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Developing a Clinical Guideline With Embedded Algorithm for the Dosing Frequency of Amoxicillin in Pediatric Group A-Beta Hemolytic Streptococcal Pharyngitis

Derek R. Doorn

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UNIVERSITY OF NORTHERN COLORADO

Greeley, Colorado

The Graduate School

DEVELOPING A CLINICAL GUIDELINE WITH EMBEDDED
ALGORITHM FOR THE DOSING FREQUENCY OF
AMOXICILLIN IN PEDIATRIC GROUP A-BETA
HEMOLYTIC STREPTOCOCCAL
PHARYNGITIS

A Capstone Project Submitted in Partial Fulfillment
of the Requirements of the Degree of
Doctor of Nursing Practice

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College of Natural and Health Sciences
School of Nursing
Nursing Practice

December 2017

This Capstone Project by: Derek R. Doorn

Entitled: *Developing a Clinical Guideline with Embedded Algorithm for the Dosing Frequency of Amoxicillin in Pediatric Group A-Beta Hemolytic Streptococcus*

Has been approved as meeting the requirement for the Degree of Doctor of Nursing Practice in the College of Natural and Health Sciences in School of Nursing, Program of Nursing Practice

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ABSTRACT

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Group A-beta hemolytic streptococcus (GABHS) pharyngitis, commonly called “strep throat,” is a commonly seen diagnosis in primary care--most commonly seen in individuals aged 5-15 years. Worldwide, 616 million estimated cases of GABHS pharyngitis occur annually. Rheumatic heart disease, which might be a consequence of GABHS pharyngitis, is estimated to cause about 6 million years of life lost annually. In spite of the wide prevalence of the disease, in the current literature, there are differing guidelines regarding treatment of GABHS pharyngitis, specifically with regard to the dosing frequency of amoxicillin. Amoxicillin is a frequently recommended and utilized drug in the treatment of GABHS pharyngitis, often chosen for its palatability and ease of administration. Current literature shows increasing trends toward once daily dosing of amoxicillin in the treatment of GABHS pharyngitis although twice daily dosing was and is still widely utilized. This Doctor of Nursing Practice capstone project evaluated whether a clinical algorithm with embedded algorithm utilizing current evidence-based practice and expert opinions could improve provider proficiency in dosing as well as improve patient outcomes and adherence.

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ABBREVIATIONS

ARF	Acute Rheumatic Fever
DNP	Doctor of Nursing Practice
EMR	Electronic Medical Record
GABHS	Group A-Beta Hemolytic Streptococcus
ICSI	Institute for Clinical Systems Improvement
IDSA	Infectious Disease Society of America
IRB	Institutional Review Board
IT	Information Technology
MMH	Melissa Memorial Hospital
NICE	National Institute for Health Care Excellence
PCP	Primary Care Provider
USDA	U.S. Department of Agriculture

CHAPTER I

STATEMENT OF THE PROBLEM

Purpose/Background

Group A-beta hemolytic streptococcus (GABHS) pharyngitis, commonly called “strep throat,” is estimated to cost between \$224 million and \$539 million annually in the United States just for children and adolescents (Pfoh, Wessels, Goldmann, & Lee, 2008). Over 616 million estimated cases of GABHS pharyngitis occur annually worldwide. Rheumatic heart disease, which might be a consequence of GABHS pharyngitis, is estimated to cause about six million years of life lost annually. Group A-beta hemolytic streptococcus is one of the top 10 pathogens in estimated global mortality (Carapetis, Steer, Mulholland, & Weber, 2005).

Group A-beta hemolytic streptococcus pharyngitis is most common in individuals aged 5-15 years, although adults may also acquire the disease. Group A-beta hemolytic streptococcus pharyngitis is very uncommon in children younger than three years with the exception of children with risk factors such as an exposure to older children or household contact with GABHS infection. Acute rheumatic fever (ARF) is also rare in adults and children younger than three years of age (Alter, Vidwan, Sobande, Omoloja, & Bennett, 2011).

While GABHS pharyngitis is self-limiting, complications such as otitis media, peritonsillar abscess, and ARF are primary rationales noted for initiating antibiotic

therapy (Shulman et al., 2012) in patients positively confirmed with GABHS pharyngitis by either culture or rapid antigen detection testing. While penicillin V is the drug of choice for non-allergic children with GABHS pharyngitis, amoxicillin has been shown to be an acceptable alternative due to better palatability and reported better gastrointestinal absorption (Curtin-Wirt et al., 2003). Palatability of amoxicillin is believed to improve patient adherence, especially in children; adherence is known to decrease antibiotic resistance among organisms. Palatability and ease of administration of antibiotics have been shown to improve adherence in children (Baguley, Lim, Bevan, Pallet, & Faust, 2012).

Since 2006, two randomized clinical studies have been published, showing amoxicillin administered once daily was non-inferior to dosing done twice daily in GABHS pharyngitis (Clegg et al., 2006; Lennon, Farrell, Martin, & Stewart, 2008). Current GABHS pharyngitis treatment guidelines continue to show differing opinions between once daily and divided dosing of amoxicillin.

Problem Statement

Amoxicillin dosing guidelines for pediatric GABHS pharyngitis vary and are not consistent with regard to dosing frequency. Current guidelines offer no direction or clinical guidance based on patient presenting factors. This Doctor of Nursing Practice (DNP) capstone project evaluated if a clinical guideline with embedded algorithm, utilizing current evidence based practice and expert opinion, could improve provider proficiency in dosing as well as improve patient outcomes and adherence.

Gap Analysis

Primary care providers (PCPs) often dose amoxicillin for pediatric GABHS pharyngitis twice daily. While patient adherence might be improved with once daily dosing. However, daily dosing might be as effective as twice daily dosing and might improve patient adherence. Practice guidelines are increasingly recommending once daily dosing.

Banner Healthcare, Kaiser Permanente, UCHealth, Centura Healthcare, HealthOne, and Kindred Healthcare are some of the largest healthcare systems in Colorado. None of these entities have published guidelines online for GABHS pharyngitis treatment or dosing frequency recommendations specific to the use of amoxicillin for GABHS pharyngitis. While both daily and twice daily dosing regimens have been shown to be effective, no current algorithms or guidelines have been published detailing which populations might benefit from differences in dosing frequency.

Literature Review

A comprehensive search of internet resources including Cinahl, Google Scholar, and The National Guideline Clearinghouse was performed using the terms *pharyngitis*, *streptococcal pharyngitis*, *evidence-based*, *group a beta hemolytic streptococcus*, *tonsillitis*, *pharyngotonsillitis*, *amoxicillin*, and *pediatric*. Dosing frequency recommendations varied across guidelines and the literature, ranging from no recommendation to once, twice, or three times daily dosing. Table 1 summarizes recommended frequency of dosing from available current guidelines.

Table 1

Current Guideline Recommendations

Clinical Guideline	Dosing Recommendation
Institute for Clinical Systems Improvement (Snellman et al., 2013)	No Recommendation
Infectious Disease Society of America (Shulman et al., 2012)	Once or Twice Daily
University of Michigan Health System (2013)	Once Daily
National Institute for Health Care Excellence (2012)	No Recommendation
American Heart Association (Gerber et al., 2009)	Once Daily
UpToDate (Pichichero, 2017)	1, 2 or 3 Times Daily
Epocrates (2017)	Once or Twice Daily

Supporting Literature: Effectiveness

Fierro et al. (2014) found,

Significant variability in the diagnosis and treatment of pharyngitis exists across and within pediatric practices, which cannot be explained by relevant clinical or demographic factors. Our data support clinician-targeted interventions to improve adherence to prescribing guidelines for this common condition. (p. 57)

In a 2006 randomized control study of 652 participants, Clegg et al. concluded,

Amoxicillin given once daily is not inferior to amoxicillin given twice daily. Gastrointestinal and other events did not occur significantly more often in the once-daily treatment group. From the data in this large, investigator-blinded, controlled study, once-daily amoxicillin appears to be a suitable regimen for treatment of GABHS pharyngitis. (p 761)

Shvartzman, Tabenkin, Rosentzwaig, and Dolginov (1993) study found,

No difference was observed in the clinical response, days at work and school lost, or residual positive cultures after two days. A significant difference in the bacteriological response was found after 14 days with no positive cultures observed in the amoxicillin group. These findings support the hypothesis that amoxicillin once daily is as effective as phenoxymethylpenicillin (penicillin V) in the treatment of group A beta hemolytic streptococcal pharyngitis. (p. 1172)

Feder, Gerber, Randolph, Stelmach, and Kaplan (1999) performed a 16-month study of 152 children with GABHS pharyngitis between 4 and 18 years of age (mean was 9.9 years); 79 children were randomly assigned to receive once-daily amoxicillin and 73 were assigned to receive penicillin V three times a day. The children in the two treatment groups were comparable with respect to age, duration of illness before initiation of therapy, compliance, and signs and symptoms at presentation. No significant differences were found in the clinical or bacteriologic responses of the patients in the two treatment groups at the 18- to 24-hour follow-up visit. Bacteriologic treatment failures occurred in 4 (5%) of the 79 patients in the amoxicillin group and in 8 (11%) of the 73 patients in the penicillin V group. These data demonstrated once-daily amoxicillin therapy was as effective as penicillin V therapy given three times a day for the treatment of GABHS pharyngitis.

Lennon et al. (2008) conducted a randomized non-inferiority trial in a school-based clinic in New Zealand. Children presenting with GABHS pharyngitis were randomized to oral amoxicillin or oral penicillin V 500 mg twice daily for 10 days. Eradication of GABHS was determined with follow-up throat cultures on days 3–6, 12–16, and 26–36. Group A-beta hemolytic streptococcus isolates were serotyped to distinguish bacteriological treatment failures (and relapses) from new acquisitions. Non-inferiority was defined as an upper 95% confidence limit for the difference in success of

eradication in the amoxicillin and penicillin V treatment groups. A total of 353 children with positive throat swabs for GABHS were randomized to amoxicillin ($n = 177$) or penicillin V ($n = 176$). The upper 95% confidence limit for the differences in positive cultures between the antibiotics was 4.9% at days 3–6, 6.5% at days 12–16 and 8.5% at days 26–36. Treatment failures (including relapses) occurred at each visit in 5.8%, 12.7%, and 10.7% of amoxicillin recipients and 6.2%, 11.9%, and 11.3% of penicillin V recipients, respectively. No significant differences in resolution of symptoms were noted between treatment groups. One case of unsubstantiated ARF occurred after seven days of amoxicillin. It was concluded once-daily oral amoxicillin was not inferior to twice-daily penicillin V for the treatment and eradication of GABHS in children with pharyngitis.

Supporting Literature: Non-Compliance

Non-compliance is defined as “the extent to which the time history of the drug administration corresponds to the drug regimen” (Urquhart, 1994, p. 203). Per Kardas (2002), non-compliance with short-term antibiotic therapy for respiratory tract infections is common. Medication non-compliance is associated with treatment failures, deterioration of health, additional consultations, additional drugs, additional hospitalizations, and increased costs of direct and indirect management.

One factor associated with non-compliance in antibiotic therapy is dosing frequency. Sclar, Tartiglione, and Fine (1994) found the highest compliance with once-daily dosing--as frequency of dosing increased, compliance decreased. Cockburn, Gibberd, Reid, and Sanson-Fisher (1987) found increasing the number of doses to be taken daily by one increased the probability of a patient being non-compliant by 72%. Kardas (2007) showed overall compliance for once-daily dosing was 93.7% versus

81.3% for twice daily dosing in antibiotic use for acute bacterial exacerbation of bronchitis. A systematic review in 2015 by Falagas, Karagiannis, Nakouti, and Tansarli found higher compliance among patients treated with once-daily dosing of antibiotics for upper respiratory infections than for those receiving twice, thrice, or four-time daily dosing.

Pharmacology of Amoxicillin

The method of action of amoxicillin is antibacterial. Orally administered doses have a half-life of 61.3 minutes. Approximately 60% of an oral dose is excreted via the kidneys within six to eight hours. Amoxicillin diffuses readily into most body tissues and fluids with the exception of brain and spinal fluid and when meninges are inflamed. In blood serum, amoxicillin is approximately 20% protein-bound (Drugs.com, 2017).

Summary

Group A-beta hemolytic streptococcus is a commonly occurring condition mostly occurring among pediatric patients, affecting millions worldwide; if untreated, it can lead to serious complications such as rheumatic heart disease as well as lost productivity and increased healthcare costs. Amoxicillin is a common first line treatment in pediatric GABHS pharyngitis. Although current guidelines vary in the frequency with which amoxicillin should be prescribed, they are increasingly recommending once daily administration.

Clinical presentation, risk of non-compliance, guideline preference, and other factors might influence provider choice of frequency dosing. This DNP capstone project evaluated if a clinical guideline with embedded algorithm utilizing current evidence

based practice and expert opinion could improve provider proficiency in dosing as well as improve patient outcomes and adherence.

CHAPTER II

PROJECT DESCRIPTION

Project Objectives

This DNP capstone project had the following four primary objectives:

1. Identify current amoxicillin dosing frequency patterns and trends for pediatric GABHS in a clinical setting and ongoing review of current literature.
2. Develop and validate clinical guideline algorithm for pediatric GABHS dosing frequency with a panel of experts.
3. Implement the clinical guideline algorithm for pediatric GABHS dosing frequencies.
4. Assess provider satisfaction and patient outcomes post-implementation.

Congruence of Organizational Strategic Plan to Project

The primary site for this project was the Holyoke Family Clinic, a frontier family practice clinic. To reach a goal of 15 providers to survey, various rural and urban providers were solicited to take part in the study. The U.S. Department of Agriculture (USDA; 2015) classifies a community as frontier and rural based on low population size and high geographic remoteness. The Banner Healthcare system is well established in Colorado and has online resources detailing its strategic plans.

The Banner Health Systems (2017) website identifies the organizations mission, vision, and definition of innovations as follows:

- Mission of Banner Health: “To make a difference in people's lives through excellent patient care” (p. 1).
- Vision of Banner Health: “We will be a national leader recognized for clinical excellence and innovation, preferred for a highly coordinated patient experience, and distinguished by the quality of our people” (p. 1).

Banner Health defines innovation as “the rapid identification and deployment of strategies leveraging Banner’s operating model and the science of care delivery to ensure an extraordinary patient experience, which is safe, efficient and effective” (p. 1).

Melissa Memorial Hospital (MMH) and Family Clinic is a site in a frontier region of northeast Colorado; it is representative of frontier health care in Colorado. Melissa Memorial Hospital is associated with Banner Healthcare but not a member of the Banner system. In 2013, MMH conducted a community health needs assessment (see Appendix A) that identified areas of developing new and enhancing existing community benefit programs and services.

This project was consistent with that organization’s goals as it sought to utilize existing evidence-based guidelines of care and expert opinions in developing a guideline with embedded algorithm to address the dosing of amoxicillin in adolescent GABHS. Some of the specific shared goals were those of clinical excellence and safe, efficient, and effective care delivery.

Theoretical Framework

This DNP capstone project utilized the Stetler (2001) model of evidence-based practice, a well-recognized model used to “assess how research findings and other relevant evidence can be applied in practice” (National Collaborating Centre for Methods and Tools, 2011, p. 1), thus allowing research use to be linked with evidence-informed practice. In this project, the outcome was to specifically translate the research regarding amoxicillin dosing frequency into a guideline for practice in the family primary care setting.

According to Stetler (1994), research use occurs in three forms. Instrumental use refers to the concrete, direct application of knowledge. Conceptual use occurs when using research changes the understanding or the way one thinks about an issue. Symbolic or political/strategic use happens when information is used to justify or legitimate a policy or decision or otherwise influence the thinking and behavior of others. These different kinds of research use can occur together and be influenced by multiple factors at the individual level.

The Stetler (2003) model outlines the following criteria to determine the desirability and feasibility of applying a study or studies to address an issue:

- Substantiating evidence;
- Current practice (relates to the extent of need for change);
- Fit of the substantiated evidence for the user group and settings; and
- Feasibility of implementing the research findings (risk/benefit assessment, availability of resources, stakeholder readiness).

For this DNP capstone project, substantiating the evidence was done by conducting an exhaustive literature search related to amoxicillin use in GABHS. After project approval, a Statement of Mutual Agreement was signed by all committee members (see Appendix B). Current practice was assessed at clinical settings that serve pediatric populations by surveying individual providers in treatment preferences with regard to use of amoxicillin for GABHS and by a review of the Holyoke Family Clinic electronic medical records (EMRs). Emphasis was placed on variances in dosing frequency, factors predisposing to non-compliance, or other characteristics that currently influenced any dosing variance.

The fit of the substantiated evidence for the user group and settings was assessed by multiple rounds of surveys utilizing the Delphi technique to establish consensus on treatment regimens. Per the Rand Corporation (Helmer, 1967), developers of the technique,

The Delphi method in its simplest form solicits the opinions of experts through a series of carefully designed questionnaires interspersed with information and opinion feedback. A convergence of opinion has been observed in the majority of cases where the Delphi approach has been used. (Abstract)

The Delphi Method

The Delphi method is a technique used to establish a consensus decision from a group. The initial questionnaire may collect qualitative comments that are fed back to the participants in a quantitative form through a second questionnaire (Hasson, Keeney, & McKenna, 2000). The results from the second round inform the questionnaire for the third round; this process is repeated until consensus is achieved or until the number of returns for each round decreases. A universally agreed proportion does not exist for the Delphi as the level used depends upon sample numbers, aim of the research, and

resources. Percentage of agreement ranges in the literature from 51% to 80% among respondents. Feasibility of implementing the research findings was dependent on reaching consensus and stakeholder readiness. The goal for participation in the Delphi surveys was to solicit responses from a minimum of 15 providers.

Project Phases and Timelines

This project utilized the following four phases based on the Stetler (2001) model of critical thinking and decision-making:

- Phase I: Preparation
- Phase II: Validation
- Phase III: Comparative Evaluation/Decision Making
- Phase IV: Translation/Application

Phase I was to identify the purpose of consulting evidence--to revise or establish existing policy on amoxicillin dosing frequency for pediatric patients diagnosed with GABHS pharyngitis based on current practice guidelines (December 2016 through May 2017).

Phase II was to assess current agency guidelines and existing evidence for credibility, applicability, and adherence to best practice. Clinic charts were reviewed to determine trends in dosing, cure rates, and returns to clinic for continued symptoms (May 2017 through August 2017).

Phase III was to organize and display all findings, utilize Delphi technique to establish consensus, determine feasibility of implementation, choose to use findings, gather more data, delay use, or reject depending on comparative evaluation (August 2017 through September 2017).

Phase IV was to develop and implement an algorithm for dosing amoxicillin dosing frequency based on expert opinions from the Delphi study and plan formal dissemination/ change strategies (September 2017 through October 2017).

Resources

Resources for the implementation of this project were low cost. Personnel costs were limited to time and travel for the project manager spent working on the project, time of the site managers and primary care providers spent taking at least two surveys, and reviewing existing facility guidelines and standards. Supply costs were limited to the printing or emailing of at least two surveys sent to providers recruited to take part in the expert panel. Technological resources included use of electronic medical records (EMR) in use at the clinical site of choice for purposes of data collection and evaluation related to project objectives.

Statement of Mutual Agreement

This author discussed the project with all committee members and with the leadership staff at Holyoke Family Clinic including medical staff and clinic director; all voiced support for the project (see Appendix B). The author has also maintained ongoing communication with all involved parties. Project approval from the University of Northern Colorado's Institutional Review Board (IRB) was granted August 2017 after all required documentation was completed (see Appendix C).

Summary

This DNP capstone project had four phases:

1. Identify current amoxicillin dosing frequency patterns and trends for Pediatric GABHS in a clinical setting.

2. Develop and validate clinical guideline algorithm for pediatric GABHS dosing frequency with a panel of experts.
3. Implement the clinical guideline algorithm for pediatric GABHS dosing frequencies.
4. Assess provider satisfaction and patient outcomes post-implementation.

The chosen site was the Melissa Memorial Hospital and Family Clinic in frontier northeastern Colorado. The Stetler (2001) model of evidence-based practice was utilized as the framework for the study. Substantiating the evidence was done by conducting an exhaustive literature search related to amoxicillin use in treating GABHS. Current practice was assessed at various clinical settings that serve pediatric populations and by surveying individual providers in treatment preferences. Emphasis was placed on variances in dosing frequency, symptom presentation, or patient characteristics that currently influenced any dosing variance. Timeline for the study was broken into phases aligning with the Stetler model. Consensus was reached by using Delphi surveys for the providers who agreed to take part.

Project resources were primarily limited to time of project supervisor, printing and email costs for delivering surveys, provider time spent taking surveys, site manager and staff time assisting with project as needed, and technological support from site IT staff.

CHAPTER III

EVALUATION PLAN

Methods

The design was a non-experimental field study utilizing Delphi surveys to obtain consensus from a panel of experts in pediatric prescribing. Sample size was determined by participation rates of PCPs at the study site and those solicited by email. The population was comprised of PCPs identified by site manager and those consenting to participate via email. Delphi questionnaires were administered either on paper or via email to facilitate ease of use and participation.

Data Collection and Analysis

Data were collected via a Delphi method focused on building a guideline with embedded algorithm for dosing frequency of amoxicillin for pediatric patients with GABHS pharyngitis. A minimum of two rounds of questions was needed to determine consensus and expert agreement with a goal of 70% concurrence. The study was done by soliciting participation in online survey through SurveyMonkey sent to primary care providers in northern Colorado. Data analysis was done by qualitative and quantitative methods consistent with Delphi study techniques, and appropriate statistical analysis of quantitative methods.

Study Objectives

Objective One

The first objective was to identify current amoxicillin dosing frequency patterns and trends for pediatric GABHS in a clinical setting and ongoing review of current literature. To meet this objective, a retrospective chart review examining current dosing guidelines, dosing frequency patterns, recurrence within four months, and trends utilized by the clinic providers was studied and compared with the most recent guidelines from the literature.

Consultation with the clinic pharmacist was done to ensure the most current pharmacodynamics, pharmacokinetics, and excretion data for amoxicillin were available. Providers were educated on the most recent guidelines via email. The clinic's Information Technologist was consulted regarding the use of the EMR system to obtain data from the previous 12 months relating to GABHS pharyngitis specific dosing trends, patterns, effectiveness, presenting symptoms, or other quantifiers influencing dosing. These data were used to educate providers and formulate the initial round of Delphi questionnaires.

Objective Two

The second objective was to develop and validate a clinical guideline algorithm for pediatric GABHS dosing frequency with a panel of experts. To meet this objective, PCPs were solicited via email to take part in online surveys utilizing the Delphi method related to presenting symptoms, factors affecting compliance, and other patient characteristics that might affect the frequency of dosing amoxicillin, current clinic trends, and rationales for decisions made related to dosing frequency. The goal of consensus was

initially set at 70% agreement to develop a clinical algorithm for amoxicillin dosing frequency in pediatric patients diagnosed with GABHS pharyngitis. Survey questions are lists are provided in Appendices D and E. Consent for participation was emailed with each round of surveys (see Appendix F).

Objective Three

The third objective was to implement a clinical guideline with embedded algorithm for pediatric GABHS dosing frequencies. To meet this objective, the guideline was implemented upon approval from the clinical site (see Appendix B). To facilitate ease of use, format was based on provider preference such as laminated cards.

Reminders were sent out via email or handout relating to guideline, algorithm, start date, etc. Information Technology was consulted on the feasibility of alerts or other cues to be placed in the EMR related to pediatric GABHS amoxicillin dosing frequencies.

A review of the guideline and embedded algorithm effectiveness was done within 90 days of implementation by review of charts, patient data, patient outcomes, and patient phone surveys relating to satisfaction and compliance.

Objective Four

The fourth objective was to assess provider satisfaction and patient outcomes post-implementation. To meet this objective, providers would be surveyed after implementation as to satisfaction with guideline, effectiveness of guideline, and any desired revisions to the guideline. This objective was not met due to time constraints of the capstone project.

Project Milestones

The timeline for completion of this project was as follows.

- Idea approval from chairperson--January 2017.
- Needs assessment--February 2017.
- Final approval from committee--February 2017.
- Defense of capstone proposal--May 2017.
- Institutional Review Board approval--August 2017.
- Electronic medical record review, evaluation of findings, and analysis of data--August 2017.
- Delphi surveys distributed--August-September 2017.
- Guideline development and implementation plan--September 2017.

Summary

This capstone project was a non-experimental field study utilizing Delphi surveys to obtain consensus from a panel of experts. Sample size was determined by participation rates of PCPs at the study site and those solicited by email. Data were collected via the Delphi method that focused on the building of a guideline with embedded algorithm for the dosing frequency of amoxicillin for pediatric patients with GABHS pharyngitis. Two rounds of questions were needed to determine consensus and expert agreement with a goal of 70% concurrence. Data analysis was done by qualitative and quantitative methods consistent with Delphi study techniques and appropriate statistical analysis of quantitative methods.

To meet objective one--identifying current amoxicillin dosing frequency patterns and trends for Pediatric GABHS in a clinical setting and ongoing review of current

literature, a retrospective chart review examining current dosing guidelines, dosing frequency patterns, recurrence within four months, and trends utilized by the clinic providers was utilized; data were compared with the most current guidelines from the literature.

To meet objective two--developing and validating a clinical guideline algorithm for pediatric GABHS dosing frequency with a panel of experts via email, providers were given a series of questionnaires utilizing the Delphi method related to presenting symptoms, attributes, or other patient characteristics that might affect the frequency of dosing amoxicillin, current clinic trends, and rationales for decisions made related to dosing frequency.

To meet objective three--implementation of a clinical guideline with embedded algorithm for pediatric GABHS dosing frequencies, the guideline would be implemented pending approval from the clinical site. To facilitate ease of use, formats were based on provider preference such as laminated cards. Reminders were sent out via email or handout relating to guideline, algorithm, start date, etc.

To assess provider satisfaction and patient outcomes post-implementation, providers would be surveyed after implementation regarding satisfaction with guideline, effectiveness of guideline, and any desired revisions to the guideline.

CHAPTER IV

RESULTS AND OUTCOMES

Project Outcomes

Objective One Outcomes

The first objective was to identify current amoxicillin dosing frequency patterns and trends for pediatric GABHS in a clinical setting and ongoing review of current literature. An EMR review of charts from Holyoke Family Clinic was performed for the time period October 2015 to March 2017. Parameters of the search were patients aged 0-18 years with a diagnosis of GABHS pharyngitis. The review identified 25 patients with a diagnosis of GABHS pharyngitis who received treatment with oral amoxicillin. Of the 25 patients treated with amoxicillin, 16 patients (64%) had orders for twice daily treatment and nine patients (36%) had orders for once daily treatment.

Objective Two Outcomes

The second objective was to develop and validate a clinical guideline algorithm for pediatric GABHS dosing frequency with a panel of experts. The author developed the first and second round Delphi Study survey questions from evidence gathered during the literature review, the EMR review of charts, and through knowledge of the population and healthcare system. Round one survey answers informed the second round of survey questions.

Consent for participation was emailed with each round of surveys (see Appendix F). Invitations to participate were emailed out in August and September 2017. Surveys were available for 10 days. Survey questions for Delphi round one are available in Appendix D and survey questions for Delphi round two are available in Appendix E. Additionally, an algorithm for determining dosing frequency appropriateness (see Appendix G) was made available for round two and participants were asked to rate the algorithm for appropriateness. All panel experts invited to participate in round one were invited to participate in round two regardless of their participation in round one. Survey questions were made available on SurveyMonkey--an online platform for developing and hosting surveys.

Participants for this DNP capstone project were experts chosen from providers caring for family or pediatric patients in multiple northern Colorado settings. Nineteen providers (10 physicians, 8 nurse practitioners, and 1 physician assistant) were invited to participate in the surveys. Invitations were sent out via email with an embedded link to the SurveyMonkey page where the survey could be accessed.

First round surveys garnered four responses for a 21% response rate. Second round surveys garnered seven responses, for a 37% response rate. Responses were confidential and data were shared with the project advisor for statistical evaluation.

Round one Delphi survey. Round one was available online from August 2 to August 15, 2017. The first question asked, *What is your current preferred treatment approach toward pediatric patients with positive Group AB Hemolytic Strep (GABHS) pharyngitis?* All respondents (100%) identified antibiotics with 50% of respondents specifically identifying amoxicillin.

The second question asked: *What guidelines (if any) do you currently utilize related to pediatric GABHS pharyngitis treatment?* Responses were “None,” “American Academy of Pediatrics,” “Nurse practitioner protocols. Uphold and Graham,” and “Up To Date and AAP.”

The third question asked: *What is your current preference for dosing frequency of amoxicillin for GABHS?* All (100%) respondents identified twice daily dosing of amoxicillin as the preferred frequency for pediatric GABHS pharyngitis.

The fourth question asked: *What presenting symptoms, or other factors, might influence your decisions related to dosing frequency?* Factors identified as influencing dosing frequency were identified as “None,” “Improve ease/compliance with dosing schedule,” “None school or day,” and “Patient compliance, allergies.”

The fifth question asked: *What factors do you believe contribute to pediatric non-compliance with antibiotic therapy?* Factors identified were “Business of life,” “Frequency & taste of medication,” “School or daycare with overlooking doses,” and “Improved symptoms in two days so parents stop medication due to relief of symptoms.”

The sixth question asked: *Would a more consistent and uniform amoxicillin dosing regimen be helpful to your current group practice if that regimen was in line with the most recent evidence based guidelines?* Two respondents said “Yes” (50%), one said “No” (25%), and one replied “Not sure” (25%) with the added comment of “only because it is already prescript bid.”

Round two Delphi survey. Responses to the first survey questions were used to build the survey questions for round two. Round two of the Delphi study received

responses from seven providers. The survey was available online from August 24 to September 5, 2017.

The first question asked: *For pediatric patients with positive Group AB Hemolytic Strep (GABHS) pharyngitis the preferred dosing frequency for amoxicillin is twice daily. Do you agree?* All seven respondents (100%) confirmed twice daily dosing as the preferred dosing frequency for pediatric GABHS pharyngitis.

The second question asked: *Patient compliance with antibiotics affects patient outcomes in practice. Do you agree?* Six of the seven (86%) respondents replied “Yes.”

The third question asked: *Some of the primary factors affecting compliance with a course of antibiotics include busy schedules, school or day care staff overseeing doses, and multiple daily doses. All seven (100%) of respondents replied “Yes.”*

The fourth question asked: *For patients with factors that could affect compliance, once daily dosing of amoxicillin is an alternative to help improve compliance. Do you agree?* Four (57%) respondents replied “Yes” and three (43%) respondents replied “No.” The sole comment was from a provider who dissented saying, “Half-life too short for once a day dosing.”

For the fifth question, a PDF file was attached in the survey (see Appendix F) asking whether the four questions to ask (who, what, when, where) gave a good indication of when variances to dosing might be warranted? All seven (100%) respondents replied “Yes”. There were no negative responses to *No. There are other indicators, please list below.*

The sixth question asked: *For guidelines and algorithms such as this (see Appendix F), what is the preferred format?* Five of six (83%) respondents thought the

preferred format was “3x5 laminated card, something small to post over a desk or work area.” One of six (17%) respondents chose “Full printed page, easy to view.” One respondent chose not to answer. There were no responses for the option of “Wallet sized card, something easy to carry in my pocket, or to pin up” or “Other (please specify).”

Concurrences ranging from 57% to 100% in the second survey were within or above the preset range deemed acceptable for this scholarly project. The Delphi responses were utilized to create the guideline presented in Appendix H.

Objective Three Outcomes

The third objective was to implement a clinical guideline with embedded algorithm for pediatric GABHS dosing frequencies. This project was divided into the following four phases based on the Stetler (2001) critical thinking and decision-making steps:

- Phase 1: Identify the purpose of consulting evidence, which was to revise or establish existing policy on amoxicillin dosing frequency for pediatric patients diagnosed with GABHS pharyngitis based on current practice guidelines. Currently, Holyoke Family Clinic has no established guideline for amoxicillin dosing frequency. Current literature suggests a clinical guideline with embedded algorithm utilizing current evidence-based practice and expert opinions could improve provider proficiency in dosing as well as improve patient outcomes and adherence.
- Phase 2: Assessment. Current agency guidelines and existing evidence were assessed for credibility, applicability, and adherence to best practice. The review of the Holyoke Family clinic EMR showed preference for twice

daily dosing of amoxicillin for pediatric GABHS pharyngitis, which is consistent with current clinical guidelines and best practice. As stated, no current guidelines exist for amoxicillin dosing frequency.

- Phase 3: Results. The Delphi technique was used to establish consensus among a group of experts toward an algorithm for determining appropriate factors, which might influence dosing frequency specifically related to risk of non-compliance.
- Phase 4: Develop and implement an algorithm for dosing amoxicillin dosing frequency based on expert opinions from the Delphi study and plan formal dissemination/change strategies. The plan for implementation of the guideline with embedded algorithm would involve the involvement of all stakeholders at the Holyoke Family Clinic for whom this guideline was intended. Implementation at a small clinic would be to formally review the proposed guideline at a scheduled meeting of providers. Pending revisions and re-verifying preferred formats, a date would be set for formal dissemination for a two- to four-week pilot/trial period. At the end of the trial period, providers would be surveyed for their satisfaction with the guideline and whether the guideline and algorithm achieved the stated objectives. A phone survey of patients would also be conducted at that time to assess patient satisfaction, treatment outcomes, and treatment compliance. Following assessing data collected after the trial period, a decision would be made by the stakeholders whether to continue using the guideline, restart use after modifying the guideline, or to stop using the guideline altogether.

Following stakeholder approval, guideline would be physically implemented.

Objective Four Outcomes

The fourth objective was to assess provider satisfaction and patient outcomes post-implementation within 90 days of implementation by review of charts, patient data, patient outcomes, and patient phone surveys relating to satisfaction and compliance; patient satisfaction and outcomes would then be performed annually. Provider satisfaction would also be reassessed within 90 days and annually to confirm its effectiveness in meeting stated objectives. Information technology would be consulted on the feasibility of placing reminders in the EMR to facilitate use of the algorithm and assist with identifying treatment failures and successes.

Phase four was not completed during this capstone project. The guideline and embedded algorithm will be available to Holyoke Family Clinic to implement if time and resources allow.

Key Facilitators to Objectives

1. Facilitators to the project included cooperation from all involved staff at Holyoke Family Clinic, especially the IT department manager for assistance with loading parameters, optimizing searches, and general support and guidance with the facility EMR in determining dosing trends.
2. All of the providers encountered at Holyoke Family clinic were likewise supportive and generous with their time regarding any questions or discussions regarding this project.

3. Capstone committee member Dr. Vicki Wilson generously supplied me with a list family practice provider email addresses to invite to take part in this study, greatly increasing the pool of experts who were likewise all very generous with their time responding to survey questions.

Key Barriers to Objectives

1. A barrier to any project is time and this project was no exception. Competing demands from all involved as well as deadlines and logistics were a factor in the scope and reach of this project.
2. The author's own limited experience with the Holyoke Family Clinic EMR platform was a barrier but was largely mitigated by the outstanding support from the clinic IT department.
3. The timing of the project, while specifically related to GABHS pharyngitis, largely took place during the summer months, which is historically when GABHS pharyngitis diagnosis is at its nadir.
4. Surveys were sent out during the month of August, which can be a particularly busy time of year for many regarding time off from work and the start of a new school year. This might have potentially affected survey responses.

Unintended Consequences

Insight gathered from the study showed a universal preference to twice-daily dosing with amoxicillin for GABHS, which was not surprising. However, there was less support than expected for guidelines recommending once-daily dosing even though current literature showed trends toward that. It would be interesting to see if once-daily

dosing becomes more adopted in the future. Another trend identified in some online resources was the utility of treatment versus nontreatment given the self-limiting nature of GABHS and ongoing concerns of antibiotic resistant “superbugs.”

Another unintended consequence was a renewed appreciation for the scope of the problems related with noncompliance--a recognized factor in efficient use of resources and contribution to microbial antibiotic resistance.

Summary

A review of the Holyoke Family Clinic EMR revealed a pattern of twice-daily dosing of amoxicillin for pediatric GABHS pharyngitis at a nearly two to one ratio as opposed to once daily. Utilizing this evidence and the current literature, two rounds of Delphi surveys were conducted using the SurveyMonkey online platform. Nineteen Colorado providers were invited to take part. After two rounds of surveys, expert consensus was reached and a guideline with embedded algorithm was developed. Plans for implementing and evaluating the guideline specific to the Holyoke Family Clinic were formulated.

CHAPTER V

RECOMMENDATIONS AND IMPLICATIONS FOR PRACTICE

The problem statement for this DNP capstone project was whether a clinical guideline with embedded algorithm utilizing current evidence-based practice and expert opinions could improve provider proficiency in dosing as well as improve patient outcomes and adherence.

This project could be easily expanded to other medication frequencies and other conditions, especially for pediatric patients where non-compliance might be an issue. The four questions that made up the algorithm could also be adjusted with input from stakeholders to be more reflective of a given practice's clientele or population served.

If this project were to continue and be physically implemented, the evaluations discussed in the implementation to be done within 90 days would be crucial in determining if the implementation of the guideline was having a real-world effect on improving patient outcomes and compliance as well as the practicality of the guideline from provider and clinic standpoints.

For the author's leadership goals, this project was enlightening regarding the increased level of confidence with regard to evaluating current literature and seeking input from other providers in relation to direct patient care concerns and practicality of any implementations.

Evaluation of Capstone Project

The American Association of Colleges of Nursing's (AACN) stated goal for DNP programs is to “produce nurses that are uniquely prepared to bridge the gap between the discovery of new knowledge and the scholarship of translation, application, and integration of this new knowledge in practice (Waldrop, Caruso, Fuchs, & Hypes, 2014, p. 300). The DNP capstone project is the culmination of these qualities. The AACN (2006) requires that DNP-prepared graduates complete a project that addresses complex clinical issues and uses evidence to improve practice, process, or outcome. Practice-focused DNP graduates are prepared to generate new knowledge through innovation of practice, translation of evidence, and implementation of quality improvement (AACN 2015).

Dennison, Payne, and Farrell (2012) described the final DNP project as “the implementation of research or other evidence into practice” (p. 233). Absent from this description were any guidelines as to project design or implementation. Nursing leaders have called for building a culture of clinical scholarship to distinguish nurses who graduate with a practice doctorate from a research doctorate (Mundinger, Starck, Hathaway, Shaver, & Woods, 2009) but did not have a systematic approach for faculty to evaluate if the final DNP project met AACN requirements for degree conferment. To this end, a 5-point system of evaluation, known by the acronym EC as PIE, was developed by Waldrop et al. (2014) to determine whether a DNP capstone project met the standards set forth by the AACN. The five criteria of EC as PIE are E = enhances health outcomes, C = culmination of practice inquiry, P = Partnerships with interdisciplinary teams, I =

Implement/apply/translate evidence into practice, and E = Evaluation of practice outcomes.

Enhances

This project enhanced health outcomes by improving provider proficiency in dosing as well as improving patient outcomes and adherence. The development of a practice guideline with embedded algorithm through use of expert opinion yielded a four-question algorithm that evaluates the primary factors influencing pediatric patient non-compliance with antibiotic regimens and created a tool providers might use to accurately determine instances in which streamlining the dosing frequency might improve patient adherence, lessen treatment failures, and improve patient outcomes.

Culminates

The culmination of practice inquiry was accomplished in this project by the author identifying a topic during clinical rotations, performing an exhaustive literature search, and identifying a gap in current practice. Through use of the Delphi method and Stetler (2001) model, a practical and likely to be used practice guideline was developed. A plan for implementation and evaluation was developed that could interface with existing EMR at the Holyoke Family clinic as well as other settings in a timely and reproducible fashion.

Partnerships

Collaboration with providers, clinic administration, IT, and patients was necessary for this project. Delphi surveys were sent to physicians, physician assistants, and nurse practitioners, representing a cross section of providers.

Implements

Translating the evidence gathered from exhaustive literature searches formed the backbone of this project. Communicating the evidence to and soliciting expert opinions helped formulate the guideline this author developed. The author also crafted a plan for implementation at the Holyoke Family Clinic.

Evaluates

Evaluation of the guideline with embedded algorithm developed during this project was also planned. Provider satisfaction, preferred format, patient outcomes, and EMR integration are all factors needing ongoing assessment and potential revisions and refinement. Ongoing literature searches would also be necessary to stay abreast of any new data relative to this topic.

Summary

This DNP capstone project could be easily expanded with input from stakeholders. Upon potential physical implementation of this project, ongoing evaluation would be crucial to ensure positive patient outcomes and provider satisfaction.

This Doctor of Nursing Practice capstone project met AANC standards (Waldrop et al., 2014) by enhancing health outcomes, culminating practice inquiry, showing partnerships with interdisciplinary teams, implementing/applying/translating current evidence into practice, and evaluating practice outcomes.

The process of developing this project has been enlightening regarding the author's personal comfort level and confidence in his ability to discover new knowledge and translate, apply, and integrate that new knowledge into practice.

Identifying a gap in practice, finding supporting literature, and constructing a Delphi study to achieve expert consensus on a clinical guideline that could identify situations warranting alternative dosing frequencies for GABHS pharyngitis has been a rewarding experience for the author. The developed guideline could easily be implemented successfully into a practice setting as it has the potential to improve patient outcomes.

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APPENDIX A
COMMUNITY HEALTH NEEDS ASSESSMENT



Community Health Needs Assessment

Melissa Memorial Hospital (MMH) was established in 1918 by an individual physician and later sold to another physician. In 1949 as a result of a community effort, funds were raised to purchase the hospital from the owner and donate it to Phillips County to be governed by an appointed Board of Directors. In July of 1960, East Phillips County Hospital District was formed; the District is comprised of a Critical Access Hospital (MMH), a Rural Health Clinic (Family Practice of Holyoke) and an ambulance service. The hospital provides healthcare services to the residents of Holyoke, Colorado and the surrounding area of Phillips County. During its history, the hospital organization has continued to carry out the mission to serve the sick of the area by providing quality services without regard to race, color, creed or national origin. Melissa Memorial Hospital has maintained an excellent working relationship with other agencies and organizations in the Phillips County area to provide for the residents' overall well-being related to physical, psychological and social needs.

MMH is located in Holyoke, Colorado. Holyoke is approximately 175 miles northeast of Denver, Colorado and being in the eastern portion of the county is about 10 miles from the Nebraska border on US Highway 6. MMH principally serves the residents of Holyoke and its home zip code #80734 as well as Amherst and its home zip code #80721. Phillips County also includes Paoli and, on the far western edge, the town of Haxtun. Haxtun Hospital District serves primarily the western portion of the County.

MMH is governed by the East Phillips County Hospital District, a political subdivision of the state of Colorado. It is led by a five-member governing Board of Directors, elected by the citizens of the District.

Phillips County, with a total population of approximately 4,500 has a land area of about 668 square miles. The population of approximately 6.7 per square miles qualifies it as a frontier county. The County's industry is predominately agricultural based.

MMH is a 15 bed Critical Access Hospital with acute care services, swing bed services, 24-hour emergency services and a wide array of diagnostic and therapeutic services provided to inpatients and outpatients, including various specialty services. MMH completed construction of a new replacement hospital in 2008.

This document provides a summary of MMH's plan to develop new, and to enhance established, community benefit programs and services. This plan is focused on addressing the top community health priorities identified in the 2013 Community Health Needs Assessment (CHNA) conducted by MMH.

I. Target Areas, Economics and Populations

Although MMH primarily serves the residents of Holyoke's immediate area zip code #80734 and that of Amherst's zip code #80721, the entire Phillips County area was selected as the service area for which data was gathered because most health data is not available at the zip code level.

As documented on the national perspective, MMH recognizes the disparities that exist in health status and health risk between those in the highest income levels and the lowest as well as between the insured and uninsured. Those in the lowest income level without insurance have the greatest health needs and are most challenged in gaining access to high quality affordable health care. This is especially challenging in a rural area such as Phillips County.

The CHNA included data on all populations in Phillips County without regard to income, insurance or any other discriminating factors. Selected characteristics of the County population include:

- A. The County population is estimated to increase 2.01% from 2012 to 2017 compared to the Colorado increase of 6.15%¹
 - a. The age segment that is expected to experience the fastest growth between 2012 and 2017 are those aged 55-64 at a 13% growth.
 - b. Those aged 85+ are estimated to grow by 9%.
 - c. Children and youth under 17 are expected to remain essentially the same and adults age 45-54 are expected to decrease by 9%².
- B. In 2012 the County's white population accounted for 90% of the total and those with Hispanic origins accounted for 19% of the total³, recognizing that race and ethnicity are not mutually exclusive.
- C. In 2017 the per capita income of County residents is expected to average \$38,819 compared to Colorado state-wide average of \$56,911 and national income of \$50,850⁴.
- D. In 2012 5.5% of the families in the County lived in poverty compared to Colorado of 8.6%.
- E. In 2010 16% of children in the County lived in poverty compared to 17.1% in Colorado⁵.
- F. In 2011-2012 the unemployment rate was approximately 4%, compared to the Colorado rate of approximately 8%⁶.
- G. In 2010 an estimated 25% of the Phillips County population under 65 years of age was uninsured compared to 18% in Colorado⁷.

¹ Nielsen Claritas

² Ibid.

³ Ibid.

⁴ Ibid.

⁵ Ibid.

⁶ U.S. Bureau of Labor Statistics

⁷ SAHIE/State and County by demographic and income characteristics/2010

Health care employment is one of the most significant service industries in a local area, usually more so in rural areas. Typically a rural hospital is one of the largest employers in a rural economy, typically one of the top two employers in the county⁸. As employees spend money locally, additional jobs are created in other businesses in the community. These additional jobs are called secondary jobs and create additional economic impact in the community. The impact is estimated using multipliers⁹ for both jobs and economic impact.

In 2012 MMH had 137 employees. Considering the secondary impact to the community of the MMH employees and wages, an estimated additional 11 employees in the County can be attributed to MMH using a multiplier of 1.08 (i.e. each hospital job contributed an additional .08 secondary job). The total income impact of MMH in 2012 is estimated to be over \$6 million using a multiplier of 1.11 times the hospital payroll.

Because healthcare facilities contribute significantly as an economic driver in the community, the use of local health facilities by area residents supports this employment and economic driver.

II. Process, Strategy and Community Input

MMH identified community health needs by undergoing an assessment process. This process incorporated a comprehensive review by the MMH Community Needs Assessment Team (CNAT). MMH also engaged the Colorado Rural Health Center (CRHC) to assist with the project. CRHC assisted by: gathering and assimilating data, facilitating and compiling results of group meetings and surveys, drafting reports and public notices and other facilitation-type activities. CRHC is well suited to this type project because of their expertise in rural health care in Colorado and work their staff has done regarding many community-oriented projects in rural healthcare. CRHC contracted with Dixon Hughes Goodman LLP (DHG), a certified public accounting and advisory firm to assist in gathering the various components of demographic and health data for the County. DHG has extensive expertise in health care in the United States. The MMH CNAT was formed with members of the management team of the organization, including the CEO and others representing areas of strategy, communications, community benefit, finance, education, quality of patient care, direct patient services.

The CNAT, assisted by CRHC (and DHG), retrieved data from public sources such as The Colorado Department of Public Health and Environment (CDPHE), United States Census Bureau, Centers for Disease and Control, US Department of Health and Human Services Health Resources and Services Administration (HRSA), County Health Rankings published by the Robert Wood Johnson Foundation and the University of Wisconsin, and others. Data was compiled and formatted from these sources relating to the health status of the County population, health needs, incidence of disease, etc. and shared with community members. This data, which helped form the assessment,

⁸ National Center for Rural Health Works, Economic Impact of Rural Health Care, September 2012

⁹ Minnesota IMPLAN Group, Inc.

provided the basis from which the CNAT and others determined the health needs of the community. It is important to note that gaps exist in reported health data at the local level. The gaps exist because of the lack of reporting certain disease data and the characteristics of unique populations that may experience certain diseases and chronic conditions. In addition, low numbers of reported instances, due in large part to a low population base, make certain data unavailable or not readily comparable to state and national data.

While MMH CNAT members had access to the entire data package developed by DHG and CRHC, a condensed version was presented by CRHC at a public meeting held in Holyoke on May 23, 2013 to inform those in attendance about the health status of Holyoke and Phillips County residents. The CRHC and DHG identified a number of “Top Positive Indicators” and “Opportunities for Improvement” based on the data. Highlights of the data package were made available to the public through the MMH website, following the public meeting.

Following the presentation of the data, the meeting attendees were divided into small groups to discuss the data presented. In addition, each discussion group was asked to identify other Opportunities that were omitted from the initial presentation and to judge if the Positive Indicators were represented appropriately. Discussion groups were also asked to identify the top 3 Opportunities that were of most concern to them and how they perceive access of healthcare providers in Holyoke and Phillips County. In addition, attendees were asked how, given the limited financial and human resources, could MMH and its health care providers improve the health status of the residents. Group findings were discussed in a “committee of the whole” to provide guidance to the CNAT. Findings were tabulated and reconsidered at the second public meeting.

The CNAT, in collaboration with CRHC, conducted a survey of interested County residents. The survey included 46 questions on a variety of health and provider issues. The Health Questionnaire for Melissa Memorial Hospital was distributed by MMH using paper surveys and web-based surveys. They were given to participants at the end of the first Community Health Assessment Meeting and participants were encouraged to have their friends and family complete the survey as well. In addition, the paper survey and link to the website survey was made available at MMH and through the organization’s website www.melissamemorial.org. The community was also informed about the survey and provided the link to the online survey in an article that appeared in the local newspaper; hospital staff and members of the CNAT were also present at the local Dandelion Daze celebration and the Phillips County Fair to provide paper and web-based surveys to citizens of Phillips County. The same questions were asked of all participants. There were 131 responses (100 paper and 31 web-based) received and tabulated. The survey was also provided in Spanish; there were 11 Spanish surveys returned. The survey questions included a series of “yes or no” questions and prioritization ranking opportunities as well as ample opportunity for the respondent to offer a free-flowing response. CRHC compiled the results of the survey to maintain the anonymity of the respondents. CNAT members were provided detailed response compilations of the

survey results. Summary results of the survey findings were presented to the community at a public meeting in Holyoke on August 15, 2013.

Following presentation of the survey results, the meeting attendees were divided into small groups to discuss the information presented and to reconsider the data from the first meeting. The groups were asked to consider the most striking survey responses and add any new opportunities that they believed should be considered. The groups were then asked to select the top three opportunities that represented the most concern to them. Findings and observations were tabulated and considered by the CNAT in preparation of the presentation at the third public meeting.

The third and final public meeting was held in Holyoke on September 26, 2013. At that meeting the members of the CNAT presented a summary of the priorities recommended at the second meeting. In addition, they presented their individual priorities and individual implementation strategies.

To aid the CNAT in the assessment of the community's health needs, representatives from interested agencies and organizations serving the health, educational, commercial and government interests of the Holyoke area were consulted. Some members of the various organizations also attended the public meeting and provided valuable perspectives in those settings. The community organizations and agencies are:

- Centennial Mental Health Center
- Holyoke Chamber of Commerce
- ECCLPS
- Phillips County Department of Social Services
- Northeast Colorado Health Department
- Melissa Memorial Hospital Foundation
- Two members of the MMH Board of Directors

III. Community Needs

Data derived from State and National resources indicated a number of health observations and needs in Holyoke and Phillips County. Among them were:

- According to the County Health Rankings¹⁰ report the County ranked 19 out of 59 in overall health factors with 1 being best and 59 being worst. Selected individual group rankings were (out of 59):
 - Tobacco use – 10
 - Diet and exercise - 39
 - Alcohol use – 42
 - Sexual activity - 36
 - Access to care – 31

¹⁰ www.countyhealthrankings.org

- Quality of care – 41
- Education – 28
- Employment - 4
- Income – 24
- Family and social support - 11
- Community safety – 25
- Built environment – 17
- According to the County Health Rankings¹¹ report the County ranked 23 out of 59 in overall health outcomes. Selected individual group rankings were (out of 59):
 - Mortality - 25
 - Morbidity – 19
- According to the County Health Rankings and CDPHE there were 76% of County residents who were obese or overweight in 2009 and 22% were obese. These percentages were greater than the Colorado amounts of 56% and 20% respectively.
- According to the USDA Economic Research Service 2009 12% of low income preschool children were obese compared to a Colorado median of 9%.
- According to the Health Indicators Warehouse, in the period 2006-2008 Phillips County heart disease death rates were 161.6 per one hundred thousand population, compared to 145.8 in statewide data.

The CNAT members used qualitative results of the survey process to frame the story portrayed by the data gathered and discussion group observations. The survey results included the following sample observations.

- 75 respondents provided feedback on their perceptions of what concerns them about health, healthcare, and healthy living in the County. Selected responses included:
 - Chronic conditions: Obesity & overweight, diabetes, cancer and heart diseases
 - Behavioral health issues and lack of mental health services
 - More physicians, including specialists
 - Cost, insurance and financial issues
 - Lack of health education including Spanish education
- Asked to respond to the need for services to be provided for extended hours at the Family Practice of Holyoke (operated by MMH), 63% of respondents indicated there is a need. Approximately 80% of the respondents indicated the clinic should stay open later.
- Asked if the respondent or someone in their household delayed healthcare due to lack of money and/or insurance, 65% of the respondents indicate they had delayed care.

¹¹ Ibid.

- Asked to respond to the concern about maintaining ambulance services in Phillips County, 64% of respondents indicated they are very concerned.

Based on these and other more detailed data, the attendees at the public meetings recommended the following opportunities to the CNAT.

- Dental care and oral health
- Education of community regarding:
 - Specialists and other services provided at MMH
 - Non-MMH services available in the community
 - Long term care services available
- Childcare
- Mental and behavioral Health
- Youth unhealthy behaviors: substance & tobacco use, teen pregnancy and unintentional death & injury
- Nutrition/Obesity
- Uninsured population
- Transportation

IV. Prioritization of Needs:

Following the assimilation of the detailed health data along with results from the surveys and public meetings, MMH developed a prioritization of the health needs. Based on review of health, health access, and health outcomes data; demographic data; economic data; economic impact data; community survey data and attendees at the public meetings; the following issues were identified by MMH.

The following needs were identified *as most pressing*, based on community input and discussions at MMH:

- Focus on education
- Nutrition and obesity
- Mental and behavioral health
- Dental care & oral health

Certain issues were identified by the community as important, but MMH *has not addressed them in this plan*. MMH has a willingness to work with other entities within the community to look at providing appropriate programs, but will not take the lead on the following issues:

- Transportation
- Childcare services
- Youth unhealthy behaviors

V. Melissa Memorial Hospital Implementation Strategy

As a result of the Community Health Needs Assessment (CHNA), MMH has identified the following priorities it can address and has developed its plan to implement changes to impact the priorities.

Pressing Needs:

Specific need identified in the CHNA:

Focus on education

Key objectives:

- Provide information about services offered at MMH including specialists.
- Provide information and support about health issues in the County, including nutrition and obesity.
- Provide information and assistance in understanding health costs, insurance, financial assistance and related issues.

Implementation strategies:

- a. Work with local newspaper and radio station (along with MMH's website) to get information regarding services/specialists offered through MMH out to the community more prominently.
- b. Offer information and education regarding charity care, insurance, and payment plans to the community through MMH's website as well as through the creation and hiring of a Financial Counselor position at MMH; the position will also provide assistance with applications, filling out forms, and pre-authorizations related to health insurance.
- c. Provide educational classes regarding health and wellness to community members.
- d. Continue to offer, and increase offerings related to, community education and training through such things as: senior strength and balance exercise classes, community newsletter, CPR/AED classes, Health Fair, first responder and EMT training, etc.

Specific need identified in the CHNA:

Nutrition and Obesity

Key objectives:

- Provide information and education regarding healthy lifestyles, weight loss and weight maintenance periodically to community and systematically to patients who seek care through the Family Practice of Holyoke.

- o Support community events and activities that raise awareness of healthy lifestyles and sound exercise and nutrition practices.

Implementation Strategies:

- a. Offer at least four weight loss and/or healthy eating classes to the community, free of charge.
- b. Develop and offer an education class, which will include healthy eating components, for patients and community members who have diabetes mellitus.
- c. Continue to sponsor, financially and/or through support and participation, community events that encourage, promote, and assist with leading healthy lifestyles (e.g. Health Fair, Healthy Weigh, Amateur Triathlon, Senior Water Exercise Programs, etc).
- d. Increase the dissemination of collateral education material relating to healthy weight/eating habits through the Family Practice of Holyoke.

Specific need identified in the CHNA:

Dental care and oral health

Key objectives:

- o Evaluate opportunities to provide or support oral health services.

Implementation Strategies:

- a. Seek collaboration with Salud Bus for underserved youth in Phillips County.
- b. Investigate opportunities for dental care through MMH specialty clinic.
- c. Include information/education related specifically through educational offerings (see identified need: Focus on Education).

Specific need identified in the CHNA:

Mental and behavioral health

Key objectives:

- o Evaluate opportunities to provide or support mental and behavioral health services.

Implementation Strategies:

- a. Continue to collaborate with Centennial Mental Health Center and look for additional opportunities to enhance collaboration.

- b. Investigate opportunities for MMH to offer care for visiting providers through the specialty clinic.
- c. Evaluate the potential to integrate mental and behavioral health services through the Family Practice of Holyoke by way of the establishment of a formal patient-centered medical home.

VI. Other Needs Identified Not Addressed by MMH but for Which Other Community Resources Are Available

Although MMH is not able to meet all the needs and concerns identified during the CHNA, the following agencies and organizations are available in the community to help meet the needs and serve as potential collaborators or partners to bring education and work together to meet these concerns.

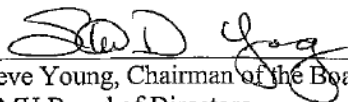
- Holyoke School District
- Centennial Mental Health Center
- Holyoke Chamber of Commerce
- ECCLPS
- Phillips County Department of Social Services
- Northeast Colorado Health Department
- Melissa Memorial Hospital Foundation

VII. Approval

The Melissa Memorial Hospital Board of Directors approves the Implementation Strategy for addressing the priorities identified in the Community Health Needs Assessment. Approval was affirmed at the regular Board meeting held on January 28, 2014.



Sheryl Farnsworth, Secretary-Treasurer
MMH Board of Directors



Steve Young, Chairman of the Board
MMH Board of Directors

APPENDIX B
STATEMENT OF MUTUAL AGREEMENT

Statement of Mutual Agreement

University of Northern Colorado

Doctorate of Nursing Practice Capstone Project

Derek Doorn RN, BSN, DNP-S

The purpose of the “Statement of Mutual Agreement” is to describe the shared view between Holyoke Family Clinic and Derek Doorn, DNP Candidate from the University of Northern Colorado, concerning his proposed capstone project.

Proposed Project Title: Developing a Clinical Guideline with Embedded Algorithm for the Dosing Frequency of Amoxicillin in Pediatric Group A-Beta Hemolytic Streptococcal Pharyngitis.

Brief Description of Proposed Project: In order to enhance quality and consistency of primary care practice, the purpose of this DNP Capstone Project is to evaluate if the development of a clinical guideline with embedded algorithm for the dosing frequency of Amoxicillin in pediatric Group A-Beta Hemolytic Streptococcus (GABHS) pharyngitis, utilizing current evidence based practice and expert opinion, can improve provider proficiency in dosing, and improve patient outcomes and adherence. Through retrospective patient chart analysis, and utilization of the Delphi method, the clinical practice guideline will address amoxicillin dosing frequency issues in pediatric GABHS. The Stetler Model will be used to translate the research findings into a method of clinical practice.

Goal of Capstone Project: The goal of this Capstone project is to develop a clinical practice guideline to aid healthcare providers at the Holyoke Family Clinic, and elsewhere, in optimally treating pediatric patients diagnosed with GABHS.

Proposed On-Site Activities: Proposed on-site activities would include a retrospective study of patient charts to identify current amoxicillin dosing trends among providers treating pediatric GABHS. A Delphi study to establish expert consensus surveying multiple providers would be utilized to create a clinical practice guideline. Guideline would be available for providers at Holyoke Family Clinic for use in the future, if so desired.

Confidentiality of Patient Records: The retrospective portion of this Capstone project will be performed by reviewing patient charts from 2015 to 2017 to identify pediatric patients diagnosed with GABHS, no personal identifying data will be collected. The purpose of the study is to identify current trends in amoxicillin dosing for this population. Information from the study will provide an increased awareness of the potential benefit, and implications of implementing a clinical practice guideline.

Responses from each round of Delphi questionnaires will be kept confidential, only the project supervisor and Capstone Chair/Research Advisor will have access to the completed surveys to protect the identity of respondents.

The designated Capstone Community member agrees to participate in the review and approval of the proposal and presentation of the final version of the project, and will attend on campus or remotely meetings for both.

The DNP Capstone project will include a final report, an abstract, potential publication or oral presentation of the report. No personal identifiers will be included, and all data will be reported in aggregate form. The author welcomes any comments or suggestions from the agency, but reserves the right to publish findings and analysis according to professional standards and principles of academic freedom. For any work of a scholarly nature, the Author agrees to follow the Agency preference in how it is to be named (or not) in the work.

Derek Doorn

07/26/2017

Signature of DNP Student

Date

Jessica Skomp FNP-C

7/26/2017

Signature of Committee/Agency Member

Date

Kathleen M. Dunne

07/26/2017

Signature of DNP Capstone Chair/Research Advisor

Date

APPENDIX C
INSITUTIONAL REVIEW BOARD APPROVAL



Institutional Review Board

DATE: July 31, 2017

TO: Derek Doorn
FROM: University of Northern Colorado (UNCO) IRB

PROJECT TITLE: [1070892-2] Developing a Clinical Guideline with Embedded Algorithm for the Dosing Frequency of Amoxicillin in Pediatric Group A-Beta Hemolytic Streptococcal Pharyngitis

SUBMISSION TYPE: New Project

ACTION: APPROVAL/VERIFICATION OF EXEMPT STATUS

DECISION DATE: July 31, 2017

EXPIRATION DATE: July 31, 2021

Thank you for your submission of New Project materials for this project. The University of Northern Colorado (UNCO) IRB approves this project and verifies its status as EXEMPT according to federal IRB regulations.

Hello Mr. Doorn,

Thank you for your modifications. Your IRB application is approved.

Sincerely,

Nancy White, PhD, IRB Co-Chair

We will retain a copy of this correspondence within our records for a duration of 4 years.

If you have any questions, please contact Sherry May at 970-351-1910 or Sherry.May@unco.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Northern Colorado (UNCO) IRB's records.

APPENDIX D
ROUND ONE DELPHI SURVEY

1. What is your current prescribing practice in regards to pediatric patients diagnosed with GABHS Pharyngitis?
2. What guidelines do you currently utilize related to pediatric GABHS Pharyngitis treatment?
3. How would you rate non-compliance with antibiotic regimens for pediatric clients in your practice?

Choose one: Not A Problem, Minor Problem, Some Problems, Definite Problem.
4. What factors do you believe contribute to pediatric non-compliance with antibiotic therapy?
5. Would a more consistent and uniform amoxicillin dosing regimen be helpful to your current group practice, if that regimen was in line with the most recent evidence based guidelines?

APPENDIX E
ROUND TWO DELPHI SURVEY

1. For pediatric patients with positive Group AB Hemolytic Strep (GABHS) pharyngitis the preferred dosing frequency for amoxicillin is twice daily. Do you agree?

Yes No

2. Patient compliance with antibiotics is an issue that affects patient outcomes in practice. Do you agree?

Yes No

3. Some of the primary factors affecting compliance with a course of antibiotics include busy schedules, school or day care staff overseeing doses, and multiple daily doses. Do you agree?

Yes No, there are other primary factors.

4. For patients with factors that could affect compliance, once daily dosing of amoxicillin is an alternative to help improve compliance. Do you agree? Yes No

5. For the PDF file attached in the survey invitation email, do the 4 questions to ask (who, what, when, where) give a good indication of when variances to dosing might be warranted?

Yes No. There are other indicators that should be addressed.

6. For guidelines and algorithms such as this one, what is the preferred format?

- Wallet sized card, something easy to carry in my pocket, or to pin up.
- 3x5 laminated card, something small to post over a desk or work area.
- Full printed page, easy to view.
- Other (please specify)

APPENDIX F
CONSENT FORM FOR HUMAN PARTICIPATION
IN RESEARCH

**CONSENT FORM FOR HUMAN PARTICIPATION IN RESEARCH
UNIVERSITY OF NORTHERN COLORADO
HOLYOKE FAMILY CLINIC**

Project title: Developing a Clinical Guideline with Embedded Algorithm for the Dosing Frequency of Amoxicillin in Pediatric Group A-Beta Hemolytic Streptococcus

Student Researcher: Derek Doorn, RN (DNP Student)

Research Advisor: Kathleen N. Dunem, PhD, APRN, CNM, School of Nursing

Co-Advisor: Vicki Wilson, PhD, MS, RN, School of Nursing

Committee Member: Jessica Skomp FNP.

Expert Consensus via a Delphi Study

Dear Provider,

I am developing a DNP Capstone project to evaluate if a clinical guideline with embedded

algorithm, utilizing current evidence based practice and expert opinion, can improve provider proficiency in dosing, and improve patient outcomes and adherence. The primary goals of this project are:

1. Identify current amoxicillin dosing frequency patterns and trends for Pediatric GABHS in a clinical setting, and ongoing review of current literature.
2. Develop and validate clinical guideline algorithm for Pediatric GABHS dosing frequency with a panel of experts through use of the Delphi method.
3. Implement the clinical guideline algorithm for Pediatric GABHS dosing frequencies.
4. Assess provider satisfaction and patient outcomes post-implementation.

The Delphi Method is a structured communication tool or technique that utilizes a questionnaire format to survey a panel of experts (within the field of study under investigation), using two or more rounds of questioning. Information gathered from the Literature Review regarding amoxicillin dosing frequency in GABHS Pharyngitis was used in development of the first round of questions. The first round of questions will also relay general information regarding current recommendations from multiple clinical guidelines in the diagnosis and treatment of GABHS Pharyngitis. Responses gathered from at least two rounds of Delphi surveys will be used in development of the clinical practice guideline. Planning how to implement the recommendation as a clinical practice guideline and evaluate outcomes is the final phase of this project.

The Delphi Method, originally developed in the 1950's, has been used in healthcare, as well as other industries and is of value when there is uncertainty or lack of empirical knowledge to achieve general consensus. It is an effective tool to assist in protocol changes as it requires integration of expert review and opinion even in the presence of disagreement. It is anticipated that two rounds will be necessary for

completion of this capstone project. All Delphi surveys will be sent and returned electronically with a private e-mail account only accessible by the DNP student. It is estimated that each participant will spend approximately 10-15 minutes in completion of survey questions within each round of the Delphi process.

Delphi survey responses will be kept **confidential**, used only for sending surveys. **Participation is voluntary.**

If you know any providers that may be interested in participating in these surveys, please pass on or forward this email to them.

If you begin to participate, you may decide to stop or withdraw at any time. If you have any questions, please contact one of the undersigned.

Having read the above document and having had an opportunity to ask any questions, please access the link to [Phase One: Delphi Study Round One Questions](#) and complete the survey.

If you complete the survey, it will be assumed that you have communicated consent for your participation. You may keep this form for future reference. If you have any concerns about your selection or treatment as a research participant, please contact Sherry May, IRB Administrator, office of Sponsored Programs, Kepner, Hall, University of Northern Colorado, Greeley, Co 80639. Phone 970-351-1910.

This informed consent will be e-mailed and accompany each round of the Delphi study

Student Researcher: Derek Doorn, BSN, RN, DNP-S

E-mail: door1075@bears.unco.edu

Phone: (720) 435-6205

Research Advisor: Kathleen N. Dunemmn, PhD, APRN, CNM

E-mail: Kathleen.Dunemmn@unco.edu

Phone: (970) 351-3081/ (303) 649-5581

Co-Research Advisor: Vicki Wilson, PhD, MS, RN

E-mail: Vicki.Wilson@unco.edu

Phone: (970) 351-1295

Committee Member: Jessica Skomp, FNP

Address: Holyoke Family Clinic, 1001 East Johnson St, Holyoke CO 80734

E-mail: jessica.skomp@bannerhealt.com

Phone: (303) 973-3529

APPENDIX G
DOSING FREQUENCY ALGORITHM

For Pediatric patients diagnosed with Group A Strep Pharyngitis, before deciding on the frequency of dosing amoxicillin, ask these 4 questions.

WHO will be responsible for administering the medication?
If more than 1 person (i.e. parent, school nurse, day care staff) consider once daily dosing.



WHAT will the patient tolerate regarding taste or multiple daily dosing?
If not tolerant, consider once daily dosing.



WHEN would doses be administered?
If caregiver has a variable work/school/other schedule, consider once daily dosing.



WHERE would doses be administered?
If doses would be administered in multiple locations (school, other family, day care), consider once daily dosing.

APPENDIX H**CLINICAL GUIDELINE WITH EMBEDDED ALGORITHM
FOR DOSING FREQUENCY OF AMOXICILLIN IN
PEDIATRIC GROUP A-BETA HEMOLYTIC
STREPTOCOCCAL PHARYNGITIS**

A Clinical Guideline with Embedded Algorithm for the Dosing Frequency of Amoxicillin in Pediatric Group A-Beta Hemolytic Streptococcal Pharyngitis.

Patient Population

Pediatric patients diagnosed with GABHS (Group A-Beta Hemolytic Streptococcal) pharyngitis, who will be treated with amoxicillin.

Clinical Specialty

Family Practice
Infectious Diseases
Internal Medicine
Pediatrics

Intended Users

Advanced Practice Nurses
Nurses
Physician Assistants
Physicians

Objectives

- Minimize duration of, and discomfort from, associated symptoms of GABHS.
- Minimize treatment failures associated with medication non-compliance.

Key Points

- In pediatric patients diagnosed with GABHS Pharyngitis, multiple factors can affect compliance.
- Twice daily Amoxicillin is the preferred treatment in pediatric GABHS Pharyngitis, although once daily dosing has been shown to be as effective, and once daily dosing has been shown to improve medication compliance compared to multiple daily dosing.

- Patients at risk for non-compliance and associated treatment failure should be identified and once-daily dosing may be considered for those patients identified as at risk.

Background

Amoxicillin dosing guidelines for pediatric GABHS pharyngitis vary and are not consistent with regards to dosing frequency. Current guidelines offer no direction or clinical guidance based on patient presenting factors.

Recommendations

The strength of recommendation (I-III) and levels of evidence (A-D) are defined at the end of the Recommendations field.

1. When treating pediatric patients diagnosed with GABHS pharyngitis with amoxicillin, twice-daily dosing frequency is the preferred approach (I, D).
2. Use of a simple four question algorithm (see chart below) should be utilized for patients deemed at risk for treatment failure related to non-compliance and to determine appropriateness of using once-daily dosing frequency (I, D).

For Pediatric patients diagnosed with Group A Strep Pharyngitis, before deciding on the frequency of dosing amoxicillin, ask these 4 questions.

WHO will be responsible for administering the medication?
If more than 1 person (i.e. parent, school nurse, day care staff) consider once daily dosing.



WHAT will the patient tolerate regarding taste or multiple daily dosing?
If not tolerant, consider once daily dosing.



WHEN would doses be administered?
If caregiver has a variable work/school/other schedule, consider once daily dosing.



WHERE would doses be administered?
If doses would be administered in multiple locations (school, other family, day care), consider once daily dosing.

Definitions

Levels of Evidence

- A. Randomized controlled trials
- B. Controlled trials, no randomization
- C. Observational trials
- D. Opinion of expert panel

Strength of Recommendation

- I. Generally should be performed
- II. May be reasonable to perform
- III. Generally should not be performed

Method Used to Formulate Recommendations

Expert Opinion

Strategy for Obtaining Expert Opinion

Expert opinions were obtained by soliciting participation from 19 providers caring for family or pediatric patients in multiple northern Colorado settings. Nineteen providers (10 physicians, 8 nurse practitioners, and 1 physician assistant) were invited to participate in the surveys. Invitations were sent out via email with an embedded link to a SurveyMonkey page where the survey could be accessed.

Related National Guidelines

ICSI, IDSA, University of Michigan, NICE, AHA, UpToDate, and Epocrates

Guideline Developer

Derek Doorn DNP-S

Disclosures

The author of this guideline reports no potential conflicts of interest.