A Retrospective Study of the Diagnostic and Treatment Practices of Health Care Professionals for Patients Receiving Out-Patient Intravenous Antibiotic Therapy for Cellulitis

by

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Abstract

Cellulitis is a common soft tissue infection that is perceived as simple to diagnose and manage, and is frequently treated on an out-patient basis. The resolution of the cellulitis should occur if the infection is properly diagnosed and treated with the appropriate oral and parenteral antibiotic therapy.

Many clients, with presenting symptoms of cellulitis, may not warrant parenteral antibiotic therapy, or may not have cellulite at all. Mismanagement of the patient produces many consequences to the client and the health care system. For clients, misdiagnosis or inappropriate treatment may further compromise their health. For the health care system, these errors result in increased health care costs and increased workload for health care professionals.

The purpose of this study was to determine if there were a significant number of clients with cellulitis that were diagnosed with an infection other than cellulitis, or whose treatment was misdiagnosed and, to determine where discrepancies may have occurred. The research questions addressed were: (1) What is the proportion of CITP clients who initially have been diagnosed with an infection other than cellulitis? (2) What is the proportion of clients with cellulitis who were not trialed on oral antibiotic therapy prior to receiving parenteral antibiotic therapy? (3) What is the proportion of clients with cellulitis who were not prescribed the appropriate oral antibiotic? (4) What is the proportion of clients

with cellulitis who did not remain on oral antibiotic therapy for a specific period of time prior to their doctor requesting they be placed on intravenous antibiotic therapy? (5) Does the incidence of cellulitis increase with certain underlying medical conditions, age group or gender?

The research design was a retrospective study that reviewed the computer database/charts located at The Winnipeg Community Intravenous Therapy Program. Data was collected from a sample population of 415. The study examined the variables of the initial and outcome diagnosis, as well as the prescribing practices of oral antibiotic therapy for clients diagnosed with cellulitis.

Frequency distributions identify the proportion values of the data. Chi-square statistical analysis identified any significant occurrences as each research question was cross-tabulated with gender, age cohort and, underlying medical conditions. Results of this analysis identified many significant frequency proportions within the sample population that addressed the research questions. As well, cross-tabulation identified significant variables that may affect the infection process, identified populations at risk for developing the disease and, presented frequency proportions of cellulite infections related to the time of year, month and day.

Based upon the findings of this study, implications for nursing practice, education and research were addressed.

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Chapter One

Introduction

Cellulitis is a common soft tissue infection that is perceived as simple to diagnose and manage, and is therefore frequently treated on an outpatient basis. Quick and successful resolution of the cellulitis should occur if the infection is properly diagnosed and treated with the appropriate oral and parenteral antibiotic therapy (Brook & Frazier; 1995, Ginsberg, 1981; Powers, 1991; Aly, Roberts, Seipol, & MacLellan, 1996).

Ideally, severe cellulitis which requires parenteral antibiotic therapy, should be managed by infectious disease specialists but, due to the commonality of cellulitis, it is frequently treated by health care professionals who work in emergency departments, outpatient/community clinics, and physicians' offices (Ginsberg, 1981, Lindbeck & Powers, 1993). If the condition is severe enough to warrant intravenous antibiotic therapy, these patients are placed on intravenous antibiotics which can be provided through home infusion programs.

The Community Intravenous Therapy Program (CITP), based in Winnipeg, has found that 42% of their referrals are clients diagnosed with cellulitis (The Winnipeg Community Intravenous Therapy Annual Report, 1998). The frequency of cellulitis referrals and assessments performed by the Clinical Resource Nurses employed by the program has allowed them to gain considerable expertise in the diagnosis and treatment of cellulitis. The nurses have frequently questioned the

need for IV antibiotic therapy and, the physician's reluctance to try oral antibiotics. Many clients who are prescribed oral antibiotic therapy, do not remain on the oral medication long enough for improvement of the disease process to be seen or, it is questioned whether the client was compliant with taking their medication (personal communication, S.C, July. 1998). Finally, the nurses have questioned the medical diagnosis of cellulitis, suspecting that the inflammation may be due to another type of infection. Two incidences where the nurses questioned a cellulitis diagnosis can be cited from the CITP database. The examples are of a lady who was unsuccessfully treated three times for cellulitis, and later rediagnosed as rheumatoid arthritis, and a gentleman who had developed gout, but was diagnosed and treated for cellulitis. Thus, these nurses have found that clients are occasionally diagnosed with an infection other than cellulitis and, that the management of cellulitis is inconsistent.

Significance of the Problem

The Winnipeg Community Intravenous Therapy Program (CITP) is a community based program that allows clients with an infection the option of ambulatory outpatient therapy as an alternative to hospitalization. A registered nurse, from The Victorian Order of Nurses (VON), administers the intravenous antibiotic therapy to the patient in the comfort of their home.

The St. Boniface Hospital's Pharmacy Department first established the CITP in 1978. It was the first home infusion program in North America. The

present program provides intravenous antibiotic therapy to clients in their own home, with care delivered by a community nursing agency, VON. The program is a component of The Winnipeg Regional Health Authority and all costs to the client are by this agency. The program has no age restrictions, and has provided care to clients as young as newborns, to as old as 95 years of age. Physicians initiate referrals to the program for clients that are deemed as outpatient therapy candidates.

Since February of 1996, the program has accepted 663 clients with a diagnosis of cellulitis. These clients have accounted for 42% of the program's client population (The Winnipeg Community Intravenous Therapy Program, Annual Report, 1999). Many clients have been referred to the program with a diagnosis of cellulitis, but their presenting symptoms may not warrant parenteral antibiotic therapy or may not have cellulitis at all. Mismanagement of the patient, from either misdiagnosis or inappropriate treatment, produces many consequences to the client and the health care system. For clients, misdiagnosis or inappropriate treatment may further compromise their health. For the health care system, these errors result in increased health care costs and increased workload for health care professionals. Misdiagnosis and mismanagement of clients with cellulitis may further compromise the current health care system that is already fiscally restrained and experiencing shortages of health care professionals.

The importance of this study is to track the diagnostic and treatment practices of health care professionals. If misdiagnosis or inappropriate treatment

continues, many clients' health status will be compromised. The results of the study will encourage the CITP to notify health care professionals of the study's results. This will make them aware of inconsistencies in diagnosis and treatment in the past and ensure appropriate care and treatment for their future practice. This will also decrease the amount of time the client remains ill and avoid any life threatening diseases that may exacerbate. Not knowing this information may place many clients with a diagnosis of cellulitis at risk for inappropriate treatment that can increase health risks to the clients and health care costs overall.

Purpose and Research Questions

The objective of this retrospective descriptive study is to examine the initial diagnosis, management practices and outcomes of adult clients, who have been initially diagnosed with severe cellulitis and treated with intravenous antibiotic therapy from a home infusion program. The purpose of this approach is to determine if there is a significant number of clients with cellulitis that are diagnosed with an infection other than cellulitis, or whose treatment is mismanaged, and to determine where discrepancies may have occurred. This information can provide a framework where preventative strategies can be developed and implemented. The research questions generated by the investigator are:

1. What is the proportion of CITP clients who initially have been diagnosed with an infection other than cellulitis?

2. What is the proportion of clients with cellulitis who were not trialed on oral antibiotic therapy prior to receiving parenteral antibiotic therapy?
3. What is the proportion of clients with cellulitis who were not prescribed the appropriate oral antibiotic?
4. What is the proportion of clients with cellulitis who were non-compliant in self-administration of their oral antibiotics?
5. What is the proportion of clients with cellulitis who did not remain on oral antibiotic therapy for a specific period of time prior to their doctor requesting they be placed on intravenous antibiotic therapy?
6. Does the incidence of cellulitis increase with certain underlying medical conditions, age group or gender?

Conceptual Framework

Neuman Health-Care Systems Model

The Neuman Health-Care Systems Model (Neuman, 1982) is the theoretical framework chosen for this study. The model conceptualizes the client as a system with a basic structure of energy resources protected by lines of resistance and defense. Three environmental stressors, intra-, inter-, or extra-personal can act upon these protective lines, which can disrupt equilibrium or wellness of the client. The system's interrelationship of the five variables, physiological, psychological, spiritual, sociocultural and developmental,

determines the degree of disequilibrium, influences decisions for interventions, and affects client outcome.

The Neuman Nursing Process consists of three parts, diagnosis, goals and outcomes. Careful assessment of the client identifies intra-, inter- and extra-personal stressors, which include the five variables described previously. Once assessment is complete, intervention strategies are negotiated as a component of the nursing goals. Finally, outcomes confirm equilibrium/wellness or identify the need for reformulation of interventions. These outcomes validate the nursing process (Neuman, 1987).

Neuman's nursing diagnostic format consists of collecting client health information to establish a complete database where it is synthesized with theory to determine variances from wellness. The database consists of the following seven-step process, that always considers Neuman's five variables, physiological, psychological, sociocultural, developmental and spiritual being:

Identification and evaluation stressors that pose a threat to the client.

Assessment of the condition and strength of the basic structure.

Assessment of flexible and normal lines of defense, and line of resistance.

Identification and evaluation of intra-, inter-, and extrapersonal interactions between the client and the environment.

Evaluation of life processes.

Identification and evaluation of internal and external resources for optimal wellness.

Identification and resolution of perceptual differences between the caregiver and client.

The variances from wellness are determined by synthesizing theory and data to develop a diagnostic statement, and determine hypothetical goals, with interventions to achieve a level of wellness.

Neuman's nursing goals are determined by negotiation for perspective change and intervention strategies to retain client system stability. Finally, Neuman's nursing outcomes are first determined by accomplishment of nursing interventions through use of one or more of the following prevention modes:

1. Primary prevention, where action is taken to retain system stability.
2. Secondary prevention, where action is taken to attain system stability.
3. Tertiary prevention, where action is taken to maintain system stability.

Evaluation of the outcome goals after interventions confirms success or determines reformulation of goals. Intermediate and long range goals for subsequent nursing actions are structured to short term goals, with client care outcome validating the nursing process.

The variables identified in this study can be easily incorporated into Neuman's Nursing Process Format. Formulation of Neuman's database begins with identification and evaluation of stressors, which for this study is the assessing and diagnosing of clients with cellulitis. Although the chart review can not properly determine the condition and strength of the basic structure, the variables of age, and underlying medical conditions can give some description to this component. These variables can also influence the flexible and normal lines

of defense, along with the line of resistance. Intrapersonal interactions between the client and environment correlate with the variables of underlying medical conditions, client not trialed on oral antibiotic therapy or not prescribed the appropriate antibiotic. The variable of not filling the oral antibiotic prescription allies with the extrapersonal interactions from the nursing process format. As this study is based on data obtained from administrative databases only, it is unable to identify and evaluate internal and external resources for wellness. Finally, the process of identification and resolution of perceptual differences in Neuman's format, coincides with the study's variables of, unfilled oral antibiotic prescriptions, and appropriate length of time for oral antibiotic to be effective prior to being placed on intravenous antibiotic therapy.

To determine a diagnosis and develop hypothetical goals, the study's following variables can be utilized; diagnosis of cellulitis, prescription of the appropriate antibiotic therapy, patient compliance with filling of oral antibiotic prescription, and an adequate period of time for the oral antibiotic therapy to be effective.

The study's variables of trialing oral antibiotic therapy, prescribing the appropriate antibiotic therapy and determining compliance through clients filling their prescriptions of oral antibiotic therapy, fit easily into Neuman's format of nursing goals and primary prevention in nursing outcomes. Finally, evaluation of the outcome goals can be evaluated and identified using two of the study's variables, these being an outcome diagnosis other then cellulitis or the referral to

CITP for intravenous antibiotic therapy. Reformulation of goals and interventions then occur, as the current therapy is not effective enough to resolve the infection. This framework is useful for this study's examination of the diagnostic, treatment and outcome practices for clients with cellulitis. The variables under investigation correlate well with the components of Neuman's Nursing Model. The variables of this study are identified as stressors to the client's equilibrium and can be identified within the first two components of the nursing process. When examining outcomes, the client's continual state of unwellness due to the unresolved cellulitis validates the study's variables as stressors to the system.

The Neuman Systems Model is considered to be wellness oriented and holistically focused. The model is proven to be useful for researchers. Louis and Koertvelyessy (1989) conducted a global survey for use of the model and found 100 researchers utilized Neuman's framework in their studies. Neuman's framework implemented within nursing practice has shown results to be equivocal. Benyon (1989) utilized the framework to promote the first theory-based nursing records in a three-year project initiated with Public Health nurses in London Ontario. Staff was to use the model for assessment, diagnosis, identifying nursing outcomes and evaluating interventions. The study was successful in incorporating theory based practice using The Neuman Systems Model. Vaughan and Gough (1995), promoted the use of the model in intensive care units where physiological needs are prioritized over other aspects of care, and will lead to a more wholistic approach to care. Neuman (1996) reports that this model is the third most utilized framework by researchers and graduate

students. Finally, this framework has been used successfully for research by other health disciplines (Neuman, 1996).

Theoretical Assumptions

Neuman (1996) bases her theory on 10 assumptions, both implicit and explicit:

1. Each client system is unique with common response ranges.
2. Each environmental stressor differs in a client's normal line of defense. The relationship of the 5 variables affects the defense reaction of the client's flexible line of defense.
3. Over time each system develops its own range of responses called their normal line of defense.
4. Stressors can penetrate the normal line of defense if the flexible line of defense if inadequate. The interrelationship of the 5 variables determines the degree of equilibrium.
5. The client system is made of the interrelationships of the 5 variables. Wellness of the system relies on available energy.
6. The system's internal lines of resistance attempt to stabilize the system.
7. Primary prevention identifies or reduces possible health risks due to stresses.
8. Secondary prevention identifies interventions and treatments to reduce symptoms from a stress reaction.

9. Tertiary prevention is the adaptive process of the system during reconstitution.
10. The system is constantly changing energy with the environment.

Basic Assumptions of this Study

The following assumptions serve as the basis of the study:

1. Health care professionals may not be able to differentiate skin inflammation from cellulitis.
2. A diagnosis of cellulitis does not necessarily require intravenous antibiotics as a treatment intervention.
3. Healthcare professionals can prescribe inappropriate oral antibiotic therapy for cellulitis.
4. Patients who fill their prescriptions are compliant.
5. Non-compliance in self-administration of oral antibiotics by clients with cellulitis will effect the outcome of the disease process.
6. Health care professionals place clients with cellulitis on intravenous antibiotic therapy before the oral antibiotics have had sufficient time to work.
7. Misdiagnosis, prescription of inappropriate oral antibiotic therapy, and non-compliance result in increased costs to the health care system.

Operational Definitions

Cellulitis: An infection of the skin and soft tissues with distinct characteristics producing redness, tenderness, pain, ill defined borders of erythema and edema. The most common causes are *Staphylococcus aureus* and *Group A beta-hemolytic Streptococci* (Lindbeck & Powers, 1993, and Hacker, 1994). All chart reviews for this study will have the client's initial and/ or outcome diagnosis of cellulitis.

Compliance: The extent to which clients modify his or her behavior in order to follow medical advice. Non-compliance is a client's behavior not coinciding with medical or health advice (Hayne, Taylor & Sackett, 1979). All chart reviews for this study that provide information regarding a date the prescription was written, will be correlated with the client's Manitoba Health Services Commission's (MHSC) Drug and Program Information Network's (DPIN) report. This information will identify the date the client filled the prescription. Compliance or non-compliance will be deemed depending upon the time period between the two dates. The researcher will determine compliance if the prescription is filled within 24 hours and determine non-compliance if not filled within 24 hours after receiving the prescription. This operational definition was not utilized for this study, as access was not attained from The Winnipeg Regional Health Authority.

Oral Antibiotic Therapy: Appropriate oral antibiotic therapy for adults, recommended by Sandford et al (1997) is cloxacillin 500 mg. every (q) 6 every (h) for 7-10 days, cephalexin 500 mg. q12 h for 7-10 days, penicillin V 500 mg q6h for 7-10 days, clindamycin 600 mg q8h for 7-10day and, erythromycin 250 mg q6h for 7-10 days. A chart review from CITP and/or DPHIN report review from MHSC will identify if the correct antibiotic and dose were prescribed for the client with cellulitis.

Chapter 2: Literature Review

Given the purpose of this study is to examine the diagnosis, management, and outcomes of clients experiencing severe cellulitis, a review of current nursing, medical and pharmaceutical practices was conducted. The literature review format operationalizes the nursing process derived from Neuman's System Model. The content was comprised from the following areas: historical prescribing practices and treatments, pathophysiology of cellulitis, presenting symptoms for proper diagnosis, current prescribing practices, pharmacodynamics and pharmacokenetics of antibiotics, nursing measures and the role of patient compliance with oral antibiotic medication.

Historical Prescribing Practices

Cellulitis is a bacterial infection, which can be fatal if not treated promptly with the appropriate antibiotic therapy. In the pre-antibiotic era, the mortality rate was 25% for patients diagnosed with cellulitis (Steele, 1937). After it's discovery, penicillin replaced such treatments as multiple incisions with antiseptic baths, autogenous vaccines and Roentgen therapy (Hughes, 1912; Cushway & Maier, 1918.) Historically, treatment for clients presenting with cellulitis was hospitalization with a course of intravenous antibiotic therapy. Due to increasing health care costs, outpatient therapy is increasingly being used as a cost-effective alternative.

As pharmaceutical companies developed newer and stronger bactericidal agents, many studies were conducted to compare disease outcomes with two or more of these antibiotics (Powers, 1991; Lindbeck & Powers, 1993; Nichols, Smith, & Geckler, 1995; Brown, Chamberlain, Goulding, et al, 1996). There is an absence of studies in the literature that examine the common prescribing practices among health care professionals, either institutional or non institutional. There are recent studies that explore the diagnosing and treatment regimes by health care professionals for hospitalized clients with cellulitis, where continuity of assessment, treatment and compliance are most likely greater within this environment than within the community (Aly, Roberts, Seipol; MacLellan, 1996 & Ginsberg, 1981). Studies examining the treatment of community clients with cellulitis were absent from the literature reviews. There have been many articles and text citations that provide diagnostic criteria and treatment plans for severe cellulitis, but the information is not research based and may be the sole view of the author (Hacker, 1994; Schwartz, Das-Young, Ramirez, -Ronda, et al, 1996; Parish, & Witkowski, 1991)

While these studies provide a framework for diagnostic criteria and prescribing practices for severe cellulitis, they do not address the continuity of diagnosis and treatment in the community. These studies also do not address compliance as a variable. Outcomes of antibiotic regimes and treatment plans are strongly affected by how the client adheres to the advice of the health professional.

Pathophysiology of Cellulitis

The pathophysiology of cellulitis will be briefly discussed to promote an understanding of the disease process, the development of diagnostic symptoms, and its susceptibility to bactericidal effects from antibiotic therapy.

The medical definition of cellulitis was found to have little variation by the various authors in the literature review, where the majority of physicians practiced in the fields of infectious disease, family practice, emergency room medicine, and dermatology. A simple description for cellulitis was an infection of the skin and subcutaneous tissues (Brook & Frazier, 1995; Lindbeck & Powers, 1993). It was further described as an inflammation of the cells, where an acute infection is found in the dermis and subcutaneous tissues. Hook (1987) along with Saiag and associates (1994), define the disease further by viewing it as a diffuse inflammation of the soft or connective tissue, in which a thin, watery exudate spreads through the cleavage planes of interstitial and tissue spaces (Curtis, 1999; Hook, 1987; Saiag et al, 1994).

The human skin is normally colonized with commensal bacteria that are considered to be normal flora. These bacteria reside in the epidermal stratum and hair follicles, with the greatest growth occurring in the skin folds (Phipps, Long, & Woods, 1983; Hook, Hooton, Horton, Coyle, Ramsey & Turck 1986). Various bacterial species can cause cellulitis, but the two most common microbial species are *Staphylococcus aureus* and *Streptococcus pyogenes* (also known as *Group A beta-hemolytic streptococcus*). These will be the only species

discussed (Fleisher, Ludwig & Campos, 1980; Hook, Hooton, Coyle, Ramsey & Turck, 1986; Duvanel, Auckenthalet, Rohner, Harms & Saurat, 1989).

Staphylococcus aureus also called *coagulase-positive Staphylococcus*, due to its ability to clot plasma, usually live in the anterior nares and spread to the skin from these nares. *Staphylococcus aureus* spreads centrally from a localized infection such as an abscess, folliculitis, incision, or foreign body (Curtis, 1999). It has a distinct microbial shape and internal structure. They are aerobic or facultative anaerobic bacteria with gram-positive cell walls, which are stronger than gram-negative cell walls due to the peptidoglycan and peptide side chains which provide rigid structure that increases resistance to chemical breakdown and high osmotic pressures (Tortora et al, 1989).

The virulence of *Staphylococcus aureus* is due to the wide array of factors and enzymes the organism emits to breakdown healthy tissue. It has the capability to attach and colonize to normal skin tissue. Once it becomes attached, it produces and secretes the enzymes, lipase, protease and hyaluronidase, which damages tissue, and allows the bacteria to spread. Lipase digests the thick lipid membrane of healthy cells, Protease breaks down protein in muscle tissue and hyaluronidase dissolves hyaluronic acid, which is a polysaccharide found to be a main cell component in many tissues in the body, such as connective tissue. These bacteria also secrete protein A that binds to the body's IgG, thereby delaying the immune response. The bacteria also produce toxins that damage tissue. Finally, its ability to clot the surrounding plasma

enables the bacteria to elude white blood cells of the immune system (Tortora et. al. 1989; Fleisher, Ludwig & Campos, 1980; Levinson & Jawetz, 1996).

Over time, *Staphylococcus aureus* has acquired a remarkable resistance to antimicrobials. It can adapt to antimicrobial pressure and acquire resistance to penicillin from inappropriate use of antibiotics such as prescribing too low of a dose of cloxacillin. It can develop resistance to synthetic penicillins such as cloxacillin and first generation cephalsporins such as cefazolin. These strains of bacteria are then called *Methicillin Resistant Staph aureus* (MRSA) and can then only be eradicated using such antibiotics as clindamycin or vancomycin, both of which are more expensive and toxic antibiotic (Sanford, 1997; Lennette, Balows, Hausler & Shadomy, 1985).

Group A beta - hemolytic Streptococci (*S. Pyogenes*) are the other bacterial species that cause cellulitis. Their name is derived from their ability to cause hemolysis on the blood agar thereby forming a clear zone on the blood agar. These bacteria are facultative anaerobes with a gram-positive cell wall. Unlike *Staphylococcus aureus*, these bacteria rapidly spread diffusely producing symptoms of lymphangitis and fever (Curtis, 1999). Its susceptibility to antibiotic therapy is greater than *Staphylococcus aureus*. Penicillin is the drug of choice but clindamycin or erythromycin can be an alternative in patients with a penicillin allergy (Sanford, 1997).

This organism also has many virulent factors such as M protein, which is located on the external cell wall on its hair like fimbria. It has a property that helps the bacteria adhere to and colonize on mucous membranes. Deoxyribonuclease

is an enzyme from the bacteria that degrades DNA cells of healthy tissue. Streptokinase is another enzyme that dissolves blood clots. *S. Pyogenes* also emit the same enzyme as *Staphylococci aureus* called hyaluronidase and its mechanism of action was explained earlier. Finally, *S. Pyogenes* have the enzyme leukocidin which kills white blood cells.

Diagnostic Criteria for Cellulitis

Cellulitis is described by many authors as a visible localized soft tissue infection with distinct characteristics producing tenderness, pain, reddened areas with ill-defined borders of erythema and edema (Lindbeck & Powers, 1993; Swartz, M, 1990; Brook & Frazier, 1995; Saiag et al, 1994; Hacker, 1994). Erythema is a congestive or exudative redness of the skin caused by engorgement of the capillaries in the lower layers of the skin, due to injury, infection or inflammation (Dorland, 1983). Cellulitis can present with lymphanditis that produces red streaking at the site of infection (Linbeck & Powers, 1993; Curtis, 1999; Brook & Frazier, 1995). Although the literature provided many symptoms for diagnosing cellulitis, it did not provide criteria for diagnosing cellulitis symptoms that would require intravenous antibiotic therapy rather than oral antibiotic therapy.

According to Powers (1991) and Linbeck & Powers (1993), it can be argued that identifying the causative agent of uncomplicated cellulitis is not necessary because it is difficult to obtain a positive culture and empiric antibiotic

therapy is effective in the majority of cellulitis patients. There are some diagnostic tests that can provide a cellulitis diagnosis and further determine the type of bacteria present in the wound. Culturing of the wound can be performed if exudate is present. The area is cleansed with an antiseptic agent and fluid is aspirated from the site (Yagupsky, 1993; Simor, Roberts & Smith, 1988). If there is no fluid, a small volume of non-bacteriostatic normal saline is injected into the subcutaneous tissues and withdrawn. The culture is then sent for a Gram stain. Yagupsky (1993) and Curtis (1999), warn that even meticulous efforts to culture material from localized areas of infection and tissue biopsies yield a causative agent in less then 30% of the cases. The low sensitivity to this kind of culturing is due to the low density of pathogens present in the infected tissue (Duvanel, Ayckenthaler, Rohner, Harms & Saurat, 1989).

Blood and serum tests may also be performed to determine if an infection process is taking place within the body. Blood cultures can determine the type of bacteria present as cellulitis pathogens can enter the blood stream. A Complete Blood Count (CBC) and Erythrocyte Sedimentation Rate (ESR) can provide a clue that an inflammatory process is in progress. The white blood cell count (WBC) will be elevated, as they routinely increase when an infection is present in the body due to an increase in neutrophils (St. Boniface Hospital Laboratory Manual, 1997). The ESR is a non-specific test that increases in an acute inflammatory process (Lefever Kee, 1983).

Antibiotic Therapy Treatment for Cellulitis

Many authors agree that cellulitis most cellulitis can be treated effectively with oral antibiotics after the patient has been screened for the presence of pre-existing medical and physiological conditions that might place them at high risk for complications or failure of the oral therapy. Examples of pre-existing conditions that can affect therapy are diabetes, edema, peripheral vascular disease and immunosupression (Linbeck & Powers, 1993; Hacker, 1994; Curtis, 1999).

Most patients with cellulitis are treated empirically against *Staphylococcus aureus* or *S. pyogenes*. Literature and common practice support the use of cloxacillin 2 gm every 6 hours intravenously for 96 hours in severe cases, then stepping down to oral doses of 250mg to 500mg four times a day for 14 days. cefazolin 2 gm given every 8 hours intravenously for 96 hours is the preferred antibiotic, as cloxacillin is irritating to the vein and there is a current worldwide shortage of cloxacillin. Cefazolin is less irritating to veins and needs to be dosed less frequently. Cephalexin is another common oral antibiotic that is given 250-500mg every 8 hours for 7-10 days. penicillin V 125-500 mg every 8 hours orally, if the microbial agent is known or strongly suspected to be Streptococcus pyogenes, as it is extremely sensitive to this antibiotic. If the patient has a history of a penicillin allergy, oral erythromycin 333 mg every 8 hours or clindamycin 300 mg every 8 hours can be prescribed. (Lindbeck & Powers, 1993; Powers, 1991;

Brook & Frazier, 1995; Sanford, 1999; Isada, Kasten, Goldman, Gray & Aberg, 1996).

If oral antibiotics are prescribed to treat cellulitis, they must be taken for a minimum of 48 to 72 hours before determining their failure in resolving the infection. Therefore, time is required in order for the body to reach therapeutic antibiotic levels, which then provide the optimal effect of the antibiotic to eliminate the microbes. It has been the experience of CITP that improvement is rarely seen before 72 hours and that cellulitis may actually worsen after antibiotics are started, before improvement is seen.

Pharmacodynamics and Pharmacokenetics of Antibiotic Therapy for Cellulitis

To better understand the treatment process and importance of patient compliance, the pharmacodynamics and pharmacokenetics of the common antibiotics prescribed for cellulitis will be examined. Pharmacodynamics refers to the medication's mechanism of action on bacteria's cell structure and the time course of drug activity. Pharmacokenetics refers to the distribution, excretion, minimum inhibitory concentration (MIC) and minimum bactericidal concentration of antibiotics within the body (Conly & Shafron,1995). This information determines the amount of antibiotic to be administered and the duration of time between each dose. It is important to administer the correct amount of antibiotic so that the levels within the body remain above the MIC, noting that MIC levels

are used only for penicillins and cephalsporins. The MIC is the minimum amount of antibiotic required in the body to inhibit the targeted bacteria. If the antibiotic level falls below the MIC, bacteria will start to multiply and the infection will exacerbate (Conly, 1995; Barrier, Ely, Kapusnik & Gambertoglio, 1985; Bundtzen, Gerber, Cohn & Craig, 1981; Drusano, 1988).

Cloxacillin and cefazolin are the two most common intravenous antibiotics prescribed for the treatment of cellulitis and share the same pharmacodynamic features of lysing bacterial cell, as penicillin. The pharmacodynamic process is the inhibition of the bacteria's cell wall synthesis as penicillin binds to the penicillin binding proteins necessary for cell wall synthesis, which then halts the peptidoglycan synthesis of the cell wall and eventually destroys the bacteria. The pharamocokenetics of these three antibiotics are similar as well. They are widely distributed in the body tissues and fluids. The metabolism occurs in the liver with elimination of 90%-100% through the urine. Cefazolin has a longer half-life than cloxacillin and therefore, remains active longer against the bacteria than cloxacillin. After cefazolin administration, the antibiotic levels peak within 30 minutes to 2 hours with a half-life from 30 –90 minutes (Isada, Kasten, Goldman, Gray & Aberg, 1996). Penicillin G intravenously or penicillin V orally, are recommended if the know microbial agent is *S. Pyogenes*. Its half-life is 20-50 minutes and peaks orally at 0.5-1 hour, where then it is excreted through the urine. The recommended dose for intravenous therapy is 400,00 unit/kg/day every 4 hours (Isada et al, 1996).

Cephalexin, an alternative oral antibiotic for cloxacillin, eradicates both *Staphylococci aureus* and *S. Pyogenes* by inhibiting bacterial cell wall synthesis through halting peptidoglycan synthesis of the bacterial cell wall. It's half life is 30 minutes to 1.2 hours peaking within 60 minutes with 80%-100% of the drug excreted through the urine (Isada et al, 1996).

Clindamycin is an alternative antibiotic that can be prescribed for cellulitis, if there is an allergy history to penicillin and in selected cases of S. Pyogenes infection. Its mechanism of action involves binding to the ribosomal subunits of the bacteria and preventing protein synthesis. It is metabolized and eliminated hepatically with a half-life of 2-3 hours and a body concentration peak level of 1-3 hours. This antibiotic should usually be given orally due to its excellent oral viability and given intravenously only if the client can not take oral medication (Isada et al, 1996).

Erythromycin is another oral antibiotic alternative, for patients with a known penicillin allergy. It blocks the transpeptidation of the bacterial cell wall by binding to the 50S ribosomal unit. Its half-life is 1.5-2 hours and peaks from 30 minutes to 4 hours. It is excreted through feces (Isada et al, 1996).

Studies or clinical trials have been performed to compare many of the above antibacterial effects between each other or with newly developed antibiotics. These trials demonstrated that the antibiotics, such as ceftazidime and ceftriaxone, performed the same but needed to be given less frequently, and provided a broader scope of microbial kill. One has to remember, when reviewing the effects of the above or newer antibiotics, we only need to treat the bacteria

that cause cellulitis and that treatment must be cost effective. The newer broadspectrum antibiotics may kill the normal flora, which is undesirable. They are generally more costly as well. This can produce adverse effects for the clients and increase costs to the health care system, with possible long-term sequelae.

Non- Pharmaceutical Treatments

Non-pharmaceutical methods such as rest, elevation, immobilization are often used in the treatment regime to relieve pain, promote healing and enhance the effect of the antibiotics. These variables are not addressed in the current analysis or discussion sections of antibiotic therapy studies.

Alternate treatments are and adjunct to antibiotic therapy and do not replace it. Hacker (1994) recommends elevation of the area of infection, avoidance of injury to the area and application of warm compresses to the site. Ginsberg (1981) also recommends rest but states that there has been no data to support that these measures will improve the signs and symptoms of cellulitis.

The Role of Compliance in Relation to Self Administering Of Oral Antibiotics

The role of compliance for self-administered antibiotic therapy is paramount in the therapeutic outcome of clients with cellulitis. The literature

provides several definitions for compliance but the most widely referenced definition is from Haynes, Taylor & Sackett (1979), who view compliance as the extent to which the client modifies his or her overall behavior, including diet, lifestyle, and daily routines, in order to follow medical advice. This definition is interpreted as authoritarian in that it is incompatible with the humanitarian approach to client care as supported by King (1981). O'Hanrahan and O'Mally (1981), define compliance from the client's perspective as improved health, achieved through a treatment approach that is manageable, tolerable and effective.

Hayne et al (1979) also defines non-compliance, as a client's behavior not coinciding with medical or health advice. Hussey and Gilliland (1989) describe two types of non-compliance behavior, non-intentional and intentional. Non-intentional non-compliance occurs if the client does not fully understand their disease or condition being treated. Intentional non-compliance is when the client makes a conscious choice to find another method or not to comply. A global review of compliance studies written by Wright (1993) found that 50% of clients were non-compliant but it was unclear if the reasons for non-compliance were global as well. A study performed by Sackett and Snow (1979), found that compliance was better in short-term therapy goals that are aimed for cure outcomes, as opposed to long term therapies which focus on improving symptoms of chronic disease.

The literature provided several theories for medication compliance. The perceptual theory states that clients interpret the world as to what they see and

already know based upon pre-existing values and beliefs (Pennington, 1990). Their perception of health and medicine will determine their degree of compliance. The value clarification theory has clients making choices based upon their own personal understanding of those choices (Morrison, 1993; Col et al, 1990). Cultural theories suggest that clients have a cultural understanding of illness, its meaning and treatment. They make choices based upon how society views and supports the choices (Col et al, 1990). Finally, the health belief model views readiness to take action and engage in health related behavior dependant on the clients perception of their own susceptibility, the client's perception of the severity of the illness which in turn develops the client's perception of their own vulnerability (Becker & Maiman, 1975). There is an absence of studies that examine non-compliance of drug regimes utilizing these theoretical frameworks. Therefore, future research is needed to support the theories and provide more complete results about social and physiological factors involved in patient compliance with oral antibiotic therapy.

Many factors that may affect compliance were discussed in the literature review but studies to support the assumptions were absent. Hussey and Gilliland (1989), felt poor reading skills affect the understanding of instructions, which can lead to misinterpretation. Hayne et al (1976), reviewed many studies and found that the level of supervision was related to non-compliance, whereby, lack of supervision promoted an increase of non-compliance in adults. Schapira, Kumar, Clark & Yag (1992), studied the use of reminder cards outlining treatment regimes and follow-up appointments with mammography patients, improved

compliance. As early as 1969, Porter identified social isolation as a contributor to non-compliance, which has been supported by many authors and studies since. Becker et al (1978), found that perceived costs and inconvenience reduce the likelihood of compliance, which can hold true for short term antibiotic therapy where some prescriptions can be as costly as $100.00 for a ten day course of therapy. Kirscht and Rosenstock (1977), studied compliance with antihypertensive drug regimes and found that compliance decreased if the patients doubted the safety of the drug or experienced side effects. This assumption could hold true for many oral antibiotics, as side effects may discourage the client to take their medication. Future research is required to further identify factors of non-compliance with short-term antibiotic therapy.

Studies examining compliance displayed a number of problems such as absence of consensus for parameters to determine when a client is considered non- compliant with their treatment, use of different measuring tools, and validity/reliability ratings. Rudd, Byyny, Zachary, et al (1989) found that clinical trials in pharmacology do not routinely address compliance as a variable, which then affect the validity and reliability of the results.

The literature review did address the possibility of predicting compliance. Lee, Nicholson, Souhami and Deshmukh (1992) studied the use of a "quality of life assessment tool" but determined it was unlikely to predict compliance. Bleehan, Girling, Machin and Stephens (1992) concluded that patients with grade 2-performance status (World Health Organization Classification) provided 55% compliance as compared to 44% for clients with grades of 3-4. Blackwell (1976)

suggested compliance may be predicted by using a compliance-oriented history with compliance monitoring throughout the treatment, but there have been absences of studies to support this idea.

Compliance is an important component in the cellulitis treatment plan but studies found in the literature review show the rate of compliance to be low. Many disciplines discuss and attempt to explain compliance issues, but are supported by research that is poorly controlled and biased.

Summary of the Literature Review

Cellulitis is a common soft tissue infection managed by many health care professionals. It is considered easy to diagnose due to its overt physical signs and symptoms. The literature indicates that *Staphylococcus aureus* and *S. Pyogenes* are the two most common bacteria that invade the soft tissue and cause a cellulitis. There is also substantial literature that educates and supports the common diagnostic symptoms for a cellulitis, but there is no research to identify if healthcare professionals are consistent in their diagnosis of cellulitis. Further study is warranted in this area as consistency in diagnostic practices among health care professionals provides clients with the appropriate treatment.

Cellulitis is also considered simple to treat when prescribing routine oral or intravenous antibiotic therapy, but again there were no research findings to identify the accuracy by health care professionals in prescribing the appropriate

antibiotic and dosing regimes. Further research to identify inconsistencies in prescribing practices of health care professionals is warranted.

The literature does provide research findings that identify appropriate antibiotic therapy and dosing schedules to eradicate a cellulitis infection, but the influence of compliance on antibiotic therapy and disease outcome is never addressed. Compliance itself as a concept and its influence on drug therapy outcome is widely researched with suggestions for prediction of compliance and strategies to enhance compliance. Bias does occur due to the researcher's inability to closely monitor the subject and results in discrediting the outcome analysis. More controlled studies researching compliance with drug regimes are warranted. Finally, nursing interventions are recommended by many literature resources with little research to support their success for infection resolution. Future research is required to determine non-pharmaceutical interventions that can improve the management of cellulitis.

The following chapter will outline the method used to investigate the health care professional's ability to assess, diagnose and, treat cellulitis. Methodological implementation will present inclusion and exclusion criteria, examination of the data collection tool, procedure for data analysis, ethical considerations and limitations of the study.

Chapter 3: Methodology

Introduction

This chapter will present the utilization of a non-experimental research design that will assist in better understanding this study's phenomena. The rationale for selecting this design will be offered and implementation of the design will be described.

Methodological Rationale

A retrospective descriptive research design was chosen for data collection. Polit and Hungler (1995), describe this style of investigation in which phenomena existing in the present are linked to other phenomena that have occurred in the past, before the study was initiated. It examines present occurring outcomes and attempts to identify antecedent factors that may have caused it. The goal of this investigation was to determine what antecedent factors or independent variables affect the disease outcome of the client. This study's antecedent factors were diagnostic criteria, compliance and prescribing practices. The outcome variables consisted of outcome diagnosis and referral to CITP.

Methodological Implementation

Procedure

To represent a portion of adult outpatient clients with cellulitis in the greater Winnipeg area, convenience sampling of clients who required intravenous antibiotic therapy from The Community Intravenous Therapy Program (CITP) for a cellulitis infection were selected. The study sample size will was estimated at 1200 clients located in the database utilized by the CITP. This sample size was chosen after a random search was performed on the CITP database identifying clients with an initial or outcome diagnosis of cellulitis, between February 1st, 1996 to June 1st, 1999. Data was to be obtained from two administrative databases.

A chart review from February 1st 1996 to June 1st 1999 was performed from the computerized database at the CITP, based in Winnipeg, Manitoba. The information collected included, chart number, Manitoba Health Service's Commission (MHSC) number, Drug and Program Information Network Number (DPIN), age, sex, address, allergies, diagnosis, underlying medical conditions that would affect the infectious process and outcome diagnosis, which was entered when the patient was discharged from the program. If provided, the following information was also recorded: type, dose and duration of oral antibiotic therapy.

The response variables collected from the chart were identified as age, gender, underlying medical problems, admitting diagnosis, outcome diagnosis, type of failed oral antibiotic treatment, date of written prescription and its duration. If the client used a prescription for oral antibiotics, a review of the MHSC's DPIN report provided the date the prescription was filled and confirm the type of oral antibiotic prescribed.

Inclusion criteria was as follows:

1. Anyone over the age of 18 referred to CITP.
2. Anyone with an initial diagnosis of cellulitis.
3. An outcome diagnosis of cellulitis.

Exclusion criteria was as follows:

1. Anyone under the age of 18 years of age.
2. Anyone with an allergy to penicillin.
3. Referrals originating from hospitalized patients.

Data Collection Tool

The data collection tool was developed by the researcher and developed into two formats (Appendix A). Information to be collected for part one included the following variables retrieved from the data base at CITP: age, gender, initial diagnosis, outcome diagnosis, referral date, type of failed oral antibiotic therapy prescribed, the date it was prescribed, and the underlying medical conditions.

Analysis using age cohorts was developed for this study based upon consultation with a statistician from the Manitoba Nursing Research Institute, and viewed as a common practice with previous research studies. The age cohorts comprised for this study were as follows: a) 18-29; b) 30-39; c) 40-49; d) 50-59; e) 60-69; f) 70-79; g) 80-99. If the database from CITP indicates the patient was prescribed oral antibiotic therapy, the second format was to be used to obtain information from the MHSC' DPIN database. This would have provided information on the type of oral antibiotic prescribed the dosage, frequency, duration, and the date the prescription was filled by the patient (Appendix B).

Data Collection

Data was obtained by chart review, utilizing the CITP's client chart and computerized database. Approval for access to this database was obtained through The St. Boniface Ethical Review Committee. Data collection for clients that were prescribed oral antibiotic therapy prior to intravenous antibiotic treatment was not obtained through MHSC's DPIN database as time constraints was an issue. This would have reviewed the date a client had their medication dispensed by a pharmacy, the type of antibiotic, duration and amount.

Data Analysis

Data from the collection tools were entered into the Statistical Program for Social Sciences (SPSS) computerized program. Quantitative measures were at the ordinal and nominal levels. Frequency distributions of all antecedent factors

or variables were conducted in order to describe and synthesize the data. Bivariate descriptive statistics identified any significant relationships between two variables utilizing cross-tabulation within a contingency table. A summary of this data is provided for each research question. The statistical data was used to draw inferences from the sample population and its proportions, using the chi-square test and correlation variance, with $P < .05$ considered significant. A 95% confidence interval was sufficient for this study as the results will not drastically affect the well-being of humans, therefore, the p value of $< .05$ was chosen for statistical significance for all data analyzed (Polit & Hungler, 1995). The Manitoba Nursing Research Institute was consulted for statistical assistance.

Ethical Considerations

Ethical approval was obtained even though analysis of administrative databases does not involve direct contact or interaction with the subjects. The study was submitted to The University of Manitoba, Faculty of Nursing Ethics Committee and The St. Boniface Hospital Ethics Committee.

The study was unable to attain access to data that would have examined the variables for the date the prescription was written by a health care worker, and the date it was filled by a pharmacist. Permission to attain access to this data would have taken from 6 months to a year, through The Winnipeg Regional Health Authority's Ethical Review Committee. The author had limited time constraints to complete the study. The author does intend to pursue this access

and, will then analyze the data as it pertains to the examination of compliance with this sample population.

Confidentiality of clients in the research data was maintained through use of assigned numbers from the CITP data base and correlated when required with the client's personal health information number (PHIN) from MHSC's DPIN report.

There was no perceived risk for the clients, as strict confidentiality was maintained. There are also no perceived benefits for the clients other than contributing to the information base of the study. However, future patients may benefit, as may health care professionals through educational programs. The institution may benefit from the data collection that may be utilized for future research projects.

Methodological Limitations

The validity of this study focused on the weakness of retrospective data collection from charts and not directly from the subjects. The charts may also have been incomplete or not available.

The study has limited generalizabiltiy as only one region of the province database was accessed, limiting the number of subjects to the study and treatment approaches.

The strengths of the study arise from the large number of charts available to review, a diverse patient population, availability of databases such as CITP and DPIN to validate treatment data, and utilization of computerized data collection that is in a standardized format.

Chapter 4: Study Findings

The following chapter provides an overview of the quantitative findings for this study. The Statistical Package for the Social Sciences, 7.5.1 (SPSS Inc., 1996) was used to analyze the quantitative measures at the ordinal and nominal levels. The sample representativeness is considered, characteristics of the sample population are described using frequency distributions of nominal and ordinal variables within the study. Frequency distributions were calculated for all recorded variables, in order to describe and summarize the data. Cross-tabulation of bivariate descriptive statistics were then performed to identify any significant relationships between any two variables. Statistical significance and, inferences were derived from the sample population, and its proportions using the Chi-square statistical test. This chapter includes frequency distribution analysis of nominal variables not addressed within the study questions in order to identify any significant findings, and concludes with a brief chapter summary.

Sample Representatives

To represent a portion of adult outpatient clients with cellulitis that required intravenous antibiotic therapy, a convenience sample was extracted from the client database located at CITP. It was anticipated that the study would review 1000 to 1200 client databases, but after applying the exclusion criteria of: less

than 18 years, repeat clients and, penicillin allergies, only 451 clients remained eligible for the study.

Characteristics of the Sample

The study included 279 men, and 172 women ranging in ages from 18 years to 97 years, with a mean age of 52 years, and standard deviation of 1.81. An additional analysis by age was performed after dividing the sample into the following cohorts (year of age), based upon consultation with a statistician from the Manitoba Nursing Research Institute, and viewed as a common practice with previous research studies: a) 18-29; b) 30-39; c) 40-49; d) 50-59; e) 60-69; f) 70-79; g) 80-99 (see Table 1, p. 39). Approximately half of the study population was between the ages of 30 to 59 years, (55.7%).

Table 1:
Age of Sample Population

Age Group (years)	n=451	Percentage Population
18-29	46	10.2%
30-39	87	19.3%
40-49	83	18.4%
50-59	81	18.0%
60-69	55	12.2%
70-79	58	12.9%
80-99	41	9.0%
Mean age	52 yrs.	
Range	18-95 yrs.	

The study found that 45% of the patients had underlying medical conditions. The chart review identified 23 different underlying medical conditions,

including diabetes mellitus (11.5%), peripheral vascular disease (5.5%), history of wound injury (4.9%) and, a history of cat bites (4.4%). Underlying medical conditions present in 5 or fewer cases were categorized as "other" (see Table 2, p 40).

Table 2:
Underlying Medical Conditions

Underlying Medical Condition	n=451	Percentages
No underlying condition	249	55.2%
Diabetes mellitus	52	11.5%
Other	34	7.5%
Peripheral Vascular Disease	25	5.5%
History of Wound Injury	22	4.9%
History of Cat Bite	20	4.4%
History of Insect Bite	17	3.8%
Heart Disease	12	2.7%
Dermatological Conditions	11	2.4%
Post Surgery	9	2.1%

Findings Related to the Study Questions

Clients diagnosed with an infection other than cellulitis comprised 16.1% of the sample population. If a certain type of infection occurred in five cases or less in the outcome diagnosis category, they were categorized as "other" (See Table 3, p 41). Seven of the clients recorded in the initial assessment category, were diagnosed with another type of infection, and were later found to have cellulitis. The most frequent diagnosis other than cellulitis was found within the outcome diagnosis category of diabetic foot infection with 4.9%, and bursitis with

2.2%. The percentages of "diagnosis other than cellulitis", for the initial diagnosis category were too few to consider analytically (see Table 3, p. 41).

Table 3:
Misdiagnosis of Cellulitis

Initial Diagnosis	n=73	Percentages
Bursitis	3	37.5%
Soft Tissue Infection	2	25%
No Diagnosis	2	25%
Dog Bite	1	12.5%
n=	8	
Outcome Diagnosis		
Other	25	38.4%
Diabetic Foot Infections	22	33.9%
Bursitis	10	15.4%
Osteomyelitis	8	12.3%
n=	65	

As the variables for this study are at the nominal level, the Chi-square statistical test was applied to determine statistical significance in testing group differences within the study. The Chi-square test was applied with the dependant variable of "diagnosis other then cellulitis", and analyzed separately with each of the following sample characteristics: gender, age cohort and underlying medical conditions.

The identification of a diagnosis other than cellulitis occurred more often in the outcome assessment category at 89%. In the initial assessment category 59% of men and 41% for women were "diagnosed with an infection other than cellulitis." The rate of "diagnosis other than cellulitis" in the outcome category for men was 57% and 43% for women (see Table 4, p. 42). Cross-tabulation with the variable "diagnosis other than cellulitis", in the outcome assessment category, identified

both age cohorts of 30-39 years and 40-49 years to have the same statistical proportion at 21% (see Table 4, p.42). Cross-tabulation of the variable "diagnosis other than cellulitis" with underlying medical conditions, found that clients with diabetes mellitus were rediagnosed with another type of infection during the outcome assessment, at 36.9%. 75% of clients with no previous medical condition were "diagnosed with an infection other than cellulitis" during the initial assessment and, 32.3% during the outcome assessment. Finally, "diagnosis of an infection other than cellulitis" of post-surgical infections in the outcome category was 4.6% (see Table 4, p.42).

Table 4:
Cross-Tabulation of Diagnosis other than Cellulitis with Sample Characteristics in the Initial and Outcome Categories

	Initial	Outcome
n=	8	65
Gender		
Men	59%	57%
Women	41%	43%
Age Cohorts (years)		
18-29	25%	6.2%
30-39	25%	9.2%
40-49	0%	23.1%
50-59	25%	23.1%
60-69	12.5%	6.0%
70-79	12.5%	17.0%
80-99	0%	15.4%
Underlying Medical Conditions		
Diabetes	12.5%	36.9%
Peripheral Vascular Disease	0%	6.2%
Wound injury	0%	3.1%
Non	75%	32.3%
Post Surgical	0%	4.6%
Heart Disease	0%	1.5%
Dermatological	0%	0%
Other	0%	15.4%

The chart review found 33.9% of the clients were not given oral antibiotic therapy prior to a referral to CITP. The chart review also found 49.2% of the clients were prescribed oral antibiotic therapy and, 16.9% did not record a response. Cross-tabulation applied to the variables " not trialed on oral antibiotic therapy ", correlating with the following variables: gender, age cohort, underlying medical condition, and where data was not recorded. Analysis found 33.3% of men and 34.9% of women were not given oral antibiotic therapy initially (see Table 5, p. 44). Cross-tabulation with age cohorts identified the ages of 18 to 29 years to have the highest incidence with no trial of oral antibiotic therapy, at 56.9%% (see Table 5, p. 44). Finally, cross-tabulation with underlying medical conditions found 76.2% had heart disease (p=<.01), 48.1% had diabetes and, 40% with peripheral vascular disease. The Chi-square test found statistical significance with p= < 0.01 (see Table 5, p. 44).

Table 5:
Cross-Tabulation of Those Not Trialed on Oral Antibiotics with Sample Characteristics

	Not Trialed	Trialed	p value
n=451	153	222	
Gender			
Men	33.3%	49.5%	0.93
Women	34.9%	48.8%	0.93
Age Cohorts (years)			
18-29	56.9%	29.4%	0.51
30-39	28.3%	52.3%	0.41
40-49	25.6%	58.5%	0.15
50-59	42 %	45.7%	0.19
60-69	36.4%	40%	0.23
70-79	48.3%	34.5%	0.03
80-99	29.3%	58.5%	0.44
Underlying Medical Conditions			
Diabetes	48.1%	32.7%	0.89
Peripheral Vascular Disease	40%	36%	0.36
Wound Injury	31.8%	68.2%	0.06
Cat Bite	20%	70%	0.16
Non	30.6%	50%	0.15
Post Surgical	35.8%	54.7%	0.30
Insect Bite	34.1%	54.5%	0.56
Heart Disease	76.2%	19%	**0.01****
Dermatological	27.3%	63.6%	0.60
Other	37%	51.9%	0.71

Note: ** = Significant at 0.05 level & NS= Non-significant

The study identified 224 clients, or 49.2%, to have been prescribed some type of oral antibiotic therapy prior to referral for the CITP. Twenty-three different oral antibiotic regimes were prescribed. The type of antibiotic prescribed was not recorded in the database for 18.2% of the clients. Where a record of the prescriptions was available, cloxacillin with the wrong or no dose recorded, was recorded most frequently at 29.5%, and cloxacillin with the recommended dose

at 8% (See Table 6, p. 46). The correct dosing of cloxacillin for a cellulitis infection is 500mg every 6 hours for 7 to 10 days (Sandford, et al, 1997).

To identify any significant correlation, the variable, oral antibiotic prescription was cross-tabulated with gender, age cohort, and underlying medical condition. The cross-tabulation results found that men were written a prescription more often than women, with 72.2% receiving cephalexin, 62.1% receiving Cloxacillin with the wrong dose or no dose, 61.1 % receiving cloxacillin with the right dose and, clindamycin at 71.4%. The analysis also found more women than men received erythromycin at 57.1% (see Table 7, p.47).

Cross-tabulation analysis of age did identify the age cohort of 30-39 years to have received the most oral antibiotic prescriptions for cloxacillin with the wrong or not recorded dose at 28.8%, followed closely by the age cohort of 40-49 years with 25.6% (see Table 7, p. 47).

Cross-tabulation with underlying medical conditions and the type of oral antibiotic therapy prescribed, found clients with no underlying medical conditions were most frequently prescribed oral antibiotic therapy ranging from 33.3% for cirpofloxacin, to 72.4% for cloxacillin with the correct dosing. 28.5% of clients with diabetes mellitus were prescribed clindamycin and, 15.2% were prescribed cloxacillin with no dose or the wrong dose recorded. Finally, 22.2% of clients with wound injuries had ciprofloxacin 500 mg BID prescribed for them.

Table 6:
Description of Prescriptions of Oral Antibiotics

Prescription	n=224	Percentages
Unknown Type	82	36.6%
Cloxacillin no dose or wrong dose	66	29.5%
Keflex no dose	18	8.0%
Cloxacillin correct dose	18	8.0%
Other	17	7.7%
Ciprofloxacin	9	4.0%
Clindamycin	7	3.1%
Erythromycin	7	3.1%

Table 7:
Cross-Tabulation with Prescription of Oral Antibiotic and Sample Characteristics

Antibiot		Ceph-alexin, no dose	Clox. no dose	Cipro. 5oo mg BID	Clind. No dose	Un-known	Erythro	Clox. Right dose	Others
N=224		18	66	9	7	82	7	18	17
Gender									
Men		72.2%	62.1%	57%	71.4%	65.9%	42.9%	61%	41.1%
Women		27.8%	37.9%	43%	28.6%	34.1%	57.1%	38.9%	58.9%
Age Cohort (years)									
18-29		27.4%	10.7%	0%	0%	8.5%	14.3%	11.1%	23.5%
30-39		16.7%	25.6%	22.2%	28.6%	14.6%	43%	27.8%	11.8%
40-49		16.7%	28.8%	22.2%	14.3%	17.1%	0%	22.2%	35.3%
50-59		5.6%	13.6%	11.1%	0%	22%	14.3%	22.2%	17.6%
60-69		11.2%	4.5%	22.2%	14.3%	13.4%	0%	11.1%	5.9%
70-79		11.2%	6.1%	11.1%	28.6%	8.5%	28.6%	5.5%	5.9%
80-99		11.2%	10.7%	11.1%	14.3%	15.9%	0%	0%	0%
Medical Cond.									
Diabet.		5.5%	15.2%	11.1%	28.5%	13.4%	0%	0%	0%
Periph. Vasc. Disease		0%	1.5%	11.1%	28.5%	4.9%	14.3%	0%	0%
Wound Injury		11.1%	12.1%	22.2%	0%	1.2%	0%	5.5%	6%
Cat Bite		0%	4.5%	0%	0%	1.2%	14.3%	5.5%	47%
Non		66.8%	51%	33.3%	43%	59.8%	57.1%	72.4%	47%
Post Surgical		0%	1.5%	0%	0%	4.9%	0%	0%	0%
Insect Bite		11.1%	6.1%	11.1%	0%	2.4%	0%	5.5%	0%
Derm.		5.5%	0%	0%	0%	1.2%	0%	0%	0%
Others		0%	7.5%	11.1%	0%	11%	14.3%	11.1%	0%

The data did identify 49.2% of clients who were prescribed some type of oral antibiotic therapy prior to referral to CITP. The number of days that clients remained on their prescription ranged from 1 to 21 days, with a mean of 6.7

days. Duration of oral antibiotic therapy were most common for 1, 2 and 3 days of oral antibiotic therapy (see Table 8, p.49).

Cross-tabulation was applied with the dependant variable of, duration of oral antibiotic therapy, with the following variables: age cohort, gender, and underlying medical conditions. The study combined all cases where duration days were recorded five times or less. Analysis of this combined group found that the duration days for self-administration of oral medication were five days or more, therefore they are identified in Table 9 (p. 50) as "> 4 days". The analysis found 66% of men self-administered their medication for one day only, and 34 % of women. Self-administration for two days of therapy identified 64% men and 36% women, three days found 69% men and 31% women and, four days found 57.1% men and 42.8% women. The data also found that men stayed on their oral prescription longer then women with 57.1% of men remaining on their medications for longer than four days (see Table 9, p. 50).

Cross-tabulation examining the duration of oral therapy with age cohort found The data showed a decrease of clients continuing their prescriptions to be greatest at day three in the age cohorts of 30-39 years and 40-49 years. The data found the highest incidence of duration for oral antibiotics was day one with 30.5% occurring in the age cohort of 30-39 years (see Table 9, p. 50).

Finally, duration of oral antibiotic therapy, cross-tabulated with underlying medical conditions found that diabetics and clients with peripheral vascular disease continued with self-administering their medications the longest, with 14.3% taking their medications longer than four days. Clients with no underlying

medical conditions remained around 50% in taking their medications for short and longer duration. Finally, the majority of clients with wound injuries and cat bites did not remain on their medication for longer than three days (see Table 9, p. 50).

Table 8:
Frequency Distribution of Duration of Days for Oral Antibiotics

Duration	
1 Day	16.1%
2 day	6.3%
3 Day	5.8%
4 Day	3.1%
> 4 days	12.5%
Unknown data	56.3%

Table 9:
Cross-tabulation of Duration of Prescription with Sample Characteristics

Duration		1 day	2 day	3 Day	4 Days	> 4 Days	Unknown
n=224		**36**	**14**	**13**	**7**	**28**	**126**
Gender							
Men		66%	64%	69%	57%	57.1%	63%
Women		34%	36%	31%	43%	42.8%	39%
Age Cohort (years)							
18-29		11.1%	14.3%	15.4%	14.3%	10.7%	53.8%
30-39		25%	28.6%	23%	0%	17.9%	19.8%
40-49		30.5%	21.4%	23%	0%	21.4%	20.6%
50-59		19.4%	21.%4	15.4%	28.6%	16%	15%
60-69		5.5%	0%	0%	14.3%	16%	11.9%
70-79		2.7%	7.1%	15.%4	14.3%	16%	8.7%
80-99		5.5%	7.7%	7.7%	28.6%	7.1%	12.7%
Med. Cond.							
Diabetes		5.5%	0%	7.7%	14.3%	14.3%	13.5%
Periph. Vasc. Disease		2.7%	7.1%	0%	14.%3	3.6%	4.0%
Wound Injury		11.1%	14.3%	7.7%	0%	7.1%	4.8%
Cat Bite		8.3%	14.3%	15.4%	0%	0%	5.5%
Non		64%	57.%1	46.2%	57.%1	53.6%	55.5%
Post Surgical		0%	0%	0%	0%	7.1%	2.3%
Insect bite		5.5%	7.1%	7.7%	0%	3.6%	3.9%
Derm.		0%	0%	0%	0%	0%	0.8%
Others		2.7%	0%	15.4%	14.3%	10.7%	9.5%

Additional Findings

Finally, frequency distributions were also analyzed looking at the months of the year, and days of the month when CITP would receive referrals. This analysis would identify any significance in the occurrence of cellulitis on specific days of the month, or months of the year. The data found the mean day of the month for cellulitis referrals was the 15th, with the 12th day having the highest percentage of occurrence at 6.7%. The months of the year with the highest occurrence were March, May and, July, with March and May at 11.1% and, 10.4% for July. The lowest occurrence of cellulitis referrals was in January with 3.8% and December with 4.4%.

Chapter Summary

In summary, the findings in this chapter indicate that the sample size appears to be appropriate in determining some significant findings within the sample population. A variety of variables were analyzed methodically by first describing frequency distributions. Cross-tabulation and Chi-square statistical testing using the sample characteristics of gender, age and underlying medical conditions, were performed with each of the variables that addressed the research questions.

Using frequency distributions for the data collected for gender, age, and underlying medical conditions, the results described the population as 62% men,

having an average age of 57 years, with 55.7% found within the age cohort of 30-59 years of age (Table 1, p.39). Statistical testing also found that 45% of the sample population had some kind of underlying medical condition with the greatest occurrence being diabetes, cat bites, and wound injuries (Table 2, p.40).

A differential diagnosis other than cellulitis was found within 16.1% of the population, with the most common diagnosis error being diabetes at 4.9% and bursitis at 2.2%. It was also found that most diagnoses other than cellulitis were identified during the outcome assessment, at 89%. The most frequently identified underlying medical conditions found within the outcome category were, clients with no underlying medical condition (32.2%), diabetes (36.9%), and peripheral vascular disease (6.2%) (Table 4, p.42.).

The frequency distribution found that 33.4% of the population were not trialed on some type of oral antibiotic therapy, with statistical significance found with heart disease at 76.2% ($p = <.01$) (see Table 6, p. 46.).

The study found cloxacillin as the most frequently prescribed antibiotic (18.2% of the population). Analysis identified clients with diabetes and peripheral vascular disease to have been prescribed clindamycin most often at 28.2%. 22% of clients with wound injuries were prescribed ciprofloxacin and 14.3% of cat bites were given erythromycin. Clients with dermatological conditions were rarely given an oral antibiotic prescription, along with post-surgical patients (see Table 7, p. 47).

The variable examining the duration of oral antibiotic therapy prior to referral to CITP found the range of days clients remained on their therapy was

from 1 day to 21 days, with a mean of 6.7 days. The study identified 70% of the clients remained on their prescription for no longer than three days (Table 8, p.49).

Additional findings also examined the months of the year, and days of the month when referrals to CITP were the most frequent. The frequency distribution found the mean month of the year being June, with March, May, and July having the highest number of occurrences of cellulitis referrals. The mean day of the month was the 15th, and, the greatest numbers of referrals were found on the 12th day of the month. The next chapter will discuss the findings of the study, how these findings compare with each of the six research questions, the related literature review and, the Neuman Health-Care Systems Model. The chapter will also examine how the study's results can affect nursing practice, education, and research.

Chapter 5: Discussion of the Findings

In this chapter the findings presented in Chapter 4 will be analyzed within the context of the six research questions, literature review and, the Neuman Health-Care Systems Model. Implications of the study for nursing practice, education and research will conclude this chapter.

Comparison of Findings to the Six Study Questions

1. What is the proportion of Community Intravenous Therapy Program? clients who had a differential diagnosis other than cellulitis?

The frequency distribution analysis identified 21% of the sample population to be either initially diagnosed with cellulitis but later found to have another type of infection, and those that were diagnosed with another type of infection initially, but later were found to have cellulitis.

As shown in Table 3 (p. 41), the study identified diabetic foot infections as the most frequent diagnosis misinterpreted to be a cellulitis infection. This finding is important, as both infections require different types of antibiotic therapy and treatment, from what is required to routinely cure a cellulitis infection. In the most recent literature, mild to moderate diabetic foot infections associated with cellulitis can be treated with oral antibiotic therapy, while the moderate infections require anaerobic coverage for gram negative bacterial infection (Embil, Choudhri, Germain, Imlah, Duerksen, Darcel, Fong, Harding, & Nicolle, 1999).

Cross-tabulation analysis found that gender and underlying medical conditions may influence the assessment and diagnostic process. Men were more frequently diagnosed with an infection other than cellulitis initially, as were clients with diabetes, and those who had peripheral vascular disease (See Table 4, p.42). The author can not suggest a reason for women being misdiagnosed more often than men. The literature does state that diabetic foot infections can display similar signs and symptoms much like cellulitis. It is important to know that these infections need to be treated by a different antibiotic regime, as they are caused by other types of bacteria that may not be eliminated by the routine cellulitis antibiotic therapy regime (Embil et al, 1999 ; Sanford, 1997).

2. What is the proportion of clients with cellulitis who were not trialed on oral antibiotic therapy prior to receiving parenteral antibiotic therapy?

The study's analysis found that 33.9% of the sample population did not receive oral antibiotic therapy prior to referral to CITP, while 49.2% did, and 16.9% had missing data. The percentage of those not receiving any oral antibiotic therapy is an important finding, as literature shows that a trial of oral antibiotic therapy is the first line of treatment for most cellulitis infection. Oral antibiotic therapy is also less costly to the Health Care System, and poses less risk to the client when compared to intravenous therapy. Statistical analysis found 76.2% of clients with heart disease, 48.1% with diabetes and 40% had peripheral vascular disease (Table 5, p. 44). The author is unsure as to why a client with heart disease would not be prescribed oral antibiotic therapy, as a risk

of bacteria and possible endocarditis would be a concern. The author does speculate that clients with diabetes may had been treated intravenously first, as their disease can decrease one's immune response thereby placing them at risk for complications and a slower resolution of the infection. Finally, peripheral vascular disease can cause leg discoloration and ulcers, which may over looked as an infectious process.

3. What is the proportion of clients with cellulitis who were not prescribed with the appropriate oral antibiotic?

The study identified 49.2% of the sample population had been trialed on some type of oral antibiotic therapy prior to their referral to CITP, though frequently the dose and duration of the oral antibiotic therapy were not recorded in the database. The frequency distribution analysis found 8% were given the appropriate oral antibiotic of cloxacillin, with the correct dose and duration (Sanford, 1997). cloxacillin was also prescribed for 29.5% of the population, but with an incorrect dose, frequency, or unknown dose/duration. Cross-tabulation identified cloxacillin being prescribed to 72.4% of clients with no underlying medical conditions, 28.5% of with diabetes mellitus and 22.2% with wound injuries. Cross-tabulation also identified a high occurrence with the variable "unknown type of oral antibiotic therapy prescribed" with post surgical infections, diabetes and, peripheral vascular disease. Also, one third of the clients that had no underlying medical conditions were also trialed on some kind of oral antibiotic therapy (Table 7, p 47.). These findings display that many health care workers

are cautious and, not only prescribe oral antibiotic therapy for certain populations with decreased immunity, but are also cautious with the sample population that have no previous underlying medical conditions.

These findings also show that clients with cat bites are treated with antibiotic therapy for cellulitis and not the recommended antibiotic regime for cat bites. Cat bites require a different type of oral antibiotic therapy, as either *Staphylococcus aureus* or *Pasteurella multocida* can cause this infection. Sanford (1997), recommends treating cat bites with either amoxicillin/clauvulin orally, or cefuroxime intravenously.

4. What is the proportion of clients with cellulitis who displayed non-compliance with self-administering their oral antibiotics?

   This research question could not be addressed by the author as permission to collect the data had to be obtained from WRHA. The Ethical Review Committee of this health care agency informed the author, that review of the proposal would take from 6 months to a year. This time frame did not work well within this study's time constraints. Permission is still being pursued and, data collection, analysis, and discussion will be communicated at a later time, after completion of the graduate program.

5. What is the proportion of clients with cellulitis who did not remain on oral antibiotic therapy for a sufficient period of time prior to their physician requesting they be placed on intravenous antibiotic therapy?

Frequency distribution analysis found that out of the 49.2% of clients that were prescribed some type of oral antibiotic therapy prior to a referral to CITP, the range of days they remained on the oral therapy were from 1 day to 21 days, with a mean of 6.7 days. The duration of 1 day had the highest occurrence at 15.6%, followed by the 2 day duration at 6.3% and, the 3 day duration at 5.8%. According to the literature review, to receive the optimal effect of oral antibiotic therapy for a cellulitis infection, most clients need to remain on their therapy for up to 72 hours (Table 8, p 49).

The author speculates that the reason for many of the clients remaining on their prescription for longer than 4 days, some for as long as 21 days before seeking medical advice, is that their symptoms may have been resolving. If the patient was prescribed with either the inappropriate oral antibiotic or improper dosing of the correct oral antibiotic, the symptoms may had exacerbated near the end of the treatment course, at which time, they may have sought out medical advice. An example of this would be clients who received a cat bite and were prescribed antibiotic therapy for cellulitis, where it is stated earlier that these types of infections need to be treated with a different type of oral antibiotic therapy. As well, it can be speculated that clients may not fill their prescription or not take their medication as prescribed. Finally, the client may have a predisposing medical condition that may impede the resolution of the cellulitis infection, such as diabetes mellitus or peripheral vascular disease.

6. Does the incidence of cellulitis increase with certain underlying medical conditions, age group, or gender?

Data analysis using frequency distributions identified the incidence of cellulitis infections were highest in the age cohort of 30-39 years, followed closely by age cohorts 40-49 years and, 50-59 years (Table 1, p. 39). The author speculates that people found within these age cohorts are more active and therefore, susceptible to injury at the work place or during physical recreation.

Frequency distribution analysis did identify that over half of the sample population did not have an underlying medical condition. However, diabetes was the most frequent underlying medical condition found within this sample population, at 11.5% (Table 2, p. 40).

Finally, frequency distribution analysis found that in this sample population, more males contracted a cellulitis infection, double that of women. This frequency may be due to the large proportion of men engaging in manual labour, thereby, increasing their chances of opening a portal of entry on the skin. Inappropriate hand washing of labourers can also contribute to bacterial growth to the skin. Finally, men tend to participate in more physical activity at work or with recreation, thereby increasing their chances of injury and, becoming more susceptible to developing cellulitis infections.

Although the additional findings are not statically significant, they do describe the months of the year and, days of the month, where referrals to the CITP occur most frequently. These findings can assist the CITP in planning staffing schedules and, ensuring adequate supplies are available for these peak times.

The frequency distribution analysis found that cellulitis referrals occurred highest in the months of July, March and, May. The author suspects that this trend may be due to warmer weather. Many people enjoy gardening during these months that can expose them to more bacteria. Injury to the skin and, inadequate washing of hands after gardening provides a portal of entry for the bacteria found in garden soil, where 90% of all bacteria live (Tortora, et. al, 1989). Also, warmer temperatures means an increase of insect bites and, trauma to the skin from outdoor physical activities. The analysis also identified that the 12th of each month had the highest occurrence of referrals. The author could not hypothesize why this occurrence would be.

Comparison of Findings to the Neuman Health-Care System Model

The Neuman Health-Care Systems Model (Neuman,1982), was the theoretical framework chosen for this study as it is useful in the examination of the diagnostic, treatment, and outcome practices for clients with cellulitis. The Neuman Nursing Process and Format, served as the model for the researcher in developing the six research questions for this study. Many aspects of this model were supported by the variables.

The study's variables of gender, age, and underlying medical conditions fit well within the "basic structure" found in Neuman's Nursing Process (1982). Frequency distributions were applied to these variables, and identified gender, age cohorts, and some underlying medical conditions as "at risk populations".

Health care professionals need to consider these variables when assessing and, diagnosing clients within the stages of Neuman's Nursing Process Format.

An increase of age parallels with a decrease in immunological resistance, thereby influencing the lines of defense and resistance. As well, certain underlying medical conditions influence the lines of resistance to infection. Cross-tabulation with underlying medical conditions, and clients not trialed on oral antibiotic therapy correlates with Neuman's intrapersonal interaction with client (underlying medical conditions) and, the environment (not being prescribed oral antibiotic therapy). This correlation was also found to be statistically significant. The process of identification and resolution of perceptual differences coincides with the variable that examines the appropriate length of time clients remain on oral antibiotic therapy. The frequency distribution did identify more men remained on oral antibiotic therapy longer than women did. Also, the number of days clients remained on oral antibiotic therapy was as low as 1 to 2 days, before seeking medical help. This displayed Neuman's perceptual importance, when health care workers know and inform the clients importance of remaining on therapy, as it can a few doses of antibiotic before an alleviation of symptoms occurs. The client's reasons for seeking medical care prior to 1 to 2 days of therapy are the observation of the their symptoms, and their belief they the medication is not working, or they are not getting better.

Once the initial assessment is complete using Neuman's format, diagnosis and, hypothetical goals are determined. Frequency distributions found 16.9% of the sample population were diagnosed with an infection other than cellulitis that

occurred at either the initial, or outcome assessment. The most common infections diagnosed as cellulitis were diabetic foot infections, or cat bites. Cross-tabulation found men were more frequently diagnosed with an infection other than cellulitis and with underlying medical conditions such as diabetes mellitus, post surgical infections and, peripheral vascular disease (Table 4, p.42).

To develop the hypothetical goals within Neuman's Nursing Process, the variables of appropriate antibiotic therapy prescribed and, remaining on the therapy for an adequate period of time can be utilized. Frequency distributions found cloxacillin to be prescribed most often with 8% of the sample population having the correct dose/duration and, 29.5% of the population having an incorrect dose, or missing data. Cross-tabulation of prescribing practices and, underlying medical conditions, found cloxacillin was prescribed to 40% of the diabetics, 60% of the wound injuries and, 37.3% to clients with no underlying medical conditions. Even though the data was unable to identify the type of oral antibiotic prescribed to some clients, it is important to note that health-care professionals did prescribe some type of oral antibiotic therapy. The data for unknown type of prescription of oral antibiotic therapy identified that 13.4% had diabetes mellitus, 4.9% of clients had a post surgical infection, 4.9% had peripheral vascular disease, and 59.8% had not underlying medical conditions. Therefore, prescribing oral antibiotic therapy is a goal of the health care professional, in hopes that infection will resolve. It is also a goal of the client to fill the prescription and remain on it for an adequate period of time to be effective.

Finally Neuron's evaluation of outcome goals after interventions is described with the study's outcome diagnosis variable. Frequency distributions found 73% of the sample population, where a diagnosis other then cellulitis was identified, happened during the outcome diagnosis stage, with diabetic foot infections and, peripheral vascular disease having the highest occurrence.

The Neuman Health-Care Systems Model (Neuman, 1982) was useful for providing a framework for this study. All the variables fit well into the Nursing Process Format. The study's analytical phase where some statistical insignificance was found did not lie in the fault of the model, but with the utilization of the retrospective data and, the lack of information for many variable categories. . Further testing of the model and, refinement of data collection is recommended for providing more descriptive and, accurate data to the CITP database. Areas where more data is required are in prescription writing, duration of oral antibiotic therapy and, compliance issues.

Study Recommendations

Recommendations for nursing practice, nursing education, and nursing research will now be presented.

Recommendations for Nursing Practice

The nursing profession is constantly evolving, with nursing duties expanding and becoming more specialized. Although it is important for nurses to embrace these changes, they still need to retain and practice nursing

fundamentals such as assessment, diagnosis, outcome goals, interventions and evaluation.

As identified by this study, the assessment phase has to be thorough with all information documented in the appropriate databases for proper communication among health care professionals. The study has identified, gender, age, and underlying medical conditions, as significant variables to consider when assessing a client with a soft tissue infection. The assessment phase should also include a summary of any oral antibiotic therapy prescribed, including the dose of each tablet and, the exact number of tablets taken by the client, as opposed to the number of days the client had been taking the prescription.

A differential diagnosis for cellulitis is considered fairly simple for most health care professionals. The study did show that populations with diabetes may be treated as a diabetic foot infection, rather then cellulitis. This is also identified for clients with cat bites, insect bites, and post surgical infections. As previously stated the oral antibiotic therapy treatment for these infections can be very different then the treatment plan required for cellulitis.

Setting of goals for the resolution of this infection is important and, educating the patient on the importance of taking their oral antibiotic therapy is imperative. Education is also needed for discussing a time limit for the oral antibiotic therapy to be effective before the client seeks out further medical advice.

Finally, even though cellulitis is a common soft tissue infection, and if treated correctly is not life threatening, follow up is important to determine a resolution of the infection.

For Nursing Education

As Neuman's Health-Care System Model is part of many Faculties of Nursing curriculums, again emphasis must be placed with the students on the importance of a thorough health assessment. Nursing staff need to be made aware of the importance of documentation and, attaining a thorough history from the patient, including oral medication. Many outpatient facilities and emergency rooms are presently in a constant state of chaos, and time restraints are imminent. The staff must be educated on the importance of taking the time to do a thorough history, properly documenting all information, and providing the education to the client on the importance of filling out and taking their oral antibiotic therapy. These facilities should also provide nursing staff the time to provide the required care.

Nurse practitioners need to be aware how similar differential diagnosis of cellulitis is with other types of soft tissue infections. They must consider the importance of age, gender and, underlying medical conditions. Nurses must be cautious is prescribing the appropriate oral antibiotic therapy and, ensure an adequate length of time is allowed for the oral antibiotic therapy to be effective.

For Nursing Research

Though retrospective studies display statistical weakness, they do serve a purpose in research. The accuracy and description of the documentation determine the strength of the study, whether from nursing notes or computerized databases. Therefore, it is of great importance that nurses keep an up to date database, with all information required to be entered.

Completion of data collection from the WRHA may answer the compliance question of client patterns in filling out and taking their oral medications. As CITP has an expansive database, more retrospective studies may be performed. Future studies for the CITP may look at the efficacy of keeping patients on oral antibiotic therapy for a period of 72 hrs prior to referral to CITP.

Summary

Cellulitis is a common soft tissue infection, which is found within many populations. This retrospective study has provided insight of a sample population with cellulitis, as well as the treatment practice of health care professionals who cared for them. Health care professionals examined population proportions for the diagnostic and prescribing practice. The incidence of cellulitis and antecedent factors that may effect the development of the disease was also reviewed. Many relationships between some of the sample population proportions and, gender, age, and underlying medical conditions were

found to be significant. These results may reflect on the future diagnostic and treatment practice for clients who develop cellulitis.

Nurses play an important role in the assessment, diagnostic, and treatment phases for this type of infection. By utilizing the information identified within this study, health care professionals can better serve their clients, by providing more comprehensive assessment and deliver a better quality of treatment. The staff at CITP can better identify clients at risk for failure of antibiotic therapy as they may identify some of the variables from the study, which were identified as a significant recurrence within the study's sample population. Overall, future client care may improve as health care professionals are made aware of risk factors that affect the development and treatment practices of cellulitis.

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Appendix A

Part I

Community Intravenous Therapy Program

Data Collection Tool

1. Code # _____
2. Age _____
3. Male ____ Female ____
4. Initial Diagnosis _____
5. Underlying Medical Conditions_____
6. Outcome Diagnosis _____
7. Referral Date._____ (D/M/Y)
8. Oral Antibiotic Therapy Prescribed Prior to Referral Yes ___ No ___

IF # 8 IS YES, THEN PART 2 OF THE DATA COLLECTION TOOL IS TO BE FILLED OUT.

9. Type of failed oral antibiotic therapy _____
10. Date the prescription was written _____ (D/M/Y)
11. Duration of antibiotic therapy _____

Appendix B

(Not Utilized with this Study)

PART 2

Manitoba Health Services Commission

Drug and Program Information Network (DPIN)

Data Collection Tool

1. Code #_____
2. Type of oral antibiotic prescribed _____
3. Dose of oral antibiotic prescribed _____
4. Frequency of administration of the prescription_____
5. Duration of the prescription _____
6. Date the prescription was filled by a pharmacy _____(D/M/Y)