Prompt Identification of Sepsis Patients:

A Retrospective Quantitative Comparative Descriptive Study

A master's project from Queens University of Charlotte, under the direction of

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Abstract

Without prompt identification and rapid initiation of treatment, sepsis maintains high mortality rates. The purpose of this study was to determine if, over a three-month period, application of additional screening criteria for adult patients in a rural Emergency Department (ED) would have identified potential sepsis patients more rapidly than the current standard practice. The study sample included all adult patients who presented to the ED with chief complaints of abdominal pain, urinary problems, and shortness of breath between November 1, 2014 and February 28, 2015. Only patients with a final billing diagnosis of sepsis, septicemia, severe sepsis, urosepsis, bacteremia, or septic shock were included (*n*=26). Via retrospective chart review, results from the application of current and revised screening criteria were compared. Revised screening criteria would have led to more rapid patient identification in five out of twenty-six screenings (approximately 19%). The outcome was unchanged in twenty-one out of twenty-six patients (approximately 81%). Further studies with a larger sample size are suggested to determine significance of findings, as the ability to successfully identify sepsis patients more rapidly would significantly improve sepsis-related patient outcomes and mortality rates.

Keywords: sepsis, septicemia, septic shock, outcomes, screen, adult, infection

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Code Sepsis Patient Identification

Sepsis is a widespread and costly diagnosis with a high mortality rate without swift identification and treatment. This illness afflicts hundreds of thousands of Americans and costs billions of dollars annually (Chang, 2010). Sepsis mortality rates increase as cases worsen. "Death rates are high, with 20% for sepsis, 40% for severe sepsis, and more than 60% for septic shock" (Chang, 2010, p.1). Rapid patient identification, before severe sepsis and septic shock occur, is essential to decrease negative outcomes. Numerous studies support early identification of septic patients using appropriate screening criteria (American Association of Critical-Care Nurses, 2014; Bernstein & Lynn, 2014; Buck, 2014; Coleman & Jackson, 2014; Dellinger et al., 2013; Kleinpell & Schorr, 2014); LaRosa, Ahmad, Feinberg, Shah, DeBrienza, & Studer, 2012; Lopez-Bushnell & Jaco, 2014; Robson and Daniels, 2013). Aitken et al. (2011) and Kleinpell & Schorr (2014) suggest utilizing screening tools and other routine assessment screens to detect signs and symptoms of early sepsis. Potential sepsis screening methods include both paper tools and electronic surveillance. Buck (2014) discusses a software program developed by Spectrum Health system that uses computer algorithms to identify potentially septic patients based upon lab results and documentation. Staff utilizes these algorithms to trigger a sepsis alert, resulting in prompt team response and early initiation of treatment.

Upon presentation to the Emergency Department (ED) at Stanly Regional Medical Center (SRMC), patients age 18 and over undergo screening for signs and symptoms of sepsis using a two-part screening tool (Appendix A). Patients who screen positive receive an immediate point-of-care (POC) lactate test to evaluate for the presence of sepsis. However, it is prudent to speculate that screening criteria may not effectively capture all potential patients. The purpose of this retrospective quantitative comparative descriptive chart review is to determine if, over a

three-month period, application of additional screening criteria for adult patients in the ED would have identified potential sepsis patients more rapidly than the current standard practice.

Theoretical Framework / Conceptual Model

Ida Jean Orlando's nursing process theory is applicable to the issue of sepsis patient identification (Peterson & Bredow, 2013). This theory most closely resembles the basics of nursing practice and the nursing process, including assessment, diagnosis, planning, implementation, and evaluation. Theory dimensions include observing a patient in need, using knowledge and experience to formulate a plan to assist the patient, and then implementing the developed plan. Once implemented, it is important to evaluate the effectiveness and appropriateness of the interventions. Based upon this evaluation, interventions may require changing or customization. Orlando's theoretical concepts assist in process improvement projects and coincide with similar information discussed by Kleinpell & Schorr (2014), who describe the nurse as an integral component of the improvement cycle.

Literature Review

Literature review findings support early detection of sepsis patients and treatment bundle implementation to improve sepsis-related morbidity and mortality (American Association of Critical-Care Nurses, 2014; Bernstein & Lynn, 2014; Buck, 2014; Coleman & Jackson, 2014; Dellinger et al., 2013; Kleinpell & Schorr, 2014; LaRosa, Ahmad, Feinberg, Shah, DeBrienza, & Studer, 2012; Lopez-Bushnell & Jaco, 2014; Robson and Daniels, 2013). Buck (2014) discusses a piloted sepsis alert program on a digestive disease medical surgical unit within Spectrum Health system in Michigan. Results demonstrated that "only 17% (n = 102) of the 617 patients who triggered a sepsis alert during the first eight months of the program had a discharge diagnosis of sepsis, severe sepsis, or septic shock" (p. 130). However, 40% of the other patients

(*n* = 246) did require some sort of advanced intervention, indicating the program was successful in improving levels of patient care overall. Data supporting early sepsis patient identification was an important finding in a prospective cohort study conducted in a medical surgical intensive care unit at a large, urban, tertiary care teaching hospital by LaRosa, Ahmad, Feinberg, Shah, DeBrienza, & Studer (2012). Patients meeting early sepsis screening criteria were placed in a "Code SMART" group. Results indicated that at time of discharge, 91% of Code SMART patients survived, but only 71% of the non-Code SMART patients survived (LaRosa, et al., 2012). In a study piloted on two medical surgical units at a University of New Mexico Hospital (*n*=225), a sepsis screening tool was tested, with a 30% reduction in sepsis mortality rates. Following house-wide implementation of the screening tool, mortality rates decreased by over 50%, with 400 out of 700 sepsis patients successfully treated (Lopez-Bushnell & Jaco, 2014).

Some studies go further, illustrating cost benefit in early sepsis patient identification (Coleman & Jackson, 2014). One quantitative study, conducted in an Intensive Care Unit (ICU) at Holy Spirit Hospital in Gettysburg, Pennsylvania, involved initial sepsis screening, with subsequent screenings every eight hours. Once completed, the process went live house-wide, incorporating the screening tool within their informatics system. Mean length of stay decreased by six days, readmission rate decreased by 12.2%, and annual cost savings totaled $347,000.

Professional nursing organizations also support early identification of sepsis patients. The American Association of Critical-Care Nurses (AACN) (2014) discussed the importance of early sepsis detection referencing a program at Lockheed-Martin in Fort Worth, Texas. Benefits of this program included less false alarms and more timely diagnosis than relying upon providers only. These findings support building sepsis screening tools into informatics systems to facilitate more rapid symptom recognition.

Designation of appropriate and accurate sepsis screening criteria is an important aspect of successful patient identification. Most healthcare organizations develop screening criteria the Surviving Sepsis Campaign guidelines (Dellinger et al., 2013). Bernstein & Lynn (2014) discuss utilizing decreased oxygen levels, organ failure signs/symptoms such as liver enzyme abnormalities, decreased urine output, and abnormal renal function tests in screening criteria. Robson & Daniels (2013) indicate screening criteria should include urine output measurements of less than 0.5mL/kg/hour for two hours, and oxygen saturation levels less than 90%.

Methodology and Procedure

Design and sample

This retrospective quantitative comparative descriptive chart review transpired in the ED of SRMC, a small 119 bed rural hospital in the piedmont of North Carolina. The study sample included all adult patients who presented to the ED with chief complaints of abdominal pain, urinary problems, and shortness of breath between November 1, 2014 and February 28, 2015.

Inclusion and exclusion criteria

Inclusion Criteria:	**Rationale:**	**Exclusion Criteria:**	**Rationale:**
Adult patients	Current Code Sepsis protocol only addresses patients age 18 and greater	Patients age 17 and younger	Current Code Sepsis protocol only addresses patients age 18 and greater
ED patients with an ED diagnosis of sepsis, septicemia, severe sepsis,	Only the ED has a Code Sepsis protocol	Inpatients and surgical patients	There are no Code Sepsis activation procedures for any department besides

urosepsis, bacteremia, or septic shock			the E.D. at this time
Patients who received a final diagnosis of sepsis based upon final billing	This will be the sample group	Patients who did not have sepsis as a final billing diagnosis	These patients will not be included in the sample group
Patients who were treated between November 1, 2014 and February 28, 2015	Sample group will only consist of patients treated within this timeframe	Patients who were treated during any other timeframe than November 1, 2014 and February 28, 2015	Sample group will only consist of patients treated between November 1, 2014 and February 28, 2015
Patients with signs/symptoms of infection (ex. nausea/vomiting, productive cough, possible skin infection, burning with urination and/or urinary frequency	Part of the current Code Sepsis protocol requires patients to have potential infectious processes	Patients with noninfectious complaints (ex. sprains, etc.)	Part of the Code Sepsis protocol requires patients to have potential infectious processes

Methods

The data collection tool utilized was a revised version of SRMC's current Code Sepsis Screening Tool, which has no existing reliability or validity data. The existing tool first assesses all patients age eighteen and greater for a potentially infectious process. The absence of signs and symptoms of infection, including nausea/vomiting, productive cough, and/or burning with urination, excludes the participant from the study. If infectious symptoms are present, the screening nurse proceeds to step two of the process. In step two, the nurse assesses for signs and symptoms of organ dysfunction using parameters such as heart rate, systolic blood pressure, temperature, and white blood cell count. These screening criteria utilize guidelines discussed in the Surviving Sepsis Campaign Guidelines (Dellinger et al., 2013). The study's revised Code Sepsis Screening Tool (Appendix B) included all existing criteria, in addition to oxygen saturation levels less than ninety percent, significant edema, and decreased urine output, to facilitate early identification of more potentially septic patients.

Data collection, management, and analysis

The method of data collection was a retrospective chart review. A report generated from the electronic documentation system based upon chief complaints and visit dates provided the initial patient list. ED records of the final sample group based upon application of all inclusion and exclusion criteria were accessed. Evaluation of patients meeting inclusion criteria incorporated both the existing and revised SRMC Code Sepsis Screening Tool. Each patient included in the study received a code number for tracking purposes, to assure de-identification

on all eighteen elements (Grove, Burns, & Gray, 2013). The paper records include the initial patient list printed from the electronic documentation system and individual screening tools. They are maintained in a notebook marked “Confidential” and maintained in a secure desk drawer within the researcher’s office. Records will remain secure for a period of three years, and will then be shredded.

An Excel spreadsheet, used to compile data, provides a comparison of the results of both existing and additional study criteria. Data were calculated using percentages, and a comparison of differences in outcomes between the two tools performed. The use of a single researcher to perform both the screenings and double data entry increased the reliability of the results.

Results

An initial report generated by the electronic medical record based upon study timeframe and presenting complaints (shortness of breath, urinary problems, and abdominal pain), yielded 1,216 results. Application of additional inclusion/exclusion criteria, patient ages, and disposition diagnoses, returned a final sample size of 26 patients. One hundred percent of these charts were reviewed utilizing the revised screening criteria (Appendix C). The revised screening criteria would have changed the result of five out of twenty-six screenings (approximately 19%). These five patients initially screened negative with existing criteria. After application of the new criteria, they screened positive, suggesting early identification of sepsis signs/symptoms would have triggered early treatment to prevent sepsis. Eighteen out of twenty-six patients (approximately 69%) screened positive initially, and application of additional criteria did not change the outcome. Three out of twenty-six patients (approximately 12%) did not screen positive initially, and application of the additional criteria did not alter the outcome.

Discussion

Several limitations of this study are noted. Implementation in a single setting (ED only) may affect generalization of results to other units, such as inpatient or surgical units. Unknown reliability and validity of the Code Sepsis Screening Tool is also a limitation. The timeframe for sample selection is a potential limitation for this study, as selecting sample patients from a narrow timeframe may not allow the generalization of results to a larger population. A potential for bias with sample selection exists, based upon a single researcher's discretion implementing inclusion and exclusion criteria. A larger number of positive sepsis screenings may lead to an increased number of false positives, causing alarm fatigue and decreased sense of urgency with frontline staff. Overall, addition of screening criteria changed the results in only a small number of cases. Suggestions for future studies include increasing the visit timeframe utilized to obtain the sample, broadening the initial inclusion criteria to more than only a few chief complaints, changing the additional criteria utilized, varying the setting, and obtaining a larger sample size.

Summary and Implications for Practice Change

Overall, a review of the literature supports implementing an early sepsis identification system to begin treatment early. Early identification and treatment of sepsis dramatically enhances the patient's chance for survival and recovery. Additional screening criteria, including decreased urine output, significant edema, and decreased oxygen levels to the screening criteria only affected a small number of patients in this study. This researcher suggests further testing with a larger sample size to substantiate the significance of these findings. Clinical Nurse Leaders (CNLs) would be an appropriate resource for this research. By researching evidence

and assisting with studies and pilots, CNLs operating within a microsystem can improve patient care processes and outcomes.

References

American Association of Critical-Care Nurses. (2014). Sepsis detection system more effective in patient diagnosis. *AACN Bold Voices, 6*(6), 15.

Aitken, L.M., Williams, G., Harvey, M., Blot, S., Kleinpell, R., Labeau, S., . . . Ahrens, T. (2011). Nursing considerations to complement the Surviving Sepsis Campaign guidelines. *Critical Care Medicine, 39*(7), 1800 – 1818. https://dx.doi: 10.1097/CCM.0b013e3182 1867cc

Buck, K. (2014). Developing an early sepsis alert program. *Journal of Nursing Care Quality, 29*(2), 124-132.

Bernstein, M. & Lynn, S. (2013). Helping patients survive sepsis. *American Nurse Today, 8*(1), 24-28.

Chang, H. (2010). Sepsis. *The Journal of the American Medical Association, 304*(16), 1856. Retrieved from http://jama.jamanetwork.com/article.aspx?articleid=186795.

Coleman, S. & Jackson, T. (2014). EB63 Beating sepsis: It's a sprint not a jog. *CriticalCareNurse, 34*(2), 8-9.

Dellinger, R. et al. (2013). Surviving sepsis campaign: International guidelines for management of severe sepsis and septic shock 2012. *Critical Care Medicine, 41*(2), 580 – 637. Retrieved from http://www.sccm.org/Documents/SSC-Guidelines.pdf.

Grove, S., Burns, N., & Gray, J. (2013). *The practice of nursing research: Appraisal, synthesis and generation of evidence (7th ed.)*. St. Louis: Elsevier-Saunders.

Kleinpell, R. & Schorr, C. (2014). Targeting sepsis as a performance improvement metric: Role of the nurse. *AACN Advanced Critical Care, 25*(2), 179-186. https://dx.doi: 10.1097/ NCI.0000000000000015

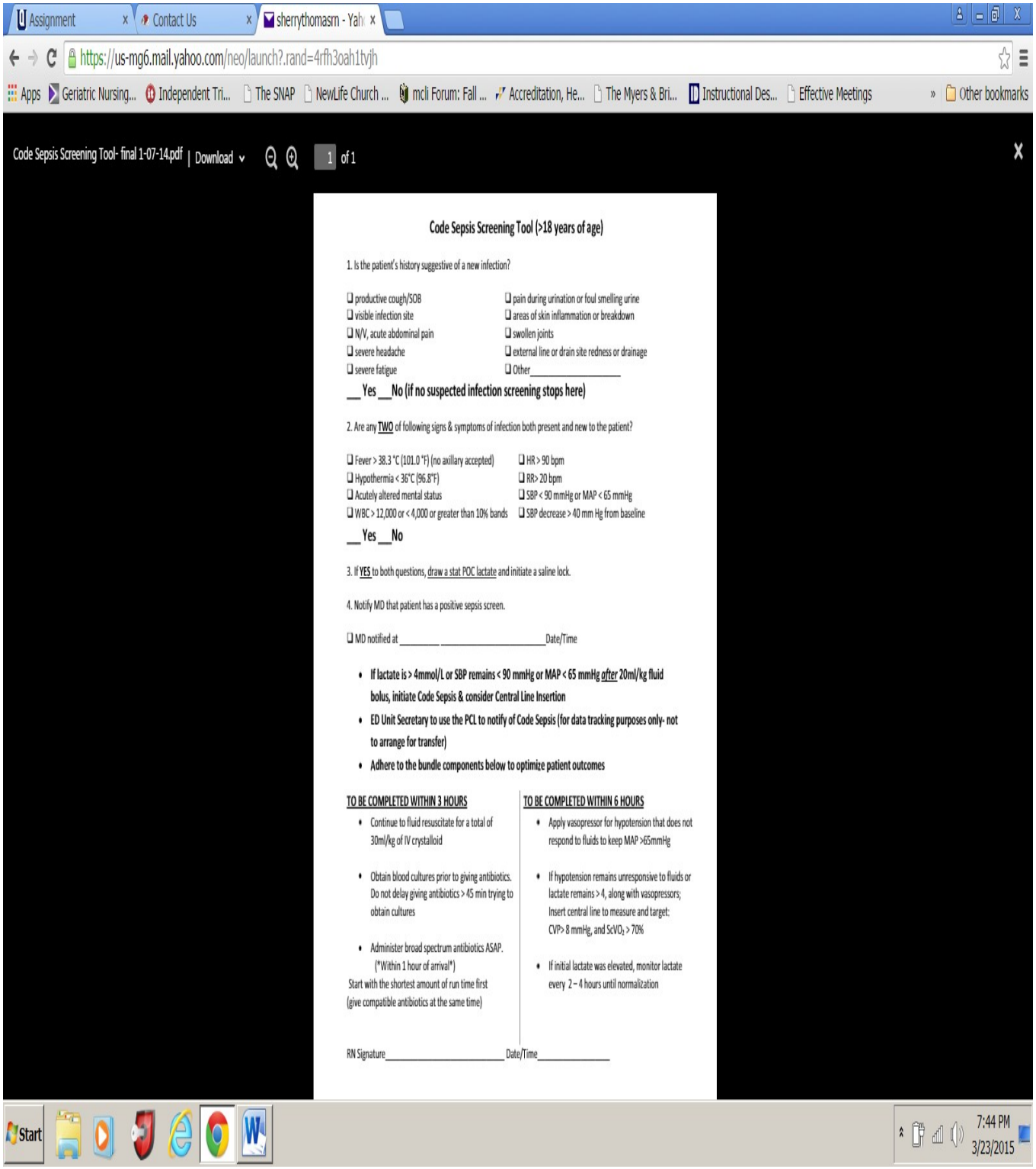
LaRosa, J., Ahmad, N., Feinberg, M., Shah, M., DeBrienza, R., & Studer, S. (2012). The use of an early alert system to improve compliance with sepsis bundles and to assess impact on mortality. *Critical Care Research and Practice*, 2012, 1-8. https://dx.doi: 10.1155/2012/980369

Lopez-Bushnell, K., Demaray, W., & Jaco, C. (2014). Reducing sepsis mortality. *MedSurg Nursing*, *23*(1), 9-14.

Peterson, S. & Bredow, T. *Middle range theories: Application to nursing research* (3rd ed). Philadelphia: Lippincott Williams & Wilkins.

Robson, W. & Daniels, R. (2013). Diagnosis and management of sepsis in adults. *Nurse Prescribing*, *11*(2), 76 – 82.

Appendix A



Code Sepsis Screening Tool- final 1-07-14.pdf | Download 1 of 1

Code Sepsis Screening Tool (>18 years of age)

1. Is the patient's history suggestive of a new infection?

- ❑ productive cough/SOB
- ❑ visible infection site
- ❑ N/V, acute abdominal pain
- ❑ severe headache
- ❑ severe fatigue
- ❑ pain during urination or foul smelling urine
- ❑ areas of skin inflammation or breakdown
- ❑ swollen joints
- ❑ external line or drain site redness or drainage
- ❑ Other_____

__Yes __No (if no suspected infection screening stops here)

2. Are any **TWO** of following signs & symptoms of infection both present and new to the patient?

- ❑ Fever > 38.3 °C (101.0 °F) (no axillary accepted)
- ❑ Hypothermia < 36°C (96.8°F)
- ❑ Acutely altered mental status
- ❑ WBC > 12,000 or < 4,000 or greater than 10% bands
- ❑ HR > 90 bpm
- ❑ RR> 20 bpm
- ❑ SBP < 90 mmHg or MAP < 65 mmHg
- ❑ SBP decrease > 40 mm Hg from baseline

__Yes __No

3. If **YES** to both questions, draw a stat POC lactate and initiate a saline lock.

4. Notify MD that patient has a positive sepsis screen.

❑ MD notified at _____ _____Date/Time

- **If lactate is > 4mmol/L or SBP remains < 90 mmHg or MAP < 65 mmHg *after* 20ml/kg fluid bolus, initiate Code Sepsis & consider Central Line Insertion**
- **ED Unit Secretary to use the PCL to notify of Code Sepsis (for data tracking purposes only- not to arrange for transfer)**
- **Adhere to the bundle components below to optimize patient outcomes**

TO BE COMPLETED WITHIN 3 HOURS

- Continue to fluid resuscitate for a total of 30ml/kg of IV crystalloid
- Obtain blood cultures prior to giving antibiotics. Do not delay giving antibiotics > 45 min trying to obtain cultures
- Administer broad spectrum antibiotics ASAP. (*Within 1 hour of arrival*)

Start with the shortest amount of run time first (give compatible antibiotics at the same time)

TO BE COMPLETED WITHIN 6 HOURS

- Apply vasopressor for hypotension that does not respond to fluids to keep MAP >65mmHg
- If hypotension remains unresponsive to fluids or lactate remains > 4, along with vasopressors; Insert central line to measure and target: CVP> 8 mmHg, and $ScVO_2$ > 70%
- If initial lactate was elevated, monitor lactate every 2 – 4 hours until normalization

RN Signature_____Date/Time_____

Appendix B

Revised Code Sepsis Screening Tool

(additional study criteria in red)

1. Is the patient's history suggestive of a new infection?

 productive cough / SOB pain during urination / foul smelling urine

 visible infection site areas of skin inflammation or breakdown

 N/V, acute abdominal pain swollen joints

 severe headache external line or drain site redness/drainage

 severe fatigue other_____

____ Yes ____No (if no suspected infection, screening stops here)

2. Are any **TWO** of the following signs & symptoms of infection both present and new to the patient?

 fever >38.3 C (101.0 F) *not axillary HR >90 bpm

 hypothermia < 36.0 C (96.8 F) RR >20 bpm

 acutely altered mental status SBP <90 or MAP <65

 WBC >12,000 or < 4,000, or >10% bands SBP decrease >40 from baseline

 decreased urine output oxygen saturation <90%

 significant edema

____ Yes ____ No (If **YES** to both questions, patient is a positive sepsis screen)

Data Analysis:

Did the patient screen positive with standard criteria? YES NO

Did the patient screen positive with addition of study criteria (in red)? YES NO

Notes / findings / observations: _____

_____

Appendix C

Capstone Project Data - Code Sepsis Screening Criteria				
Pt #:	Pt positive for Code Sepsis with original screening tool?	Pt positive for Code Sepsis with REVISED screening tool?	Disposition (admit, transfer, expired)	Final diagnosis
1	No	Yes*	Admit	Unspecified Septicemia
2	Yes	Yes (no change)	Admit	Unspecified Septicemia
3	No	Yes*	Admit	Septic Shock
4	Yes	Yes (no change)	Admit	Unspecified Septicemia
5	No	Yes*	Admit	Unspecified Septicemia
6	Yes	Yes (no change)	Admit	Unspecified Septicemia
7	Yes	Yes (no change)	Admit	Unspecified Septicemia
8	Yes	Yes (no change)	Admit	Unspecified Septicemia
9	Yes	Yes (no change)	Admit	Unspecified Septicemia
10	No	Yes*	Admit	Unspecified Septicemia
11	Yes	Yes (no change)	Admit	Unspecified Septicemia
12	No	No (no change)	Admit	Unspecified Septicemia
13	Yes	Yes (no change)	Admit	Unspecified Septicemia
14	No	No	Admit	Septicemia d/t E coli.
15	No	Yes*	Transfer	Sepsis, Pneumonia, ARF
16	Yes	Yes (no change)	Admit	Unspecified Septicemia
17	Yes	Yes (no change)	Admit	Unspecified Septicemia
18	Yes	Yes (no change)	Admit	Unspecified Septicemia
19	Yes	Yes (no change)	Admit	Unspecified Septicemia
20	No	No	Admit	Unspecified Septicemia

21	Yes	Yes (no change)	Admit	Unspecified Septicemia
22	Yes	Yes (no change)	Admit	Unspecified Septicemia
23	Yes	Yes (no change)	Admit	Unspecified Septicemia
24	Yes	Yes (no change)	Admit	Unspecified Septicemia
25	No	No	Admit	Bacteremia
26	Yes	Yes (no change)	Admit	Unspecified Septicemia