Antibiotic Stewardship: Implementing the Use of Centor Scoring for Pharyngitis

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Notes from the Author

Special thanks are given to my family, friends and co-workers for the support and encouragement over the past two years while I worked on this project. I want my boys to know that it may not be easy, it may not be fun, but if you work hard enough, you can do anything you want and succeed in doing so. To my mom, thank you for reading and editing more papers that you ever thought you would; you earned this degree too. To my husband, thank you for picking up the slack at home while I focused on my education. To my co-workers, project site champion, organization leads, and university faculty, thank you for being an instrumental part of this project and helping to make it successful. Hopefully this project has provided growth in the clinical arena and will benefit providers and patients in clinical practice for years to come.

Abstract

Antibiotics are prescribed at an alarmingly high rate and can lead to antibiotic resistance. Pharyngitis is one of the more common complaints seen in outpatient clinics and too often patients are sent home with antibiotics when not deemed necessary. The Centor clinical tool has been established, however often not employed, to aid providers in decision making and to determine the likelihood of a patient having bacterial strep pharyngitis. After review of the most up to date evidence-based literature, the Centor tool has proven beneficial in aiding providers in clinical decision making. The purpose of this paper is to describe the steps that were involved in initiating a Quality Improvement Project at a local urgent care. The goal was to decrease unnecessary testing and inappropriate antibiotic prescribing by incorporating the Centor scoring tool into practice for provider use when evaluating patients with complaints of pharyngitis.

Keywords: antibiotic stewardship, antibiotic resistance, prescriptions, Centor score, strep pharyngitis

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Section I: Introduction

Background

Antibiotics are composed of bacteria and fungi and are prescribed by medical personnel to treat numerous infections, such as strep pharyngitis which is caused by group A beta-hemolytic streptococci (GABHS) bacteria. Initially discovered in 1928 by Alexander Fleming, antibiotics are used to fight off microorganisms and kill or inhibit bacterial growth (American Chemical Society [ACS], 2021). Penicillin was one of the first-named antibiotics and is still one of the most widely used today (ACS, 2021). While antibiotics help to save the lives of many by combating harmful bacteria and disease processes, antibiotic overuse continues to remain a challenge. Concerns arising from overprescribing include ordering antibiotics when they are not indicated, ordering the wrong medication or dosage, and prescribing for the incorrect duration.

Antibiotic stewardship is defined as an effort to measure and improve how antibiotics are prescribed with the goal of improving prescribing methods while effectively treating patients and reducing the concerns for antibiotic resistance (Centers for Disease Control and Prevention [CDC], 2020). Antibiotics are prescribed daily with prescribing rates being highest in outpatient settings, such as urgent care facilities (Stenehjem et al., 2020). To help combat the rising cost of healthcare, clinicians must have training and guidelines in place to curtail the inappropriate prescribing of antibiotics. In addition to increasing health care costs, the overprescribing of antibiotics can lead to antibiotic resistance. More than two million antibiotic resistant infections in the United States (U.S.) have been reported because of overprescribing (Sanchez et al., 2016).

Greater than 12 million office visits annually are due to symptoms of pharyngitis, commonly known as a sore throat (Institute for Clinical Systems Improvement [ICSI], n.d.). Although most cases of pharyngitis are viral in nature, ICSI noted that it remains one of the most

common illnesses for which antibiotics are prescribed with more than 60% of those cases receiving a prescription. To understand why limiting overuse of antibiotics is such a concern, one must understand the implications of antibiotic overuse. Antibiotics do not improve viral symptoms and can lead to multi-drug resistant organisms (MDRO) which are bacteria that over time become harder to treat and more impervious to antibiotics (CDC, 2020). Antibiotic use is also one of the leading causes of the MDRO organism Clostridium Difficile, a bacterium that affects the healthy bacteria, causing diarrhea and inflammation within the colon, sometimes resulting in death (Mayo Clinic, 2020). The incorrect treatment of a simple ailment such as pharyngitis may seem harmless but may have a detrimental effect on patients and their overall healthcare outcomes. This Doctor of Nursing (DNP) Quality Improvement project will look specifically at the use of the *Centor/McIsaac* scoring tool for screening and antibiotic prescribing recommendations for patients that present to two local urgent care clinics with a complaint of pharyngitis.

Organizational Needs

Currently, there are no set guidelines to follow when testing and treating patients that present with pharyngitis at these two clinics. Rapid strep antigen tests are available and often ordered by clinical staff based on complaints prior to the provider evaluation (personal communication, June 21, 2021). As noted, antibiotics are most frequently prescribed in outpatient settings and often done so inappropriately. The four elements set forth by the 2016 *CDC's Core Elements of Outpatient Antibiotic Stewardship* are commitment, action for policy and practice, tracking and reporting, and education and expertise (Sanchez et al., 2016). The CDC also states that making one small change in practice can improve overall health outcomes and decrease inappropriate antibiotic use (Sanchez et al., 2016).

The Centers for Medicare and Medicaid Services (CMS) recommends that a diagnostic test be used to differentiate between bacterial and viral pharyngitis to decrease antibiotic prescribing for viruses (CMS, n.d.). The Centor rule, originally developed by Dr. Robert Centor and later modified by Dr. Warren McIsaac to the Centor Score (Modified/ McIsaac) tool, now includes age as part of the scoring measures (Karla et al., 2016). During this project, this algorithm will be referred to as the Centor tool and will include the additional age criterion. The Centor scoring tool is based on multiple factors (age, cough, fever, lymphadenopathy, tonsillar exudate) and the score (-1 to 5) determines the necessity of a strep test and the likelihood of a bacterial strep infection (Medcalc, n.d.).

While patient treatment is ultimately at the discretion of the provider, the CDC, American Academy of Family Physicians (AAFP), and the American College of Physicians-American Society of Internal Medicine (ACP-ASIM) recommend that the Centor tool be used to determine the necessity of a rapid strep test and/or culture based on presenting symptoms (Mustafa & Ghaffari, 2020; Luo et al., 2019). Currently providers in these clinics did not routinely use any specific guidelines or decision-making tools (such as the Centor) to aid in determining if a strep test is warranted (personal communication, June 21, 2021). Mustafa & Ghaffari (2020) note that studies have indicated that lack of such tools in ambulatory settings has led to overprescribing for viral pharyngitis.

Benchmarks

Even with the decreasing number of antibiotic prescriptions written, the most recent data from 2018 showed North Carolina (NC) had a slightly higher rate of 799 antibiotic prescriptions written per 1,000 population, as opposed to the nations' 791 per 1,000 (CDC, 2019). Overall antibiotic resistance rates for NC also remain higher at 3.3% compared to the U.S. average of

2.4% (CDC, 2019). The U.S. Department of Health and Human Services' *Healthy People 2020*

(2021) aims to improve overall health care for Americans and does so by monitoring specific

metrics, including antibiotic use. Healthy People 2020 objective IID-6 seeks to decrease the

number of prescriptions being prescribed for symptoms of the common cold, which would

include sore throat symptoms (Healthypeople.gov, 2021). Decreasing healthcare associated

infections and reducing rates of inappropriate outpatient antibiotics prescribing are also among

the goals of Healthy People 2030 and, while currently in the developmental phase, may soon

become a core objective (Healthypeople.gov, n.d.).

The Triple Aims of the Institute for Healthcare Improvement (IHI) added a fourth feature

to include improved clinical experiences to the three previous elements: better outcomes, lower

cost, and improved patient care (Bodenheimer & Sinsky, 2014). Antibiotic stewardship improves

patient experiences by limiting unnecessary side effects and secondary yeast or Clostridium

Difficile infections. Healthcare costs will be lowered by not having to purchase antibiotics and

public health is improved by reducing antibiotic resistance and MDROs. The antibiotic

resistance rates and the large number of prescriptions being written indicate that there is still

work to be done to decrease antibiotic resistance. Applying standard protocols in practice and

utilizing the Centor tool for patients with complaints of a sore throat can help to reduce these

concerns. Medical providers can help to combat the antibiotic crisis by ensuring proper screening

and treatment of patients starting at our local urgent care clinics.

Problem Statement

This project analyzed data from two urgent care clinics that have a combined daily

average of 40 to 60 visits. These numbers have increased dramatically, sometimes to more than

60 visits per clinic per day, due to the COVID pandemic. Data included those visits with chief

complaints of sore throat, tests ordered, and documentation of findings. During the two months

prior to implementation, these two clinics encountered approximately 80 visits for upper

respiratory infection symptoms in patients aged six months and older (personal communication,

July 8, 2021). Currently, these clinics do not utilize a specific screening tool to determine when

testing and prescribing antibiotics for strep pharyngitis should be initiated. The challenge

continues to be the overuse of antibiotics for viral illnesses which results in unnecessary testing

and possible antibiotic resistance.

Purpose Statement

The purpose of this project was to decrease unnecessary testing and inappropriate

antibiotic prescribing by incorporating the Centor scoring tool into a protocol for provider use

when evaluating patients with complaints of pharyngitis. A secondary aim was to look at

potential cost savings that might occur by eliminating unnecessary strep tests. The measurable

outcome was tracking strep tests ordered, antibiotics being written, and provider compliance with

implementation of the Centor tool into practice.

Section II: Evidence

Literature Review

Antibiotic stewardship is an increasing concern in healthcare and can lead to antibiotic resistance. The lack of standard protocols when evaluating patients with complaints of a sore throat (pharyngitis) contribute to antibiotic overuse for viral pharyngitis. The Centor scoring tool is readily available, yet not routinely utilized, and could help providers appropriately screen, test and treat. This section of the paper reviews the literature that is available regarding antibiotic stewardship and implementing the Centor score into current practice.

This literature review was completed using the University Health Library databases. Searching for general terms without inclusion criteria, such as antibiotic stewardship, antibiotic resistance, and Centor score led to over 500 articles from various databases. Browsing specific databases helped to narrow down the search and the three most utilized were Cumulative Index to Nursing and Allied Health Literature (CINAHL) COMPLETE, CINAHL PLUS and PubMed; however, the ProQuest Nursing and Allied Health database were also reviewed in addition to conducting a search using general key terms within the health library. Other sources included Medscape and various well-established health organizational websites. Due to the vast variety of literature found, inclusion criteria included articles that were primarily within the last five years, English language, full-text, scholarly journals, and peer-reviewed articles. Key terms and phrases used for this review included: *antibiotic stewardship, urgent care, Centor score, Centor tool, prescribing for pharyngitis,* and *gold standard for pharyngitis* (Appendix A).

The emphasis of this Doctor of Nursing Practice Quality Improvement project was to set forth the use of an established guideline for the two clinics to eliminate unnecessary screenings and antibiotic prescribing for patients presenting with a sore throat. Antibiotic stewardship is a

worldwide concern and hence geographic location was not a limiting criterion. The articles

reviewed were from scholarly journals and consisted of varying levels of evidence, with the

highest being systematic reviews. However, retrospective, cohort, cross-sectional studies, and

literature reviews were also included, thus no limitations based on the study type. Dissertations

revealed during the search process were excluded along with any studies that were strictly done

in an inpatient setting (emergency room services were included as the care is like that of an

urgent care). The level of evidence was determined using the evidence-based practice for

healthcare professionals pyramid hierarchy.

The initial search using CINAHL COMPLETE database produced more than 200 results.

By limiting the criteria to English, full-text, and a three-year time frame the search resulted in 29

articles and 5 were kept for further review. Using the same criteria, CINAHL PLUS was reduced

from 18 to 8 results; however, the search included a five-year time frame due to the limited

number of articles. PubMed produced 130 results using several of the key search terms but was

reduced to 28 results after limiting to English, full-text, three years and limiting to the following

search terms: gold standard for strep pharyngitis, and Centor score for strep pharyngitis. Each of

these 28 articles were analyzed and 13 were kept for further review. The Nursing and Allied

Health database produced more than 500 results and was narrowed down using specific criteria

like the prior searches resulting in 25 articles being reviewed and five kept for further reference.

Upon using the stated criteria and reviewing the mentioned articles, 14 were found to be relevant

and provided support for the scope of this project and included in the final review (Appendix B).

These 14 articles had the most relevant information to support the project. It was also found that

many of the articles stated information that was repeated in other articles or applied to settings

with a different aim. Several of the searches produced the same results which narrowed down some of the articles retained.

Current State of Knowledge

Numerous studies and literature reviews have been conducted worldwide to explore and mitigate antibiotic overuse. The Centers for Disease Control and Prevention (CDC) has focused on this continued crisis and has initiated public campaigns and antibiotic stewardship guidelines to help abate antibiotic overuse such as the 1995 *Get Smart: Know When Antibiotics Work Campaign.* In 2015 the *National Action Plan for Combating Antibiotic-resistance Bacteria* was implemented to help decrease outpatient antibiotic prescribing (Young et al., 2020). The CDC also released the *Core Elements of Outpatient Antibiotic Stewardship* in 2016 which provides direction for antibiotic stewardship in outpatient settings. While patients often believe antibiotics will cure their symptoms, frequently supportive care is all that is needed for many of the most common presenting ailments seen in outpatient care, including pharyngitis. The Centor scoring tool has been developed to aid providers in determining the need for strep testing or throat culture and reduce inappropriate prescribing.

Pharyngitis continues to be one the most frequently encountered visit complaints in outpatient settings and accounts for more than 15 million healthcare visits yearly in the United States alone (Luo et al., 2019). Young et al. (2020) noted viral upper respiratory symptoms to be one of the top three conditions in which antibiotics were inappropriately prescribed in outpatient settings. Young et al. noted that antibiotic over-prescribing rates are highest in the southern states and may be attributed to socioeconomic status and provider beliefs towards antibiotics. While most cases of pharyngitis are viral, antibiotics continue to be overprescribed. The updated 2018 Infectious Disease Society of America (IDSA) and the American Society for Microbiology

(ASM) guidelines state that symptoms of pharyngitis should only be treated with antibiotics if

proven to be of bacterial origin and thus laboratory testing plays a key role in aiding in diagnosis

(Miller et al., 2018). Distinguishing between viral and bacterial causes of sore throat symptoms

can pose a challenge; however, there are key findings that help to distinguish the difference

between the two, such as additional presenting symptoms or the lack of specific symptoms.

Group A beta-hemolytic strep pharyngitis (GABHS) typically does not present with a runny

nose, cough, conjunctivitis, or diarrhea which often are seen when symptoms are viral (Nadeau

et al., 2020). While a large percentage of pharyngitis complaints are viral, Group A Strep does

account for more than 500 million deaths annually worldwide, thus necessitating appropriate

treatment if diagnosis is confirmed. GABHS is also a large driver of increased healthcare costs

related to testing, treating, and caring for these patients. The average cost in the U.S. has been as

high as 539 million dollars when caring for children with strep throat (Mustafa & Ghaffari,

2020).

Although antibiotics are important for GABHS treatment, these are only to be used when

the diagnosis is confirmed with rapid antigen testing or throat cultures. Health organization

guidelines remain in controversy as to the best choice for diagnosing and treating. The CDC,

AAFP, and The American College of Physicians-American Society of Internal Medicine (ACP-

ASIM) give physicians the option to treat based merely on results from a scoring tool while other

organizations, such as the IDSA, believe testing is still warranted to prevent antibiotic overuse

(Mustafa & Ghaffari, 2020). Luo et al. (2019) restated the importance of diagnosis with the use

of a rapid antigen detection test or culture.

A retrospective analysis was completed by reviewing the diagnosis and treatment of

Group A strep pharyngitis between 2011 and 2015 with over 11 million patients treated by a

variety of providers and facilities (Luo et al., 2019). In conclusion, Luo et al. noted that antibiotic

prescriptions were given to 49.3% of the adult population and adults received antibiotics more

often than the pediatric population. Young et al. (2020) conducted a cross-sectional study of data

from 2009-2016 consisting of outpatient visits from the CDC National Ambulatory Medical Care

Survey and found that 55.9% of antibiotics were considered inappropriate and were often written

without a supportive diagnosis, including viral upper respiratory infection symptoms. When

comparing the prescribing rate to the prevalence of confirmed Group A strep, 5-30% of

antibiotics are often overprescribed (Luo et al., 2019). The results of a 2010-2011 study that

sampled ambulatory care visits concluded that 72.4% of patients aged 20 and older were given

antibiotics for pharyngitis symptoms when only 18% met clinical criteria or had a positive strep

test (Fleming-Dutra et al., 2016).

  An older study that was conducted by Fine et al. (2012) in an outpatient pharmacy clinic

compared a Minute Clinic Strep Pharyngitis Algorithm to the Centor tool in patients presenting

with sore throat symptoms. This study included 142,081 patients over a two-year period.

Findings from this 2012 study concluded the Centor score had a 95% confidence interval and

was a strong scoring tool validating its use. Fine et al. mentioned a previous study conducted by

Linder et al. (2006) which concluded antibiotics are still overprescribed despite strep testing.

While the Linder et al. study is over fifteen years old, the conclusion still holds true today, noting

"consistent application of any clinical guideline for the evaluation and treatment of adults with

pharyngitis has a much greater potential to reduce inappropriate streptococcal testing and

antibiotic prescribing" (p.1379).

Current Approach to Solve the Problem

While the Centor score is supported by several trustworthy health organizations (CDC, ACP-ASIM, AAFP), this tool is underutilized in practice. Mustafa & Ghaffari (2020) note that while there are various guidelines that have been developed to help aid in clinical decision making, these are often not applied. A few other tools that have been developed and used include an algorithm that involves using seven physical indicators and historical features while another uses a Bayesian framework (uncertainty combined with probability) which looks at fourteen variables as predictors including physical exam findings and additional laboratory data. Other available tools include the FeverPAIN score, Walsh diagnostic algorithm, and the Breese nine-factor scorecard (Mustafa & Ghaffari, 2020). However, Mustafa & Ghaffari note that these tools are not often used due to the complexity of each. The focus has been on the Centor tool due to the sensitivity and high specificity for effectiveness in diagnosing GABHS in children and adults and is the most widely accepted scoring tool as it is easy to implement and does not require any specialized equipment. Other scoring systems can be used to focus on other diagnostic methods.

The Centor tool was developed to help identify those patients at increased risk of GABHS (Willis et al., 2020). As noted previously, the Centor score was later modified to include age criterion as the likelihood of having a GABHS bacterial infection varies with age (Appendix D). One must also note that this is most effective for patients with symptoms presenting within three days of onset. Due to the current pandemic, additional criteria asks if the person being screened is a COVID patient, however this does not impact the score (Medcalc, n.d.). Multiple studies have been performed and reviewed in numerous settings to measure the efficiency of using the Centor score in guiding clinical decision making (Fine et al., 2012). It has been noted that it is a reliable resource used to determine the need for additional screening with rapid strep

tests and/or throat cultures in diagnosing strep pharyngitis. The CDC and ACP-ASIM both

endorse the use of the Centor score as a guide for clinical decision making (Buensalido, 2019;

Fine, 2012).

Evidence to Support the Intervention

Antibiotics continue to be overprescribed and are often given for viral symptoms that

would improve with supportive care and time. Antibiotic stewardship and unnecessary

prescribing can be best achieved by applying the Centor tool into practice and performing a rapid

strep test when indicated (Karla et al, 2016). The ACP-ASIM has also recommended using the

Centor tool along with clinical decision making and a rapid antigen detection test (RADT) to

diagnose GABHS but also states that a strep test is not indicated if the Centor score is a zero. The

Centor score is based on the five criteria previously mentioned and this score determines whether

a test is warranted, whether a culture should follow, or if a patient can be treated empirically

based on symptoms.

The Centor criterion is a reliable predictor of GABHS and aids in determining the need

for further testing. The score determines whether a patient would benefit from a RADT and

eliminates those that have a low probability of a bacterial strep infection. Coutinho et al. (2021)

noted that few providers follow specific guidelines for treatment of sore throat and the

consistency of treatment is not uniform. Coutinho et al. goes on to state that the lack of

symptomatic treatment recommendations is missing in most of the guidelines and impedes

strategies to improve antibiotic stewardship. A Brenhan-Krohn et al. (2018) study targeted

children specifically and while treatment for children seems to be more congruent, there is still a

disparity between ideal and actual management of strep pharyngitis. This difference may

possibly be due to increased familiarity due to more strep cases being noted in the pediatric

population. An additional study completed in a university health setting concluded that antibiotics were often prescribed when there was not a clear indication for doing so but was often performed based on physical symptoms and patient satisfaction (Knoderer et al., 2019). It was concluded in Knoderer et al.'s study that there should be establishment of a specific algorithm as well as shared decision making between provider and patient to help decrease unnecessary prescribing. The consensus among most of the articles reviewed is that a specific guideline for testing and treating sore throat is not followed, thus necessitating the need for further provider education and protocols to be put into practice.

The urgent care clinics where this DNP project was implemented did not routinely follow any specific guidelines for screening patients with a sore throat. Many patients receive a rapid antigen detection test (RADT) based on complaints without the use of any screening tool to justify this test being completed. The project site lead, an advanced care provider, noted that there are not any specific screening tools in place and utilization of such a tool would be beneficial for these clinics (personal communication, July 8, 2021). Providers and all clinical staff should be educated and instructed on the ease of utilization of the Centor tool and how to effectively implement and document results within the charts to help guide their clinical decision making and determining whether ordering a strep test is indicated.

Evidence Based Practice Framework

The Plan-Do-Study-Act (PDSA) model was used as a guide for this quality improvement project. The Institute for Healthcare Improvement (IHI) describes the PDSA model as a process that is used for action-oriented learning (2021). Each of the four steps have specific criteria and questions to be addressed before proceeding to the next step. The *PLANNING* phase included determining the need and considering why and how this project could be completed.

Specifically, the purpose of this project was to improve antibiotic stewardship by implementing use of the Centor tool by practitioners to aid in clinical decision making and prescribing. The initial step involved reviewing patient encounters that had presented with complaints of sore throats. Those charts included patients of age six months and up (minimal criteria to be evaluated in clinic) and that had the ICD:10 code for sore throat, pharyngitis, or strep pharyngitis. The *DO* phase involved educating providers in the clinic on the use of the Centor tool and score interpretation. The expectation was to have providers use this in patient screenings on a regular basis prior to a rapid strep test or culture being ordered. The *STUDY* phase included comparing data prior to and during implementation, monitoring for changes, and identifying potential barriers and overall compliance. Data was continually reviewed during this project and the process was modified if deemed necessary as part of the *ACT*. If data showing results from the utilization of the Centor tool reflected improved testing and prescribing stewardship the Centor scoring tool would then become part of standard protocol in the project site clinics for patients with pharyngitis.

The PDSA model has proved to be an effective tool and has served as the foundation for putting ideas into practice (Reed et al., 2016). Reed et al. also report that while providers are often hesitant to change and overcome by the ever-evolving advancements, they will begin to see "greater impact from its use, greater insight and learning about the problems being uncovered, and less effort expended on things that do not work" (p.201). For example, Razai and Hussains' (2017) found that by applying the PDSA model to their antibiotic stewardship study, they had a 40% improvement rate in documenting Centor scores and overall antibiotic prescribing rates were decreased.

Ethical Considerations & Protection of Human Subjects

This DNP Quality Improvement project involved the implementation of the Centor Score

tool into practice and did not pose any health threat or harm to the patients. The use of the Centor

tool required the clinical staff and providers asking the indicated questions or noting these on

physical exams as an additional clinical screening component. Initiating this tool would help to

ensure all providers were screening in a consistent manner and using the same documentation.

Bias would be limited as charts reviewed would be exclusively based on specific ICD-10 code

criteria. No personal identifying information such as name, gender, or race would be collected.

Patient age was noted as age is part of the criterion of the Centor tool. Additionally, as part of the

chart review, data collected was not linked to specific providers to protect confidentiality. All

data collected was stored on a password protected computer. These patients, while no identifiers

were collected, may be affected by the utilization of this screening tool as it could potentially

impact the testing and treatment they receive in alignment with evidence-based guidelines.

As part of approval prior to implementation, this project was discussed with the project

site champion to determine need and practicality. The executive leader of the two clinics also

granted authorization to proceed with this project pending Institutional Review Board (IRB)

approval. Prior to starting IRB approval, the project site required the project lead to complete the

21 Collaborative Institutional Training Initiative (CITI) modules to ensure that ethical and moral

standards were clear. These modules also reviewed the steps involved in the IRB approval

process. The project sites IRB committee reviewed the project purpose and implementation

process and deemed the project as QI with no need for additional IRB review.

Additional CITI modules were also completed as part of the DNP program. The

administrative director at the project site provided a letter or support for the project. A data

collection tool was submitted as part of the university faculty approval process. The university

deemed this a QI project after reviewing the completed Self-Certification Quality/Research

forms. The project purpose and the details supporting the need for this project have been

reviewed and approved by both the university and project site. Project implementation was

approved in Fall 2021 and implementation began in Spring 2022.

Section III. Project Design

This purpose of this DNP quality improvement project was to decrease unnecessary strep testing in an effort to prescribe antibiotics correctly based on the use of the Centor scoring tool. For the project to be successful, several key criteria had to be met including an appropriate project site, a willing population, clear data, and guidelines to support necessity of the project. This section of the paper describes the project site and the population of patients being treated in these urgent care clinics. Data collection methods, outcome measures, and a full description of project implementation are also discussed.

Project Site and Population

The project site involved two urgent care clinics that are affiliated with a large healthcare system on the eastern coast of North Carolina. The organization at large is staffed with over 200 medical providers and employs more than 7,000 persons (███████████, 2022). Services include primary and specialty care clinics and urgent care services, now known as express care clinics. The clinics targeted for this QI project were in two separate counties, New Hanover County and Brunswick County. Both sites are affiliated with the organizations' physicians' network and are located within primary care offices. Each site is classified as primary care for billing and insurance purposes. Services are offered to self-pay patients as well as those insured by commercial and private insurance; however, out of state Medicaid is not accepted at these clinics. Patients ages six months and up are seen at these clinics.

Description of the Setting

These clinics are considered walk-in clinics, although patients are allowed to pre-schedule appointments online. Due to the current COVID pandemic, these clinics now offer telehealth visits utilizing Zoom, Doximity, and video visits via the electronic patient portal.

Additionally, telephone visits are available to those without computer access. The goal is to treat urgent and acute care needs when a patient cannot be seen by his/her primary care provider or does not have a primary care provider. Many of the patients seen in these clinics are patients of the network with their primary care providers being located within one of the six affiliated primary care offices. Each express care clinic is staffed by one advanced care provider or medical doctor during each shift as well as support staff including a nurse or medical assistant, lab tech, radiology tech, and front desk personnel. Office hours are 8am -8pm daily, 365 days a year. These two clinics have the capability to run multiple in-house lab tests, perform basic procedures, and x-ray imaging on-site. When needed, off site advanced imaging is available with same day results.

Description of the Population

This DNP QI project targeted the providers and clinical support staff in these clinics. Each provider has a home base clinic but may rotate between clinics as required by scheduling needs. These two clinics are primarily staffed by nurse practitioners and physician assistants; although, medical doctors are part of the per diem staff pool. Full-time providers work three shifts per week while part-time providers work two shifts weekly. These clinics employ six full-time providers, one part-time provider, and five per diem providers. There are both male and female providers with experience ranging from less than a year to more than twenty years. Each clinic is staffed with one provider per shift with access to an on-call physician who is also part of the primary care team. The support staff includes a medical assistant or licensed practical nurse, or both. The providers working these clinics have a variety of clinical experience including urgent care, emergency room and primary care.

Project Team

The project team consisted of the project lead, project site champion, advanced care providers, and support staff. The project lead executed the Antibiotic Stewardship: Implementing the use of Centor/McIsaac Scoring for Pharyngitis project. The project lead provided education and information about the project to the clinical providers prior to project implementation. Data was reviewed weekly by the project lead throughout the twelve-week implementation period. The PDSA model was used to determine if the current plan was successful or if changes were needed. Needed changes could include increased provider and staff education and increased charts reviews based on the ICD-10 codes.

The project site champion is the lead advanced care provider of this organization and immediate supervisor over the providers at these two clinics. The project site champion is a certified acute care nurse practitioner and board-certified family and adult-geriatric practitioner with a total of 19 years of nursing experience. He currently practices as a nurse practitioner in primary care and in the acute care hospital setting. After several discussions, the project site champion expressed the need for such a project as the two clinics currently do not adhere to any standard screening or treatment protocols for patients with pharyngitis. The project lead met with the project site champion biweekly throughout this project to schedule provider education and to discuss the weekly chart review findings as well as to discuss any potential ideas that might enhance the project. This plan was approved by the administrative director of primary care at the project site; however, this director was not directly involved in any planning of the project.

Additional team members for this project included the university DNP faculty and the project sites' Analytics Department. During these four semesters, which included the developing, planning, implementing, and disseminating phases, multiple meetings were held with faculty

mentors to help guide and make suggestions for project implementation. Faculty provided suggestions and approved the data collection process. The Analytics Department for the project sites organization was contacted and assisted in running weekly reports. They were able to ensure that the project lead knew how to run pertinent reports in a timely manner for the pre-implementation period and duration of the project.

The project team during implementation included the full and part time providers of the urgent cares, including nurse practitioners, physician assistants and medical doctors. Support staff included the medical assistants and licensed practical nurses on shift. The support staff helped to triage the patients and gathered pertinent information such as vital signs, including temperature, which is part of the Centor tool scoring. They also gathered subjective data that was placed in the chart for provider review.

Project Goals and Outcome Measures

The purpose of this project was to decrease unnecessary testing and inappropriate antibiotic prescribing by incorporating the Centor scoring tool into a protocol for provider use when evaluating patients with complaints of pharyngitis. This project aimed to work with the providers at the two clinics to educate them on the use of the Centor tool specifically for those patients that presented with chief complaints of a sore throat. Providers were additionally educated on the recommendations for testing and treatment based on the Centor score.

Provider education started after the pre-implementation data was collected and was reviewed at the January 2022 monthly staff meeting. The project lead sent emails to each provider with a short PowerPoint presentation (Appendix E) and a copy of the Centor tool (Appendix D). The project lead was in contact with each provider and clinic the week that implementation began to answer any specific questions. Data was analyzed for three weeks prior

to implementation to see if, or how often, the Centor score was being documented in the two clinics. During implementation, late January through April 2022, data was reviewed on a weekly basis to evaluate utilization of the Centor tool and documentation in the electronic medical records (EMR). The process for collecting and analyzing data was reviewed each month using the PDSA model to ensure effectiveness. The outcome measures included increased provider comfort utilizing the Centor tool, strep test and/or throat cultures being ordered based on the Centor score, and improved antibiotic stewardship.

Description of the Methods and Measurements

The Centor tool consists of five criterion including age, lymphadenopathy, presence of cough, temperature, and tonsillar exudate. Age is divided into three categories: 3 to 14, 15 to 44, and >45. Based on the patient meeting a criterion, a point is either added or deducted to determine the final score. The score can range from -1 to 5. The score determines if a strep test and/or culture is warranted or if the patient can be treated for a presumed strep pharyngitis. Antibiotics and testing are not indicated with a score of -1 to 1. A score of 2 recommends optional rapid strep testing or throat culture while a score of 3 to 4 indicates that testing be considered. However, a score of 4 to 5 also indicates a higher percent likelihood of strep and states empiric antibiotics can be considered based on the scenario. Due to the COVID pandemic, a sixth criterion is also listed to note covid exposure status, however, this does not affect scoring.

A data collection tool was used for the pre-implementation chart review and weekly chart review during the 12-week implementation period. The data tool was stored in a password protected Excel spreadsheet. This Excel document included a separate worksheet for each week of data and included diagnosis codes as well each of the Centor criterion. Data from each chart reviewed indicated Centor tool data recorded, whether a strep test and/or culture was completed,

the result of the test, and if an antibiotic was prescribed (Appendix F). The spreadsheet included

whether a strep test was performed and the test results. Strep cultures and antibiotic prescribing

were also noted. Data during implementation was tracked weekly and compared to pre-

implementation data to analyze trends in improvement during the progression of the twelve-week

period to determine if the number of Centor scores documented increased and if tests ordered

were based on the Centor tool recommendations. Overall percentage of charts reviewed which

had Centor score criteria documented, testing performed and antibiotics prescribed were then

depicted graphically using bar graphs, line graphs, and histogram graphs.

A 10-question survey was sent out to all nineteen participants (providers and clinical

staff) during the last week of implementation. It included questions about the Centor score and

addressed how providers felt after implementation. To facilitate scoring, questions used were

multiple choice and the Likert scale variety. Questions included job title, years' experience,

Centor familiarity, ease of use, and questions on likelihood of continued use. A couple of

questions also included rationale for ordering strep tests as well as antibiotic prescribing

awareness (see Appendix I).

Description of the Data Collection Process

Initially, a chart review was conducted during a three-week pre-implementation period to

evaluate the number of charts which showed provider utilization of the Centor scoring criteria to

guide decision making in treating pharyngitis (sore throat). These charts were reviewed during

the weeks of November. Data collection for implementation began after provider education was

completed during a staff meeting and a power point presentation sent to each provider. The

presentation included the purpose of the project, briefly discussed the Centor criteria,

documentation tips, the timeline for the project, and the overall project goals. Education also

included a tip sheet giving directions on how to access the Centor tool and documentation of results in the electronic medical record (EMR) which was developed by the Analytics Department.

Data collection was based on the ICD-10 codes for sore throat/pharyngitis (J02.9) and strep pharyngitis (JO2). The Analytics Information Technology team at this organization provided the project lead with directions on how to generate a list of charts with the diagnoses codes within a specific time frame at these clinics so that the review could be completed. Pre-implementation data collection utilized a retrospective chart review approach which occurred over a three-week time frame prior to provider education. The implementation process took place over a period of 12 weeks, starting in late January. The data collection process, the *study* component of the PDSA model, was ongoing during implementation and charts were analyzed on a weekly basis. Any charts where the project lead was the acting provider were excluded. Data collected during each weekly chart review was entered into an Excel spreadsheet and included multiple categories specific to the Centor criteria as well as graphical depiction, provider compliance with Centor use, and prescriptions written.

Implementation Plan

While initially the plan was to analyze charts from two clinics, shortly into the project, it was determined a third urgent care clinic in the organization should also be included. This clinic was staffed by the same providers as the initial two clinics, however located in a different county. Due to the decrease in patient volume over time at the clinics, the project lead determined that it would be more beneficial to include all three clinics in chart reviews and implementation of the Centor tool and thus all providers could become familiar with using the tool in the EMR. After discussing these concerns with the course faculty and project site

champion, this clinic was included in the weekly chart reviews and the support staff at the third clinic was provided guidance on use of the Centor tool. Additionally, providers were rotating between clinics due to staffing needs more than anticipated, so to ensure the clinic charts were reviewed in the most efficient way possible, all providers at all clinics were included, resulting in a slight increase of weekly charts being reviewed.

The Plan, Do, Study, Act (PDSA) cycle was continuously utilized during the implementation phase. The project lead generated a report at the end of each week, using the SlicerDicer program (embedded within Epic), and generated a list of charts with the ICD-10 codes for strep pharyngitis and sore throat. It was noticed that even with the addition of the third clinic at week three into the implementation process, the number of charts reviewed were still low. As part of the study component of the PDSA cycle, the project lead asked the providers which diagnosis codes were being used in the charts with Centor tool use to ensure charts were not unintentionally excluded. It was discovered that the Centor tool was being used correctly for patients with complaints of a sore throat, but that a sore throat identifier was often not the primary diagnosis code being used. This was partially due to patients being seen during the COVID pandemic and patients with sore throats, cough, and congestion were also receiving COVID testing which added additional diagnosis codes to the chart. The SlicerDicer program could only run a list based on the primary diagnosis code rather than all codes documented within the chart and for this reason, additional diagnosis codes (suspected Covid-19 and nasal congestion) were utilized to generate the list starting at week three. However, only those that also had sore throat, acute pharyngitis, or throat pain as primary or secondary diagnosis were included for review.

Implementation, the *ACT* of the PDSA model, began with Centor tool education for the providers in order that this tool be used effectively in the clinical setting. The providers documented the Centor score in the charts which were continuously reviewed. While charts were analyzed weekly, approximately once a month a PDSA review took place and outcomes were reviewed. This data was reviewed with the project site champion and based on these reviews the project lead provided further education with additional emails and discussions as needed. The goal at the end of implementation was to employ this tool into daily practice for patients presenting with sore throat complaints and for the score be documented in the EMR. The use of this tool, along with medical judgment and experience, aided the providers in making accurate diagnoses and treatment plans which were noted in the EMR indicating tests ordered as well as treatment plans. The goal was to see improvement in provider documentation with Centor scores noted and ultimately improved antibiotic stewardship based on prescribing rates.

Timeline

The initial start of this project began in May 2021 when the idea was developed and discussed with the chief Advanced Care Provider, now project champion, who stated there was a need for this project within the organization's clinics. The administrative director then gave approval for this QI project to be conducted at the clinics. Research on the necessity of this project, including literature review and conversations with the site champion continued throughout the implementation process. IRB approval per the organization university was completed in December 2021. During pre-implementation, provider education included simple explanations of when and how to use the Centor screening tool. Implementation included provider use of the tool along with weekly data collection and monitoring. The final portion of implementation was evaluation of the data to determine effectiveness of this QI project.

Dissemination will take place during summer of 2022. A visual of the complete timeline can be

found in Appendix K.

Section IV: Results and Findings

Results

This DNP Quality Improvement (QI) project was conducted over a period of 12 weeks. Eighty-two patient visits were reviewed as part of the three-week pre-implementation data analysis with 89% (n=73) of those patients receiving a rapid strep test. Fifteen percent (n=12) of the charts had full Centor examination criteria documented within the physical examination findings (i.e., tonsillar exudate present, temperature recorded); however, there were no formal Centor score results documented. Twenty-three percent (n=19) of the 82 patients received a prescription or a prescription to hold at the time of the visit. All 19 of those patients had a negative strep test, and if a throat culture was performed, the results were also negative. It must be noted that prior to the project, the project site did not have any formal Centor calculator embedded into the electronic medical record and it is unknown if the providers considered this score when treating patients. All providers reported being aware of the tool and the purpose of such tool prior to starting implementation.

Of the 212 patient encounters during the 12-week implementation period, 69% (n=148) had Centor criteria documented. The largest subset of patient visits was for those aged 15-44, accounting for 114 (54%) patient encounters. Forty-nine (23%) encounters were within the 3-14 age range and 49 (23%) encounters were for patients aged 45 or older. Centor scores varied from -1 to 4 with a total of 169 strep tests ordered. It was noted that during this time overall Centor documentation improved and antibiotic prescribing rates decreased. Despite a few weeks of decreased documentation compliance, the overall trend for provider conformity improved as displayed in the compliance graphs (Appendix G). Overall rates for compliance varied weekly from 38% (week two) to 89% (week 10). Week 9 (60%) and week 12 (61%) had decreased

compliance rates which may have been a result of decreased project lead reminders as well as staffing changes. Three of the 79 cultures were positive, with each of these patients initially being negative on the rapid strep test. The additional 76 tests confirmed the same negative results as the rapid test, resulting in a 96% accuracy rate which is congruent with McKesson's data of the Quidel rapid strep tests 95% specificity and 97% sensitivity rates.

Of the 212-patient encounters during implementations, 32 prescriptions were written. Fifty-three percent (n=17) of the 32 prescriptions were a direct result of a positive strep test, positive throat culture, or met Centor guidelines for empiric therapy. The CDC recommends that strep pharyngitis be treated with oral Penicillin VK, oral Amoxicillin, or intramuscular Penicillin G. Patients with a Penicillin allergy can be treated with a cephalosporin or macrolide antibiotic (CDC, 2018). Each of the prescriptions written for a positive strep test or throat culture was in alignment with the CDC recommendations. The doses varied slightly, however; the correct medication was prescribed for the recommended duration.

Provider pushback is also worth mentioning. A couple of providers/staff were initially concerned about the extra time required to obtain and document the Centor criteria. Another concern was the effectiveness of the tool as most visits were virtual due to the Covid pandemic. Providers and clinical staff were sent a survey at the end of implementation, and of the nineteen surveys sent out, only eight (40%) were returned. Fifty percent (n=4) of the participants stated they were aware of the Centor tool prior to the project, while only 25% (n=2) reported using Centor score in their daily practice. Sixty-two percent (n=5) found that critical thinking and plans of care were affected after utilizing the Centor tool and stated they would continue to incorporate the tool in their practice. Five participants admitted to ordering strep test always, often, or

sometimes based on patient request. Antibiotic comfort recommendations were high among all respondents.

Discussion of Major Findings

Early in the review process the project lead noted that the numbers of sore throat complaints were low, thus after inquiry, it was found that the SlicerDicer program could only depict charts from the primary diagnosis. For this reason, additional diagnosis codes were added to ensure patient encounters were not missed. These same diagnosis codes were used for the remainder of implementation. Per the Centor guidelines strep tests are not indicated for scores of 1 or below, are optional for a score of 2, and should be considered for a score 3 or greater. Most of the scores analyzed during the project were a 2 or 3, which would explain the higher number of tests completed. However, throughout implementation there were tests ordered based on low Centor scores or when a Centor tool calculation was not completed. It was observed that some of these tests were ordered based on patient request and others with no rationale stated in documentation. All patients with a score of 4 were tested except for several patients who were treated empirically based on symptoms, meeting Centor criteria recommendations. Thirty percent (n=52) of those who were screened for strep also received a strep culture to confirm accuracy.

Antibiotic stewardship in these clinics did not appear to be as much of a calamity as would be expected based on the literature reviewed. Overall antibiotic stewardship rates improved throughout the implementation and of the 32 prescriptions written, all had justification of a positive strep test, positive throat culture, empiric treatment based on examination or an additional finding noted on exam warranting treatment (otitis media, uvulitis, parotitis, sinusitis), except for three situations. Two of those cases were based solely on exposures and the Centor criteria was not documented. Furthermore, the post implementation survey depicted that testing

is useful in clinics, however, patient satisfaction tended to outweigh the Centor rationale for testing. This implementation project held in alignment with prior research stating that Centor scoring has proven beneficial for ordering strep tests and for prescribing with a downwards trend in antibiotic prescribing noted at theses clinics (Fine et al, 2012; Kalra et al., 2016 ; Stenehjem et al., 2020).

Section V: Interpretation and Implications

Cost and Resource Management

      The direct costs associated with development of this DNP Quality Improvement project were minimal. The project involved primarily weekly retrospective chart reviews performed from a virtual location. While the project lead met and discussed the implementation plan with providers, this was done virtually via a TEAMs meeting platform as well as phone calls, text, and email communication. This was in part due to the COVID pandemic, with the goal of limiting unnecessary persons in the clinic buildings.

      The SlicerDicer program used to depict the list of charts to be reviewed was already embedded within the EMR and is available to all providers to use as needed for data collection. SlicerDicer education was provided to the project lead prior to implementation. This training consisted of several hours of phone calls and Zoom meetings. A presentation was presented to providers using the free PowerPoint platform. The clinical informatics team created a clinical calculator which required research on the EMRs user web and viewing online versions of the Centor tool. The project lead presented the project plan to the ambulatory clinical content group prior to the Centor tool being integrated into the EMR. The clinical informatics team lead spent approximately 13 hours working with the project lead prior to implementation. This was done during regularly scheduled work hours, thus resulting in no additional costs, only an increased workload.

      Organizational staff had an increase in workloads during the development of the project in preparation for implementation. While this work was done in the background, labor costs for added assignments during the workday were estimated to be around $280. The project site champion spent time outside of his typical working hours consulting with the project lead.

Project site champion held a salaried position thus no additional cost were incurred. Costs for the expansion of this project to additional offices in the future would be minimal, requiring tip sheets (ten cents per copy) to be printed and placed at provider and staff workstations. A larger scale expansion of this project to the primary care offices affiliated with this organization would include additional costs for provider and nurse training and additional printouts.

Further costs to consider other than the development of tip sheets, embedding the Centor tool into the EMR, are the costs associated with each test and the lab staff that collect, analyze and document test results. It takes approximately 30 minutes per test from the time of specimen collection to complete processing of results and data documentation. A culture includes an additional step of streaking the setup plates resulting in additional time. Culture results are then interpreted at an outside lab at 24 and 48 hours post collection. Currently the three clinics use the Quidel consult strep kits by McKesson. Each box of step test kits costs $45.20 and includes 50 tests per box. The patient cost, not factoring in insurance, is $49 per test and $26 per throat culture. Although these clinics are specifically a bottom-line practice and revenue is generated from each test performed, the primary concern must be the patient and his/her appropriate diagnosis and treatment. During the implementation period a total of 169 strep tests and 52 throat cultures were completed. A detailed breakdown of the associated costs with the project and labor can be found in Appendix J.

A secondary aim was to look at potential cost savings that might occur by eliminating unnecessary strep test. Introduction of the Centor tool into practice would help to eliminate needless test and reduce overall cost. During the twelve-week period the prospective patient cost, not considering insurance coverage, for strep test and cultures were $9,633. Had tests been completed based on the Centor tool recommendations for testing with a score of 2 or greater, a

potential cost saving could have been over $1800 alone in rapid strep testing. An additional element to consider is the infinite cost that may be elicited upon the patient if they are prescribed an antibiotic, specifically for a patient that lacks prescription coverage, or an unnecessitated cost if prescribed antibiotics inappropriately. While this project did not look at antibiotic cost in detail, this is a factor that must be considered when treating and prescribing. In all facets of healthcare, the potential costs associated with additional healthcare visits can drive-up healthcare cost. Some of these increased visits may be attributed to medication side effects and complications from multidrug resistant organisms.

Implications of the Findings

This project has proved to be beneficial and can continue to have an impact of patients and providers. Using this clinical calculating tool adds an additional element to our decision-making and can further support the providers recommendation. It can be used a visual aid as well when discussing with patients their likelihood of having a viral vs bacterial pharyngitis. Nursing practice and the healthcare system also benefit from use of such a tool as it holds in alignment with evidence-based practice and aims to reduce cost and overprescribing. Overall, this QI project was deemed beneficial and will be included in the clinics standards of care and providers are encouraged to continue utilizing the Centor clinical tool and documenting the information in the patient's chart.

Implications for Patients

The patient remains the top precedence in healthcare and treatment should always be with his or her best interest in mind. Most patients do not understand the difference between viral and bacterial infections and thus do not know when antibiotics are appropriate. Patients also need to be further educated on the potential risk of taking an antibiotic that is not warranted. Shared

decision making between the provider and patient can help to build the provider/patient relationship and will leave the patient feeling like they are part of the decision-making process. For this to be effective, the provider must take time to educate patients as to why evidence-based guidelines, such as the Centor tool, are used for predicting likelihood of bacterial strep infections. While patient risk associated with a throat swab is harmless, providers should remain cognizant of cost and inform patients about the potential increased cost associated with testing. Patients also need to be aware of the risk with antibiotic resistance and adverse effects when taking unwarranted medications.

The pandemic has changed healthcare immensely with a larger number of visits being provided virtually to enhance both patient and staff safety. This QI project was completed during the pandemic and shown to be successful despite primarily being completed via telehealth visits. Pecina et al. (2021) conducted a retrospective study which showed that Centor tool use in face-to-face encounter and virtual encounters were effective. Patient satisfaction is often improved when he or she can be seen and treated virtually. This can also decrease cost associated with a clinic visit. While Pecina's study was looking at scores specifically, it was found that patients could be triaged effectively during virtual visits. Additional concepts that could improve screening virtually would include allowing patients to upload pictures (tonsillar exudate), if warranted. These visits also prevent delay in screening/treatment for patients without access to clinic visits due to location, or those that may be in confinement. Delays in patient treatment can also be prevented when providers incorporate the Centor criteria in their decision making, as those with higher scores could be treated empirically at time of these visits. (Pecina et al., 2021).

Implications for Nursing Practice

This Quality Improvement project has the potential to impact nursing in a multitude of ways. One of the Doctor of Nursing essentials is to incorporate grounded evidence, such as the Centor tool, into nursing practice (American Association of Colleges of Nursing, 2022). Additionally, intertwining the use of this tool into practice has resulted in improvement in provider documentation, antibiotic prescribing and provider/patient dialogue. This tool has also been utilized by nursing staff (Medical Assistants, Licensed Practice Nurses, and Registered Nurses) when triaging patients and they have demonstrated a better understanding of the importance of screening patients before assuming a patient needs a strep test. This can help to reduce visit times and simplify the patient/provider dialogue. This improved understanding of the Centor proves helpful for nurses when screening and triaging patients but also gives the nurse insight on some of the criteria used in provider decision-making. Having this knowledge, can also help to nurses to better explain to patients, if they ask, why a test was/wasn't performed. Having the tool documented within the patient chart provides the provider with the information of patient symptoms and the Centor score prior to the visit. Furthermore, implementation of this tool by the nurses can serve as a communication tool between them and the provider.

Impact for Healthcare System(s)

Application of the Centor tool into practice can positively impact the healthcare system. While this project focused specifically on a small subset of patients in urgent care clinics, it could be employed on a larger scale in any office that provides care for acute sick visits. Using the Centor tool as part of the screening process for sore throat complaints aims to improve the standards of care to ensure patients are screened in the same manner and will help to follow similar documentation within charts. Wait times in offices, specifically urgent cares, are known

to be a common patient complaint, thus unnecessary testing could improve wait times and

improve lab staff availability for other tasks.

The United States has one of the costliest healthcare systems nationwide but has the

reputation for providing lower quality of care. The Institute for Healthcare Improvement (IHI)

has focused on reduced cost per capita as part of their Triple Aims initiative. This initiative aims

for organizations to find ways to reduce costs but at the same time increase quality, identify at

risk populations, and improve community health concerns (Norman, 2020). The Institute of

Medicines *To Err is Human* report has focused on preventing medication errors. Providing

increased used of clinical decision support (CDS) in healthcare can help to align with this

objective. CDS tools can help to improve quality of care by providers, policy makers, experts,

and consumers (Richardson et al., 2019). While these tools have been useful for detecting

preventative care service needs, they are also useful for aiding in diagnosis and treatment.

Richardson et al., also note that CDS tools must be quick, and easily accessible to prevent

interruptions in workflow. When the patient is present, the tool can be viewed concurrently by

both provider and patient during clinical decision-making discussions. Ultimately an improved

patient/provider relationship is going to improve patient satisfaction and outcomes, thus shared

decision making would certainly affect healthcare in a positive manner.

Sustainability

This QI project could easily be continued despite completion of the implementation

process as the Centor tool is now embedded in the EMR clinical tools tab. These three clinics

specifically will continue to employ this tool during patient encounters with sore throat

complaints. The tool is available to anyone that accesses the EMR within these three clinics or

that has access to the EMR within the organization. The Centor tool has been included in the

orientation guidelines and tip sheets for newly hired providers at these clinics. Additional factors

to improve usability would be to provide "hard stops" so that the tool pops up based on certain

chief complaints or diagnosis codes, requiring completion prior to signing or ordering strep

testing. The tool requires less than a minute to complete, thus limiting the time spent in the EMR

during patient visits so that the provider can focus on the patient. Tip sheets and a Power Point

presentation have been completed, thus other than time for additional education and increasing

staff awareness, the tool is available for use.

Dissemination of Plan

The Antibiotic Stewardship: Implementing the Use of Centor/McIsaac Scoring for

Pharyngitis QI project implementation phase was completed April 2022. The outcome of this

project was distributed to those providers, staff, and stakeholders involved in making this project

feasible. Additionally, in July a poster project with presentation of the data was presented to the

university faculty and cohorts. The final paper was posted in the University Scholarship

repository for public access.

This project was identified based on an organization with many acute care visits for sore

throat complaints and no specific standards of care or protocols in place. There have been prior

studies and literature reviews conducted that note the advantage of employing the Centor tool in

daily practice to help curtail unnecessary test and antibiotic prescribing (Kalra, 2016 & Mustafa

& Ghaffari, 2020). The project lead aims to have this specific project published with expectation

that the data collected and noted outcomes will guide other clinics and/or providers to consider

employing the Centor tool into their practice. To reach as many providers as possible, a

manuscript for potential publication will be submitted for publication to the Journal of Doctoral

Nursing Practice (JDNP) upon completion. The project lead will also seek to present this at a

local or state nursing conference, such as the North Carolina Nurses Association conference, that

targets primary and acute care advanced care providers. This project poster and finalized paper

will be distributed to the stakeholders that made implementation possible and to the

organizations' primary care providers. The project lead hopes that after viewing the data

dissemination from this project, more primary care providers incorporate the Centor tool into

their own practices.

Section VI: Conclusion

Limitations and Facilitators

The major limitation to this DNP Quality Improvement project was that it was started during a pandemic resulting in provider education being done virtually as well as patient visits being done primarily via telehealth. Clinical decision-making tools can be used effectively despite the type of encounter; however, this could have been more cumbersome for staff that were using this tool for the first time. Provider compliance and support staff neglecting to use the tool were additional barriers. Lack of compliance was noted at one clinic more than the others as evidenced by the low Centor score documentation in those site patient encounters. This may have been to staffing shortages at this clinic and some days primary care nursing staff were filling in for the urgent care clinical team. Also, while the providers rotate between clinics, a couple of the providers at this clinic only worked part time or PRN and may have not become as adapted to using the tool. The 12-week time frame may have also been an obstacle, especially when providers and staff only work a few shifts per week, thus making it harder for Centor documentation to become a routine component of charting. A further limitation for this project that may have affected the number of patients seen as well as the overall results was the season in which implementation took place. Strep pharyngitis is most common in the late fall and winter months and this project was implemented in the late winter and spring months. Strep is also more prevalent in school-aged children which was the least population served at the three clinics.

Documentation improved throughout the implementation period, and compared to pre-implementation data, there continued to be a downward trend in antibiotic prescribing rates. Despite these improvements, as noted within the major findings, multiple strep tests were still ordered on patients with low Centor scores. While some of the charts reviewed indicated the

patient-provider discussion on the low likelihood of a bacterial infection, patients requested the

test. Rationale for testing was noted in many of the charts as well as documentation noting

patient education on viral vs bacterial processes. However, some tests were still performed

though not indicated by the Centor score and the rationale for testing in some instances was not

known. There continues to be a need for better communication and enhanced communication

between providers and patients as to the justification for antibiotic usage. This is a topic that will

need to be ongoing to better educate patients and to better understand when an antibiotic is

justified.

From the beginning of the project idea, the ambulatory clinical content group was

supportive of the Centor tool being placed into the EMR for provider use. Ample support was

provided by the project lead throughout the project. Both the project lead and the project site

champion continuously reiterated the importance of Centor tool usage and the plan to continue

its use post implementation. Clinical nursing staff engagement remained a crucial facilitator as

they often charted the Centor questions prior to the provider seeing the patient. There is

grounded evidence supporting positive outcomes associated with the use of the Centor tool.

Providers stated utilizing the tool stated led to improved decision making and discussions with

the patient. One provider specifically developed a smart phrase that could be embedded into the

patient chart that discussed a plan based on a positive versus negative test result and patient

education based on symptoms. This was shared with the team to improve ease of documentation

and consistency. Smart phrases help to decrease charting times which improves compliance.

Recommendations for Others

There remains a need for continued education for the project to be sustained in the three

clinics and expanded to additional clinics within the organization. Options to be considered

might include discussions with the Analytics team to provide short cuts, such as hard stops and chart alerts, that could be generated based on the chief complaint, to trigger providers to complete the scoring tool. Another consideration would be if the Centor score could be added onto the strep test order within the EMR. This would be an additional trigger for providers to use this clinical calculator in clinic. This tool would be beneficial for all offices that treat patients with acute care complaints. While the three clinics treat children and adults, children are the least seen population, but also more likely to have strep pharyngitis. For this reason, implementation of this tool could prove beneficial in pediatric clinics or specifically for primary care providers with a large pediatric population.

Recommendations for Further Study

It may be beneficial to analyze the overall Centor score and prescribing rates based on specific populations. While this project included all patients aged three and up based on the Centor age criteria, the data was not broken down specifically to look at rates of positive scores in each age group. Further study could be advantageous for offices that care for specific populations, such as pediatrics. Additional studies could include follow-up on the patients that were tested with negative results and the outcomes of treatment if a throat culture was also ordered. Future studies may also benefit from being done during late fall and winter when strep is most prevalent. With overall compliance uptake and a decrease in antibiotics being prescribed, future studies may consider additional clinical tools that could be embedded into the EMR for other illnesses. Ensuring patients are screened and treated appropriately would continue to improve patient outcomes, overall satisfaction and healthcare costs.

Final Thoughts

This Quality Improvement project was deemed beneficial by both the university and the healthcare organization as there were no current standard screening protocols in place for patients with acute pharyngitis. Despite implementing a new tool during a pandemic with increased patient volumes, increased provider stress, and anxious patients, results were successful. Using this tool to determine test need, rather than testing based on patient request or as reassurance, helped to decrease unnecessary testing which results in improved healthcare cost. The application of this tool decreased antibiotic prescribing which is a cost savings to patients. Provider compliance improved in screening patients and antibiotic prescribing rates decreased. While this project was straight-forward and short in duration, the overall outcomes aligned with the research and national organization recommendations that the Centor tool is effective and useful in aiding clinical decision making while improving patient outcomes and the patient-provider relationship.

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Appendix A

Literature Search Log

Date of Search	Database	Key Word Searches	Limits	# of Citations Found / Kept	Rationale for Inclusion / Exclusion (include rationale for excluding articles as well as for inclusion)
6/28/2021	general library database search	urgent care antibiotic prescribing pharyngitis	no limitations	491 found	due to large volume, search was further narrowed down as noted
6/29/2021	general library database search	urgent care antibiotic prescribing pharyngitis	5 yr., English, full text	239	those these three criteria due to large volume of articles. However, will continue to narrow down with further inclusion criteria as the search is still broad and will a large number of results.
6/30/2021	general library database search	urgent care antibiotic prescribing pharyngitis, strep	5 yr., English, full text, inclusion: "Strep"	47	continue to further narrow down specific to topic
7/1/2021	general library database search	urgent care antibiotic prescribing pharyngitis, strep, Centor score	6 yr., English, full text, inclusion: "Strep" and "Centor score"	16/1 kept	several of these were related to COVID, specific to children, or textbook guidelines. Article kept looked at overall guidelines for diagnosis and treatment of strep in the US.
7/1/2021	general library database search	Urgent Care Centor score	no limitations	394	continue to further narrow down to specific topic
7/1/2021	general library database search	Urgent Care Centor score	limited to 3 years	35	continued to narrow down as many were not relevant to the topic. Articles were discussing cancer, rapid response systems, pharmacy, etc. wanted to get as specific articles as possible.

7/1/2021	general library database search	Urgent Care Centor score, antibiotic stewardship	included 3 yrs. and additional inclusion of "antibiotic stewardship"	11	articles were not very relevant, however, continued to narrow down to US search as some were in different countries.
7/1/2021	general library database search	Urgent Care Centor score antibiotic, stewardship	3 yrs. and United States criterion	4/kept 0	those abstracts reviewed were not relevant, but discussed strep skin infections, URI infections not limited to strep, were in a different country. A couple were also repeat articles from prior search
6/22/2021	Cinahl complete	Centor Score	no limitations	212: continued to narrow	search was to long, thus continued to narrow down with specific criteria
6/22/2021	Cinahl complete	Centor Score	3 yr., English, full text, scholarly and peer reviewed	25, kept 9	wanted to find the most up to date articles with full text. I was trying to look for specifics of the screening tool of interest, narrowed down search based on most recent data due to large amt or results and to ensure scholarly articles. 9 kept for review, however, after review these were not keep for use in the paper.
6/24/2021	Cinahl Plus	Centor Score	no limitations	39	narrowed down to include specific criteria, however the initial glancing of articles are looking more relevant for this specific topic
6/24/2021	Cinhal Plus	Centor Score	5 years, English, full text	18/8 kept	search was kept at 5 years as the initial search was not as large as some of the other searches with hundreds of articles. Upon review of these kept articles, three were included in section I&II of the paper
6/23/2021	PubMed	gold standard for strep pharyngitis	no limitations	53	narrowed down to include specific criteria
6/23/2021, revised/7/16/21	PubMed	gold standard for strep pharyngitis	5 yr., English, full text	9, kept 5	five articles saved to NCBI collections folder
6/29/2021	General Lampus search, all search engines	"strep pharyngitis"	5yr, English	84	narrowed down further to include English and due to the initial large search, the key terms were included in quotations and further narrowed down based on article type.
6/29/2021, revised 7/17/21	General Lampus search, all search engines	strep pharyngitis	3 yr., English, full text, journal article, scholarly and peer review	35/ kept 5	these were kept for further review

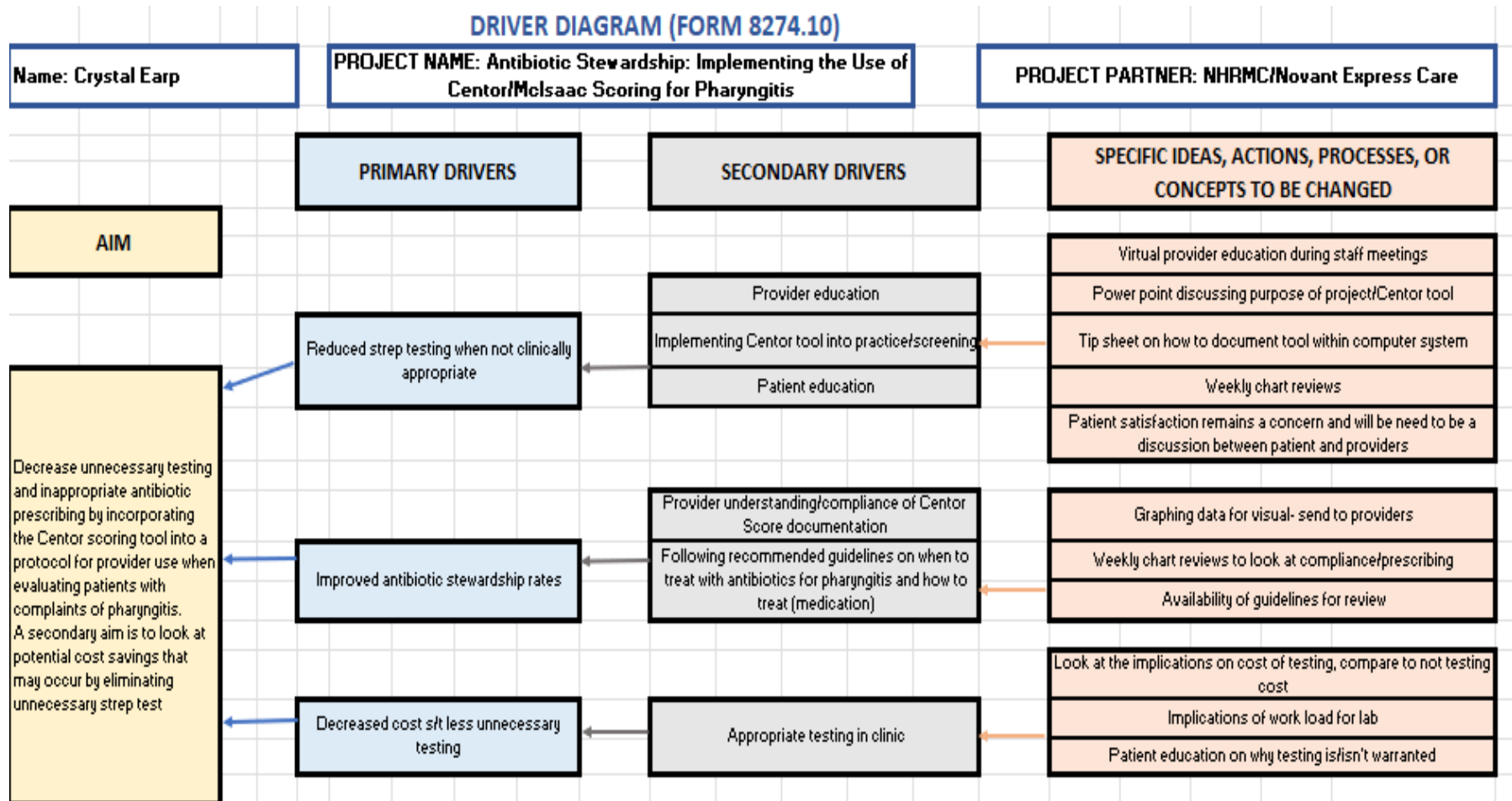|					
6/29/2021	PubMed	urgent care antibiotic prescribing pharyngitis	no inclusion criteria	77	due to volume, search was further narrowed down. Given the size was not >100, kept at a five year search range.
6/30/2021	PubMed	urgent care antibiotic prescribing pharyngitis	5 years, full text, English	22	further narrowed to most recent articles with a 3 yr. search
6/29/2021	PubMed	urgent care antibiotic prescribing pharyngitis	3 yr., full text, English	18	read these abstracts but many focused on tonsillectomy, antibiotics in pediatrics or were literature review findings. Two were saved, and one included in section I&II of paper
7/6/2021, revised 7/17/21	PubMed	Centor Score for strep pharyngitis	5 yr., full text	**20 kept 8**	tried to limit to the ones that specifically discussed use of the Centor score.
7/16/2021	Nursing and Allied Health	Centor score	no inclusion criteria	570	this search was overwhelming and thus further narrowed down
7/17/2021	Nursing and Allied Health	"Centor score"	included adding quotations around search terms	89	the initial search was large with 89 results, thus added " to ensure using this complete phrase". Also wanted to try a different database that was not as familiar with.
7/17/2021	Nursing and Allied Health	"Centor score"	Peer reviewed articles, 5yr, full text	26	narrowed to 3 yrs.
7/16/2021	Nursing and Allied Health	"Centor score"	3 yr., scholarly, peer reviewed, English	**25/kept 5**	5 reviewed in detail

Appendix B

Literature Matrix

Authors	Year Pub	Article Title	Journal	Purpose and take home message	Design/Analysis/Level of Evidence	Instr. Used	Sample Size	Sample method	Subject Charac.	Comments/critique of the article/methods GAPS
Fine et al.	2012	Large-Scale Validation of the Centor and McIsaac Scores to Predict Group A Streptococcal Pharyngitis	*Archives of Internal Medicine*	purpose of this study is to examine the effectiveness of the Centor screening tool	retrospective from one large site/*Level II*	Clinical Laboratory Improvement Amendments-waived Quick Vue In-Line Strep A test. confirmatory test was a streptococcal DNA probe or throat culture	142,081 encounters	500 Minute clinic encounters for patients that had strep test	age 3 or older, had not been treated within last month for strep	*Limitations*: clinical interpretation of symptoms may vary and data only included symptomatic patients. *Synthesis*: the Centor tool is validated and useful for patients with strep pharyngitis
Fleming-Dutra et al.	2016	Prevalence of Inappropriate Antibiotic Prescriptions Among US Ambulatory Care Visits, 2010-2011	*JAMA*	purpose is to estimate rated of outpatient oral antibiotic therapy by age and diagnosis	Systematic review, looking at cross-sectional surveys/*Level I*	surveys which used a 3-stage probability sampling design	184,032 sample visits reviewed	data review from 2010-2011 National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical care Survey	prescription rates	*Conclusion:* noted that in the United States antibiotics are overprescribed.
Kalra et al.	2016	Common questions about streptococcal pharyngitis	*American Family Physician*	rapid test are reliable and the use of scoring tools helps to determine whom needs tested	Systematic review / *Level I*	Rapid strep test to aid in diagnosis for any with c/o sore throat	5,352 (17 trials)	patients presenting to pharmacy-based clinic	c/o score throat	*Limitations*: large population to study
Knoderer et al.	2019	Assessment of pharyngitis management at a university student health services clinic	*Journal of Pharmacy Practice*	purpose is to evaluate management of students presenting with pharyngitis. Found that management is inconsistent	retrospective cohort study/Level III	Centor tool	197	data extracted from EMR with specific diagnosis codes	c/o sore throat with specific dx codes, average age: 20 with >50% female	*Limitations:* based on dx codes, unable to access antibiotic adherence, and symptom duration varied which can affect effectiveness of the centor score.

Authors	Year Pub	Article Title	Journal	Purpose and take home message	Design/Analysis/Level of Evidence	Instr. Used	Sample Size	Sample method	Subject Charac.	Comments/critique of the article/methods GAPS
Linder et al.	2016	Evaluation and treatment of pharyngitis in primary care practice: the difference between guidelines in largely academic	*Archives of Internal Medicine*	guidelines are available to providers in clinical decision making, but are not routinely utilized	retrospective analysis/*Level I*	Research Patient Data Repository	5499 encounters, 2097 met inclusion criteria	based on claim diagnosis of acute pharyngitis or strep pharyngitis	those with the noted diagnoses codes, from Brigham and Women's primary care clinic	*Limitations* : only included specific diagnoses so other pts with the sore throat complaint and different dx code, were excluded. Limited to an academic facility, and there was not a gold standing in this clinic for testing.
Luo et al.	2019	Diagnosis and management of group A streptococcal pharyngitis in the United States, 2011-2015	*BMC Infectious Disease*	purpose to conduct review of pharyngitis events as well as patient and provider characteristics	retrospective analysis/*Level I*	MarketScan commercial/ Medicare database	11,631,556 patients	database review	health plan enrollment, dx of sore throat	*Findings* : Antibiotics are commonly prescribed for sore throats and guidelines are often not followed.
Miller et al.	2018	A guide to utilization of the microbiology laboratory for diagnosis of infectious diseases: 2018 updates by the Infectious Disease Society of America and the American Society for Microbiology	*Clinical Infectious Diseases*	discussing symptoms, testing and treatment for GABHS	n/a: not a study	n/a	n/a	n/a	n/a	*Synthesis* : this was not a study, but was rather a narrative review discussing GABHS
Mustafa & Ghaffari.	2020	Diagnostic methods, clinical guidelines, and antibiotic treatment for group A streptococcal pharyngitis: A narrative review.	*Frontiers in Cellular and Infection Microbiology*	this article discusses also the details of GABS and clinical testing tools	n/a: not a study	n/a	n/a	n/a	n/a	*Synthesis* : this was not a study, but was rather an overview of strep pharyngitis, the clinical tools and concludes that there are varied approaches in treatment and which guidelines are
Nadeau et al.	2020	Impact of viral symptoms on the performance of the modified Centor score to predict pediatric streptococcal pharyngitis	*The American Journal of Emergency Medicine*	to measure viral symptoms that are not currently incorporated into the Centor scoring	retrospective cohort study/*Level IV*	natural language processing (NLP) to identify the subgroup c/o sore throat.	1574	ED encounter notes were reviewed, uses computer tool to extract data	pediatric pts, age 3-21 that had a RAT test: 1574	*Limitations* : conducted in a single center, didn't determine active vs carrier state of GAS, retrospective and based on chart review only.
Reed et al.	2016	The foundations of quality improvement science	*Future Healthcare Journal*	reviewing the PDSA model	n/a: not a study	n/a	n/a	n/a	n/a	PDSA can help maximize learning and can be used to help ensure problems are understood before the planning and implementing takes place.

Authors	Year Pub	Article Title	Journal	Purpose and take home message	Design/Analysis/Level of Evidence	Instr. Used	Sample Size	Sample method	Subject Charac.	Comments/critique of the article/methods GAPS
Stenehjam et al.	2020	Antibiotic prescribing variability in a large urgent care network: A new target for outpatient stewardship	*Clinical Infectious Diseases*	Antibiotics are often prescribed at higher rates in outpatient urgent care clinics and there are several contributing factors potentially for this increase. Often patient satisfaction is higher when patients receive a prescription.	Retrospective cohort study/*Level IV*	data obtained from human resources database	1,163,849 UC encounters within the IH healthcare delivery system	Database collection based electronically from patient encounters	Children and adults presenting to UC clinics	*Limitations* : this was limited to one large healthcare system and focused on upper respiratory illness *Usefulness* : gave good statistics and discussed the concern for overprescribing in UC centers *Synthesis* : antibiotics are overprescribed and sometimes not first line. antibiotic prescribing in this clinic was lower and more appropriate in regards to first line for the children UC clinics
Willis et al.	2020	Comparison of Centor and McIsaac scores in primary care	*British Journal of General Practice*	both Centor and McIsaac are equivalent in performance	Meta-analysis/*Level I*	database search: MEDLINE, EMBASE, PsycINFO	10 studies	sample method based on multiple criteria (see methods section).	varied by age, location, year and sample sizes. 8 in Europe, 2 in US	*Conclusion:* scoring methods using these tools are insufficient to r/o infection while score equal or greater than 3 is sufficient to consider antibiotics. However, providers should consider the public health needs to decrease antibiotic use.
Young et al.	2020	National trends in oral antibiotic prescribing in United States physician offices from 2009-2016	*Pharmacotherapy*	purpose of study to describe antibiotic practices in physician offices in the US	Cross-sectional study/*Level VI*	CDC and Prevention National ambulatory Medical Care survey (2009-2016)	7 billion visits reviewed	see instrument. ICD-9 and ICD-10 codes used to assess diagnose and categorize antibiotics	at least one antibiotic prescribed.	*Conclusion:* prescribing varied by region, however, no significant reduction during the years reviewed. Antibiotics continue to be prescribed inappropriately

Appendix C

Driver Diagram

DRIVER DIAGRAM (FORM 8274.10)

Name: Crystal Earp

PROJECT NAME: Antibiotic Stewardship: Implementing the Use of Centor/McIsaac Scoring for Pharyngitis

PROJECT PARTNER: NHRMC/Novant Express Care

PRIMARY DRIVERS

SECONDARY DRIVERS

SPECIFIC IDEAS, ACTIONS, PROCESSES, OR CONCEPTS TO BE CHANGED

AIM

Decrease unnecessary testing and inappropriate antibiotic prescribing by incorporating the Centor scoring tool into a protocol for provider use when evaluating patients with complaints of pharyngitis. A secondary aim is to look at potential cost savings that may occur by eliminating unnecessary strep test

Reduced strep testing when not clinically appropriate

Provider education

Implementing Centor tool into practice/screening

Patient education

Virtual provider education during staff meetings

Power point discussing purpose of project/Centor tool

Tip sheet on how to document tool within computer system

Weekly chart reviews

Patient satisfaction remains a concern and will be need to be a discussion between patient and providers

Improved antibiotic stewardship rates

Provider understanding/compliance of Centor Score documentation

Following recommended guidelines on when to treat with antibiotics for pharyngitis and how to treat (medication)

Graphing data for visual- send to providers

Weekly chart reviews to look at compliance/prescribing

Availability of guidelines for review

Decreased cost s/t less unnecessary testing

Appropriate testing in clinic

Look at the implications on cost of testing, compare to not testing cost

Implications of work load for lab

Patient education on why testing is/isn't warranted

Appendix D

Centor Tool

Age Group A streptococcus (GAS) rare under 3		
3-14 years		+1
15-44 years		0
≥45 years		-1

Exudate or swelling on tonsils	No 0	Yes +1

Tender/swollen anterior cervical lymph nodes	No 0	Yes +1

Temp >38°C (100.4°F)	No 0	Yes +1

Cough		
Cough present		0
Cough absent		+1

Appendix E

Provider Education PowerPoint Presentation

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Next steps??

We, as providers, need to be diligent in using the Centor score to determine if a strep test is warranted. This will help to guide in decision making based on current recommendation. Ultimately, it is at the provider of the discretion, however, the goal minimize antibiotic and improve antibiotic stewardship in our clinics

CDC, American Academy of Family Physicians (AAFP), and the American College of Physicians-American Society of Internal Medicine (ACP-ASIM) recommend that the Centor tool be used to determine the necessity of a rapid strep test and/or culture based on presenting symptoms

Per CDC, 2018 data concluded that NC had a slightly higher rate of 799 antibiotic prescriptions written per 1,000 population, as opposed to the nations' 791 per 1,000. Overall antibiotic resistance rates for NC also remain higher at 3.3% compared to the U.S. average of 2.4%.

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Documentation in the EMR

Document the Centor score and whether this was followed with a strep and/or throat culture.

Indicate why this was or wasn't done if was not based on the scoring criteria.

Document findings:
This may be tricky as patients are limited in clinic with c/o sore throat d/t the pandemic, however, the questions can still be asked.

Ex: pt reports fever, c/o swollen lymph nodes. (this would equal + 2 points)

Work in process to get a EMR smart phrase set up for ease of documentation.
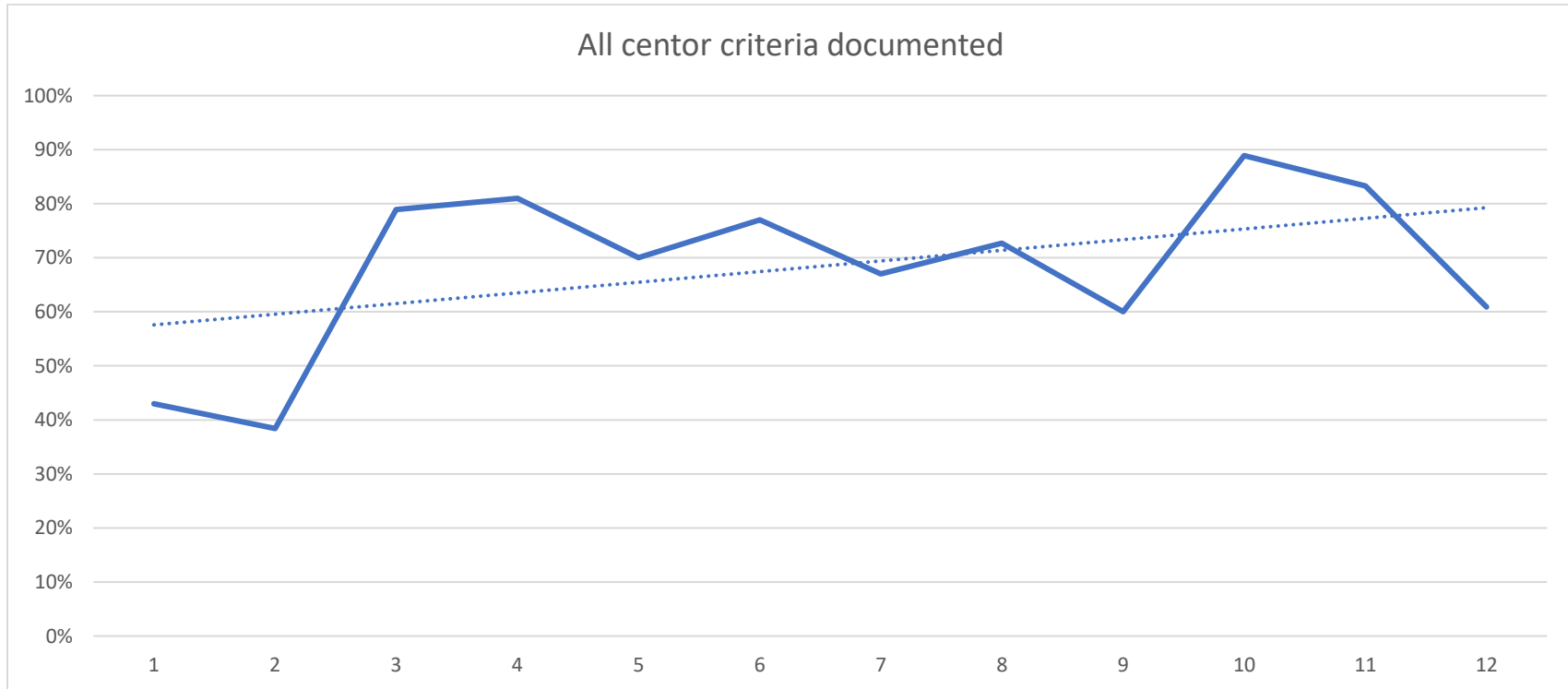

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Thank you for your support in helping me to complete the final phases of my DNP project. Please reach out with any questions or concerns!

References

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Appendix F

Excel Data Collection Tool

| Diagnosis | Sore throat/pharyngitis: J02.9 |
| | Strep pharyngitis: JO2 |

WEEK FOUR		Centor criteria documented							Documentation					
Patient	Dx Code	Age group 3-14	Age group 15-44	Age >45	Exudate or swelling on tonsils	Tender/s wollen anterior cervical lymph nodes	Temp > 100.4	Cough present	Centor Score documented in chart yes/no	Centor score	Strep test ordered yes/no	Strep positive yes/no	Throat culture ordered yes/no	Antibiotics prescribed yes/no
1	1	1	0	0	1	1	1	0	Yes 0 / No 1		1 / 0	0 / 1	0 / 1	Yes 1 / No 0
1	J02.9	x			x	x	x		No	-1	yes	no	no	Yes

Appendix G

Centor Criteria Documentation

All centor criteria documented

Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
43%	38%	79%	81%	70%	77%	67%	73%	60%	89%	83%	61%

Appendix H

Prescriptions Written
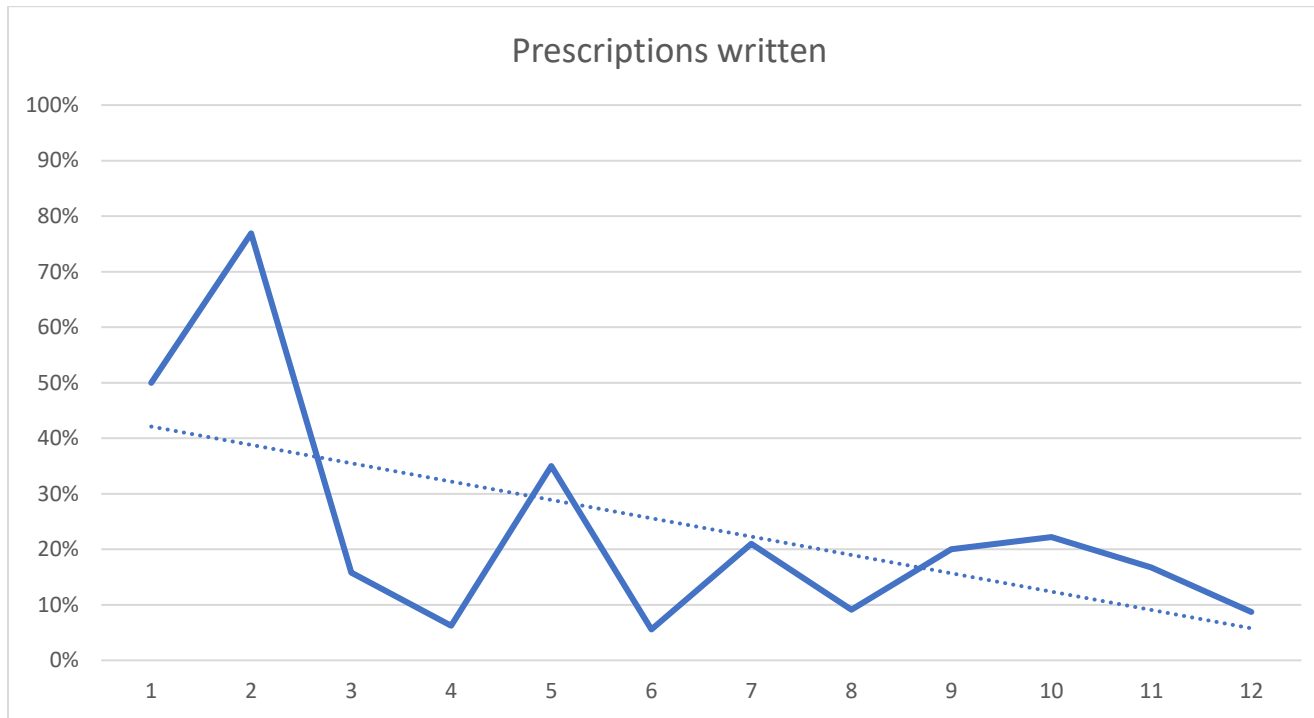
Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
50%	77%	16%	6%	35%	6%	21%	9%	20%	22%	17%	9%

Appendix I

End of Implementation Survey

1. What is your current position?

○ MA

○ LPN/RN

○ NP

○ PA

○ MD

What is your current position?

Answered: 8   Skipped: 0   First: 4/11/2022   Zoom: 3/21/2022 to 4/18/2022
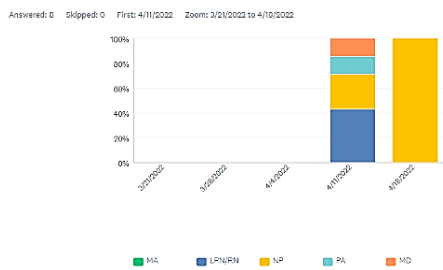
2. How many years' experience do you have in your current position?
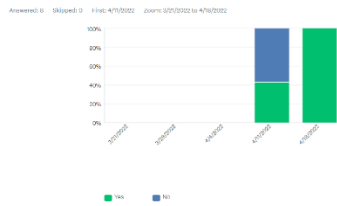
○ <1

○ 1-3

○ 4-7

○ 8-10

○ >10
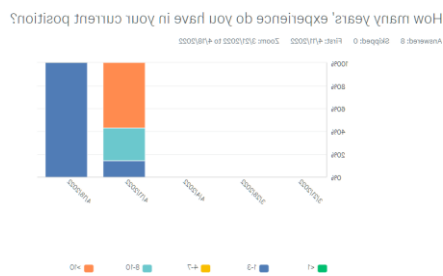
3. Were you familiar with the Centor tool for pharyngitis prior to this QI Implementation project?
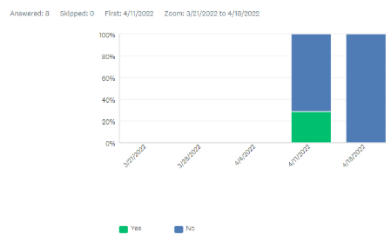
No ▾

Were you familiar with the Centor tool for pharyngitis prior to this QI
Implementation project?

Answered: 8   Skipped: 0   First: 4/11/2022   Zoom: 3/21/2022 to 4/18/2022

4. If yes, did you use the Centor score prior to Implementation?

○ Yes

○ No

If yes, did you use the Centor score prior to Implementation?

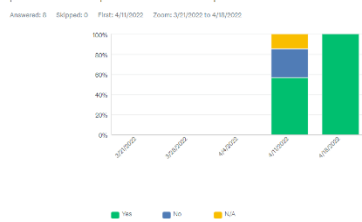Answered: 8   Skipped: 0   First: 4/11/2022   Zoom: 3/21/2022 to 4/18/2022

5. Do you find the Centor tool within Epic easy to use?

[▼]

Do you find the Centor tool within Epic easy to use?

Answered: 8   Skipped: 0   First: 4/11/2022   Zoom: 3/21/2022 to 4/18/2022
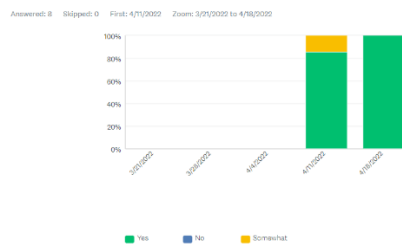
6. Has using the Centor tool in practice changed your critical thinking and plan of care for patients with a complaint of a sore throat?

[▼]

Has using the Centor tool in practice changed your critical thinking and
plan of care for patients with a complaint of a sore throat?

Answered: 8   Skipped: 0   First: 4/11/2022   Zoom: 3/21/2022 to 4/18/2022

7. Do you feel that you are likely to continue using the Centor tool in your current and future practice?

Do you feel that you are likely to continue using the Centor tool in your current and future practice?
Answered: 8   Skipped: 0   First: 4/11/2022   Zoom: 3/21/2022 to 4/18/2022
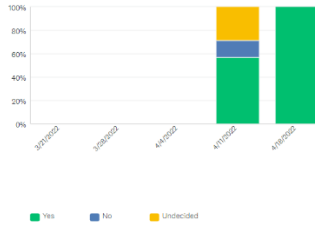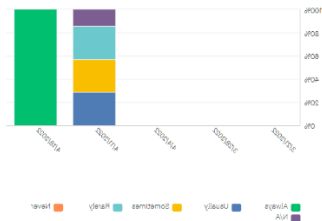
8. How often do you order rapid strep test on patients because they ask for the test to be done, even though your suspicion is low for strep pharyngitis?
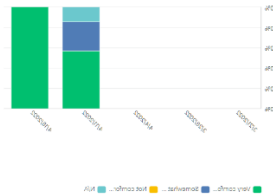
○ Always

○ Usually

○ Sometimes

○ Rarely

○ Never

○ N/A

9. How comfortable are you with the current antibiotic recommendations for pharyngitis treatment based on current guidelines?

10. How has this implementing utilization of the Centor tool into practice been in the setting of a Covid pandemic with limited patients entering the facilities?

○ Very easy

○ Easy
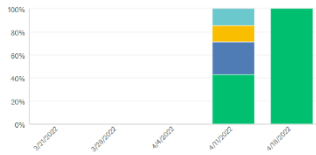
○ Neither easy nor difficult

○ Difficult

○ Very difficult

How has this implementing utilization of the Centor tool into practice been in the setting of a Covid pandemic with limited patients entering the facilities?

Answered: 8   Skipped: 0   First: 4/11/2022   Zoom: 3/21/2022 to 4/18/2022

Very easy   Easy   Neither eas...   Difficult   Very difficult

Appendix J

Budget Analysis

Project Planning

ROLE	TIME	COST	TOTALS
IRB team (pre-implementation for project approval	1 hour	$22	$22
Analytics and Informatics Team (developing Tip Sheets, embedding Centor into EMR	13 hours	$20	$260
Printouts	20 copies	.10 per copy	$2
			=$282

Lab Cost per Test

TEST	COST	TOTALS
Single test	.90	.90
Test analysis 30 minutes of lab employee time	$9.00 (Estimating $18 pay/hour)	$9.00
		=$9.90

Cost of Strep Tests Supplies During Twelve Weeks of Implementation

TEST	COST	TOTALS
169 total tests	.90	$152.10
Test analysis for lab employee x 169	$9.00 (Estimating $18 pay/hour)	$1521.00
		=$1673.10

Potential Patient Cost for Strep Test/Cultures over 12 weeks

TEST	COST	TOTALS
Strep test x 169	$49	$8,281
Throat Culture x 52	$26	$1,352
		=$9,633

Appendix K

Implementation Timeline

May 2021-
Oct 2021:
recognizing
project need,
literature
review and
working on
the steps for
project
approval.

January 2022: Two
weeks of pre-
implementation
data collection,
followed by
provider education

February/March
/April 2022:
Data collection
and weekly
chart reviews
with montly
PDSA reviews

Summer
2022: Project
dissemination

Fall semester
2012, October:
finalizing project
approval. Project
site as well as the
university
deemed the
project Quality
Improvement

Late January
2022:
Implementation
starts and spans
over 12 weeks

May 2022:
finalizing chart
reviews and
calculating
outcomes

Appendix L

DNP Essentials Table

	Description	Demonstration of Knowledge
Essential I *Scientific Underpinning for Practice*	**Competency** – Analyzes and uses information to develop practice **Competency** -Integrates knowledge from humanities and science into context of nursing **Competency** -Translates research to improve practice **Competency** -Integrates research, theory, and practice to develop new approaches toward improved practice and outcomes	• Literature review • CITI modules for university and organization as part of the project approval process • Provider and staff education on importance of antibiotic stewardship and research that has proven Centor tool to be useful in practice • Worked with Analytics to integrate Centor calculator into clinical tools within the EMR • Developed PowerPoint presentation as part of staff education
Essential II *Organizational & Systems Leadership for Quality Improvement & Systems Thinking*	**Competency** –Develops and evaluates practice based on science and integrates policy and humanities **Competency** –Assumes and ensures accountability for quality care and patient safety **Competency** -Demonstrates critical and reflective thinking **Competency** -Advocates for improved quality, access, and cost of health care; monitors costs and budgets **Competency** -Develops and implements innovations incorporating principles of change	• Weekly chart reviews to evaluate implementation • Patient identifiers not included in weekly data collection to meet HIPPA guidelines • Utilized PDSA model to evaluate implementation during course of the 12-weeks • Advocate for use of Centor tool to be utilized as can improve antibiotic prescribing and patient cost for unnecessary testing/medications • Updated provided to staff weekly via emails, TEAMS files and monthly meetings

	Competency - Effectively communicates practice knowledge in writing and orally to improve quality **Competency** - Develops and evaluates strategies to manage ethical dilemmas in patient care and within health care delivery systems	• IRB process completed to ensure project deemed appropriate, determined to be QI project
Essential III *Clinical Scholarship & Analytical Methods for Evidence-Based Practice*	**Competency** – Critically analyzes literature to determine best practices **Competency** – Implements evaluation processes to measure process and patient outcomes **Competency** – Designs and implements quality improvement strategies to promote safety, efficiency, and equitable quality care for patients **Competency** – Applies knowledge to develop practice guidelines **Competency** – Uses informatics to identify, analyze, and predict best practice and patient outcomes **Competency** – Collaborate in research and disseminate findings	• Centor utilization for improvement of care based on review of literature and similar studies • Recommendation for use became part of new orientation guide to help with standardized charting • Weekly encounters reviewed to determine best practice: end results noted with provider compliance, decreased antibiotic prescribing • Communication with stake holders and ECU faculty to finalize results for dissemination of findings
Essential IV *Information Systems – Technology & Patient Care Technology for the Improvement & Transformation of Health Care*	**Competency** - Design/select and utilize software to analyze practice and consumer information systems that can improve the delivery & quality of care **Competency** - Analyze and operationalize patient care technologies **Competency** - Evaluate technology regarding ethics, efficiency and accuracy	• Worked closely with Analytics and IT team to embed Centor tool into the EMR (Epic) clinical tools • Tip Sheet developed to instruct on use with Analytics help • Developed PowerPoint for patient education • Developed end of implementation survey

	Competency - Evaluates systems of care using health information technologies	- Using SlicerDicer EPIC program to capture patient encounters based on diagnoses codes
	Description	**Demonstration of Knowledge**
Essential V ***Health Care Policy of Advocacy in Health Care***	**Competency**- Analyzes health policy from the perspective of patients, nursing and other stakeholders **Competency** – Provides leadership in developing and implementing health policy **Competency** –Influences policymakers, formally and informally, in local and global settings **Competency** – Educates stakeholders regarding policy **Competency** – Advocates for nursing within the policy arena **Competency**- Participates in policy agendas that assist with finance, regulation and health care delivery **Competency** – Advocates for equitable and ethical health care	- Staff education using up to date literature - Information was presented to interdisciplinary teams on project plan and goals
Essential VI ***Interprofessional Collaboration for Improving Patient & Population Health Outcomes***	**Competency**- Uses effective collaboration and communication to develop and implement practice, policy, standards of care, and scholarship **Competency** – Provide leadership to interprofessional care teams **Competency** – Consult interprofessionally and interprofessionally to develop systems of care in complex settings	- Consulting university and organizational team prior to implementation - Staff (nursing staff and providers) education via PowerPoint and used most up to date literature recommendations - Ongoing communication with team during implementation

Essential VII *Clinical Prevention & Population Health for Improving the Nation's Health*	**Competency**- Integrates epidemiology, biostatistics, and data to facilitate individual and population health care delivery **Competency** – Synthesizes information & cultural competency to develop & use health promotion/disease prevention strategies to address gaps in care **Competency** – Evaluates and implements change strategies of models of health care delivery to improve quality and address diversity	• Providing up to date literature which supports need for this project, Centor tool use • Reviewed IHI and Healthy People 2020/2030 data and recommendations to improve healthcare • CITI modules to ensure ethical standards are met • PDSA
Essential VIII *Advanced Nursing Practice*	**Competency**- Melds diversity & cultural sensitivity to conduct systematic assessment of health parameters in varied settings **Competency** – Design, implement & evaluate nursing interventions to promote quality **Competency** – Develop & maintain patient relationships **Competency** –Demonstrate advanced clinical judgment and systematic thoughts to improve patient outcomes **Competency** – Mentor and support fellow nurses **Competency**- Provide support for individuals and systems experiencing change and transitions **Competency** –Use systems analysis to evaluate practice efficiency, care delivery, fiscal responsibility, ethical responsibility, and quality outcomes measures	• Consistent reviews of patient encounters using the same standards weekly to ensure quality • Continuous communication with stakeholders • Positive reassurance to staff during implementation • PDSA model