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Point of Origin and Mortality When an Elderly Person is Diagnosed with Sepsis

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Introduction

Evaluating complex health phenomena is the method by which changes in health care practice take place. Without inquiry into all modifiable aspects of diseases, treatment would not advance. Such is the case of sepsis. Sepsis is diagnosed in the health care environment in hundreds of thousands of patients every year and 28.6 in every 100 die prior to discharge from the hospital (Angus et al., 2001). There is a question of what modifiable variables, if researched, would affect outcome. Variables can fluctuate from something as complex as co-morbidities in the patient's past medical history, to simple variables, such as length of hospital stay. Such is the case of point of origin, determining whether a person comes from home or a nursing home, increases risk of death when admitted to a hospital with the diagnosis of sepsis.

If a person comes from home to a facility for treatment of an illness, often times they self-medicate or delay treatment for a variety of reasons. They may take inappropriate over the counter medication, minimize symptoms or they may simply feel too poorly to leave their bed. If a person is in a nursing home, they are more dependent on their care givers for assessment of their health status through observed changes in vital signs or level of consciousness. If a trending decline is not noticed as a potentially infectious process, the patient can become critically ill with sepsis.

This study was done to evaluate if a patient's point of origin, home versus nursing home, has an impact on mortality on the patient diagnosed with sepsis. Decreased mortality on the nursing home patients would indicate that the facilities' staff is doing an effective job identifying illness and seeking treatment for elderly persons. Concurrently, increased mortality of the home patient could indicate that people who remain at home and self-medicate or delay treatment are at higher risk. However, results specifying that a person has an improved outcome if they

originate from their home as opposed to a nursing home would indicate that the needs of the patient regarding infectious processes may be in question.

Few studies have been conducted on this subject and it warrants further exploration. The findings could be used to spring-board further studies regarding educational possibilities for the elderly patient that live at home or for providers at long term health-care facilities. Improvement of patient outcome and advancement of evidence based practice is the goal of this study.

Background and Significance

Improvements in the study of the pathology of sepsis enhance treatment of the disease. Part of the pathological process begins well before the patient reaches the hospital. In fact, these are the defining reasons the patient seeks treatment. Fever, lethargy, decreased nutritional intake, and pain (in addition to other symptoms), is often exhibited either individually or in conjunction with each other, when an opportunistic infection is culminating. By determining what variables of an infectious process can be modified by care-givers of a specific population (elderly in this study), improvements can be made in mortality and morbidity. The researchers of this project attempted to determine if a patient's origin makes a difference in the advancement of the sepsis disease process.

If a defining correlation exists then modifications can be made by nursing homes and assisted living facilities, as well as education given to home-care providers with regard to identification of infection. If changes in policy and standards of care are instituted on the topic of recognition of disease processes, steps towards obtaining earlier treatment can improve patient outcome.

Problem Statement and Statement of Purpose

Infections in the elderly population are generally more severe and are associated with increased mortality rates (McCance & Huether, 2006). Factors contributing to increased mortality of the elderly are weakened immune systems and one or more associated illnesses (Cunha, 2001). The purpose of this study is to investigate whether an elderly patient's point of origin or residence has an effect on their outcome when they have been admitted to the hospital with the diagnosis of sepsis. Determining if a difference exists between elderly septic patients who are cared for at home and those cared for at a nursing home, will supply valuable information to enhance the health of those who are 60-90 years of age. Information and statistics received and analyzed may help to ensure that those who are in the nursing home are getting appropriate care, and the elderly who are cared for at home are receiving home-based care that prevents, recognizes and intervenes in infectious processes.

Research Question

Does point of origin (home versus nursing home) increase patient mortality in the elderly person who is 60-90 years of age when diagnosed with sepsis?

Framework

This study used Betty Neuman's Systems Model (NSM) as the theoretical framework design. The NSM incorporates the concept that living organisms interact with each other and with the environment. The living organism achieves homeostasis by adjusting or adapting its needs to the environment by which it is surrounded. Through this adjustment process, the living organism achieves health and equilibrium. Many needs exist and if the adjustment or adaptation process fails, then imbalance occurs and consequently illnesses may develop. If the equilibrium process fails entirely, the organism may die as a result (Tomey & Alligood, 2006).

Along with the concept of an organism being the center core, Neuman added that the center, a patient in this instance, is surrounded by rings called lines of resistance. These rings help the patient to defend against harmful stressors, and in turn help to strengthen the patient's normal line of defense to return the client to wellness in their environment. When the lines of resistance are ineffective or broken, instability occurs and death may follow (Tomey & Alligood, 2006).

In this study, the patient is the center core. There are several lines of resistance the patient needs to maintain for equilibrium and wellness. One line of resistance is environment. Environment is a major component to a person's wellbeing and wellness. According to a study in 2000, 66% of those 65 and older live in a residence with others and 6% live in a nursing facility (Gist & Hetzel, 2004). A patient at home may have the benefit of being in familiar surroundings, but may not have the ability to care for oneself adequately or maintain the cleanliness of the home. Patients in the nursing home are exposed to other people's germs and infection, nosicomial microbes, and are often dependent on others for their daily living needs, such as bathing, elimination needs and ambulation. All these factors are important and may cause a shift in the patient's equilibrium which may be detrimental.

Another example of a NSM line of resistance is the patient's caretakers. In 2000 it was noted that 28% of the elderly (compared to 10% of the entire U. S. population) lived at home alone (Gist & Hetzel, 2004). This person is responsible for all self-care and may have no one to assist in the evaluation of subtle physical and mental changes. The patient at home, who may be getting care from another family member, may not recognize signs and symptoms of developing severe illness and may not seek appropriate help in a timely manner. The caretaker may also expose the home patient to outside pathogens from exposure to the outside public. The patient in

the nursing home may have nursing assistants who provide most of their daily care. The assistants may not be trained to recognize developing stages of illness and do not report the symptoms until too late. Understaffing and too little use of resources can add to improper care of the elderly in the nursing home.

Additional lines of resistance that surround the patient who remains at the center of the NSM include physiologic ones such as the propensity of the elderly person to exhibit physical disabilities. Forty-two percent of the 65 and older population state that they live with at least one type of long lasting, life-altering disability (Gist & Hetzel, 2004). Other physiologic variations include changes in the immune system, defenses from infection, and skin integrity. Because of waning immune systems, the elderly are more predisposed to pneumonia and that diagnosis is often the terminal infectious disease process that claims their lives (Cunha, 2001).When the immune system line of resistance is broken the elderly patient often has a difficult time recuperating and returning back to equilibrium.

Similarly, the skin barrier is another common line of defense that that can lead to infection when it is disrupted. The epidermis and dermis layers become fragile making skin tears a common problem for the elderly (Hampton, 2010). Proper skin care and prevention of decubitus ulcers is a basic nursing expectation. Improper skin care can lead to pressure sores, decubitus ulcers and severe infections. The elderly nursing home patient should have attendants to assess skin integrity, but the patient who is cared for at home is left to the mercies and knowledge of their family caregiver. In either case, the main objective is the prevention of skin breakdown or the restoration of skin integrity once it has become altered (Voegeli, 2010).

Conceptual and Operational Definitions

For purposes of this study, "point of origin" was determined by the patient's residence prior to hospital admission. A residence can mean different things to different people. A homeless person may consider "home" as the street or a shelter. In an effort to ensure clarity, the researchers narrowed the definition of a patient's residence to either the house where they live or a nursing home.

Included in the research question is the term, "patient mortality." For the purposes of this study, the researchers considered patient mortality to be whether the patient lived or died during the same hospital stay where they were diagnosed with sepsis.

The final term "elderly" is often referred to in research literature as those who are 65 years or older (Duthie, Katz, & Malone, 2007). However, in an effort to gain a larger sample, the researchers of this study chose the age range of the population to be 60-90 as the designated inclusion criteria.

Assumptions

Assumptions made during this research process included the cohesive use of the Systemic Inflammatory Response System (SIRS) criteria upon patient admission and this was the same information used between collaborating physicians when diagnosing sepsis. Doctor's diagnosis, orders, and progress notes were accepted as accurate information as well as the nurse's notes of timely nursing care. It was assumed that the patients that were reviewed in this study came to the hospital with signs and symptoms of sepsis or early sepsis as indicated by their International Classification of Diseases, 9th Revision (ICD-9) code on their charts. ICD-9 codes are developed by the World Health Organization (WHO) (n.d.) and are the standard for classifying diseases. The chosen population of this study was selected randomly by the hospital Health Information

Services (HIS) department and their computer database. It was also assumed all the patient's charts that were reviewed came into the hospital through the Emergency Department (ED).

Limitations

Limitation of this study included the patient's arrival from home or the nursing home to the ED with symptoms already exacerbated for an unknown length of time. Additional limitations were related to the physician's reluctance to diagnose sepsis in the early stages due to lack of positive initial blood cultures or other lab tests, and those physicians with limited exposure to the SIRS criteria regarding symptoms and not diagnosing sepsis accurately. Biophysiological measurements such as *in vivo* and *in vitro* data were collected through standard of care guidelines. *In vivo* measurements are those such as oxygen saturation, blood pressure and body temperature of living organisms. *In vitro* measurements are those that are done outside of the living organism, such as collecting blood and urine, and the use of instrumentation systems for measurement and display (Polit & Beck, 2008). Other limitations may include patient's age, co-morbid diagnosis or diseases that may complicate sepsis symptoms and the sepsis disease process.

Chapter 2

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Introduction

The investigation of sepsis is a popular area of medical research. There are a multitude of peer-reviewed articles and studies regarding sepsis and its clinical management. The foremost reason for such extensive analysis of this disease process is because it is so prevalent and has a high mortality. The libraries and computer databases are full of relevant information regarding the subject of sepsis. The researchers for this particular study began in the McKee Library at Southern Adventist University (SAU). They used electronic catalogs specific to nursing research that is provided by the school. The Cumulative Index to Nursing and Allied Health Literature (CINAHL) is an internet database that was researched while another one was Medical Literature on-Line (MEDLINE®). A third database explored was PubMed.

The initial internet search began with the subject, "sepsis" and "elderly." There were literally thousands of articles to sort. In an effort to narrow the list, the researchers focused on text-word and phrase examination using phrases such as: "sepsis in the nursing home," "treatment of sepsis," and "delayed treatment of sepsis in home care." The researchers were able to retrieve some useful articles through the initial subject search and subsequent text-word or phrase search. However, these articles provided no information regarding point of origin. They were mainly focused on epidemiology, treatment, pathophysiology and development of protocols in the hospital setting. The majority of the articles gathered were secondary sources that were summaries of studies by other authors. In an effort to use mainly primary sources for this review of literature, the researchers studied those secondary sources and traced their origin of information using the bibliography. Then the primary source was located and used.

The researchers also gained information through search engines such as Up-to-Date and Google. Again, most of these were secondary sources and when that was found to be the case, the same pattern of retro-investigation using the bibliography to find the original study and author, was performed by these researchers. The information gathered was timely and current; no articles were used that were over 10 years old.

During the investigation of whether an elderly patient's point of origin has an impact on his/her morbidity, the researchers did not find any relevant articles or reviews. While there are a multitude of articles on the disease process, and treatment of sepsis, there appears to be none specific to the criteria which, if enlightened, could inspire a care-giver at a nursing home or at a private residence to seek treatment early enough to thwart the disease progression. According to Charles P. Davis, MD, PhD (2009), prevention is the best defense from sepsis. However, should an infection occur, immediate treatment is paramount in order to keep the infection from reaching the blood stream. This is particularly important in elderly patients because they often carry multiple coexisting illnesses.

Research Literature

Sepsis occurs in the United States in over 750,000 patients each year and is responsible for an estimated 215,000 deaths annually. This is a mortality rate of 28.6% and is considered the tenth leading cause of death in the U.S. The oldest of the old (those greater than 85 years of age) have the highest incidence of sepsis, occurring in 26.2 people per 1000 as compared to children who are afflicted only 0.2 per 1000. At the time these were collected (1995) the authors predicted that sepsis would increase at a rate of 1.5% each year (Angus, et al., 2001). These statistics were accumulated for a research study that was conducted to investigate the epidemiology of sepsis. Angus et al. (2001) analyzed hospital discharge data of 847 U. S. hospitals in 7 states for the year 1995. The design for this particular research was an observational cohort study and was

considered an appropriate representation of the population as a whole (Braun, Cooper, Malatestinic, & Huggins, 2003).

More than 65% of the cases of sepsis occur in those who are 65 years or older (LaRosa, 2009). This population is especially susceptible to infections due to advanced age and chronic medical conditions. The term "elderly" is used to refer to those who are 65 years or older (Duthie et al., 2007). According to the 2005 U.S. Census Bureau report, elderly people are the largest growing segment in the U.S., and are growing more rapidly than the population as a whole. This same report states that the overall U.S. population is expected to grow at a rate of 18% by the year 2030, but the elderly population will double during that time; increasing from 35 million in 2000 to 72 million by 2030. This is due to the aging of the "baby boomer generation." Baby boomers are Americans that were born between 1948 and 1964. The first baby boomers will turn 65 in 2011 and by 2030, 20% of the U.S. population (72 million) will be 65 or older. Currently, those 65 and older make up 13% (40 million) of the total population (Wan, Sengupta, Velkoff, & DeBarros, 2005).

A report by the Center for Disease Control (CDC) called the National Health Statistics Report (2008), lists the analysis of all admissions to hospitals; whether they come from the Emergency Department (ED) or from an out-patient setting. It differentiates age ranges of those admitted to the hospital. In a separate table it provided a breakdown of those who came to the ED from home and those who came from a nursing home. However, these two tables are not cross-referenced, so one cannot determine the point of origin for those who are 65 and older and are admitted to the hospital. While this report was informative, the statistics do not apply to this particular study of defining whether a patient's point of origin is related to mortality.

Sepsis is identified as Systemic Inflammatory Response Syndrome (SIRS) and a site of infection. SIRS delineation was determined in 1992 by the members of the American College of Chest Physicians (ACCP) and Society of Critical Care Medicine (SCCM). This was the beginning of the accepted terminology used globally by physicians regarding patient care and treatment plans when progressive infections were suspected. In an article for *Chest*, the official publication of the ACCP, Bone et al. (1992) defined SIRS and subsequent systemic responses. SIRS is diagnosed when there is evidence of two or more of the following objective conditions. There must be a documented temperature of >38° Celsius (100.4° Fahrenheit) or < 35° Celsius (95° Fahrenheit), heart rate of > 90 beats per minute, respiratory rate of > 20 breaths per minute (or a PaCO2 < 32 mmHg), and a white blood cell (WBC) count of > 12,000 per cu mm, or < 4,000 per cu mm, or the presence of 10% immature neutrophils (bands). The ACCP further defines a worsening of the acute condition as "severe sepsis," which is sepsis associated with organ dysfunction or hypoperfusion. Hypoperfusion can manifest itself to include lactic acidosis, oliguria or a sudden change in mental status. Further delineation of this disease process signaling worsening of the acute stage is "septic shock." This occurs when there is reduction in systolic blood pressure (BP) of greater than or equal to 40 mm Hg from the baseline or a systolic BP of less than 90 mm Hg in the absence of other causes of hypotension (Bone et al., 1992).

Case studies regarding the effects of delayed recognition of sepsis are abundant. One such report illustrates the two different patient presentations under scrutiny of this study; one septic patient coming from home (32 year old female) and one from the nursing home (70 year old female). The first patient does not fit into the researcher's aggregate due to her age of 32 being well below those included in the study. However, the illustration of the relationship between the consequences of missed treatment opportunities and outcome are relevant. The 32

year old septic patient was not given antibiotics for a urinary tract infection (UTI) because she was thought to have kidney stones. The 70 year old nursing home patient was admitted to the hospital after presenting with progressive weakness and diarrhea for three weeks. Though upon admission she fit the criteria for severe sepsis (temperature of 38.8°C [101.8°F], pulse of 99 to 109 beats per minute, respiratory rate of 24 per minute and WBC count of 26.5), her symptoms went unrecognized. She too was given inappropriate treatment and her conditioned worsened through her hospital course, finally resulting in death. The 32 year old survived after suffering quadruple amputation and is currently blind in one eye as a result of sepsis. The comparison between these case studies and this study is merely to show the potential outcome of delayed intervention of the infectious process (Nelson, LeMaster, Plost, & Zahner, 2009).

A factor in the missed diagnosis of sepsis in the elderly is rooted in the difficulty of discerning the presenting symptoms. The elderly population is notorious for atypical presentation of infectious processes. Hals (2010) effectively expresses age related physiological differences of the elderly. Some such differences are exhibited in his use of examples of disease processes such as UTI and pneumonia. Both of these illnesses are large contributors to the mortality of the elderly population and potentiate sepsis but due to the uncharacteristic presentation (and similarly to the patients in the prior case study), inappropriate treatment can be initiated.

Elderly frequently have the presence of infection but exhibit fever in only 53% of the cases, while younger adults age 18 – 44 present with fever 85% of the time. Altered mental status (AMS) is a frequent complaint of the elderly when seeking treatment for an infection; however, there are many reasons for AMS that include but are not limited to: pathology, overdose, and polypharmacy. Older adults present only 50% of the time with alteration in mental status and those who are younger are altered only minimally. Elderly people exhibit a cough in

association with pneumonia in as little as 66% of the time in comparison to adults age 18 - 44 who present with a cough 90% of the time (Hals, 2010). This is due to the physiological changes that occur within the lung tissue over the life span. Interestingly, the colonization of the pathogenic bacteria occurs more often in the elderly than in the younger patient who, however, if they are not coughing, the pathogenicity continues (Beers & Jones, 2010). Sputum is represented equally in both age groups (elderly and adults) at 64% (Hals, 2010).

There are other reasons besides obtuse presenting symptoms that might keep an elderly person from getting treatment in a timely manner. In the auspice of the nursing home, there may be factors involved such as inexperience or apathy of the health care workers or the fact that many state laws only require physicians to see and evaluate the nursing home patient once every 30 to 60 days (Gallic, Schmaader, & Sokol, 2009). Transfer criteria decisions are another component that contribute to delays in diagnosis and treatment of the nursing home patient with a new onset of a disease process. This was the subject of a qualitative study conducted that evaluated how the nursing home staff came to a decision to transfer a patient to the ED. This study assessed three comparably sized nursing homes in Virginia and used a hermeneutic phenomenologic approach to gather data from those directly involved in the transfer decision making process. The conclusion was that three main themes arose when making the decision regarding transfer. Those themes are “consensus” where the family, patient and health care workers are in agreement to send the patient to a higher level of care and “conflict” where there is disagreement between the family and the health care workers regarding this decision. The final theme is “cogency” where the participants attempt to persuade those with differing opinions in order to reach a consensus about future plans of care (Jablonski, Utz, Steeves, & Gray, 2007). Considering the time taken to examine all accounts in an effort to find a resolution, including

multiple phone calls made to family members and physicians, it is not surprising that there may be a delay in nursing home transfers and treatment.

The prevalence of sepsis has been and is under continuous scrutiny. Its incidence has been calculated and published in many research forums. A frequently cited recent study performed a retrospective trend analysis from 1993 to 2003 to reflect trends in rates of hospitalization and mortality of the septic patient in the U.S. The setting was a stratified sample of 20% of all U.S. community hospitals and identified 8.4 million patients with sepsis. The 11 year study includes data from the National Inpatient Sample (NIS), which was developed as part of the Healthcare Cost and Utilization Project under federal, state and industry partnership. This detailed study differentiated via ICD-9 codes and sub-codes, all types of sepsis including those individualized from different pathogens, and those that fit the different sepsis criteria; SIRS, sepsis, septic shock and severe sepsis. Sepsis fatality rates were compared to the 2000 U.S. Census Bureau age-and sex-specific national population estimations for the years 1993 to 2003 and were used as the denominator in the calculation (Dombrovskiy, Martin, Sunderram, & Paz, 2007).

A chi-squared test for trend was developed to conclude if there was a noteworthy linear trend in severe sepsis hospitalization, mortality and case fatality (the ratio of severe sepsis cases resulting in death divided by the total number of cases of severe sepsis). The *p* value was $p < .05$ and was considered significant. The findings for this study details that the rate of hospitalization almost doubled during the 11 year period evaluated increasing from 64.7/100,000 in 1993 to 134.6/100,000 in 2003 ($p < .001$). The annual mortality rate for severe sepsis increased 5.6% overall ($p < .001$) during the same time frame. An additional finding was that the case fatality rate decreased by 1.4% ($p < .001$). The reasons for improvement in case fatality rates could not

be determined by the researchers of this particular study, but it could be due to advancements made in management and care of the septic patient through evidence based care. It should be noted that the results of this trend analysis contradicts the previously mentioned Angus et al. (1992) study in that the rate of severe sepsis was initially reported to increase at 1.5% each year. However, these researchers found the rate of increase to be much lower than anticipated though the authors do not give a specific percentage (Dombrovskiy et al., 2007).

In an analysis of the National Center for Health Statistics' multiple-cause-of-death (MCOD) dataset, the authors investigated trends and differences in the mortality associated with sepsis. It was the first of its kind to use the MCOD data to approximate national-level mortality rates related to sepsis. The years studied were from 1999 to 2005 with comparisons of age, sex, ethnic groups of those who died as a result of sepsis. Statistical comparisons of a five-category system based on ethnicity (Hispanic, African-American, Asian, American Indian, and Caucasian) was completed and cross-referenced with eleven different age categories. The medians were contrasted using the Wilcoxon-Mann-Whitney test for independent samples. The differences in relative risk of the comparison (rate ratio) were calculated using the chi-squared test for consistency. Time trends were evaluated using the Poisson regression. Results regarding the age specific and ethnic specific categories noted that African-American males were at an over-whelming increased risk for sepsis-associated death with 117.6 deaths per 100,000, while Asian females had the lowest incidence of sepsis-related deaths at 29.5 in 100,000. Also noted were that participants that were age 75 to 84 years of age or 30.6% of the study population, were more likely to die from sepsis (Melamed & Sorvillo, 2008).

Conclusions derived by the authors were that 6.0% (1,017,616) of deaths related to sepsis from the total number of deaths (16,948,482) during the six year period and the median age was

76 years of age ($p < .0001$). This study further differentiated the place of death reporting that 86.9% occurred in the hospitals, 6.3% occurred in nursing homes, 5.7% occurred in the personal residence, and 1.2% occurred in an unknown location. While these are interesting statistics, they offer no clarity on how or if point of origin impacts sepsis mortality in the elderly. It was interesting to note that the Melamed and Sorvillo (2009) study contradicts the Dombrovskiy et al. (2007) study by showing a decrease in sepsis trends by 0.18% per year from 1999 to 2005, while the Dombrovskiy study reported an increase of 5.6% for the 11 year time period of 1993 to 2003 (Melamed & Sorvillo, 2009).

Theoretical Literature

Sepsis is one of the most common diagnosis' for hospital admission. As the elderly population increases, the incidence and mortality of sepsis will rise. Sepsis arises from a severe systemic bacterial infection in which the body or part of the body is invaded by a pathogen and can result in multiple organ failure and death. When the pathogen multiplies, it triggers an inflammatory response and harmful effects.

The pathophysiology of sepsis is complex and is driven by the immune system to attack foreign antigens. The attack includes simultaneous stimulation of leukocytes, monocytes, macrophages, platelets and natural killer cells. The cytokine system releases high levels of interleukins, tumor necrosing factor (TNF) cells, and also activates the complement cascade system. In response to high levels of TNF, the host response changes and causes disseminated intravascular coagulation (DIC) to develop. Concurrently, the immune system also activates the adaptive immune response which stimulates the T and B cells. This immune response generates a specific recognition of antigens by antibodies or receptors on the surface of B or T cells. The B and T cell role is to recognize antigens and bind to them, which helps to fight off the invading pathogen (McCance & Huether, 2006).

Anti-inflammatory cytokines are produced which helps to keep the inflammatory process in check. Most people with infections can achieve a homeostatic balance between the inflammatory and anti-inflammatory process. Patients with sepsis have a disturbance in this equilibrium which results in SIRS and multisystem organ dysfunction syndrome (MODS) and possible death (Irwin & Rippe, 2008). MODS is the progressive decline in two or more organ systems resulting from an uncontrolled inflammatory response to an illness or injury. MODS frequently occur in severe sepsis and can progress to complete organ failure and death (McCance & Huether, 2006).

Many aspects of the immune system are altered in immunosenescence which leaves the elderly at risk for developing infections easily. The T-cell stores are decreased and are not as responsive, macrophages have decreased ability to present antigens, neutrophils have decreased phagocytic capability, and the cytokine secretion release is diminished with age. The humoral immune system, which is imperative to fighting bacterial infections, is decreased with age and specific antibody production diminishes with age (Gibson et al, 2009). Morbidity and mortality due to infectious disease is greater in the elderly than in the young, partly because of age associated decreased immune competence, which leaves elderly individuals more susceptible to pathogens (Pawelec et al., 2005).

Because of weakening immune systems, the elderly are more predisposed to pneumonia, and that diagnosis is often the terminal infectious disease process that claims their lives (Cunha, 2001). The incidence of pneumonia in the elderly population for community acquired cases is 20-40 per 1000 and 100-250 per 1000 for those in nursing homes (Beers & Jones, 2010). An additional culprit to aid in the increased incidence of sepsis is the diagnosis of UTI. It is estimated that 10% of all elderly people 65 and older have a symptomatic bacterial UTI at any

given time and it occurs in women more than men at a ratio of 2:1 (Beers & Jones, 2010). Elderly women develop UTIs more frequently than men due to the post-menopausal changes that occur such as vaginal atrophy and dryness, decreased secretions during intercourse, and increased propensity to have incomplete bladder emptying leading to stagnant urine. Eighty-six percent of the cases of UTI are due to Escherichia coli (Mills, 2006). When the immune system line of defense is broken, the elderly patient often has a hard time recuperating and returning back to equilibrium.

Elderly patients are more susceptible to infections of the integumentary system due to normal physiological changes and from improper skin care. It is imperative to assess the elderly patient's skin on a daily basis. As a person ages, collagen levels decrease significantly, which impairs the elasticity of the skin and then it begins to atrophy. The epidermis and dermis layers become fragile making skin tears a common problem for the elderly (Hampton, 2010). When a patient has a skin tear, the protective barrier against external environmental pathogens is broken and the patient becomes susceptible to infections. Proper skin care and prevention of decubitus ulcers is a basic nursing expectation. Improper skin care can lead to pressure ulcers, decubitus ulcers, and severe infections. Unfortunately, the incidence of skin breakdown and development of pressure ulcers has become an indicator of the quality of care provided to an elderly individual, whether at home or in a nursing home facility (Joint Commission [JC], 2006). Urinary and fecal incontinence are additional culprits of skin breakdown, but nursing homes have adopted stringent policies for maintaining skin integrity in the immobile patient. The patient at home is left to the mercies and knowledge of their family caregiver. In either case, the main objective is the prevention of skin breakdown or the restoration of skin integrity once it has become altered (Voegeli, 2010).

Summary

The majority of information regarding sepsis was found in journals, textbooks and the internet. There was an abundance of information on the epidemiology, pathophysiology and treatment of sepsis. However, there was essentially no literature to demonstrate whether an elderly patient's point of origin affects their outcome when hospitalized with this disease process. Stringent effort was taken by the researchers of this study to use primary sources as opposed to secondary sources in an attempt to give credibility to their analysis.

With such prevalence of sepsis in the health care environment and with the incidence expected to rise dramatically due to the aging of the baby boomers, all variables surrounding sepsis should be subject to continued research. The current research supports the fact that sepsis cases have increased and will continue to increase (Melamed and Sorvillo, 2009; Dombrovskiy et al., 2007). Though these two investigations disagree on the exact percentages that sepsis will increase, they both agree that it will increase regardless.

The ACCP definition of SIRS and its subsets are the standard by which all diagnoses of sepsis are judged. However, keeping in mind the age-related changes the elderly person goes through, their presenting symptoms may not correlate with those of the general population. Due to these physiological changes, specifically the impaired immune system, the elderly patient is more susceptible to the infectious disease process that leads to sepsis and ultimately death.

Chapter 3

Methods and Procedures

Research Design

The research design that was used for this study was a quantitative, retrospective design with a cross-sectional approach. This design was best for this study because data on both the dependent and independent variables were collected at once. Inferential statistics were used to determine if the outcome of the study was related to point of origin or an outcome of chance.

Sample

Selection of the sample occurred by obtaining patient information based on chart review from those that had been hospitalized after presenting to the Emergency Department (ED) from home or a nursing home. Further criteria included that the patient was admitted with a diagnosis relative to an infectious process; altered mental status, hypotension, pneumonia, leukocytosis, UTI, sepsis or SIRS. The decision was made to study those whose age ranged from 60-90 and had at least one of the specified co-morbidities: (1) Cardiovascular disease such as coronary artery disease (CAD), myocardial infarction (MI), congestive heart failure (CHF), (2) chronic obstructive pulmonary disease (COPD), (3) cerebral vascular accident (CVA), (4) dementia or Alzheimer's disorder (AD), (5) diabetes mellitus (DM), and (6) immune deficiency.

In addition to the above mentioned specifications, additional criterion for the study was based on patient's admission diagnosis of sepsis by the International Classification of Diseases, 9th Revision (ICD-9). ICD-9 codes are developed by the World Health Organization (WHO) (n.d.) and are the standard for classifying diseases. Data were recorded by the researchers if the patient was discharged from the facility back to their point of origin after a diagnosis of sepsis, or if they expired as a result of sepsis.

The sample size consisted of 106 charts. Information gleaned from patient charts was during the year 2009. The manager of the Health Information Services (HIS) office at the selected hospital was informed of the researchers' intent during an informal conversation, followed by a formal request through e-mail. The HIS manager was made aware of the aggregate required for the study. She screened from her computer system 106 charts that fit the researcher's above mentioned criteria.

Setting

All chart review took place in the Medical Records office at the chosen hospital. The researchers accessed the computer program used by the hospital called, "ChartMax." ChartMax is the charting system used by physicians and nurses at the specified hospital and compiles all of the patient information during their hospitalization. This was done after obtaining the appropriate approval from the hospital Internal Review Board (IRB).

Ethical Considerations

Permission from the Internal Review Board (IRB) was obtained from the university and from the selected hospital prior to the study. All chart review information was kept confidential. All standard procedures to protect identities were met. To increase patient anonymity, no patient names and identifying factors were included in the review process. The researchers signed a confidentiality agreement and completed the Collaborative Institutional Training Initiative (CITI) course as requested by the hospital's IRB. Patients were not interviewed nor accessed during this study and no damage was caused to their person as a result. The results of this study will not be used against or exploit the patients in any way.

Instrumentation

Most nursing studies use clinical data for obtaining information regarding independent and dependent variables (Polit & Beck, 2008). In this research study, biophysiologic

instrumentation measures such as *in vivo* measurements such as oxygen saturation, blood pressure, temperature, urine output and cardiac output, if available, was reviewed. *In vitro* measurements such as lab values, blood cultures, and urine cultures were assessed. Objective data such as physician documentation and nurse's notes were reviewed. A data record sheet was developed by these researchers specifically for this study. The data sheet consisted of a checklist with headings including: (1) patient chronological number studied (i.e. 1-106), (2) patient's age, (3) patient's gender, (4) patient's outcome at discharge (alive or expired), (5) point of origin at admission (home or nursing home), and (6) known patient co-morbid diseases such as: CAD, MI, CHF, COPD, CVA, Dementia/Alzheimer's, DM, Immune deficiency. A checklist system was used to ensure that each chart was reviewed only once.

Data Collection

After permission was obtained from the IRB at SAU and the selected hospital IRB, a retrospective chart review study was conducted. The chart review took place in the Medical Record department of the hospital. There were 106 charts reviewed from ED admissions during the year 2009 with the diagnosis of sepsis. The researchers accessed the hospital's ChartMax program to view chart information. A checklist data sheet was developed by the researchers and used to increase patient confidentiality. All standard procedures to protect identities were met. To further increase patient anonymity, all patient names and identifying factors were excluded from the data checklist. The information obtained was used for quantitative statistical analysis. The researchers used the Statistical Package for the Social Sciences (SPSS) software for analysis, charts, graphs and figures.

Data Analysis

The researchers used chi-square (x^2) test of independence which compares whether two variables are independent of each other (Cronk, 2008). Chi-square assumes nothing about the

shape of the population distribution from which the sample was drawn (Polit & Beck, 2008). In the case of this study, the chi-square test was calculated comparing the occurrence of life versus death in the septic elderly patient with regard to their point of origin (home versus nursing home). Additionally, the outcome of this research study indicates if there is a statistical significance regarding point of origin and patient outcome. The dependent variable in this case is the outcome variable of interest. The researchers wanted to determine whether the elderly septic patient lived or expired, which was influenced by the independent variable of whether the patient came from home or the nursing home prior to admission to the hospital.

Information obtained from the patient's charts was placed on a data sheet by the researchers. Those facts were then entered into SPSS, version 15, for analysis. Statistical significance was set at $p < 0.05$.

Plan for Dissemination of Findings

The results of this study will be presented to the nursing faculty and students at this university and submitted for publication in a peer-reviewed nursing journal. The information will be presented to the IRB of the hospital. It is also possible that the medical director of the hospital, the ED director and the Tennessee Department of Health Long-term Care Division may be able to use this information for possible change of protocol with utilization of evidence based review. Additional dissemination of the findings will be sent to the Joint Commission's Division of Quality Measurement and Research Department to generate new knowledge related to health care quality in the nursing home (JC, 2010).

Chapter 4

Data Analysis

Introduction

A sample of 106 charts was randomly selected to represent a study population of patients age 60-90, admitted to a hospital in 2009 with the diagnosis of sepsis. The goal of the study was to differentiate if a patient's point of origin increased their chance of death associated with that hospital admission when diagnosed with sepsis. The point of origin was delineated between home versus nursing home. Data collected was a cross sectional, retrospective, quota sample from one hospital chosen by these researchers to represent a larger population. A correlative comparison between independent variable conclusions was done. This determined whether the patient mortality was impacted if patients came to the hospital from home versus a nursing home (Polit & Beck, 2008).

Demographic Data

The male to female gender ratio of the participants was evenly split at 50%; 53 participants were male and 53 were female. The mean age of the participants of this study was 76.17 years. The mean age of males was 75.13 years (*sd* = 7.9) and females 77.21 (*sd* = 8.1). Distribution frequencies were performed on the following categories: age, gender, length of hospital stay, mortality (lived or expired), point of origin, CAD, MI, CHF, COPD, CVA, Alzheimer's, DM, and immune deficiency. The frequency of occurrence for the following co-morbid diseases were: CAD – 36 people (34% of the population), MI -16 (15.1%), CHF – 30 (28.3%), COPD – 34 (32.1%), CVA – 33 (31.1%), Alzheimer's – 22 (20.8%), DM – 42 (39.6%), and Immune Deficiency – 14 (13.2%). The mean hospital stay was 8.84 days. Length of stay and point of origin were tabulated by a *t* test. Results were N = 69 of home patients with a mean of

9.39 days (*sd* = 8.9). Nursing home patients were N = 37 with a mean of 7.81 days (*sd* = 5.7). Participants who lived were 76.4% (81 patients) of the sample and those who died were 23.6% (25).

The majority of the study participants 65.1% came from home. Of the patients who came from home 51.9% (55) lived and 13.2% (14) died. The patients that came from the nursing home equaled 34.9% of the total sample with 24.5% (26) who lived and 10.4% (11) that died.

Analysis of Hypothesis

There does not appear to be any significant correlation between an elderly patient's mortality when diagnosed with sepsis and point of origin. The researchers found that 14 people died that came from home and 11 people died that came from a nursing home. While there is a three person difference in the death rate, it is not statistically significant in reference to this study population. More significant results may be obtained from a much larger sample size.

A Spearman *rho* correlation coefficient test was calculated for the relationship between the participant's mortality and point of origin. No statistical correlation was found (r (104) = .106, p =.280). This again solidifies that a septic patient's mortality is not reflective of point of origin.

A chi-square test of independence was calculated between the patient's point of origin and mortality. No significant relationship was found (x^2 (1) = 1.191, p = .275). Mortality and point of origin appear to be independent variables.

Other Findings

Following the analysis of the hypothesis, a *t* test was performed to compare differences in length of stay and co-morbidities. No significant difference was found t (101) = 1.113, p = .268. Information obtained through frequency data indicated that some patients demonstrated only one

co-morbid disease as defined above; however, there were a large portion of patients that had two or more co-existing diseases, with DM having the most frequent occurrence at 42 total patients. CAD, COPD, and CVA had the next highest occurrences at 36, 34, and 33 respectively.

Summary

Though the researchers did not find statistical significance between mortality and point of origin, there was other useful data obtained regarding sepsis and length of hospital stay. For instance, statistical analysis using the Spearman *rho* correlation test indicated a small correlation that patients with the co-morbid diagnosis of DM had a longer stay in the hospital. These tests further indicated that with increasing age, the incidence of Alzheimer's, CAD, and MI increased as well. The rest of the co-morbid diseases did not appear to make any difference in length of hospital stay.

Further evaluation related to hospital length of stay in reference to sepsis is warranted. These researchers incidentally found that the average length of hospital stay was increased at 9.39 days for patients that came from home while the patients that came from the nursing home had an average hospital stay of 7.81 days.

There does not appear to be any significant correlation between an elderly patient's mortality when diagnosed with sepsis and point of origin. The researchers found that 14 people died that came from home and 11 people died that came from a nursing home. While there is a three person difference in the death rate, it is not statistically significant in reference to this study population. However, on a personal level, to a family with an elderly loved one, this would be immeasurable.

Chapter 5

Discussion, Conclusion, and Recommendations

Discussion of Results

The analysis of the study was based on point of origin and mortality. The researchers did not differentiate between ethnicity of the participants, socioeconomic status, insurance status or post discharge quality of life. The mean age of the participants of this study was 76.17 years. These data are consistent with research that was done in the study 1999-2005 of sepsis-associated mortality in the U.S. by Melamed and Sorvillo, (2009), which reported a mean age of 76. With this study there were 34.9% of the participants who came from the nursing home, 65.1% came from home; 23.6% of the patients died, and 76.4% lived. Of those that lived, 42 were female and 39 were male. Conversely, of those that expired, 14 were male and 11 were female. The death rate of 23.6% is noteworthy for such a small sample size considering a national study by Angus et al. that had 192,980 septic participants which resulted in a death rate of 28.6% (2001).Though not the intent of this study, it was interesting to note that the findings indicate that elderly men died from sepsis more frequently than females. This agrees with the Melamed and Sorvillo study which showed that men are more likely to experience sepsis-associated death (2009). However, this study sample size is so small that the significance would need to be further determined by a larger sample population.

The conclusion of the study was that there was no statistical significance found between point of origin and whether the patient lived or died. Further analysis revealed that the specified co-morbidities of the study did not make a difference in the patient's outcome. DM was the only co-morbidity that appeared to increase the length of hospital stay, but did not increase the chance of mortality. Despite the efforts of the researchers to chose a sample that was reflective of the

elderly population, this study sample size was small and did not give a significant overall picture. Further information could be determined from a broader and larger sample population.

Recommendations

The elderly is the largest growing sector of the current population and is expected to double by the year 2030 (U.S. Census Bureau, 2005). The mortality rate of sepsis in the elderly is 28.6% and is expected to rise 1.5% each year (Angus et al., 2001). Because of these numbers, all aspects of sepsis need to be studied: race, culture, point of origin, and quality of life with regard to treatment of sepsis and length of hospital stay. There is an abundance of research literature regarding early diagnosis, intervention and treatment of sepsis, however, these researchers found no information concerning modifiable factors such as a patient's origin prior to hospital admission.

It is understood that nursing home staff should do an effective job at identifying potentially infectious illnesses and seeking timely, appropriate treatment for elderly persons. This is particularly important for those families who pay for a service, such as a nursing home, and expect a more positive outcome than those patients who come from home. This small study showed that there was no statistically significant difference in the outcome despite the patient's point of origin. However, a larger sample population size might indicate different results and should be further studied to ensure those who are in the nursing home are getting appropriate care. Likewise, a larger study would help to determine if elderly at home are receiving suitable home-based care that prevents, recognizes and intervenes in infectious processes.

Summary

The researchers of this study would like this study to initiate further studies to identify trends regarding point of origin and patient outcome. Considering 65% of sepsis cases occur in

patients 65 and older, it is imperative to recognize the beginning of a septic illness (Angus et al., 2001). Definable risk factors have been identified through research, but there is still room for improvement. Every effort must be made in the spirit of evidence based practice to improve modifiable factors of the elderly lifestyle to decrease sepsis mortality.

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