unsuspected obstruction was present and when the obstruction was found to be more severe. Spirometry performed in the primary care setting detects a clinically significant amount of airflow obstruction and influences management practices for clients.

The previously mentioned study by Dostaler et al. (2011) aimed at using two different guidelines (Global Initiative for Asthma and Canadian Thoracic Society) to compare asthma control standards. The researchers discovered that asthma control was consistently overestimated by the subjective symptom standards if spirometry was not utilized. The patient and provider may have differing opinions or standards for what constitutes asthma symptoms and what asthma control means. Thus, spirometry as a physiologic measurement of pulmonary function is an integral component in the assessment of asthma control.

Another useful indication of spirometry is when evaluating and differentiating between unknown forms or causes of airway obstruction. A study by Buffels, Degryse, Liistro and Decramer (2012) assessed the diagnostic opinion and their degree of certainty of their diagnosis after various steps of a sequential work-up. The proposed work-up included (a) reading a client’s medical chart, (b) after a spirometry course and questionnaire, (c) after history taking and clinical examination, (d) after office spirometry, (e) after learning the diagnostic opinion of a pulmonologist evaluating the client, and (f) the general practitioner’s final diagnosis after control visits. With regard to the GPs’ final opinion, “the highest diagnostic gain for asthma was obtained after office spirometry” (p.50). In clients who did not follow-up with the pulmonologist, office spirometry was more helpful than questionnaires, careful history taking,
and clinical examination. Respiratory complaints are extremely common in primary care and this study supports the use of spirometry in primary care, especially among clients with a diagnosis of asthma.

The above studies were grouped together as they served to highlight the importance of spirometry in primary care. Spirometry is recommended by the national EPR-3 guidelines (NHLBI, 2007) and is integral to avoid under- and misdiagnosing asthma among individuals with respiratory symptoms (Dostaler, Olajos-Clow, Sands, Licskai, Minard & Lougheed, 2011). Without an objective measurement of lung function, providers and patients have a tendency to consistently overestimate level of asthma control, potentially leading to under-treatment of airway obstruction and serious sequelae (Dostaler et al., 2011; Nair, Daigle, DeCuir, Lapin & Schramm, 2005). The use of spirometry increases the diagnostic certainty when making an asthma diagnosis (Buffels, Degryse, Liistro & Decdramer, 2012) and influences the management of airway obstruction when it is detected in clients with respiratory complaints (Dales, Vandemheen, Clinch & Aaron, 2005).

Spirometry is a powerful diagnostic tool which has the potential to improve care delivery to individuals with asthma who are seen in the primary care setting. Provider estimation of asthma control should not solely drive treatment decisions, nor should clients’ perceptions of their control. Spirometry stands as an objective measurement of airway function that lends an unbiased perspective of physiologic function. These studies outline why spirometry is vital to asthma care, which has proved to be effective in the primary care setting, and is recommended by asthma care guidelines (Yawn et al., 2007). Next, the current state of spirometry use in the primary care setting will be discussed.
 Spirometry Utilization in Primary Care

An initial step before planning this intervention was to determine how spirometry is currently utilized in the primary care arena. In 2010, Dombkowski, Hassan, Wasilevich and Clark conducted a study among pediatric primary care physicians to assess their use of spirometry in clinical practice. The authors’ surveys revealed that 52% of respondents caring for children utilized spirometry, while only 21% routinely using spirometry for all guideline-recommended clinical scenarios. The survey included a clinical vignette in which respondents were asked to interpret spirometric results and this revealed that 49% of providers correctly classified the spirograms, with 14% of respondents stating that they did not know how to interpret these results. The authors suggested that additional provider training was warranted and that a review of spirometry training may need to continue on an ongoing basis.

More recently, in 2015, Sokol, Sharma, Lin and Goldblum sought to determine the trends in spirometry use over a 10-year period in patients newly diagnosed with asthma. This study strategically encompassed a time period before and after the 2007 EPR-3 guidelines to assess if the new recommendations conferred a change in practice. The authors found that only 47.6% of individuals diagnosed with asthma during the selected timeframe had spirometry performed within one year of diagnosis. As part of secondary measures, the authors also discovered that of the patients with asthma without documented spirometry, 78.3% received emergency inhaler therapy and over 50% of patients were prescribed asthma long-term control medications. Patients receiving care from specialists, including allergists and pulmonologists, were more likely to receive spirometry than those cared for by primary care physicians. The most disturbing trend that confounded the authors’ working hypothesis was that despite the new national guidelines, the use of spirometry declined over the ten year span of the study.
Yawn et al. (2007) sought to assess the quality and impact of office spirometry in family medicine practices. These authors measured the technical adequacy of primary care spirometry results, examined the concordance of family practitioner interpretation of these results to that of the interpretation of a pulmonary expert, and finally, assessed changes in the management of asthma and COPD following spirometry testing. The authors found that over the 6-month study period, 71% of the 368 spirometry tests performed were technically adequate. The spirometry interpretation of the primary care practitioners was concordant in 76% of the completed tests, and there was a higher concordance among providers caring for individuals with asthma compared to those with COPD. Following spirometry, decisions by providers to change management occurred in 48% of subjects, which included 107 medication changes. Of these changes in drug therapy, over 85% were in line with guideline recommendations for disease management. Overall, it was determined that family physicians can perform and interpret spirometry for asthma and COPD patients at rates comparable to providers in other international primary care studies.

To summarize, it is crucial that interventions for those with asthma are partially based on an objective measurement, such as spirometry, and do not rely solely on a provider’s clinical impression or a client’s subjective symptoms. In addition, the above studies illustrate that spirometry is woefully underutilized in the primary care setting (Sokol, Sharma, Lin & Goldblum, 2015) that providers lack confidence, and they struggle to accurately interpret spirometric reports (Dombkowski, Hassan, Wasilevich & Clark, 2010). Pulmonologists and other respiratory experts utilize spirometry with clients with asthma far more frequently than GPs, but unfortunately the records of these diagnostic tests often never arrive back in the primary care office to assist in sustaining optimal asthma management (Averame et al., 2009). Office
spirometry allows providers to tailor the management strategy in the moment in the client’s presence, and it has been demonstrated that medication changes following spirometry typically follow the recommended guidelines (Yawn et al., 2007). The most recent study conducted in 2015 by Sokol, Sharma, Lin and Goldblum revealed, disturbingly, that even after the updated 2007 guidelines (NHLBI) were published, the use of spirometry continued to decline.

This literature review has revealed that many primary care providers are diagnosing and even treating asthma with quick-relief (rescue) inhalers as well as long-term control medications without ever obtaining an objective measurement of the client’s airways. Spirometry is a tool which can inform and guide the diagnosis and management of asthma directly from the clinician’s office. With the proper education and training, providers and support staff can implement spirometry, which can lead to optimal management in the primary care setting. If warranted, clients could later be referred to specialty care for difficult or refractory cases.

Several barriers may explain why GPs seldom use office spirometry. These reasons will be explored in the next section.

**Barriers to Spirometry**

While access to spirometry equipment in the primary care setting has increased, it is underutilized, and the outcomes for individuals with asthma carry significant morbidity and even mortality. Barriers exist to using spirometry as a diagnostic tool in primary care offices. Despite access to spirometry equipment, in one study it was discovered that 25% of primary care physicians reported that they did not obtain any objective measurements of pulmonary function in the evaluation of new clients with asthma, compared to 3% of asthma specialists (O’Dowd, Fife, Tenhave & Panettieri, 2003). Pulmonary specialists also stated they performed spirometry in clients with asthma presenting for return visits more than twice as often as primary care
providers. Among practices owning spirometers, 15% of primary care physicians stated they
never used the device and an additional 42% used it in less than 50% of their clients with asthma.
Ultimately, individuals with asthma managed by primary care physicians are much less likely to
have any objective evaluation of lung function than those receiving care with a specialist.

When seeking to examine the disconnect between the recommendations for using
spirometry as a diagnostic and staging tool, and its actual use in practice, novice clinicians cited
unfamiliarity and lack of confidence in interpreting the results of spirometry as major barriers
(Roberts, Smith and Partridge, 2011). An additional finding was that even though veteran
practitioners were enthusiastic in focus groups about utilizing spirometry, this interest was not
perceived by younger residents and clinicians enrolled in affiliated educational institutions.
Recommendations from this study included utilizing senior staff as role models and trainers in
the use of spirometry; and that hands-on practical experience paired with explicit instruction is
vital to adequately prepare budding clinicians in performing spirometry.

To summarize, the major barriers preventing providers from adhering to asthma
guidelines include gaps in provider knowledge, provider skills, such as interpreting spirometry,
and provider beliefs such as a perceived lack of time to educate clients (Lee & Le, 2013). In
addition to being aware of the guidelines, clinicians must maintain competence in asthma related
skills, such as classifying asthma severity and control in order to execute the guidelines. The
self-efficacy of the provider does affect the clinician-client interaction and can lead to a lack of
engagement and optimal care and outcomes in practice (Lee & Le). Finally, Lee and Le suggest
educational interventions with repeated exposures to attempt to have a lasting impact.

A variety of barriers exist which pose challenges for clinicians when utilizing spirometry
as an objective measurement of lung function in the care of clients with asthma. It has been
shown that offices that owned a spirometer used it very infrequently, and providers’ attitudes regarding this diagnostic tool trumped the convenience of having the equipment readily available (O’Dowd, Fife, Tenhave & Panettieri, 2003). Another aspect to consider when planning an intervention is that providers who are familiar with the national asthma guidelines and perceive spirometry to be useful to clinical decision making do not necessarily utilize spirometry more often in actual practice (O’Dowd, Fife, Tenhave & Panettieri, 2003).

Other major barriers include being unfamiliar with performing and lacking confidence in interpreting spiromgrams (Roberts, Smith & Partridge, 2011). Mere knowledge of the national guidelines is not enough to itself improve the use of spirometry by providers; they must value and appreciate its usefulness to drive medical decision making. A logical initial step is to educate providers on the intended role of spirometry and how it can help in clinical decision making, and hopefully improve outcomes for clients with asthma. In such an intervention the presence of a spirometry role model or champion who could conduct training and instruction activities with staff would be invaluable to both the sustainability of this care delivery and also to remove barriers that may exist.

**Spirometry Centered Interventions**

In the next section, interventions aiming to improve the care primary care practices delivered to clients with asthma through improved spirometry quality and utilization will be explored.

The earliest and most referenced study employing spirometry training for providers was conducted by Eaton, Withy, Garrett, Mercer, Whitlock and Rea (1999). These researchers sought to determine the quality of spirometry performed in the primary care arena and to assess the impact of formal training in the form of a spirometry workshop. The spirometry workshops
were very consistent in the magnitude of their training effect between groups, and the retesting at week 12 of the trained group demonstrated the grave need for continuing education to maintain quality standards. Although this study focused on quality of spirometry, it shockingly revealed that 47% of the client tests were interpreted incorrectly by the physicians, again highlighting an area of opportunity. The authors concluded that if spirometry is to be adequately performed in primary care, effective training with periodic quality assurance is absolutely vital to a successful and robust practice.

The first study to address the quality of pediatric primary care spirometry after a training program was conducted by Zanconato, Meneghelli, Bragas, Zacchello and Baraldi (2005). In this study the authors used 2 pediatric pulmonologists to educate 10 primary care pediatricians over two 5-hour sessions, separated by 12 weeks. These authors determined that 78% of the spirometric tests met the acceptability and reproducibility criteria, and 21% of spirometry readings were interpreted incorrectly. The results led the authors to conclude that spirometry is well suited for use in primary care as long as the office has access and follow-up with respiratory care experts to assist with expert training and quality assurance, which are vital for successful spirometry use. In summary, this study showed that properly utilizing spirometry equipment with educated clinical staff in a primary care office can generate useful and reliable spirometric data to drive quality care.

In 2006 Lusuardi et al. reported that spirometry performed in the office of general practitioners in Italy was feasible, and modestly helped improve the diagnosis of asthma and those with chronic obstructive pulmonary disease (COPD). The authors found that concordant diagnoses between specialists and general practitioners were made in 78.6% of cases for the spirometry group, and 69.2% for the conventional evaluation group. This unfortunately
demonstrated that the inclusion of office spirometry conferred an advantage, but an insignificant one \((p = 0.35)\), in improving the diagnosis of asthma and COPD in general practice. The feasibility of performing office spirometry was high, but the GPs were less enthusiastic about the usefulness of spirometry, as evidenced by the decreasing use of spirometry as the study progressed. The authors emphasize that spirometry in primary care is most successful with close collaboration with a pulmonary clinic to provide retraining and quality assurance to the spirometry practices of the office.

The only study discovered in this literature review that showed no measurable improvement in the use of spirometry post-intervention was a study conducted by Holton et al. (2011). The authors concluded that their study did not provide evidence that training and support of clinical staff in the performance and interpretation of spirometry would lead to health improvements in adults with asthma. Unfortunately, analysis of the secondary measures in this study demonstrated that there was an overall low level of spirometry use during the study period, and that adherence to other asthma management guidelines, such as written asthma action plans, was also poor. After acknowledging significant limitations, the authors ultimately determined that the spirometry training was valued, but in this instance, this fact did not change spirometry usage rates. Thus, no improvement in health outcomes were seen.

A study assessing both the short and long-term effectiveness of a spirometry training program for primary care providers was conducted by Represas-Represas et al. (2013). They utilized a structured training program to educate physicians and nursing staff. The authors found that during the first supervised month of spirometry use in practice monitored by experts, 71% of the spirometry tests were correctly performed and interpreted; 90.9% the second month; and, at the one-year follow up, 83% were valid and well interpreted. On a satisfaction survey, a mean
score of 8.6 points on a ten point scale was found, indicating the structured training programs were well-received. This study highlighted that the theoretical and practical knowledge regarding spirometry remained over time; however, the quality of the studies performed and their interpretation degraded with time, justifying the need for periodic support to maintain clinical competency.

Spirometry is a useful tool to the primary care clinician when it is performed correctly and interpreted in the moment. Technically poor tracings inconvenience the client and may even increase unnecessary referrals to specialty care offices (Carr, Telford & Waters, 2011). In this study, the initial audit sought to identify the technical error of inadequate expiratory effort, which had previously been identified as an issue in the clinic. The study employed three interventions: (a) review of initial findings and suggested improvements that could be made by a pulmonary specialist, (b) a visit by a secondary care specialist reviewing respiratory physiology and spirometry technique, and (c) a visit from a respiratory nurse who dealt with specific technique and measurement issues with the practice nurses. The authors found that 38% of the first audit spirometry reports were technically flawed. The re-audit showed 2% to be flawed. There ultimately was a 50% reduction in chest clinic referrals. This study did not incorporate long term follow up but showed how powerful a spirometry intervention could be in improving technique, allowing results to be more accurate and meaningful to practice.

Interventions focused on improving the quality and overall use of spirometry in the primary care setting highlight that there is a grave need for continuing education and periodic quality assurance to maintain high standards of spirometry performance and interpretation. The literature confirms that spirometry is well-suited for use in primary care and can provide useful and reliable data to drive clinical decision making (Zanconato, Meneghelli, Bragas, Zacchello &
Baraldi, 2005). If primary care practices adopt and begin utilizing office spirometry it is important to have effective expert training in the proper use of the equipment and interpretation of the results and to be most effective, access to a respiratory expert is vital for retraining and quality assurance purposes (Lusuardi et al., 2006). The addition of spirometry to the diagnostic capacity of a primary care practice can reduce referrals to pulmonary clinics, allowing treatment decisions to be made in the moment with expert support still available if needed (Carr, Telford & Waters, 2011).

The one study of the ones reviewed, in which increased spirometry usage rates or improvement in asthma health outcomes following spirometry were not found, did demonstrate that training in spirometry was valued by providers (Holton et al., 2011). The authors of this study did concede significant limitations to their design including overall low use of spirometry, which most likely contributed to the results. The main outcomes measured in this study also varied from the outcomes of interest set forth in this project intervention (spirometry usage), making the results less pertinent to planning an intervention geared toward increased spirometry utilization.

To summarize, the above studies demonstrate that primary care based spirometry is a valuable tool which can deliver accurate and meaningful results that can drive best practice. Periodic support and education to maintain the clinical competency of those performing and interpreting spirometry is recommended by most of the authors. Spirometry utilization is ultimately dependent on the individual preferences of providers, and thus their attitudes and enthusiasm toward the practicality and benefit of office-based spirometry is integral to consider when planning an intervention such as that used in this project.
Spirometry and Medical Review Interventions

This next section will examine studies which implement the combined benefits of utilizing spirometry with medical review as an intervention to improve asthma control. Oei et al. (2011) conducted a study which aimed to investigate the effect of spirometry on asthma control in general practice. The study included an intervention group which received spirometry every 3 months for a year following a baseline measurement. The interpretation of results were communicated to the provider, and an invitation was sent to clients in this group to return for medical review if they desired.

There was also a usual care cohort, which underwent spirometry before and after the trial with the provider blind to the results. Finally, a control group was included which received usual medical care with no spirometry component. Asthma control and compliance with inhaled asthma medication was measured using the Asthma Control Test and a four item compliance tool at baseline, 3, 6, 9 and 12 months. The authors determined that asthma control was significantly better in the intervention group than the spirometry-only, or usual care groups. These results favorably support the use of primary care driven spirometry in controlling asthma symptoms.

A group of Australian authors combined and pooled results of two cluster randomized controlled trials, seeking to determine if spirometry and regular medical review could improve quality of life or other outcomes in pediatric clients with asthma (Abramson et al., 2014). In the first study, every 3 month spirometry and medical review for one year were utilized, and the second involved 2- or 6-hour spirometry training for GPs and clinical staff. None of the outcome measures, including the secondary measures involving symptom control and use of asthma action plans, exhibited a significant improvement. Both trials did have low rates of participation and fairly prevalent attrition, which may have skewed results.
Spirometry combined with medical review has the ability to significantly improve asthma control and compliance with inhaled asthma medications (Oei et al., 2011). The national asthma guidelines, which will be discussed next, outline that the objective measurement of lung function via spirometry should not be reserved for the diagnosis of asthma alone. Spirometry is useful to assess level of asthma control as a comparative diagnostic tool to track disease severity in an objective measure over time. The second study in this section, conducted by Abramson et al. (2014), showed no improvement in outcome measures, but did not directly examine the provider’s change in attitudes or rate of spirometry use pre- and post-educational intervention. Spirometry performed at an outside laboratory is beneficial if follow-up and dissemination of results occurs, but care can be even more seamless if the primary care provider is capable of interpreting the results and can make treatment decisions in the moment with the client.

**Guidelines Recommend Spirometry in Primary Care**

The current authority for the management of asthma in the United States is the National Asthma Education and Prevention Program’s Expert Panel Report 3 (NHLBI, 2007). The EPR-3 is evidence-based with all of its recommendations labeled with their supporting level of evidence (George & Stoloff, 2012). Focusing on the discussion of spirometry to drive asthma care, this document states that “Spirometry is an essential objective measure to establish the diagnosis of asthma, because the history and physical examination are not reliable means of excluding other diagnoses or of assessing lung status” (p. 12). Spirometry will indicate if airflow obstruction is at least partially reversible in individuals age 5 or older, after inhalation of a short-acting beta²-agonist, and is preferred as a diagnostic tool over peak flow meters, which are intended for routinely monitoring asthma and measure only the large airways. The severity of the asthma must be determined before therapy is initiated, and spirometry is essential in this process, along
with the domains of impairment and risk. To illustrate the efficacy of the guidelines, several studies among minority populations with asthma have demonstrated reductions in emergency department use and hospital admissions when clinicians manage asthma using the current guidelines (Self, Chrisman, Mason & Rumbak, 2005).

After a diagnosis of asthma has been established, providers should obtain lung function measures via spirometry after treatment is initiated and symptoms have stabilized; during periods of progressive or prolonged loss of asthma control; and at least every 1-2 years (NHLBI, 2007). As asthma can be highly variable over time and season, periodic monitoring of disease control is necessary and spirometry can be utilized along with other assessment tools to track severity and control status. Follow-up care and monitoring are crucial for establishing and maintaining disease control, and these guidelines recommend scheduling provider visits at 2- to 6-week intervals while gaining control of asthma; at 1 to 6 month intervals to determine if sufficient control is maintained depending on the step of care and duration of control; at 3-month intervals if a step down in therapy is anticipated.

When reviewing the monitoring of pulmonary function, the guidelines discuss how one measure of lung function, the forced expiratory volume in one second, or FEV₁, is associated with increased risk of future severe asthma exacerbations (NHLBI, 2007). This is especially important for the subset of individuals with asthma who do not perceive their symptoms until airway obstruction is severe and they are in crisis. Those more likely to poorly perceive airway obstruction include the elderly, and individuals who have had a near-fatal asthma exacerbation in the past. Lung function declines with age, and periodically assessing lung function is especially important in older clients with asthma to maintain control and quality of life.
The national asthma guidelines outline how asthma should be diagnosed, treated, and managed, all of which can and should take place in the primary care setting. Offices equipped with spirometers, staff effectively trained in their proper use, and providers comfortable with the interpretation of the results can deliver evidence-based asthma care to individuals with asthma in the moment, with no delays in care. Pulmonologists and allergists should be available for clients refractory to conventional asthma treatment or for complicated cases, but the majority of chronic asthma care should be handled in the primary care arena.

**Provider Education to Improve Asthma Care**

Clark et al. (2000) conducted a study to determine the long-term effects of a provider education training program on providers’ provision of patient care, and the subsequent healthcare utilization among their pediatric population of clients with asthma. The treatment group physicians attended an interactive seminar in which they learned optimal clinical practice according to EPR-3 expert guidelines, and how to provide effective client teaching and education.

The authors found that (during visits that took no longer than they had prior to the acquisition of these new skills) physicians in the intervention group engaged clients in meaningful ways using teaching and communication strategies presented in the seminar. Compared to the control group, children in the intervention group were less frequently hospitalized for asthma exacerbations, and those who had historically high emergency department use lowered their use. This study was the first to study the long-term effects of such an intervention, and gives promise to interventions aimed at improving asthma care through provider education and engagement.
A study by Jones and Portnoy (2003) created a disease management program in eight offices with a Medicaid health maintenance organization that utilized certified asthma educators to launch the program. The authors stated that the programs were developed to emphasize alteration of provider behavior using operant conditioning to align practice closer to the evidence-based guidelines. The intervention employed certified asthma educators who remained up to 8 weeks in each office and focused on improving the accuracy of asthma diagnoses, increasing provider and staff knowledge of asthma; utilized asthma action plans more regularly; increased long-term control medication use among individuals with persistent asthma; and reduced the cost to treat clients with asthma. Of interest to this project was the asthma knowledge portion of this program. It was delivered to providers by the asthma educators in the form of didactic lectures, problem-based learning modules, modeling the desired behavior, and repetitive practice of these behaviors with positive feedback.

Jones and Portnoy (2003) measured the acquisition of asthma knowledge by providers with a pre-and post-intervention knowledge survey. In order to standardize patient asthma education, the offices were provided with Asthma Action Cards, a patient-friendly curriculum written in a consistent and easy-to-understand format that is used as a comprehensive educational tool. The reward which provided motivation for providers to change their practice behaviors was the activation of two Current Procedural Terminology (CPT) codes for asthma education payment at the end of the intervention. The authors found the post-intervention knowledge assessment scores to be significantly higher than the pre-intervention scores (with only eight offices participating in this disease management program) and the health plan saw a net decrease in the cost for treating asthma.
Lozano et al. (2004) sought to determine the effect of physician education and organizational change in chronic-asthma care, and was part of the Pediatric Asthma Care Patient Outcomes Research Team II Study. Researchers utilized a peer leader education strategy in which a physician at each practice site served as an asthma “champion”. The champions shared asthma guidelines with colleagues, encouraged implementation of the guidelines, and were given specific education and support functioning in this change agent role. The study took place in 42 primary care pediatric offices. The outcomes the authors measured included annualized asthma symptom days, asthma-specific functional health status, and frequency of brief oral steroid use. The authors found that the physician peer leader educational intervention resulted in 6.5 fewer symptom days per year than usual care (but which was not significantly decreased); reduced the rate of oral steroid bursts, and had positive effects on 3 of 5 domains of the functional health status questionnaire.

Although not directly related to spirometry, a randomized quality improvement trial was conducted involving a learning collaborative intervention in Boston and Detroit (Homer, Forbes, Horvitz, Peterson, Wypij & Heinrich, 2005). This study is relevant to this project as it involved provider education promoting the national asthma guidelines, was included in one of the systematic reviews which were previously discussed, and used a theoretical framework to guide the project intervention. The authors based this learning collaborative project on the Breakthrough Series developed by the Institute for Healthcare Improvement, a continuous quality improvement intervention. The aim of this study was to attempt to combat historic deficits seen in the quality of care provided to children with asthma. The outcome measures were transfer of written asthma action plans to the parents of a participant in the previous year, daily use of inhaled steroids in the previous 4 weeks, daily use of long-term control medications
in the previous 4 weeks, asthma hospitalization or emergency department care use, asthma attack frequency, and parent-relayed functional status reports of the child.

In this study, a total of 43 primary care pediatric practices were included (22 intervention sites, 21 control sites), that participated in this randomized trial which lasted for 12 months (Homer, Forbes, Horvitz, Peterson, Wypij & Heinrich, 2005). The learning collaborative intervention required each intervention site to send a 3-member multidisciplinary team (physician, nurse, front office staff member) to three 1-day learning sessions spread out throughout the yearlong study. After collecting baseline data to identify gaps in performance pre-intervention, the intervention group underwent training regarding how to comprehensively and proactively care for children with asthma using the Chronic Care Model and the Breakthrough Series Model for Improvement.

The providers in these intervention groups were given materials and information based on the EPR-3 guidelines, and tools to help support the implementation of these practices. The authors ultimately stated that they “consistently found that our intervention did not exert a substantial positive effect in the intervention group beyond that found in the control practices” (p.467). This study encountered organizational challenges and acknowledged some design limitations such as grant timing and funding that could not be altered, and concluded that the effectiveness of this approach to quality improvement should not be determined to be ineffective based on these results.

A more recent study by Cabana et al. (2006) measured the effectiveness of the interactive seminar known as the Physician Asthma Care Education (PACE) program. The authors measured changes in physician attitudes, practices, and patient asthma-related outcomes such as health status and health care utilization for asthma. The authors found that implementation of the
PACE program was effective in changing physician behavior and patient outcomes up to 1 year after the intervention. Physicians in the intervention group felt more confident discussing the care plan and asthma counseling with clients, and this was not associated with longer visit times. The PACE program only involved 5 hours of commitment, but demonstrated impressive improvements in clinical performance and client outcomes.

In a related study, physicians who had undergone the PACE program educated their physician peers on the same PACE program material (Clark, Cabana, Kaciroti, Gong & Sleeman, 2008) were utilized. This study was unique in that it was conducted in 10 United States cities, and had a follow-up data collection point two years later. This study used a randomized controlled design, and took place in pediatricians’ offices among 2 to 12 year old pediatric clients with asthma. After two years, the authors found that in the intervention group there was greater patient satisfaction with the pediatricians’ performance, and benefits in symptom control and health care for children with asthma. Of note is the fact that these outcomes were achieved with the physician spending less or equivalent time during the visits with the client compared to usual care. This study had an unusually long data collection period which proved to solidify the effectiveness of the PACE program and the potential for peer led education.

Academic detailing paired with problem-based learning and improved systems support to change practice patterns of pediatric practitioners was used in a study conducted by Ragazzi, Keller, Ehrensberger, and Irani (2011). This mixed-methods study took place in 6 pediatric practices in Richmond, Virginia, and was led by a pediatric physician and nurse practitioner who was a certified asthma educator. These clinicians were both part of an asthma community collaborative funded by a Centers for Disease Control and Prevention grant. They partnered with a physician and nurse in each study site who functioned as practice “champions” for their
office. The intervention used two elements of the Chronic Care Model: delivery system redesign and decision support to help the practices implement and follow the essential clinical activities recommended by the national guidelines. Specifically the intervention included: (a) physician and staff education in the EPR-2 guidelines, (b) spirometry administration and interpretation, (c) practice systems redesign to support optimal asthma care, and (d) decision support to ensure appropriate implementation of the key clinical activities.

A unique feature of this intervention was that through close collaboration with the “champions” and intervention leaders, it truly allowed each practice to tailor the intervention to the individual site in order to directly address barriers and obstacles (Ragazzi, Keller, EMRensberger & Irani, 2011). The evaluation of this study triangulated findings using evidence from questionnaires, semi-structured interviews with champions, and chart reviews to capture data on practice engagement and participation, sustainability plans, to catalog improvements in the quality of care, and to document improvements in procedures and systems. The authors found that across all practices, a majority of staff improved their ability to delivery evidence-based asthma care, demonstrated at least four changes in line with the national clinical recommendation guidelines, and showed an improvement in almost all practices in documenting the clinical indicators. Limitations to this study include the one year timeframe, as the sustainability piece would be better assessed for a longer duration; the sampling used practice sites that volunteered; and there was no control group.

Provider education interventions show potential in improving asthma care through engaging providers to reflect on their practice and how their clinical decision making could be improved through following the current evidence-based approaches. Utilizing an office change-agent clinician to function as an “asthma champion” is one way to help continually educate other
providers on implementing the national asthma guidelines (Lozano et al., 2004). Interactive seminars tailored to primary care providers are another way to enhance the behaviors and care delivery approaches clinicians use when managing clients with asthma. To be effective interventions must be tailored to the practice environment and culture in which they will be implemented (Ragazzi, Keller, EMRensberger & Irani, 2011). The use of certified asthma educators in academic detailing has been shown to lend credibility and expert counsel to asthma improvement interventions, especially among those seeking to implement the national guidelines.

**Literature Review Summary**

There are multiple studies related to improving the care primary care offices provide to individuals with asthma. Spirometry is recommended by national guidelines to assist the clinician in diagnosing, treating, and managing asthma, yet it is underutilized and often not performed or interpreted correctly according to industry standards. Derom et al. state that “spirometry is an important diagnostic tool for general practice and should have a central role in the diagnosis and management of chronic respiratory diseases” (2008, p. 202) provided that the quality of spirometry is periodically reviewed to ensure accuracy and reproducibility. The quality improvement studies demonstrate that educating providers and staff about proper spirometry technique and interpretation is not enough to drastically change outcomes, but paired with meaningful provider education regarding evidence-based asthma management strategies may have the power to significantly improve asthma care delivery.

Although important advances have been made, significant gaps still exist between what is known about asthma and what is commonly practiced (Mattke, Martorell, Sharma, Malveaux & Lurie, 2009). This literature review has helped inform this author’s understanding of spirometry-
based asthma quality-improvement interventions as well as provider education strategies. Combined with a careful organizational assessment, this knowledge helped guide the drafting of this targeted intervention to improve asthma care in a primary care practice.

As demonstrated by this review of the literature, asthma is a health condition that carries significant impact when it is mismanaged in the primary care setting. The care provided to individuals with asthma warrants focused attention to promoting accurate diagnoses, assessing level of control accurately, and managing long-term control medications responsibly (NHLBI, 2008). The literature has shown that asthma in the primary care setting is underdiagnosed, its severity misinterpreted, and that provider familiarity with the national asthma guidelines is not likely to improve the use of objective lung testing (O’Dowd, Fife, Tenhave & Panettieri, 2003). Moving forward, these authors suggest improving physician training in performing and interpreting spirometry, as limitations were seen in this area. Thus, the overall recommendation from the literature that was incorporated into this intervention was to educate providers on the usefulness of spirometric testing with objective proof of its utility to drive practice change. The next sections will describe a way in which to utilize the resources this primary care office possesses to improve asthma care by improving quality and reducing cost due to long-term sequelae.

**Conceptual Models**

In order to design a spirometry quality improvement intervention at this primary care site, three conceptual frameworks were selected to guide the process. Conceptual frameworks are useful for guiding project design and implementation to ensure maximum efficacy and that efforts are recruited to their full potential (Moran, Burson, & Conrad, 2014). The Chronic Care Model (Bodenheimer, Wagner & Grumbach, 2002) was utilized to understand the phenomenon
of caring for clients with asthma in the primary care setting. The Iowa Model (Titler et al., 2001) was used to guide the process of developing and implementing this evidence-based quality improvement educational intervention. Social Cognitive Theory (Bandura, 1986) was utilized to plan the educational sessions with the clinical support staff and providers and to design the post-intervention surveys to evaluate the outcomes of the intervention.

**Chronic Care Model**

The Chronic Care Model (CCM) was designed to improve chronic illness management in the primary care setting (Bodenheimer, Wagner & Grumbach, 2002). The CCM is appropriate to examine a chronic condition such as asthma because the majority of chronic illness care takes place in the primary care setting, and clinicians in this environment spend considerable time treating such chronic conditions (Bodenheimer & Grumbach, 2002). This model is comprised of six essential overlapping elements: community resources and policies, health care organization, self-management support, delivery system design, decision support, and clinical information systems. The two tenets most related to the intervention in this project are delivery system design and decision support which will be further discussed. See Appendix A for a depiction of the CCM.

**Delivery system design**

The CCM calls for alterations in the structure of medical practice with an emphasis on actively providing treatment for acute conditions while creating space for the planned management of chronic conditions (Bodenheimer, Wagner & Grumbach, 2002). Clinicians and support staff must be intentional in arranging appropriate follow-up for the management of chronic conditions and to ensure these visits are planned. According to the EPR-3 (NHLBI, 2007) individuals with asthma should have spirometry performed every 1-2 years and be seen by
a provider during scheduled follow-up visits at periodic intervals (at least every 6 months) to assess asthma control and modify the treatment plan, if warranted. Asthma as a chronic condition requires intentional care planning to optimize asthma control, and this merits a shift in care provision strategy to focus on planned visits to prevent serious consequences from occurring in the future.

Decision support

The CCM cites evidence-based clinical practice guidelines as the foundation for optimal chronic care delivery (Bodenheimer, Wagner & Grumbach, 2002). The CCM further recommends integrating guidelines into daily practice via reminders of some fashion. Given the vast number of clinical practice guidelines, it was hoped that the proposed spirometry and educational intervention would serve as a refresher, while the addition of asthma-related visual job aids would help clinicians provide quality care more efficiently. The CCM further recommends that the clinical guidelines should be reinforced by provider “champions” who lead educational or refresher sessions for the clinicians and clinical staff. The intervention used in this project was just such an effort and this author’s site mentor was willing to function as an asthma champion for the practice team and the office in general.

Iowa Model

The Iowa Model is an evidence-based practice model developed by Titler et al. (2001) that has been extensively used in clinical research programs. The Iowa Model seeks to address practice gaps by focusing on knowledge and problem-focused triggers that lead to investigating if a practice change is needed and desired by the organization (Doody & Doody, 2011). After this occurs, users of the Iowa Model introduce evidence-based practice (EBP) changes through a seven step progression which includes (a) selecting a topic, (b) forming a team, (c) evidence
retrieval, (d) grading the evidence, (e) developing an evidence-based practice standard, (f) implementing the EBP, and (g) evaluation of outcomes. The Iowa Model guides users through the process of how evidence may be introduced into practice in a logical and systematic manner that allows for revisions and quality improvement along the way.

This project involved utilizing evidence-based interventions supported by the literature to employ spirometry to improve the quality of care delivered to individuals with asthma. The Iowa Model was an excellent tool to guide this scholarly project as it informs each step of such an evidence-based translation project from topic selection to evaluation (Titler et al., 2001). The steps of the Iowa Model will be discussed in relation to this project as appropriate in the rest of the project. See Appendix B for a depiction of the Iowa Model.

**Social Cognitive Theory**

Social cognitive theory (SCT) seeks to explain how environmental (physical, sociocultural), personal (cognitive, affective), and behavioral (actions, habits) factors interact to determine motivation and ultimately human functioning (Bandura, 1986). SCT progressed from Albert Bandura’s social learning theory which served as a model for understanding how people learned through vicarious observation of others modeling the topic of interest. Learners were found to be more likely to adopt modeled behavior if it results in outcomes they value, if the model is similar to the observer, and if the behavior possesses functional value (Bandura, 1977).

As SCT developed, the concept of self-efficacy emerged as a prominent and influential construct when considering motivation and decision making behavior (Bandura, 1997). Bandura defines the perception of self-efficacy as the “beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments” (p. 3). The premise of self-efficacy is that individuals are more likely to engage in activities in which they have high self-
efficacy and less likely to engage in those they do not. The level of an individual’s confidence in
the ability to perform an activity will influence the decision making of the individual following a
cognitive appraisal and integration of past experiences.

Bandura (1977) outlines four sources of information that contribute to an individual’s
judgement of his or her self-efficacy: (a) performance outcomes (past accomplishments), (b)
vicarious experiences (modeling), (c) verbal persuasion (encouragement), and (d) physiological
feedback (emotional state). Through modeling, individuals pattern their manner of thinking and
behaving after the functional examples set forth by other individuals (Bandura, 2005).
Individuals most likely will take action when they hold efficacy beliefs and outcome
expectations that make the required effort to perform the behavior worth the sacrifice. The SCT
theory and notion of self-efficacy applied to this project because the overarching goal was to
increase the confidence of the clinical support staff and providers in performing and interpreting
spirometry to improve asthma outcomes.

When evaluating an intervention targeted at bolstering self-confidence in the ability to
carry out a certain activity, measurement of perceived self-efficacy seeks to identify the upper
limits of an individual’s perceptions of his or her capabilities. This limit is best measured with
an expansive efficacy assessment that allows for gradations in efficacy rather than a single
judgment regarding a very difficult task (Bandura, 1989). Visual analog scales were selected for
use in both the clinical support staff and provider surveys, because this format avoids verbal
anchors, provides a wide range of responses, and reduces scale vulnerability to ceiling effects
(Bandura, 1997). Visual analog scales also are very sensitive to change, have fine gradations
between responses, and are simple to understand and use.
It has been demonstrated in multiple studies that SCT and concepts of self-efficacy have been successful in driving better asthma care. Authors Chiang, Hsu, Liang, Yeh and Huang (2009) used Bandura’s construct of self-efficacy from SCT to develop a scale to measure the confidence that nurses perceive in their abilities to provide teaching to clients with asthma. In another study, an intervention was implemented to increase providers’ self-efficacy in their abilities to provide asthma self-management skills education to their clients and to ultimately change provider behavior (Morrow, Fletcher, Mulvihill & Park, 2007). Both studies demonstrated significant gains in providers’ confidence in their abilities to provide adequate asthma education. See Appendix C for a depiction of the Social Cognitive theory.

**Need and Feasibility Assessment of Organization**

An organizational assessment of the primary care office was completed using the Institutional and Organizational Assessment Model (IOAM) (Lusthaus, Adrien, Anderson, Carden & Montalván, 2002). The IOAM can be used as a framework for external evaluation and also as a self-assessment tool to gauge the organization’s purpose, which is a measure of the organization’s effectiveness, efficiency, relevance, and financial stability. The IOAM examines the organization’s motivation, environment and capacity as underlying forces that shape and drive overall organizational performance (Lusthaus, Adrien, Anderson, Carden & Montalván, 2002). These three factors will be briefly discussed in the following sections.

The health system operating this primary care office had an ambitious mission statement focused on transforming the health of the communities it serves through innovative and personalized care (Mercy Health, 2016). The selected practice site was no exception and its individual and collective constituents were motivated to provide the best care possible to the individuals and families it serves. The primary care providers were interested in following
evidence-based best practices whenever possible, and displayed a desire to keep abreast of changing guidelines and recommendations. The study site also fostered a culture of beneficence making it an ideal location for a quality improvement project.

The second aspect of the organization impacting its performance according to the IOAM is the environment. The environment within the primary care office was conducive to an evidence-based provision of care project for many reasons. The physical environment was capable of accommodating increased use of the existing spirometer within the office workflow; coding and billing for the services provided; and the technology existed to incorporate this assessment into the EMR. The clinical support staff had prior training in the equipment’s use and, because these skills were reviewed on an annual basis, the project did not introduce a novel procedure requiring ground-breaking training and validation.

The third contributing factor according to the IOAM model is the organization’s capacity, which is comprised of the strategic leadership, financial management, infrastructure, and program, process, and service management which affects overall performance. The leadership of the primary care office was aligned with and willing to support the facilitation of this project change. Although asthma care was not actively being tracked and audited by payers to the extent that diabetes, heart disease, and hypertension were, the office processes supported an asthma improvement initiative. It was deemed a feasible time for such a practice improvement project because the staff had recently transitioned to a new EMR, and could benefit from assistance navigating the documentation of asthma care in general. Also, new employees were recently on-boarded, and needed to learn or review spirometry, and individuals with allergy-induced asthma triggers would be more prevalent due to the change in season (spring and summer).
SWOT Analysis

An analysis of the Strengths, Weaknesses, Opportunities, and Threats (SWOT) to carrying out this project at the primary care office was conducted. A SWOT analysis is a powerful tool to assist and inform the planning process of a project (Harrison, 2010) and was utilized as a strategic tool to help categorize the state of the organization before formulating the intervention.

Strengths

There were many strengths of this health system at large, including embracing a mission, brand vision, promise, core values, and guiding behaviors that supported the provision of high quality care which would transform the communities it serves (Mercy Health, 2016). The health care organization’s brand vision stated it employed a care team that will continuously innovate to deliver high quality care that is comprehensive, coordinated, accessible and personalized. This primary care office was prepared to adapt and innovate to provide the highest level of care to the community possible, as evidenced by the successful transition to a new EMR. This office utilized engaged, enthusiastic providers and clinical support staff who sought to provide individualized quality care to each individual they encountered. A final strength was that this primary care office was very open to participating with student learners and this author worked with several providers within the office during clinical practicum rotations.

Weaknesses

The providers in the office underutilized spirometry and felt uncomfortable interpreting the results. This, in turn, impacted clinical support staff who did not perform spirometry often enough to feel comfortable operating the equipment and instructing the clients in appropriate technique. From a resource perspective, not all of the providers knew the office owned a
spirometer. This contributed to having a group of clinical support staff members who had not had the opportunity to operate the equipment during an actual encounter, except during the annual competence reviews. Another weakness was the pressure of competing priorities facing providers and clinical support staff, such as full schedules and inbox management, and the pressure to deliver high quality care despite the workflow challenges. In this regard, clinical staff may have felt too busy to take the time to perform spirometry for a client who would benefit from an objective measurement of lung function. Finally, the sustainability of a spirometry initiative was also a concern if it failed to be seen as a priority or benefit to the clients, or was never used, and thus its perceived benefit diminished.

**Opportunities**

Implementation of this asthma quality improvement project provided the primary care office with the possibility of new business initiatives. Spirometry is a billable service that was underutilized at the office, and this project helped to spur a culture of evidence-based care that incorporated use of in-office diagnostic testing when appropriate. In addition to potential improvement of the care of clients with asthma, this project had the potential to spearhead preventive care practices that would meet client needs and expectations, but also drive outcome-based care for the health of an entire patient population.

The possibility of creating clinical protocols to improve quality and efficiency was an opportunity that could result from this initial quality improvement work. There was opportunity at this practice site to improve the primary care that was delivered to clients, and to reduce the need for referrals to specialists, such as a pulmonary function testing lab, for the sole purpose of spirometry testing. This particular primary care office has historically been open to change, and it was hoped that this practice change would be valued and trialed with enthusiasm.
Threats

Threats that would negatively affect the intervention included competing demands already impacting providers and clinical support staff, such as negotiating the new EMR. They were also adjusting to transitions in provider mix, and coping with hectic patient loads. The addition of another quality improvement measure with associated education and training was in the best interest of clients, but perhaps would not be regarded as a priority by clinicians. Not all staff embrace change in the same manner, as illustrated by the EMR transition, and this had the potential to affect the implementation as well as sustainability of the spirometry intervention project. These threats were taken into consideration when planning the project to mitigate the potential negative effects and perceptions surrounding it. The success of this project depended on understanding the perspectives of the organization regarding the perceived and actual barriers to moving forward with the intervention.

Organizational Needs Identified by the Assessment and SWOT Analysis

To ascertain the needs of this specific primary care office, all three key stakeholders’ perspectives were considered when planning this evidence-based spirometry intervention. These three groups included the clinical support staff, the providers, and the practice manager. All three groups expressed some level of interest in using the office-owned spirometer, provided proper training was provided. Central to this venture was the clinical support staff who would be performing the spirometry and documenting asthma-related care in the guidelines section of the new EMR. The provision of high quality spiromgrams was crucial for subsequent accurate interpretation by the providers who would use the results to make care decisions. The success and sustainability of this project depended on the cooperation and support of all stakeholders and their willingness to take ownership of any new processes that developed. Fortunately, for this
team, a prevailing tenet in the office was providing exceptional care to the clients, and if a valuable practice change was introduced that aligned with this goal, it most likely would be embraced.

After obtaining baseline reports of spirometry utilization and specific asthma codes billed during encounters at this primary care practice, it became apparent that gaps existed between the current state and the level of care the organization desired to provide to the community. During the 2015 fiscal year (7/1/2014 to 6/30/2015) there were 417 visit encounters that included a diagnosis of asthma on the visit summary, while only two instances of basic spirometry use were documented. Even though spirometry is a valuable billable service with practical utility in diagnosing, treating, and managing asthma throughout the lifespan, it was woefully underutilized at this primary care practice.

Based on the findings from the organizational assessment and SWOT analysis, implementing an evidence-based asthma intervention based on spirometry and its interpretation was determined to be a beneficial project for this primary care office. The project addressed the problem of how to improve asthma care for clients at the office while utilizing existing office equipment to generate additional revenue. As spirometry is essential to the diagnosis, management and treatment of asthma (NHLBI, 2007), it was suggested that spirometry should be incorporated into routine care of individuals with asthma in this practice. This project was in alignment with the organization’s mission to improve the health of the community, as provider education programs similar to this intervention have proven to improve asthma care, decrease the frequency of days of asthma symptoms, and decrease emergency care utilization (Cabana et al., 2006).
Project Plan

Purpose of Project with Objectives

It was the intent of this project to revitalize the use of spirometry for the care of clients with asthma at this primary care practice. The ultimate goal of this project was to improve delivery and quality of care to all individuals with asthma seen in the office. This primary care clinic used their spirometer infrequently and many staff were unaware the office owned such a device. The objectives for this project were:

1. To conduct a clinical support staff spirometry training session. This included:
   a. demonstrating the process of ordering spirometry;
   b. describing and demonstrating the process of calibrating the spirometer and handling the equipment
   c. demonstrating how to properly engage a client to perform spirometry; how to prevent common mistakes; and how to achieve quality spirometric results;
   d. demonstrating how to document and handle the spirometric results via actual screenshots from the EMR; and
   e. creating job aids in a walk-through format to assist staff in navigating these steps in the future.

2. To educate providers on the interpretation of spirometry and the current evidence-based guidelines for diagnosing, treating, and managing clients with asthma. This included:
   a. partnering with a nurse practitioner and certified asthma educator who manages a local asthma network, to prepare the educational material for the
provider education sessions including interactive exercises practicing interpreting spirometric reports; and

b. developing a spirometry use in primary care summary handout, job aids, and asthma guideline summaries to assist providers in following the national evidence-based recommendations when caring for clients with asthma.

3. To disseminate the findings of this project via the Scholarly Project Final Report at the University’s college of nursing.

4. To present a business case to key stakeholders for promoting spirometry for clients with asthma to leadership at this practice site, discussing sustainability efforts.

**Type of Project**

This scholarly project was a quality improvement project via demonstration and review of an objective and diagnostic form of lung function testing via spirometry. This intervention was delivered through an in-service with clinical staff and educational sessions with providers, and utilized existing resources the office already possessed.

**Setting and Needed Resources**

This evidence-based quality improvement project took place at a primary care practice affiliated with a national health system. Necessary resources for the success of this project included the office owned Midmark IQSpiro spirometer, calibration mouthpiece, testing mouthpieces; access to the EMR to develop stepwise screenshots and documentation strategies for spirometry initiation, calibration, performance, and spirometry usage and asthma diagnosis tracking; time during the clinical staff meeting, which took place on the morning of Tuesday, June 21st, 2016, and time during the daily lunch hour on Wednesday, June 29th and Thursday, June 30th, 2016, to allow interested providers to attend the educational sessions.
The team necessary to execute this project included: (a) the project advisory team for its support; (b) the practice manager to assist with planning the educational sessions; (c) a certified asthma educator and nurse practitioner to help review the educational material, develop the evaluation plan, and assist with conducting the provider educational sessions; (d) the NP site mentor in the role of the community project advisor and site spirometry champion; and (e) the staff at the primary care office, for their feedback and effort.

**Design for the Evidence-based Initiative**

Observational data was collected in this project following an educational intervention with the clinical support staff and providers at the primary care practice site. The clinical support staff (MAs and LPNs) were required to attend a monthly clinical staff meeting where a spirometry demonstration, training, and documentation session was conducted by this author, with provision of pertinent job aids and walk-through guides. Interested providers attended one of two identical educational sessions held over the lunch hour that was facilitated by this author with expert assistance from the certified asthma educator. Data in the form of post-intervention surveys were collected as described below after at least one week following the interventions. Also, a data collection period was completed for the month of July 2016 to assess actual spirometry use after this intervention, and how many referrals were placed for pulmonary function testing. See Appendix D for a diagram illustrating the flow of the project.

**Participants/Sampling and Recruitment Strategies**

The participants in this project included the author, the scholarly project advisory team, and staff of the primary care office. This quality improvement initiative used no sampling strategy; all primary care clinical staff could participate. All data collection from participants was completely voluntary in the form of a survey. The surveys were distributed following the
interventions and each respondent was asked to assess their level of confidence before and then after the intervention. Informal feedback from the MAs and LPNs pertaining to the spirometry demonstration session and feedback from providers regarding the lunch and learn sessions was solicited verbally and also via an open-ended question at the end of the surveys. Usage data were gathered via report queries run by the governing organization’s information technology department from the EMR. The number of billed spirometry procedures, the number of pulmonary function tests ordered at an external entity, and the number of visits that included an asthma diagnosis during the month of July 2016 were the data extracted for these reports.

**Measurement: Sources of Data and Tools**

The sources of data for the protocol part of this project included the staff at the primary care office and the EMR. The MAs and LPNs were asked to complete a brief survey created using social cognitive theory (Bandura, 1986). The aim of this survey was to assess their self-rated confidence level regarding performing and documenting spirometry following the in-service demonstration, as well as to solicit suggestions for aspects of the training that should be reviewed again soon. A verbal query following the training session took place in an effort to elicit questions directly following the training session in the moment. A copy of this survey is included in Appendix E.

The providers were also asked to complete a brief survey also created using social cognitive theory (Bandura, 1986). This survey aimed at determining the merit of the educational session in improving their confidence in their ability to interpret spirometry; determine how often they utilized the national asthma guidelines to drive the care they provide; how useful they perceived the guidelines to be after the education; and what topics or aspects of care they felt required clarification. A copy of this survey is included in Appendix G. Each survey was
completed following the intervention with each respondent providing both pre-and post-intervention confidence levels for comparison.

To evaluate the value and adoption of this evidence-based spirometry intervention, the EMR was queried via assistance from the organizations’ information technology specialists for data regarding the number of times spirometry was ordered (Current Procedural Terminology (CPT) codes 94010 (traditional) and 94060 (bronchodilation responsiveness via pre-and post-bronchodilator administration). To capture additional data on this office’s population of clients with asthma, the number of office visits with persistent or unspecified asthma as a diagnosis on the claim form (International Classification of Disease, ICD, 10) diagnosis codes J45.3, J45.4, J45.5, J45.901, J45.902, J45.909) were queried as well as the number of referrals there were to pulmonology offices or other laboratories for any form of pulmonary function testing for clients with asthma.

Steps for Implementation of Project, including Timeline

On June 13\textsuperscript{th}, 2016, the organizations’ institutional review board determined that this project was not human subject research and was deemed a clinical quality improvement measurement (Appendix J). On June 14\textsuperscript{th}, 2016, the university human research review committee made the same determination that this project was a quality improvement initiative (Appendix K). This project was undertaken as a clinical quality improvement initiative at the organization and, as such, was (per their policies) not formally supervised by the organization’s institutional review board.

It was previously determined that the primary care office had the proper equipment (Midmark IQSpiro spirometer with USB computer interface, disposable mouthpieces, a calibration canister, appropriate device vendor manuals, a previous walkthrough manual for the
prior EMR) and that it was all in working order and interfaced with the new EMR. An initial step was to develop a spirometry calibration, performance, troubleshooting, and documentation job aid, walking users through these processes in the EMR. This “How to Perform Spirometry” guide (Appendix F) was housed in the current spirometry binder along with the PowerPoint presentation slides highlighting the screenshots that corresponded to the walk-through steps. Each clinical support staff member received a copy of the guide and extras were provided to the practice manager to disperse to staff members unable to be in attendance. The clinical staff spirometry demonstration and training took place on June 21st, 2016.

The provider educational sessions were planned with a nurse practitioner and certified asthma educator who was a member of the project advisory committee and who also manages a local asthma network. This certified asthma educator had previously presented educational asthma lunch seminars at two other regional primary care offices in the same health system. She divided the presentation time into a review of spirometry interpretation strategies, with case studies and overview of how these objective results relate to the management of asthma in accordance with the EPR-3 guidelines (NHLBI, 2007).

A PowerPoint presentation was used to deliver information, with actual spirogram results that were interpreted collectively for practice utilizing the “Spirometry in Primary Care” guide (Appendix I) created by this student. The NHLBI “Asthma Care Quick Reference” (2012) guidelines from the EPR-3, and two handouts detailing bronchodilator references and classifying asthma severity were provided by the certified asthma educator. The provider education sessions took place on two consecutive days: Wednesday, June 29th, and Thursday, June 30th, 2016, from approximately 1215 to 1315 to accommodate the office workflow and appeal to as many provider schedules as possible. Each session was identical.
The in-office spirometry data collection period ran from July 1st, 2016 to July 31st, 2016, for a total of four weeks of observation following the clinical staff training day and provider educational sessions. The data were analyzed after obtaining the report from the organizational IT representatives, then integrated into the final report which was presented to the university nursing community at the final defense of the project on August 8th, 2016. A meeting with the practice manager was set for mid-August to review the results of the project and discuss sustainability of spirometry educational efforts at the primary care office. The results of the project were disseminated to staff at a morning all-staff huddle on August 11th, 2016. A timeline for each phase of this project is included in Appendix L.

**Project Evaluation Plan**

The first evaluation of this project was to determine the success of the clinical staff spirometry demonstration and training, measured by the post-training clinical staff survey (Appendix E). These voluntary, anonymous surveys were given to the MAs and LPNs following the training session and returned to a marked envelope at the site mentor NP’s work station. The surveys were collected on June 30th, 8 days after the training session. Success was determined by measuring change in the clinical staffs’ comfort level, comparing answers to questions 2 and 3 on a visual analog scale. Level of confidence in performing spirometry was assessed with question 4.

Questions 2 and 3 asked each respondent to rate his or her comfort level at performing spirometry before the training session, to comfort levels immediately after the session. It was expected that both the level of comfort at participants’ perceptions of abilities to perform spirometry and confidence in their abilities to perform spirometry on a client the next day would increase following the training session. Albert Bandura’s social cognitive theory was used to
create and inform the surveys and was the inspiration for using a visual analog scale to rate self-efficacy (1986).

Success of the provider educational sessions was evaluated through use of measures similar to the ones utilized with the clinical staff. The post-education provider survey was relatively similar to the clinical staff questionnaire (Appendix G). As was the procedure used for clinical staff, the voluntary, anonymous surveys were given to the providers following both educational sessions, with instructions to return them to a marked envelope at the work station used by the site mentor. All returned surveys were collected from the envelope on July 18th. A perception of positive change in providers’ comfort level in interpreting spirometry (comparing questions 2 and 3), greater confidence in interpreting spirometry for a client the next day (question 4), and intent to use the asthma guidelines in the future (question 6) were the indicators of success.

Questions 2 and 3 provided visual analog scales on which respondents were to rate their comfort level at interpreting spirometry before the training session, and their comfort level immediately after the session. The providers’ reports of their pre-session comfort levels were compared to their perceived comfort after the session. It was expected that both the level of comfort of providers in their ability to interpret spirometry reports and confidence in their ability to interpret spirometry on a client the following day would increase following the training session and that responses to question 6 would indicate that the guidelines would be perceived as useful to practice.

To assess whether these interventions increased the use of in-office spirometry, the EMR was queried by the organization’s information technology specialists to determine how many times spirometry was ordered, how many visits with an asthma diagnosis were included on claim
forms, and how many referrals were made to pulmonology offices or other laboratories for any form of pulmonary function testing for clients with asthma. These reports were collected for the entire month of July, 2016. These data were compared to data from the prior fiscal year during the same time period, the month of July, 2015. Unfortunately, the orders for referrals to outside entities for objective measurement of lung function could not be obtained for July 2015 in time for the writing of this report. It was expected that spirometry would be ordered more often in 2016, and that the ratio of visits with asthma diagnoses to spirometric testing orders would improve.

Ethics and Human Subjects Protection

The scholarly project was deemed a quality improvement study on June 14th, and thus considered not to be research by the university’s human subjects research protocol review (Appendix K). The same determination was made on June 13th, by the governing health system’s IRB (Appendix J).

Budget

The cost of implementing this project was limited to the time and effort expended by this student at no cost to the organization. The clinical staff spirometry demonstration and training session took place during a mandatory monthly all-support staff meeting, which typically discusses clinical processes, workflow, standardization of tasks, and competencies. The competencies have included spirometry in the past. The provider educational sessions were voluntary and conducted over the lunch hour when the office is closed. The practice site already owned all the necessary equipment to perform office spirometry and no additional cost was incurred from the potential need to order mouthpieces more frequently if the spirometry unit was
utilized more often after the intervention sessions. However, billing for spirometric procedures would cover the cost of the necessary equipment.

Regarding the office-owned equipment, a comparable brand new IQspiro spirometer with calibration syringe costed approximately $2,600 (Rayce Robinson, Midmark Diagnostic Group, Personal Electronic Mail Communication, May 1st, 2016). The disposable spirometer mouthpieces cost $75 per box of 25 mouthpieces.

If office spirometry is adopted and ordered more frequently, it would cost the organization time for the MA or LPN to perform the spirometry, taking him or her away from other job-related tasks in which he or she would otherwise be engaged. However, the more the clinical staff performs spirometry, the more proficient they will be and less time will be taken. According to the certified asthma educator involved in this project, a spirometry maneuver should take an average of just a few minutes with a trained staff member and compliant client. The highest reimbursement payment for simple spirometry in recent years (CPT 94010) was $51.42 (national average $37) and the highest reimbursement payment for pre- and post-bronchodilator spirometry (old CPT code 94640, now 94060) was $89.39 (national average $62) making this a potentially lucrative diagnostic test to perform in the office instead of referring the client to an outside laboratory. A spirometry calibration and performance-timed walk-through was not completed for this project but could give further insight for a business case promoting office spirometry at this site.

**Implications for Practice**

The implications of conducting this project at this primary care office had the potential to positively affect the care delivered to, and thus the health of individuals with asthma seen in this office, and to reduce the overall health care expenditures of the organization while modestly
increasing revenue for this practice site. The adoption and enactment of the objectives of this project would rejuvenate evidence-based asthma care in this office that aligns with the national asthma guidelines. This project put into use previously underutilized office-owned equipment that confers a billable charge, and would reduce referrals out of the office for similar testing. The care delivery process would improve if providers were able to make decisions about managing a client’s asthma during the visit, utilizing a readily available objective measurement of lung function. Though not measured in this project, client satisfaction would most certainly increase if clients had a visible measurement of their lung function and have their therapy adjusted before departing the office. Office-based spirometry would improve the care delivery to clients with asthma, while reducing emergency service utilization and subsequent costs as well.

**Sustainability**

Regarding the sustainability of promoting spirometry use in this office, the decision to utilize this diagnostic test lies with the providers. If the providers choose to follow the guidelines and order in-office spirometry, the clinical support staff will become more familiar with, and efficient at the process. As many providers as possible were made aware of the national asthma guidelines. With continued support from the mentor NP acting as the site spirometry champion, it is likely that spirometry use will continue to increase, especially with continued support from office leadership. It is the opinion of this student that if spirometry is valued at this office, these changes are sustainable and will be profitable for all.

**Dissemination of Outcomes**

The final deliverable of this project was the training of clinical support staff and providers at the primary care office who can now perform and interpret spirometry for clients with asthma. A secondary deliverable is the job aids and guideline summaries supporting staff in
the provision of high quality asthma care. These can promote the sustainment of office-based spirometry, if it is valued by the office. A meeting to discuss the results of this project as well as present a business case for promoting office-based spirometry in accordance with national asthma guidelines at the primary care site was offered several times, and in mid-August 2016 was declined by the practice manager. On August 11th, the results of this project and recommendations for sustainability were presented to the clinical staff at this practice site at a daily all-staff huddle. A DNP portfolio, which includes the Organizational Assessment, Integrated Literature Review, White Paper, Project Proposal, and Scholarly Project Final Report was made available to future employers upon request and also be available through the ScholarWorks online repository through the university’s library website.

**Project Outcomes**

The following section is organized following the project objectives: (a) to train and educate the clinical support staff on the process of performing and coaching spirometry; (b) to educate providers regarding the interpretation of spirometry reports and to review the national asthma guidelines; (c) to evaluate the effectiveness of the education and training regarding the clinical staff’s confidence in their ability to perform and interpret spirometry (included within each respective section for clarity); and (d) to determine if this intervention increased the office’s utilization of spirometry.

**Objective One: Clinical Support Staff Spirometry Training**

The mandatory clinical support staff monthly meeting at which the spirometry training was held occurred on June 21st, 2016. The practice manager allotted thirty minutes for the presentation. This was less time than requested. There were minor technical difficulties synching the projector for the PowerPoint presentation after it had worked seamlessly during
initial set-up. The 30-minute timeframe was sufficient for the student to review and demonstrate how to order spirometry in the EMR, how to calibrate the spirometer, how to safely position and optimally coach the client, how to finalize documentation, how to troubleshoot, and how to sanitize the equipment. However, time constraints and other setbacks, which will be discussed further in the limitations section, prevented any demonstration or hands-on practice time for the staff using the equipment in a training environment within the EMR.

The “How to Perform Spirometry Guide” (Appendix F) job-aid handouts were provided to each attendee, and placed in the ECG/Spirometry binder in the equipment storage area where the spirometry equipment is located. Extra copies were given to the practice manager to dispense or store as appropriate. A printed copy of the PowerPoint used for the clinical support staff training presentation detailing the screenshot walk-through in the EMR was also placed in the binder for general screen identification purposes when used with the walk-through guide. Digital copies of both the handout and PowerPoint were given to the practice manager.

Following the spirometry training session for the clinical support staff, 10 participants returned completed surveys. Figure 1 illustrates how respondents rated their confidence in performing spirometry testing before the session, compared to their confidence afterward. Respondents replied to all items except the final question, (question 5), which was open-ended. It was determined that 60% of the clinical support staff reported they had previously performed in-office spirometry. This was a larger proportion than expected, because during 2015 it had been ordered only twice, and the clinical staff have a relatively high attrition. All the clinical staff who were questioned during the organizational assessment had never before performed spirometry on an actual client.
The primary outcome of interest was assessing the change in self-rated comfort level with performing spirometry after the training session (comparing questions 2 and 3 on the Post-Training Clinical Staff Survey- Appendix E). After the training session, each respondent rated his or her self-comfort level at performing spirometry before the intervention via question 2 and this response was compared to the same respondent’s post-training response on question 3 of the survey. The self-comfort level at performing spirometry increased by an average of 32.1% after the training session (M = 31.5, SD = 34.5 pre-intervention; M = 63.6, SD = 20.4 post-intervention) and the average overall confidence level in ability to perform spirometry on clients in the imminent future was 74.8% (SD= 16.0). Using a paired t-test it was determined that there was a significant difference in the scores pre-intervention and post-intervention (t(9) = 6.16, p < .001), indicating that the spirometry training session significantly improved the clinical staff’s confidence in their ability to perform spirometry in actual practice.

All responses to the last item, which was open-ended, question 5: “Which aspects of spirometry should be reviewed again soon (if any)?” included: (a) two responses of “None”, (b) “Opportunity to practice”, (c) “Timing- how long it would take to perform test in office”, (d) “Hands on practice”, (e) “Actually perform the test- work with the equipment”, (f) “Ordering in Athena”, and (g) no response from three participants.

Objective Two: Provider Educational Session

The provider “Lunch & Learn” educational sessions were held on Wednesday, June 29th and Thursday, June 30th from approximately 12:15 pm until 1:15pm. Figure 2 illustrates provider self-ratings of their confidence in ability to interpret spirometry prior to, and following the sessions. Disappointingly, only 3 (27.2%) of the providers in the office attended one of the lunch-hour educational sessions. A nurse practitioner and physician attended on Wednesday,
and one physician attended on Thursday. Only one of the providers (33.3%) had previously ordered in-office spirometry.

The primary outcome of interest was assessing the change in self-rated comfort level with interpreting spirometry after the education session (comparing questions 2 and 3 on the Post-Education Provider Survey- Appendix G). After the educational session, with their answers to question 2, each respondent rated his or her self-comfort level at interpreting spirometry before the intervention. This response was compared to their response to question 3 after the educational session.

Despite the poor attendance overall, the providers’ reported comfort-level in their ability to interpret spirometry reports increased by an average of 30.8% (M = 61.9, SD = 8.0 pre-intervention; M = 92.7, SD = 5.5 post-intervention). There was also an average overall 96.3% confidence (SD = 5.4) in ability to accurately interpret a spirogram in the imminent future following the educational session. A paired t-test was used to determine that there was a significant difference in the retrospective rating of scores pre-intervention and post-intervention (t(2) = 5.39, p = .033), indicating that the spirometry training session significantly improved the providers’ confidence in their ability to interpret spirometry reports when providing asthma care.

The provider survey also revealed that providers were previously utilizing the national asthma guidelines an average of 73.6% (SD = 23.7) of the time, and did value their utility (M = 91.9, SD = 1.27) in their personal practice. All responses to the final open-ended question (question 7) soliciting feedback for future suggestions: “Which aspects of asthma/spirometry should be reviewed again soon (if any)?” included: (a) “Make sure utility has increased in office”, (b) “Interpretation yearly”, and (c) “Helps to have guideline”.

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Objective Three: Evaluation of Spirometry Use

During fiscal year 2015, plain spirometry (CPT 94010) had been ordered twice, with zero orders in the month of July. During the month of July 2015, the office saw 41 unique patients with a diagnosis of asthma listed on the encounter. This included two new clients to the office. In-office spirometry was not ordered for any of the clients during this time period.

During July 2016, immediately following the clinical support staff spirometry training and provider educational sessions, the office saw 46 unique patients with a diagnosis of asthma listed on the encounter. This included 4 new clients to the office. In-office spirometry (basic spirometry- CPT 94010) was ordered twice by the same provider, 12 days apart. One of these spirometry orders was placed for one of the new clients to the office, supporting guideline-recommended asthma care. It was anticipated that spirometry use would increase following the training and educational sessions and this hypothesis was confirmed as in-office spirometry use from 2015 to 2016 increased by twofold. This primary care office utilized their spirometer as much during the one month following this project’s interventions than it did the entire 2015 fiscal year.

Referrals outside the office for pulmonary function testing during the month of July 2016 occurred 7 times. Routine pulmonary function testing was ordered 5 times and basic spirometry was ordered twice. Of these orders, in only two instances was spirometry used for a diagnosis of asthma. Other diagnostic indications included reactive airway disease, dyspnea (3 patients), and dyspnea on exertion. Referral data from 2015 has been requested but as of yet is not available at the time of this writing.
Implications for Practice

Several successes occurred during the implementation of this project, despite numerous difficulties, and many recommendations can be made to better inform future efforts. A discussion of both strengths and successes related to each objective is provided, followed by a summary of the project weaknesses and difficulties encountered. Following this, the selected conceptual frameworks and implementation model will be used to analyze the process and outcomes of this project. Next, limitations to the project will be reviewed, followed by a plan for sustainability. Finally, the findings from this project will be related to other evidence and current healthcare trends, and the student will reflect on how this project experience led to enactment of the DNP competencies, as described in the American Association of Colleges of Nursing position paper, *The Essentials of Doctoral Education for Advanced Nursing Practice* (2006).

Objective One: Clinical Support Staff Spirometry Training

**Strengths and Successes**

The clinical support staff spirometry training took place during the second portion of the mandatory monthly meeting hour, and thus was well attended. The student heard positive affirmation from the practice manager, site mentor, and clinical support staff that the staff overall were eager to hone their clinical spirometry skills and review how to document the process in the new EMR. The student had support from an information technology (IT) liaison employed by the EMR vendor, who was extremely helpful in negotiating the details of the EMR and troubleshooting issues as they arose, such as finding that the pre-and post-bronchodilator spirometry order (CPT 94060) was not listed as a point-of-care test. The practice manager was in full support of this project and allotted the student time to add this material to the monthly meeting. Although the clinical support staff monthly meeting was mandatory, most of the staff
in attendance filled out the voluntary post-training survey. There was general appreciation from the clinical staff for this education and for reviewing in greater detail the step-by-step process, because most of what they knew was only enough to satisfy the requirements of the annual competency validation. The validation is comprised of a successful demonstration of calibrating the office spirometer.

**Weaknesses and Difficulties**

Originally, an actual live demonstration of the process of calibrating the spirometer and modeling how to coach a client to perform spirometry were planned, but this was not possible for several reasons. Also, it was planned that a projector would be available for use during the training so that one of the clinic laptops could be used in the EMR training environment to highlight each step of the demonstration live on-screen. However, despite assurances it would be available, a projector was not available; and as a result a PowerPoint presentation had to be created with multiple screen shots and photographs of equipment to attempt to clearly articulate the process. Also, because there was no EMR display, the clinical support staff could not practice or walk-through the steps in a safe training environment after reviewing them in the training session. The hands-on practice may still not have been possible because of the aforementioned time constraints, but it would have been preferable to have had this option.

When examining the evaluation aspect of the spirometry training session there were areas that could have been improved. The post-training survey was anonymous and no attendance tally of clinical support staff was done. A total participant count would have proved useful in order to determine what percentage of training session attendees submitted a survey and to better inform the results from the data analysis. It is estimated that most of the clinical staff in attendance completed a survey, but it would have been ideal to have an exact number.
At the beginning of the training session, the practice manager introduced the student and announced that he would be available the rest of the morning and until 1pm as a spirometry resource. The intent of this was to allow time for staff to review the spirometry processes, to actually practice spirometer calibration with the office spirometry equipment and clinic computer, and to demonstrate spirometry coaching in the training environment of the EMR on a clinic laptop. This was also announced following the training session. No clinical support staff approached the student with any questions or requested a walk-through of any steps in the EMR.

Perhaps there would have been additional attendees at future opportunities if a similar training could have been made available to clinical support staff. However, as no interest was shown immediately after the session, no further effort was applied to this endeavor. It is difficult to believe that none of the staff had any questions about the process of performing spirometry. Considering that several responses mentioned how demonstration would have been helpful and given the low pre- (31.5%) and post-training session (63.6%) average confidence level in ability to perform spirometry, it is likely that there were clinical staff who were not entirely comfortable with the process.

Given the sub-optimal confidence level of the clinical staff in their ability to perform spirometry post-educational session, additional opportunities to practice using the spirometry equipment should be provided in the future. This demonstration time could perhaps be on a voluntary basis over the lunch period, or included in a mandatory monthly clinical staff meeting for a portion of the hour. Having a clinical support staff member trained as an “expert user”, in a role similar to the one performed by the site mentor NP as the office “asthma champion”, is a viable strategy supported by the literature (Roberts, Smith and Partridge, 2011) to lend assistance to support staff who do not feel comfortable with the spirometry process.
Objective Two: Provider Educational Session

Strengths and Successes

This project was greatly impacted by the good fortune of having a certified asthma educator available to share her expertise and practice experience. Almost all of the content in the provider educational sessions was presented by this educator, who used her own PowerPoint presentation reviewing the role of spirometry in managing asthma care. The certified asthma educator brought many examples of spirometry reports and case studies. She used these to interact with the providers, and systematically assisted them in interpreting a spirogram and determining how the results impact care. The providers expressed appreciation at having her available, and she offered her services as a resource as she does for other primary care offices in the same health system. Another strength is that the site mentor NP was present for the clinical staff training session as well as both provider educational sessions and, as she plans to function as the site “asthma champion,” she can work to share what she has learned within her sphere of influence in the office.

Weaknesses and Difficulties

The most glaring weakness in this project was the poor attendance at the provider educational sessions. This occurred despite having the practice manager announce the “lunch and learn” educational sessions at each morning huddle for at least a week prior to the first session, and the distribution of fliers (Appendix H). An announcement was made for providers present in the office on June 23rd (6 days prior to the first presentation). Fliers were left at work stations for providers who were not present on the 23rd and the practice manager was also given additional copies to distribute as appropriate. The providers in attendance were very appreciative of the educational session and willingly chose to fill out the voluntary surveys. However, it was
hoped that the provider attendance would have been more robust. Unlike the clinical support staff training sessions, which were mandatory, the provider educational sessions were voluntary, and held during the lunch hour. The office does have a monthly provider meeting. The student petitioned to present at this meeting, but the agenda had been set for some time prior to the educational initiative and time for the educational session could not be included.

**Objective Three: Evaluation of Spirometry Use**

**Strengths and Successes**

The most obvious success of the measurement of in-office spirometry use was the twofold increase in basic spirometry use from July 2015 to July 2016. In fiscal year 2015, basic spirometry was only ordered twice and not at all in the month of July. In July 2016, the month after the clinical support staff spirometry training session, and provider educational sessions, the office achieved the same amount of spirometer use that was realized in the year prior to the project. A second success was that one of the uses was for a brand new client to the office on their first visit. This, to a certain extent, highlights the fact that the importance of in-office spirometry and its role in driving asthma care may have been internalized by at least one provider.

Another strength of this study was that this student strove to creatively communicate the importance of spirometry in asthma care and attempted to clearly deliver the message of how optimal asthma care should be planned using the national asthma guidelines. The assistance of a certified asthma educator was enlisted to help drive home spirometry interpretation, and how spirometry should be incorporated into clinic visits and routine care, in accordance with the guidelines.
Weaknesses and Difficulties

The baseline data collected at this primary care office was over a one-year time period and it would have been ideal to have a longer post-intervention evaluation period beyond the one allotted. Most of the studies discussed in the review of the literature included an observational data collection period of at least 3-6 months. This organization’s IT specialists had a much more difficult time extracting out-of-office referrals from the prior EMR for the month of July 2015, and as of this writing this information is still not available.

Project Limitations

This project has several limitations that must be discussed. A chief challenge in enacting this quality improvement initiative is that the student is not a provider at this primary care office and thus cannot influence other providers’ opinions or drive change in the same way an embedded provider could. It was previously determined through the steps of the organizational assessment that the topic of improving asthma care was a priority for the organization. This determination is a key step before proceeding (Titler et al., 2001).

The student may have selected a problem-focused trigger in the form of office-based spirometry that was seen as a priority to him and not the organization as a whole. It is possible that the student may have misinterpreted the lack of spirometry use as a deficit in knowledge or confidence, rather than one of value and perceived utility by the clinicians. If this was the case, the next step in the Iowa model would be to examine the problem-focused and knowledge-focused triggers, and then choose a topic more in line with the priorities of the organization (Titler et al., 2001). It is important to note that primary care based spirometry is supported and encouraged by both the national asthma guidelines (NHLBI, 2007) and the literature (Derom et al, 2008) and that this was an evidence-based translation project at its core.
Another limitation and challenge this project faced is that the educational interventions targeted only two of the three determinants of human behavior according to social cognitive theory (Bandura, 1986). Cognitive factors such as knowledge deficits and general attitudes relating to the use of spirometry were directly addressed in the training and educational sessions. Similarly, behavioral factors in the form of skill sharpening and increased self-efficacy at performing and interpreting spirometry were targeted in the interventions. The third component determining human behavior, environmental factors, was not addressed to the same extent as the other two factors. To affect this domain, social norms relating to a culture that embraces the suggested practice change would need to be addressed. This was difficult as only 27.2% of the providers in the office attended the provider educational sessions, making a large scale culture change in the way asthma care is provided a challenge.

A third limitation to this project suggested by the Chronic Care Model (Bodenheimer, Wagner & Grumbach, 2002) is the inability of this intervention to solidify any lasting change in structure of the office’s delivery system design. Such a change is most likely beyond the scope of a time-limited intervention such as the one employed in this project, but nonetheless deserves consideration. The CCM calls for the intentional arrangement of planned visits to manage chronic conditions. The use of spirometry in assessing asthma control and managing medication therapy at periodic intervals is recommended by the national asthma guidelines.

Out of necessity, the interventions used in this project were performed in relative isolation. The clinical support staff received training on how to perform spirometry, and the providers reviewed the interpretation and utility of spirometry to drive care, but no overarching plan to integrate the two was solidified. Each clinical group was aware of both interventions but
more intentional communication between providers and clinical staff could have improved the provision of office-based spirometry for clients with asthma.

Time constraints were certainly limitations identified in this project. This primary care office holds only one clinical support staff monthly meeting and one provider meeting each month. The student was fortunate to have been invited to present at the clinical support staff meeting, but even this opportunity had time constraints preventing the ability to actually demonstrate the use of spirometry. During both interventions it was exceedingly difficult to share information with all personnel as a result of absences due to factors such as, vacations, emergent patient care situations, or disinterest. Mass e-mail communication was considered as a means of disseminating the provider educational sessions but the student was not granted this access and informed that this is not a reliable or valued form of communication amongs the providers.

Additionally, the student would like to acknowledge that after reflecting further on the project evaluation, both surveys could have been improved. The first item of the post-training clinical staff survey (Appendix E), should be amended to specify whether the staff had ever before performed spirometry in that particular primary care office. In the same way, on the post-education provider survey, (Appendix G), the first item should specify whether the provider ever ordered in-office spirometric testing at that office. This would allow for the subsequent education activities to be tailored to this office in order to gain further understanding of the current practice. To better align with social cognitive theory and the construct of self-efficacy, the term “comfortable” on questions 2 and 3 of both surveys should be replaced with “confident” (Bandura, 1986).

On the provider survey (Appendix G), it would have been beneficial to assess the confidence of the providers in their ability to interpret a spirogram before the educational
session, so that this item could be compared to question 4, which assesses confidence in the ability to interpret a spirogram “tomorrow”. In the same way, it would have been useful to change question 5 to assess perceived usefulness of the asthma guidelines before the intervention so that a paired t-test could be performed to assess change in perception more accurately. These additions would have taken slightly longer for the respondents to complete, but would have allowed for more direct comparison during the data analysis.

**Recommendations for Sustainability**

It is important for any quality improvement project to consider sustainability and how to keep a worthy initiative valued by stakeholders (Titler et al., 2001). The literature discussed in the aforementioned evidence-based initiative section recommends periodic re-education and training to ensure quality spirometry reports are being generated by support staff, and that providers maintain their competence in interpreting them (Eaton, Withy, Garrett, Mercer, Whitlock & Rea, 1999; Lusuardi et al., 2006; Represas-Represas et al., 2013; Zanconato, Meneghelli, Bragas, Zacchello and Baraldi, 2005). To be effective, interventions must be tailored to the practice environment and culture in which they will be implemented (Ragazzi, Keller, EMRensberger & Irani, 2011).

The literature also highly recommends an “asthma champion” in the form of a provider who takes responsibility for acting as a spirometry expert and resource to lend aid to other providers in the office. Utilizing an office clinician to function as a change-agent clinician is one way to help continually educate other providers on implementing the national asthma guidelines (Lozano et al., 2004). The student’s site mentor NP graciously offered to function as the “asthma champion” of this practice and to support and encourage the use of in-office spirometry. As previously mentioned, the NP’s collaborating physician asked her to work on improving
asthma care in the office. Hopefully, this project helped to endorse her support of office-based spirometry through her participation and presence. This student helped bolster the NP’s role as “asthma champion” by sharing her willingness to function in this capacity with the staff at the morning huddle on August 11th, when the results of this project were disseminated. The practice manager was also made aware of the NP’s desire to function as a change agent in supporting sustainability efforts for promoting office-based spirometry.

When considering maintenance of the clinical competency of the providers in interpreting spirometry, it would be beneficial for providers in this office to have the option of attending an in-service similar to the two provider educational sessions presented in the “lunch and learn” offerings of this project. The certified asthma educator had presented evidence-based asthma care practices to three other offices in the same health system, and was available on an as-needed basis to provide education to those who did not attend. One of the suggestions given by one of the providers on the post-education provider survey was to review interpretation yearly. This seems prudent. Future educational refreshers could perhaps be conducted during one of the monthly provider meetings to expand the initiative to more providers. These may only require 30 minutes for review of the basic information following the two in-depth sessions led by the asthma educator during this project.

To ensure the accuracy, quality, and sustainability of primary care-based spirometry, the literature recommends close contact with a pulmonology office for the best long-term results (Lusuardi et al., 2006). The rationale for this arrangement is to provide expert support for the clinical staff in the primary care setting, either on an as-needed or scheduled basis. To address the sustainability of this project, the student contacted a pulmonologist in the same health system as the primary care office. After establishing contact with this pulmonologist the student
discovered that this provider no longer visits the primary care office where the intervention took place, but his partner does. This specialist shares office space with the primary care office on Wednesdays.

The intention behind this action was twofold. First, it was an attempt to make the pulmonology office, and this provider in particular, aware of the spirometry initiative taking place in the primary care office. Second, it was intended to solicit his help on an as-needed basis, in the event a provider in the office encounters a difficult spirogram to interpret, or has a question pertaining to spirometry-based asthma care. It is hoped that the pulmonologist could answer while on-site. At the time of this writing the appropriate pulmonologist was contacted, but there has not been a response. Her suggestions for sustaining the efforts of this project would also be appreciated.

A significant recommendation that the student would make to further the sustainability of this project would be to make a video recording of actual spirometer calibration and use. A major limitation to this project was the lack of hands-on demonstration and practice time with the spirometry equipment at the monthly clinical staff meeting. Although beyond the scope of this project, creating a recording of the spirometry process would be a powerful way to standardize and optimize spirometry throughout the organization. This content could then be uploaded onto the organization’s clinical resource page on the local network. This video or a series of videos would allow clinical support staff the opportunity to observe how to handle the equipment and how to safely coach a client through performing a series of spirometric maneuvers.

Although certainly not hands-on, this vicarious experience would afford office staff an opportunity to see a walk-through of how the entire spirometry ordering, calibration,
performance of maneuvers, documentation, and sanitizing equipment process flows. This recording could perhaps be played annually before the spirometry competency at a mandatory clinical support staff meeting, and even shared throughout the organization so other offices and practice settings could benefit. If such an annual review took place it would be beneficial to have a standard agenda item encompassing spirometry and how the clinic’s in-office spirometry use had been since it was revisited last.

Although a formal business case was not part of this project, being a good steward of resources and utilizing existing office-equipment to drive evidence-based care certainly was. It was beyond the scope of this project to determine the amount of time required for spirometer calibration and performance of spirometry maneuvers by a clinical support staff member, how this time compares to pre-and post-bronchodilator spirometry maneuvers, and how these times correlate to workplace productivity and overall net gain to the organization. The MidMark IQSpiro spirometer was purchased in 2011, prior to the current practice manager’s administration. It was not part of this project, but it would be of interest to ascertain if the office recouped the cost of the machine over the years through in-office use. A MidMark representative was contacted but he was not able to provide an average life span for an IQSpiro spirometer. The current model is already almost six years old. There are newer models that do not require calibration and are thus simpler to operate. It would not be prudent to purchase a newer device until the older model has been paid for. Part of a future business case, therefore, could be to see if the current spirometer has paid for itself. If not, how many uses would be required to do so.

Two other recommendations that were beyond the scope of this scholarly project but would be useful to sustaining office-based spirometry at this practice site include the creation of
an asthma registry, and performance of a timed spirometry calibration and performance walk-through. The formation of a registry containing data for all of the clients with an established diagnosis of asthma would align with the chronic care model tenet of delivery system design (Bodenheimer, Wagner & Grumbach, 2002) and would allow for organized tracking of spirometry completion and scheduling. Time studies for the length of time required for spirometry calibration and performance may better inform office staff of the impact on their workflow. It may also provide further insight into a business case for a cost-benefit analysis.

Relation to Other Evidence and Healthcare Trends

The challenges this project faced seem to echo the struggles other health care organizations are experiencing when attempting to institute quality improvement initiatives. These barriers include competing priorities, a lack of specificity and agreement regarding the desired process changes, and limited engagement of providers (Hroscikoski, Solberg, Sperl-Hillen, Harper, McGrail & Crabtree, 2006). Many organizations are seeking implementation models such as the Iowa Model (Titler et al., 2001) used in this project, to attempt to identify and promote organizational priorities that can sustain lasting change for the well-being of all. Researchers support the notion of utilizing a practice facilitator, such as a change agent champion promoted in this project, as a way to implement evidence-based practices (Baskerville, Liddy, & Hogg, 2012). There is much needed change in health care and the barriers seen and strategies utilized in this project are consistent with current literature.

In Canada, there is a growing concern and need for improving the chronic disease prevention and management practices of the national health care system (Morgan, Zamora & Hindmarsh, 2007). As more individuals live with chronic diseases, they are at increased risk for developing more chronic illnesses and coordinated, comprehensive chronic disease care is
needed more than ever to improve the health of individuals and populations and to ensure sustainability of the health care system. The authors discuss the rift between recommended and received care, and list episodic care, poor integration of clinical decision support tools, and reluctance to measure quality and performance as barriers that prevent clinicians from providing the standard of care that minimizes the burden of chronic disease. Asthma is one such chronic disease, and the chronic care model (Bodenheimer, Wagner & Grumbach, 2002) was utilized in this project and also recommended by Morgan, Zamora and Hindmarsch to improve outcomes and decrease costs in the Canadian health care system.

In the healthcare literature there is also emphasis on improving quality of life while reducing health care utilization. Chronic respiratory conditions especially confer a significant burden on individuals, families, and society at large. In 2009, a systematic review of disease-management interventions in asthma and COPD was conducted by Lemmens, Nieboer and Huijsman. The authors determined that multifaceted strategies to improve care delivery and disease management processes lead to better outcomes for all.

Again, the chronic care model (Bodenheimer, Wagner & Grumbach, 2002) was cited as a strategy to improve care through patient engagement in the form of increased responsibility for self-management and improved care coordination by providers. While not the focus of this project, asthma self-management education combined with other evidence-based guideline-recommended approaches, like spirometry-driven care, can work synergistically to improve care for individuals with asthma. Chronic disease management is complex and this scholarly project highlighted one small way to improve evidence-base asthma care through a provider education intervention.
Reflection on Enactment of DNP Essential Competencies

The American Association of Colleges of Nursing (AACN, 2006) recommends that DNP scholarly projects contain the eight Essentials associated with DNP education. Most of these eight essentials were developed through the process of planning, implementing, and evaluating this project and will be briefly discussed in the following sections.

Scientific Underpinnings for Practice

This project utilized three different conceptual models from varying disciplines to plan and guide the interventions and to improve the health of clients with asthma through the provision of evidence-based care supported by the national guidelines. In addition, this project utilized science-based theories and concepts to evaluate the outcomes of the project through the creation of the two novel post-intervention surveys based on social cognitive theory (Bandura, 1986). The student introduced a practice change in the form of office-based spirometry and had to first analyze the current state of care and develop strategies to help the staff embrace a different way of caring for clients with a chronic respiratory disease, based on current guideline recommendations.

Organizational and Systems Leadership

Organizational and systems leadership was displayed through the process of conducting an organizational assessment of the practice site and determining what an appropriate intervention would be to meet the needs and goals of the organization. This project was designed with implications for the client, provider, practice, and health system in mind, and considered how care is currently delivered and how it could be improved in a way recommended by the literature. Leadership skills and advanced communication skills were displayed when interacting with key stakeholders at the practice site to ensure that the opinions and priorities of all parties
were understood and incorporated into the organizational assessment. The student considered the principles of business when examining how office-based spirometry would impact the office workflow and throughput, and rudimentary finance when detailing the revenue this intervention may bring to the office. The student sought to be a change agent that considered how the suggested practices would affect clinicians and planned the education accordingly.

**Clinical Scholarship and Analytical Methods**

The implementation of this project followed an extensive literature review of the existing evidence including systematic reviews, randomized controlled trials, quasi-experimental studies, and evidence-based guideline summaries. The findings from this synthesis of the literature were used to plan the intervention and allowed the student to be a content-expert in spirometry-driven evidence-based asthma care. This synthesis allowed the student to develop a guide for spirometry in primary care (Appendix I) to educate providers regarding the evidence-base for the suggested practice change. A new “How to perform Spirometry” job-aid (Appendix F) was also developed, in the form of a step-by-step clinical walk-through guiding clinical support staff to locate the spirometry equipment; calibrate the spirometer; perform standard or pre- and post- bronchodilator spirometry; to save and review the results; and to provide basic trouble-shooting suggestions, as well as where to obtain information technology support assistance if needed. Finally, descriptive statistics, paired t-tests, and box-plot charts were utilized to analyze the data generated from the interventions, and disseminated the findings orally and in the form of this scholarly project final report.

**Information Systems Technology**

In activities of this project, information systems and technology competencies were developed through close consultation with the EMR IT department, which ran various queries to
obtain data to understand the current and past office practices. The student also navigated the EMR in the test environment to develop, test, and document a clinical walk-through job aid for clinical support staff. The student advocated for changes to the EMR that would improve existing procedures. An example is the suggestion of adding the pre- and post-bronchodilator CPT code to be performed as a point-of-care test. The student was prepared and technologically proficient to demonstrate and assist others to practice calibrating the spirometer and in performing spirometric maneuvers in the EMR training environment to facilitate hands-on practice. Microsoft Excel and SPSS 20 were used to analyze the data from the surveys to evaluate the training and educational interventions.

**Advocacy for Health Care Policy**

This project did not incorporate advocacy for health care policy directly into this project aside from analyzing literature that had aspects of health policy and from assessing existing practices within the health care system. There is still room for growth in this DNP Essential. The student attended a meeting of the Asthma Network of West Michigan, co-led by this project’s certified asthma educator, and learned about local initiatives and grants that are being utilized to improve care for individuals with asthma in the region. The student also attended a statewide asthma educator sharing day sponsored by the Michigan Department of Health and Human Services and learned about statewide initiatives and research that is taking place to promote and optimize asthma care in Michigan.

The student also accompanied Asthma Network staff on home visits to directly observe innovative home-based asthma case management services being provided to individuals with uncontrolled asthma in West Michigan. This experience naturally led the student to communicate to providers the resources the local asthma network has to offer clients seen in the
project site. Health policy such as the recent smoking legislation improvement efforts directly affects those living with asthma. Hopefully, more environmental protection efforts will be seen in the future.

**Interprofessional Collaboration**

This project extensively used collaboration with other disciplines including clinical support staff, providers, the practice manager, information technology specialists, and specialists within the health system. These collaborative efforts required the student to communicate effectively via many routes to advocate for the approval and to garner support for the evidence-based intervention. The student directly partnered with the certified asthma educator to plan the provider educational sessions and also closely partnered with a medical assistant to understand current office procedures, challenges, and expectations. He also worked extensively with the practice manager to plan the training and educational dates, disseminate information and announcements, and understand the office culture in a meaningful way that informed this project.

**Population Health and Clinical Prevention**

This project analyzed the way health care is currently provided to clients with asthma in this primary care office and helped to deliver a tailored intervention to improve care for this population. Epidemiologic data regarding the prevalence of asthma in the region helped to inform the literature review and the evidence-base for a change in practice. This intervention was carefully planned in such a way that considered the way the objective measurement of lung function was obtained in the office, and then sought to make a care delivery improvement that could be administered in the office but would have the ability to drive care in the moment.
**Advanced Nursing Practice**

This project sought to facilitate optimal care and promote improved patient outcomes for individuals with asthma. The student functioned as a change agent in the office by conducting an assessment of the organization, identifying gaps in care, and leading educational interventions with staff to improve the care this office provided to clients with asthma. Through the organizational assessment this project also evaluated the links among practice, organizational, fiscal, and policy issues. The student extensively utilized systems thinking to design the interventions and to determine how best to deliver the education and analyze the data. He also acted as a guide through this intervention, encouraging the office to transition to a better care delivery system more in line with the national asthma guidelines.

**Dissemination of Outcomes**

The last step of the Iowa Model (Titler et al., 2001) is to disseminate the results. The outcomes of this project were presented through an oral presentation at the university on August 8th, 2016, in the presence of the student’s project advisory team and the student’s family. The tentative project plan was already disseminated orally to the 2016 DNP cohort as well as other DNP students. The outcomes of this project and future recommendations to maintain the sustainability of in-office spirometry to drive asthma care were briefly disseminated with the staff of the primary care office at an all-staff am huddle meeting on August 11th. The outcomes and recommendations of this project were also shared with the practice manager of the primary care site through electronic communication, as she declined a face-to-face meeting. A copy of the “How to perform Spirometry” job-aid (Appendix F) clinical walk-through and the “Spirometry in Primary Care” (Appendix I) reference for providers was distributed to two NPs at
different primary care offices in the same health system who are resident asthma experts and assisted with aspects of this scholarly project.

**Conclusion**

A quality improvement project was conducted in order to improve the use of office-based spirometry to drive evidence-based asthma care at a primary care practice in the Midwest. The objectives included: (a) to train and educate the clinical support staff on the process of performing and coaching spirometry; (b) to educate providers on the interpretation of spirometry reports and to review the national asthma guidelines; (c) to evaluate the effectiveness of the education and training regarding the clinical staff’s confidence in their ability to perform and interpret spirometry; and (d) to determine if this intervention increased the office’s utilization of spirometry.

Project outcomes included increasing the clinical support staff’s confidence in their ability to perform spirometry by an average of 32.1% and increasing the providers’ confidence in their ability to interpret spirometry by 30.8%. There were many barriers and limitations experienced during the enactment of this project such as the poor attendance rate by the providers (27.2%), possibly indicating a lack of engagement in the evidence-based initiative. This project offers a sustainability plan for continuing the initiative of office-base spirometry in this primary care office which could greatly impact the care delivery, and ultimately, outcomes and quality of life for clients with asthma in this office. The student also developed and refined aspects of all of the DNP Essential competencies through the completion of this scholarly project and will incorporate these experiences and knowledge to impact care and drive change as the DNP journey continues.
Figure 1. Clinical support staffs’ confidence level at performing spirometry before and after the training session.
Figure 2. Providers’ confidence level at interpreting spirometry before and after the training session.
Appendix A

The Chronic Care Model

Community

- Resources and Policies
- Self-Management Support

Health Systems

- Organization of Health Care
- Delivery System Design
- Decision Support
- Clinical Information Systems

Informed, Activated Patient

Productive Interactions

Prepared, Proactive Practice Team

Improved Outcomes

Retrieved from:
http://www.improvingchroniccare.org/index.php?p=Chronic+Care+Model&s=124

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Appendix B
The Iowa Model

Diagram is reproduced with permission:

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Appendix C

Social Cognitive Theory

Diagram is reproduced with permission from ETR and ReCAPP (Resource Center for Adolescent Pregnancy Prevention):

“All material on ReCAPP may be reproduced and distributed for educational and research purposes, providing you credit ETR and ReCAPP as the source and use the material as written”
Appendix D
Design for the Evidence Based Initiative

Step 1 • Develop a comprehensive clinical support staff spirometry demonstration training session (EMR screenshots, calibration, performance, infection-prevention measures)

Step 2 • Partner with Karen Meyerson to develop a provider spirometry interpretation and evidence-based guideline lunch session review and evaluation strategy

Step 3 • Obtain IRB Determination

Step 4 • Conduct clinical support staff demonstration and training

Step 5 • Conduct provider education sessions

Step 6 • Collect data

Step 7 • Complete steps to present Final Scholarly Project Report to KCON community

Step 8 • Disseminate results to clinic staff
1. Have you EVER performed spirometry before?  

YES  NO

2. How comfortable were you with performing spirometry BEFORE this session?
(Draw a mark on line where your comfort level WAS)

NOT Comfortable ———————————————————— VERY Comfortable

3. How comfortable were you with performing spirometry AFTER this session?
(Draw a mark on line where your comfort level is NOW)

NOT Comfortable ———————————————————— VERY Comfortable

4. Using the job aids do you think you could perform spirometry on a client tomorrow?

NOT Sure I Could ———————————————————— VERY Sure I Could

5. Which aspects of spirometry should be reviewed again soon (if any)?
Appendix F
How to Perform Spirometry Guide

Initial Troubleshooting: Check that athenaNet Device Manager is installed:

a. Open your browser.  
b. Log into athenaNet.  
c. Go to the Device Management page (Main Menu > Settings > Device Management)  
d. In the athenaNet Device Manager section, make sure the Status displays as Running and a version number appears. If not, download current version or call Local Help Desk below.

CALIBRATING SPIROMETER

-Spirometer must be calibrated once per day (by first user)  
-Software will prompt calibration prior to actual test  
-Calibrate in equipment storage room (Exam #26)  
-Machine will direct process after connection with USB port (IQ USB port) if updates current

1. Choose **SPIROMETER CALIBRATION** (lower right)  
2. Now on **CALIBRATION UTILITY** screen, choose **CALIBRATION**  
3. Fill out form: **PERFORMED BY** - enter full name  
4. **SYRINGE VOLUME** = 3,000mL  
5. **SYRINGE S/N** (Southwest): 557-32568  
6. **PRESSURE** - 760 mmHg  
7. **SENSOR SN** - 543731  
8. Fully attach spirometry canister to LONG end of CALIBRATION ONLY mouthpiece  
9. Choose **NEW CAL**  
10. Select **START CAL**  
11. Instructions will appear directing user to slowly pull OUT plunger. Begin pushing plunger in EVENLY matching speed with blue moving line. After several repetitions (at least 3) a **VERIFICATION PUMP** box will appear designating a **PASS** or **FAIL** status. Answer question **IS THIS ACCEPTABLE?** – with **YES** (pass) or **NO** (fail). Fail (NO) means calibration process must be restarted.  
12. After receiving **PASS (YES)** designation, choose **EXIT** to return to main screen where actual spirometry tests will be performed
13. Please initial Calibration Log form in the Spirometry Binder with the current date to track use.

Follow these instructions if prompted while using MidMark IQSpiro Spirometer:

(*Please make sure the AthenaNet Device Manager Tray application is running. If it is running, please update the tray application. To do so, visit the device management page (under settings), click the "show advanced ADM files" link, then download and run athenaNetDeviceManagerSetup.exe. Once running, click "Perform Test" again.*)

**BASIC SPIROMETRY (CPT 94010)**

- Software will prompt spirometer calibration if not performed already
- Attach new disposable spirometer mouthpiece to spirometer handle (**SAVE CALIBRATION ONLY** mouthpiece- place in spirometry drawer for next days use)
- After obtaining order under diagnosis code (asthma, shortness of breath, wheezing, etc.) choose **SPIROMETRY** (CPT 94010)
- **SAVE** order to have **PERFORM SPIROMETRY** icon appear next to “N/A (Point-of-care test)”
- If patient had prior spirometry, the last results screen should appear, if not new empty results screen will appear
- **AGE, GENDER, HEIGHT, WEIGHT**, and **RACE** need to be recorded in chart somewhere for program to make predicted values for client

1. Choose **START NEW TEST**
2. To choose display settings (vertical meter, **BIRTHDAY CANDLES**, trees, etc.) choose: **SETTINGS → INCENTIVE/MISCELLANEOUS**, under incentive display type follow drop-down menu to select most appropriate display (**BIRTHDAY CANDLES**), press **APPLY** then **OK** (should be saved for future tests)
3. Middle **BLUE BOX** should always say “**PRE-BRONCHODILATOR**” with the **GREY PRE** box highlighted, Select **START NEW TEST** below the **PRE** (machine will zero)

**PREPARING PATIENT FOR TEST:**

A. Remove restrictive overgarments, Remove gum/candy from mouth
B. Sit up straight BOTH feet flat on floor holding head level
C. Nose Clips NOT recommended unless client requests (be consistent)
D. Have client hold spirometer with BOTH hands, position them so they are not blowing on computer but can see display to motivate them

E. Bite mouthpiece hard AFTER inhaling and seal lips around tightly

“Deep breath in and then BLAST air out as FAST and HARD as you CAN to blow out all the candles (GOAL= at LEAST 6 seconds for ADULTS, at LEAST 3 seconds for children over 5)

“Once you begin breathing in I will cue you to BLAST air out and yell GO GO GO until you have pushed all the air out of your lungs as FAST and HARD as POSSIBLE”

-Be alert for clients who become dizzy/lightheaded

-Coch client avoid bending over

4. Screen with candles will show up stating “Start when ready…”

5. Begin first test by having client FORCEFULLY BLAST air out until their lungs are empty (screen will show progress with #liters of air blown and a % on bottom)

6. Once client finished and stable hit ENTER, click STOP or wait for SPIROMETRY GUIDELINES screen to automatically appear which will either state GOOD TEST or give feedback for client to perform better next time. ALWAYS choose the YES radio button to ACCEPT TEST (unless extremely poor effort or interruption occurs- then discard that maneuver)

7. The SPIROMETRY GUIDELINES screen will tally the ATTEMPTED, ACCEPTED, and MATCHED tests

8. NEED at LEAST 3 breaths with 2 GOOD matches and 3 ACCEPTED tests (limit of up to 8 breaths per session) Once this happens, select NO on SPIROMETRY GUIDELINE screen when prompted to perform another test

9. Now back on main spirometry screen, Select the blue SAVE REVIEW button on bottom right of screen

10. Spirometry details screen of each maneuver will appear with an INTERPRETATION on the bottom box if a predicted value is listed for clients demographics

11. **IF provider desires a paper copy to reference select PRINT. If NOT select EXIT and skip to step 12. **IF they INTERPRET or make COMMENTS the report it MUST be
SIGNED and sent to MEDICAL RECORDS to have report scanned in to AthenaNet (default should be usual printer associated with computer, PRINT SETUP has drop-down menu to select printer)

12. A message asks if the test is done and ready to upload to athenaNet, select OK

13. A preview of the spirometry report SHOULD be visible below the order with the full report accessed through the Edit Test button. **NOTE: The provider can interpret and make comments directly in AthenaNet in the Results/Interpretations section via the SPIROMETRY Result section (Spirometry Result (Normal or Abnormal), Comments, and Result Note).

14. **LATER, IF the provider wants a Post-Bronchodilator test performed, order this separately (for billing clarity) however the test can be performed from the Main Spirometry Screen via selecting POST above Start New Test

Note: After a spirometry test has been saved, a Post-Bronchodilator test can still be added onto it when accessed via “edit test”

Note: Once spirometry test has been signed off, “edit test” is no longer available, but one still has access via preview on bottom of screen.

15. Remove mouthpiece (save in plastic wrap until client leaves - ? bronchodilator trial per provider order)

16. Wipe spirometer handle and USB cord down (avoiding inside electronics) with any disinfecting wipe (Clorox, purple CHG wipes, alcohol swab) DO NOT SUMBERGE HANDLE

17. Return spirometer to Exam Room #26 to drawer

18. Dispose of mouthpiece in waste receptacle

**PRE/POST BRONCHODILATOR (CPT 94060)**

-Should be functional in AthenaNet at Mercy Health

1. Order PRE/POST BRONCHODILATOR SPIROMETRY (CPT 94060) under diagnosis
2. Perform spirometry according to BASIC SPIROMETRY walk-through, remove spirometer from exam room back to circulation
3. Provider must order a nebulized bronchodilator treatment (albuterol)
4. Client must rest for 15 minutes after completion of nebulizer

5. Find the result document that contains the pre-bronchodilator report (under orders) and select **UPDATE RESULTS** (open report) which should display the main spirometry test page displaying the pre-bronchodilator test results, the grey **POST** button should be pre-selected above **START NEW TEST**, select this

6. Perform a second round of maneuvers collecting at LEAST 3 breaths with 2 **GOOD** matches and 3 **ACCEPTED** tests (limit of up to 8 breaths per session) Once this happens, select **NO** on **SPIROMETRY GUIDELINE** screen when prompted to perform another test

7. Now back on main spirometry screen, Select the blue **SAVE REVIEW** button on bottom right of screen

8. Spirometry details screen of each maneuver will appear with an **INTERPRETATION** on the bottom box if a predicted value is listed for clients demographics

9. **IF** provider desires a paper copy to reference select **PRINT**. If NOT select **EXIT** and skip to step 10. **IF** they INTERPRET or make written **COMMENTS** on the report it MUST be SIGNED and sent to **MEDICAL RECORDS** to have report scanned in to AthenaNet (default should be usual printer associated with computer, **PRINT SETUP** has drop-down menu to select printer)

10. A message asks if the test is done and ready to upload to athenaNet, select **OK**

11. A preview of the spirometry report **SHOULD** be visible below the order with the full report accessed through the **Edit Test** button. **NOTE:** The provider can interpret and make comments in the **Results/Interpretations** section via the **SPIROMETRY Result** section (Spirometry Result (Normal or Abnormal), Comments, and Result Note). Note: Once spirometry test has been signed off, “edit test” is no longer available, but one still has access via preview on bottom of screen.

12. Remove and dispose of mouthpiece in waste receptacle

13. Wipe spirometer handle and USB cord down (avoiding inside electronics) with any disinfecting wipe (Clorox, purple CHG wipes, alcohol swab) **DO NOT SUMBERGE**

14. Return spirometer to Exam Room #26 to drawer
Appendix G
Post-Education Provider Survey

1. Have you EVER ordered in-office spirometric testing?  **YES  NO**

2. How comfortable were you with interpreting spirometry BEFORE this session?
   (Draw a mark on line where your comfort level WAS)
   
   NOT Comfortable ———————————————————— VERY Comfortable

3. How comfortable are you NOW with interpreting spirometry AFTER this session?
   (Draw a mark on line where your comfort level is NOW)
   
   NOT Comfortable ———————————————————— VERY Comfortable

4. Using the job aids do you think you could accurately interpret a spirogram for a client tomorrow?
   
   NOT Sure ———————————————————— VERY Sure

5. BEFORE today how OFTEN did you utilize the National Heart, Lung, and Blood Institute 2007 Guidelines for Asthma care?
   
   Almost NEVER ———————————————————— Almost ALWAYS

6. How useful do you feel these asthma guidelines will be in your practice?
   
   NOT Useful ———————————————————— VERY Useful

7. Which aspects of asthma/spirometry should be reviewed again soon (if any)?
LUNCH & LEARN !?!  

ALL Providers Welcome

Spirometry Interpretation & Evidence-based Asthma Care Review

Wednesday, June 29th & Thursday, June 30th

Presented By:

- Karen Meyerson, NP, Certified Asthma Educator, Manager of the Asthma Network of West Michigan
- Doug Rau, RN, GVSU DNP Student

Approximately 1215-1315

Conference Room #2

*Dessert will be provided!*
Appendix I

Spirometry in Primary Care

**Asthma Statistics:**

- Asthma is a chronic condition with significant morbidity- 55% of adults with asthma have uncontrolled disease (Peters, Jones, Haselkorn, Mink, Valacer & Weiss, 2007)
- Michigan’s most recent asthma hospitalization was 13.3 per 10,000 citizens with an average of 13,617 hospitalizations per year (Wisnieski, Anderson & Wahl, 2015).
- Although most asthma deaths are considered preventable in 2013 110 individuals in Michigan died of asthma related complications (CDC, 2013)
- Locally, asthma affects 9.8% of Kent County residents with the highest prevalence among Black females (Fussman, 2015).

**Spirometry:**

- Providers have high variability in adherence to current national recommendations = National Asthma Education and Prevention Program’s Expert Panel Report 3 (Gipson, Millard, Kennerly & Bokovoy, 2000; Asthma Initiative of Michigan, 2014)
- Spirometry is the recommended objective measure to diagnose asthma and monitor asthma control nationally (NHLBI, 2007) and is part of international primary care guidelines (Levy, Quanjer, Booker, Cooper, Holmes & Small, 2009)
- Spirometry is often when diagnosing, treating, and managing asthma (Dostaler, Olajos-Clow, Sands, Licskai, Minard & Lougheed, 2011).
- Spirometry is woefully underutilized in primary care and making an asthma diagnosis without an objective measure of lung function has been implicated in misdiagnoses (Dostaler, Olajos-Clow, Sands, Licskai, Minard & Lougheed, 2011; Sokol, Sharma, Lin & Goldblum, 2015).
- Physician estimates of asthma severity appear to determine asthma care leading to ineffective care less in line with national guidelines (Wolfenden, Diette, Krishnan, Skinner, Steinwachs & Wu, 2003).
- Many barriers, chief one is lack of confidence in performing and interpreting spirometry (Goeman et al., 2005; Dombkowski, Hassan, Wasilevich & Clark, 2010).
- A systematic review of the implementation and impact of asthma protocols found that asthma guidelines improved provider performance and the care delivered to clients regardless of the manner of implementation (Dexheimer, Borycki, Chiu, Johnson & Aronsky, 2014).
- Without spirometry providers often overestimated the degree of asthma control, potentially leading to suboptimal therapy that may even endanger the asthmatic client (Nair, Daigle, DeCuir, Lapin & Schramm, 2005)
• In 66.4% of the previously diagnosed asthma clients had spirometry performed in a laboratory in the past but the general practitioners (GPs) had no record regarding the specialized diagnostic testing (Averame et al., 2009)
• Spirometry has the ability to impact GPs decision-making process (Chavannes et al., 2004) and to differentiate between chronic respiratory diseases
• Spirometry performed in the primary care setting detects a clinically significant amount of airflow obstruction and influences management practices for clients (Dales, Vandemheen, Clinch & Aaron, 2005)
• Yawn et al. (2007) found that following spirometry, decisions by providers to change management in occurred 48% of subjects which included 107 medication changes. Overall it was determined that family physicians can perform and interpret spirometry for asthma and COPD patients at rates comparable to other international primary care studies.
• Dostaler et al. (2011) discovered that asthma control was consistently overestimated by the subjective symptom standards if spirometry was not utilized.
• Buffels, Degryse, Liistro and Decrader (2012) office spirometry was more helpful than questionnaires, careful history taking and clinical examination.

Ordering Spirometry:

CPT 94010 Spirometry Complete- includes graphic record total and timed vital capacity, expiratory flow rate measurement(s) with or without maximal voluntary ventilation- National Average $37

CPT 94060 Bronchodilation Responsiveness- spirometry as in 94010, pre- and post-bronchodilator or exercise- National Average $62 (At Southwest bronchodilator = nebulized albuterol with post-spirometry 15 minutes after completion of nebulizer)

Mercy Health Southwest:
In fiscal year 2015 (7/1/2014 to 6/30/2015) there were 417 documented visit encounters that included a diagnosis of asthma on the visit summary with two instances of in-office spirometry use (basic spirometry- 94010)

Southwest Equipment:
In 2011 Office purchased a MidMark IQSpiro spirometer in 2011 (current price ~ $2600), housed with other equipment in Exam Room #26
Clinical support staff- part of annual competencies, reviewed calibration and performance of spirometry on 6-21-16.

Currently functional in AthenaNet, staff to print report (should be embedded digitally) to sign and scan. When performing pre-and post-bronchodilator order under “spirometry” and staff will select PRE then POST after nebulizer.

**SUMMARY:**

- Spirometry is recommended by national guidelines (NHLBI, 2007)
- Spirometry integral to avoid under and misdiagnosing asthma among individuals with respiratory symptoms (Dostaler, Olajos-Clow, Sands, Licskai, Minard & Lougheed, 2011).
- Not all asthmatics perceive their symptoms similarly and an objective feature of severity classification is crucial
- The patient and provider may have differing opinions or standards for what constitutes asthma symptoms and what control means. Thus spirometry as a physiologic measure of pulmonary function is an integral component in the assessment of asthma control.
- Office spirometry allows providers to tailor the management strategy in the moment in the client’s presence (PATIENT SATISFACTION) with no separate lab order or delays
- Without an objective measure of lung function providers and patients have a tendency to consistently overestimate level of asthma control, potentially leading to undertreatment of airway obstruction and serious sequelae (Nair, Daigle, DeCuir, Lapin & Schramm, 2005; Dostaler et al., 2011).
- The use of spirometry increases the diagnostic certainty when making an asthma diagnosis (Buffels, Degryse, Liistro & Decdramer, 2012) and influences the management of airway obstruction when it is detected in clients with respiratory complaints (Dales, Vandemheen, Clinch & Aaron, 2005).

**AthenaNet:**

Patient instructions → Templates → Search “asthma” → Asthma Action Plan Global, MG Asthma Action Plan

Assessment/Plan → Templates → ACT (Asthma Control Test), also Asthma (Pre-written statement “Patient advised on appropriate use of inhalers and avoid environmental irritants to which one is sensitive. No smoking and avoid second hand smoking also. Regular 30 mts exercise daily”
References (order of appearance)


NOTICE OF CLINICAL QUALITY IMPROVEMENT MEASUREMENT DESIGNATION

To: Douglas Rau, BSN, OCN
7331 Old Mission Drive
Rockford, MI 49341

Re: IRB# 16-0613-8
Implementing Spirometry-Driven Evidence-Based Asthma Care in a Primary Care Practice

Date: 06/13/2016

This is to inform you that the Mercy Health Regional Institutional Review Board (IRB) has reviewed your proposed research project entitled "Implementing Spirometry-Driven Evidence-Based Asthma Care in a Primary Care Practice". The IRB has determined that your proposed project is not considered human subjects research. The purpose and objective of the proposed project meets the definition of a clinical quality improvement measurement. All publications referring to the proposed project should include the following statement: "This project was undertaken as a Clinical Quality Improvement Initiative at Mercy Health and, as such, was not formally supervised by the Mercy Health Regional Institutional Review Board per their policies."

The IRB requests careful consideration of all future activities using the data that has been proposed to be collected and used "in order to assess quality and outcomes of the implementation of spirometry-driven evidence based asthma care at Mercy Health Southwest primary care office."

The IRB requests resubmission of the proposed project if there is a change in the current clinical quality improvement measurement design that includes testing hypothesis, asking a research question, following a research design or involves overriding standard clinical decision making and care.

Please feel free to contact me if you have any questions regarding this matter.

Brenda Hoffman
IRB Chairperson

Copy: File
Appendix K

Grand Valley State University Human Research and Review Committee Determination

DATE: June 14, 2016

TO: DOUGLAS RAU, BSN
FROM: Grand Valley State University Human Research Review Committee
STUDY TITLE: [919225-1] Implementing Spirometry-Driven Evidence-Based Asthma Care In a Primary Care Practice
REFERENCE #: New Project
SUBMISSION TYPE: New Project
ACTION: NOT RESEARCH
EFFECTIVE DATE: June 14, 2016
REVIEW TYPE: Administrative Review

Thank you for your submission of materials for your planned research study. It has been determined that this project: DOES NOT meet the definition of covered human subjects research* according to current federal regulations. The project, therefore, DOES NOT require further review and approval by the HRRC.

*Research is a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge (45 CFR 46.102(d)).

Human subject means a living individual about whom an investigator (whether professional or student) conducting research obtains: data through intervention or interaction with the individual, or identifiable private information (45 CFR 46.102(f)).

Scholarly activities that are not covered under the Code of Federal Regulations should not be described or referred to as research in materials to participants, sponsors or in dissemination of findings.
Appendix L

Implementation Timeline

- **Beginning of June**: Draft HRRC applications
- **June 6th**: Proposal Defense
- **June 13-14th**: Determination by GVSU & Organization's HRRC/IRBs
- **Mid-June**: Create Job-Aids for clinical support staff and providers
- **June 21st**: Clinical staff spirometry demonstration and training meeting
- **June 29th & 30th**: Provider Educational Sessions
- **July 1st**: Data collection begins
- **July 31st**: Data collection ends
- **Early August**: Complete data analysis, write final report
- **August 8th**: Final Defense of project
- **August 11th**: Disseminate results to practice manager and staff
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