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Implementation of a Daily Checklist to Improve Patient Safety and Quality of Care in a Pediatric Intensive Care Unit

Catherine Reese
University of Missouri-St. Louis, cjr1338@bjc.org

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Catherine J. Reese
M.S, Nursing, University of Missouri-St. Louis, 2003
B.S. Nursing, University of Missouri- Columbia, 1997

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Advisory Committee

Susan L. Dean-Baar, Ph.D., RN, FAAN (Chair)
Ericka Sanner-Stiehr, Ph.D., RN
Cynthia Brooks, MS(N), RN, NE-BC

ABSTRACT

Background

Multiple industries have demonstrated checklists to be of great value in reducing errors of omission and improving communication. In healthcare, checklists have been shown to ensure patients receive evidence-based, safe care. In a fast paced environment of a critical care unit, adverse events are common and can have significant consequences on patient outcome. Safety guardrails are necessary to minimize naturally occurring human error. Safety checklists help support best practices to standardize care and support processes to improve outcome.

Objectives

To develop and implement a daily safety checklist in a pediatric intensive care unit (PICU) to enhance clinical care and improve patient outcome.

Methods

After an extensive review of the literature, a multidisciplinary team was created to determine the structure and content for the checklist then placed on an electronic device. The setting of a 30-bed pediatric intensive care unit (PICU) in an urban academic institution was chosen. The PICU nurse practitioner team was identified as the data collection team. Pre and post-implementation surveys regarding perceptions of benefit of the checklist were administered to the data collection team.

Results

A total of 447 checklists were completed in thirty days. Data was successfully captured, and a reporting system was established. Results of the checklist were communicated with the multidisciplinary team daily. Surveyed practitioners reported an improved perception of the benefits of the checklist including improved team

communication, improved outcomes, identification of safety issues, and the importance of the role in safety after implementation.

Conclusion

The use of a daily safety checklist in a pediatric critical care unit has the potential to enhance clinical care and improve patient outcome. Multidisciplinary communication, enhanced awareness of safety, and improved team perception of value can be improved from collaborative efforts to improve safety in a high paced critical care environment.

Acknowledgments

I would like to thank my family for supporting me along this journey, especially my husband, parents, and five children. My husband, Kevin, spent countless hours as a single parent caring for our children and ensuring I was nourished with enough sleep to continue my work and studies to complete this initiative. I would like to acknowledge my children, Colby, Carson, Cooper, Colton, and Chloe for being supportive and encouraging throughout the endless hours of my work and for the extra love they gave me when I was ready to give up. I would also like to thank all of my colleagues, especially Dr. John Lin and the PICU nurse practitioner team for the time and commitment they provided to complete this project and to the support given by St. Louis Children's Hospital and the faculty of the University of Missouri-St. Louis nursing program.

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Introduction

Problem

Critically ill children have higher risks of secondary illnesses due to the acuity of their illnesses, weakened immunity, and challenges with medical management leading to healthcare-associated problems. The management of these extreme illnesses also place these patients at higher risk for side effects, adverse events, and morbidities secondary to necessary invasive treatments to improve health. A multidisciplinary intervention is necessary to minimize these risks and promote health in a pediatric critical care unit setting. The Institute of Health has identified one strategy to minimize risks through the development and implementation of a safety checklist (Kohn, Corrigan & Donaldson 1999).

Background information

According to the Center for Disease Control, about one in twenty-five hospitalized patients has at least one healthcare-associated infection (HAI). There were an estimated 722,000 HAIs in U.S acute care hospitals in 2011 in which about 75,000 hospitalized patients with HAIs died during their hospitalizations (CDC, 2016). These infections include blood stream infections, ventilator acquired pneumonias, catheter-acquired urinary tract infections, pressure ulcers, and deep vein thrombosis. Critically ill children have significant risks of acquiring one or more of these infections contributing to healthcare-associated problems.

In addition to HAIs, there are additional challenges when caring for critically ill children. One significant challenge is related to sedation management to prevent injury from mechanical ventilation in this fragile population. Many complications secondary to

oral endotracheal tubes (ETTs) can occur during initial placement as well as with on-going use. Complications such as inflammation and edema of the airway, mucosal ulceration, granulomas, laryngotracheal stenosis, and injury of the vocal cords from the use of ETTs may prolong the admission within the intensive care unit (Tadie et al., 2010). Younger patients can be particularly difficult to keep intubated safely as anxiety, agitation, inability to communicate, and pain control issues due to the many possible side effects.

The prevalence of malnutrition amongst hospitalized patients is also a significant health-care problem with implications on patient outcomes. Malnutrition is often an independent predictor of outcome and has demonstrated effects of increased rates of infectious and non-infectious complications, higher mortality, longer lengths of hospital stays, and increased hospital costs. Malnutrition in hospitalized children has been shown to be associated with altered physiological responses, increased resource utilization, and worsening outcome for critically ill patients (Correia, 2003).

Effective communication among caregivers is necessary to minimize risk factors and complications secondary to the medical management of critically ill children. Long work hours, highly acute patient illness states, excessive responsibilities, and the fast paced environment of an intensive care unit places additional burdens on health-care teams that lead to a lapse in communication. Established patient care goals are impossible to achieve without the support from the bedside team. Likewise, the bedside nurse knows intricate details regarding the patient's health trends and statistics, pain control needs, and social concerns. Daily and long term patient goals cannot be met without effectively sharing this data and assessment of needs with the multidisciplinary health-care team.

Close monitoring of side effects of medications, decreasing the risks of common hospital-acquired infections, and effective team communication are necessary to improve the quality of care and prevent avoidable events of morbidity and mortality.

Purpose

The purposes of this health care initiative are to develop and implement a daily safety checklist in a pediatric intensive care unit (PICU). The aims of this project are to ensure measures to reduce risk factors and morbidities within the PICU are assessed and recorded and to facilitate communication of the checklist results among care providers. With successful implementation and improved communication, it is possible to minimize hospital-acquired infections (HAIs) and adverse events related to sedation management in mechanically ventilated critically ill pediatric patients, reduce risks of venous thromboembolism, prevent pressure ulcers by identifying patients at risk, and optimize enteral feeds while minimizing risks of peptic ulcer disease.

The success of this project will be determined by the creation and implementation of the checklist within the setting identified. Success includes the unbiased completion of the checklist on each PICU patient during the trial period. Additional success will be measured by improved perceptions of the utility of the safety checklist by the data collection team as evidence from the pre and post-implementation surveys.

Review of the literature

The purpose of a checklist is to attempt to detect a potential error before it leads to harm. Adverse events and significant errors are common in the critical care setting due to its complex and multidisciplinary nature (Rothschild et al., 2005). In addition, critically ill individuals may be at higher risk of iatrogenic injury due to the severity and instability

of their disease in addition to the frequent need of high-risk interventions and medications (Rothschild et al., 2005). A review was completed to examine data of safety checklists including settings of health care.

A review of the literature showed a variety of data related to the use of checklists in health care. The results illustrated in the attached evidence table (Appendix A) highlights the outcomes of the use of a daily checklist or patient goals sheets to improve patient outcome. One study by McKelvie, Creery, Marchand, Reddy, and Barrowman (2014) was used to evaluate the compliance of a checklist and how it affected patient care. The results showed that the use of the checklist most commonly affected the patient management plan regarding the need for chest X-Ray the following day, evaluation of blood work frequency, recognition of a need for a new consult, and verification of nasogastric/nasojejunal (NG/NJ) tube position. Decreasing use of daily chest X-Rays and random laboratory collection when possible can produce a cost savings of approximately $200-500 per day in addition to life-saving costs of decreased radiation exposure ("How Much Does An X-Ray Cost? - Costhelper.Com", 2017). Verification of NG/NJ tube position can prevent certain adverse events secondary to malpositioned tubes that could lead to aspiration pneumonia, more frequent use of mechanical ventilation, increased length of hospital stay, and even death (NPSA, 2017).

Two studies were systematic reviews of safety checklists. One of the systematic reviews by Ullmann, Long, Horn, Woosley, and Coulthard (2013) reviewed various checklists that had been implemented. The goals of the review were to develop evidence-based checklist as a tool to reduce preventable adverse events and enhance clinical care in a pediatric ICU. From this review, the group then developed KIDS SAFE, a checklist for

a total of 8 areas of care for patients in a PICU setting: kids' developmental needs, infection, prophylaxis for deep vein thrombosis, sedation, skin integrity, analgesia, family, and enteral needs. No data has yet been reported from this study.

Multiple studies have demonstrated that poor and ineffective communication among health care professionals can lead to medical errors and patient harm. An examination of reports from the Joint Commission revealed that communication failures were implicated at the root of over 70 percent of sentinel events (Dingley, Daugherty, Derieg, & Persing, 2017). Interventions and implementation methods can be instrumental in preventing negative patient outcomes. Several studies have demonstrated improved communication and patient outcome by use of a daily safety checklist or a patient goal sheet. A systematic review by Ko, Turner, and Finnigan (2011) set out to evaluate if checklists improved patient outcome in an acute setting. The findings did suggest some benefits of using safety checklists to improve protocol adherence and patient safety but were not consistent. The following studies reviewed improvement in communication among team members after initiation of patient goal sheets or safety checklists. Narasimhan, Eisen, Mahoney, Acerra, and Rosen (2006) reported findings of improved scores for understanding daily goals and communication shown after implementation of goal sheets with decreased length of stay. Phipps and Thomas (2007) set out to assess the impact of daily goal sheet implementation upon nursing perception of communication. In this study, 85% of nurses felt daily goal sheets led to improved communication between physicians and nurses in the PICU. Agarwal, Frankel, Tourner, McMillan, and Sharek (2008) also studied team communication after implementation of daily goal sheets showing that communication between health care providers was improved by use of a

daily patient goal sheet as evident by the perceptions of nurses and physicians of improved understanding of patient care goals. However, length of stay in this study was not impacted. Rehder et al. (2012) demonstrated improved team agreement on daily goals and provider behaviors, decreased barriers to communications, and improved communication facilitators improved after interventions completed by use of a patient goal board that was completed and communicated during patient care rounds. All four of these studies showed marked improvements in the perception of communication amongst the multidisciplinary team. In addition, some data on quality and safety measures improved while others were marginal. One study by Tarrago and Leonard (2012) showed increased quality indicators and safety metrics after the initiation of a safety checklist. This study demonstrated favorable outcomes of quality and safety with a statistical decrease in HAIs related to decreased numbers of invasive lines per patient days. This study also showed a significant cost improvement by decreasing infections, medication usage, laboratory testing, and invasive device use by over $500 per day.

As demonstrated, checklists can be valuable to patient outcome and cost savings within an acute care hospital setting. They have been shown to ensure patients receive evidence-based, safe care. According to the World Health Organization, it is inevitable to have human error due to complexity of modern medicine. However, it is believed that resultant harm to patients is preventable. Utilizing checklists can allow function of complex pathways of care to continue by encouraging a "pause" before proceeding to next steps in patient care (WHO, 2017). In-patient safety checklists are increasing due to research findings showing improved patient outcome and decreased safety events with their use. Checklists utilized in the medical setting can promote process improvement and

increase patient safety (Health Research & Educational Trust., 2013). Implementation of a formalized process reduces errors caused by lack of information and inconsistent procedures. Multiple reports have demonstrated checklists to be helpful for improving processes for hospital discharges and in-patient transfers for patient care in intensive care and trauma units. Along with improving patient safety, checklists create a greater sense of confidence that the process is completed accurately and thoroughly (Health Research & Educational Trust., 2013).

Methods

This health care initiative is intended to provide a systematic process to assess safety risks for critically ill pediatric patients. The initiative focuses on designing and implementing a daily PICU patient safety checklist.

Formation of Team and Setting

For successful design and implementation including administrative support, key stakeholders were identified. Expert attending PICU intensivists, nursing leadership, and information technology experts were identified as the key stakeholders to develop this initiative. This group of stakeholders formed the team, including front line patient care providers, to guide development of the project. Goals and objectives of the checklist were developed. The team then chose the setting for this project. A thirty bed PICU within a 260-bed free-standing pediatric hospital was agreed upon. This setting is an academic-based hospital in the city of Saint Louis. This PICU cares for a wide variety of patient disease states including neurological, surgical, medical, pulmonary, infectious disease, hematologic, oncologic, endocrinology disorders, and nephrology illnesses. It is a teaching facility that employs a multidisciplinary team including attending physicians,

fellow physicians, resident physicians, nurse practitioners, and registered nurses. After identifying the setting for the pilot, pre-implementation data (safety events, invasive devices, HAIs) of this unit was evaluated by the team. After reviewing the data, the stakeholder group determined the questions/items to be placed onto the checklist (Appendix B). Guidelines for creation of the checklist and implementation strategies were established by the multidisciplinary ICU team and based on an evidence-based literature review.

Development of Checklist and Survey

The checklist tool was created with the assistance of the information technology (IT) team at the institution where the initiative was implemented. The team agreed to utilize the Washington University School of Medicine REDCap (Research Electronic Data) system for data collection. REDCap was chosen as it is a secure, web-based application for building and managing online databases and is specifically geared to support online data capture for research studies and operations. After agreement of checklist items was reached, the checklist tool (Appendix B) was loaded onto an electronic data device. Due to the extensive knowledge, skill, experience, and consistent presence of the PICU nurse practitioner team within the pilot setting, this group of ten providers were identified as data collectors for the initiative. To evaluate the perceived benefits of the safety checklist by the collection team, a survey was created to assess pre and post-implementation perceptions of the nurse practitioner data collection team (Appendices C and D). This project was approved by the University of Missouri-St. Louis Internal Review Board (IRB) (Appendix E) and an informational letter (Appendix F) was distributed to the data collection team before survey distribution. The checklist

tool and proposed collection process was also reviewed by the PICU leadership team and received approval for implementation. Informative materials were given to the data collector participants regarding rights/responsibilities of the initiative and project coordinator contact information. The entire PICU staff was educated on the use and purpose of the tool, checklist items, and how the tool was to be completed. The nurse practitioner team had extensive education by the project coordinator and IT team on the data collection process, guidelines for care, and technology use.

Pilot Checklist and Survey Implementation

Based on feedback from nursing management, physician leadership, nursing staff, and the nurse practitioner team, it was determined that the nurse practitioners would collect data with assistance from the bedside nurses during routine day time work hours Monday through Friday following completion of multidisciplinary patient rounds. Due to limitations in staffing, this first phase did not attempt to capture data on weekends or holidays. As planned, the nurse practitioner team was asked to complete a pre-implementation survey to gain feedback on the perception of the usefulness and impact of the checklist, the perceived acceptance of the checklist by the PICU team, and opinion of the achievements of the checklist before implementation. The implementation date was set and began as scheduled in January 2017. Safety checklist data was communicated with the multidisciplinary team before evening sign out. After two weeks of data collection, a follow-up meeting was conducted with the data collection team and project coordinator. Based on feedback from the data collection team, the process of checklist completion was changed to be added to the morning multidisciplinary rounds. The purposes of this change were to improve workflow, decrease time to complete data

collection and data entry, and to engage the multidisciplinary team and families into this safety initiative. This change was implemented successfully on week three of the pilot. The pilot continued for a total of six weeks.

Analysis

Electronic data reports were available from the data collection tool as set up by the IT team. After six weeks of data collection, evaluation with the safety checklist team took place to review preliminary data. The safety checklist survey was redistributed to the nurse practitioner team for post-implementation feedback (Appendix C). Feedback from the data collection team, nursing staff, physician staff, and IT team were discussed and recommendations for improvement were made. Due to encouraging preliminary results of the survey and pilot data collection, the team proposed recommendations to continue the data collection initiative in this PICU.

Results

The project sampled all PICU patients daily Monday through Friday during the pilot. Data was collected for a total of six weeks from 1/16/2017 to 2/24/2017. A total of 447 checklists were completed during the pilot study. Since the checklist was completed on all patients every weekday, many patients had multiple checklists completed based on their length of stay. A tracker was kept by the data collection team to identify any missed opportunities. The data from the tracker showed no missed opportunities during the trial period.

Safety Checklist

Of the 447 completed checklists, 115 of these patients were on mechanical ventilators, in which 88 had safety mechanisms in place to decrease the risks of a

ventilator-associated pneumonia or unintended extubations (head of bed > 30% with a secure, properly placed endotracheal tube). A total of 104 of the mechanically ventilated patients had a documented State Behavioral Scale to assess the individual sedation goal of each patient.

Of the 196 patients that had a documented central line in place, eight (8) patients were identified as not meeting criteria set by the Center for Disease Control for an on-going need for this catheter (CDC, 2011). The top two indications for the continued need of the central catheter included: caustic IV medications (102), and difficult IV access (62).

Eighty-one (81) patients surveyed had an arterial catheter in place. Of these 81 patients, 16 were identified as not meeting guidelines for accepted indications for on-going arterial line catheterization (CDC, 2011). The top two indications for arterial catheterization use were: need for continuous blood pressure monitoring (39), and frequent laboratory draws (26).

Eighty-one (81) patients were found to have an indwelling urinary catheter in place. Of these, 24 were noted to not meet criteria set forth by the Center for Disease Control for indications of indwelling urinary catheter recommendations (CDC, 2009). The top reasons for continuation of indwelling urinary catheter use were: accurate measurement of intake and output (37) and prolonged immobilization after a traumatic injury or unstable spine (16).

Of the 64 patients that had a device in place placing the patient at increased for a pressure ulcer, 52 had a barrier in place for skin protection. Devices placing patients at

increased risk of pressure ulcers included EEG leads, on-going skin adhesive pads, and respiratory masks.

Ninety-six (96) patients met criteria for prophylactic venous thrombosis therapy set forth by the evidence-based medicine guidelines accepted by the pilot institution (Reese, C. & Lin, J., 2016). However, only 79 patients were found to have the appropriate therapy in place per the guideline recommendations.

Lastly, 141 patients were not actively receiving enteral feeds. The most common documented indications for lack of enteral feeds were: unstable respiratory status (55), other (42), and hemodynamic instability (28).

The chart below summarizes the overall findings of the patient checklist data during the six-week trial period.

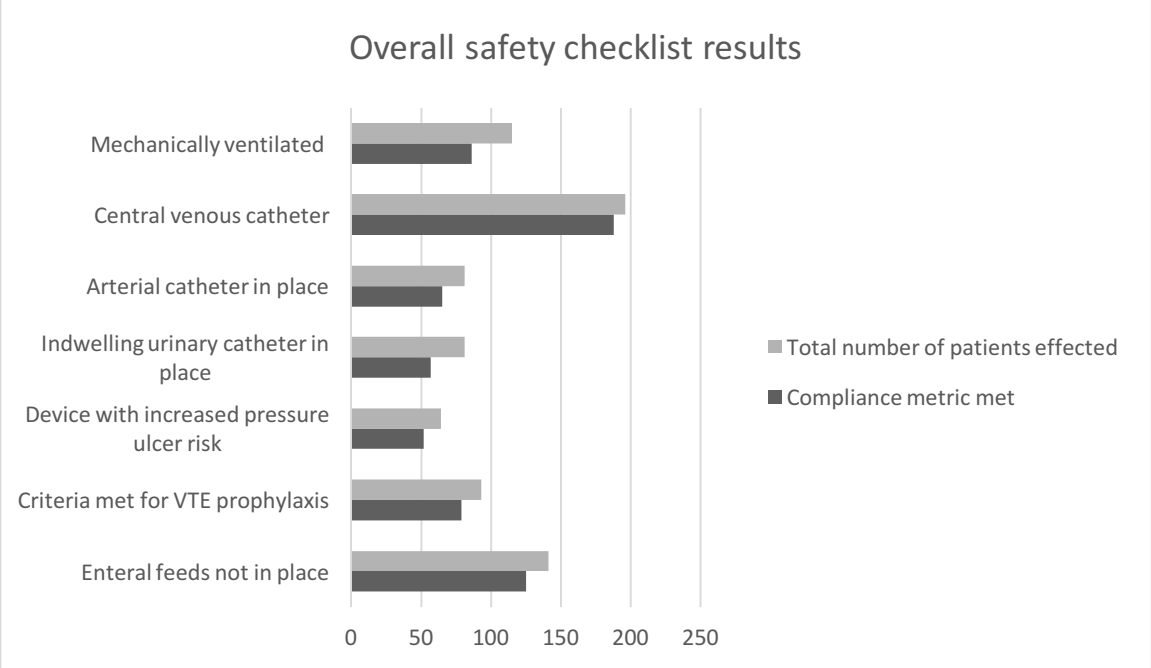

Figure 1. Overall Safety Checklist results. This figure shows the total number of patients effected compare to the compliance met.

Practitioner Survey

The PICU nurse practitioner team is comprised of ten practitioners. All ten practitioners were anonymously surveyed two weeks before implementation of the pilot to gain feedback on the usefulness and value of the daily safety checklist. The survey was closed on the first day of the pilot. All ten practitioners were again anonymously surveyed one week after the end of the checklist pilot. The survey was closed after two weeks. Nine practitioners completed the pre-implementation survey, and nine practitioners completed the post-implementation survey. Pre- implementation, four (44.4%) practitioners agreed or strongly agreed that the use of the checklist would help identify potential safety issues in this population, improve communication among care providers, and influence the decisions for patient care. Post-implementation, all nine (100%) agreed or strongly agreed with these statements. Pre-implementation, three practitioners (33.3%) agreed or strongly agreed that the checklist would improve overall health outcomes for critically ill children and that the nursing staff in the piloted unit were engaged in safety initiatives pre-checklist implementation. However, all nine (100%) agreed or strongly agreed with these statements post-implementation. Pre-checklist implementation, only three (33.3%) of practitioners agreed or strongly agreed that the results from the safety checklist would be appreciated by the PICU team. Post-implementation, nine (100%) respondents agreed or strongly agreed with this statement. Last, only two (22.2%) of respondents agreed or strongly agreed that their role in completing the checklist was important. After implementation, all nine (100%) of respondents agreed or strongly agreed with this statement. The following graph depicts a summary of these respondents:

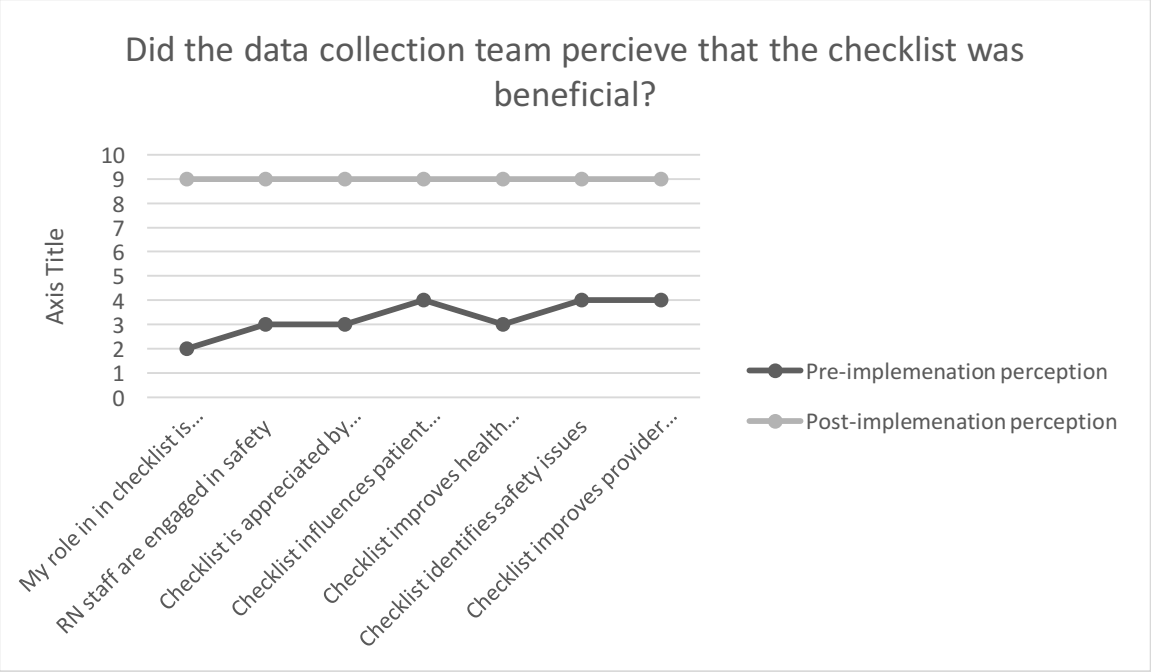

Figure 2. Perception of the safety checklist. This figure shows pre- versus post-implementation perception of the safety checklist.

Discussion

Evaluation

Implementation and quantity of data were evaluated to determine the successfulness of this initiative. The checklist was successfully developed and the project pilot was achieved as projected in the identified setting. The goal was to complete the safety checklist and document the data on all patients Monday through Friday for a six-week period in the setting described. This goal was fully met. No missed opportunities were reported during this six-week pilot period.

The other measurement of success was demonstrated by practitioner survey results. All questions showed marked improvement in acceptance and value of the use of the safety checklist from pre-implementation to post-implementation. The most

significant areas of improvement were increased agreement that the checklist would improve overall health outcomes, increase engagement of nurses in safety initiatives, and that the practitioner's role in the completion of the checklist was important. In addition, all respondents also reported marked improved perceptions that the checklist would help identify potential safety issues, improve provider communication, influence daily patient care decisions, and results would be appreciated by the PICU team.

Interpretation

The development and implementation of the daily safety checklist in this PICU were successful. The tool was completed by the checklist team as projected. Utilization of a research-based data collection technology system was utilized. This technology was reliable without set-backs throughout the pilot. Data was successfully entered and downloaded without notable challenges. Alterations in the process of data collection were made after two weeks of the pilot due to the collection team feedback with reported improvement and satisfaction of the collection process. No additional funding or changes to staffing were necessary during the pilot to collect data. No missed opportunities for data collection were identified during the pilot.

Nine of ten nurse practitioners participated in the pre- and post-implementation survey. All nurse practitioners that responded to the surveys reported improved agreement in regards to the benefit of the safety checklist initiative. No survey respondent reported a negative effect of the safety checklist after completion of the pilot. These results lead to the interpretation that a daily safety checklist is achievable in this PICU setting with a highly engaged and reliable team.

Limitations

Due to limited staffing and work hours, the checklist was only able to be completed during routine day time hours Monday through Friday. Limitations in IT individuals and potential for malfunctioning electronic devices could have posed limitations to the collection of data. During the trial and data analysis, this was not identified as a problem. Commitment to the project through financial and personnel resources may be beneficial for on-going data collection and interpretation. Increased census and complicated patient populations pose challenges to data collection as time is limited and patient care is prioritized. It is currently unknown if the checklist collection actually improves patient outcome as this was not measured in this phase of the trial.

With only six weeks of data collection, it is unable to be determined if the use of the checklist will improve patient outcome as measured by decreased central line catheter days, decreased urinary catheter days, decreased complications secondary to venous-thrombosis, improved nutrition, decreased pressure wounds, and improved goals of sedation that may impact endotracheal trauma or unintended extubations. Baseline data is available that will require frequent review to determine if the checklist is making a positive impact on these outcome measures. In addition, it may be challenging to know if the safety checklist is the sole reason for improvements in outcome as other initiatives may take place within this unit setting for quality improvement purposes. Last, it is possible that variations may occur in the data collector process that could cause limitations in validity.

Implications and Future Direction

In the early discussions of this project, it was agreed upon by the checklist team that the success of this project was dependent upon a collaborative team within a

respectful, trusting environment. The checklist development team was comprised of front line staff and nursing and physician leaders. Agreement was made in the planning phases that nursing and physician leadership would level set the expectations of each member of the team in this initiative and hold team members accountable for their behaviors. Engagement of all members of the multidisciplinary team may have played a large impact on the success of this project. For this limited trial, successful implementation and positive feedback was received. It is hopeful that the results of this project show implication that continued use of a daily safety checklist within a safe to speak and collaborative environment can have great impact in patient impact. It is still to be determined if the checklist will have long term positive outcome effects within this setting. Due to the perceived success of this pilot by the PICU team and leadership, it has been determined that continued efforts will take place in data collection of the PICU Safety Checklist at the pilot institution. Future directions include: incorporating checklist data collection and discussion in standard daily work of the bedside team, increase engagement of the multidisciplinary team in the communication and completion of data collection, evaluate patient outcomes post-implementation and analyze any correlation as result of the checklist initiative, and incorporate any lessons learned from the planning and implementation of the checklist initiative.

To incorporate the data collection and discussion in standard daily work and increase engagement of the multidisciplinary team, The data collection team already made a very important change in collecting the data during multidisciplinary rounds to incorportate the data collection and discussion in standard daily work and in. This change improved the communication among all care team members in addition to initiating

safety discussions in the presence of parents and patients. Another direction may include adding the discussion data results in the shift change huddles to ensure all members of the team are appropriately informed. Lastly, sharing data that influenced patient care or even prevented an error or safety event should be shared in the moment and highlighted in staff meetings and huddles to show the effectiveness of this initiative.

The next phase of this initiative is to evaluate the effectiveness of this initiative on patient outcomes including decreased VAPs and unintended extubations, feeding status, central and arterial lines days and infection rates, VTE data, CAUTIs, and pressure ulcer occurrences. After six and twelve months of continued checklist data collection, this data will be re-evaluated to determine if a significance in patient outcome was noted since checklist implementation.

According to the checklist development team, the most important lesson learned from this initiative was that the collaborative efforts of leaders, physicians, information technology staff, and bedside staff made this project successful. This information will be extremely helpful in future unit and hospital initiatives.

Conclusions

The implementation of a daily safety checklist in a pediatric intensive care unit is possible. There is potential for significant improvement of patient outcomes with the use of a daily safety checklist. To ensure success, a collaborative, multidisciplinary model is necessary. Both nursing personnel and leadership support play key roles in this success. Knowledgeable, skilled staff are key to promoting health and preventing harm. Commitment from the entire multidisciplinary team is required for full support and success. The next phase of this initiative is to ensure sustainability. Feedback from

nursing staff, physicians, trainees, and practitioners will be important. Frequent data collection and analysis will need to take place to measure patient outcome that may be impacted from the checklist.

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Appendix A
Evidence Appraisal Table

Author/Year /Title	Evidence Quality & Type	Study Objective(s)	Sample/ Setting	Method	Results	Study Limitations
McKelvie, B., Creery, D., Marchand, M., Reddy, D.,& Barrowman, N. (2014). A PICU Patient Safety Checklist: Rate of Utilization and Impact on Patient Care.	II Quasi-experimental	1. Assess compliance with checklist use 2. Assess how often checklist elements affected patient care 3. Determine if patient and unit factors influenced checklist use	N= 148 encounters Setting: 12 bed cardiac and medical-surgical pediatric ICU in Canada	Research assistant attended daily bedside rounds to assess compliance with use of checklist and determined whether discussion of checklist element was associated with a change in patient's management plan.	Compliance with checklist use at daily bedside PICU rounds was high and frequently resulted in change in the patient management plan. -compliance of checklist 89.2% (95% CI) -checklist affected daily patient management 52.6% of the time (95% CI) -most commonly affected patient management: plan for CXR the following day, evaluation of	Non-experimental Not a randomized trial Small unit

Author/Year /Title	Evidence Quality & Type	Study Objective(s)	Sample/ Setting	Method	Results	Study Limitations
					blood work frequency, need for new consult, verification of NG/NJ position	
Narasimhan, M., Eisen, L., Mahoney, C., Acerra, F., & Rosen, M. (2006) Improving Nurse-Physician Communication and Satisfaction in the Intensive Care Unit With a Daily Goals Worksheet	II Quasi-Experimental Pre-Post Test	Evaluate the effect of a standardized worksheet on physicians' and nurses' perceptions of their understanding of goals of care and on patients' length of stay in an ICU	n= unknown Setting: 16 bed medical ICU in teaching hospital in New York.	Daily goal worksheet completed during multidisciplinary rounds and posted at each bedside of medical ICU. Contained information on tests/procedures, medications, sedation, analgesia, catheters, consultations, nutrition, mobilization, family discussions, consents, and disposition. Pre and post-implementation questionnaires completed by physicians and nurses regarding	Improved scores for understanding daily goals and communication shown after implementation of goal sheets with decreased LOS. -Scores for understanding goals improved from 3.9 to 4.8 for nurses and 4.6 to 4.9 for physicians. -Significant improvement in communication scores seen in both nurse and physician groups.	Conducted in single institution Completed in university setting Not a randomized trial Small unit

Author/Year /Title	Evidence Quality & Type	Study Objective(s)	Sample/ Setting	Method	Results	Study Limitations
				understanding of goals and communication ratings. Mean length of stay was also evaluation pre and post implementation	-Mean ICU length of stay decreased from 6.4 to 4.3 days after implementation	
Ko, H., Turner, T., & Finnigan, M. (2011) Systematic Review of Safety Checklists for Use By Medical Care Teams in Acute Hospital Settings – Limited Evidence of Effectiveness	IV Systematic Review	Systematic review of literature to evaluate if safety checklists improve patient safety in acute hospital settings	N= 9 cohort studies from four hospital care settings (ICU, ER, surgery, and acute care)	Search of Cochrane Library, MEDLINE, CINAHL, and EMBASE for randomized controlled trials published in English before September 2009.	Studies suggest some benefits of using safety checklists to improve protocol adherence and patient safety but were not consistent	Non-experimental Low to moderate quality of studies Risk of bias from studies Varying levels of design, setting, educational training, and outcomes measured

Author/Year /Title	Evidence Quality & Type	Study Objective(s)	Sample/ Setting	Method	Results	Study Limitations
Phipps, L. & Thomas, N. (2007) The Use of a Daily Goals Sheet to Improve Communication in the Pediatric Intensive Care Unit	II Quasi-experimental Pre-posttest	Assess the impact of daily goal sheet implementation upon nursing perception of communication	N= 40 nurses were given the initial survey, 26 completed. 42 nurses were asked to complete the post implementation survey, 22 completed. Setting: University-affiliated 12 bed pediatric ICU in Hershey Pennsylvania	Questionnaire administered to PICU nurses addressing perception of communication before and after implementation of a daily goals sheet.	Implementation of a daily goals sheet led to improvement in nursing perception of communication -85% of nurses felt daily goals sheet led to improved communication between physicians and nurses in the PICU -perception of PICU staff working as a team reached statistical significance (p=0.05)	Conducted in single institution Completed in university setting Not a randomized trial Small unit Small sample size
Agarwal, S., Frankel, L., Tourner, S., McMillan, A., & Sharek, P. (2008)	II Quasi-experimental Pre-posttest	Determine if PICU daily patient goal sheet 1. Improved communication between health	N= 419 questionnaires completed pre-implementation and 387 after implementation	Questionnaire administered to PICU nurses and physicians rating measures of effectiveness of communication,	Improvements in communication between health care providers were improved by use of a daily	Possible bias of volunteers No data regarding audits of use

Author/Year /Title	Evidence Quality & Type	Study Objective(s)	Sample/ Setting	Method	Results	Study Limitations
Improving Communication in a Pediatric Intensive Care Unit Using Daily Patient Goal Sheets		care providers 2. Decrease length of stay 3. was perceived as helpful/useful by PICU staff	Setting: PICU is 12-bed unit within a 254-bed quaternary care children's hospital in university setting in California	nurses' knowledge of physicians in charge, and length of stay in the PICU pre and post implementation of a daily patient goal sheet	patient goal sheet. -nurses and physicians perceived an improved understanding of patient care goals (p<.001) - nurses and physicians listed a higher number of patient care goals after implementation (p<.01) - nurses and physicians reported increased comfort in explaining patient care goals to parents (p<.001) -nurses identified patient's attend MD and fellow with increased accuracy after	of daily goal sheets on every patient – would bias results Small unit University setting Self-reporting Not a randomized trial Conducted in single institution

Author/Year /Title	Evidence Quality & Type	Study Objective(s)	Sample/ Setting	Method	Results	Study Limitations
					implementation (p<.001) -median length of stay was unchanged	
Rehder, K., Uhl, T., Meliones, J., Turner, D., Smith, P., & Mistry, K. (2012) Targeted Interventions Improve Shared Agreement of Daily Goals in the Pediatric Intensive Care Unit	II Quasi-experimental	Improve communication during daily rounds using sequential interventions	N= 736 patient rounds observed over nine months Setting: Multidisciplinary pediatric 16-bed intensive care unit in a university setting in North Carolina	Prospective cohort study completed. Daily rounds on 736 patients observed over nine months. Sequential interventions were timed 8-12 weeks apart including: 1.Implementing a new resident daily progress note format 2.Creating a performance improvement "dashboard" 3. Documenting patients'daily goals on bedside whiteboards.	Improved team agreement on daily goals and provider behaviors, decreased barriers to communications, and improved communication facilitators improved after interventions completed.	Single center study University setting Unable to evaluate individual interventions Not a randomized trial
Tarrago, R., & Leonard, C. (2012)	II Retrospective Case-	Improve patient safety and reduce costs by	N= 4001 patient days Setting:	Development and implementation of PICU safety checklist to prompt	Improved safety, quality, and collaborative culture improved	Not a randomized trial

Author/Year /Title	Evidence Quality & Type	Study Objective(s)	Sample/ Setting	Method	Results	Study Limitations
Reductions in Invasive Device Use and Care Costs After Institution of a Daily Safety Checklist in a Pediatric Critical Care Unit	Control Series	development of a safety checklist	13-bed Pediatric ICU in Minnesota during a 21 month period	the care team to address quality and safety items during rounds. Initially paper with subsequent versions in electronic forms. Eight measures were analyzed for three intervention periods and compared to baseline. Measures included central venous, arterial and urinary catheter days, percent intravenous (IV) doses of furosemide and ranitidine, number of antibiotic doses and laboratory studies, and use of gastric ulcer prophylaxis and continuous end-tidal CO2 monitoring in ventilated patients.	after implantation. -improvements on all quality and safety metrics identified including: invasive device use, medication costs, antibiotic use, laboratory tests, and compliance with standards of care. -Catheter days per patient day decreased for central venous (0.75 vs. 0.41), arterial (0.18 vs. 0.12) and urinary catheters (0.43 vs. 0.32) ($p < 0.001$). The percent of IV doses for furosemide decreased from 77% to 46%,	Single center study University setting

Author/Year /Title	Evidence Quality & Type	Study Objective(s)	Sample/ Setting	Method	Results	Study Limitations
					resulting in 847 fewer IV line entries. Antibiotic exposure decreased from 3.7 to 2.4 doses per patient per day, a reduction of 33% ($p < 0.001$). Laboratory test use decreased from 11.7 tests per patient per day to 5.8 in the final period ($p<0.001$), and resulted in charge savings of over $500 per patient per day. Use of gastric ulcer prophylaxis and continuous end-tidal CO2 monitoring increased by 15% and 117%, respectively.	

Author/Year /Title	Evidence Quality & Type	Study Objective(s)	Sample/ Setting	Method	Results	Study Limitations
Ullman, A, Long, D., Horn, D., Woosley, J., & Coulthard, M. (2013)	IV Systematic review of literature and retrospective review of local reporting of adverse events	Develop evidence-based checklist as a tool to reduce preventable adverse events and enhance clinical care in pediatric ICU	N = n/a Setting: n/a	After systematic review of literature of 53 articles and retrospective review of local reporting of adverse events 2008-2009 in a local PICU, a nominal group technique was used to determine the structure and content of a checklist. The group then developed KIDS SAFE, a checklist for eight areas of care for PICU patients: kids' developmental needs, infection, prophylaxis for deep vein thrombosis, sedation, skin integrity, analgesia, family, and enteral needs	No data to report	Team that created tool were volunteers from a single tertiary center with concern for bias Prospective studies needed to evaluate effectiveness in reducing adverse events No data post implementation

Appendix B

PICU safety checklist

1. What is the patient's MRN?
2. Is the ETT in place? y/n
    a. If yes, is HOB >30, ETT secure and properly placed?
3. Are SBS goals in range? y/n
4. Is a Central line in place? y/n
    a. If yes, where is the central line located?
    b. If yes, can the central line be d/c'd
        i. If no, reason central line is still needed: difficult IV access/TPN/frequent lab draws/dialysis/CVP measurement/fluid resuscitation/caustic IV medications/other
5. Is an Arterial line in place? y/n
    a. If yes, where is the arterial line located
    b. If yes, can it be d/c'd? y/n
        i. If no, reason arterial line is still needed: continuous BP monitoring needed/frequent lab draws/other
6. Is a urinary catheter in place? y/n
    a. If yes, reason urinary catheter is still needed: acute urinary retention/bladder outlet obstruction/accurate measurement of urine output/open sacral/perineal wounds/prolonged immobilization after traumatic injury or unstable spine/end of life comfort
7. Is a device in place making the patient at risk for a pressure ulcer? (respiratory mask, on-going skin adhesive pads, etc)? y/n
    a. If yes, is a proper protective barrier in place? y/n
8. Does the patient meet criteria for VTE prophylaxis? (10+ years of age; moderate high risk) y/n
    a. Is therapy in place? (moderate = mechanical prophylaxis; high risk = mechanical prophylaxis + pharmacologic if not contraindicated [requires discussion with attending MD]) y/n
9. Are the current enteral feedings in place? y/n
    a. If no, reasons current enteral feedings not in place (ileus/trauma/obstruction/GI bleed/hemodynamic instability/unstable respiratory status/other)

Appendix C
Safety Checklist Data Collector Pre Survey

1. The daily use of a safety checklist will help identify potential safety issues in critically ill pediatric patients

- strongly agree
- agree
- neutral
- disagree
- strongly disagree

2. The use of a daily safety checklist will improve overall health outcomes for critically ill pediatric patients

- strongly agree
- agree
- neutral
- disagree
- strongly disagree

3. The use of a daily safety checklist will improve communication among care providers

- strongly agree
- agree
- neutral
- disagree
- strongly disagree

4. Results of a daily safety checklist in a pediatric critical care unit will influence decisions regarding patient care

- strongly agree
- agree
- neutral
- disagree
- strongly disagree

5. Results from a daily safety checklist is appreciated by the ICU team

- strongly agree
- agree
- neutral

- disagree
- strongly disagree

6. In this unit, nursing staff are engaged in participation of safety initiatives

- strongly agree
- agree
- neutral
- disagree
- strongly disagree

7. My role in the completing a daily patient safety checklist is important

- strongly agree
- agree
- neutral
- disagree
- strongly disagree

Appendix D
Safety Checklist Data Collector Post Survey

1. The daily use of a safety checklist helped identify potential safety issues in critically ill pediatric patients

- strongly agree
- agree
- neutral
- disagree
- strongly disagree

2. The use of a daily safety checklist improved overall health outcomes for critically ill pediatric patients

- strongly agree
- agree
- neutral
- disagree
- strongly disagree

3. The use of a daily safety checklist improved communication among care providers

- strongly agree
- agree
- neutral
- disagree
- strongly disagree

4. Results of a daily safety checklist in a pediatric critical care unit influenced decisions regarding patient care

- strongly agree
- agree
- neutral
- disagree
- strongly disagree

5. Results from a daily safety checklist is appreciated by the ICU team

- strongly agree
- agree
- neutral
- disagree

- strongly disagree

6. In this unit, nursing staff are engaged in participation of safety initiatives

- strongly agree
- agree
- neutral
- disagree
- strongly disagree

7. My role in the completing a daily patient safety checklist is important

- strongly agree
- agree
- neutral
- disagree
- strongly disagree

Appendix E

Office of Research Administration

One University Boulevard
St. Louis, Missouri 63121-4499
Telephone: 314-516-5899
Fax: 314-516-6759
E-mail: ora@umsl.edu

DATE:	January 21, 2017
TO:	Catherine Reese
FROM:	University of Missouri-St. Louis IRB
PROJECT TITLE:	[1003704-1] Daily Safety Checklist in Pediatric Intensive Care Unit
REFERENCE #:	
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	January 21, 2017
REVIEW CATEGORY:	Exemption categories # *2, 4*

The chairperson of the University of Missouri-St. Louis IRB has APPROVED the above mentioned protocol for research involving human subjects and determined that the project qualifies for exemption from full committee review under Title 45 Code of Federal Regulations Part 46.101b. The time period for this approval expires one year from the date listed above. You must notify the University of Missouri-St. Louis IRB in advance of any proposed major changes in your approved protocol, e.g., addition of research sites or research instruments.

You must file an annual report with the committee. This report must indicate the starting date of the project and the number of subjects to date from start of project, or since last annual report, whichever is more recent.

Any consent or assent forms must be signed in duplicate and a copy provided to the subject. The principal investigator must retain the other copy of the signed consent form for at least three years following the completion of the research activity and they must be available for inspection if there is an official review of the UM-St. Louis human subjects research proceedings by the U.S. Department of Health and Human Services Office for Protection from Research Risks.

This action is officially recorded in the minutes of the committee.

If you have any questions, please contact Carl Bassi at 314-516-6029 or bassi@umsl.edu. Please include your project title and reference number in all correspondence with this committee.

Appendix F
Informational Letter to Survey Participants

Implementation of a Daily Safety Checklist in a Pediatric Intensive Care Unit (PICU)

The purposes of this initiative are to develop and implement a daily safety checklist in a pediatric intensive care unit (PICU) to improve patient outcomes. The aims of this project are to ensure measures to reduce risk factors and morbidities within the PICU are assessed and recorded and to facilitate communication of the checklist results among care providers. With successful implementation and improved communication, we propose that it is possible to minimize hospital-acquired infections (HAIs) and adverse events related to treatments necessary for the management of critically ill children.

As data collectors for this initiative, we ask that you complete the following survey prior to and 4-6 weeks after implementation of the safety checklist. The purpose of this questionnaire is to determine your opinions regarding the implementation and use of a daily safety checklist in the Pediatric Intensive Care Unit in your institution. The results of this survey will remain anonymous and not be able to be traced back to your identity. All results will be confidential and will be viewed only by the project coordinator. There are no known risks associated with completing this survey. The completion of this survey is completely voluntary. You have the option to complete the survey to its entirety, complete the questions you choose to answer, or not answer any questions at all.

For any questions, concerns, or follow up thoughts, please contact the project coordinator: Catherine Reese, MSN, RN, NP-C; 314-454-7722; Cjr1338@bjc.org