Implementation of an Evidence Based Early Sepsis Recognition and Treatment Protocol in the Emergency Department and Critical Care

Project Proposal

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Abstract

There are more than 750,000 occurrences of sepsis annually with mortality rates 30 to 40% for severe sepsis and 50 to 60% for septic shock (Angus et al., 2001; R. Phillip Dellinger et al., 2008). Sepsis is a complex disease with numerous guidelines and most recently sepsis bundle treatment regimes have been recommended. Despite these measures and evidence supporting early goal directed therapy (EGDT), identifying sepsis remains problematic within both the emergency department and critical car unit settings. Efforts must focus on early recognition and identification of sepsis so aggressive intervention of EGDT can be implemented to assist in the decrease of both patient morbidity and mortality. The purpose of this pilot project was to develop a rapid sepsis identification and treatment protocol originating in the Emergency Department (ED) leading to timely transfer to the critical care unit. Furthermore, the intensivist team coordinated the EGDT in an effort to optimize meeting the goals of most recent recommended guidelines. The emergency department nursing and medical staff collaborated to identify potential sepsis patients >18 years of age using a predetermined sepsis checklist. As potential sepsis patients were recognized, the fast sepsis protocol was used for prompt intervention with appropriate diagnostic data, intravenous fluid bolus, and notification of the critical care nursing and intensivist team for a fast sepsis protocol admission leading to urgent transfer for further review for EGDT interventions.

RESULTS

A needs assessment identified gaps in knowledge of critical care and ED staff that was used to develop and sepsis update program based on current evidence. A posttest of 78 ED and critical

care staff attending the program revealed correct answers with a mean raw score of 55 (range 34-76). Correct answers with a mean raw score of 40 (range 9-68) included 75 step-down nurses who did not participate in the sepsis program. A sepsis checklist tool developed by the projector director based on evidenced based practice screened 3841 ED patients for sepsis with 629 admissions. Twenty-six patients were admitted to critical care with severe sepsis/septic shock, but 11 were not enrolled due to limited care, transfer or death prior to the six-hour timeframe. The 15 remaining enrolled in the pilot study included a mean ED length of stay 203 minutes (range 95-495 minutes). Three-hour goals include initial lactate 47 minutes (range 12-192 minutes), IV bolus of 30 mls/kg was given in mean of 229 minutes (range 31-574 minutes), with antibiotic administration mean 114 minutes (range 35-239 minutes). Successful 180-minute goals were lactate 93%, IV bolus 33%, antibiotics 97%, and obtaining cultures prior to antibiotic administration 93%. Goals for the six-hour entails mean repeat lactate 343 minutes (range 234-771 minutes), reaching mean arterial pressure (MAP) in 293 minutes (range 93-872 minutes), and central venous pressure (CVP) mean in 515 minutes (range 292-1748 minutes). Achieving 380-minute goals include second lactate 20%, MAP 80%, CVP 93%, and 93% with central line placement. Mortality for the pilot study was 20%.

CONCLUSION

This is a small pilot project showing decreased mortality with a prolonged ED length of stay. Improvements included increased percentages of obtaining cultures prior to antibiotic administration, achieving three-hour lactate and antibiotic administration, and achieving six-hour MAP and CVP goals. Percentages for achieving IVF bolus and a second lactate decreased, and increased mean timeframes for three and six hour goals create further opportunities to evaluate current systems with driving and restraining forces along with collaborative efforts

between disciplines and departments. Changes in practice, implementing nurse-driven protocols, and working within complex systems requires a multidisciplinary team, buy-in from administration to front line staff, overcoming barriers belief systems and cultures to create excitement and motivate to reach new challenges and commitments.

Identification of the Problem

There are more than 750,000 occurrences of sepsis annually in the United States with mortality rates 30-50% for severe sepsis and septic shock (Angus et al., 2001; Dellinger et al., 2008) Sepsis rates are estimated to increase 1.5% annually, with a potential of reaching over 1 million by 2020 (Aneja & Fink, 2006). The Centers for Disease Control and Prevention (CDC, 2010) lists sepsis as one of the ten major causes of death in the United States. With the aging population in the United States, the incidence of sepsis is expected to continue increasing. The Emergency Department (ED) evaluates 280,000 to 500,000 septic patients annually with an average 5-hour length of stay within their department (J.-L. Wang et al., 2009; Wang Z, 2010; Z. Wang, Schorr, C., Hunter, K., Dellinger, R. P., 2010).

Sepsis is the largest diagnosis related group (DRG) at the facility including 11.5% of the patient population in 2014 (B. Hogan, personal communication, June 9. 2015). Medicare introduced sepsis core measure trending in October 2015 with public core measure scorecard reporting as early as October 2016. Medicare payment for performance based on adherence to core measures and outcomes is scheduled to begin in 2018. Public reporting and future reimbursement creates motivation to address identification of opportunities and systems to improve and support optimal intervention and treatment of sepsis.

Local trends in sepsis prevalence mirror national ones. Over the past seven years, hospital admissions with sepsis, severe sepsis, and/or septic shock based on discharge diagnosis have continued to increase 650 in 2009, 872 in 2012, 1291 in 2013, and 2217 in 2014 at Maury Regional Medical Center. More than 60% of septic, severe sepsis, and septic shock patients are admitted through the ED, 15% transferred from another hospital, 10% from a nursing home

facility, and less than 5% originating from direct admission by the primary care provider (B. Hogan, personal communication, February 18, 2015). Mortality for septic, severe sepsis, and septic shock patients in 2011 was 22.3%, 25% in 2012, 24.9% in 2013, and 28% in 2014 (B. Hogan, personal communication, April 14, 2015). The focus of this project was to improve early recognition of sepsis and septic shock patients presenting to the ED.

With the current system in the ED, patients have been admitted to medical-surgical units with unrecognized symptoms of sepsis. Several hours were able to pass before significant hypotension, tachycardia, and oliguria were recognized, thus leading to transfer to the critical care unit for optimization of aggressive treatment and intervention for complications of sepsis. Prior to this project there was no formal checklist to identify or screen for sepsis in the ED and treatment of sepsis was initiated only after the provider identified potential sepsis or source of sepsis and subsequently referred to established ED guidelines for antibiotic choices per pharmacy formulary. The purpose of this scholarly pilot project was to develop a nurse-driven sepsis screening protocol to improve early sepsis recognition and intervention with urgent transfer to critical care when severe sepsis and/or septic shock are identified. Based on outcomes, the ED, critical care, and quality department identified opportunities for improved recognition and treatment of septic patients.

Review of Literature

Overview

A literature search was conducted for the years 2000 through 2015. The search was limited to the English language with a focus on adult patients >18 years old. Database searches included Cochrane Database of Systematic Reviews, EBSCO, EMBASE, Google Scholar, Medscape, and PubMed. Key search words included septic shock, severe sepsis, sepsis

treatment bundles, sepsis screening tools, early sepsis symptoms, sepsis in the emergency department, sepsis outside of critical care, biomarkers of sepsis, and surviving sepsis campaign.

Defining Sepsis

Sepsis has been identified in the medical community for many years, along with numerous treatment modalities. In 1991 an attempt was made to assist with the identification of a variety of septic states. Systemic inflammatory response syndrome (SIRS) was defined and definitions of septic shock, severe sepsis, sepsis, and multiple organ dysfunction syndrome were standardized by a consensus panel including the American College of Chest Physicians (ACCP) and the Society of Critical Care Medicine (SCCM) (Bone et al., 1992). Unfortunately, missed opportunities for diagnosing sepsis remain. In an attempt to combat these missed opportunities, the definition of SIRS was revised at a conference in 2002 that included representatives from SCCM, ACCP, the American Thoracic Society (ATS), and the European Society of Intensive Care Medicine. The definitions represented a better understanding of pathophysiologic changes in the stages of sepsis (Ely, Kleinpell, & Goyette, 2003). From this collaboration, the Surviving Sepsis Campaign (SSC) guidelines were published in 2004 (Coba et al., 2004). Other organizations joined this effort to optimize evidence-based practice against the growing sepsis epidemic. The Institute for Healthcare Improvement (IHI) in the United States collaborated with the SSC developing the 100,000 Lives Campaign focusing on education and utilizing sepsis bundles to lead to an improvement in overall sepsis outcomes (Angus et al., 2001; Marshall, Dellinger, & Levy, 2010). Sepsis guidelines were again revised in 2012 to reinforce evidenced-based practices (R. P. Dellinger et al., 2013).

Recognizing and Identifying Sepsis

Despite measures and evidence supporting early goal directed therapy (EGDT), identifying sepsis remains problematic (Casserly et al., 2011). Interventions and treatment modalities cannot be implemented until sepsis is recognized; therefore, identification and recognition of a sepsis state is key to improving outcomes. Efforts must focus on early recognition and identification of sepsis so aggressive interventions of EGDT can be implemented to decrease morbidity and mortality. Suspicion of an infection is the initial stage for sepsis consideration. SIRS criteria for sepsis include evaluation of temperature (<36 or > 38 ^{o}C), heart rate (>90 beats/min), respiration (> 20 breaths/min), and white blood cell count (<4,000 or >12,000, or >10% bands). Other considerations include elevated lactate (>2 mmol/L), hypotension, altered mental status, coagulopathy, decreased urine output, and decreased oxygen saturation (R. Phillip Dellinger et al., 2004).

Many studies use SIRS criteria to identify sepsis states (R. Phillip Dellinger et al., 2004). Shorr, Micek, Jackson, & Kollef (2007) identified septic shock as two SIRS criteria along with known or suspected infection and continued hypotension after receiving intravenous (IV) fluid bolus requiring vasopressors. Other studies identified severe sepsis/septic shock as ongoing hypotension after IV fluid resuscitation of 30 ml/kg or a lactate $\geq$ 4 with two SIRS criteria ((Casserly et al., 2011; Castellanos-Ortega et al., 2010). Guiliano (2013) suggests that using a MAP $\leq$ 69 and T >38 ^{o}C can identify septic patients with up to an 80% sensitivity

A survey of 414 adult critical care facilities in the United States revealed over half of the hospitals surveyed have an organized nurse-driven approach to identify sepsis in the intensive care unit (ICU) population (Durthaler, Ernst, & Johnston, 2009). A nurse-driven sepsis screening tool and sepsis protocol utilized in a Netherlands ED increased sepsis recognition (Tromp et al., 2010). A Spanish ICU implemented a multidisciplinary team approach to

identify, recognize and treat sepsis based on SIRS criteria with significant improved outcomes by means of prompt sepsis identification and treatment (Castellanos-Ortega et al., 2010). Ferrer, et al., (2014) showed an increase in mortality with each hour delaying antibiotic administration. Appropriate and timely antibiotic administration prior to critical care admission was also showed to decrease mortality (Garnacho-Montero, Gutierrez-Pizarraya, Escoresca-Ortega, Fernandez-Delgado, & Lopez-Sanches, 2015).

Serum markers for sepsis have been widely studied. A low serum bicarbonate (HCO3) in the absence of fever with a suspicion of infection and an elevated anion gap ($\geq$12) with a possible infection, should alert providers to consider a diagnosis of sepsis and to obtain a lactate level along with EGDT and resuscitation efforts (Berkman, Ufberg, Nathanson, & Shapiro, 2009; Caterino, Jalbuena, & Bogucki, 2010). Comparisons of central venous oxygenation (ScvO2) and tissue oxygenation (StO2) with sepsis patients in an ED setting have yet to be supported as benificial (Napoli, Machan, Forcada, Corl, & Gardiner, 2010). By contrast procalcitonin (PCT) has been available in Europe for several years and used to identify bacterial infections and augment antibiotic therapy (Jensen et al., 2006). C-reactive protein and PTC have been used in numerous studies as predictor of severe sepsis outcomes, but their values remain unclear. PTC to identify sepsis is more helpful in the pediatric population (Ryu et al., 2015). This technology is available in the United States, but not widely available and it is cost prohibitive for many facilities. Sepsis is a complex disease, and numerous biomarkers are undergoing research which may help future identification and trending of sepsis response including endothelial proteins, cell surface receptors, cytokine/chemokine signaling, immunomodulary biomarkers, and genomic regulators (Biron, Ayala, & Lomas-Neira, 2015).

Mahajan et al, (2015) conducted a retrospective study to evaluate patterns to predict

sepsis mortality by comparing Scv02, lactate, and veno-arterial C02 (vaC02) differences. Initial lactate and Scv02 were not associated with higher mortality, although survivors had precipitous lactate decrease. Interestingly, those with vaC02 $\leq$6 mmm Hg were at higher mortality risk only when associated with Scv02 $\geq$70 (Scv02 $\geq$70 is a normal finding).

Interventions, EGDT, and Sepsis Bundles

Sepsis is a complex disease with numerous guidelines and sepsis bundle treatment regime recommendations. Research supports EGDT for patients with sepsis states. Treatment should include the following: fluid resuscitation, appropriate and timely antibiotic choices, vasopressor support, and achievement of blood pressure goals as this can decrease patient mortality and create financial benefits (Puskarich et al., 2011; Kumar et al., 2006; Rivers et al., 2001; Shapiro et al., 2006). With the use of fluid resuscitation, vasopressors and/or packed red blood cells to optimize blood pressure (BP), CVP, and/or ScVO2 per protocol and appropriate antibiotic administration within the first 6 hours of sepsis diagnosis, mortality was reduced from 46.5% in the control/standard group to 30.5% in the EGDT group (Rivers et al., 2001). Recognition, identification, and diagnosis/treatment of septic states are key to EGDT protocol and intervention.

Numerous studies support that the early recognition, identification, and treatment of sepsis have positive impacts on mortality (Ely et al., 2003; Puskarich et al., 2011; Rivers et al., 2001; Shapiro et al., 2006; Tromp et al., 2010). Barnes-Jewish Hospital ED in St. Louis implemented a sepsis protocol focusing on identification and appropriate interventions for this identified population, which improved patient mortality and decreased financial expenditures (Shorr, Micek, Jackson, & Kollef, 2007 & Kollef, 2007). Christiana Care Health System in Delaware had similar results when a sepsis alert program was instituted in the ED and critical

care areas when emphasis was placed on identification of sepsis with aggressive EGDT interventions (Zybrow et al., 2008). Puskarich, Marchick, Kline, Steuerwald, and Jones (2014) implemented EGDT in the ED that was found to show long-term, one-year patient mortality benefits. A medical critical care unit in Brazil created opportunities to increase sepsis bundle compliance with EGDT over a 5-year period revealing compliance increased from 7.2% to 41% and patient mortality decreased from 54% to 16% (Shiramizo et al., 2011).

Nurse driven protocols have been successfully utilized to improve quality and enhance evidenced based practice (Beck & Johnson, 2008; Kishel, Maguire, Pankratz, & Julian, 2009; Smith et al., 2007). A multidisciplinary team approach can enhance optimal health care delivery in a timely manner and impact quality outcomes (Fleischman & Gitzgibbon, 2008; Padula, Hughes, & Baumhover, 2009; Smith et al., 2007; Shimet et al., 2008; Williams, Sullivan, Lacey, Adoryan, & Watts, 2010). An ICU in Spain used a multidisciplinary approach implementing SSC protocols resulting in significant decrease in hospital and ICU mortality, length of stay, and increased compliance of protocol goals (Castellanos-Ortega et al., 2010). By actively participating in the assessment and evaluation process, nurses can be empowered to use their education to a fuller extent and to improve quality and delivery of evidence based practice (Davis, 2001).

Theoretical Framework – Lewin's Change Theory

The process of change has been found to be very difficult in any organization. For implementation of this pilot project, Lewin's Change Theory was used to identify driving and restraining forces to create an environment for successful change (Appendix A). Kurt Lewin developed a three-stage theory in 1951 involving focus on steps of unfreezing, change, and refreezing (Kritsonis, 2005). Unfreezing begins as a recognition that a change needs to occur.

The ED nursing and medical staff of the identified medical facility had already identified opportunities for improved of sepsis recognition and treatment among the ED patient population.

Driving and restraining forces must be identified to create an environment for change. Driving forces include evidence-based practice guidelines, commitment to provide excellent care, improve quality, achieve benchmarking objectives, and reduced health care expenditures. A subgroup including staff from critical care, ED, information systems, and quality were working since 2014 to improve sepsis identification and guideline adherence with a goal to achieve Sepsis Certification. The Chief Medical Officer (CMO), Quality Services, and senior leadership at MRMC were supportive of this endeavor for improved patient care and outcomes. The ED and critical care managers, directors, and educators were also supportive of this project. The ED physician director and intensivist team were updated throughout the development process via email communication and staff meeting updates and contributed to the development of the fast protocol with efforts to improve sepsis identification and management.

Restraining forces consist of staff opposition including nursing, physician, and support staff in the ED and critical care areas, laboratory staff, radiology department, respiratory therapy, etc. A lack of knowledge regarding current sepsis guidelines and treatment, conflict regarding changes in status quo for rapid ED disposition and transfer of patients, discord among the disciplines, and a lack of teamwork were identified as restraining forces during this type of change. As administration and senior management refocused mandates to meet productivity models, new patient/staffing ratios created an environment of employee frustration due to more limited resources. To proactively address decreasing hospital reimbursements, administration and the Human Resources department modified shift differential benefits resulting in further

staff discontent. Nursing attrition contributed to new, inexperienced nursing staff and changes in the management team. It should also be noted that several of the ED physicians are contract employees through a national company that create issues of hospital allegiance and commitment to this project. Most ED providers are hospital-based permanent staff, but some providers float to various facilities producing fragmented care due to lack of knowledge of organizational policies, procedures, and programs. Physician and nursing collaborative efforts can be strained, as physicians were reluctant to allow nursing autonomy and responsibility by use of protocols and guidelines. Some nursing staff were hesitant to accept a more autonomous and active role to identify, recognize, and treat sepsis states. The intensivist team workload continues to increase, especially after hours and on weekends. An advanced practice nurse role was been added to the daytime weekend intensivist team coverage in an effort to balance this increased workload. Education was provided for all staff members involved in the fast sepsis process with timely transfer of unstable septic patients to critical care for optimization of EGDT including potential invasive line placement and further diagnostic studies.

Unfreezing involves developing strategies to combat the restraining forces and support the driving forces. This was be supported by providing staff and provider education and training, obtaining staff buy-in with recognition and rewards, support by administration and front line managers involved in the process, developing a multidisciplinary team for protocol development, encouragement by facilitators and change champions, providing feedback, allowing for exploration of feelings and emotions, ensuring adequate available resources (man power, equipment, and time management opportunities), open communication, developing camaraderie among the disciplines, and building trust among all team members. To encourage ED physician buy-in, a physician packet provided information which emphasized time

management opportunities utilizing the ED fast sepsis protocol and impacting ED length of stay (Cohn, 2009). Decreasing length of stay was a prime goal of the ED providers. Patients presenting with severe sepsis and septic shock consume vast resources in the ED environment creating further delays for those with stable presentations. If unstable septic patients are identified, optimally treated, stabilized, and urgently transferred to critical care, the ED patient flow will improve leading to an overall improvement in patient satisfaction. Critical care nurses included in the fast sepsis protocol education process for availability of timely interventions including potential urgent central line placement, continued aggressive fluid resuscitation, vasopressor support, and antibiotic management that was previously started in ED.

After protocol development, education, team building activities, and continued support, a go-live date was set for implementation. On the start date of the fast sepsis protocol, key players and line managers were available to assist with identifying and resolving potential process issues. Staff members were encouraged and supported as this new endeavor improved patient care creating new opportunities for teamwork and growth. As changes occurred, there was continued support from formal (line managers, administration, change champions, and facilitators) and informal leaders (staff members who supported the new process). Refreezing occurs as the new process becomes accepted as usual practice. Continued support and reinforcement continued to maintain the new pattern of practice. Quality outcomes and results of the new protocol were formally and informally shared with all staff members during the process. Recognition and celebration was incorporated to emphasize the achievements, success, and satisfaction associated with practice modifications.

Implementation

Setting

A combined adult ICU is the largest southern middle Tennessee hospital served as the setting for this pilot project. This institution is a not-for-profit 275-bed tertiary acute care facility serving over 260,000 people within a seven-county area. Five smaller area hospitals transfer critically ill patients to the tertiary center for a higher level of care. The facility offers services for cardiology, 24/7 intensivist staffed critical care, orthopedics, general and vascular surgery, obstetrics, oncology, pediatrics, and a level-2 neonatal intensive care supported by a joint venture with a local teaching medical center. Neurosurgical services are also supported through a teaching medical center with limited availability. Neurology services are available 24 hours a day, seven days a week.

The emergency department (ED) has 32 beds with 45,000 encounters annually (H. Kunz, personal communication, June 5, 2014). The ED includes a fast-paced environment where the initiation of a new screening tool required efficiency, ease of use, and inexpensive to avoid failure. Materials for the tool, protocol, and pilot program information were readily available and convenient for staff use. Members of the ED staff strive for excellent patient care and are committed to evidence based practice. By using an uncomplicated screening process to identify patients at risk for sepsis with immediate implementation of the ED sepsis protocol leading to optimal outcomes.

Quality service department at the facility has followed trends for patient populations with various diagnoses including length of stay, mortality, comorbidities, disposition, etc. with benchmarking comparison from a contracted company. This data reflected hospital outcomes based on discharge diagnosis and the discharging physician or physician group. The impact of this information did not directly reveal or trend the efforts of the intensivist team. Sepsis order sets were developed by the intensivist team implemented based evidenced based guidelines for

severe sepsis/septic shock care patient population in the critical care environment. As a quality improvement project, the intensivist group began trending compliance guidelines in 2011 that expanded to inclusion of interventions received in the ED. The pilot project information was compared to retrospective data utilizing EGDT.

Assessment Tools

To identify current knowledge of sepsis concepts and potential improvement opportunities, a needs assessment was developed. The needs assessment consisted of seven questions with multiple-choice answers and administered to ED and critical cares staff (Appendix B) during department staff meetings. Review of the needs assessment revealed knowledge deficit of elements of the SIRS criteria used to identify sepsis and inability to differentiate stages of sepsis. Staff members identified the need for multifactorial efforts necessary to treat sepsis and acknowledged a high mortality associated with sepsis. Eighty-eight percent of participants indicated that sepsis mortality was higher than 30 to 50 percent (Appendix C). Using information obtained from the needs assessment, a sepsis update program and posttest was developed for ED and critical care nursing staff based on evidence of sepsis identification and guideline practice interventions.

The data collection tool was developed to document retrospective data collection for capturing time including ED triage, critical care arrival, obtaining lactate and cultures, antibiotic administration, attaining MAP and CVP goals, and hospital disposition. The tool allows for documenting time (minutes) for ED length of stay, achieving goals for antibiotics, lactate, IVF bolus, repeat lactate, MAP, and CVP. Cultures obtained before antibiotic administration and hospital disposition are also included in the data collection document (Appendix D).

The Scholarly Project Director in collaboration with the ED and critical care physicians, directors, nurse managers, and educators developed a nurse-driven sepsis checklist to enhance identification, optimal treatment, and appropriate ED disposition based on SIRS criteria and other existing evidence in the literature (Appendix E). ED staff members reviewed the checklist format to identify potential areas confusion and/or clarifications necessary for optimal usage prior to implementation.

The posttest consisted of 12 questions with multiple-choice answers focusing on application of identification, treatment, and intervention of sepsis states (Appendix F) and administered after the sepsis program. A pretest was administered to nurses on the step-down unit for comparison of scores. The education department assisted with pre and post testing via Survey Monkey.

A sepsis protocol was developed in 2009 specifically for the ED population with collaborative efforts of ED, infectious disease, and critical care physicians. Unfortunately, the protocol was not readily available, thus leading to inconsistent use amongst many other limiting factors. Leadership in the ED was in flux due to contract negotiations, changes within administration, ineffective communication, and erratic staffing patterns due to attrition. Both nursing and physician leadership have since stabilized resulting in collaborative ED nursing/physician and critical care/ED teams. The electronic health record (EHR) has expanded to include computer provider order entry (CPOE) and the development of order sets. The ED and critical care sepsis order sets were revised by a multidisciplinary team including physicians, nursing, pharmacy, and laboratory staff based on current guidelines and evidenced-based treatment of severe sepsis and septic shock (R. P. Dellinger et al., 2013). The ED sepsis order

set is now easily accessible via CPOE by all ED providers for more consistent management of potentially sepsis patients (Appendix F).

Staff Education

The project initiated the sepsis screening with the triage nurse who is first to encounter the patient and continued with the assigned primary ED nurses who spend the majority of the time with the patient. Nurses were educated to assess, identify, and discern potential pathological disease states. The project director developed, educated, and implemented a nurse-driven screen to identify severe sepsis/septic shock patients in the ED, with prompts for appropriate laboratory testing, coordination and collaboration with ED providers, and urgent transfer to the appropriate critical care unit. CPOE order sets with updated management for sepsis, severe sepsis, and septic shock diagnoses were available for ED and critical care providers to ensure consistent guideline intervention.

To help ensure a successful process change, information was disseminated along with education about upcoming modifications in the current practice. Nursing ED and critical care staff attended a 25 minute PowerPoint program with an overview and update of the most current sepsis guidelines including fast sepsis protocol (Appendix G). The sepsis update was presented 2 to 3 weeks prior to implementation of the pilot project at various times to accommodate staffing schedules including day, night, and weekend shifts. Nursing staff completed a posttest via Survey Monkey. The presented program reinforced recognizing signs and symptoms of sepsis, classifying stages of sepsis with scenarios, use of the nurse-driven sepsis checklist assessment tool, expected laboratory data to guide diagnosis, treatment modalities, and the fast sepsis protocol with appropriate ED disposition. Upon arrival to critical care, the fast sepsis patients were usually unstable requiring further fluid resuscitation, placement of invasive lines

(central venous catheter and/or arterial catheter) for optimal monitoring, and vasopressors. Additional laboratory tests and pending lab results required continue monitoring. The fast sepsis protocol was also presented to the ED and critical care physicians. A copy of the PowerPoint presentation and introduction to the fast sepsis protocol was emailed to all staff members including ED and critical care physicians.

Research pilot materials were posted in the ED and critical care lounge for providers and nursing staff along with the program director's contact information for questions or concerns and a poster of the fast sepsis protocol was placed prominently in all ED rooms (Appendix H). All ED and critical care staff members were provided a pocket sized fast sepsis protocol card that was laminated including criteria and treatment options for quick reference.

Procedure and Protocol

The triage nurse screens adult patients >18 years of age presenting to the ED to evaluate possible signs/symptoms of infection. The project director was available via telephone to answer questions or clarify issues that arose. The sepsis checklist form was started upon triage. A patient sticker was placed on the checklist for tracking purposes only and remained with the patient record until ED disposition. The checklist form was printed on brightly colored paper for easy identification, available in the triage area, and followed the patient throughout the ED visit with updates as additional information became available (laboratory results, changes in vital signs, etc.). The nurse was prompted to notify the ED provider of potential fast septic protocol subjects for optimal EGDT interventions.

Fifteen patients who met severe sepsis/septic shock criteria in the ED admitted directly to critical care were included in the pilot project. Patients requiring surgery prior to critical care arrival were not included in the study. The data was analyzed and compiled by the project

director. Tracking data included patient mortality rates and timeframes for the ED length of stay, obtaining cultures prior to antibiotics, and successful achievement of 180 minute (antibiotic administration, completion of IV fluid boluses, and lactate level) and 360 minute goals (MAP $\geq$ 65, CVP goal, and 2nd lactate). ED length of stay was monitored as critical care arrival time with ED triage as time zero. Patients who required surgical intervention or those transitioned to limited care (palliative care or comfort measures) within the six-hour monitoring goal were excluded from the pilot study analysis.

Upon disposition from the ED (discharge or admission), the sepsis checklist was placed in a secure locked cabinet in the ED, and forwarded to the project coordinator to protect patient confidentiality. The sepsis checklist with patient data remained on MRMC campus, secured in the critical care office, and destroyed after 12 months. Health Insurance Portability and Accountability Act (HIPAA) regulations were maintained. Data collection for the project continued until 15 participants were enrolled in the fast protocol with admission to critical care (based on 111 patients in physical year 2011, 138 patients for physical year 2012, 157 patients for physical year 2013, and 160 patients in 2014 meeting severe sepsis/septic shock criteria during the ED length of stay). Resources necessary for implementation of this project included copies of the screening tool, a secure location for completed checklists, computer access to electronic medical records (EMR), and database trending with Microsoft Excel.

A retrospective chart review collected by the project director focused on nurse compliance of the sepsis screening tool, and compliance with the ED and critical care severe sepsis protocols including appropriate labs were obtained, fluid resuscitation, antibiotic administration, and achievement of MAP/CVP goals were achieved. Evaluation data was entered into a Microsoft Excel program.

Hospital bylaws require an intensivist consult for all critical care patients upon arrival to the critical care unit. ED physicians frequently consult the intensivist service for assistance with sepsis management in the ED and with disposition for admission to critical care. To enhance sepsis intervention and meet goals of treatment, a fast sepsis program was developed by a multidisciplinary team including nursing, physician, and advanced practice staff within the ED, critical care, and intensivist team to expedite transfer of septic patients from the ED to the critical care unit.

Endorsement was granted for the scholarly project, Institutional Review Board (IRB) and the agency approval was obtained. The pilot project was presented to the IRB/Ethics Committee at Maury Regional Medical Center on December 2, 2013 and approved for one year. An additional extension for the project was granted through December 2, 2015 (Appendix I). The committee did not recommend or require obtaining informed consent because the project did not alter usual care with a revised hospital protocol and retrospective review. The project director coordinated procedures in accordance with policies to ensure patient information is adequately secured and all policies and procedures specific to HIPAA are followed per Research Council, IRB, and Compliance departments.

Results

A sepsis checklist was developed and implemented by the project director based on evidenced based practice and guidelines. Critical care and ED educators, directors, and staff to identify confusing and/or clarification for optimal use of the tool reviewed the checklist. A needs assessment identified current gaps in knowledge and practice, which was used to format the sepsis update program. After completing the sepsis program, a 12-questions multiple-choice posttest was administered to 78 participants (ED and critical care staff nurses) with correct

response mean raw scores of 55 (range 34-76). For comparison only, the test was administered to 75 step-down staff nurses without sepsis education revealed mean correct raw scores of 40 (range 9-68). Although the sepsis update program posttest shows higher raw scores, no inference can be made due to dissimilar group participants and limitations of the Survey Monkey test results.

During the pilot study 3841 ED patients were screened using the sepsis checklist with 629 patients admitted with an infection and some degree of sepsis. Of those screened, 176 responses failed to identify an immunosuppressed host (chronic steroids, chemotherapy, post transplant, etc.) involving 15 nurses. There were 1286 patients evaluated and treated in the ED with infections (urinary tract infection, upper respiratory tract infection, cellulitis, pneumonia, influenza, pelvic inflammatory disease, etc.) who were discharged home with outpatient antibiotics. During the pilot study 629 patients were admitted with sepsis that initially presented to the ED with 26 meeting severe sepsis/septic shock criteria. Fifteen patients were included in the pilot study presenting to the ED with severe sepsis/septic shock directly admitted to critical care during an eight-week period. Eleven other patients were excluded after arriving to critical care from another department, death prior to completion of the six-hour goal monitoring, or care deescalated due to limited interventions.

Adherence to the nurse driven protocol obtaining lactate and other laboratory chemistries of the 629 patients meeting SIRS, severe sepsis, or septic shock criteria was 618 (98.3%). There were 605 (96%) patient blood cultures obtained by ED nurses, but ED providers only ordered 578 (91%) cultures. Blood cultures obtained in the ED were sent to the laboratory and processed when the admitting provider entered appropriate culture orders. When patients are admitted to critical care, ED nurses include hand-off communication to the team regarding

culture status of complete, in the lab without orders, or not obtained. Eleven of the patients without cultures obtained n the ED was due to inability to obtain appropriate venous access.

The pilot study revealed a mean ED length of stay 203 minutes (range 95-495 minutes). Three-hour goals included initial lactate 47 minutes (range 12-192 minutes), IV bolus was given in mean of 229 minutes (range 31-574 minutes), with antibiotic administration mean of 114 minutes (range 35-239 minutes). Successful 180-minute goals were lactate 93%, IV bolus 33%, antibiotics 97%, and obtaining cultures prior to antibiotic administration 93%. Goals for the six-hour goals entailed mean repeat lactate 343 minutes (range 234-771 minutes), MAP mean of 293 minutes (range 93-872 minutes), and central venous pressure (CVP) mean in 515 minutes (range 292-1748 minutes). Achieving 380-minute goals included second lactate 20%, goals for MAP 80% and CVP 65%. Central line placement was 93% (Appendix J). Mortality for the pilot study was 20%.

Evaluation Plan

Sepsis patient population represented 11.5% of DRGs in 2014 at the facility with public reporting and reimbursement based on core measure adherence in the near future. With development of a sepsis screen in the ED with nurse driven protocols, the pilot project improved protocol adherence in some areas including obtaining initial lactate, cultures prior to antibiotic, antibiotic administration, MAP goal, central line placement and mortality. Opportunities continue to be identified for IVF bolus, repeat lactate, and attainment of CVP goals. This is a small study and is not indicative of sustaining future results. The results of this study is only a springboard for the creation of further large studies with the implementation of evidenced based practice, improved patient outcomes, and enhanced reimbursement based on outcomes.

Historical data regarding severe sepsis/septic shock ED and critical care patients with three and six hour EGDT has been trended at the facility by the projector director since 2011 (Appendix K). During this period, a second lactate was added to guidelines, clinical coding specialists were employed for more accurate and appropriate documentation leading to increased capture of sepsis diagnosis, and the management team has stabilized. The intensivist team has increased to five physicians, three moonlighter critical care fellows, and 2.3 nurse practitioners for coverage.

Mortality rates for this subset of critically ill severe sepsis/septic shock population have ranged from 20-30% over the past several years. In 2011 mortality was 20%, 29% in 2012, 30% in 2013, 28% in 2014, and 20% for the pilot study.

ED mean length of stay has increased from 180 minutes in 2011, 205 in 2012, 229 in 2013, 204 in 2014, and 230 in the pilot study. During the pilot project implementation, the hospital had high census and acuity with significant wait times for bed availability including patients transferring out of the unit. Critical care occupancy during this timeframe was 98 percent.

A comparison of initial lactic acid goals since 2011 have improved with increased ED point of care testing. Mean minutes obtaining initial lactate were 193 in 2011, 97 in 2012, 124 in 2013, and 41 in 2014, with the project time of 47 minutes. Registered nurses and technicians in the ED obtain laboratory and cultures to increase efficiency and productivity to meet EGDT and optimize interventions.

IV fluid resuscitation involves reviewing medication administration records from the EMR and potentially a paper documented form depending on the patient status. EMR cannot accept documentation until the patient has been registered and may require urgent treatment

prior to finalization of the admission process. IVF bolus goals in 2011 were a mean of 126 minutes, 287 in 2012, 319 in 2013, 105 in 2014, and 229 during the project. With retrospective review, the ED hand-off information reflects the total amount of fluids given but not always consistently documented in EMR records. ED CPOE added an order for 30 ml/kg IVF that is automatically calculated by the computer system.

Administration of timely and appropriate antibiotics is key to decreasing mortality with 93% meeting the three-hour goal during the pilot study. Rates in 2011 were 67%, 46% in 2012, 58% in 2013, and 89% in 2014. In 2011 mean minutes to antibiotic administration was 126, 287 in 2012, 319 in 2013, 105 in 2014, and 229 during the pilot study. To address some of the antibiotic concerns, pharmacy, physicians, nursing, and quality collaborated to supply appropriate antibiotic availability in the ED accudose system for immediate usage when the order is entered into CPOE.

Obtaining cultures prior to antibiotic administration has improved since 2011 82% compliance, 53% compliance in 2012, 92% compliance in 2013, 95% compliance in 2014, and 97% for the pilot study. With use of the nurse driven protocol, cultures are obtained by the ED staff and sent to the lab according to the sepsis protocol. Numerous times on admission to critical care, ED staff report that cultures were sent and antibiotics started, but there no CPOE order was entered. With collaborative team efforts, appropriate culture orders are entered and the specimen was already collected and sent to the laboratory.

A repeat lactate for an initial lactate >2.0 was added to goal directed therapy in 2012. In 2012 mean minutes for a repeat lactate was 481, 490 in 2013, 312 in 2014, and 343 for the pilot project. The CPOE order set for critical care sepsis protocol includes a pre-checked order to

repeat lactate in two hours. Unfortunately for an ED length of stay is over four hours, this is a potential missed opportunity.

Six hour MAP goals have improved since 2011 with mean minutes of 461, 375 in 2013, 303 in 2014, and 293 in the pilot. Forty percent MAP goal was met in 2011, 49% in 2012, 65% in 2013, 81% in 2014, and 80% for the sepsis project. Teamwork is exemplified between the ED and critical care staff with hand off reports and extra efforts to coordinate optimal, efficient interventions on arrival to critical care.

Achieving CVP goals remain challenging with many opportunities for improvement. CVP goal in 2011 was 586 mean minutes, 614 in 2012, 558 in 2013, 366 in 2014, and 515 in the pilot. The pilot study revealed 65% reaching the 360-minute goal, which has improved from 2011 with 32%, 45% in 2012, 55% in 2013, and 64% in 2014. Factors affecting successful CVP 360 minute goals include time-frame process for the provider to place a central line or for the IV service to place a peripheral invasive central line (PICC) with limited daytime availability. Appropriate and lack of CVP monitoring documentation is also problematic requiring remediation.

The project director covered all incurred costs personally, except for the sepsis protocol pocket cards supplied by the printing department at the facility. Pizza was provided for staff meetings when presenting the sepsis programs. Upon completion of the project, homemade cakes were presented to critical care and ED for their cooperation. The education department was given a gift card for all of her assistance during this process. Throughout the eight week duration of the project, baskets of candy with a reminder note was left at the desk for staff members.

Application to Practice

Since completion of the pilot study, the sepsis committee with collaborative efforts from information systems has implemented an ED sepsis screen included in the EMR nursing documentation and all questions must be addressed prior to completing the intervention. The ED bed board and computer interface with alarms alerting nurses and providers of potential sepsis patients based on vital signs and lab results. An ED quality employee tracks all ED admissions with sepsis including three hour EGDT monitoring with appropriate feedback (positive and negative) to nursing and physician staff within 72 hours and presents results at the monthly critical care meeting.

This project has created a culture change in the evaluation and tracking of sepsis treatment with quality improvement initiatives (M. Lipp, personal communication, September 26, 2016). A sepsis committee was created in December 2014 with the goal of attaining sepsis certification with a key portion of information obtained from the retrospective project data. July 2015 the facility received sepsis certification from The Joint Commission. When results of the pilot project were disseminated, the sepsis committee identified further opportunities for improvement and appointed a subcommittee to trend, identify, and create interventions to impact outcomes of sepsis care. The sepsis subcommittee is co-chaired by the ED quality RN and a critical care RN/charge nurse who is a master-prepared clinical nurse specialist (CNS).

The subcommittee consists of a multidisciplinary team including ED quality employee, critical care CNS, intensivist NP, education director, six nurse champions (one from each patient area), a hospitalist MD champion, information systems member, and a physician from ED and critical care. The goal is to create a code sepsis alert any where within the hospital setting to urgently evaluate, intervene, and emergently transfer to the appropriate discipline with focus on meeting core sepsis measures. Currently the facility has numerous code alerts

including cardiac arrest, rapid response, stroke, weather, missing patient (baby, children, and adults), and hostile environment which requires urgent intervention with specific plans in place to address the unique situation. Code sepsis is another opportunity to create an optimal intervention to impact lives and outcomes.

The critical care area documents 360-minute goals on a weekly based to staff members. Currently critical care is involved in an expansion program and more timely feedback is planned in 2017 after moving to a new area. The rapid response team is currently updating the documentation form to include SIRS criteria, sepsis tool, and protocoled sepsis interventions. Efforts are also focused on an attempt to implement a sepsis screen into EMR format for the medical surgical units including a multidisciplinary team that is nurse driven.

Using the sepsis checklist has increased identification of septic patients presenting to the ED requiring admission to critical care, empowered nursing staff, and created opportunities for providers to reevaluate and trend patient status. This project has reinforced that patient care is a team effort and all must work together to create positive patient outcomes. Critical care length of stay for severe sepsis/septic shock patient population has decreased .5 days during the pilot study. Many factors have influenced the decreased length of stay including step-down staff providing care for patients with higher acuity and an active palliative care service presence in critical care. The palliative care service requires a provider consult and provides supportive services for staff, patients, and families. With family meetings including providers, palliative care, social worker, case manager, and bedside nurse for discussion re progress, goals of care, and prognosis, many family members are choosing transition to comfort care with inpatient hospice options.

Evidenced based protocols and guidelines are disseminated throughout the literature from medical and nursing associations and societies, disease focused committees and collaborations, pharmaceutical companies, and insurance companies. Compliance to guidelines is rapidly moving toward reimbursements and fee for performance. Implementation of DRG reimbursement several years ago totally changed the health care environment as providers and facilities were challenged to redesign systems, decrease cost, and increase productivity to remain financially solvent. Development of outpatient facilities and surgical centers increased. Hospital length of stay decreased with increased use of home health and outpatient rehabilitation facilities. Improved technology also created opportunities for cost savings in patient care.

Nurses have a unique perspective and opportunity to assess, identify, and create systems to create a positive impact with patient care and appropriate interventions. As a Doctor of Nursing Practice (DNP) prepared nurse, guidelines and evidence can be critically evaluated, implemented in a variety of settings for improved patient outcomes, and create financial opportunities. Administrators and board of directors understand final line on the financial statement, but require guidance and education for the total impact for system changes. Information must be presented representing the impact on the total health care environment including all disciplines and services. As fee for performance reimbursement looms closer, all disciplines must come to the table with knowledge, a willingness to listen, attitude of teamwork and cooperation, and weight alternative procedures to maintain financial stability and continued excellent evidenced based care.

Applying existing evidence based on a framework creates unlimited opportunities and positive outcomes within the health care environment. Specific patient populations can be

targeted with improved outcomes when existing evidence is applied to enhance current treatment modalities. Evidence without implementation is useless information until applied which is the intention and objective of Doctor of Nursing Practice.

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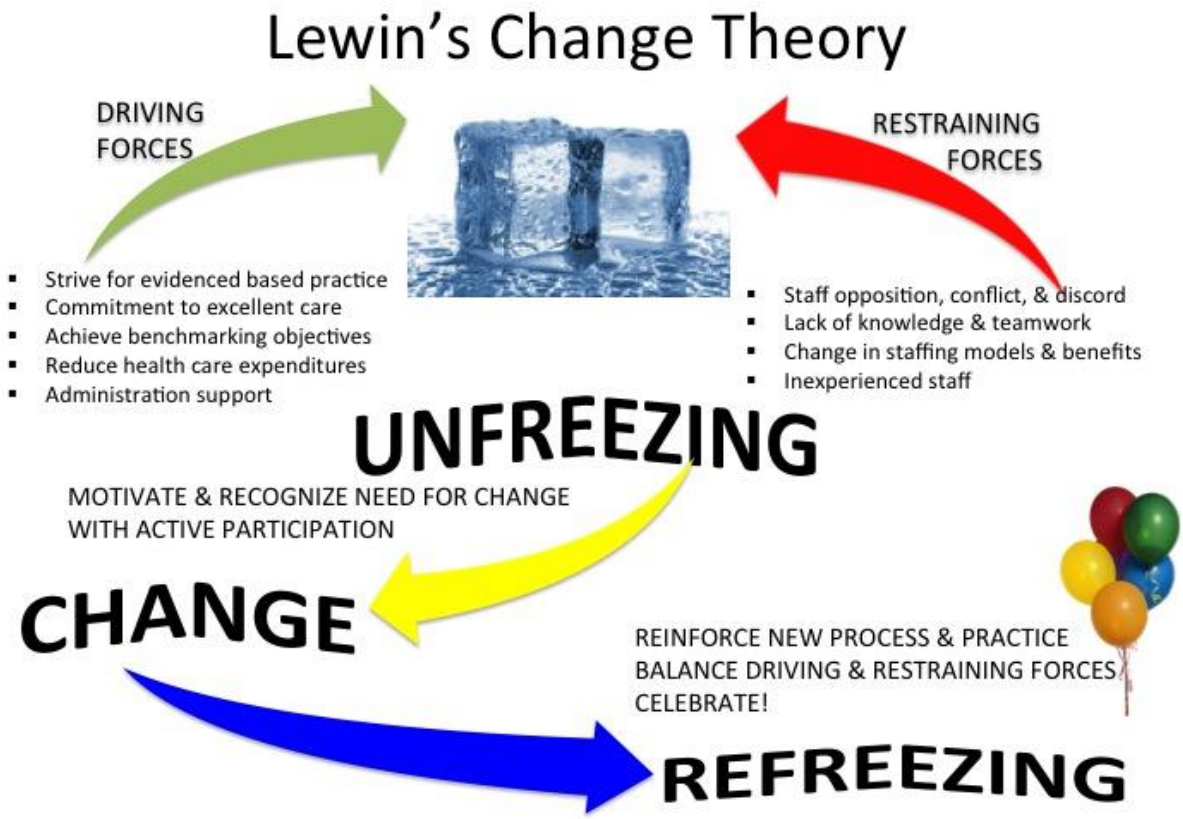
Appendix A

Lewin's Change Theory



Appendix B

Sepsis Needs Assessment

To make an impact on the treatment and management of sepsis, a potential infection must be suspected and subtle symptoms must be recognized. Sixty percent of septic patients at MRMC are admitted through the ED. A multidisciplinary approach of all health care providers must work together to combat the war on sepsis.

Completion of this assessment will help to identify current knowledge and potential opportunities to better identify sepsis states, patients at risk for sepsis, initial sepsis intervention. This will take 10-15 minutes to complete.

1. **Systemic Inflammatory Response Syndrome (SIRS) is characterized by which elements? Only two elements are required to meet SIRS criteria.**
    A. WBC, temperature, heart rate, respiration
    B. Lactate, WBC, blood pressure, temperature
    C. Mean arterial pressure (MAP), altered mental status, WBC, heart rate
    D. Heart rate, lactate, temperature, oliguria

2. **Sepsis associated with hypotension, hypoperfusion, and organ dysfunction is classified as:**
    A. Septic shock
    B. SIRS
    C. Severe sepsis
    D. Severe infection

3. **Sepsis with persistent hypotension despite adequate IVF resuscitation is called:**
    A. Neurogenic shock
    B. Cardiogenic shock
    C. Severe sepsis
    D. Septic shock

4. **The triage nurse evaluates a patient presenting with fever, WBC 20,000 and UTI symptoms. Which septic stage is represented?**
    A. Septic shock
    B. SIRS
    C. Severe sepsis
    D. Sepsis

5. **Which of the following may represent organ dysfunction associated with severe sepsis?**
    A. Respiratory failure requiring ventilator support
    B. New onset altered mental status
    C. Coagulopathy/DIC
    D. UOP < 0.5 ml/kg/hr despite volume resuscitation without previous renal dysfunction
    E. All of the above

6. **Early goal directed therapy (EGDT) includes:**
    A. Aggressive IVF resuscitation
    B. Appropriate and timely antibiotics
    C. Vasopressor support for persistent hypotension despite adequate IVF
    D. All of the above

7. **In the US about 750,000 cases of sepsis occur annually. Mortality rates for severe sepsis and septic shock are:**
    A. 10-20%
    B. 80-90%
    C. 30-50%
    D. 40-60%

Answers:

1. A
2. C
3. D
4. D
5. E
6. D
7. C

Appendix C

Needs Assessment Evaluation

	Percent of Answers				
	1	2	3	4	5
Q1 Systemic inflammatory response syndrome (SIRS) is characterized by which elements? Only two elements are required to meet SIRS criteria.	**47**	45	1	6	
Q2 Sepsis associated with hypotension, hypoperfusion, and organ dysfunction is classified as:	40	7	**53**	0	
Q3 Sepsis with persistent hypotension despite adequate IVF resuscitation is called:	1	10	20	**69**	
Q4 The triage nurse evaluates a patient presenting with fever, WBC 20,000, and UTI symptoms. Which septic stage is represented:	4	43	11	**42**	
Q5 Which of the following may represent organ dysfunction associated with severe sepsis?	3	1	0	2	**94**
Q6 Early goal directed therapy (EGDT) includes:	4	3	0	**93**	
Q7 In the US about 750,000 cases of sepsis occur annually. Mortality rates for severe sepsis and septic shock are:	0	36	**12**	52	

Correct answers:

1. A
2. C
3. D
4. D
5. E
6. D
7. C

Appendix D

Pilot Project Database Collection Form

Assigned #	ED arrival- triage	CC arrival	ED TIME minutes	1st Lactate drawn	TIME Lactate minutes	1st Antibiotics given	TIME Abiotic - minutes	Culture before antibiotics?	IVF 30ml/kg completed	TIME IVF minutes	MAP goal met	TIME MAP minutes	CVP goal achieved	TIME CVP minutes	2nd lactate obtained	TIME 2nd Lactate	Disposition
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	

Appendix E

	SEPSIS SCREEN	**YES**	**NO**
1	**SIRS** (systemic inflammatory response syndrome) Are any **TWO** or more signs & symptoms of infection present AND new to the patient? *Circle the appropriate responses* • T > 100.9 or < 96.8 • HR ≥90 • Respirations ≥ 20, PaCO2 ≤32 or need for ventilator • WBC ≥12,000 or ≤4,000 or ≥10% bands		
2	**Sepsis:** SIRS due to known or suspected infection. Patient history suggestive of new infection? *Consider* • Pneumonia/Empyema • UTI • Abdominal infection • Meningitis • Skin/soft tissue • Bone/joint infection • Wound infection • Chills or rigors • Catheter or device infection • Endocarditis		
3	**Severe sepsis:** sepsis with organ dysfunction, hypoperfusion or hypotension • Severe hypoxemia requiring >40% Fi02 • Lactic acid > 4 • MAP ≤70 or SBP ≤ 90 or need for continued vasopressors despite IVF resuscitation (30ml/kg) • Acute altered mental status • New serum creatinine ≥ 2.0 • Unexplained metabolic acidosis (pH ≤ 7.3 or BE ≤ -5) • Platelets ≤ 80,000 • Bilirubin > 3.0 (acute) • UOP ≤ 0.5ml/kg/hr despite IVF resuscitation		
4	**Septic shock:** septic induced hypotension or hypoperfusion despite adequate IVF resuscitation. Acute circulatory failure unexplained by other causes.		

IF ANSWER YES TO QUESTIONS 1,2 3, AND/OR **4 INSTITUTE ED SEPSIS PROTOCOL**

- STAT: labs & cultures per protocol – Notify ED provider of possible sepsis patient
- Start 2 large bore IV's with large bore tubing for NS infusion or bolus
- Notify ED Physician of potential sepsis patient – start antibiotics per physician order ASAP **after** cultures obtained

Appendix F

EMERGENCY DEPARTMENT SEPTIC SHOCK/SEVERE SEPSIS ORDER SET

<table>
<tr><td colspan="2">Provider may delete any orders below by striking through the order</td></tr>
<tr><td colspan="2">STAT Labs: CBC with Diff, PT/INR, PTT, CMP, Serum Venous Lactate, TSH, Troponin</td></tr>
<tr><td colspan="2">Blood cultures x 2 (different sites) PRIOR to antibiotic administration</td></tr>
<tr><td colspan="2">☐☐ABG</td></tr>
<tr><td colspan="2">☐☐Sputum Culture</td></tr>
<tr><td colspan="2">Foley catheter - UA with C&S</td></tr>
<tr><td colspan="2">Oxygen: titrate NC or face mask for SaO2 >92%</td></tr>
<tr><td colspan="2">IV: 2 large bore IV catheters with saline lock</td></tr>
<tr><td colspan="2">EKG</td></tr>
<tr><td colspan="2">Chest X-Ray – portable</td></tr>
<tr><td colspan="2">For SBP <90 and/or lactate ≥4 mmol/L, initial minimum NS 30ml/kg bolus on pressure bag.</td></tr>
<tr><td colspan="2">Antibiotics within 1 hr of Triage in absence of suspected source, treat for pneumonia, CAP or HCAP</td></tr>
<tr><td>☐☐Levofloxacin 750 mg IV STAT

☐☐Ceftriaxone 1 gram IV STAT

☐☐Levaquin 750 mg IV STAT

☐☐Zosyn 4.5 GM IV STAT
OR
☐☐Merrem 1 Gm IV STAT

☐☐Ampicillin 2 grams IV STAT

☐☐Clindamycin 900 mg IV STAT

☐☐Vancomycin 1 gram IV STAT

☐☐_____

☐☐_____

☐☐_____</td><td>Presumed Community Acquired Pneumonia:
Levofloxacin 750 mg IV STAT
Ceftriaxone 1 gram IV STAT

Presumed Health Care Associated Pneumonia
Zosyn 4.5 Gm IV STAT or Merrem 1 GM IV STAT
Levequin 750 mg IV STAT
Vancomycin 1 gram IV STAT

Presumed Abdominal Source:
Merrem 1 Gm IV STAT

Presumed Meningitis:
Ceftriaxone 2 grams IV STAT
(consider Ampicillin and/or Vancomycin)

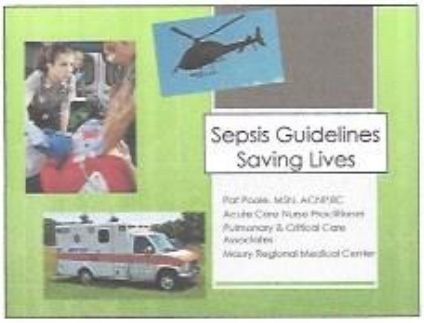
Severe Skin / Soft tissue infections:
Clindamycin 900 mg IV STAT
Vancomycin 1 gram IV STAT
(consider Levofloxacin or Merrem if Diabetic)

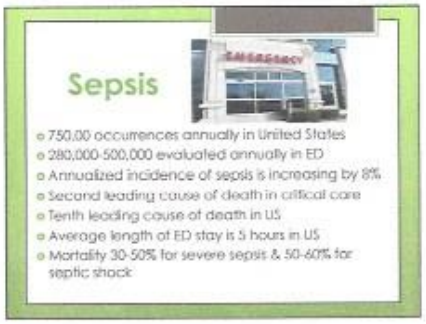
Line Sepsis:
Vancomycin 1 gram IV STAT
(consider antifungal if on TPN)</td></tr>
<tr><td colspan="2">Vasopressors for hypotension not responding to fluid resuscitation – titrate FOR MAP > 65 ☐☐Levophed (Norepinephrine) infusion @ 2 to 20 mcg/min - begin @ _____ mcg/min
☐☐Dopamine Infusion @ 3 to 20 mcg/kg/min begin @ _____mcg/kg/min
DO NOT START DOPAMINE IF TACHYCARDIC</td></tr>
</table>

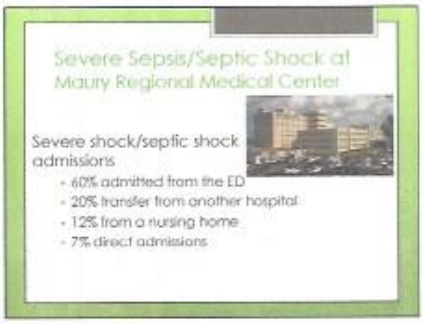
Signature/Date/Time:

Appendix G

Sepsis Update and Fast Sepsis Protocol Program



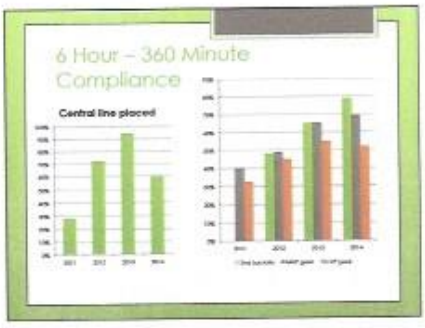




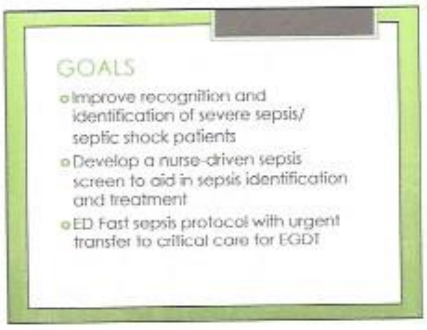

3 Hour (180 minute) Goal Compliance
Cultures before antibiotics


Early Goal Directed Therapy (EGDT) – Sepsis Treatment Bundles
6 Hour Goal – 360 minutes
MAP > 65 mm Hg
CVP goal > 8-10 or 12-15 if intubated
Recheck Lactate
Document re-evaluate volume status & tissues perfusion
VS, CV exam, cap refill, peripheral pulse documentation
OR
Two of these – CVP, Scv02, bedside echo US, passive leg raises or IVT bolus


6 Hour (360 minute) Goal Compliance
2nd Lactate 360 goal
MAP 360 goal
CVP 360 goal


6 Hour – 360 Minute Compliance
Central line placed


OPPORTUNITIES
Signs & symptoms of sepsis
Improving recognition of sepsis
Optimal treatment with early goal directed therapy (EGDT)
Appropriate ED disposition


GOALS
Improve recognition and identification of severe sepsis/ septic shock patients
Develop a nurse-driven sepsis screen to aid in sepsis identification and treatment
ED Fast sepsis protocol with urgent transfer to critical care for EGDT

Implementation

Team Members
- ED/critical care managers, providers/staff
- Unit Champions
- Quality Service
- Senior Leadership
- IT Support

Staff Education
- Needs assessment
- Sepsis PowerPoint presentation including use of sepsis tool and fast sepsis protocol
- Pre & post test

SIRS Criteria

- Temperature > 100.4 or < 98.6
- Heart Rate ≥ 90 beats/minute
- Respiration ≥ 20, or CO_2 ≥32, or ventilator requirement
- White blood cell count ≤4,000 or ≥12,000 or ≥10% bands

Sepsis Etiology Considerations

- Pneumonia or empyema
- UTI
- Cancer
- Chronic steroids
- Abdominal infection
- Skin/soft tissue
- Meningitis
- Bone/joint
- Wound
- Fever or chills
- Indwelling catheter or device

Severe Sepsis

- MAP ≤ 70 or SBP ≤ 90 or continued need for vasopressors after 30 ml/kg IVF bolus
- Severe hypoxemia requiring ≥ 40% FiO2
- Acute severe altered mental status
- Lactic Acid ≥4 (normal 0.4-2)
- Unexplained metabolic acidosis with a pH ≤ 7.3 or base excess ≤ -5
- New serum creatinine > 2.0

EGDT in the ED

- IV access for IVF bolus 30 ml/kg – NS or LR
- If unable to obtain access, consider intraosseous
- STAT peripheral blood cultures x2, UA with culture, sputum culture if indicated
- Rainbow lab tubes – CBCD, CMP or BMP or renal panel, serum lactate, VBG
- CXR
- IV antibiotics AFTER cultures obtained
- If MAP <70 or SBP <90 after IVF bolus, add a vasopressor – Levophed, Neosynephrine or Dopamine

ED Sepsis Triage

9/10/16

Fast Sepsis Protocol

EGDT in Critical Care

- MAP goal >65
- Central venous catheter access with CVP goal 8-12 or 12-15 mm Hg if intubated
- Consider arterial catheter if requiring vasopressors
- Repeat lactate to re-evaluate perfusion
- Continue appropriate broad spectrum antibiotics

Community Acquired Pneumonia Antibiotics

Non-ICU patient	ICU Patient
Levaquin OR Rocephin & Zithromax OR Rocephin & Doxycycline	Rocephin & Zithromax OR Rocephin & Levaquin

Healthcare Acquired Risks

- Received antibiotics within last 3 months
- Hospitalization within past 3 months – includes hospital, nursing home, etc.
- Previous drug resistant organisms

Antibiotic Choices - Healthcare Acquired Pneumonia (HCAP)

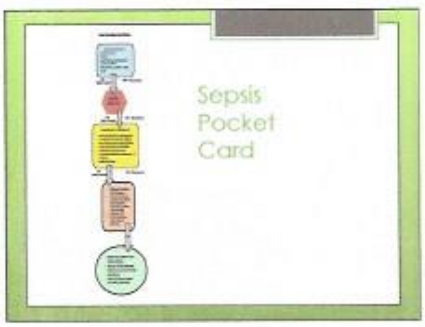
- Zithromax & Cefepime
- Zithromax & Zosyn
- Zithromax & Meriem
- Levaquin & Aztreonam (for PCN allergy)
- If Zithromax and Levaquin contraindicated, substitute Doxycycline

For neutropenic patients with septic shock or a history of multiple drug resistant Gram negative organism, may add Tobramycin

MRSA Risk

- Vancomycin or Linezolid
- THIS SHOULD BE THE FIRST ANTIBIOTIC GIVEN!

9/10/16



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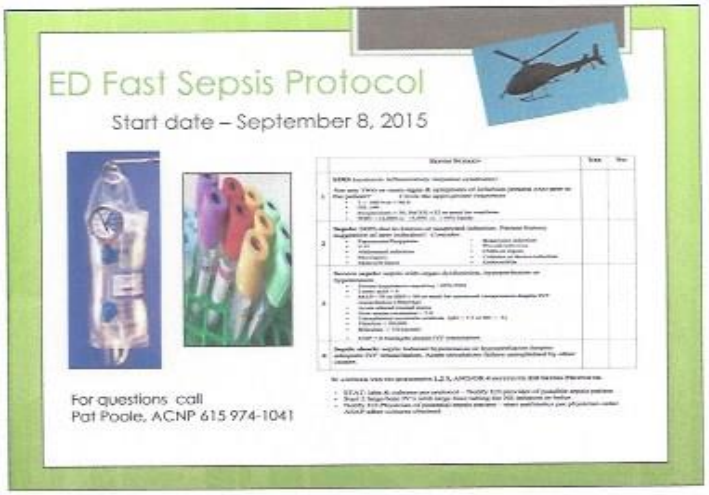
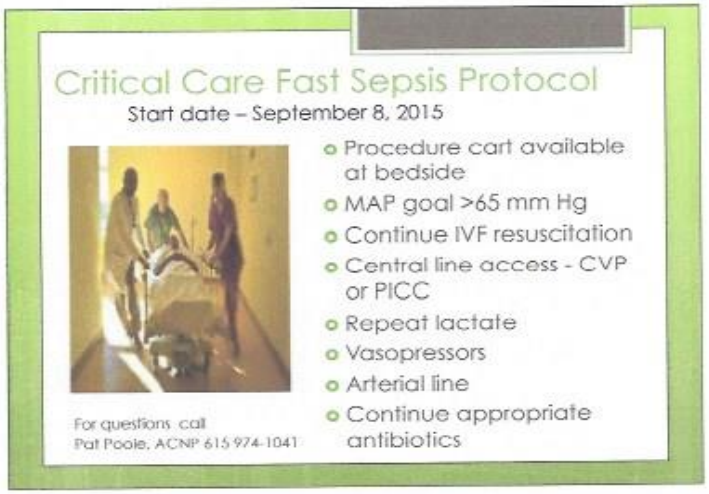
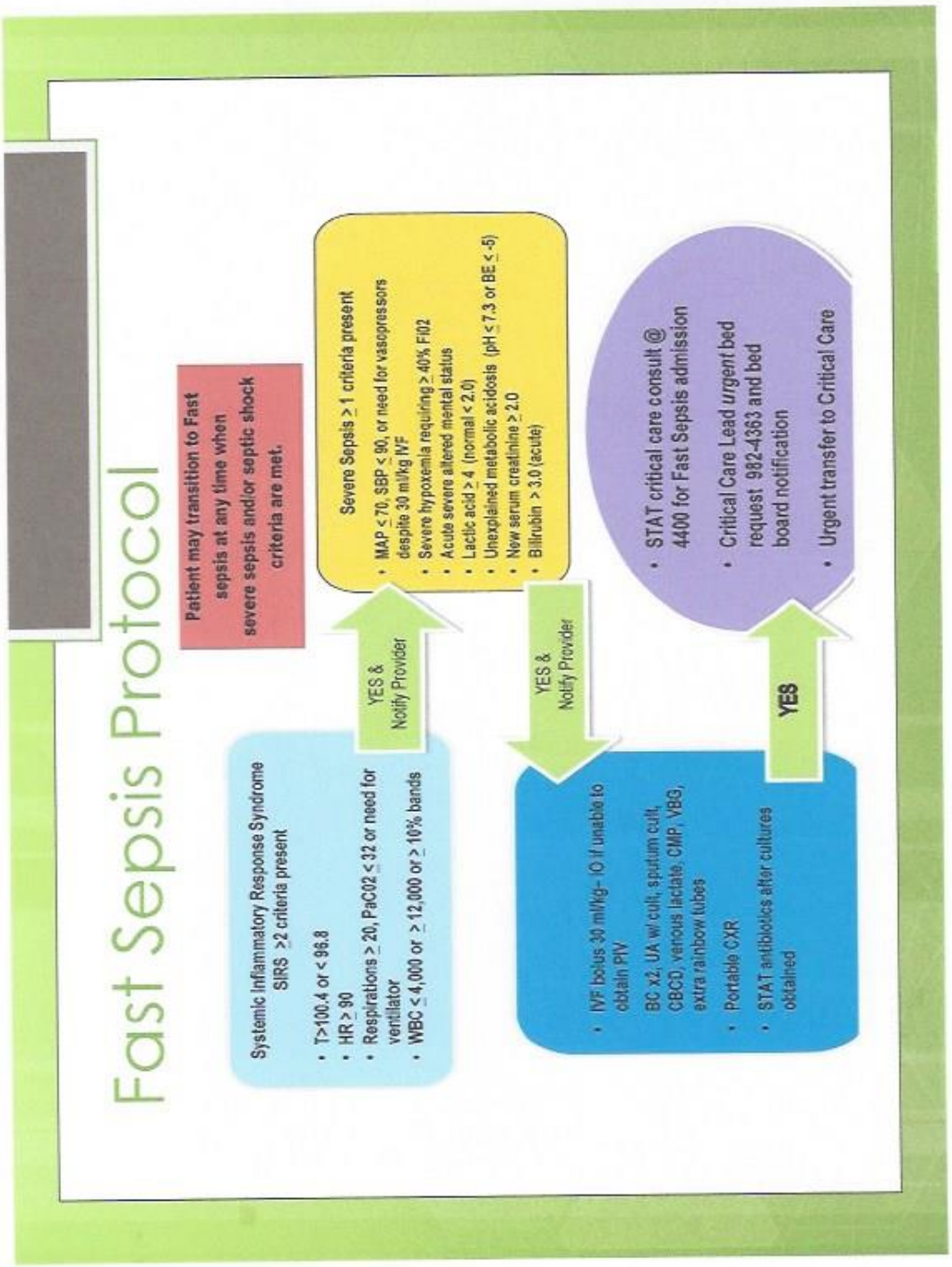
Appendix H

Fast Sepsis Project Announcement & Poster






Fast Sepsis Protocol
Patient may transition to Fast sepsis at any time when severe sepsis and/or septic shock criteria are met.
Systemic Inflammatory Response Syndrome SIRS ≥2 criteria present
T>100.4 or < 96.8
HR ≥ 90
Respirations ≥ 20, PaC02 ≤ 32 or need for ventilator
WBC ≤ 4,000 or ≥ 12,000 or ≥ 10% bands
YES & Notify Provider
Severe Sepsis ≥ 1 criteria present
MAP ≤ 70, SBP ≤ 90, or need for vasopressors despite 30 ml/kg IVF
Severe hypoxemia requiring ≥ 40% FiO2
Acute severe altered mental status
Lactic acid ≥ 4 (normal < 2.0)
Unexplained metabolic acidosis (pH ≤ 7.3 or BE ≤ -5)
New serum creatinine ≥ 2.0
Bilirubin > 3.0 (acute)
YES & Notify Provider
IVF bolus 30 ml/kg– IO if unable to obtain PIV
BC x2, UA w/ cult, sputum cult, CBCD, venous lactate, CMP, VBG, extra rainbow tubes
Portable CXR
STAT antibiotics after cultures obtained
YES
STAT critical care consult @ 4400 for Fast Sepsis admission
Critical Care Lead urgent bed request 982-4383 and bed board notification
Urgent transfer to Critical Care

Appendix I

IRB Approval

MAURY REGIONAL MEDICAL CENTER

February 28, 2014

Patricia W. Poole, Nurse Practitioner
Maury Regional Medical Center
1222 Trotwood Avenue
Medical Office Building, Suite 503
Columbia, TN 38401

RE: **Implementation of an Evidence Based Early Sepsis Recognition and Treatment Protocol in the Emergency Department and Critical Care**

Dear Ms. Poole,

On December 2, 2013, the Institutional Review Board/Ethics Committee conducted a review of your request to approve the above-referenced study at Maury Regional Medical Center. The purpose of the project was explained to the committee as a pilot project to develop a nurse-driven sepsis screening for improving early sepsis recognition and intervention with urgent transfer to critical care.

This letter is to confirm that the IRB/Ethics Committee approved your study with a suggestion that you consider modification to the study design. This suggestion for modification is not mandatory, but provided for consideration, only.

Approval is effective as of **December 2, 2013**. This approval expires on **December 2, 2014** at which time the IRB/Ethics Committee requires annual review and approval for continued use. The annual report of results should include any unanticipated adverse events related to the study.

As noted above, the IRB/Ethics Committee approval will expire one year from the initial approval date of December 2, 2013. Please inform our IRB/Ethics Committee if there are any significant changes in the project or intent of the study. Feel free to contact us if you have any questions. Contacts are as follows:

IRB/Ethics Committee Chair: James Grant Barr, MD PhD
IRB/Ethics Committee Contact: Beth Fleming, Director, Risk Management (ext. 2264)

Sincerely,

James Grant Barr, MD PhD
Chairman, Institutional Review Board/Ethics Committee

JGB/bf

cc: Deborah Lumpkins, Senior VP Nursing Services/Chief Nursing Officer
Holly Kunz, Assistant CNO/Administrative Director of Emergency Services
Cathy Malone, Administrative Director CV/Pulmonary Services
Ginger Dickens, Nurse Manager – Critical Care

MAURY REGIONAL
MEDICAL CENTER

December 16, 2014

Patricia W. Poole, Nurse
Practitioner Maury Regional
Medical Center 1222 Trotwood
Avenue Medical Office Building..
Suite S03 Columbia, TN 38401

RE: Implementation of an Evidence Based Early Sepsis Recognition and Treatment Protocol in the Emergency Department and Critical Care Twelve-Month Extension

Dear Ms. Poole,

On December 2, 2014, the Institutional Review Board/Ethics Committee conducted a review of your request for a four-month extension of the above-referenced study

This letter is to confirm that the IRB/Ethics Committee approved the extension. This approval expires on December 2, 2015 at which time the IRB/Ethics Committee requires annual review and approval for continued use. The annual report of results should include any unanticipated adverse events related to the study.

Please inform our IRB/Ethics Committee if there are any significant changes in the project or intent of the study. Feel tree to contact us if you have any questions. Contacts are as follows:

IRB/Ethics Committee Chair:	James Grant Barr, MD PhD
IRB/Ethics Committee Contact:	Beth Fleming. Director, Risk Management (ext. 2264)

Sincerely,

James Grant Barr, MD by Beth Fleming

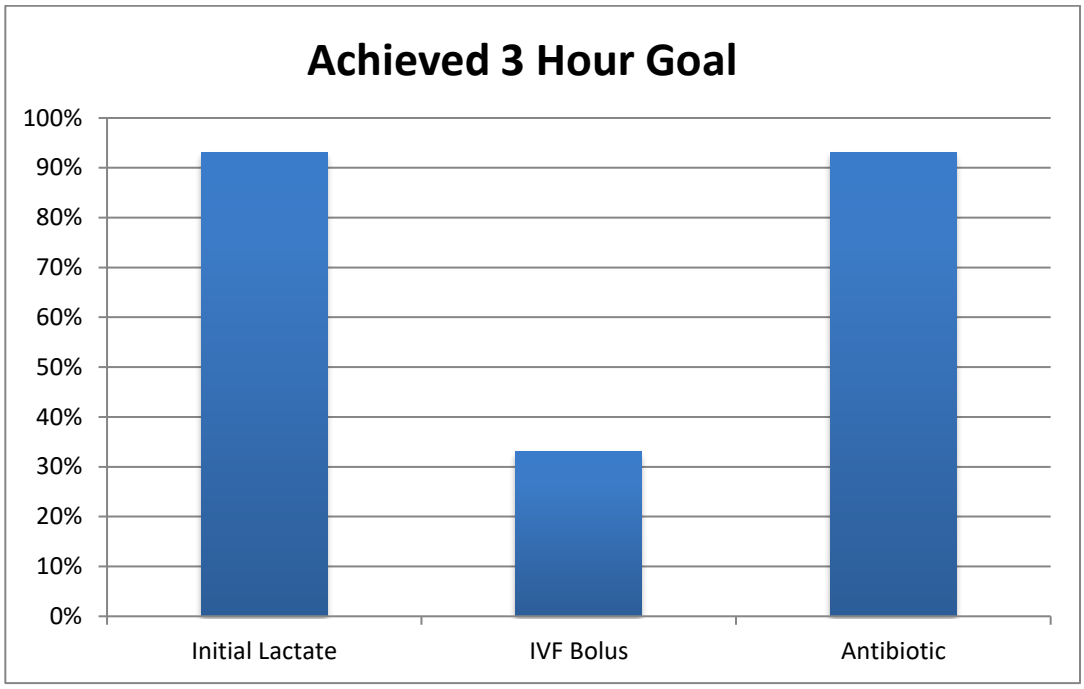
James Grant Barr, MD PhD
Chairman, Institutional Review Board/Ethics Committee

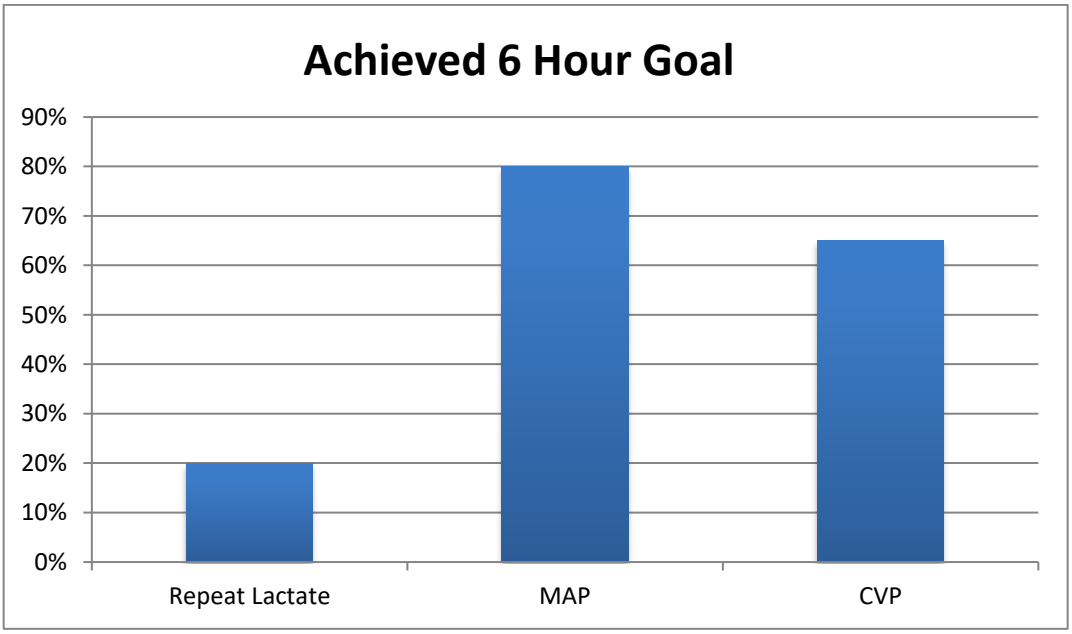
JGB/bf

cc: Deborah Lumpkins, Senior VP Nursing Services/Chief Nursing Officer
Holly Kunz, Assistant CNO/Administrative Director of Emergency Services Cathy Malone, Administrative Director CV/Pulmonary Services Ginger Dickens, Nurse Manager - Critical Care

Appendix J

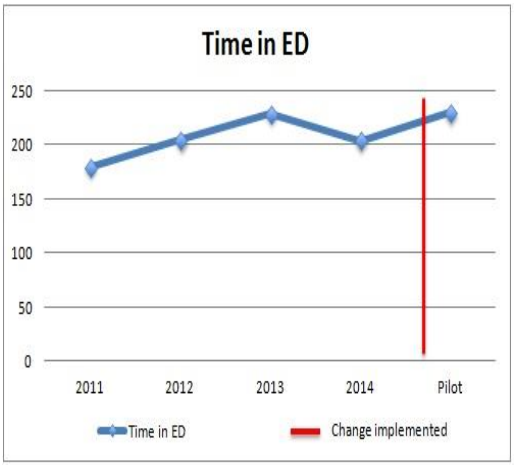
Pilot Project Goal Compliance

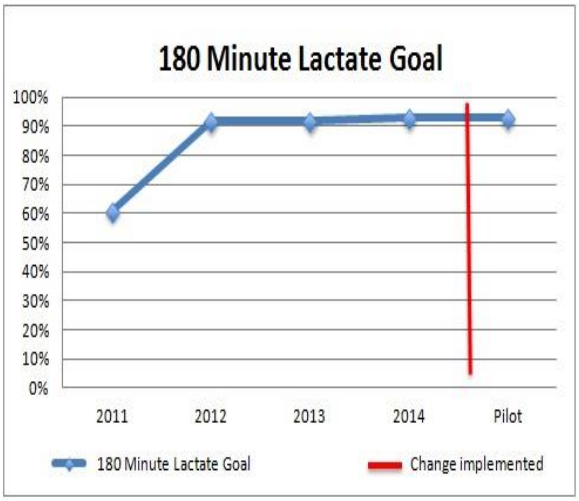


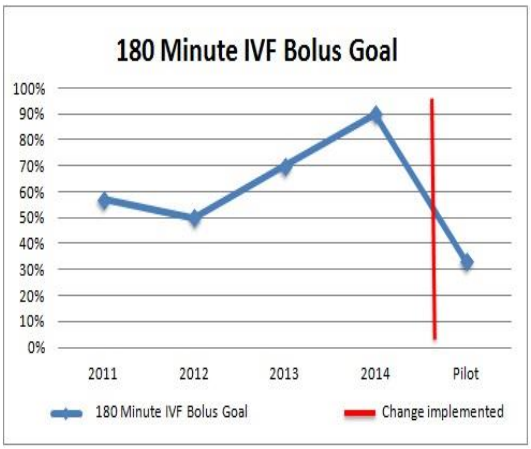


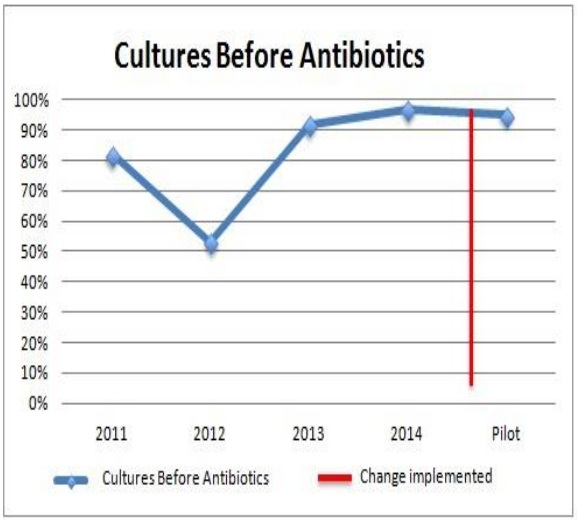
Appendix K

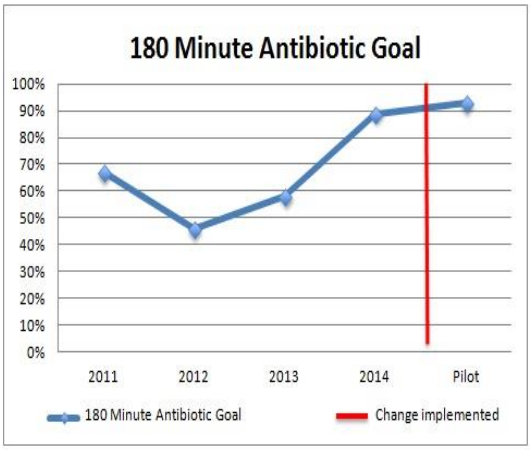
Compliance Results 2011-Pilot Project

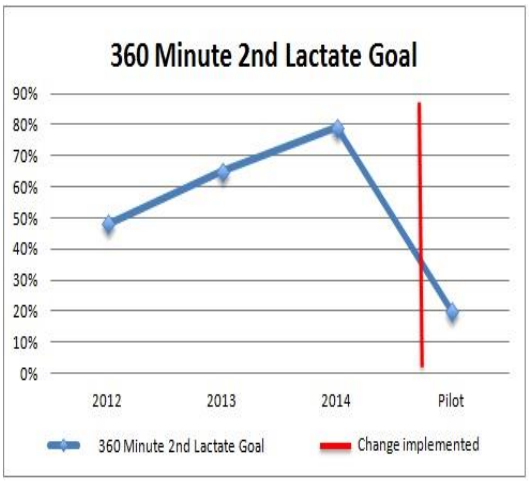


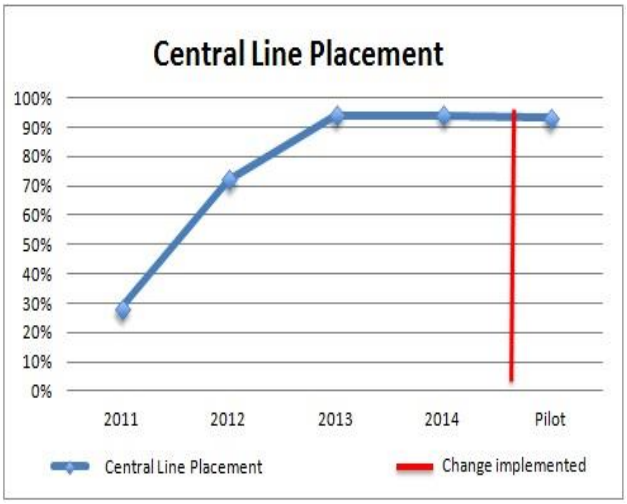




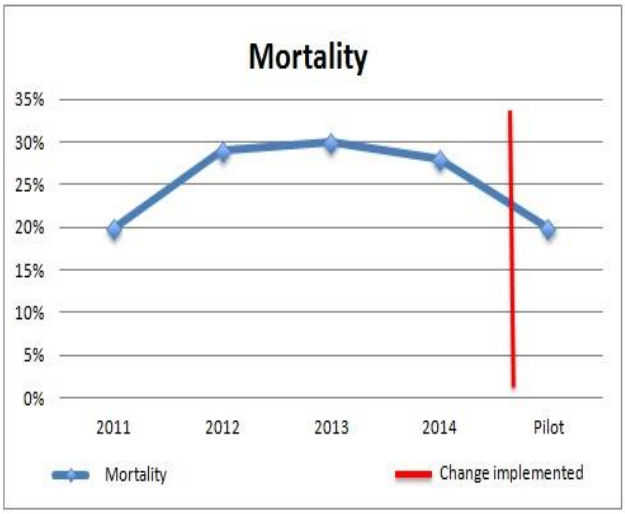





360 Minute 2nd Lactate Goal
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2012
2013
2014
Pilot
360 Minute 2nd Lactate Goal
Change implemented


Central Line Placement
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2011
2012
2013
2014
Pilot
Central Line Placement
Change implemented


360 Minute MAP Goal
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2011
2012
2013
2014
Pilot
360 Minute MAP Goal
Change implemented


Mortality
35%
30%
25%
20%
15%
10%
5%
0%
2011
2012
2013
2014
Pilot
Mortality
Change implemented


360 Minute CVP Goal
70%
60%
50%
40%
30%
20%
10%
0%
2011
2012
2013
2014
Pilot
360 Minute CVP Goal
Change implemented

Appendix

Sepsis Post Test

Completion of this test take 20-25 minutes.

Mr. Smith is a 74 year old male presenting to the ED via EMS with a 3-day history of fever, chills, and cough. His family was unable to arouse him for supper and called EMS. The family report no prior medical conditions, he takes no medications, and "He never sees a doctor." Over the past 24 hours, Mr. Smith has been confused and lethargic. Vital signs on arrival to the ED: T 102.5, HR 138 with sinus tachycardia, R 32, BP 70/40, and SaO2 84% on room air.

1. **Which of the following can best describe the patient's condition?**
    A. Septic Shock
    B. Systemic Inflammatory Response Syndrome (SIRS)
    C. Severe Sepsis
    D. Sepsis

2. **How will you initially manage this patient?**
    A. IV fluid bolus
    B. Antibiotic therapy
    C. Vasopressor support
    D. Supplemental O2 and airway management

3. **After receiving IV Normal Saline 20 ml/kg, Mr. Smith is more awake and denies any pain or discomfort. Vital signs include: HR 128, R 22, BP 80/41, and SaO2 92% on 1.00 NRB. Chest X-ray shows left lower lobe pneumonia. This represents which stage of sepsis?**
    A. Septic Shock
    B. Systemic Inflammatory Response Syndrome (SIRS)
    C. Severe Sepsis
    D. Sepsis

4. **Mr. Smith continues hypotensive despite a total of 30 ml/kg of IVF. What is your next treatment option?**
    A. IV steroids
    B. Vasopressin
    C. Levophed
    D. Dopamine

5. **The patient will be admitted to the critical care unit with a diagnosis of community acquired pneumonia, severe sepsis, and septic shock. What antibiotic regime would you expect to be ordered per ED sepsis protocol?**
    A. Linezolid and Clindamycin
    B. Levofloxacin and Ceftriaxone

C. Ampicillin and Vancomycin
D. Vancomycin and Metronidazole

Mrs. Jones is an 86-year-old female nursing home resident. She's been hospitalized numerous times in the past few months with recurrent UTI and sepsis requiring outpatient antibiotics. This morning she was unresponsive with a BP 60/30. EMS service was requested for transport to the ED for further evaluation and treatment. Upon arrival to the ED, vital signs are: T 95.7, HR 130, R 24, BP 72/34, SaO2 87% on 40% VM. In route she received 1 L normal saline via PICC placed 2 months ago. Scant, dark, cloudy urine is in the Foley bag. Mrs. Jones remains minimally responsive.

6. **Mrs. Jones represents which stage of sepsis?**
   A. Septic Shock
   B. Systemic Inflammatory Response Syndrome (SIRS)
   C. Severe Sepsis
   D. Sepsis

7. **According to EGDT, what is the order of your priorities?**
   A. STAT call to PICC service to replace line, IVF, replace Foley, call respiratory therapy for assistance with airway
   B. CXR, EKG, IVF, antibiotics, labs and cultures
   C. Labs and cultures, contact family for code status, IVF, and antibiotics
   D. Airway management, IVF, sepsis labs with pan cultures, and appropriate antibiotics ASAP

8. **Mrs. Jones has increased work of breathing and respiratory failure. She remains lethargic with little response. Levophed at 12 mcg/min is required for BP support. How will you support her airway?**
   A. BIPAP
   B. Intubation and ventilator support
   C. CPAP
   D. 1.00 NRB

A 57-year-old male comes to the ED with complaints of fever, chills, and rigors for 3 days. He has a history of HTN and poorly controlled DM II with A1c 9.2 six weeks ago. He denies any urinary symptoms. No cough. No source of infection is identified. Chest x-ray is unremarkable. Vital signs: T 100.9, HR 92, R 20, BP 100/56, SaO2 92% on 2 LPM. Labs: WBC 18,000, HCT 42, Na 138, K 4.9, creatinine 1.6, glucose 245, and lactate 1.4, and UA negative. The patient receives antibiotics and admitted to step-down.

9. **What stage is sepsis is represented?**
   A. Septic Shock
   B. SIRS
   C. Severe Sepsis
   D. Sepsis

E. He does not have sepsis

10. **At midnight the patient is transferred to critical care after a CAT call. His BP is 70/40, HR 114, and R 28. UOP for past 8 hours 240 ml. The patient meets criteria for which stage of sepsis?**
    A. Septic Shock
    B. SIRS
    C. Severe Sepsis
    D. Sepsis

11. **The patient is fluid resuscitated; per EGDT guidelines, how much IVF should he receive?**
    A. 2 L NS
    B. 30 ml/kg NS
    C. 10-20 ml/kg D5W
    D. 3 L ½ NS

12. **Adequate organ and tissue perfusion must be maintained while efforts are made to identify and treat the underlying infection contributing to sepsis states. How is adequate organ and tissue perfusion preserved?**
    A. Preventing hypotension
    B. Maintaining body temperature
    C. Prevent hypoventilation
    D. Administration of antibiotics

Answers:

1. C
2. D
3. A
4. C
5. B
6. C
7. D
8. B
9. B
10. C
11. B
12. A