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Impact of Emergency Department Sepsis Policy

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IMPACT OF EMERGENCY DEPARTMENT SEPSIS POLICY

by

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DEDICATION

I would like to dedicate this project to my family. Jim, LaVera, Paul, and Jennifer for all their support and patience throughout this DNP journey.

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ABSTRACT

Sepsis is a serious concern of key healthcare stakeholders due to high incidence, mortality, and cost. The objectives of this evidence-based project were to 1) identify potential sepsis patients early during the emergency department (ED) triage process and 2) implement Sepsis Order Sets. Kotter's change model and the Stetler model of evidence-based practice guided this project. An extensive literature search was undertaken to find best practice evidence regarding care of sepsis patients. Recommended care includes a protocolized format utilizing a screening tool and point of care lactate levels for early identification of sepsis, and early treatment with antibiotics and fluid resuscitation. A sepsis policy was developed based on recommended care. Education of the ED staff was accomplished. During the implementation period, EHRs of all ED triage patients $\geq$18 years of age were monitored to measure staff compliance with policy components. A chi square test of independence was calculated comparing screening rates pre and post policy implementation. A significant interaction was found ($X^2(1) = 438.505$, $p<.001$. Patients were more likely to be screened post policy implementation than pre implementation. Staff compliance with Sepsis Order Sets was also analyzed for the post implementation group and increased compliance with all components was demonstrated. Secondary outcomes of the post implementation group included a length of stay of 7.7 days and a mortality rate of 11.11%. EHRs of patients who were discharged with a sepsis diagnoses during the implementation period were further analyzed. An odds ratio was calculated and illustrated that patients who were screened were 34% less likely to die when compared to patients who were not screened. Results demonstrate that implementation of a sepsis policy that includes a computer based screening tool and point of care lactate significantly impacts early identification of sepsis patients, and leads to timely treatment with subsequent decreased length of stay and mortality. These findings can be used to change current practice in both emergency department settings and in-patient units.

CHAPTER 1

INTRODUCTION

Background

Sepsis is the body's reaction to an infection. In a healthy individual, the immune system usually fights infection; however, in some instances assistance is needed in the form of antibiotics, fluids, and other treatments to prevent sepsis from becoming severe. When this occurs, time to treatment is essential to combat the infection and prevent organ dysfunction. Evidence from numerous studies has shown that early sepsis identification and treatment with antibiotics and fluid can make a difference in a patient's morbidity and mortality (Dumont & Harding, 2013; Keegan & Wira III, 2014).

Sepsis can be described on a continuum from initial infection/trauma to severe sepsis and septic shock. Initial attempts at identifying sepsis patients relied on Systemic Inflammatory Response Syndrome (SIRS) criteria (Balk, 2014). This criteria includes two or more clinical responses such as temperature and heart rate. However, this criteria did not identify all potential sepsis patients and a more comprehensive screening tool was developed to include signs of organ dysfunction.

Statement of the Problem

Sepsis and the care of sepsis patients impact the healthcare industry on a number of levels. It is a serious concern for health care providers, policy-makers and patients due to the large number of cases, high mortality, and cost. According to the latest data from the Agency for Healthcare Research and Quality (AHRQ) septicemia (and its related diagnoses) was the sixth most common reason for hospitalization in the United States with over one million patient stays (AHRQ, 2012). This number has more than doubled since 1993 with an average increase of 6% per year. The highest rates of septicemia occur in the elderly population which explains why Medicare is the most frequent payer of expenses. The mean length of stay (LOS)

for a patient with sepsis is 8.8 days with an average daily cost of $2,300 per day. The cost of treating sepsis patients in 2009 was over $15.4 billion. This cost grew 3 times faster than other diagnoses due to increasing numbers of patient stays and increasing costs per stay.

Mortality is also a major concern of those caring for sepsis patients. The average mortality rate in 2009 was 16% which is higher than the 8% mortality rate credited to other diagnoses. This is partly due to sepsis patients presenting with vague symptoms or extremely serious symptoms. Of those patients who do not die in the hospital, an increasing number are being discharged to either nursing homes or other types of long-term care facilities. This practice impacts the healthcare system by increasing the need for available beds and staff in those long-term care options. The community is impacted by this practice with an increase in costs to patients and payers, as well as affecting the family dynamics and community resources (AHRQ, 2012).

Data from the Literature

The landmark study by Rivers et al. (2001) published in the *New England Journal of Medicine* demonstrated the need for early identification and the use of early goal-directed therapies such as blood cultures prior to antimicrobials, early initiation of antimicrobial and fluid therapy, and early transfer to the intensive care unit. These practices provided significant benefits to patients suffering from sepsis and septic shock. The primary result was in-hospital mortality reduced from 46.5% to 30.5% in the intervention group. Findings also indicated that patients in the intervention group suffered less organ dysfunction than those patients who were treated conventionally (Rivers et al., 2001).

The Surviving Sepsis Campaign (SSC) is a consensus committee of 68 international experts representing over 30 international groups who have an interest in the care of sepsis patients. The SSC's mission is to decrease sepsis mortality by 25% in five years. This organization is responsible for analyzing all available evidence on the care of sepsis patients and generating best practice recommendations. These guidelines, originally published in 2004,

were revised in 2008, and again in 2013. The SSC also provides education to healthcare organizations on sepsis and maintains a sepsis patient database (SSC, 2015).

Levy et al. (2014) analyzed the SSC database of patients over a 7.5 year period. Researchers found that hospitals with high compliance to the guidelines demonstrated a mortality rate of 29% while hospitals with low compliance to guidelines had a mortality rate of 38%. Additionally, with every 10% increase in guideline compliance a significant decrease in the odds ratio for hospital mortality occurred (Levy et al., 2014). Wang, Xiaong, Schorr and Dellinger (2013) also compared mortality rates before and after a sepsis performance improvement bundle was utilized in the emergency department (ED). A significant decrease in mortality from 44.8% to 31.6% resulted from the initiation of the change.

Monitoring of biomarkers is another clinical tool used in the early identification of sepsis patients. Schuetz, Haubitz, and Mueller (2012) discussed the role of a sepsis specific biomarker, lactate, in early identification of sepsis patients. Authors determined a linear relationship exists between blood lactate levels and mortality.

Once a patient is identified as having sepsis, early treatment is essential. Ferrer et al. (2014) found that effective antimicrobial administration within the first hour of documented hypotension led to 79.9% survival to discharge for sepsis patients. Schorr and Dellingeer (2014) validated the need for the early administration of antibiotics to sepsis patients identifying this measure as the highest priority in the SSC guidelines.

A common thread throughout the literature is the practice of protocolizing identification and treatment of sepsis to improve patient outcomes. Identification of patients needing sepsis care was the main problem when implementing the SSC guidelines according to Vanzant and Schmelzer (2011).Their response was to implement a screening tool and lactate level protocol as part of the ED triage process to quickly identify these patients. Buck (2014) also implemented the SSC guidelines and found staff education and process changes to develop an early sepsis alert program for their hospital system led to an improvement in patient outcomes. The primary

benefit of early identification of deteriorating patients is the ability to provide necessary care in a timely fashion.

Francis, Rich, Williamson and Peterson (2010) examined the impact of a sepsis protocol on the time to antibiotic administration. They found an overall reduction of 79 minutes in time to antibiotic administration with the implementation of a guideline based ED sepsis protocol. Christiana Care Health System received a Joint Commission Codman Award for their implementation of a sepsis alert program (Zubrow et al., 2008). The program consisted of care guidelines, a treatment algorithm, and the streamlining of sepsis patient identification. The results were a 49.9% decrease in mortality, a 34% decrease in hospital LOS, and a 188% increase in patients discharged home.

Data from the Agency

The clinical agency for this evidence-based practice (EBP) project is a not-for-profit hospital in Northwest Indiana that is an affiliate of an alliance owning 13 hospitals and clinics in Indiana and Illinois. Their website states that the alliance “is a trusted leader in providing faith-based, integrated health care by bringing together the latest technology, innovative procedures and brightest, most compassionate people to serve our patients”. The project was implemented in two EDs within the hospital system.

The care of sepsis patients has become a priority initiative for the organization. With a mission to provide the best care to patients, it is imperative that benchmarks of care be met. The 1st quarter 2015 data demonstrates:

1. The sepsis mortality varies monthly between 29.2% and 16.67%.
2. In 73% of patients with sepsis, blood cultures are drawn prior to antibiotic administration.
3. Average time from identification of possible sepsis to first antibiotic is over 6 hours.
4. Average ICU LOS is 9 days and average total LOS is 8 days.

These data do not meet current organizational benchmarks which include mortality rates of less than the national average of 16%, and 85% compliance with the best practice SSC guidelines.

Purpose of the Evidence-Based Practice Project.

The purpose of this EBP project was to 1) identify potential sepsis patients early during the ED triage process and 2) implement Sepsis Adult Initial Resuscitation Evidence Based Order Sets (EBOS), which is a protocolized treatment plan, within one hour of triage time. This was accomplished by the implementation of an ED sepsis policy. The policy includes the use of a screening tool that is embedded in the ED triage computer system and a protocol for early recognition and treatment of the sepsis, severe sepsis, or septic shock patients. The desired outcome of the project is to provide early, aggressive best practice care to patients with sepsis to decrease patient mortality, decrease ICU and total LOS, and increase staff compliance with recommended guidelines.

This EBP project addresses the PICOT question: “In adult emergency department patients, what is the impact of a sepsis policy on staff compliance to best practice recommendations (early identification of potential septic patients, diagnosis utilizing lactate levels and cultures, and timely treatment with the sepsis bundle), length of stay, and patient mortality as compared to no policy over a four month period?”

Significance of the Project

Approximately one in four people who develop sepsis while in the hospital will die as a result of their illness (Dellinger et al., 2013). It is imperative that patients are recognized early and aggressively treated to decrease patient mortality, LOS, and cost.

This EBP project established an early identification and treatment process aimed at identifying potential sepsis patients in the ED triage area and providing appropriate care as recommended by the evidence. Utilizing this process can save lives, decrease LOS, and reduce cost to patients and payers.

CHAPTER 2

THEORETICAL FRAMEWORK AND REVIEW OF LITERATURE

An EBP project builds on the research of other practitioners. This project utilized the change process of John Kotter, the Stetler model of evidence-based practice, and an extensive review of all the pertinent literature available. This chapter will outline the Kotter process and the Stetler model and discuss how these frameworks facilitated development and implementation of the project. The literature search process is also explained and appraisal of the articles chosen for inclusion are presented in an evidence table. Synthesis of the literature leads to the compelling PICOT question regarding early identification and treatment of sepsis patients in the emergency department and best practice recommendations.

Theoretical Framework: Kotter

Theory description. The theoretical framework chosen for this EBP project is the John Kotter's 8-stage process of creating change (1996). Kotter describes eight errors organizations, primarily large businesses, make when trying to institute change within their organizations. These errors include: (a) allowing too much complacency, (b) failing to create a sufficiently powerful guiding coalition, (c) underestimating the power of vision, (d) under communicating the vision by a factor of 10, (e) permitting obstacles to block the new vision, (f) failing to create short-term wins, (g) declaring victory too soon, and (h) neglecting to anchor changes firmly in the corporate culture.

These eight mistakes were identified by Kotter during his greater than 20 years of experience as both an educator and business consultant. These mistakes have been magnified during the increasing globalization and competitiveness in today's marketplace. If an organization wants to stay profitable or solvent in the current environment, these mistakes must be anticipated. To that end, Kotter (1996) developed an eight stage change process to address the errors he witnessed.

The first step in the process is to establish a sense of urgency. In other words, ensure that the members of the organization understand the importance of making a change and why it needs to be changed now. To combat the error of complacency, an organization has to realize it cannot grow by continuing the status quo; it must change with the current environment.

The next step is to create a guiding coalition. No one member of an organization, not even the Chief Executive Officer, can know all the potential issues, barriers or possibilities that a certain change may create. Key stakeholders need to be involved at the inception of the change process. Who those stakeholders are is dependent on the change. By developing a guiding coalition, an organization can address the common error of failing to create a powerful group for change.

The third step is developing a vision and strategy. This may seem to be an easy step as most organizations have a vision statement, however, this vital period is when the guiding coalition needs to critically look at the current vision and decide how they want the proposed change to alter that vision. Following this process is the development of a strategy to make the new vision come to fruition. This step helps an organization from failing to understand the power of vision. Members of an organization need to have a purpose or reason to change which the vision provides. Additionally a strategy to communicate the vision is vital.

This leads to step four of the process – communicating the change vision. An organization can make a change only if the guiding coalition communicates the impact of the proposed change to all associates. People need to buy-in to a change, especially if the initial consequences of change negatively impact those associates; e.g. job loss or change, increased responsibility or total renovation of a process. Members of the organization must understand the change vision, the ultimate purpose of the change or the change will not be sustained. Only by communicating the vision, multiple times and in multiple ways, and ensuring that members embrace the vision can the problem of under communicating be avoided.

After communicating this change vision, the next step is to empower broad based action. This step includes everything necessary to bring about the change including eliminating obstacles, changing or removing processes that do not support the change, and encouraging “outside the box” thinking and activity. This is the most difficult step in the process since it personally affects the members of the organization by requiring them to leave their comfort zones. Members must change processes, change thinking, and possibly change jobs. The guiding coalition must make the vision clear and follow through on the actions that facilitate the change. Otherwise barriers may impede the change process.

Once a change has been communicated, discussed and implemented, the process is still not over. The last three steps of Kotter’s change process work towards ensuring that the change continues, leads to more positive change, and ultimately becomes part of the organizational culture (Kotter, 1996). Generating short-term wins, consolidating gains and producing more change, and finally, anchoring new approaches in the culture are essential strategies for lasting change.

Generating short-term wins is vital, especially if the desired result of the change is a long-term goal. Members of an organization must be able to visualize the change occurring. By setting short-term goals and celebrating achievements, members can more readily see progress towards the shared vision. This positive reinforcement encourages members to continue on the change process journey thus preventing short-term failure.

Consolidating the gains achieved is necessary to maintain change. All too frequently once a few short-term gains have been celebrated, the focus on the long term result and vision is forgotten. The guiding coalition team needs to use those “wins” as springboards for the long term goal to be achieved. Most change goals take longer than a couple of months to achieve. During this long process, new employees should be made aware of the change vision, and updated processes should be implemented as needed to continue the change vision. These strategies will prevent the organization from declaring victory and goal achievement too soon.

Finally, the change process must become a part of the organizational culture. Accomplishments and benefits of the change must be articulated to the members of the organization. Establishing new goals on an ongoing basis ensure that all involved realize that the change process is never ending, just changing focus. By continuing this process, organizations prevent the error of reverting to the way it has always been done.

Application of theory to evidence-based practice project. The Kotter 8 step change process fits nicely with the EBP project of implementing a change regarding care of potential sepsis patients in the ED setting. Hospitals are in the midst of major organizational challenges. Competition from other healthcare companies, government and state regulations, and a more knowledgeable client base are just a few of the ongoing issues facing a health care organization. To remain competitive and receive government payment, an organization needs to change its processes regarding patient care. Healthcare organizations need to remain current and care for their patients from an evidence-based perspective. This allows patients, staff, and the organization to benefit from better patient care, lower healthcare costs, and a healthier society. The change involved the development of an ED sepsis policy, which encompassed both a change in the identification and treatment of sepsis patients.

Following the steps of the change process, the first need was to establish a sense of urgency at the top of the organization. This was accomplished by reviewing the mortality of sepsis patients, along with compliance of practitioners to the recommendations of the 2012 Surviving Sepsis Campaign (SSC). In addition, the Healthcare Facilities Accreditation Program organization for the hospital will require reporting of statistics and quality benchmarks related to the care of sepsis patients within the next few years. The urgency was magnified when the organization realized that although their mortality rate was similar to the national average, none of the SSC components benchmarks were being met on a consistent basis.

Next the guiding coalition was created. This coalition was comprised of members that had the power to make the change including key stakeholders responsible for the change, as

well as those primarily affected by the change. For this project the group consisted of: Vice-President for Quality, Clinical Nurse Specialist of the ED, Director of ED and Behavioral Health, Manager of the ED, Clinical Informaticist, Quality Improvement Facilitator, Rapid Response RN, and the project implementation coordinator.

Once the group was established, a vision and a strategy to achieve that vision were developed. The organization's broad vision was to become a leader in the identification and care of sepsis patients in Northwest Indiana. Specific goals identified to achieve the vision included compliance to SSC recommendations such as early sepsis identification, blood culture obtainment prior to antibiotic administration, and administration of antimicrobials and fluids within an hour of arrival to the ED.

The strategy developed was multi-faceted and included reviewing the literature to identify best practices and developing a sepsis policy that included a triage screening tool and an early treatment algorithm. Additionally ED staff were educated about the vision, process, and outcomes of the project.

Communicating the change focused on the ED staff, both registered nurses and practitioners. The communication was multi-pronged to saturate the staff with the evidence supporting the change. Posters that outlined the process were hung throughout the ED. Cards that included key points of the policy were developed and distributed. These cards or "Badge Buddies" attach to ID badges, so they are readily accessible. Lastly, education was provided to the staff in two formats, face-to face and online.

In the next step, empowering broad-based change, the guiding coalition identified barriers to the change process and worked to make the transition as easy as possible. Multiple meetings embraced input from all members of the coalition, encouraging ideas that were new and different.

Generating short-term wins was a priority of the guiding coalition. Members of this organization value feedback and more readily change practice when supported by data. Wins,

defined as positive patient outcomes and compliance with bundle components, were celebrated with gold medals for individual staff. ED administration received weekly feedback relating to staff compliance and bundle usage for performance evaluation documentation. Data were placed on a prominent bulletin board in the ED to maintain positive changes.

The final two steps in the change process, consolidating gains and anchoring the change in the organizational culture, are ongoing. The process has not yet been in place long enough for these steps to be accomplished. The guiding coalition will continue to monitor and refine the process as it progresses and utilize lessons learned to expand the change throughout the organization.

Strengths and weaknesses of theory. Cohn et al. (2009) discuss using Kotter's change process to drive the implementation of an electronic medical record (EMR) with physicians. Success of the project was demonstrated by 95% of physicians using the EMR, and 90% of the patient population having the benefit of EMR to streamline their care. Cohn et al. discuss the major strengths of the model which include urging teams to perform groundwork (the first four steps). The primary foci were on creating a sense of urgency with the physician staff to make the change and building a guiding committee to drive the process. Another strength was the process of embedding the change (final four steps) which was accomplished by empowering the physicians with technology assistance and consolidating the gains with ongoing feedback. Hospital leadership felt use of this framework led to sustainable change. No limitations of the model were identified.

Faculty of medicine at McGill University utilized Kotter's change process to develop a new approach for faculty in regards to teaching and evaluating professionalism. They found the approach particularly useful in understanding the process of change. It was also utilized to analyze the success of different faculty awareness techniques that were developed (Steinart, Cruess, Cruess, Boudreau & Fuks, 2007).

The Kotter model has been criticized as a linear model that requires the user to focus on one step at a time when in actuality multiple activities should be happening at the same time. Also, the fourth step, communicating the vision has been identified as occurring too late in the process when the momentum with associates has been lost. The final limitation is the model's top-down approach which is illustrated by ideas and strategies being championed by upper administration with minimal input from organizational members (Wilson, 2015).

Evidence-Based Practice Model

Model description. The Stetler model of evidence-based practice was used to guide the implementation of this project. This model was chosen due to its incorporation of both individual practitioner and organizational components. Also, the similarities of the model to the nursing process increased relatability for the nursing staff which facilitated the acceptance of the change implementation.

The Stetler model was first described in 1976, then updated in 1994 and 2001 (Melnyk & Fineout-Overholt, 2011). Revisions to the model included integrating emerging evidence-based practice concepts and categorizing evidence as external research, conducted outside the organization, or internal research, from within the organization. The model was developed to facilitate application of research findings at the individual practitioner level in the hope of making research real for students and bedside practitioners (Stetler, 1994).This is a practitioner oriented model because it focuses on critical thinking of the bedside nurse, findings of individual practitioners, and evidence from external sources combined to achieve best practice. Using internal and external evidence, healthcare organizations can make changes on individual units or organization wide.

The Stetler model consists of 5 phases: (a) stage I, preparation; (b) stage II, validation; (c) stage III, comparative evaluation/decision making; (d) stage IV, translation/application; and (e) stage V, evaluation (Stetler, 2001). Stage I requires either the individual practitioner or organization to identify the issue, affirm the priority of the issue, and search for best practice

evidence. Stage II, the validation stage, requires appraisal of evidence and determination of support for the evidence-based change. If the existing evidence is weak or does not support the change, the process stops. Once the change has been validated, the findings are synthesized and evaluated in stage III to ascertain whether the change is an appropriate fit for the practitioner and the organization. One of three decisions can be made at this juncture, (a) do not use the change, (b) use the change now, or (c) consider using the change in the future.

If the decision is made to use the change now, stage IV, transition and application, begins. Questions such as: how is the transition going to occur, will the change be formal or informal, and how will the organization evaluate the benefits of the change, are asked during this stage of the model. The final stage is V, evaluation which uses practice evidence to identify if the change achieved the goal as expected.

Application of model to evidence-based practice project. The Stetler model was used as a guideline for this EBP project. It mirrors the nursing process which facilitated its use and focused the project coordinator's efforts during the change process. The first stage, preparation, included recognizing the need to improve early identification and treatment of ED sepsis patients and searching the literature to locate best practice patterns. Stage II included critical appraisal of evidence and creation of an evidence table which included data from 14 studies and guidelines. The best practice recommendations gleaned from this evidence are consistent with the guidelines presented by the Surviving Sepsis Campaign in 2013. During stage III, the individual practitioner and the organization decided that a change was necessary to meet the recommendations identified in the literature. These recommendations included: early sepsis identification, blood cultures obtained prior to antimicrobial administration, and administration of antimicrobials and fluids within an hour of presentation to ED.

In stage IV the project coordinator with the sepsis committee developed and implemented a plan for the transition to best practice recommendations which included development of a sepsis policy, advancement of a protocol for the early identification and

treatment of sepsis patients, creation of a Code Sepsis algorithm, and face to face education for the ED staff. Posters depicting the new process, “Badge Buddies” given out as reminders, and a follow-up computer based learning module were also part of this stage.

Stage V, the final stage, of evaluation is ongoing. A monitoring tool was developed to track compliance with the new policy, as well as patient outcomes relating to the change. These data will continue to be shared with individual ED practitioners, staff, and the organization’s administration, to maintain the change as well as generate ideas to continuously improve the process.

Strengths and weaknesses of model. There have been a number of evidence-based changes initiated using the Stetler model. Freeman et al. (2009) explained how they changed decontamination policies in the operating room utilizing the Stetler model. Romo and Kiehl (2009), two staff development experts, used the model to modify a preceptor program at their hospital organization. Both examples cited ease of use as a strength of the model. Its similarity to the nursing process made the model user friendly for individual practitioners and easily explainable to healthcare organization administrators.

Few limitations of the Stetler model were discussed in the examples cited. Romo and Kiehl (2009) stated that even with the use of the model sometimes changes cannot be made due to organizational priorities.

Literature Search

An extensive literature search was undertaken to find best practice evidence regarding the care of sepsis patients. The following search engines were utilized: (a) Joanna Briggs Institute (JBI), (b) The Cochrane Library, (c) Cumulative Index to Nursing and Allied Health Literature (CINAHL), (d) Medline via EBSCO, (e) Proquest, and (f) National Guideline Clearinghouse. The key words searched were grouped into three categories: a) disease process - using sepsis, severe sepsis, and septic, b) therapeutic intervention using early goal-directed therapy, sepsis alert, early recognition, guideline, bundle, and early identification, and

c) population using emergency and ED. Search terms were used consistently throughout all databases to ensure saturation.

Inclusion/exclusion criteria. Inclusion criteria included articles that were peer-reviewed, scholarly, published in the English language, and had a publication date 2012 or later. Articles were included if they pertained to the adult population, focused on the early identification and treatment of sepsis patients in the ED, initiated or utilized point of care (POC) lactate levels, included interventions consistent with the 2012 Surviving Sepsis Guidelines, or discussed opportunities or barriers to implementing a change in the ED.

Exclusion criteria included studies that included areas other than the ED, focused only on advanced care (in the intensive care setting) of sepsis patients, utilized computerized alert systems only, used guidelines developed prior to 2012, focused on pediatric or obstetric populations, or included only a single case study. Articles that were published before 2012 were also excluded as the Surviving Sepsis Campaign guidelines had included all data through 2012.

Search results. Search results from all databases are shown in Table 2.1. JBI and Cochrane had no evidence that met search criteria. Medline returned 261 articles while CINAHL (after duplicate articles were removed) returned 15 articles. Proquest (also after duplicates removed) rendered 237 articles, and the National Guideline Clearinghouse rendered one article for review.

Levels of evidence. Articles meeting the inclusion criteria for this EBP project were appraised using the John Hopkins Nursing Evidence-Based Practice Research Evidence Appraisal and Non-Research Evidence Appraisal tools (John Hopkins Nursing Evidence-Based Practice, n.d.). The John Hopkins tools are used to level evidence from level 1 to level 5 with level 1 being the highest level. The level 1 evidence is delineated as randomized controlled trials (RCT's) or a meta-analyses of RCT's. Level 2 includes quasi-experimental studies that involve manipulation of an independent variable. Level 3 encompasses non-experimental studies without manipulation of the independent variable, qualitative studies, or meta-syntheses

Table 2.1

Evidence Search Table

Database Searched	Articles Found	Duplicate Articles	Abstracts Reviewed	Articles Appraised
JBI	43	0	0	0
Medline (EBSCO)	261	0	261	10
CINAHL	81	66	15	0
Cochrane	46	0	23	0
Proquest	248	11	237	4
National Guideline Clearinghouse	16	1	0	0
Total	695		536	14

of qualitative research. This John Hopkins Nursing Evidence-Based Practice system also was used to establish the quality of the research with a grade of A for high quality, B for good quality, or C for low quality or major flaws.

The non-research tool delineates level 4 as systematic reviews that summarize evidence from research studies and clinical practice guidelines that are synthesized from scientific findings, clinician expertise, and patient preferences. The lowest level (5) encompasses organizational quality improvement projects, expert opinions, case studies, and literature reviews. The non-research evidence tool also includes a grading scale to rate the quality of evidence: A for high quality where expertise is evident, B for good quality where expertise is credible, and C for low quality or major flaws when the expertise is not discernible (John Hopkins Nursing Evidence Based-Practice, n.d.). After review of levels and quality of evidence, 14 articles were included in this evidence-based project (Table 2.2). No level 1 evidence was found. Six quasi-experimental studies which are at a level 2 were included. Two articles, a survey and a retrospective review, met criteria for level 3 inclusion. The Surviving Sepsis Campaign 2012 Guidelines met criteria for level 4 non-research. The final five articles that were reviewed consisted of two quality improvement projects and three expert opinion pieces which were categorized as level 5.

Appraisal of Relevant Evidence. Fourteen articles were appraised to determine usability of evidence, validity of results, and applicability to the goals of this project. Strengths and weaknesses of the evidence were also determined (Table 2.2).

Level 2 evidence. Bruce, Maiden, Fedullo, and Kim (2015) conducted a quasi-experimental retrospective chart review at two tertiary medical center EDs. Researchers focused on adult patients discharged with a diagnosis of severe sepsis or septic shock. Their objective was to evaluate the impact of a nurse-initiated ED sepsis protocol on time to initial antibiotic administration, in-hospital mortality rates, and compliance with the Surviving Sepsis Campaign Guidelines.

This was accomplished by a chart review comparing pre and post implementation data. The intervention was the initiation of an ED sepsis protocol that included a triage nurse diagnostic workup with a screening tool, notification of the ED practitioner of a potential sepsis patient, and use of a stepwise treatment algorithm. A weakness of the study was lack of explanation of the data collection process; therefore, validity and reliability of the data cannot be assured. Researchers concluded, clearly presented, and demonstrated an increase in compliance with lactate levels, a significant decrease in time to initial antibiotic administration, but no significant change in in-hospital mortality with a nurse-initiated sepsis protocol. This protocol enhanced early patient identification and treatment. There was an adequate sample size; however, only one medical system was involved which may affect the generalizability. Other limitations of this study were the retrospective nature of the data collection and failure of the investigators to examine if patients with a diagnosis of severe sepsis or septic shock at discharge triggered protocol use in the post implementation group. The study was given a grade of A due to the sample size, control of the intervention, and conclusions and recommendations based on extensive evidence.

The second level 2 evidence article was a quasi-experimental study that examined adults during specific day shifts at a tertiary care, not-for-profit Magnet designated hospital. Kent and Fields (2012) measured the effect of a nurse-based severe sepsis screening tool on the early recognition of sepsis. There were 200 patients in the pre-implementation phase and 206 patients post-implementation. The intervention was the development and utilization of a screening tool. Researchers measured the number of patients who met Systematic Inflammatory Response Syndrome (SIRS) criteria, number of positive SIRS patients with an infection, number of positive SIRS patients with infection who had organ dysfunction, and the

Table 2.2

Appraisal of Evidence Table

Citation	Design/Level	Sample/Setting	Major Outcomes/ Measurements	Findings/Recommendations	Grade
Bastani, Galens, Rocchini, Walch, Shaqiri, Palomba, Milewski, …Anderson (2012) ED Identification of patients with severe sepsis/septic shock decreases mortality in a community hospital	Non-Experimental Retrospective Review Level 3	Suburban Community Hospital Patients admitted to ICU with severe sepsis/septic shock over a 3 year period. Post-surgical patients were excluded 2 groups: Patients with sepsis identified in ED (n=155) Patients with sepsis not identified in ED (n=112)	Primary: • Mortality of patients with severe sepsis/septic shock identified in the ED vs. those patients identified later in hospital stay Secondary: • Final discharge disposition • Overall LOS • Direct Cost	• Mortality in ED Cohort = 27.7% • Mortality in NED Cohort = 41.1% • ED Cohort d/c home = 66.1% • NED Cohort d/c home = 27.7% • ED Cohort d/c LTCF = 2.5% • NED Cohort d/c LTCF = 10.8% • ED Cohort Median LOS = 7 days • NED Cohort Median LOS = 12.5 days • ED Cohort Direct Cost = $9,861 • NED Cohort Direct Cost = $16,031 Identification of sepsis patients in ED leads to decreased mortality, LOS and cost while increasing discharges home and decreasing discharges to LTCF	A
Bruce, Maiden, Fedullo, & Kim (2015) Impact of nurse-initiated ED sepsis protocol on compliance with sepsis bundles, time	Quasi-Experimental Retrospective Chart Review Level 2	2 Academic Tertiary Medical Center ED's Adult patients discharged with diagnosis of	Primary: Evaluate the impact of a nurse-initiated ED sepsis protocol on: • Time to initial antibiotic administration	• Compliance with lactate measurement increased from 83.9% to 98.7% • Compliance with blood cultures before antibiotics was not significant	A

to initial antibiotic administration, and in-hospital mortality		severe sepsis/ septic shock 3 groups: 1 - Pre- (n=62) 2 – Transition (n=58) 3 – Post- (n=75)	• Compliance with SSC 3 hour bundle targets ▪ Lactate level measurement ▪ Blood culture before antibiotic ▪ Broad spectrum antibiotic administration ▪ Weight-based IV fluid bolus • In-hospital mortality rate Secondary: Identify in-hospital mortality variables in admitted patients. diagnosed with severe sepsis or septic shock	• Broad spectrum antibiotic administration had similar compliance • Median time to initial antibiotic administration was significantly reduced by 27 minutes: pre-135minutes, post – 108 minutes • Compliance with fluid administration improved post implementation • No significant change in in-hospital mortality rate Respiratory dysfunction, CNS dysfunction, UTI, vasopressor administration, and body weight emerged as significant predictors of in-hospital mortality: ER nurses play critical role in identifying patients with potential sepsis, initiating diagnostic workup, and reducing time to initial antibiotic administration.	

Burney, Underwood, McEvoy, Nelson, Dzierba, Kauari & Chong (2012) Early detection and treatment of severe sepsis in the ED: Identifying barriers to implementation of a protocol-based approach	Non-Experimental On-line survey Level 3	Major Urban Academic Medical Center Full-time staff; RN's, physicians, and physician residents of the ED (n=101)	Primary: Identify specific barriers to sepsis protocol implementation • Baseline knowledge and self-reported confidence in identification of SIRS and sepsis • Current practices in treatment • Difficulties encountered in managing sepsis cases • Perceived barriers to implementation of clinical pathway • Elicit suggestions for improvement of sepsis treatment	• 72.7% of physicians cite familiarity with SIRS and sepsis protocol • 85% of nurses reported "somewhat" or "not at all" familiar with SIRS identification • 43.2% of physicians "hardly ever" order lactate • 43.9% of nurse "hardly ever" receive an order for lactate • 50% of physicians were "very confident" in choosing appropriate antibiotics • Barriers/Difficulties cited by physicians included: lack of available nursing staff, lack of recognition in triage, delay in nurses completing orders, lack of access to CVP, overcrowding, and delay in assembling team to transport to ICU • Barriers/Difficulties cited by nurses included: Physical space in ED, delay in diagnosis by physician, lack of nursing staff, number of staff to carry out protocol, delay in registration and heavy task load for septic patients Suggestions for Improvements included: earlier critical care consultation, sepsis rapid response team, and in-servicing regarding sepsis	
Dellinger, Levy, Rhodes, Annane, Gerlach, Opal, …Moreno	Clinical Practice Guidelines	Revision of 2008 Guidelines analyzing evidence through fall 2012.	Primary: What is best available evidence and, therefore, best practice	• Protocolized, quantitative resuscitation of patients with sepsis-induced tissue hypoperfusion.	A

(2013) Surviving sepsis campaign: International guidelines for management of severe sepsis and septic shock: 2012	Level 4	636 individual articles were used including meta-analysis, systematic reviews, randomized controlled trials and single studies.	in the care of the sepsis population? Secondary: Recommendations were divided into three categories: 1) Those specific to sepsis 2) Those considering general care of a critically ill patient 3) Pediatric considerations	• Target resuscitation to normalize lactate in patients with elevated values. • Routine screening of potentially infected patients • Performance improvement efforts in sepsis should be used • At least two sets of blood cultures prior to antimicrobial therapy. • Administration of intravenous antimicrobials within the first hour of recognition. • Initial empiric anti-infective therapy of one or more drugs that have activity against all likely pathogens. • Use of low procalcitonin levels to assist clinician in discontinuation of empiric antibiotics. • A specific anatomical diagnosis of infection requiring consideration for emergent source control be sought and diagnosed.	
Dumont & Harding (2013) Development and implementation of a sepsis program	Organizational QI Project Level 5	Community based not-for-profit health system Emergency Department patients after project implementation in Jan. 2013 as compared to data from Nov./Dec. 2012 prior to implementation	Implementation of Protocol • Mortality compliance with order sets • Time blood cultures drawn • Time of lactic acid draw • Time of antibiotic administration • Amount/time of crystalloid administration	None reported	B

			• Appropriateness of admission level of care • Sepsis screening time		
Keegan & Wira III (2014) Early identification and management of patients with severe sepsis and septic shock in ED	Expert Opinion Review of Literature Level 5	Emergency Department 146 Articles Reviewed	Epidemiology and pathophysiology of sepsis. Identifies and validates the Surviving Sepsis Guidelines: 2012	• Early identification and risk stratification of patients with sepsis is essential for prompt initiation of treatment • Triage assessment and vital signs must be considered • Serum lactate has important prognostic value • Organ dysfunction has negative patient outcomes which increase with each organ that malfunctions • Prompt administration of broad-spectrum antibiotics is necessary • Early fluid resuscitation with 30ml/kg of crystalloid is recommended • Compliance with sepsis bundles improves outcomes.	A
Kent & Fields (2012) Early recognition of sepsis in the emergency department: An evidence-based project	Quasi-Experimental Performance Improvement Level 2	Tertiary Care, not-for-profit Magnet designated community hospital Adult patients presenting to the ED on M/W/F between 7am – 3pm Group 1 patients prior to	Primary: Outcomes of a nurse-based Severe Sepsis Screening tool including: • Number of SIRS criteria • Number of positive SIRS patients with infection • Number of positive SIRS	No recommendations could be made due to the small sample size. Severe sepsis screening tool has the potential to facilitate early recognition of potential sepsis patients	C

		implementation (n=200) Group 2 patients post implementation (N=206)	patients with infection who have organ dysfunction • Treatment of above patients		
Patocka, Turner, Xue, & Segal (2014) Evaluation of an emergency department triage screening tool for suspected severe sepsis and septic shock	Quasi-Experimental Retrospective Chart Review Level 2	Emergency Department in an urban tertiary teaching hospital Pre-implementation cohort – patients between 1/1/05 – 12/31/05 who met inclusion criteria of infection or sepsis Post-implementation cohort – patients after 12/31/05 who met the above criteria Pre/Post charts were reviewed and only patients who received antibiotics within the first 24 hours of arrival to hospital were included	Primary: Did the implementation of a triage screening tool decrease time to antibiotic administration? Secondary: • Time from triage to first IV fluid bolus • Lactate values • Time of blood culture collection • Disposition of patient	• Time to antibiotics decreased 21% • Patients in post-implementation cohort were more likely to have serum lactate measured in the ED, and less likely to be admitted to the hospital • Post-implementation cohort had a non-significant trend toward a decrease in mortality • Implementation of triage tool was at 64% Implementation of a sepsis triage screening tool significantly decreased time to antibiotic administration	A
Perman, Goyal & Gaieski (2012)	Expert Opinion	Emergency Department	Brief summary of the pathophysiology of sepsis	• Optimization of ED management of the septic patient is a priority	A

Initial emergency department diagnosis and management of adult patients with severe sepsis and septic shock	Review of Literature Level 5	54 Articles	Identification and substantiation of clinical aspects of identification/ resuscitation of the septic patient in the ED	• Initial management requires correct identification. SIRS criteria does not always capture sepsis patients • Elevation in serum lactate is an effective marker for risk stratification • Each additional organ dysfunction increases mortality rates in sepsis patients • Use of bundled care • Initial management of sepsis patients should include: 1) Blood and urine cultures 2) Source control 3) Rapid administration of antimicrobials 4) Volume resuscitation of 20-30ml/kg	
Powell & Fowler (2014) Driving sepsis mortality down: Emergency department and critical care partnerships	Organizational Performance Improvement Project Level 5	Large Health care system Emergency Department patients after project implementation in July 2011 – June 2012 as compared to data prior to implementation	• Median time from ED arrival to lactate testing • Median time from ED arrival to antibiotic administration • Median time from ED arrival to IV fluid bolus • Median time from ED arrival to transition time to ICU	• Median time to antibiotic administration decreased from 122 minutes to 74 minutes • Median time to completion of IV fluid bolus decreased from 119 minutes to 88 minutes • Compliance for time of ED arrival to antibiotic administration within 180 minutes improved from 70% to 90% • Compliance for time to completion of IV fluid bolus within 180 minutes improved from 56% to 83%	A

			• Compliance with bundles	• From 2009 – 2013 555 patient lives were saved as a result of improved sepsis care	
Rivers, Katranji, Jaehne, Brown, Dagher, Cannon & Coba (2012) Early interventions in severe sepsis and septic shock: A review of evidence one decade later	Expert Opinion Review of Literature Level 5	Emergency Department 146 articles	Brief explanation of the pathophysiology of sepsis. Explanation of the origin of resuscitation bundle and its components Review of each step of early goal directed therapy and the decade of evidence that support each section	• Early identification of patients at high risk for sepsis by lactate levels • Source control and appropriate cultures should be obtained • Early antibiotic therapy is a benefit • Early, aggressive fluid therapy is beneficial • Early, goal-directed therapy has been shown to decrease hospital related costs by 20% • Significant reductions in mortality have been shown even when compliance rates are below 51% • Standardized order sets and quality improvement feedback modify clinician behavior and is associated with decreased hospital mortality	A
Singer, Taylor, Domingo, Ghazipura, Khorasorichi, Thode & Shapiro (2014) Diagnostic characteristics of a clinical screening tool in combination with measuring bedside lactate levels in ED patients	Quasi-Experimental Prospective, Observational Study Level 2	Suburban, academic tertiary-care medical center ED Convenience sample of all adult patients presenting to ED with suspected infection who met 2 SIRS criteria	• Presence or absence of sepsis as a final diagnosis upon discharge • Lactate levels • ED interventions • Specificity and sensitivity of bedside lactate and identification of sepsis	• Low sensitivity for early POC lactate in ED patients • Specificity was very high in patients with severe sepsis • Elevated lactate levels were associated with poor outcomes (ICU admission, need for vasopressors, and mortality) • 82% of patients received antibiotics in ED • Median time from triage to antibiotics was 109 minutes • Bedside POC lactate may be helpful in some patients	B

with suspected sepsis			• Association of bedside lactate and: ICU admissions Use of vaso-pressors Mortality	• Patients with confirmed sepsis had higher median lactate levels • Lactate levels were associated with sepsis severity	
Singer, Taylor, LeBlanc, Williams & Thode (2014) ED bedside point-of-care lactate inpatients with suspected sepsis is associated with reduced time to IV fluids and mortality	Quasi-Experimental Before and after study Level 2	Suburban, academic tertiary care medical center ED Pre-implementation SSC adult patients with 2 SIRS criteria and lab lactate level > 2.2mmol/L (n=80) Post-implementation Convenience ED sample adults with 2 SIRS criteria and lactate levels with results of > 2.2mmol/L	Implementation of POC lactate Primary: • Effect of POC lactate on time to IV fluids and antibiotics • Time to lactate results Secondary: • Time from triage to ordering of antibiotics • Total volume of IV fluids given within ED • ED length of stay • LOS in ICU • Total LOS • In-hospital mortality	• Reduction in IV fluids in post-implementation group from 71 minutes to 55 minutes • Time to lactate reduced in post-implementation group by 88 minutes • Time from triage to ordering of antibiotics showed no difference between pre and post implementation groups • Total volume of IV fluids given or time to antibiotics showed no difference • No difference in ED, ICU or total LOS • Reduction in in-hospital mortality from 19% (pre-implementation) to 6% (post-implementation)	B
Tipler, Pamplin, Mysliwiec, Anderson & Mount (2013) Use of a protocolized	Quasi-Experimental Retrospective chart review Level 2	175 bed academic military medical center Patients 18 years and older admitted	Implementation of a Sepsis Protocol for Antibiotics Primary: • Time from antibiotic order	• Average time pre protocol 160 $\pm$ 128 minutes • Average time post protocol 99 $\pm$ 99 minutes	A

approach to the management of sepsis can improve time to first dose of antibiotics		to ICU from ED with severe sepsis by 2 SIRS criteria and initial lactate level > 2.1mmol/L over a 36 month period One group 18 months prior to implementation (n=71) Second group 18 months post implementation (n=132)	placement to administration of first dose of antibiotics	• Average time to 1st dose decreased by 61 minutes (38%) • Improvement in time to delivery of each antibiotic after sepsis protocol initiated – except for gentamycin Initiation of a sepsis protocol which emphasized early goal-directed therapy can improve time to administration of first dose of antibiotics.	

treatment of that patient population. This evidence received a grade of C due to an extremely small sample size (three patients pre and five patients post) that met inclusion criteria. Due to this small sample size no recommendations or conclusions could be made. The results did show that a sepsis screening tool has the potential to increase recognition of sepsis patients which could lead to earlier, aggressive treatment of this patient population.

Patocka, Turner, Xue and Segal (2014) conducted a pre/post retrospective chart review of all patients who met the inclusion criteria of infection or sepsis based on admission/discharge diagnosis or diagnosis on ED death certificate. Researchers implemented a triage tool designed to identify septic patients. The primary objective was to identify the effect of the tool on antibiotic administration time. Multiple secondary objectives were also measured which included: time from triage to first IV fluid bolus, time to placement in a monitored bed, time to central line placement, time first Central Venous Pressure (CVP) and Mean Arterial Pressure (MAP) measured, lactate values, blood culture collection, and disposition of patient. There was an extremely detailed description of the data collection method with five researchers trained to collect pre and post implementation data. The primary investigator reviewed 15 to 20 charts of each investigator to ensure reliability and validity of the data. The study results were clearly described and Patocka et al. concluded that the implementation of a triage sepsis screening tool significantly decreased the mean time to antibiotics of patients in the ED. The secondary findings of the post implementation group, specifically the lactate levels being drawn early and a trend towards a decrease in mortality, support the idea that early identification of septic patients leads to earlier and more aggressive treatment. The large sample size, control of the intervention, and consistent recommendations led to a grade of A for this evidence.

Singer et al. (2014) conducted a quasi-experimental prospective observational study in a suburban tertiary care ED. The objective was to determine the diagnostic characteristics of POC lactate in combination with a sepsis screening tool. Researchers utilized a convenience sample of adult ED patients with suspected infection who, after screening, exhibited at least one

symptom of infection compared to a group who had not been screened and had a lab lactate level drawn. A POC lactate sample was obtained from the study group at triage and ED practitioners were immediately notified if the lactate was > 2.2mmol/L. The results showed a low sensitivity for early POC lactate in ED patients but a very high specificity, especially in patients who were more severely ill concluding that triage POC lactate may be helpful in identifying some sepsis patients. This study received a B quality rating due to a relatively small sample size, although the size was determined to provide sufficient power to obtain confidence intervals of ± 10%. The study was also limited to a single medical center site and used a convenience sampling method both which could affect generalizability.

Singer, Taylor, LeBlanc, Williams, and Thode (2014) used the same sample to determine whether POC lactate decreased time to IV fluid and antibiotic administration. Secondary measurements included: time to lactate results, ED length of stay (LOS), need for vasoactive agents, admission to ICU, LOS in ICU, total LOS, and in-hospital mortality. Researchers found a reduction in IV fluid administration time from 71 minutes to 55 minutes and time to lactate results were reduced by 88 minutes. ICU admission rates were higher in the group prior to POC lactate implementation (51%) as compared to those patients after implementation (33%). The study also found a reduction in in-hospital mortality from 19% to 6%. There was, however, no difference in ED LOS, need for vasoactive agents, or time to antibiotic administration. This study was also graded a B for quality due to relatively small sample size, single site implementation, and convenience sampling method which could affect generalizability.

Tipler, Pamplin, Mysliwiec, Anderson, and Mount (2013) performed a retrospective chart review to determine if a sepsis protocol would impact the time from antibiotic order placement to the first dose of antibiotic given. They collected data from patient charts 18 months prior to protocol implementation and 18 months post implementation. Their findings showed that the initiation of a sepsis protocol which emphasizes early goal-directed therapy can improve time to

administration of first dose of antibiotics by an average of 38%. Study results indicated a decrease of 61 minutes in the post-implementation group. This study received an A grade due to large sample size, consistent data collection, and results based on solid research findings.

Level 3 evidence. Bastani et al. (2012) performed a retrospective review of patients admitted to the ICU with severe sepsis or septic shock over a three year period. The objective was to determine whether those patients identified in the ED as having sepsis had a lower mortality rate than those patients identified with sepsis later in their hospital stay. Secondary measurements included final disposition, overall LOS, and direct cost to the patient. The conclusion was that early identification of sepsis patients in the ED significantly improved mortality by an absolute difference of 13.4%. Secondary conclusions were that ED patients were discharged home 3 times more frequently than those patients identified later during their stay. The median LOS for those patients identified in the ED was lower by 5.5 days and the direct cost to the ED patient was $7,000 less than those patients identified later. Data collection methods were described and reliable. Results were clearly presented and analyzed with study limitations discussed. The primary limitation was the retrospective study design which does not allow for determination of causality. For these reasons, this study received an A for quality.

Burney et al. (2012) conducted an on-line survey targeting full-time registered nurses and physicians at a major urban academic center ED. The purposes of the survey were to determine specific barriers to the implementation of a sepsis protocol, establish baseline knowledge of current practices regarding sepsis care, and to elicit suggestions for improvement of sepsis treatment. Findings were categorized by profession with 72.7% of physicians stating they are familiar with SIRS and sepsis identification while 85% of nurses reported being “somewhat” or “not at all” familiar with SIRS identification. More than 43% of physicians “hardly ever” ordered lactate levels and 43.9% of nurses “hardly ever” received an order for lactate. Barriers to implementation stated by physicians were lack of available nursing staff, lack of recognition in triage, delay in nurses completing orders, overcrowding of ED, and delay in

assembling team to transport patient to the ICU. Barriers identified by nursing staff were physical space in ED, delay in diagnosis by physician, lack of nursing staff, number of staff to carry out protocol, delay in registration, and heavy task load for septic patients. Improvement suggestions were earlier critical care consultation, creation of a sepsis rapid response team, and education to staff regarding sepsis and sepsis care. There were a number of weaknesses regarding this study. These included: the voluntary nature of survey completion, development of the survey by the institution (not tested for validity or reliability), and results of the survey being limited to one institution. For these reasons this research carried a grade of C.

Level 4 evidence. One article met criteria for Level 4 evidence, the systematic review that was utilized by the SSC to revise the 2008 guidelines (Dellinger et al., 2013). All evidence available through the fall of 2012 was analyzed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system. Each recommendation had a separate literature search performed specific to the question posed. More than 600 pieces of evidence including systematic reviews, randomized controlled trials, single studies, and expert opinions pieces were used to develop these guidelines. Recommendations were divided into three categories: a) specific sepsis care, b) general care of the critically ill and c) sepsis care of pediatric patients. This review concentrates on those recommendations specific to sepsis. The recommendations include the best available evidence and best practice for the care of the sepsis population. These recommendations are numerous and the items specific to this project are: a) protocolized quantitative resuscitation (with crystalloid solutions) of patients with sepsis-induced tissue hypoperfusion, b) resuscitations to normalize lactate in patients with elevated values, c) routine screening of potentially infected patients to allow for earlier implementation of therapy, d) performance improvement efforts to improve patient outcomes, e) procurement of at least two sets of blood cultures prior to antimicrobial therapy, f) administration of intravenous antimicrobials within the first hour of recognition, and g) initial empiric anti-infective therapy of one or more drugs that have activity against all likely pathogens.

These guidelines received a grade A since they were authored by a committee of care experts in the field of sepsis. All pertinent literature were evaluated according to the GRADE system. Validation of each guideline was extensive with rationale provided for each and a listing of supporting literature included. The recommendations are clear, focused, and substantial with all conclusions based on available evidence.

Level 5 evidence. Dumont and Harding (2013) described a quality improvement project conducted in a community, not-for-profit health system ED. The sample included all ED patients after project implementation from January to June 2013. These data were compared to pre project implementation data from November to December 2012. The protocol implementation included education to the ED staff, an electronic screening process for sepsis patients, development of standing orders for sepsis patients, and a plan for early transportation to ICU. Researchers measured a) mortality, b) compliance with order sets, c) time of blood culture draws, d) time of lactate draws, e) time of antibiotic administration, f) amount/time of crystalloid administration, g) appropriateness of admission level of care, and h) sepsis screening time. Unfortunately, no results were included in the publication as the protocol had been in place for less than one year. Due to lack of conclusions and recommendations the article was graded B since expertise appears to be credible.

Keegan and Wira III (2014) provided expert opinion, based on a review of 146 articles, related to the appropriate care of septic patients. The authors gave a brief explanation of the epidemiology and pathophysiology of sepsis and validated the 2012 Surviving Sepsis Guidelines. Their recommendations reiterate the need for early identification, risk stratification, and prompt initiation of treatment for patients with sepsis. Prompt administration of broad-spectrum antibiotics and early fluid resuscitation with 30 ml/kg of crystalloid are recommended. Finally, compliance with sepsis bundles improves patient outcomes. Triage assessment, vital signs, and serum lactate levels have important prognostic value. Organ dysfunction results in

negative patient outcomes which increase with multiple organ dysfunctions. Based on the authors' credentials and the extensive review of literature, this article was graded A.

Perman, Goyal, and Gaieski (2012) reviewed 54 articles to substantiate the clinical aspects of ED identification and resuscitation of the septic patient. Authors concluded that optimization of ED management of the septic patient is a priority as sepsis is a time critical disease. Optimization of initial management requires correct identification which SIRS criteria can possibly miss. Elevation of serum lactate is identified as an effective marker for risk stratification and an appropriate screening tool for sepsis. In sepsis patients, each additional organ dysfunction increases mortality rates; therefore, the management of sepsis patients should include blood and urine cultures, source control, rapid administration of antimicrobials, and volume resuscitation with 20-30 ml/kg of crystalloid fluid. The final piece of optimization recommended for the septic patient is the use of sepsis bundled care. The authors' credentials and recommendations based on evidence resulted in an A grade for this evidence.

Powell and Fowler (2014) described a performance improvement project conducted in the ED of a large health care system. The objective of the project was to reduce sepsis mortality. The methods used were: goal setting, reporting, resource availability, engaging participants, quality improvement approach utilization, and the use of best practices and results. Once this project was implemented the measures of time to lactate testing, time to antibiotic administration, time to IV fluid bolus, transition time to the ICU, mortality, and compliance with the use of bundles were reported. Median time to antibiotic administration decreased from 122 minutes to 74 minutes. Completion of IV bolus decreased from 119 minutes to 88 minutes, and compliance with bundled care increased from 70% to 90%. Researchers concluded that 555 patient lives were saved as a result of improved sepsis care based on actual versus expected results. The data were clearly presented as was the quality improvement process leading to a grade of A for this article.

A review of 146 articles published in the decade since Emmanuel Rivers published his landmark study on early-goal directed therapy was analyzed. Rivers et al. (2012) reviewed each step of early-goal directed therapy and substantiated each step with the latest evidence. Authors found that early identification of patients with high risk for sepsis by lactate levels is useful. Source control, attainment of appropriate cultures, early antibiotic therapy, and aggressive fluid therapy are beneficial. Additionally, external validity and generalizability of various versions of the resuscitation bundles have been established. Early goal-directed therapy has been shown to decreases hospital related costs by 20% and significantly reduce mortality even when compliance rates are below 51%. Lastly, standardized order sets and quality improvement feedback have led to modifications of clinicians' behavior and are associated with decreases in hospital mortality. The expertise of the authors is unassailable and each recommendation is backed by high quality evidence leading to a grade of A for this article.

Construct EBP

Synthesis of literature. Best practice for care of a sepsis patient in the ED consists of a protocolized format that encourages early identification, early treatment to prevent organ dysfunction, and compliance with the use of bundled care. These guidelines were summarized in the Surviving Sepsis Campaign: 2012 (Dellinger et al., 2013). Recommendations presented in the guidelines were validated in multiple publications. Early identification decreases mortality (Bastani et al., 2012; Dellinger et al., 2013; Keegan & Wira III., 2014; Kent & Fields., 2012; Perman et al., 2012; Rivers et al., 2012; Singer et al. 2014). This early identification comes in multiple variations, whether it is a nurse-initiated screening tool (Bruce et al., 2015; Dumont & Harding, 2013; Kent & Fields, 2012; Patocka et al., 2014); or the use of a POC lactate (Bruce et al., 2015; Dellinger et al., 2013; Keegan & Wira III, 2014; Perman et al., 2012; Singer et al., 2014[a]; Singer et al. 2014[b]).

This protocol approach also effects the early treatment provided to potential sepsis patients. Antibiotics administered as soon as possible after sepsis identification improve patient

outcomes (Dellinger, 2013). The use of protocols to decrease time to antimicrobials was demonstrated in multiple studies (Bruce et al., 2015;; Dumont & Harding, 2013; Keegan & Wira III, 2014; Patocka et al., 2014; Perman et al., 2012; Powell & Fowler, 2014; Rivers et al., 2012;Tipler et al., 2013). Implementation of protocols and early identification also decrease the time to administration of IV fluids improves patient outcomes (Dellinger et al., 2013). An overall decrease in time to fluid administration demonstrated better patient outcomes (Bruce et al., 2012; Dumont & Harding, 2013; Keegan & Wira III, 2014; Perman et al., 2012; Powell & Fowler, 2014; Rivers et al., 2012; Singer et al., 2014).

Use of sepsis protocols decrease LOS. Bastani et al. (2012) showed that early identification and treatment of sepsis patients decreased LOS by 5 days. A decrease in direct cost to the patient was also demonstrated.

Compliance with bundles of care for sepsis patients has impacted patient outcomes positively (Bruce et al., 2015; Dumont & Harding, 2013; Keegan & Wira III, 2014; Perman et al., 2012; Powell & Fowler, 2014; Rivers et al., 2012). Burney et al. (2012) recommended education of the staff and use of a sepsis rapid response team to address the barriers inherent in using protocol based sepsis care.

Best practice model recommendation. Best practice for the care of sepsis patients has been clearly outlined in the SSC guidelines. Care includes a protocolized format for early identification of the sepsis patient by using a screening tool and POC lactate levels. Early treatment includes administration of antibiotics and fluid resuscitation of 30 ml/kg of crystalloid fluids (within one hour). An ED policy including these recommendations was developed to answer the clinical question, “What is the impact of a sepsis policy on staff compliance to best practice recommendations (early identification of potential septic patients, diagnosis utilizing lactate levels and cultures, and timely treatment with the sepsis bundle), length of stay, and patient mortality as compared to no policy over a five month period?”

CHAPTER 3

IMPLEMENTATION OF PRACTICE CHANGE

The implementation of this EBP project occurred over six months with a focus on changing how emergency triage nurses screen potential sepsis patients. The goals of implementation were for ED nurses to screen all patients ≥ 18 years of age for sepsis and obtain point-of-care lactate levels for early identification purposes. By utilizing Kotter's change model, measures to achieve project outcomes were continuously updated to meet the needs of the ED staff, the organization's administration, and the project coordinator.

Participants and Setting

The setting for this EBP project included two EDs affiliated with a not-for-profit hospital located in Northwest Indiana. One of the EDs is located within the main hospital and the other is a free-standing ED approximately 15 miles from the main hospital. These ED's provide care 24 hours a day, 365 days a year, to a primary service area of one county with secondary service areas that include portions of the surrounding six counties. This is an extremely diverse service area that includes many different socioeconomic, ethnic, and cultural groups.

This project compared pre-implementation (prior to policy initiation) to post-implementation (after policy initiation) data. Data were collected from electronic health records of patients utilizing the services of the two EDs and included all triaged patients ≥ 18 years of age. The post-implementation group included the triaged patients from the beginning date of implementation (August 1, 2015) to the date of project completion (December 1, 2015). The pre–implementation group included the triaged patients from the same time period one year earlier.

Outcomes

For this project three primary outcomes were monitored: staff compliance to the new sepsis policy, patient mortality, and patient length of stay. Staff compliance to the new sepsis

policy was evaluated by measuring the following data obtained from electronic health records:

- sepsis screening tool completion
- bedside lactate level obtainment
- Code Sepsis implementation
- blood culture draw prior to antibiotic administration
- antibiotic administration within one hour of triage arrival time
- fluid bolus administration as required, and
- Evidence-Based Order Set initiation.

These compliance measures, in addition to patient mortality and length of stay, were compared between the pre-implementation and post-implementation groups.

Intervention

The intervention for this project was multi-faceted. The initial step was to identify and appraise the best evidence regarding ED care to potential sepsis patients. Once synthesized the literature was integrated into an ED Sepsis policy. Since literature did not support use of the previous screening tool which focused on SIRS criteria, the policy included the use of a new sepsis screening tool which was available in the EPIC computer system.

The tool was used on every patient 18 years or older who presented to the ED triage staff. If the patient exhibited three or more new signs/symptoms listed on the tool, it was considered a positive screening. At this point, the ED triage nurse obtained a bedside lactate level utilizing the i-stat device. If that level was > 2.2 mmol/L., the ED nurse activated a Code Sepsis and notified the ED practitioner.

This activation triggered a number of steps that included: moving the patient directly to an ED bed, notifying lab in order to draw immediate blood cultures, notifying Rapid Response team for facilitation of in-patient transfer, and alerting the ED practitioner of the potential sepsis

patient so that implementation of the EBOS could be initiated. Rapid implementation of the EBOS facilitated appropriate time of antibiotic administration and fluid resuscitation.

All ED staff were educated on the policy prior to implementation. The education was conducted face to face by the project coordinator with an online computerized learning module available for those staff unable to attend the face to face sessions. “Badge Buddies” are tags all staff received. These tags clip on staff name tags and highlight the steps of the sepsis policy. Posters that delineated the process were also placed throughout the EDs for reinforcement of knowledge.

A feedback system was utilized for celebrating short term wins. This system included gold star flyers that displayed names of staff members complying with the process and achieving positive outcomes. These flyers were posted in the ED and emailed to staff. Names of those complying were also forwarded to ED administration for inclusion in their staff performance evaluations. Outcome data were shared with the staff and input on how to further improve the process was elicited. Changes to the process were made based on that input.

Data from electronic medical records were compiled into daily reports showing staff compliance with the screening tool. That information was then shared with the sepsis committee team for further review and discussion.

Planning

This project began as a result of an institution initiative regarding sepsis patients. A sepsis committee was formed to improve care of sepsis patients. The committee was multi-disciplinary and included key stakeholders responsible for the process as well as those who were primarily affected by the changes.

Once the literature search was completed and best evidence was brought to the committee, a strategy was developed that had the potential for optimal change. A policy was drafted, along with an educational PowerPoint, monitoring tool, and data collection process, as

well as supplemental educational items. These were all reviewed by the committee for accuracy and completeness prior to implementation with the staff.

The sepsis committee determined the process for monitoring outcomes. There was also a consensus made on how individual and organization follow-up regarding data should take place.

Data

Measures and their reliability/validity. Data for the project were collected by the project coordinator by means of an EPIC computer reporting system that retrieved specific outcome measures from electronic health records. When auditing medical records reliability may be a concern as data are determined by what was charted by healthcare professionals. To strengthen validity, one individual, the project coordinator, performed all data collection and analysis using a consistent reporting program.

Collection. Data were obtained from electronic medical records from August 1, 2014 through December 1, 2014 to provide pre-implementation comparison information. The data were retrieved by the use of a computer generated report. Pre-implementation data were downloaded into an Excel spreadsheet and SPSS system for analysis. Patient records that indicated a positive screening (by use of the SIRS criteria) in the pre-implementation group underwent a chart review completed by the project coordinator using the self-developed monitoring tool.

Post-implementation data were collected on a daily basis by utilizing a specific computer report developed for this project. This list included the age, chief complaint, sepsis screening information, and i-stat lactate information of each patient triaged in the EDs the previous day. The project coordinator reviewed the list, excluded those patients under the age of 18, identified screening percentages, and performed a chart review for those patients who screened positive for potential sepsis. These data were maintained for each individual patient (with identifiers

removed) on the self-developed monitoring tool. Tools were kept in a secured cabinet within a locked office.

Management and analysis. The project coordinator was responsible for data associated with this EBP project. All of the process outcomes were compared pre-implementation to post-implementation. The primary outcomes of overall policy compliance and subcomponents of the policy were analyzed using chi-square test of independence to determine differences between the pre and post implementation groups. Additionally, descriptive statistics were used to show trends in compliance over the post implementation period. Differences in patient mortality and length of stay between the pre and post implementation groups were determined. SPSS software version 22.0 was utilized for this analysis.

Protection of Human Subjects

In order to ensure protection of human subjects, a project proposal was submitted to the Institutional Review Boards (IRBs) of both the university associated with the project and the institution where the project took place. Approval was obtained from both the University's and institution's IRBs. To maintain patient confidentiality, data were free from patient identifiers and stored in a password protected computer in a locked office. Additionally, findings were reported as aggregate data with individual information not discernable.

CHAPTER 4

FINDINGS

This EBP project focused on the impact of a sepsis policy that incorporated the use of a screening tool and lactate levels to identify and treat potential sepsis patients in the ED setting. The PICOT question for this EBP project was, ""In adult emergency department patients, what is the impact of a sepsis policy on staff compliance to best practice recommendations (early identification of potential septic patients, diagnosis utilizing lactate levels and cultures, and timely treatment with the sepsis bundle), length of stay, and patient mortality as compared to no policy over a four month period?" After completion of the implementation phase of this project the data were analyzed. The following analysis describes the demographics of the participants, project outcomes, and comparison of the pre and post implementation groups.

Participant Characteristics

Size. The medical records of 2219 patients who were $\geq$ 18 years of age and presented to the ED triage desk at either the primary ED located within the facility or a secondary free-standing ED from August 1, 2014 through November 30, 2014 comprised the pre-implementation group. Data were collected utilizing a computer generated report that listed patients' age, gender, and chief complaint on arrival to the ED. According to facility policy at that time all patients were to be screened using the SIRS criteria for sepsis screening.

The same data were collected from medical records of the post-implementation group which included patients who visited the same EDs from August 1, 2015 through November 30, 2015. Appropriate completion of the computer sepsis screening tool in the triage area was also determined. There were 6963 patients that met initial criteria for inclusion into the project. As a result of feedback from the ED triage staff additional criteria were applied as to which patients required screening beginning on September 21, 2015. This brought the September 21, 2015 post implementation group number to 2107.

Due to an inability to run POC lactate levels and no Rapid Response staff available at the secondary ED, those participants were separated out for data analysis as of September 1, 2015. Those secondary participants numbered 825.

Demographics. The demographics for both the pre and post implementation groups were reviewed. The pre-implementation group consisted of 41% male and 59% female. The age range for the pre-implementation group was 18 to 96 years of age with the mean age being 45 years old (*SD* = 19.49).

The demographics of the post-implementation group were very similar to the pre-implementation group with 40% being male gender and 60% being female. The age range for this group was 18 to 105 years of age with the mean age again at 45 years old (*SD* = 19.79). See Figure 4.1 and Figure 4.2.

The secondary ED demographics mirror the pre and post implementation groups with 39% male and 61% female. The age range for this group was 18 – 100 years of age with a mean of 45 (*SD* = 19.021).

Changes in Outcomes. In this section the type of statistical testing will be discussed. The findings regarding the primary outcomes of screening percentage and compliance with policy components will be disseminated.

Statistical testing. Data were entered into the Statistical Package for the Social Sciences (SPSS) version 22 for statistical analysis. A chi square test of independence was calculated comparing screening rates pre and post policy implementation. In further analysis of the post-implementation data, descriptive statistics were used examine compliance to specific policy components. Secondary outcomes regarding length of stay and mortality were determined for the post-implementation group participants whose medical record indicated a discharge diagnosis of sepsis or “related to” sepsis.

Figure 4.1. Average Age

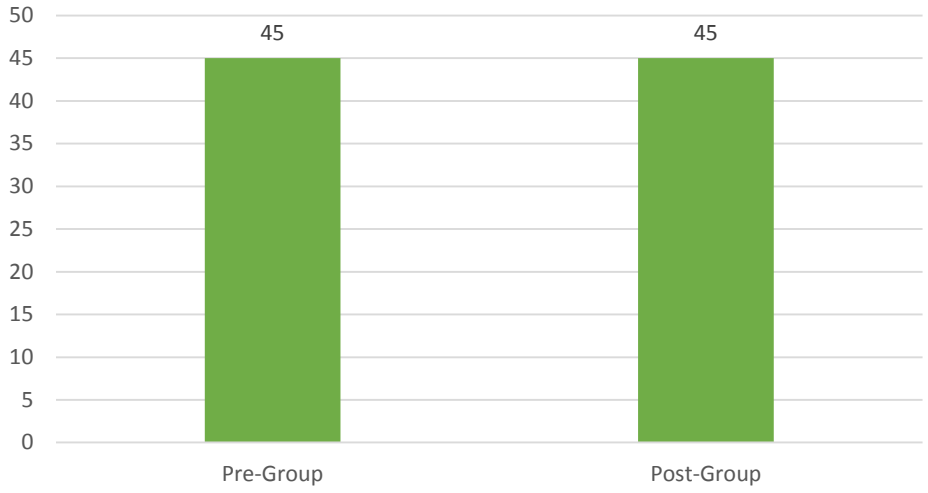
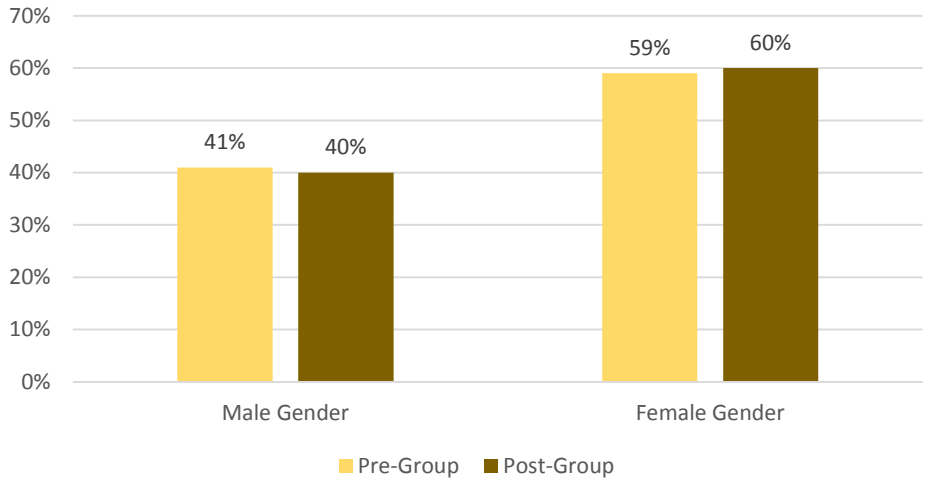


Figure 4.2. Gender



Primary outcomes. The primary outcomes of screening and compliance to policy were analyzed. Subsequent treatment components were analyzed to determine timing and compliance with policy.

Significance. Results demonstrated a statistically significant increase in appropriate screening of potential sepsis patients in the post-implementation group when compared to the pre-implementation group. Compliance with specific policy components also increased each month during the implementation period. Secondary outcomes demonstrated a decrease in both length of stay and mortality for those patients that were screened for sepsis.

***Screening*.** A chi - square test of independence was calculated comparing the frequency of screening rates pre and post policy implementation. Completion of SIRS screening within the pre-implementation group was 26.3%. Monthly percentages of patients screened were tracked over the implementation period. Figure 4.3 shows the progression of screening beginning with the initial project implementation on August 1, 2015 through November 30, 2015. A change in the initial policy occurred on September 21, 2015 after feedback from facility stakeholders. Instead of screening all patients, specific patients were excluded from sepsis screening. See Figure 4.3 for detailed monthly screening results of primary facility. The post-implementation group results demonstrated a monthly increase with an overall result of 57.7% of patients being screened appropriately. A significant interaction was found ($X^2(1) = 438.505$, $p < .001$). Patients were more likely to be appropriately screened for potential sepsis post policy implementation than pre implementation. See Table 4.1 for chi - square results.

The free-standing emergency department facility outcomes data were analyzed separately. This determination was made due to the nature of the facility. Point of care lactate levels and an on-site pharmacy were unavailable at this site. Screening results are depicted in Figure 4.4.

Figure 4.3 Percentage of Screening - Primary Facility

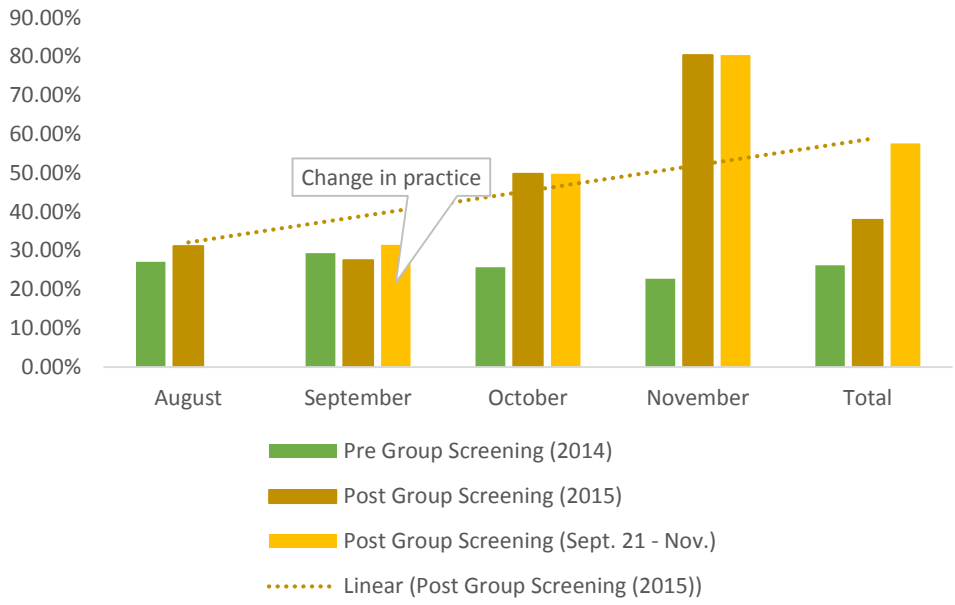


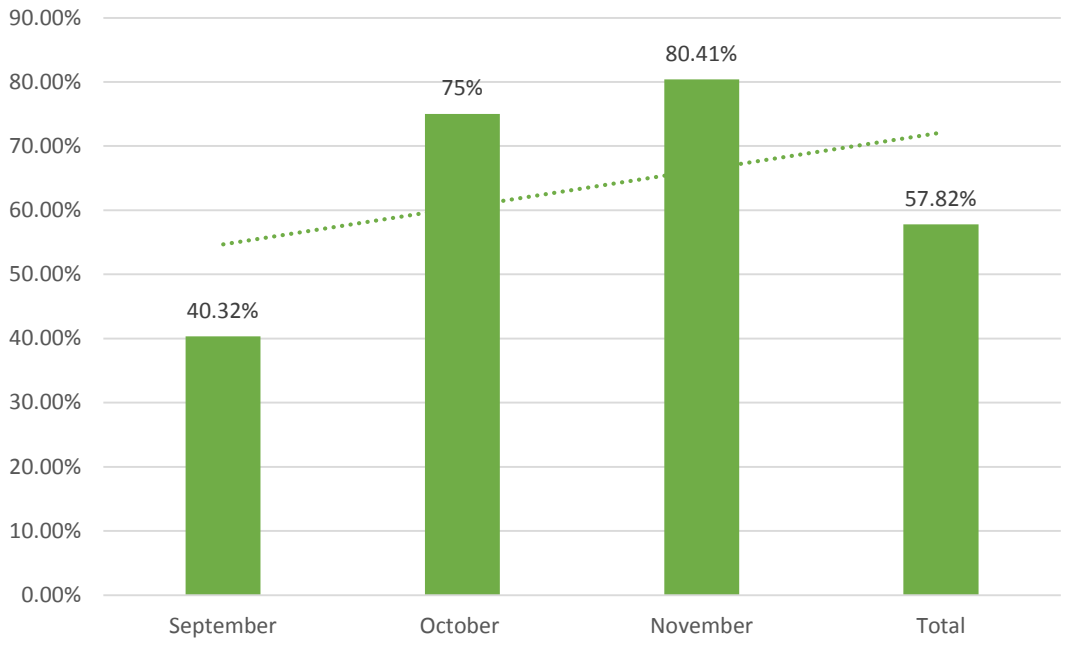
Table 4.1

Comparison of Policy Screening Compliance

Outcome	Pre (*n*) %	Post (*n*) %	X^2	*p* value
Screening	(2219) 13.5%	(2107) 57.7%	438.505	.000*

**p* < .05

Figure 4.4 Percentage of Screening - Second Facility



Policy compliance. Staff compliance with individual sepsis policy components was also analyzed for the post implementation group and increased compliance with all components was demonstrated. Figures 4.5 through 4.9 represent the specific components of: lactate levels drawn, blood cultures drawn prior to antibiotic administration, antibiotic administration within one hour of arrival, fluid resuscitation as appropriate, and use of the Evidence Based Order Sets (EBOS) achieved at the primary ED facility.

The sepsis policy states that a patient who is screened during the implementation period and exhibits a positive screening is required to have a lactate level drawn. Figure 4.5 depicts the progressive increase in compliance with that policy component.

Once a patient has been positively screened and has a lactate level greater than 2.2mmol/L. the policy requires source control and organism identification for the potentially septic patient. Therefore, blood cultures must be drawn prior to the administration of an antibiotic. Figure 4.6 illustrates compliance to this component of the policy.

Figure 4.7 depicts the compliance of the ED staff with the policy component of administering antibiotics within one hour of identification at triage. An increase from 20% to 53.85% was shown during the implementation period.

Figure 4.8 represents the consistently observed administration of fluids, as appropriate, for a patient who has been positively identified (by screening and lactate levels) for sepsis. The use of the EBOS varied from month to month but showed a gradual increase during the implementation period. See Figure 4.9.

Due to difference in practice (no point of care lactate available), the free-standing facility compliance with individual components was analyzed separately. These data encompass the months of September through November 2015. The monthly numbers were too small for individual depiction. Figure 4.10 illustrates the compliance for the entire implementation period.

Figure 4.5 Lactate Drawn

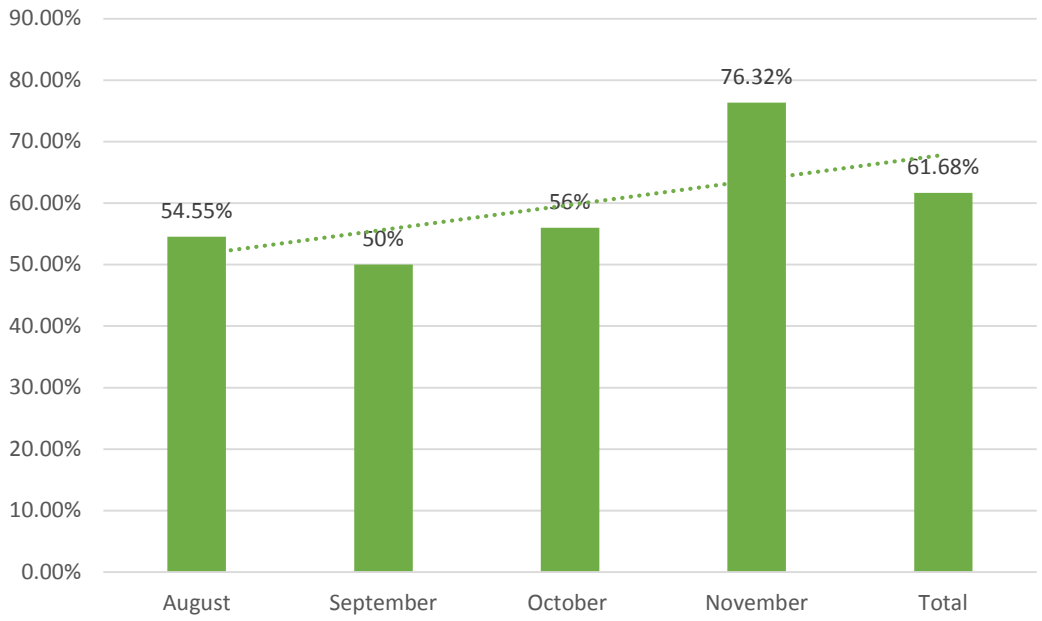


Figure 4.6 Blood Culture Prior to Antibiotics

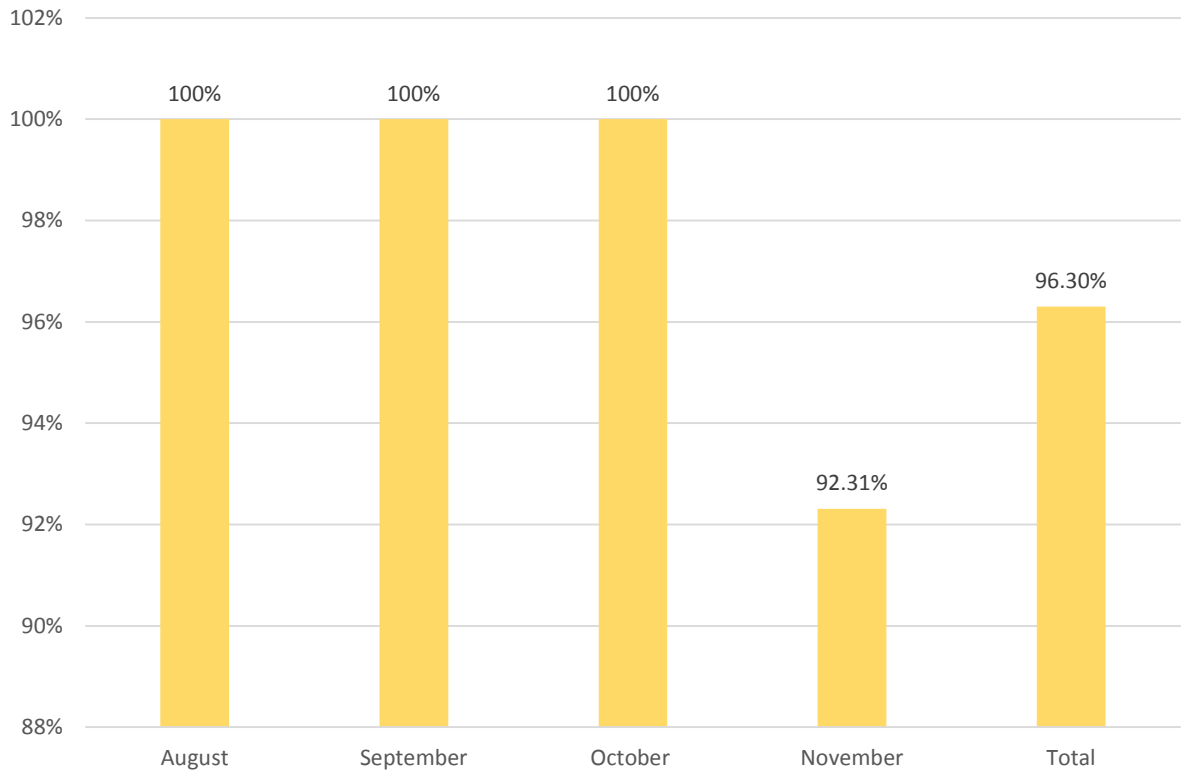


Figure 4.7 Antibiotics Within One Hour

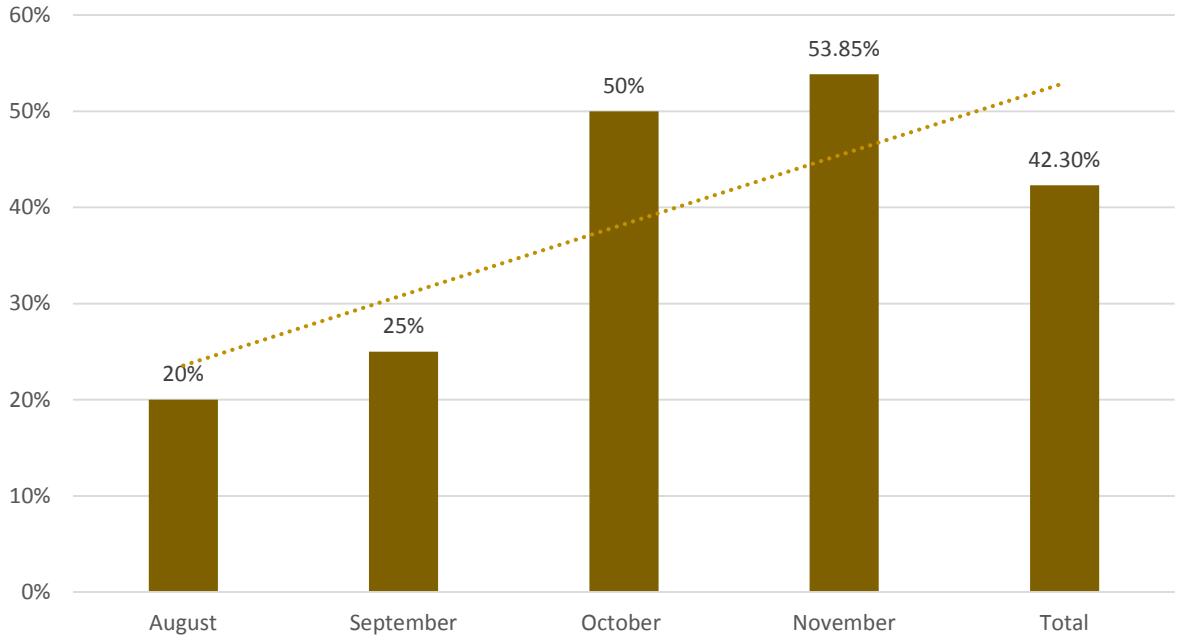


Figure 4.8 Fluid Resuscitation

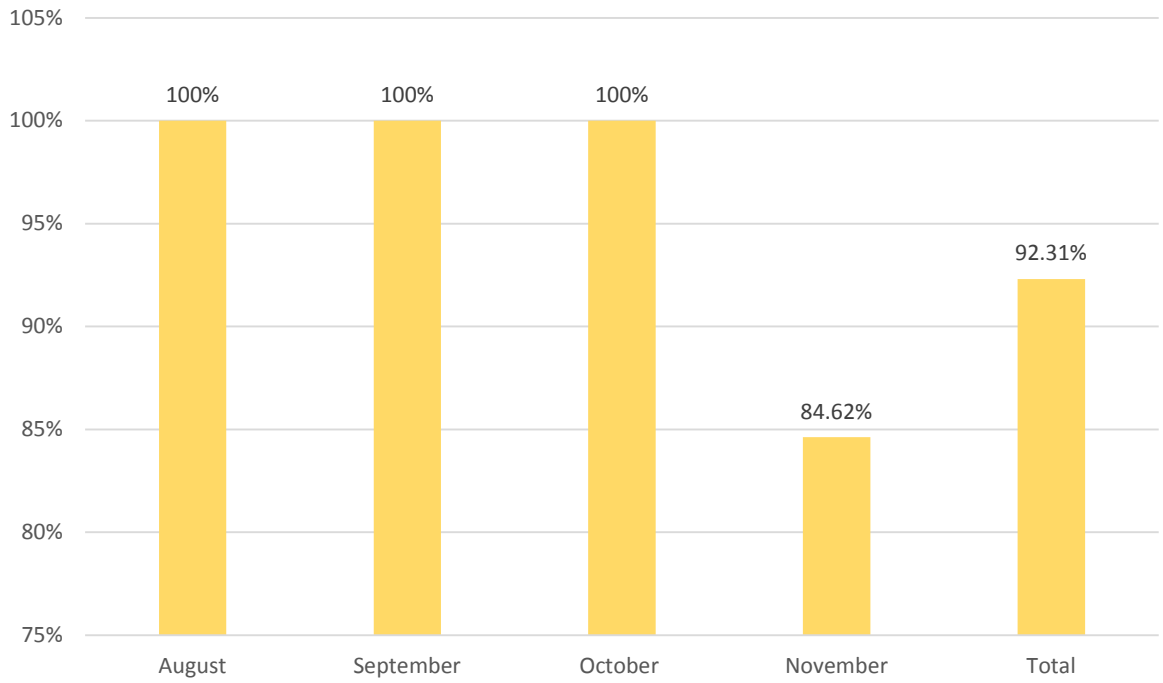


Figure 4.9 EBOS Usage

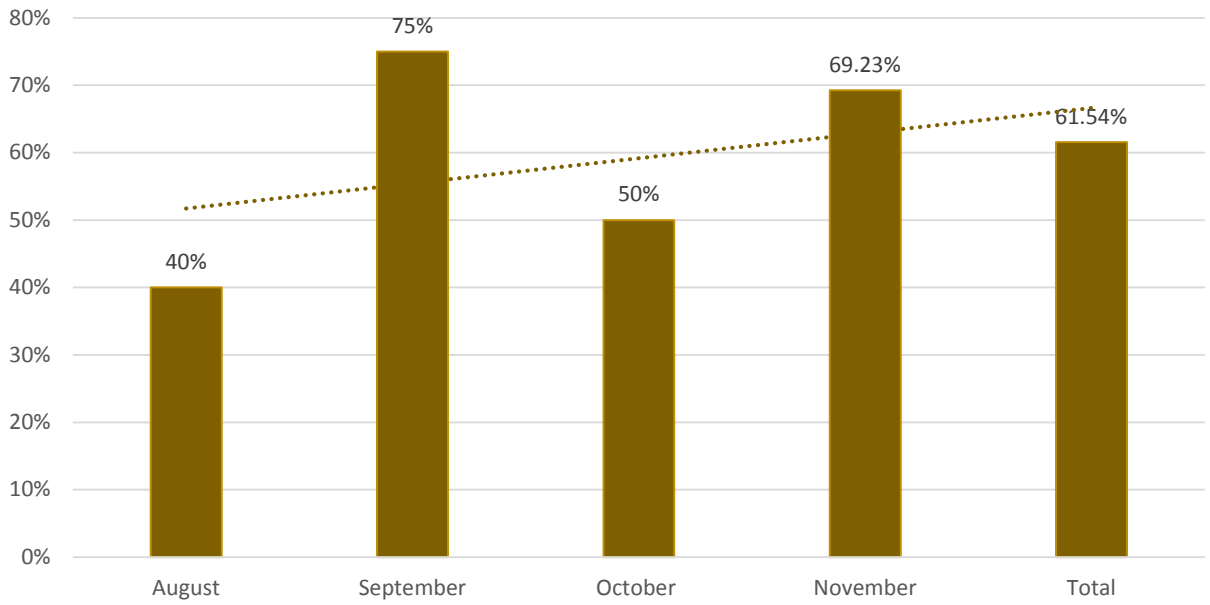
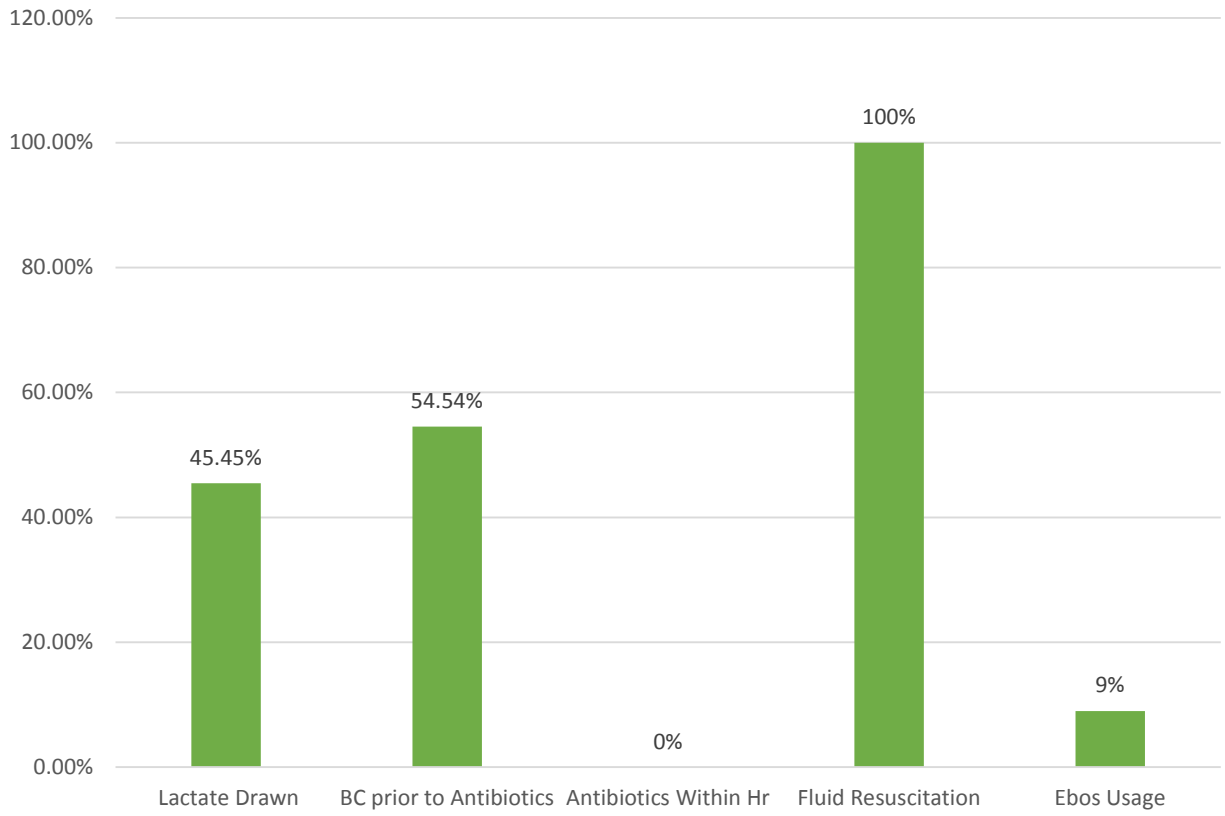


Figure 4.10 Compliance with Protocol Elements - Second Facility



Secondary outcomes. Secondary outcomes regarding length of stay and mortality were identified and analyzed. Significant changes were discovered between the pre and post implementation groups.

Length of stay. Average length of stay of patients who were identified as potential sepsis patients based on a positive screen and elevated lactate levels during the implementation period was also examined. The average length of stay for these patients during the implementation period was 7.16 days. In comparison, the facility's length of stay for sepsis patients for the first quarter of 2015 was 8 days. See Figure 4.11.

***Mortality*.** Final disposition of patients who were screened for sepsis during the implementation period was tracked. The average mortality rate of these patients was 15.38%. In comparison the facility's mortality rate for sepsis patients in the first quarter of 2015 was between 29.2% and 16.67%. At the beginning of the implementation period mortality was 40%. This represents a dramatic decrease during the implementation. See Figure 4.12.

Electronic health records (EHRs) of patients who were discharged with a sepsis diagnosis during the implementation period were further analyzed. An odds ratio was calculated and a weak association between screening and mortality was determined. Patients who were screened were 34% less likely to die when compared to patients who were not screened. See Table 4.2.

Figure 4.11 Average LOS in Days

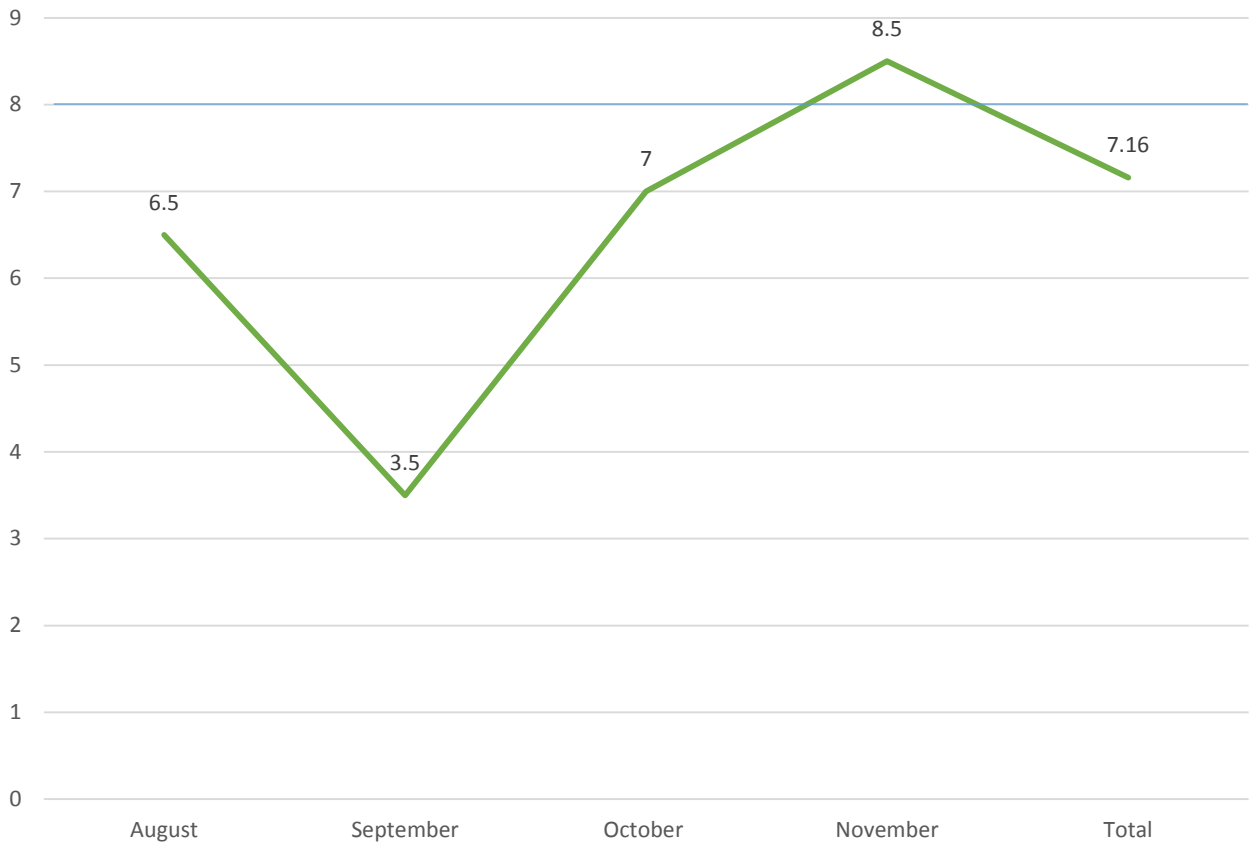


Figure 4.12 Mortality

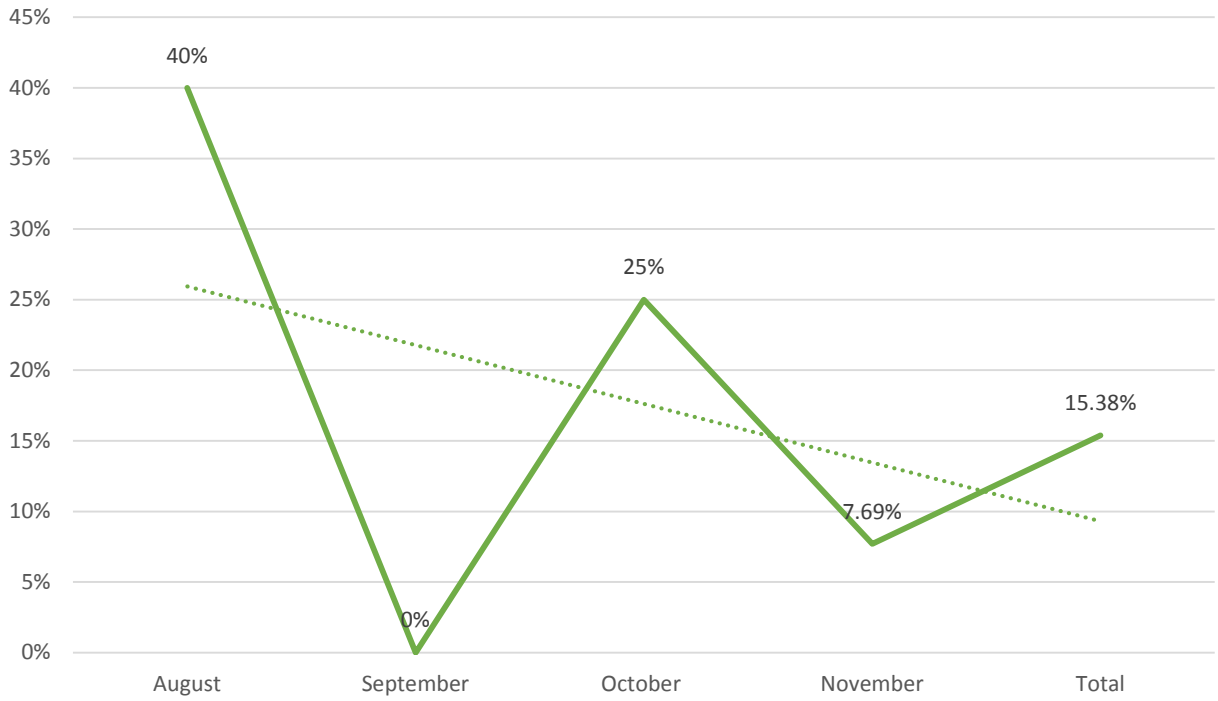


Table 4.2

Odds Ratio for Screened versus Non Screened Patients

	Dead	Alive	
Screened	9	58	67
Non Screened	7	30	37
Total	16	88	104

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CHAPTER 5

DISCUSSION

The results of the evidence-based practice project support the use of an early screening tool for the identification of potentially septic patients presenting to the emergency department. Early screening of patients leads to appropriate early treatment (Dellinger et al., 2013) with antibiotics and fluids. This project was designed to answer the PICOT question, “In adult emergency department patients, what is the impact of a sepsis policy on staff compliance to best practice recommendations (early identification of potential septic patients, diagnosis utilizing lactate levels and cultures, and timely treatment with the sepsis bundle), length of stay, and patient mortality as compared to no policy over a four-month period.

There was a statistically significance increase in screening of appropriate patients in the post-implementation group when compared to the pre-implementation group. An examination of the factors associated with this successful outcome will be covered in this chapter. Other topics covered include: implementation steps, barriers and successes, and strengths and weaknesses of the project. The appropriateness and utilization of Kotter’s change theory and Stetler’s model for evidence based practice are analyzed. Finally, implications for future education, research, theory, and practice are discussed.

Explanation of Findings

Primary outcome. A statistically significant difference was demonstrated by a chi square test of independence calculation comparing the completion of a screening tool between the pre and post implementation groups. Implementation of a sepsis policy resulted in an increased percentage of emergency department patients being screened upon presentation to the emergency room. This finding corroborates the findings of Bruce et al (2015), Dellinger et al (2013), and Keegan & Wira III (2014) who also found that early screening and identification of potentially septic patients is critical. Obtaining this result was achieved by delivering a multi-prong educational strategy, garnering administrative support, providing daily feedback to the

staff, and distributing rewards to the staff. Face to face communication, a computer based learning module, individualized badge buddies, and posters were distributed throughout the emergency department. Screening scores were reviewed daily with immediate feedback given to the staff on their performance, and follow up with administration regarding those staff members who were underperforming. Staff not screening appropriate patients had a follow up meeting with the clinical nurse specialist followed by a meeting with department administration.

This daily feedback led to a change in the identification of which patients needed to be screened on admission. Staff stated that based on chief complaint they were able to decide the need for screening. This change is depicted in Figure 5.1 that shows the change in practice as of September 15, 2016. This feedback also resulted in analyzing data from the free standing ED facility separately as the staff identified an inability to meet the policy requirements for point of care lactate levels being drawn. This result ties in with both Kotter's change theory regarding employee buy-in and Stetler's evaluation step of EBP leading to successful outcomes.

The simple process of giving out certificates to those staff members who were screening patients, drawing lactate levels, and initiating early treatment as directed by the policy drew others into the process. Burney et al (2012) found barriers such as: lack of baseline knowledge, lack of recognition in the triage setting, and delay in diagnosis of sepsis led to decreased protocol implementation. Reducing those barriers by recognizing staff input and success, enhanced effective implementation of the protocol. The achievement of early screening led to the improvement of a number of outcomes discussed below.

After analyzing if appropriate patients were screened, compliance to subsequent components of the sepsis policy were analyzed. For those patients whose screening was positive, point of care lactate levels should have been drawn. During the monitoring phase of this project, drawing of lactate levels increased from 54.55% to 76.32% which facilitated identification of potentially septic patients.

Figure 5.1

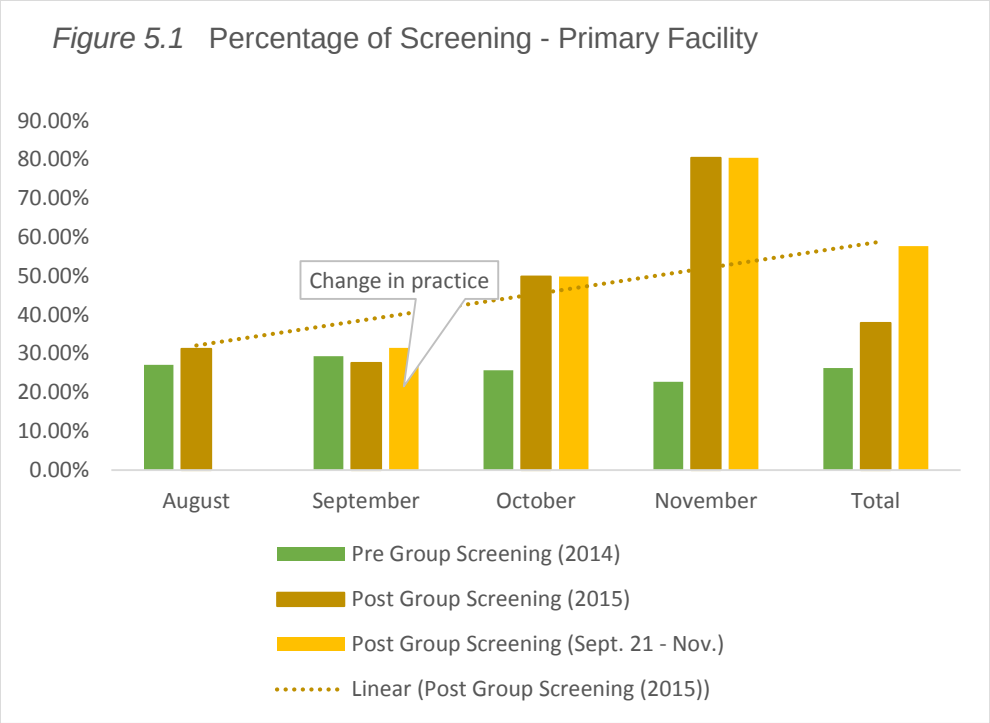
Figure 5.1 Percentage of Screening - Primary Facility
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Change in practice
August
September
October
November
Total
Pre Group Screening (2014)
Post Group Screening (2015)
Post Group Screening (Sept. 21 - Nov.)
Linear (Post Group Screening (2015))

Patients who had both a positive screening and a lactate level of > 2.2mmol/L were considered potentially septic according to the newly developed sepsis policy. Early treatment for these patients is recommended by the Surviving Sepsis campaign guidelines as discussed in Dellinger et al (2013). This treatment includes: blood cultures drawn before antibiotics, antibiotics and fluids received within one hour, and use of EBOS. Compliance to these components was evaluated on the 107 patients that met these criteria. Facility data from the first quarter of 2015 reflected that 73% of patients received blood culture draws prior to antibiotic administration, whereas 96.3% of those in the post-implementation group had blood cultures drawn prior to antibiotics being given. This practice corresponds to the Surviving Sepsis campaign guidelines reviewed by Dellinger et al. (2013) and reiterated by Rivers et al. (2012) that in multiple studies instituting sepsis policies increased compliance with early and appropriate treatment.

Antibiotics given within one hour increased from 20% to 53.8% during the implementation phase of the project. This increase corroborates the findings from several studies who found that a nurse-initiated policy led to a decrease in time to antibiotic delivery. (Bruce et al.,2015; Dellinger et al, 2013; Keegan & Wira, 2014; Patock et al., 2014; Perman et al., 2012; Powell & Fowler, 2014; Rivers et al., 2012; Singer et al., 2014; and Tipler et al., 2013).

In appropriate patients, initiation of fluid resuscitation within one hour occurred in 92.3% of cases. Perman et al. (2012) identified fluid resuscitation as a necessary early component in the treatment of sepsis patients to improve patient outcomes. Powell & Fowler (2014) determined that a nurse driven policy increased compliance with fluid resuscitation to 83%. Singer et al (2014) also determined a sepsis policy decreased time to fluid administration by 16 minutes.

The final component of sepsis treatment is the use of order sets. The use of order sets for this patient population varied from month to month ranging from 40% to 75% with an average usage of 61.64% over the four month implementation period. This increase in usage

corresponds to the increase noted by Dellinger (2013), Keegan & Wira III (2014), Perman et al. (2013), and Powell & Fowler (2014). These studies also found that an increase in bundled care led to improved patient outcomes, primarily lives saved.

Length of stay was also analyzed. Prior to implementation of the sepsis policy, the facility's average length of stay for sepsis patients was 8 days. Post implementation of the sepsis policy, the average length of stay varied monthly from 3.5 to 8.5 days with an average length of stay of 7.1 days. This change could be related to the increase in early identification of patients and earlier treatment as delineated by the sepsis policy. A decrease in length of stay after initiation of a sepsis protocol (or bundle) was also described by Bastani et al (2012) where a change from 12.5 to 7 days was identified; Keegan & Wira III (2014) also detected a positive effect on patient outcomes such as length of stay.

Patient mortality for patients who had a diagnosis of sepsis upon discharge was determined. These patients were identified by a report that specified date of discharge and discharge diagnosis codes. Prior to the sepsis policy implementation, first quarter patient mortality for 2015 varied monthly between 16.6% and 29.2%. National mortality levels average 16% (AHRQ, 2012). Post implementation mortality rates decreased from 40% the first month to 7.69% at the end of the implementation period with an average mortality rate of 15.38%. An odds ratio determined a weak association between screening and increased survival. This result could also be related to the increased early identification and treatment of these patients due to the sepsis policy initiative. Previous studies done by Bastani et al. (2012), Keegan & Wira III (2014), Powell & Fowler (2014), Rivers et al. (2012), and Singer et al (2014) demonstrated a reduction in patient mortality when implementing a protocol for early identification and treatment of sepsis patients.

Evaluation of the Project: Kotter's Change Theory

Kotter's change theory was the theoretical platform that guided this project. Kotter describes eight steps that address the eight major errors that organizations make when trying to institute change within their organizations (Kotter, 1996). These eight steps are: establish a sense of urgency, create a guiding coalition, develop a vision and strategy, communicate that vision, empower action, generate short-term wins, consolidate gains, and finally anchor the new approaches. All of these steps were used when designing, implementing, and evaluating the project.

Creating a sense of urgency had already been accomplished at the facility since the data regarding the appropriate and timely treatment of sepsis patients was below the national average and payment organizations (the federal government and insurance companies) were developing benchmark criteria for the care and reimbursement of these patients. This urgency was a strength of the theory when combined with this project since it produced a highly motivated administration and staff.

This urgency allowed the project coordinator to use an already existing guiding coalition of people who were focused on the achievement of the goal to improve care of sepsis patients. Key stakeholders were involved and excited to develop a plan of care based on the best available evidence. That best available evidence translated into the vision for the organization to make substantial gains regarding the appropriate care for sepsis patients. Utilizing that vision the project coordinator was able to research and present to the coalition a plethora of evidence supporting the project change. The strategy for this organizational change was the crux of this evidence-based practice project. The development of a policy incorporating all the necessary aspects of care, along with the dissemination of that policy, was facilitated by the use of this theory and its steps.

Communication of the vision and its components was one of the most vital aspects of the project. A project will not succeed if the employees do not understand the vision or the importance of the change (Kotter, 1996). Having that step of communication, along with its recommendations that the communication take multiple forms, led the project coordinator to develop not only the policy but the many styles of communication involved with the project.

The next step, empowering change, allowed staff involved with the project to make suggestions on how best to meet the outcomes. Involving the staff encouraged dialogue and an embracing of the process. Generating short term wins also inspired the staff to embrace the change. The simple process of giving out certificates to those staff members who were screening patients, drawing lactate levels, and initiating early treatment as directed by the policy drew others into the process. An actual competition arose regarding who could initiate treatment the quickest, culminating in staff actively checking times in order to be the fastest.

The final steps in the process are still ongoing. The daily feedback was so successful that administration and staff have joined in making sure that feedback continues to happen even after the project's completion date leading to consolidating the gains. Making the process anchored in the organization is also occurring as the policy has been incorporated into the orientation of emergency department staff.

The Kotter theory was very applicable to this project. Some literature has found the theory to be too linear in that each step is done one at a time, however, the project coordinator did not find that to be the case. Certain steps must be done in a specific order but circling back to the previous steps ensures a complete and successful process.

Evaluation of the Project: Stetler Model of Evidence Based Practice

The purpose of the Stetler model is to facilitate application of research findings at the individual practitioner level in the hope of making research real for bedside practitioners (Stetler, 1994). It focuses on critical thinking, findings of individuals, and evidence from external sources.

These combine to achieve best practice. Using this evidence, healthcare organizations can make changes on individual units or organizational wide. It was for these reasons that this model was chosen to guide this evidence based practice project. The Stetler model consists of five phases: preparation, validation, comparative evaluation/decision making, translation/application, and evaluation.

Each of these phases was used during the course of this project and worked in concert with the eight steps of the Kotter change theory. The first phase of preparation guided the project coordinator during the literature search, meetings with the key facility staff, and identifying the need for the project. By using the model to make sure of the completeness of the search the project coordinator was able to present a thorough picture regarding the project to the facility stakeholders.

Phase two, or validation, led the project coordinator to compare multiple tools for article critiquing to ensure that the best evidence was found. A strength of this model is that, at this point, if the evidence does not support the project change, the process stops. This saves time and effort for all involved in the care of patients. There was a large amount of evidence available and by utilizing the appropriate tools, the evidence presented to the staff was of the highest quality.

That evidence was analyzed and consolidated, during phase three – the decision making phase, to present a reason for the change to the staff. The decision was made to continue the process. This is another strength of the model since all involved in the project can review the evidence and decide if this change is the right change for both the patient and the organization.

Phase four was the most critical phase for the project coordinator as this is the translation/application phase. At this point decisions need to be made as to how to put research into practice. How will this change occur? By reviewing Stetler's model an understanding as to how best to implement a change was achieved. Multiple educational plans were developed that

encouraged application of the change at the bedside nurse level which influenced practice at the organizational level. During the application phase, changes were made to the process based on the feedback of individual bedside nurses, a key component of the Stetler model. Even though the screening took less than a minute to perform feedback from staff highlighted two main issues. The first issue was that, even though the screening process did not take a long time, the minutes could still add up since every patient was being screened. This ties in with the second issue which was that the bedside nurse had the clinical expertise to decide who needed to be screened for sepsis and who did not. The nurses felt they had the expertise to determine that specific patients were not likely septic, e.g., a person with a dislocated finger.

After consulting with the guiding coalition, it was agreed that this feedback was helpful and a list of chief complaints that required screening was developed. The change in the screening policy was communicated to the staff and met with an overwhelmingly positive response.

This change was validated in the final phase of the model which is evaluation. Identifying whether a change is making a difference is a crucial step in solidifying a practice change. Daily monitoring and evaluation of the process took place during the course of this evidence based project. This feedback to the staff was a primary strength of the model. Some stakeholders were convinced that not screening all patients would decrease the impact of the sepsis policy. When evaluating patient outcomes, it was determined that daily screening increased to almost 100% by the end of the project. Additionally, during the last month of monitoring, no patients with a diagnosis code of sepsis had been missed by the emergency department staff. The feedback was solicited, evaluated, and led to a revision in the policy which impacted the project outcome.

Evaluation of the Project

This EBP project focused on staff compliance to a sepsis policy that emphasized early identification of potentially septic patients and early, appropriate treatment for those patients. The implementation of this policy increased the emergency department staff compliance to

screening and treatment recommendations for these patients. A decrease in length of stay and mortality was demonstrated for those patients who were screened appropriately. Daily feedback to staff regarding compliance to appropriate screening and timeliness of implementation of policy components was a primary strength of the project as was listening to staff feedback on how to improve the process. Types of patients who actually required screening and the need for more point of care lactate resources are examples of staff feedback. Sepsis has become a topic discussed on a daily basis in the emergency departments with a focus on how to further improve the care of the patients.

Education is an ongoing need when dealing with healthcare and quality patient care. Best practice initiatives occur almost on a daily basis and staff are hard pressed to remain current on all these initiatives. By introducing the evidence supporting this project in a multitude of educational offerings, the staff was introduced to meaningful application of research and best practice. Demonstrating positive outcomes related to best practice ensured that the staff is more receptive to changes in other aspects of patient care.

Another strength of this project was the amount of administrative support provided to the project coordinator by the facility. When the entire team, not just the project coordinator, is on board regarding the importance of a practice change, staff listens and embraces the vision. The project coordinator provided the names of those staff members who were not screening patients appropriately to administration on a daily basis. Administration developed a plan to address those staff members individually. The clinical nurse specialist would have a face to face conversation with poorly performing staff explaining the importance of the screening. The date of that conversation was documented and if the same staff member continued to have poor performance, the unit director counseled the staff member further. Ultimately the unit manager could issue a written warning and document the behavior in the performance evaluation. When staff realized that there were consequences of not screening, percentages for screening increased.

A weakness of the project was the setting. Although implementation involved two emergency departments, they were of the same health system. Therefore, the results may not be generalizable to other emergency departments or in-patient units. Also, since a specific computer screening tool was utilized only facilities with that system could replicate the process. A final weakness of the project was the availability of certain resources. Point of care lactate is the recommended diagnostic test for any patient who presents with a positive sepsis screen. With a patient volume of over 100 patients per day and only two point of care devices, this step was difficult to implement at peak patient volume times and thus not always implemented due to lack of access to the device. More point of care testing devices need to be procured.

Implications for the future

Practice. The APN is well-positioned to influence and change practice. This project demonstrated that significant practice changes occur when the evidence is presented in a succinct fashion and reinforced multiple times. Additionally when change is monitored, and feedback is provided from both the change agent and the staff involved in the change successful outcomes are possible. Use of a sepsis screening tool that is consistent with current recommendations as opposed to SIRS criteria is a practice change that needs to spread to the greater emergency department community. If an organization does not have the specific computer based tool used in this project one could be developed that would work for that organization. Early identification of potentially septic patients is a high priority for the nation and early treatment has been shown to save lives.

Use of the screening tool throughout the organization to include in-patient areas is the next step for this healthcare system. The policy will be modified to meet the needs of the in-patient areas and staff. Use of not only the screening tool but also the sepsis policy should be incorporated into every patient's care. The decrease in length of stay and mortality demonstrated through implementation of this project encourages the use of point of care testing,

drawing of blood cultures, and early antibiotic and IV fluid treatment throughout all areas of the healthcare organization.

Use of evidence based sepsis order sets that include all necessary components of care would ensure that all the steps of the process were completed in a timely fashion. APNs working with practitioners and technology staff could develop a protocol whereby the screening nurse could enter a sepsis order set after a positive screen and generate all the components at once.

Theory. The results of this project bear out the use of both the Kotter change theory and the Stetler model for evidence based practice. Both theories lead the investigator through the different steps required to complete a project of this magnitude successfully. Understanding how change happens, the potential barriers and pitfalls of that change, and using tools designed to overcome those barriers culminate in a successful change. An APN who has been exposed to these different theories has a major advantage with facilitating change in the workplace.

The use of the Stetler model also gives the APN an advantage by facilitating the integration of best practice and evidence into the workplace setting. Understanding and working through the steps of the model with the bedside nurse can help to ensure that the practice change is more likely to occur.

Research. The findings of this evidence based practice project clearly demonstrate that following a sepsis policy increases the screening of potential sepsis patients in the emergency department. It also validates the Surviving Sepsis campaign guidelines that specify early identification, diagnosis with lactate levels and blood cultures, and early treatment with antibiotics and IV fluids. Implications for further research are extremely varied and exciting. Subsequent questions for the APN to investigate include: (a) At what lactate level is sepsis mortality more likely to occur? (b) What treatments affect lactate levels the most quickly? and (c) Which patient chief complaints are more likely to reveal a positive screen? This determination could lead to underscoring the need for point of care testing, identifying the intervals for drawing lactate levels, and delineating which patients are best served with the screening tool.

Determining which treatment components have the greatest impact on the patient length of stay and mortality is another area of potential research. Differences among specific antibiotics and intravenous fluids could be studied using a retrospective chart review design.

Finally, a number of patients did not meet criteria for a positive screening or met screening criteria but did not have a lactate level > 2.2 mmol/L, yet received the same treatment as those patients who met sepsis criteria. APN researchers concerned with cost containment and value based care could determine why these patients received these treatments through a qualitative study. This could help practitioners plan therapy that is most appropriate for the patients under their care. This type of study could also be designed to examine patients who present with a negative screening profile but are treated with the sepsis protocols.

Education. One of the principle roles of the APN is education. Obtaining the evidence for best practice is just one step in the change process. As both theories utilized in the project stated, communication of the evidence is just as important. This communication is needed at the start of the project where the education consists of translating the knowledge into practice and policy. The staff involved need to understand why the change is taking place and what the expected outcomes are. That education needs to take place consistently, frequently, and in a manner that works for the different staff members.

Not only should the outcomes of this project be discussed with current clinical staff but should also be shared with nursing education faculty. Nurse educators are responsible for exposing both undergraduate and graduate nursing students to the utilization of best practice to ensure that the next generation of nurses are utilizing best practices when caring for patients.

Conclusion

Implementation of a sepsis policy has a significant positive impact on screening of potentially septic patients in an emergency department setting. The policy included the best evidence available for the identification and treatment of sepsis patients which corresponds with the recommendations of the Surviving Sepsis campaign guidelines. That early identification led

to the use of point of care testing for lactate levels and the implementation of recommended treatment.

There was a consistent upward trend in use of the sepsis policy treatment components over the course of the implementation period. Appropriate use of all components improved after the implementation of the sepsis policy. These treatment outcomes led to decreases in patient mortality and length of stay.

APNs are charged with promoting quality patient care. By synthesizing best practice evidence, implementing policy change, and monitoring and evaluating outcomes, patient care can be significantly and positively impacted.

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BIOGRAPHICAL MATERIAL

Lynette M. Rayman

Ms. Rayman graduated from Valparaiso University in 1983 with a BSN. She worked at Porter Memorial Hospital in the Intensive Care unit for three years before returning to Purdue University Calumet to obtain her Master's Degree in Nursing with Clinical Specialty in 1988 and is currently attending Valparaiso University to earn a DNP in 2016. Between 1989 and 1998 Ms. Rayman was the Clinical Nurse Specialist for the Intensive Care/Cardiovascular Care Unit at Porter Hospital and was responsible for implementing evidence-based practice, coordinating quality improvement efforts, and educating the staff of the critical care areas of the hospital. She also led the organ donation initiative, was a clinical instructor for Valparaiso University, and became certified through the American Association of Critical Care Nurses. In 1998 she added the responsibility of Cardiovascular Case Manager and coordinated the care of patients requiring cardiac surgery. In 2011 Ms. Rayman changed her career focus and became a Clinical Assistant Professor at Valparaiso University, where she continues to teach. She also was the Stroke Coordinator for Franciscan Alliance – Michigan City, where she led the process to obtain hospital stroke certification and continues to participate as an education coordinator. Lynette is a member of Sigma Theta Tau – Zeta Epsilon chapter and has held numerous offices. She is also a member of the American Heart Association, American Association of Critical Care Nurses, and the National Association of Clinical Nurse Specialists. Most recently Lynette has become interested in the early identification of sepsis while working with staff in the Emergency Department in Michigan City. She has presented this topic on numerous occasions and has submitted an article on the subject for publication.

ACRONYM LIST

AHRQ: Agency for Healthcare Research and Quality

EBOS: Evidence Based Order Set

EBP: Evidence-Based Practice

ED: Emergency Department

ICU: Intensive Care Unit

LOS: Length of Stay

POC: Point of Care

RCT: Randomized Control Trial

SSC: Surviving Sepsis Campaign

SIRS: Systemic Inflammatory Response System