7-8-2020

Increasing CMS Sepsis Core Measure Adherence Rates Through Virtual Consultation

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A Dissertation Submitted to The Graduate School at the University of Missouri-St. Louis

in partial fulfillment of the requirements for the degree

Doctor of Nursing Practice with an emphasis in Leadership Population Health &

Healthcare Systems

By

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August 2020

Abstract

Problem: According to the Centers of Disease Control and Prevention (CDC, 2016), it is estimated that sepsis affects around 1.5 million individuals in the United States annually, causing the death of 250,000 individuals and being responsible for one out of three hospital deaths. One-fourth of patients who develop severe sepsis will die during their hospital stay. Delays in sepsis treatment contribute significantly to increased morbidity, mortality, and length of stay in the hospital. The Centers for Medicare and Medicaid (CMS) sepsis bundle guideline adherence rate in the Emergency Department of a Level III Trauma Center was stagnant at 55% through October 2019. A virtual sepsis consult was initiated in the Emergency Department of a Level III Trauma Center to potentially enhance the adherence rate.

Methods: This quality improvement project used a descriptive pre-post design, and the Plan-Do-Study-Act (PDSA) methodology to evaluate the sepsis bundle process.

Results: Sixty-one (N=61) sepsis cases were reviewed in this project. Twenty-three (N=23, 37%) were pre-project and 38 (N=38, 63%) were during the project. Results of the two-tailed independent sample z-test were not significant using an alpha value of 0.05, t (55) = -0.27, p=.791. A two-tailed independent sample *t*-test was conducted and showed there was not a significant difference between pre-project and project data on the number of false negative and false positive sepsis cases.

Implications for practice: Healthcare systems that utilize a virtual sepsis consult could standardize their workflow processes around sepsis care. Analysis of a larger number of cases may lead to significant results, which should be expected when workflow is improved.

Increasing Centers for Medicare and Medicaid (CMS) Sepsis Adherence Rates

Aggregate hospital costs for 35.6 million hospital stays totaled $381.4 billion in 2013. Septicemia is one of the five most expensive conditions and accounts for more than 34% of in-hospital deaths in the United States (Torio & Moore, 2016). In 2015, to promote earlier aggressive management for sepsis, CMS adopted the Early Management Bundle, Severe Sepsis/Septic Shock (SEP-1) performance measure as part of the Hospital Inpatient Quality Reporting Program (Seetharman et al., 2019). In the 2017 Surviving Sepsis Campaign, essential bundle elements were identified that, if employed within the first three hours of severe sepsis identification, reduce adverse outcomes. Diagnosis of severe sepsis/septic shock is based on an algorithm that identifies criteria for infection, systemic inflammatory response syndrome (SIRS) criteria, and end-organ dysfunction. CMS guidelines for severe sepsis/septic shock are outlined at http://www.survivingsepsis.org/Bundle.

The CMS sepsis core measure adherence rate for a local Level III Trauma centers' emergency room was stagnant at 55% through October 2019. The virtual sepsis consult was implemented to improve this rate by increasing CMS sepsis bundle adherence to a rate consistently greater than 75% and to reduce the number of false positives and false negative sepsis cases. A false positive indicates sepsis is present when it is not. A false negative indicates the patient does not have sepsis when in fact he/she does. The virtual sepsis team located outside of the physical hospital but in a centralized organization initiated a virtual sepsis consult utilizing a care delivery tool within the electronic chart. This process enabled bedside staff to administer broad-spectrum antibiotics, measure initial lactate level, start appropriate fluid

resuscitation and ensure completion of tissue perfusion assessment, re-measure a lactate post fluid resuscitation if necessary, and begin vasopressor therapy if clinically indicated within the timeline per the CMS bundle guidelines.

Diagnosis of sepsis relies on clinical signs and lab tests to identify pathogens and organ failure. Traditionally, the clinical picture of sepsis was overlooked due to subtle changes in vital signs and/or laboratory values. Furthermore, a comprehensive sepsis diagnosis is often delayed by a long turnaround time from diagnosis to treatment. Identification of severe sepsis and septic shock has been expedited by the creation of electronic tools based on criteria to trigger when signs of systemic inflammatory response syndrome (SIRS) and organ dysfunction are present. The purpose of this quality improvement initiative was to standardize work within the healthcare system and increase adherent rates of CMS sepsis bundle compliance. The aim was to pilot this in one setting in hopes to utilize it system wide, leading to decreased morbidity and mortality in septic patients. The outcomes of interest were increased CMS sepsis bundle adherence rates and decreased false positives and false negative results. Therefore, this project addressed the clinical question: *How does implementation of a virtual sepsis consult, compared to standard practice of EMR alerts, lead to an improved target bundle adherence rate above 75% and a decrease in false negative and false positive septic cases?*

Review of Literature

A comprehensive review and evaluation of published peer-reviewed literature was conducted. Electronic databases searched included PubMed, MEDLINE, CINAHL, Cochrane Library, University of York Centre for Reviews and

Dissemination (CRD) databases, Canadian and major international health technology agencies, and Agency for Healthcare Research and Quality. Only peer-reviewed journals were used in the selection process. Filters were applied to limit retrieval to health technology assessments, CMS sepsis guidelines, systematic reviews, and meta-analyses. The search was limited to English language documents published between January 1, 2010 to present. Articles were excluded if they did not meet the selection criteria, were duplicate publications, or were published prior to 2010. Through extensive review of research six articles met criteria and were included in the literature review (Appendix A).

Sepsis and severe sepsis are the most common cause of death in critically ill patients outside of the intensive care unit and the leading causes of death in the hospital (Barochia et al., 2012). To address this wide-spread clinical problem, CMS adopted the National Quality Forum (NQF) sepsis care bundle as a chart-abstracted core measure known as the Early Management Bundle, Severe Sepsis/Septic Shock (SEP-1). The focus of the SEP-1 measures early diagnosis and rapid initiation of appropriate treatment (Ramsdell, Smith, & Kerkhove, 2017).

The retrospective cohort study by Ramsdell et al. (2017) compared adherence to the three- and six-hour sepsis care bundles and sepsis-related patient outcomes prior to and following the introduction of the SEP-1 core measures. The study reported a significant increase in compliance with sepsis care bundles since the implementation of this core measure and that the care bundle may improve in-hospital survival. One strength of this study was there was minimal risk of selection bias as CMS only requires sampling of a specific number of patients based on the size of an institution's

patient population. Another strength of the study generated meaningful data, i.e. frequently occurring criteria seen in patient populations and commonly identified infections as well as a noted decrease in hospital mortality when complying with CMS measures. To contribute to the pool of existing data on usefulness and validity of the CMS bundle guidelines, this organization's QlikView database collects these same meaningful data to show which elements of the bundle were and were not met and reasons why. These data points can then be used to identify where quality improvement cycles are needed.

Antibiotic therapy is a critical element of the bundle guideline. A meta-analysis of clinical trials assessed the association between outcome of antibiotic administration and utilization of component therapies in studies of sepsis bundles (Barochia et al., 2012). This analysis consisted of eight unblinded trials, one of which was randomized, and seven with historical controls. The authors compared adult patients with identified sepsis who received bundled care versus those that did not. Demonstrating that time to antibiotics (hours from time of admission) significantly decreased with bundled care. These same findings were supported across five studies showing a consistent and significant increase in the odds of receiving appropriate antibiotics with bundled care compared with control group. This confirms the need for timely orders for the bundle care with the virtual sepsis consult.

A retrospective observational cohort study identified a seven percent increase in mortality for every hour delay of antibiotics (Seetharaman et al., 2019). The authors explained that contaminated blood cultures contributed to a high number of false-positive sepsis cases. This study also showed a higher risk of patients being

inappropriately treated with an antibiotic based on contaminated blood culture results. One -third to one-half of blood cultures analyzed from a contaminant collection were false positives, resulting in unnecessary antibiotic therapy with potential adverse reactions (Thompson, 2017). In a retrospective analysis study carried out between Massachusetts General Hospital and Harvard Medical School, the rate of false positives directly influenced antibiotic use, length of stay, healthcare-associated conditions (HACs) and the associated healthcare costs (Biospace, 2019).

Virtual monitoring has been shown to be effective in providing specialist expertise while remaining sensitive to healthcare costs. A systematic review by Ramnath et al. (2014) demonstrated that centralized monitoring and virtual consultant models positively impacted clinical practice adherence. Increasing staffing shortages combined with the escalating cost of care, the appetite for telemedicine or virtual care has increased. The virtual consult model in this systematic review utilized technology to provide periodic, real-time interaction with staff and patients remotely. Technology included a robot, cart-based video conferencing hardware, or handheld tablet with two-way video and audio connections such as Apple iPad, Samsung Galaxy Tab, Google Nexus and Asus Transformer Pad. Findings from this review indicated that utilizing centralized monitoring and virtual medicine allowed for easier and effective data collection and analysis (Ramnath et al., 2014). Use of electronic medical records is part of a growing effort to improve the value of inpatient healthcare through meaningful use technology. “The remote multidisciplinary team is essential to the centralized monitoring system infrastructure allowing for easy expansion and enhanced economies of scale, as one control center or “hub” often addresses needs of

multiple hospitals in multiple locations" (Ramnath et al., 2014, p. 949). Based on this evidence, it is feasible the virtual sepsis team can simultaneously support multiple hospitals by using fewer nurses and providers. As a result, this strategy is both cost-effective and consistent with ongoing efforts to employ healthcare solutions based on data analysis and leverage technology in sepsis awareness to the bedside staff and increasing engagement with the virtual sepsis team.

This project utilized the plan-do-study-act (PDSA) quality improvement framework. The PDSA model is a four-stage problem-solving model to improve processes or carry out change. Utilizing the PDSA steps helps to break down planning tasks (Plan) into steps for implementation (Do), evaluating the outcome (Study), adjusting and testing again (Act) (Taylor et al., 2013). Strategies for successful PDSA models include using an interdisciplinary team, selecting a champion, identifying specific goals and providing feedback on progress, using workflow analysis, creating standard work and celebrating successes.

Methods

Design

This quality improvement project utilized a descriptive pre-post design for the evaluation of the sepsis bundle process. Virtual consultation was used to implement enhanced adherence to the sepsis bundle guide. This was a quality improvement initiative to test the change in the emergency department (ED) of the organization using the Plan-Do-Study-Act (PDSA) methodology.

Setting

The setting was the emergency department in a Level III Trauma Center in a midwestern rural area with a population of 14,055 according to most recent United States census estimates (World Population Review, 2019). This hospital is the only acute care facility for approximately 50 miles west of the metropolitan area. The secondary setting included nurses and physicians who are specialized in sepsis care, located remotely who continuously monitor patients via the EMR for the sepsis bundle.

Sample

The sample included patients who presented to the emergency department and met the inclusion criteria. The data collection periods were between November 1, 2019 through January 1, 2020 prior to the project pilot and March 3, 2020 through May 3, 2020 for the pilot data. Selection of patients for inclusion were those who were 18 years or older with an ICD-10 code for sepsis, severe sepsis or septic shock. Patients were included if there was provider documentation of severe sepsis or septic shock or if the patient met CMS-specified criteria for severe sepsis or septic shock. Exclusion criteria were based on CMS guidelines, i.e. patients under the age of 18, actively in the operating room, with directives for comfort care within three hours of presentation of severe sepsis or six hours of septic shock, length of stay for more than 120 days, transferred from another acute care facility, expiration within three hours of presentation of severe sepsis or six hours of septic shock, or administration of intravenous (IV) antibiotics for more than 24 hours prior to the presentation of severe sepsis (Surviving Sepsis Campaign, 2019).

Approval Process

Initially, the Medical Director and Executive Director for Virtual sepsis and administration in the ED reviewed and approved the proposed project. Approvals from the Doctor of Nursing Practice (DNP) committee, organization, the Institutional Review Board and University of Missouri Saint Louis Institutional Review Board were obtained. There were no identified risks associated with this quality improvement project. Ethical considerations were considered by the administrative team and there were no concerns.

Data Collection/ Analysis

Data from patients receiving sepsis care in the ED from November 1, 2020 through January 1, 2020 were compared to data collected from March 3, 2020 through May 3, 2020. Adherence rates to the three- and six-hour sepsis care bundles pre and post were compared using data of patients who had a diagnosis using ICD-10 codes, meet CMS guidelines, or initiated by the ED provider based on his/her assessment. At the time a patient was identified for inclusion in the project, he/she was coded by the primary investigator (PI) with a unique numerical identifier, specifically birth month/day and admission date. This numerically coded list with patient project data was entered into a spreadsheet and stored on a password-protected computer on the health care system's computer. Patient data from the control group were coded and stored in the same way. Aggregate data were emailed through a secure electronic enterprise solutions system for internal and external file transfers.

Procedures

In the *Plan* phase, information was collected by meeting with key stakeholders at the Virtual Care Center and in the ED at the organization. Decisions were made on the timing and presentation of education to both the virtual team and the bedside teams. Approval was obtained for access to the electronic medical records and use of patients' data tool by the Office of Risk Management for the associated hospital. The project dates were March 3, 2020 through May 3, 2020.

The *Do* step involved training of the virtual team regarding changes to the current process managing septic patients. A workflow algorithm was incorporated to place a virtual sepsis consult, creating a standardized documentation template (smartphrase) for documentation, and implementing the procedure (described below) to trigger the intervention. Before the project, bedside staff in the ED and staff at the Virtual Care Center were trained on use of the virtual sepsis consult by the facility's Education Department. To standardize and reinforce training, the workflow algorithm used by the virtual sepsis team was placed on the shared online document repository called SharePoint, to allow a readily accessible reference for staff.

This project used virtual monitoring to assess criteria for severe sepsis/septic shock that was further enhanced by the electronic care delivery system. In this process, the early warning tool isolates criteria for presence of infection, SIRS, and end-organ dysfunction. Data were then reviewed by the virtual sepsis team and sepsis management begins. This process was further reinforced by direct contact with the bedside provider, through secure chat, to determine whether the patient should be

included in the sepsis bundle. Scripting for the secure chat allowed for consistent messaging of needed elements to complete the sepsis bundle.

Using an interdisciplinary team, a “smartphrase” was created in the EMR for use by the virtual provider and nurses. The smartphrase provides a consistent method to document a progress note, relaying that sepsis orders have been placed. The smartphrase was created and placed in the EMR by the Epic Team. Access to this phrase was given to all staff placing orders for the sepsis consult.

The current process for all hospitals in the system utilizes the virtual sepsis team to help monitor sepsis management. Using tools built into the EMR, the virtual sepsis team reviews patients who meet CMS criteria for severe sepsis/septic shock. This team helps determine suspected true positives and which are false positives, using interaction with the bedside teams for confirmation when needed. After a case is declared a true positive, the virtual sepsis team starts a sepsis timer that is visible within the EMR and available to the bedside staff. The virtual sepsis team notifies the bedside team of missing elements periodically throughout the patient’s three- and six-hour bundle time frames. Currently, the virtual sepsis team only places orders for missing lactic acid level orders (both initial and repeat). With the pilot, the virtual ICU provider orders missing elements that the virtual nurse could not.

This quality improvement project enhanced the current sepsis management process, continuing the standard initial identification and notification process at the bedside, but additionally offered the ability for the virtual sepsis provider to complete the missing bundle elements. Virtual sepsis nurses communicated with the virtual provider by using the electronic call log system and the use of secure chat, indicating

that a sepsis review and orders are needed. This provided the centralized sepsis team to adequately and efficiently complete the time-sensitive sepsis bundle by working closely with the bedside nurse and ED provider.

In the *Study* phase of the project, de-identified data from the ED were compared to pre project data and project data in the healthcare system that use current sepsis bundle guidelines before the virtual consult was implemented. Data were displayed on control chart using a Shapiro-Wilk analysis to determine if there are significant differences between the groups on the outcomes. A t-test was also used to determine before and after results. These outcomes were bundle adherence rates, false positives and false negatives. Using the tools built in the EMR, false positives and false negatives were measured to determine if there was an improvement. Descriptive statistics summarized the sample.

Results

Sixty-one (N=61) sepsis cases were reviewed during this quality improvement pilot. Twenty-three (N=23, 37%) were pre-project and 38 (N=38, 63%) were project data. A Shapiro-Wilk test was conducted to determine whether false negative/positive cases could have been produced by a normal distribution. Results of the Shapiro-Wilk test were significant based on an alpha value of 0.05, $W = 0.47$, $p < .001$ (Intellectus Statistics, 2020).

A two proportions *z*-test was conducted to examine whether there was a significant difference between the proportions of pre-project adherence rate and project adherence rate. The assumption of normality was assessed using the Central Limit Theorem (CLT). The result of the two proportions *z*-test was not significant

based on an alpha value of 0.05, $z = 1.95$, $p = 0.052$, CI = [-0.00, 0.46], indicating the null hypothesis cannot be rejected. This suggests there was no significant difference between the proportions of pre-project and project data. The confidence interval ($\alpha = 0.05$) for the difference between the proportions of pre-project and project is -0.00 to 0.46.

A two-tailed independent sample *t*-test was conducted to examine whether the mean of false negative/positive cases were significantly different between the pre-project and project data. The result of the two-tailed independent sample *t*-test was not significant based on an alpha value of 0.05, $t\ (73) = 1.84$, $p = 0.069$. This finding suggests the mean of false negative/positive cases were not significantly different between the pre-project and project data (Figure 1).

Discussion

The purpose of this process improvement project was to standardize workflows around sepsis care and increase CMS sepsis bundle adherence rates. Results indicate this project approached a significant difference in the adherence rate after implementing a virtual sepsis consult. There was a slight decrease in the number of false negative and false positive sepsis cases. Data collected from the organization noted that sepsis adherence rates decreased in every facility in the healthcare system outside of the project in February and March of 2020. Adherence rates in the ED through October 2019 were stagnant at 55%. The adherence rates increased to 78% between November 2019 and January 1, 2020 and decreased to 55% from March through May of 2020. This difference may be due to the onset of the COVID-19 pandemic. There was an increase in bilateral pneumonia infection cases during the

project. This diagnosis may have been coded as sepsis, however it was coded as COVID-19. In addition, as a result of the COVID-19 pandemic, facilities changed their processes, moving resources and efforts away from this project. While COVID-19 patients likely confounded the project data, these data were analyzed as a complete set to determine significance. It is probable that removal of the COVID-19 patients from the analysis would bring the results closer to significance. In addition, the project had a limitation of being a small, retrospective review.

This project offered improvements in standardization of communication via secure chat in the EMR. Comments from staff in the ED and from the sepsis team expressed an increase in staff satisfaction due to limitation of phone calls, reduction of time on hold, and reduced time to initiate protocol. This method of communication was adopted because of this project and has improved the communication between the bedside provider and the virtual sepsis team. More studies are needed to determine if there is a correlation between a centralized virtual sepsis team and a decrease in-hospital mortality and morbidity. Despite some differences, overall, there is an agreement in the literature regarding a centralized monitoring approach to help standardize care. Knowledge gained from this initiative gave general awareness regarding the importance of standardized quality sepsis care.

Conclusion

Implementation of a virtual sepsis consult using secure chat within the EMR in the emergency department setting was feasible and associated with a decrease in false positive and false negative cases. Results reported show favorable trends. Further cycles with data not confounded by COVID are necessary to determine how a virtual

sepsis consult can standardize sepsis treatment and increase adherence to CMS sepsis bundle guidelines. Measures of sepsis guideline effectiveness should focus on not only immediate results and mortality rates, but also return to function and long-term effects on survivors.

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Table 1

Two Proportions z-Test for the Difference between pre-project and pilot adherence rates.

Samples	Responses	*n*	Proportion	*SD*	*SE*
Pre-project	18	23	0.78	0.41	0.09
Pilot	21	38	0.55	0.50	0.08

Note. $z = 1.95$, $p = .052$, CI for $\alpha = 0.05$: [-0.00, 0.46]

Note: 18 cases out of the 23 (78%) was compliant before the pilot. 21 of the 38 (55%) was compliant post pilot.

Table 2

Two-Tailed Independent Sample t-Test for False negative/positive cases by Time

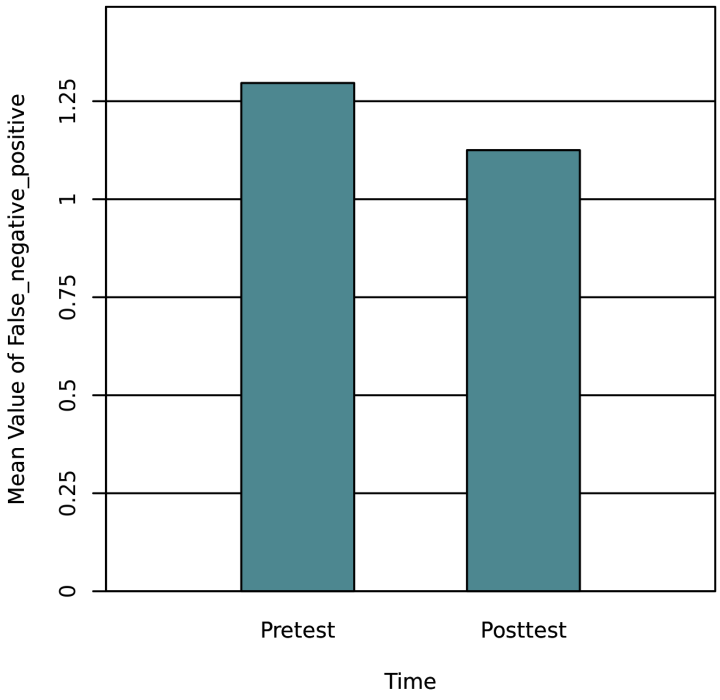
Variable	Pre-project		Pilot				
	M	*SD*	*M*	*SD*	*t*	*p*	*d*
False negative-positive	1.30	0.47	1.12	0.33	1.84	.069	0.42

Note. N = 75. Degrees of Freedom for the *t*-statistic = 73. *d* represents Cohen's *d.*

Note: The mean dropped from 1.30 in the pre-project to 1.12 in the pilot suggesting a slight drop in false negative/positive sepsis cases.

Figure 1

The mean of False negative-positive by levels of Time



Note: Pre-project data was collected from November 1, 2020 through January 1, 2020 and was compared to data collected from March 3, 2020 through May 3, 2020.

Appendix A

Evidence table

CITATION Author(s), Date, Title, Journal Information, doi	**PURPOSE / BACKGROUND** Purpose & Outcome Measures or Goals (Aims)	**PARTICIPANTS / SETTING** Sample & Setting	**METHODS / DESIGN** Study Design & Interventions	**RESULTS / LIMITATIONS / RECOMMEND-ATIONS** Results, Strengths/Weaknesses, Limitations, & Recommendations
Andersson, M., Ostholm-Balkhed, A., Fredrikson, M., Holmborm, M., Hallgren, A., Berg, S., & Hanberger, H. (2019, March). Delay of appropriate antibiotic treatment is associated with high mortality in patients with community-onset sepsis in a Swedish setting. Retrieved from *European Journal of Clinical Microbiology & Infectious Diseases:* https://link.springer.com/article/10.1007/s10096-019-03529-8	The main goal was to evaluate the impact of early treatment with focus on appropriate administration of first and second doses of antibiotics in patients with severe sepsis and septic shock.	A retrospective chart review on adult patients admitted to the emergency department with community-onset sepsis and septic shock was conducted 2012–2013.	The criterion "early appropriate antibiotic treatment" was defined as administration of the first dose of adequate antibiotics within 1 h, and the second dose given with less than 25% delay after the recommended dose interval. A high-risk patient was defined as a septic patient with either shock within 24 h after arrival or red triage level on admittance according to the Medical Emergency Triage and Treatment System Adult. Primary endpoint was 28-day mortality.	The results showed that there is a higher mortality among high-risk patients not receiving early appropriate antibiotic treatment and that adherence to giving antibiotics sooner was very poor.
Barochia, A., Xizhong, C., Vitberg, D., Suffredini, A. F., O'Grady, N. P., Banks, S. M., . . . Eichacker, P. Q. (2012, June). Bundled care for septic shock: An analysis of clinical	Assess the association between outcome and the utilization of component therapies in studies of sepsis bundles.	Inclusion required comparison of septic adults who received bundled care vs. non protocolized care. Survival and use rates for individual interventions were abstracted.	Eight unblinded trials, one randomized and seven with historical controls, were identified.	Bundle use was associated with consistent and significant improvement in survival and antibiotic use. Use of other bundle components changed heterogeneously across studies, making

trials. Retrieved from *National Center for Biotechnology Information*: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3383776/				their impact on survival uncertain. However, this analysis should be interpreted cautiously as these studies were unblinded, and only one was randomized.
Torio, C., & Moore, B. J. (2016, May). National inpatient hospital costs: The most expensive conditions by payer, 2013: Statistical Brief #204. Retrieved from *National Center for Biotechnology Information:* https://www.ncbi.nlm.nih.gov/books/NBK368492/	The purpose of the statistical brief is to show data from the Healthcare Cost and Utilization Project (HCUP) on costs of hospital inpatient stays in the United States in 2013. It breaks down the cost between Medicare, Medicaid, private insurance and uninsured.	It covered all the inpatient hospital patients nationally in the year 2013.	This is a brief reviewing the data that was pulled from the Healthcare Cost and Utilization Project (HCUP).	The breakdown between payor source for inpatient hospitalization was 68% Medicare and Medicaid, 28% private insurance and 5% was from the uninsured. Sepsis was one of the top four diagnoses of hospitalization within all four payor groups.
Siddiqui, S., & Razzak, J. (2010). Early versus late pre-intensive care unit admission broad spectrum antibiotics for severe sepsis in adults *(Review)*. Retrieved from *Cochrane LIbrary: Cochrane Database of Systematic Reviews:* doi/10.1002/14651858.CD007081	The purpose of this retrospective chart review was to see if there was a difference between administering antibiotics within one hour of diagnosis in the ED versus administering the antibiotic later when the patient was admitted to the intensive care unit (ICU).	The participants included patients over the age of 18 that was diagnosed in the Emergency Room (ER) with sever sepsis or sepsis shock.	The interventions were early (within one hour of ED admission) versus late (defined as greater than one hour after admission) administration of broad-spectrum antibiotics. Late administration of antibiotics was independent of microbiol-ogy cultures, waiting for cultures, or both. The specific type of antibiotic was not observed.	The specific timing of when to administer the antibiotics was undetermined. There should be continued observational cohort studies due to it being ethically wrong to do randomized control studies and not treat the patient with an antibiotic for sepsis for long periods of time. It was recommended to research quality improvement strategies on timely administration of antibiotics in the ER and implementing the sepsis bundle guidelines.
Loyola, S. M., Wilhelm, J. B., & Fornos, J. B. (2011, September). An innovative approach	The purpose of this article was to show how using telemedicine helped with early detection	The setting was in the Baptist Health System (BHS) in San Antonio, Texas covering the ICU's	The intervention used was having critical care nurses and physicians using a high-tech system that	The result was validation that telemedicine has a positive impact on both the urgency of

to meeting early goal-directed therapy using telemedicine. Retrieved from *National Center for Biotechnology Information:* https://www.ncbi.nlm.nih.gov/pubmed/21670617	and early treatment of severe sepsis in the intensive care unit (ICU).	in five hospitals, each ranging in size from 12 to 30 beds. The participants where critically ill patients 18 years or older and having a diagnosis of severe sepsis or septic shock.	used real time automatic alerts and audiovisual tools to assess critical trends and abnormalities in laboratory studies and physiologic parameters. Once reviewed by the e-ICU nurse, the information is communicated to the bedside nurse and/or physician at the facility for early interventions.	identification of patients with sepsis and promoting evidence-based treatments in a timely manner.
Song, J.-U., Kyung Sin, C., Kyeong Park, H., Ryul Shim, S., & Lee, J. L. (2018). Performance of the quick Sequential (sepsis-related) organ failure assessment score as a prognostic tool in infected patients outside the intensive care unit: A systematic review and meta-analysis. *BioMed Central Journals*: doi10.1186/s13054-018-1952-x	The purpose of this study was to measure the value of the qSOFA score and compare its value to the SIRS criteria for early detection of hospital mortality in patients with an infection outside of the ICU.	The authors used 23 studies with a total of 146, 551 patients that was considered to have an infection and was admitted as inpatient outside of the ICU.	The authors did a systematic review of the articles and a meta-analysis to identify the sensitivities for a positive qSOFA score and positive SIRS criteria	The results showed that a positive qSOFA score had high specificity outside the ICU in early detection of in-hospital mortality, acute organ dysfunction but it was low for adverse outcomes.
Roney, J. K., Whitley, B., Maples, J. C., Futrell, L. S., Stunkard, K. A., & Long, J. D. (2015, June). Modified early warning scoring (MEWS): evaluating the evidence for tool inclusion of sepsis screening criteria and impact on mortality and failure to rescue. Retrieved from *Journal of Clinical Nursing*: doi: 10.1111/jocn.12952	One of the aims was to evaluate the impact of the MEWS tool on patient mortality events the literature and validate MEWS physiologic screening parameters for incorporation of sepsis identification (systemic inflammatory response syndrome (SIRS) criteria) standard values.	The authors focused hospitalized adult medical-surgical/telemetry patients.	This was a comprehensive review of literature.	A significant finding in the literature was the lack of criteria for validation and standardization of MEWS physiologic measurements and reliability testing of the MEWS tool. The study suggests MEWS tools' scoring of physiologic findings, including vital signs have a positive relationship with earlier detection of clinical deterioration.

Kruse, C. S., & Beane, A. (2018). Health information technology continues to show positive effect on medical outcomes: Systematic eview. Retrieved from *Journal of Medical Internet Research*: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5818676/	The purpose of this systematic review was to evaluate if Health Information Technology (HIT) has a positive or negative effect on Medical Outcomes.	The summary measure used in this analysis was the medical outcome specified in terms of either efficiency or effectiveness.	The authors used articles less than 5 years old due to that was when the last review was published.	I found it interesting that the authors chose to only include papers that demonstrated effects of efficiency and effectiveness in terms of medical outcomes. This could be a bias to a positive result of the study. An area for further research in Organizational factors related to the success of HIT implementation and improved medical outcomes was suggested.