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Abstract

BACKGROUND: Readmissions from post-acute care to acute care hospitals is well documented in the literature. Inadequate management of infection is a top readmission diagnosis and is often preventable. Nurse driven, protocolized treatment is the gold standard for treating sepsis patients in post and acute care settings. A quality improvement (QI) project was implemented in a 58-bed inpatient rehabilitation facility (IRF) to determine if a nurse-driven sepsis algorithm would decrease readmission rates to acute care hospitals, increase nursing staff sepsis knowledge, clinical confidence and communication.

METHODS: This QI project was performed during a 3-month period in 2020. Readmission findings were compared before and after the study intervention implementation. Changes overtime in sepsis frequency were assessed through run charts. Pre- and post- survey data of sepsis knowledge, clinical confidence caring for a sepsis patient and care provider and clinician communication was assessed using a Wilcoxon Signed Rank Test.

INTERVENTION: By utilizing the Systemic Inflammatory Response (SIRs) criteria, the Situation, Background, Assessment and Recommendation (SBAR) tool and Surviving Sepsis Campaign guidelines, a nurse driven sepsis algorithm was created and implemented in the rehabilitation facility. Additionally, pre- and post-surveys were administered to assess nurses' knowledge of sepsis, clinical confidence in caring for a patient with suspected sepsis and bedside clinician to provider communication.

RESULTS: Results show a decrease in readmissions to acute care hospitals post intervention but no statistically significant change in pre-post survey of sepsis knowledge, confidence or communication.

CONCLUSIONS: An additional PDSA cycle of this QI project is needed to determine a true sepsis decrease overtime using the sepsis algorithm. A sepsis pre and post-test, and role play simulations may be key to a change in sepsis knowledge, confidence and communication.

Keywords: inpatient rehabilitation facility, IRF, readmissions, sepsis, infection, surviving sepsis campaign, algorithm

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sepsis, algorithm, inpatient rehabilitation facility, IRF, readmissions, nurses, nurse driven, sepsis video, SIRS criteria, SBAR, SSC, surviving sepsis campaign

Disciplines

Nursing

**Implementing and Evaluating a Sepsis Algorithm to Mitigate Acute Care Readmissions in
an Inpatient Rehabilitation Facility**

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NURS 854: DNP Project Implementation

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December 1, 2020

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Implementing and Evaluating a Sepsis Algorithm to Mitigate Acute Care Readmissions in an Inpatient Rehabilitation Facility

According to the Uniform Data System for Medical Rehabilitation (UDSMR) (2019), nearly 10% of patients from inpatient rehabilitation facilities (IRFs) are readmitted to acute care hospitals. Ninety-four percent of IRF patients are comprised of acute care facility discharges with the remaining 6% arriving from home, skilled nursing facilities (SNFs) or other post-acute facilities. It is estimated that 92% of patients who enter an IRF have at least one comorbidity, and have an average age of 67.7 years. Neurological issues such as stroke (23.7%), traumatic brain injury (11.6 %) and spinal cord injury (6%) are the most common diagnoses within the IRF population though orthopedic, pulmonary and cardiac diagnoses can also be seen in this patient mix.

A 58-bed IRF in the northeast section of Pennsylvania specified the mitigation of readmissions as an obstacle. After a retrospective chart review utilizing the hospitals EPIC documentation system as well as quality and patient safety data, it was reported that 16% of patients were readmitted to acute care hospitals in fiscal year 2019- four percent above the national average (UDSMR, 2019). Neurological complications and inadequate management of infection were the top two readmission categories to acute care hospitals among all cases. Transitions in care was a recurring theme in this data review as many IRF patients readmitted for inadequate management of infection had been diagnosed with an infection prior to being admitted to the IRF. It was found that these patients did not have comprehensive infection management throughout their rehabilitation stay.

Acute care readmissions increase the overall healthcare expenditure. The average cost of a single hospital readmission is \$14,400 (Kommers, 2019) and total readmissions to acute care

hospitals from the IRF costs over 160 million dollars per year (Middleton et al., 2017).

Decreased functional independence, clinical instability and inadequate management of infection have been reported as increased risk factors for IRF readmissions to acute care hospitals (Huang 2018; Xue et al., 2018).

The Center for Medicare and Medicaid (2019), states that each IRF patient must be evaluated and given a Functional Independence Measure (FIM) score on admission and discharge. The FIM evaluates function in 13 motor and 5 cognitive categories; scores range from 18 to 126, with higher scores indicating optimal functional independence (page 3). Although comorbidities and prolonged hospitalization affect readmission rates in IRF patients (Shih et al., 2015; Fisher, 2016), FIM scores on admission were directly linked to readmissions from inpatient rehabilitation facilities (Faulk et al., 2013; Shih et al., 2015; Ottenbacher et al., 2012; Schneider et al., 2012; Hoyer et al., 2014). FIM scores can serve as predictors to readmissions to acute care hospitals in neurological and general inpatient populations (Shih et al., 2015).

Clinical instability and inadequate management of infection is widely studied in the post-acute setting. Infection is a precursor to sepsis – a life-threatening condition. Multiple studies report nurse driven, early goal directed therapy as a gold standard for treating potential or suspected sepsis patients and improving overall outcomes (Jacobs, 2019, Herran-Monge et al., 2019, Horton et al., 2020). Further, standardized IRF assessments and protocols are reported as necessary to decrease readmissions and properly discharge this population to a lower level of care without interruption (Guerini et al., 2009; Pellicane, 2014). Thus, given the observed associations between infection, sepsis, and hospital readmissions, this project will focus on infection management as a preventable cause of readmissions post IRF admission.

This quality improvement (QI) project was framed using the Donabedian Framework for Health Care Quality. This specific framework focused on structure, processes and recovery at the service delivery level while recognizing the culture and social systems within the organization. (Ayanian and Markel, 2016). In order to mitigate sepsis readmissions to acute care hospitals, the structure (qualifications of providers), processes (components of care delivered) and outcome of the processes (recovery, survival) was key. Hence, the development of a nurse-driven process to improve and treat sepsis in the early stages was explored.

The Systemic Inflammatory Response Syndrome (SIRs) tool has been implemented in hospitals all over the United States and abroad to detect suspected or confirmed sepsis. A meta-analysis conducted by Gando et al. (2020) concludes that 91.6% of patients who were evaluated using SIRs criteria showed a high rate of infection than that of non-SIRs criteria patients (p.0018). The 'Situation, Background, Assessment and Recommendation' (SBAR) is a tool that is widely used by nurses to effectively and methodically communicate pertinent patient information to their providers. Because bedside clinicians are the first responders to ascertain positive sepsis criteria, it is vital for these providers to communicate effectively to care providers. According to a study conducted by Renz, et. al., the use of the SBAR tool has been reported to decrease unplanned transfers in long term care (2015). The SBAR tool begins with the clinician communicating the situation to the provider, providing background data and key assessment findings, and concludes with bedside clinician recommendations of interventions to the providers. Early identification of infection markers identified by the SIRs criteria followed by communication to the care team is critical to mitigating readmissions. The recommendation portion of the SBAR tool may arguably be the most critical piece. Bedside nurses must recommend prompt patient assessment from providers followed by obtainment of blood cultures,

lactate levels and white blood cell count as these are evidenced based interventions for suspected sepsis (Surviving Sepsis Campaign, 2019). Further, initiation of IV fluids (if hypotensive) and broad-spectrum antibiotics are critical in treating a suspected sepsis patient, can reduce morbidity and mortality, and decrease overall costs (Levy, Evans & Rhodes, 2018). Inpatient Rehabilitation facilities are staffed to adequately care for a potentially septic patient under all of the listed SSC guidelines and interventions.

The overarching goal of this project was to mitigate readmissions to acute care hospitals secondary to sepsis through the use of a nurse driven algorithm. The nurse driven algorithm aimed to detect potential or suspected sepsis and initiate early goal directed therapy with the use of an early sepsis detection screening criteria, bedside clinician to provider tool, and evidenced based interventions for sepsis treatment. Specifically, this QI project investigated whether the implementation of this algorithm for early recognition and management of sepsis post discharge to IRF resulted in reduced readmission rates to acute care hospitals, increased nursing staff sepsis awareness, clinical confidence, and improved staff communication when caring for a suspected sepsis patient.

Methods

Context

The QI project integrated a sepsis algorithm into an IRF in Pennsylvania. This facility is a leading provider in physical medicine and rehabilitation (rehab) and known for their neuroscience, musculoskeletal and comprehensive rehabilitation services. Most patients in this facility are between the ages of 45 and 74 with an average of 70 years. 96% of patients admitted come directly from acute care hospitals and 89% are receiving rehabilitation for the first time. 65.5% of patients admitted to this IRF have at least one comorbidity. Most notably, more than

50% of patients admitted were diagnosed with a stroke, traumatic brain or spinal cord injury and is the population adversely affected by readmissions.

53 registered nurses (RNs) and 40 certified nursing assistants (CNAs) are employed within the facility full time and have a staffing ratio of 4/5:1 RN and 8:1 CNA on the rehabilitation unit. There are an additional 15 nurses who are employed on higher acuity floors and/or the float pool who work on the rehab unit when staffing needs arise. In addition, therapy staff (physical, occupational, speech and respiratory) collaborate with nursing and board-certified physical medicine and rehabilitation interns, residents and attending physicians to provide individualized plans of care for each patient to endure for at least three hours a day. There are three internal medicine and one infectious disease physician on service in the event of medical or infectious disease consultation request. Traditionally, every staff member works together to prevent patient readmissions.

Intervention(s)

All nurses in the facility who were employed or could potentially service the rehabilitation unit were notified of the upcoming QI project. Three months prior to the implementation, a huddle sheet was created outlining the project goals and projected start dates. The principal investigator (MLL) attended weekly nursing huddles and performed unit rounds to inform the nursing staff of this upcoming project.

A pre-survey was created and administered to all eligible RNs during the pre-implementation phase (Appendix A). All pre -surveys were completed using a virtual questionnaire and data collection platform, Redcap. The pre-survey was created by MLL to gather data about the unit culture, general sepsis knowledge, clinical confidence in caring for a suspected sepsis patient and bedside clinician to provider communication.

An educational video was created using an application called Animaker (Appendix B). This application allows the user to create characters, scenes and voiceovers to explain concepts. The video created was a 2 minute and 17 second animation that briefly defined sepsis, reported evidenced based treatments as well as hospital statistics regarding readmissions due to sepsis and specifically articulated the readmission rates of the specified unit. Further, the video introduced the quality improvement project goals and aims, explained the survey rationale and introduced the sepsis algorithm with key concepts the nurses needed to understand in order to successfully follow the pathways. After each nurse completed the pre-survey and watched the video, a sepsis algorithm was introduced.

The sepsis algorithm used a combination of the SIRS criteria, SBAR tool and SSC treatment guidelines (Appendix C). Each tool within the algorithm was selected due to the evidence of the validity and sensitivity of identifying sepsis patients, communicating effectively among staff members and treating sepsis patients. The sepsis algorithm commenced with identifying suspected sepsis patients using the SIRS criteria. In order for a patient to have a positive SIRS score, two infectious markers within the criteria had to have been present. If negative, the standard of care was maintained. If the nurse assessed a positive SIRS criteria, the next step in the algorithm was the SBAR tool. The SBAR portion of the algorithm listed key words for the bedside clinician to use when calling the provider to give an update on the patient status such as “there is a change in the patient’s baseline” and “I suspect early sepsis”. The next phase of the algorithm goes into a recommendation portion where the nurse has access to all of the proposed evidenced-based interventions for a suspected sepsis patient and is able to communicate each recommendation to the provider. Subsequently, the nurse implemented the interventions chosen by the MD and continued to analyze the patient’s characteristics. Lastly, the

nurses evaluated the interventions to determine improvement. If symptoms did not improve, the criteria moved back into the SBAR tool to communicate to the provider a recommendation of a possible readmission to an acute care hospital.

Notably, if a readmission occurred during the implementation period, a separate survey was sent to the primary nurse who cared for the patient prior to the acute care readmission. Largely, this survey was used to determine the effectiveness of the sepsis algorithm as well as the ease of integration into the workflow of the RN in the setting of a readmission secondary to sepsis. After three months of implementation of the algorithm, a post-survey was administered. (Appendix E). The process of nurses' sepsis knowledge, clinical confidence during a sepsis event and communication between bedside clinician and the care provider was just as important as the outcome measure of a decrease in readmission rates.

Study of the interventions

Measures

Readmission Rates (primary outcome). For this project, a readmission is defined as a patient who was admitted to the pilot IRF and subsequently readmitted during their rehab stay to an acute care hospital secondary to inadequate management of infection or suspected sepsis. Readmission rates were computed as the number of readmissions over a three-month period. All datasets collected pre-implementation were retrospectively examined and compared with post implementation datasets to determine a change in frequency.

Sepsis Awareness, Clinical Confidence and Communication (secondary outcome). The pre-survey questionnaire was comprised of eleven questions- 5 demographic questions, and 6 questions regarding sepsis awareness, clinical confidence of caring for sepsis patients, and perception of bedside clinician to provider communication. The aforementioned questions were

structured as *true or false and Likert scale* questions. A follow-up survey was comprised of 6 questions to determine algorithm efficiency, recommendations from the bedside clinician to the care provider and actual provider interventions (Appendix D). A key component of this survey was open-ended responses for nurses to describe interventions that were not typical sepsis treatment guidelines as well as any barriers faced during the readmission process. The post survey is identical to the pre survey's 6 *true or false and Likert scale* questions with the exception of an additional question on the overall utility of the sepsis algorithm.

The surveys given were intended to gauge staff perception of sepsis awareness, clinical confidence, and communication between bedside clinician and care provider communication.

Analysis

The readmission rate to acute care hospitals secondary to inadequate management of infection/suspected sepsis was tracked and analyzed by chart audits and monthly readmission data. A run chart was completed to examine readmission rates over time applying graphical exploration. Run charts are underutilized in healthcare but are a common quality improvement tool used to depict variations in processes (Perla et al, 2011). Descriptive statistics were used to summarize the pre- and post-survey data (median, range). Additionally, to assess for statistically significant differences in nurses' sepsis knowledge, clinical confidence and bedside clinician to provider communication pre and post survey, a Wilcoxon Signed Rank Test was performed.

Ethical considerations

The University of Pennsylvania Institutional Review Board (IRB) qualified this project as QI. There are no aspects that require ethical consideration. The data obtained from the nurses in this study were deidentified and all patients were given the standard of care. The author would like to highlight the chief nursing officer, chief medical officer, quality assurance manager,

attendings, residents, nurse management, and bedside clinicians for their cooperation in this quality improvement project.

Results

Of the 57 nurses who completed the pre-survey questionnaire, sepsis video and algorithm download, 45 nurses successfully completed the post-survey and were subsequently included in data analysis. The nurses who completed the survey were between the ages of 22 and 64 (mean=39.72). The years worked as a nurse ranged from 0 to 33 (mean = 11.56) with 0 – 12 years worked on the IRF (mean= 3.89) 62% of nurses who completed the survey worked on a 12-hour day shift with the remaining survey respondents working a 12-hour night shift. (Table 1).

Table 1	Mean (SD) or Frequency (%)
Age	39.72 (9.54)
Years as a nurse	11.56 (8.18)
Years working on the IRF	3.89 (4)
Primary Shift	
Dayshift	28 (62%)
Nightshift	17 (38%)

A run chart was completed with 15 months of readmission data from July 2019 to September 2020 to assess our primary outcome of readmission frequency. The first 12 months of data is pre-intervention data. During the first 12 months, the median for sepsis frequency was 5 with sepsis readmission frequencies ranging from 3 to 6 admissions on any given month. The 12-month mark is noted as the beginning of the sepsis algorithm intervention. Post intervention sepsis frequencies ranged from 2 to 7 with the median dropping from 5 to 4. It is important to note that month 13 reported the highest frequency of sepsis readmissions with a subsequent decrease in frequencies during months 14 and 15 (Figure 1).

During the intervention implementation period, there were 13 patients readmitted to an acute care hospital. Of all sepsis readmission during that period, 55.6% of nurses reported algorithm utilization.

Figure 1

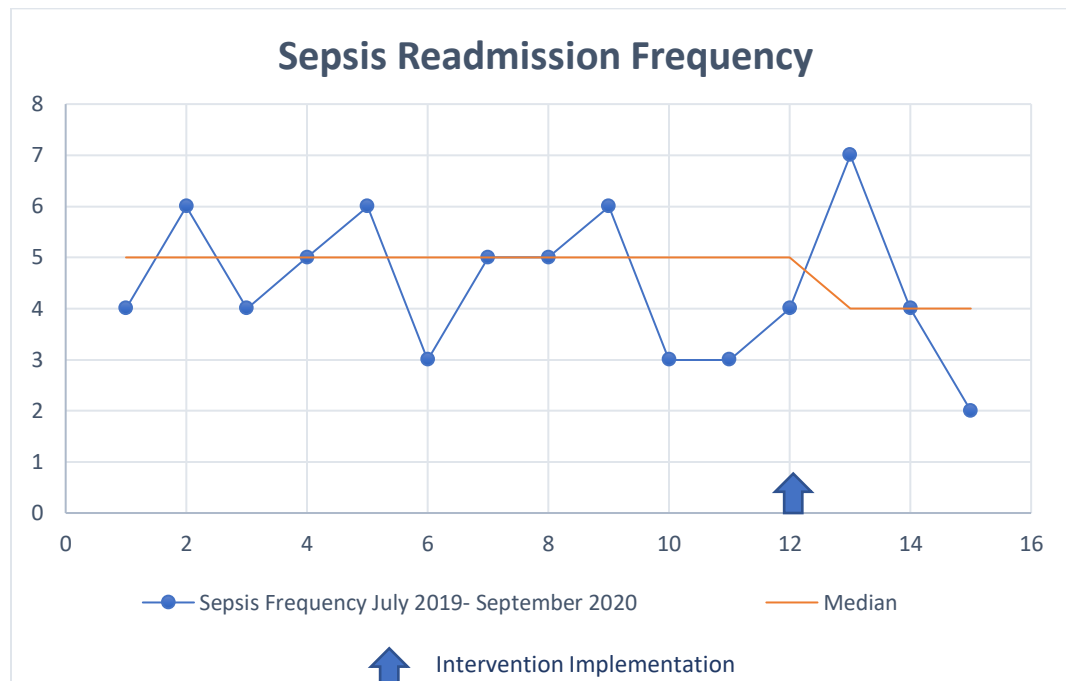
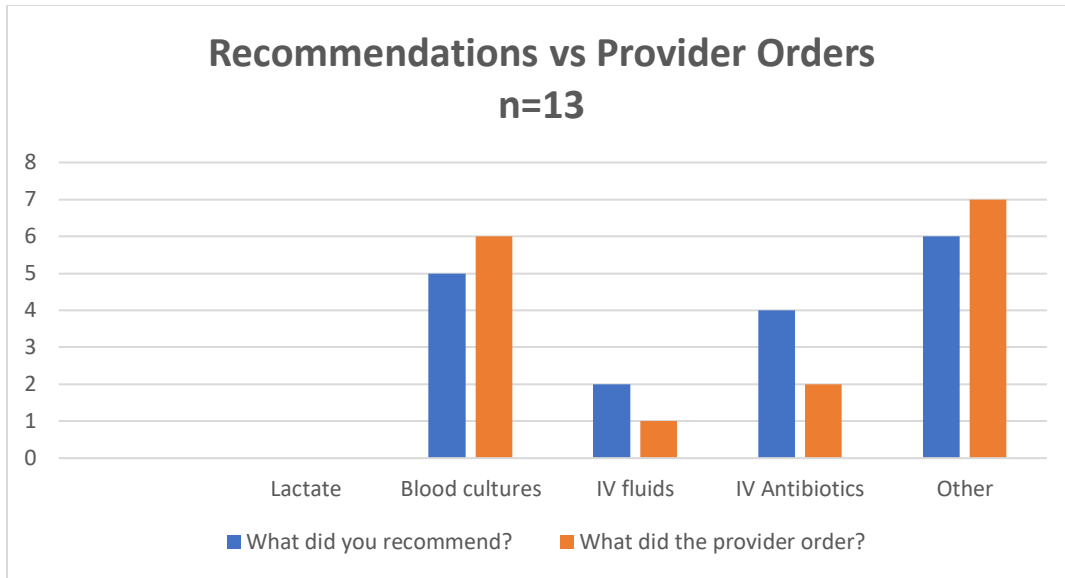


Figure 2 outlines the nurse’s recommendations versus the actual provider orders. Although over half of the nurses who cared for a septic patient readmitted to an acute care hospital used the algorithm, 0% of nurses recommended ordering lactate, 38% recommended obtaining blood cultures, 22% recommended initiating intravenous (IV) fluids and 44% recommended administering stat antibiotics. What is most interesting to note is that 67% of all nurses who primarily cared for a patient readmitted to an acute care hospital recommended an “other” assessment which included CT scans, x-rays and chest tube insertion (Figure 2).

Figure 2



Although the pre and post test results show a slight increase in all three outcome measures, these differences were not statistically significant at an alpha level of .05 (p value, .283).

Figure 3

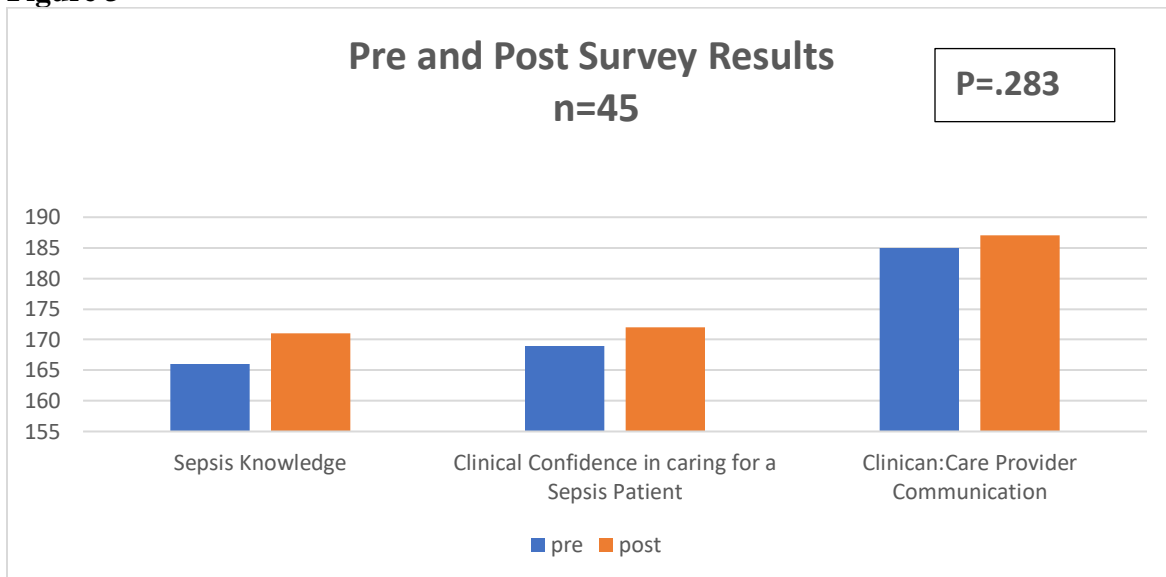
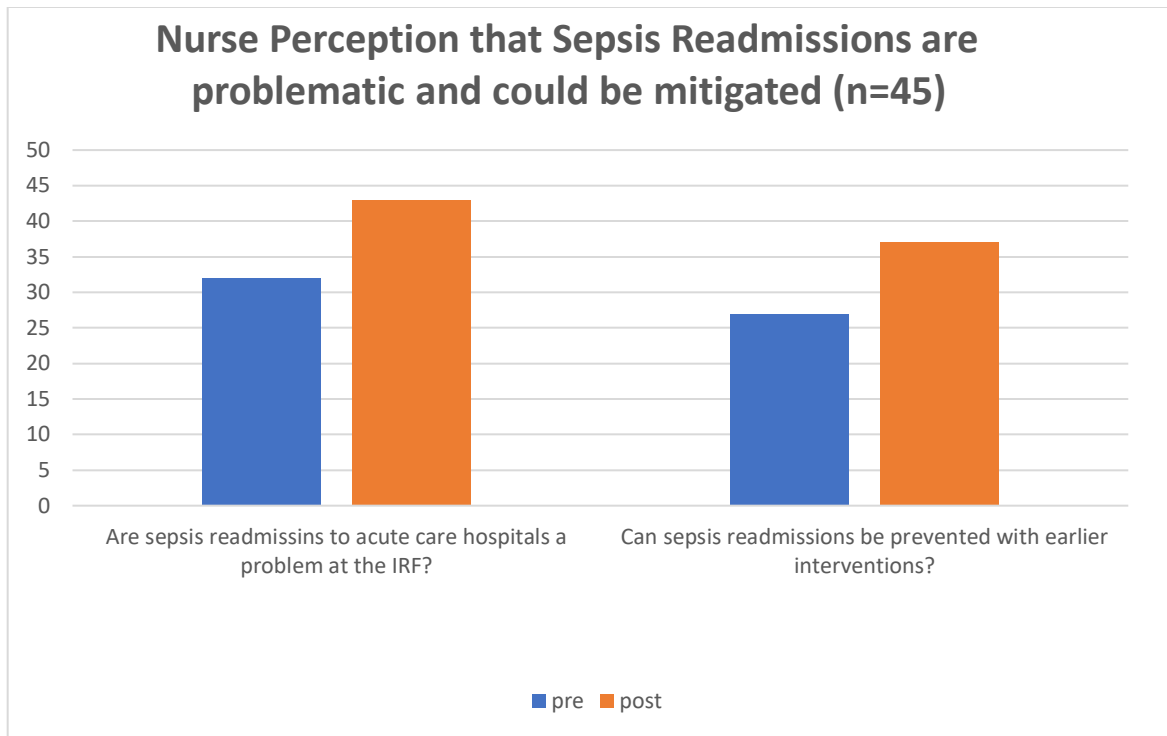


Figure 4



An additional comparison of pre and post intervention implementation of nurse perception of sepsis being a problem at the IRF and perception of readmissions potentially being mitigated with earlier interventions. Although nurse perception was not an initial outcome measure, it is important to note that after the sepsis intervention, 95% of nurses believed readmissions were a problem and 82% of nurses believed sepsis readmission could be mitigated with earlier interventions (Figure 4).

Discussion

Summary

The key findings in this quality improvement project was an overall decrease in readmission frequencies post implementation yet no statistically significant differences between pre and post sepsis knowledge, clinical confidence in caring for a sepsis patient, and care provider to clinician communication. Based on the clinical experience of the lead investigators of

this quality improvement project, many patients are readmitted to an acute care hospital for various reasons, however, the sepsis readmissions are very challenging and could theoretically be prevented with earlier interventions. This study was able to engage and empower a large percentage of full-time nursing staff and is the largest sepsis quality improvement project in this IRF to date.

Interpretation

We noticed the sepsis algorithm yielded an astronomical data point in month 13 with a sharp decline in months 14 and 15. According to the rules of a run chart, this data could not have happened by chance. We speculate the increased frequency of readmissions was due to the reinforced awareness of our project implementation and heightened sepsis awareness from the clinical nursing staff. Additionally, this project intervention period coincided with new resident physicians being onboarded to the rehab facility. Although there was a slight increase in each secondary outcome measure of sepsis knowledge, clinical confidence in caring for a sepsis patient and care provider to clinician communication from pre to post implementation, such differences were not statistically significant. The pre-test scores were already on the higher side with a mean of 11.56 (sd=1.984) with post test scores slightly higher with a mean of 11.78 (sd=1.650). Because knowledge was already high prior to the intervention implementation, there was not much of an increase in the secondary outcome measures. According to the demographic data, many nurses have worked on the IRF for a number of years and have experienced sepsis readmissions firsthand. Moreover, because the overall pre-post survey only assessed nurse perception in each secondary measure domain, a more comprehensive measure for assessing knowledge about sepsis would be more sensitive to detect change pre- post intervention.

With an 80% in sepsis algorithm utilization post implementation survey, we learned that nurses are eager to use tools given to them to improve their workflow and patient outcomes. Clinical nurses taking part in the QI project resulted in a positive changes in readmission rates each month. Most nurses were enthusiastic to be involved in the process once they understood the potential outcomes for their patients.

If this projected were to be replicated, buy-in from medicine, therapy and nursing is key. A big part of this project was care provider to clinician communication. If the interdisciplinary team is not on the same page to mitigate sepsis readmissions, the project will not be successful.

Limitations

This study had several limitations. Three months of intervention data did not present a clear picture of the readmission frequency overtime but rather a snapshot. A longer timeframe of six months, nine months and then one full year will present a more complete picture of the readmission frequency and provide a more precise analysis of the algorithm impact.

The COVID-19 pandemic presented unique challenges as well. The original plan for this project was to hold in-person sessions in for all nursing staff. Due to COVID-19 restriction after an initial project halt, the project was completed 100% virtually. Therefore, all staff members were not individually trained on the sepsis algorithm by the QI team but rather given information to contact the investigators if there were any questions. As the pandemic progressed, nurses were inundated with policy changes for COVID-19. Nurses reported experiencing burnout with multiple requests for process changes.

Staffing challenges was arguably our biggest limitation. Various staff members resigned due to life changes at all stages of the project. Due to full time staff exposures and quarantine periods, many agency nursing staff members cared for patients during the intervention period. 5

of the 13 patients who were readmitted to an acute care hospital were cared for by an agency nurse at the time of readmission.

Conclusion

Although there was a decrease in readmission frequency post sepsis algorithm implementation, it was found that there was no statistically significant difference between the sepsis algorithm and sepsis knowledge, clinical confidence of the clinical nurse, and/or care provider to clinician communication. Nurses became empowered through this QI project and believe many sepsis readmissions can be prevented with earlier interventions.

Quality improvement projects improve patient outcomes and the delivery of care. Time, skill and communication are important as rehab facilities are receiving more and more complex patients. Mitigating sepsis readmissions is driven by clinical nurses at the bedside, care providers, as well as administration and ancillary staff (i.e. therapy). Such staff members should have basic training on SIRs criteria and communication strategies within their individual scopes of practice.

The sustainability of this QI project depends on the outcome of the next cycle of data collection as well as the interdisciplinary teams ability to direct significant interest and responsiveness to the phenomena of mitigating sepsis readmissions in real time.

Next steps for this project include lengthening the data collection phase to obtain more data on readmission frequencies and algorithm utilization over time as well as an exploration in pre-post testing and clinical simulation. Working together in the interdisciplinary team is how readmissions can be prevented and even mitigated in the future.

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References


- Ayanian, J. Z., & Markel, H. (2016). Donabedian's Lasting Framework for Health Care Quality. *The New England journal of medicine*, 375(3), 205.
- Center for Medicare and Medicaid Services [CMS]. (2019, December 12). *Inpatient Rehabilitation Facility Prospective Payment System*. Retrieved from <https://www.cms.gov/Medicare/Medicare-Fee-for-ServicePayment/InpatientRehabFacPPS/IRFPAI.html>
- Faulk, C. E., Cooper, N. R., Staneata, J. A., Bunch, M. P., Galang, E., Fang, X., & Foster, K. J. (2013). Rate of return to acute care hospital based on day and time of rehabilitation admission. *PM&R*, 5(9), 757-762.
- Guerini, F., Frisoni, G. B., Morghen, S., Speciale, S., Bellelli, G., & Trabucchi, M. (2010). Clinical instability as a predictor of negative outcomes among elderly patients admitted to a rehabilitation ward. *Journal of American Medical Directors Association*, 11(6), 443–448. doi: 10.1016/j.jamda.2009.10.005.
- Herran-Monge, R., Muriel-Bombin, A., Garcia-Garcia, M. M., Merino-Garcia, P. A., Martinez-Barrios, M., Andaluz, D., ... & Alvarez-Martinez, B. (2019). Epidemiology and changes in mortality of sepsis after the implementation of Surviving Sepsis Campaign guidelines. *Journal of intensive care medicine*, 34(9), 740-750.
- Horton, D. J., Graves, K. K., Kukhareva, P. V., Johnson, S. A., Cedillo, M., Sanford, M., ... & Kawamoto, K. (2020). Modified early warning score-based clinical decision support: cost impact and clinical outcomes in sepsis. *JAMIA Open*.
- Hoyer, E. H., Needham, D. M., Atanelov, L., Knox, B., Friedman, M., & Brotman, D. J. (2014).

- Association of impaired functional status at hospital discharge and subsequent rehospitalization. *Journal of hospital medicine*, 9(5), 277-282
- Huang, V. (2018). Factors Related to Transfer to Acute Care Hospital during admission to Free-standing Inpatient Rehabilitation Facility (IRF). Poster Presentation.
- Jacobs, J. L. (2019). Implementation of an Evidence-Based, Nurse-Driven Sepsis Protocol to Reduce Acute Care Transfer Readmissions in the Inpatient Rehabilitation Facility Setting. *Rehabilitation nursing: the official journal of the Association of Rehabilitation Nurses*.
- Kommers, A. (2019). Average hospital readmission costs for 18 diagnoses. *Becker's Hospital Review*. Retrieved from <https://www.beckershospitalreview.com/rankings-and-ratings/average-hospital-readmission-costs-for-18-diagnoses.html>
- Levy, M. M., Evans, L. E., & Rhodes, A. (2018). The surviving sepsis campaign bundle: 2018 update. *Intensive care medicine*, 44(6), 925-928.
- Middleton, A., Graham, J. E., Krishnan, S., & Ottenbacher, K. J. (2016). Program interruptions and short-stay transfers represent potential targets for inpatient rehabilitation care-improvement efforts. *American journal of physical medicine & rehabilitation*, 95(11), 850. doi: [10.1097/PHM.0000000000000629](https://doi.org/10.1097/PHM.0000000000000629)
- Ottenbacher, K. J., Karmarkar, A., Graham, J. E., Kuo, Y. F., Deutsch, A., Reistetter, T. A., ... & Granger, C. V. (2014). Thirty-day hospital readmission following discharge from postacute rehabilitation in fee-for-service Medicare patients. *Jama*, 311(6), 604-614.
- Pellicane, A. J. (2014). Relationship between nighttime vital sign assessments and acute care transfers in the rehabilitation inpatient. *Rehabilitation Nursing*, 39(6), 305-310. doi: 10.1002/rnj.169.

- Perla, R. J., Provost, L. P., & Murray, S. K. (2011). The run chart: a simple analytical tool for learning from variation in healthcare processes. *BMJ Quality & Safety*, *20*(1), 46-51.
- Renz, S. M., Boltz, M. P., Capezuti, E., & Wagner, L. M. (2015). Implementing an SBAR communication protocol: a quality improvement project. *Annals of long-term care*, *23*(7), 27-31.
- Schneider, J. C., Gerrard, P., Goldstein, R., DiVita, M. A., Niewczyk, P., Ryan, C. M., ... & Zafonte, R. (2012). Predictors of transfer from rehabilitation to acute care in burn injuries. *Journal of Trauma and Acute Care Surgery*, *73*(6), 1596-1601.
- Shih, S. L., Gerrard, P., Goldstein, R., Mix, J., Ryan, C. M., Niewczyk, P., ... & Schneider, J. C. (2015). Functional status outperforms comorbidities in predicting acute care readmissions in medically complex patients. *Journal of general internal medicine*, *30*(11), 1688-1695.
- Shih, S. L., Flavin, M., Goldstein, R., Slocum, C., Ryan, C. M., Singhal, A., ... & Schneider, J. C. (2019). Weekend Admission to Inpatient Rehabilitation Facilities is Associated with Transfer to Acute Care in a Nationwide Sample of Patients with Stroke. *American journal of physical medicine & rehabilitation*.
- Uniform Data System for Medical Rehabilitation (UDSMR) (2019, August 8). Retrieved from Penn Institute for Rehabilitation Medicine. Philadelphia, PA
- Xue, Y., Liang, H., Norbury, J., Gillis, R., & Killingworth, B. (2018). Predicting the risk of acute care readmissions among rehabilitation inpatients: A machine learning approach. *Journal of biomedical informatics*, *86*, 143-148. doi: 10.1016/j.jbi.2018.09.009.

Appendix A

Pre Implementation Survey

Confidential		Page 1
Pre Implementation Survey		
Please complete the survey below. Your information is confidential and will only be used for quality improvement purposes.		
Thank you!		
1) What is your current age?	_____	
2) How many years have you worked as a registered nurse (RN)?	_____	
3) How many years have you worked on the GSPP LTACH?	_____	
	((Enter "0" if N/A))	
4) How many years have you worked on the GSPP PIRM?	_____	
	((Enter "0" if N/A; Enter a numerical value if you have floated to the unit))	
5) What shift do you primarily work?	<input type="radio"/> Day Shift <input type="radio"/> Night Shift	
6) How much do you know about sepsis?	<input type="radio"/> a great deal <input type="radio"/> much <input type="radio"/> somewhat <input type="radio"/> little <input type="radio"/> nothing	
7) How comfortable are you managing a patient with suspected sepsis?	<input type="radio"/> very comfortable <input type="radio"/> comfortable <input type="radio"/> neutral <input type="radio"/> uncomfortable <input type="radio"/> very uncomfortable	
8) How likely are you to recommend patient interventions for a suspected sepsis patient to your organizations care providers (MDs, NPs, PAs)?	<input type="radio"/> very likely <input type="radio"/> likely <input type="radio"/> somewhat likely <input type="radio"/> not likely <input type="radio"/> never	
9) Are you aware there are emergency antibiotics located in the omnicell at the LTACH POD area (near rooms 5050-5055)?	<input type="radio"/> Yes <input type="radio"/> No	
10) True or False: *I believe readmissions to acute care hospitals ("acute outs") are a problem on the GSPP PIRM.*	<input type="radio"/> True <input type="radio"/> False	
11) True or False: *I believe some readmissions to acute care hospitals ("acute outs") on the PIRM can be prevented with earlier interventions.*	<input type="radio"/> True <input type="radio"/> False	
07/30/2020 8:04pm	projectredcap.org	

Appendix B

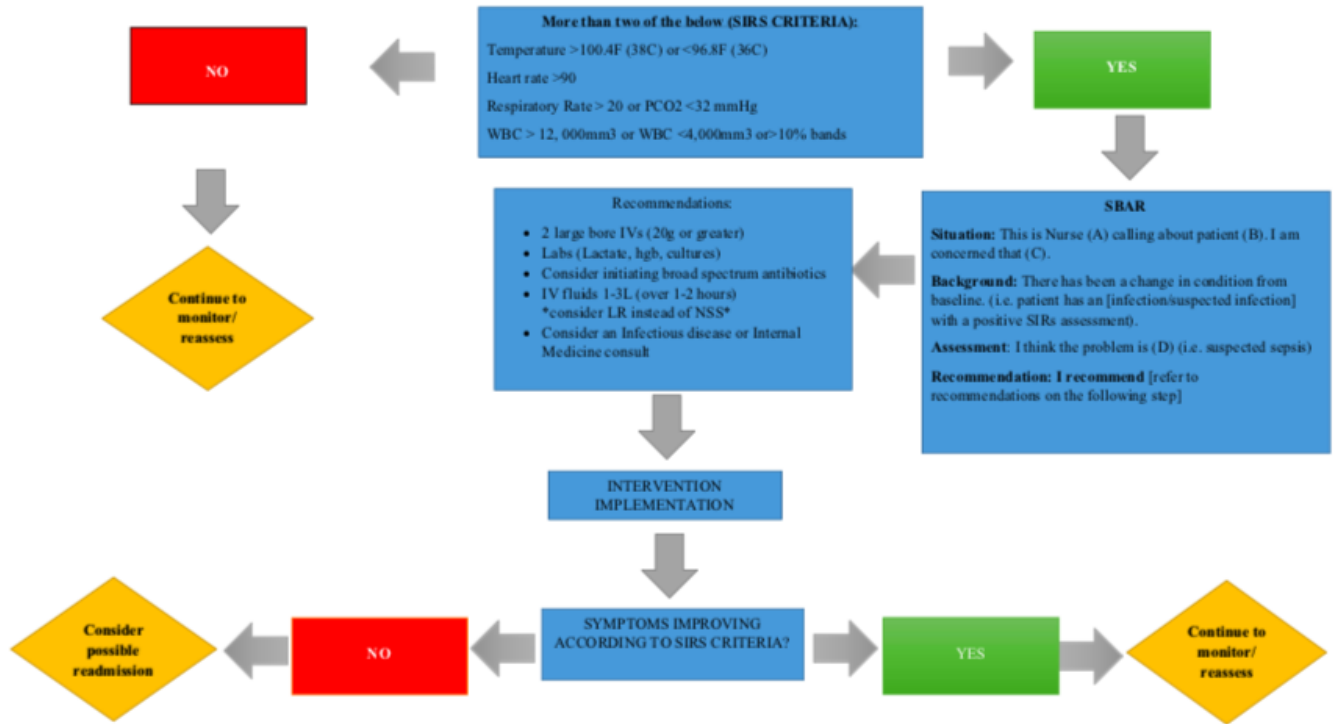
Sepsis Education Video



Appendix C

Nurse Driven Sepsis Algorithm

NURSE DRIVEN SUSPECTED SEPSIS PATHWAY



Appendix D

Readmission Follow-Up Survey

Confidential Page 2

Acute Out Follow-up Survey

Please complete the survey below.

Thank you!

Did you care for a patient who was readmitted to an acute care hospital (an "acute out")? Yes
 No

Did you use the sepsis algorithm steps to communicate patient findings to your organization's care provider (MD, PA, NP, etc). Yes
 No

What did you recommend the care provider to do? Lactate
 Blood cultures
 IV Fluids
 IV antibiotics
 Other


Please specify "other" _____

What did the care provider order? Lactate
 Blood cultures
 IV Fluids
 IV antibiotics
 Other

Please specify "other" _____

Approximately how long from the onset of symptoms was the patient sent to an acute care hospital? 1 to 2 hours
 2 to 3 hours
 3-4 hours
 5-6 hours
 Over 6 hours

Is there any additional information the you'd like to share? _____

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Appendix E: Post Implementation Survey

<i>Confidential</i>		<i>Page 1</i>
Post Implementation Survey		
Please complete the survey below. All of your responses remain confidential.		
Thank you very much for participating in this quality improvement project.		
<hr/>		
1) How much do you know about sepsis?	<input type="radio"/> a great deal <input type="radio"/> much <input type="radio"/> somewhat <input type="radio"/> little <input type="radio"/> nothing	
<hr/>		
2) How comfortable are you managing a patient with suspected sepsis?	<input type="radio"/> very comfortable <input type="radio"/> comfortable <input type="radio"/> neutral <input type="radio"/> uncomfortable <input type="radio"/> very comfortable	
<hr/>		
3) How likely are you to recommend patient interventions for a suspected sepsis patient to your organizations care providers (MDs, NPs, PAs)?	<input type="radio"/> very likely <input type="radio"/> likely <input type="radio"/> somewhat likely <input type="radio"/> not likely <input type="radio"/> never	
<hr/>		
4) True or False: *I believe readmissions to acute care hospitals ("acute outs") are a problem on the GSPP PIRM.*	<input type="radio"/> True <input type="radio"/> False	
<hr/>		
5) True or False: *I believe some readmissions to acute care hospitals ("acute outs") on the PIRM can be prevented with earlier interventions.*	<input type="radio"/> True <input type="radio"/> False	
<hr/>		
6) *When caring for a patient with a suspected infection, I used the sepsis algorithm steps to effectively screen and communicate my findings with my organizations care providers (MD, NP, PA).*	<input type="radio"/> Yes <input type="radio"/> No	
<hr/>		
07/30/2020 8:10pm	projectredcap.org	