

Implementation of an Intubation Checklist

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Abstract

The issue that this capstone project addressed was the use of a standardized checklist during rapid sequence intubation. To address this problem, the purpose was to address the effectiveness of utilizing a standardized checklist during intubation in preventing complications associated with rapid sequence intubation such as oxygen desaturation or systolic hypotension. To gather data, a thorough review of current literature was reviewed. This data led to three themes in the literature: implementation of a rapid sequence checklist, safety related to intubation, and complication of intubation. These themes will be useful for understanding the effectiveness of a standardized checklist during rapid sequence intubation. Implementation occurred in three phases and was completed in a rural setting emergency department. After an intubation occurred, staff were asked to complete a post intubation tool. One successful intubation occurred during the implementation phase. Due to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), there was limited data obtained for analysis. After implementation was completed, one successful intubation occurred utilizing the checklist.

Implementation of an Intubation Checklist

Airway management by endotracheal intubation is an important but potentially hazardous area of critical care medicine and is associated with a higher risk of morbidity and mortality. Providers who perform intubation on this vulnerable population can increase the success of intubation by being adequately prepared for intubation by utilizing a checklist prior to performing endotracheal intubation.

Overview

Background

Endotracheal intubation has been the standard in advanced airway management for rapid establishment of a patent airway in seriously ill or injured patients since the first anesthetic laryngoscope was invented in 1913 (Abraham, 2013). The decision to intubate is commonly based upon actual or potential airway compromise, anticipated clinical course, ventilatory failure, or Glasgow Coma Scale (GCS) less than 8 after head injury (Nakstad, Heimdal, Strand, & Sandberg, 2011). Endotracheal intubation can pose life threatening complications and can be considered a high-risk procedure, resulting in significant morbidity and mortality with up to 40% of cases associated with marked hypoxemia or hypotension (Lapinsky, 2015). Intubation of critically ill patients can also be associated with an increased risk of hypoxia, cardiovascular collapse, risk of aspiration with failed first pass attempt or multiple attempts and death. These critically ill and injured patients frequently require intubation. These patients are often at risk of adverse events during intubation due to the urgency of the situation, lack of time for preparation, the presence of a full stomach, hemodynamic and respiratory decompensation, and

decreased physiologic reserves. Therefore, it is important to understand the effect of first pass success and the risk of adverse events associated with multiple attempts at orotracheal intubation.

Checklists have been publicized to decrease patient morbidity and mortality by assuring that the primary care provider does not overlook some important aspects of care which may decrease patient complications and even death (Tobin, Grabinsky, McCunn, Pittet, Smith, Murray, & Varon, 2013). One recent study found checklist implementation was associated with a reduction in immediate, intubation-related complications in an ER setting (Smith, High, Collins, & Self, 2015). With proper education and implementing a standardized checklist for providers in a rural setting, some of the common complications can be reduced leading to improved patient outcomes.

While some complications of intubations are inevitable, other reasons for complications during intubation include lack of proper equipment, inadequate training of the clinician, lack of appropriate planning and poor communication among crew members (Wijesuriya, & Brand, 2014). A review of one study indicated the high rate of procedural complications during intubation and the low cost of a checklist intervention make this a promising target for improvement of procedural performance (Janz et al., 2018).

Problem Statement

Endotracheal intubation can pose life threatening complications unforeseen by the patients who require intubation and the provider performing this lifesaving procedure. Lack of a pre-procedural checklist places patients who require endotracheal intubation at an increased risk of complications. This project attempted to answer the question that in

patients who require endotracheal intubation, utilizing an endotracheal intubation checklist affected the success of intubation and improved first pass success rate while minimizing adverse events during or immediately following intubation.

Purpose Statement

The purpose of this project was to implement an intubation checklist in a rural hospital setting to improve first pass success of intubation which decrease adverse events in patients who require intubation.

Outcomes

Expected outcomes after implementation of the checklist included improved first pass success rates of endotracheal intubation and decrease in adverse events related to intubation.

First pass success rates and adverse events related to intubation were measured by collecting data from each individual patient records utilizing the post intubation tool. Within this tool, documentation of the number of intubation attempts demonstrated the expected outcomes of improved first pass success. The tool acknowledged variations in vital signs prior to and after intubation and identified any adverse events that occurred as a result of endotracheal intubation.

Review of the Literature

A comprehensive, structured review of literature was completed utilizing the PICOT question of providers who perform endotracheal intubation, how does utilizing an RSI checklist affect success of intubation and minimize adverse events immediately following intubation. Online databases were utilized and included CINAHL complete and Medline complete. Key search words included patients who require intubation as well as

providers who perform intubation, adverse events during intubation and the use of an RSI checklist. Initial search combined all key terms resulting in Medline with 19,348 and CINAHL retrieved 6,398 articles. Limiters were then applied and included English language, academic journal in the last 5 years and peer reviewed narrowing down in Medline to 5,911 articles and in 455 articles in CINAHL. Inclusion criteria included focused area, systematic review, education related intervention and evidenced-based. Exclusion criteria utilized was not related to intervention, subject matter not related to PICOT question and duplicates which yielded a result of twenty-two in CINAHL and seven in Medline. There were a total of eight articles utilized for this capstone project. Of the level of evidenced used for this literature search, four articles were level three, one article was a level four, and three articles were a level five according to the level of evidence hierarchy (Petrisor & Bhandari, 2007) (Appendix B).

Significance

Research related to implementation of an intubation checklist can be found in a variety of articles. The use of a checklist prior to intubation solidifies the importance of team dynamics, planning, and equipment availability. The use of a checklist identified and reduced a surprisingly large number of missing items required in a standard induction protocol. A review study conducted by Birks (2016) evaluated the team dynamics and overall safety related to intubation in a hectic and stressful clinical environment. This article supports the use of a pre-intubation checklist to provide a safe system with a safe culture by assisting with cognitive offloading and indicated that is just as important as the individual clinician. While there was limited statistical data to support the use of an intubation checklist, a systematic review by Smith, High, Collins, and Self (2015)

reviewed 141 trauma patients intubated utilizing a pre-intubation checklist. Results of this study indicated after implementation of a checklist there was a reduction in intubation-related complications, decreased paralysis-to-intubation time, and improved adherence to recognized safety measures.

In order to improve patient safety and quality outcomes, health care professionals are using multiple methods to reduce patient harm and eliminate medical errors.

Checklists used in the medical setting can promote process improvement and increase patient safety. Implementing a formalized process reduces errors caused by lack of information and inconsistent procedures.

Adverse Events

Intubation of critically ill or injured patients can be associated with several adverse events. Some common events include hypoxia, hypotension, cardiovascular collapse, and aspiration. The concept of first pass success is frequently promoted as the goal of emergency intubation. Literature have revealed that multiple attempts at tracheal intubation are associated with an increase in the incidence of adverse events (Mort, 2004). When performing orotracheal intubation, first pass success is associated with a relatively small incidence of adverse events. As the number of attempts increases, the incidence of adverse events increases substantially. Statistically, if the intubation was successful on the first attempt, the incidence of one or more adverse event was 14% In cases requiring two attempts, the incidence of one or more adverse event was 47% and in cases requiring three attempts, the incidence of one or more adverse event was 64% (Sakles, Chiu, Mosier, Walker, & Stolz, 2013). There was a significant increase in the rate of airway-related complications as the number of intubation attempts increased (≤ 2 versus >2 attempts):

hypoxemia (11.8% versus 70%), regurgitation of gastric contents (1.9% versus 22%), aspiration of gastric contents (0.8% versus 13%) bradycardia (1.6% versus 21%), and cardiac arrest (0.7% versus 11%; $P < 0.001$) (Mort, 2004). While the use of a checklist does not directly result in a decreased number of adverse events, proper planning will result in an improved rate of first pass success. A retrospective study completed by Conroy, Weingart, and Carlson (2014) examined 187 trauma patients who underwent endotracheal intubation utilizing a pre-intubation checklist over a 2-year period. After completion of this study, successful intubation rate was 90.7% compared to 75.6% success rate without using a pre-intubation checklist. This study positively reflects first pass success rates with the implementation of a pre-intubation checklist.

After review of literature, the use of a checklist does not significantly or directly affect adverse events related to endotracheal intubation. However, using a checklist will improve the preparation needed to perform this procedure. A checklist will encourage team dynamics, validate proper planning is completed, and ensure all equipment is available for the providers.

Theoretical Framework

The revised Iowa Model located in Appendix D was utilized for evidence-based practice to promote excellence in health care and was the example of framework that exists to help guide practice change (Cullen, et. al., 2018). Implementation of an RSI checklist followed the framework outlined within the Iowa Model for evidence-based practice to promote excellence in health care. Key components of the revised Iowa model in relation to this capstone project included establishing outcome measures, collecting data, and developing, implementing, and evaluating an evidence-based practice change.

Identification of the knowledge problem of adverse events during intubation was the first step within the revised Iowa Model. The next step was to identify a team that would work closely with this practice change. In this case, the team has been identified as ER providers and support staff who share the responsibility of intubation of critically ill or injured patients. The next step was to retrieve and evaluate the quality of evidence that would support the use of an RSI checklist. After obtaining research that supports the use of a checklist, the next step within the Iowa Model was to develop an evidence-based practice standardized checklist. This process ultimately involved ER physicians, support staff, and hospital administration to ensure the checklist was tailored to meet the needs identified by these individuals who perform intubation. After the checklist was developed, it was implemented into practice by first providing hands on education sessions to educate providers on the importance of the checklist. Once the checklist had been implemented into practice, one evaluated the use of the checklist as well as identified any adverse events that happened during intubation.

Organizational Assessment

Difficult intubations occur for a variety of reasons. Some can be because of patient anatomy or the circumstances surrounding the need for intubation. Most failed intubation attempts occur commonly in the emergency room or prehospital setting. One challenge of working in a rural setting is the lack of continuous training, especially in procedures such as endotracheal intubation that are not performed on a daily basis. With this challenge, the proposal of a pre-intubation checklist is a solution to ensure no necessary steps are missed during endotracheal intubation. The intended organization for this practice change initiative shares the belief in continued educational opportunities to

improve patient care outcomes. One reason for choosing this particular community is the strong working relationship between the emergency room providers in relation to the pre-hospital providers who share responsibility in performing intubations of the critically injured or ill patients. While the number of intubations vary throughout the year, the ER usually performs at least one intubation a month. During the pre-implementation phase completed, the readiness for change by the organization is discussed. Some barriers to incorporating the checklist into practice would include lack of understanding of the checklist, overlooking aspects of the checklist, and defiance of utilizing the checklist. An unintended consequence of the utilizing the pre-intubation checklist would be taking too long to intubate a critically ill patient. This risk will be mitigated by ensuring proper education is provided to individuals who perform intubation. Ideally, using the checklist will take less than 30 seconds to complete unless a life-threatening situation exists, then use of the checklist should be skipped and documented in the post intubation tool.

Methodology

Implementation of an intubation checklist was an evidence-based practice change. Quantitative data methods were used to obtain necessary data that evaluated this practice change. With the incorporation of a checklist, one evaluated the effectiveness of this change practice by analyzing intubation success rates, incidence of adverse events related to intubation and preparation by the provider prior to intubation.

Setting

This capstone project was aimed at a Midwest rural community hospital. The town population was 5,600 people with a median age of 40 years of age and a variety of ethnic groups. The emergency department was staffed by a physician or mid-level

provider with assistance from paramedics who were all certified in advanced trauma, pediatric life support, advanced cardiac life support and neonatal resuscitation. Critical skills were performed by physicians, mid-level providers, and critical care paramedics. The emergency department cared for an average of 450 patients per month. The emergency department was a level IV trauma center designated to provide trauma treatment and stabilization services. The key stakeholders and target population affected by the use of a checklist included paramedics, emergency room providers, hospital administration, and patients who require rapid sequence intubation. The emergency medical service personnel and emergency room providers were the individuals who performed advanced skill and was the focus of education and training. The checklist gave these providers a way to ensure all aspects of intubation were completed and increase the chance of first pass success of an endotracheal tube. The hospital administration staff benefited from this checklist by decreasing costs of unsuccessful intubations and increasing overall success of their providers. The patients who require intubation benefited the most from a checklist. While the checklist did not directly impact the patients, anyone who required intubation were at the mercy of the trained provider. The goal of the intubation checklist was to improve preparation, crew resource management, communication, and first pass intubation success while minimizing adverse events.

Sampling

Most intubations occurred in the prehospital setting or within the emergency room. This capstone project was aimed at providing education and performing a preintubation checklist to any individual who performs endotracheal intubation as well as the support staff who assist with endotracheal intubation. The personnel who performed

intubation included emergency room physicians, mid-level providers, and support staff to include nurses, respiratory therapists, and paramedics. Inclusion criteria was any provider, of any age who performed intubation as well as documentation of the checklist. There were no exclusion criteria.

Implementation Procedures

According to the revised Iowa Model, evidence-based practice change will occur in a 7-step process which includes selection of a topic, forming a team, evidence retrieved, grading of evidence, developing an evidence-based standard, implementing the evidence-based practice, and finally evaluating (Cullen et al., 2018).

Phase 1: Pre-intervention

Topic selection for this capstone project was implementation of a pre-intubation checklist while the team was identified as emergency room physicians and mid-levels who perform endotracheal intubation as well as support staff who assist with intubation. Pre-intervention began with examining the extent of evidence-based practice research on the use a pre-intubation checklist. Building on the evidenced based practice research, discussions with local hospital administration staff, emergency room physicians, mid-level providers and support staff personnel was completed by the investigator. The discussion topics included current protocols for rapid sequence intubation to ensure a willingness to adapt practice change within the hospital system resulting in approval for the use of the proposed preintubation checklist. With this information, a checklist was tailored to their needs and adapted to fit into their protocols.

Next, determining a timeline was essential for implementing the checklist into daily practice. The timeline started with one month of planning and collecting data from

the primary stakeholders such as hospital administration, emergency room supervisors, pre-hospital director and respiratory therapist lead.

Phase 2: Intervention

After collecting the data, one month was used to analyze data to evaluate the areas of weakness and target a checklist to enhance these areas. After the development of a checklist that was specific to this organization, one month was aimed at providing education and training to emergency room providers, pre-hospital staff and support staff that perform and assist with rapid sequence intubations. Once training was completed, a 2-month trial of incorporating the checklist into practice provided an insight into the success rate of utilizing a checklist during intubation. During these 2 months, data was collected on any patient who required intubation to examine if adverse events happened.

Phase 3: Post-Intervention

Upon completion of an endotracheal intubation, providers were asked to complete the post intubation tool. This tool examined all necessary steps taken during an intubation attempt. The tool also identified any adverse events during intubation or complications related to the intubation. After the 2-month trial was completed, data collected from the post intubation tool was examined and presented to the key stakeholders to evaluate the effectiveness of utilizing a checklist.

Intervention

Utilizing a pre-intubation checklist was a practice intervention. It was an implementation of an evidence-based intervention into clinical practice. The format began with multiple educational classes, each approximately 25 minutes. These educational classes provided training to individuals who perform endotracheal intubation

on all necessary steps that were included in the checklist. After training was complete, handouts as well as laminated posters were displayed in any area that performs intubation.

Measurement Instrument(s)

To measure the effectiveness of the pre-intubation checklist, support staff including the nurse and respiratory therapist were asked to complete a post intubation tool which included the number of intubation attempts, medications used during intubation, vital signs of patient before and after intubation attempt, and any complication that occurred during or after intubation. The tool was created to identify pre-procedural steps as well as any complication associated with intubation.

Data Collection Procedures

After an intubation had occurred, data collection began with asking the nurses and respiratory therapist who assisted with the intubation to complete the post intubation tool. This tool was created to identify pre-procedural steps which are included in the use of the pre-intubation checklist. The nurse and respiratory therapist were asked to complete each tool within 4 hours pending the stability of patient following intubation and then submitted the completed form to their supervisor for review. The complete post intubation tool was stored in the ER supervisor's office in a locked file cabinet. The investigator then collected completed tools.

Ethical Considerations/Protection of Human Subjects

Institutional Review Board (IRB) approval was obtained prior to initiating the capstone project. There was no personal benefit, other than scholarly experience and support, to the investigator that resulted from this capstone project. Therefore, no conflict

of interest existed. The CITI certification was completed for the investigator and assigned faculty member. There was no direct physical or psychological risks to the population of individuals who require intubation as this capstone project was aimed at the individuals who performed endotracheal intubation as well as the pre-procedural steps taken prior to intubation. The only potential risk this capstone project had was a delay of intubation to perform the pre-procedural checklist. This risk was mitigated by ensuring proper education was provided to individuals who perform intubation. Ideally, using the checklist would take less than 30 seconds to complete unless a life-threatening situation existed, then the use of the checklist was skipped and documented in the post intubation tool. Ensuring all necessary steps were taken to maximize first pass success prior to intubation was one benefit this capstone project had on individuals who perform endotracheal intubation. Completion of the checklist also encouraged team communication by providing a template for dialogue prior to intubation attempt. Data was collected using the post intubation tool. Since this capstone project was a practice change, no informed consent or assent was necessary for collecting data from the post intubation tool. The investigator was the only person collecting data for this capstone project. Paper data was stored in a locked file cabinet. Only the investigator had access to this information. There was no contact information for individuals who required endotracheal intubation. Demographic information collected included age and gender.

Data Analysis

Data was collected with the use of the post intubation tool specifically designed for this capstone project. After an intubation occurred, the post intubation tool was completed by the providers and support staff helping with the intubation. The post

intubation tool focused on the outcomes of improved first pass success and decrease in adverse events.

Results

One post intubation tool completed by staff indicated a successful first pass intubation and no adverse events during the intubation or immediately following intubation.

Discussion

Due to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) there were limited participants. One can speculate that due to the stay at home orders implemented by the state, individuals were not exposed to illnesses that otherwise would have required immediate attention. While this capstone project was able to be successfully implemented, there was a lack of participants which limited the data collection ability. Part of this was due to SARS-CoV-2. The Center for Disease Control and Prevention placed recommendations to limit the spread of the virus by advocating to avoid potential exposure by staying home (Center for Disease Control and Prevention, 2020). Other recommendations included social distancing, frequent hand washing, enhanced pulmonary hygiene and encouraged anyone able to work from home to do so. Vulnerable population included older adults and people of any age with serious underlying medical conditions. By limiting contact with the public, many individuals who would have been at an increased risk for illness substantially reduced life threatening illnesses that otherwise would have required endotracheal intubation. One participant was utilized for this capstone project. Data from that intubation was collected by the staff who assisted with the intubation. While there was only one participant for this project, the data

that was collected indicated a compliance to the use of the pre-intubation checklist. A completed post intubation tool completed by staff indicated a successfully first pass intubation and no adverse events during the intubation or immediately following intubation. By using the pre-intubation checklist, participants were able to improve pre-procedural preparation, encourage crew resource management, communication, and enhance first pass intubation success while eliminating adverse events.

Limitations

Limitations associated with this project were the lack of individuals who required endotracheal intubation and SARS-CoV-2.

Plan for Sustainability

Continued education should be performed annually on the importance of utilizing the intubation checklist. Also, any new employees should be professionally trained on importance and benefits of utilizing the checklist. With any practice change, employees should be encouraged to suggest modifications to the checklist to evolve adherence to utilizing the checklist.

Conclusion

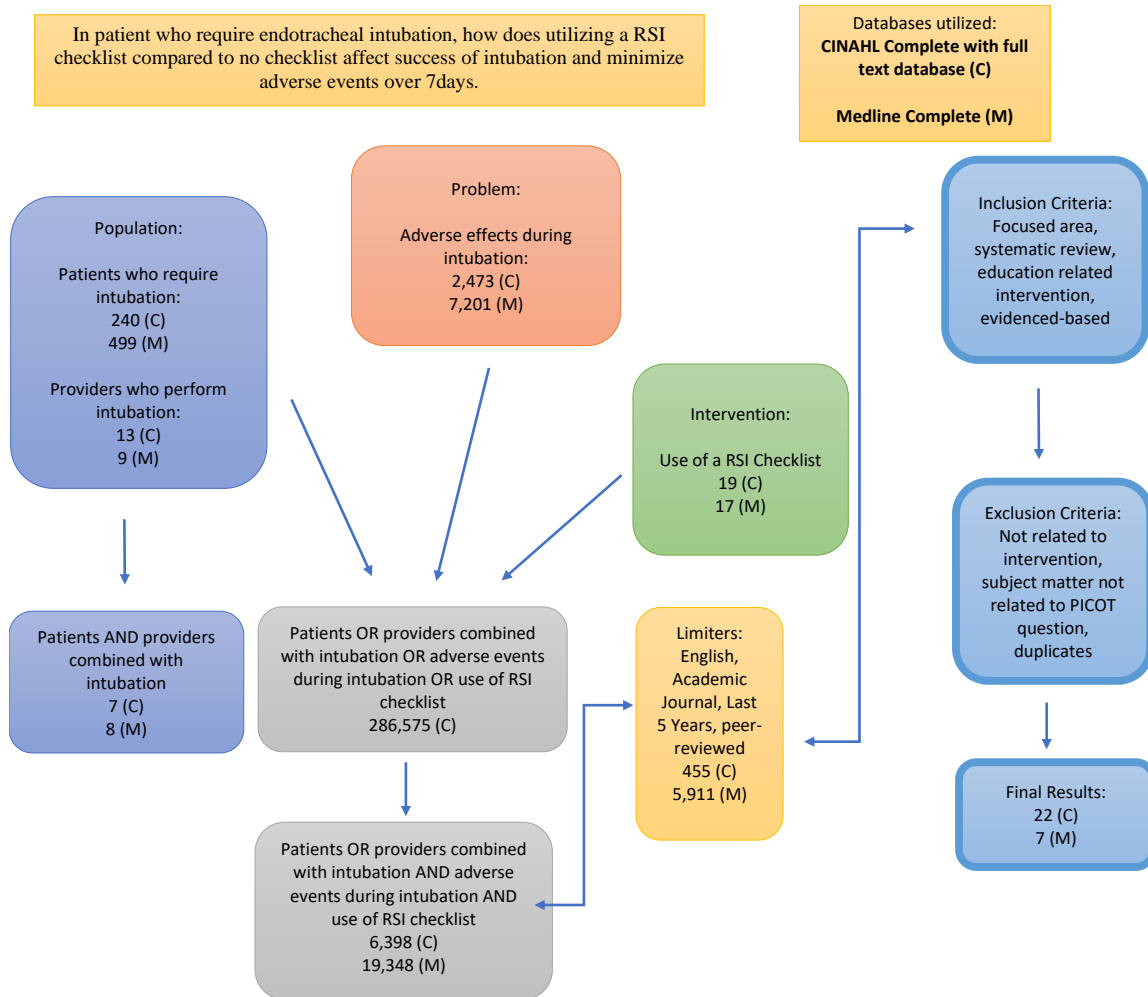
In conclusion, first pass success is associated with a relatively small incidence of adverse events. As the number of attempts increases, the incidence of adverse events increases substantially. This project addressed the use of a pre-intubation checklist for providers in the rural hospital settings to improve first pass success and decrease adverse events for patients who require intubation. Findings indicated improve pre-procedural preparation, a successful first pass intubation which directly reduced complications associated with endotracheal intubation.

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Appendix A: Search Trail



Appendix B:
Reference Matrix

Reference Matrix

Clinical Question:

In patient who require endotracheal intubation how does utilizing a RSI checklist compared to no checklist affect success of intubation and minimize adverse events over 7days?

Citation/Level of Evidence	Participant/ Setting/ Sample Size	Purpose/Backgroun d	Methods/Design & Limitations	Findings/Summary/Strengths/ Weakness	Applicability to Own Research
<p>Birks, J. (2016). Conducting a safe rapid sequence induction in pre-hospital care. <i>Trauma (United Kingdom)</i>, 18 (2), 119-123. https://doi.org/10.1177/1460408615619196</p> <p>Review study, level V</p>	<p>Review study, no participants or sample size</p>	<p>Review article considering how to conduct a safe rapid sequence induction of anesthesia in the pre-hospital environment.</p>	<p>No methods or design for this review article</p> <p>No limitations identified.</p>	<p>It is recommended that individuals ‘should not practice pre-hospital anesthesia in isolation. Rather, they should practice with multiple providers and utilize a checklist.</p>	<p>This article supports the use of a safe system with a safe culture and indicated that is just as important as the individual clinician. This article supports the use of a pre-rsi checklist to assist with cognitive offloading in an already complex environment.</p>
<p>Chen, C., Kan, T., Li, S., Qiu, C., & Gui, L. (2016). Use and implementation of standard operating procedures and checklists in prehospital emergency medicine: a literature review. <i>American Journal of Emergency Medicine</i>, 34(12),</p>	<p>Literature search found 2187 potentially relevant articles, A final total of 13 studies were identified that described the use and implementation of SOPs (9studies) and</p>	<p>This review aimed to analyze published literature to introduce the use and implementation of standard operating procedures (SOPs) and checklists in prehospital emergency</p>	<p>The design methods started with eligibility criteria and was restricted to original articles that used SOPs and checklists in</p>	<p>The use and implementation of SOPs and checklists in prehospital emergency medicine have shown some benefits of improving guidelines adherence and patient outcomes in airway management.</p> <p>One strength of this article would be the extensive literature search in order to find</p>	<p>This article supports the use and implementation of checklists in prehospital emergency medicine. The use of checklists has</p>

<p>2432–2439. https://doi.org/10.1016/j.ajem.2016.09.057 Literature review, level V</p>	<p>checklists (4studies) in different areas of prehospital emergency medicine</p>	<p>medicine and their impact on guideline adherence and patient outcome.</p>	<p>prehospital environments. Limitations included lack of detailed information about development of checklists, persons who takes charge of checklists completion, time needed for checklist completion and staff perceptions. Another limitation was the majority of studies took place in a single prehospital medical service and were carried out over a short period of time. Lastly, many studies took place in European systems which typically have physician led pre-hospital unlike the US in which paramedics and EMTs are utilized in the prehospital.</p>	<p>specific articles related to the use of checklists. One weakness would be limited statistical data to support the use of checklists.</p>	<p>improved guidelines adherence and patient outcomes in airway management.</p>
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<p>Conroy, M. J., Weingart, G. S., & Carlson, J. N. (2014). Impact of checklists on peri-intubation care in ED trauma patients. <i>American Journal of Emergency Medicine</i>, 32(6), 541–544. https://doi.org/10.1016/j.ajem.2014.02.006</p> <p>Retrospective review, level III</p>	<p>All trauma patients intubated in the ED of an urban, level 1 academic center from November 2010 to October 2012. During the 2-year study period, 187 trauma patients underwent endotracheal intubation in the ED, 90 prechecklist and 97 postchecklist.</p>	<p>Checklists have successfully been used to improve metrics of critical care. Proper peri-intubation care including use of appropriate induction agents and postintubation sedation is crucial when performing endotracheal intubation (ETI) on critically ill patients, especially in the emergency department (ED). This article evaluated the impact of checklists on peri-intubation care in ED trauma patients.</p>	<p>Conducted a retrospective analysis of all trauma patients requiring intubation through a locally maintained trauma registry at a level 1 academic medical center.</p> <p>Limitations included lack of significant difference in mortality, ICU days or days of mechanical ventilation. Unable to identify if all areas of the checklists were utilized. The ER did undergo renovations during this study. Only identified trauma patients, not medical patients.</p>	<p>During the 2-year study period, 187 trauma patients underwent ETI in the ED, 90 prechecklist and 97 postchecklist. Rapid sequence intubation (RSI) use was greater with the checklist than without (90.7% vs 75.6%, P = .005). No difference was found between the number of ETI attempts per patient, hemodynamic parameters (heart rate, blood pressure, and oxygen saturation), postintubation anxiolysis, median number of ventilator days, length of ED stay, length of ICU stay, or mortality.</p> <p>Strength of this study would include the length of time of this study.</p> <p>One weakness is evaluating only trauma patients. It may be beneficial to expand to any patients who require endotracheal intubation.</p>	<p>Peri-intubation checklists result in higher rates of RSI in ED trauma patients but do not alter other measured metrics of peri-intubation care. Larger studies are required to evaluate changes in patient outcomes with the use of these checklists.</p>
<p>Janz, D. R., Semler, M. W., Joffe, A. M., Casey, J. D., Lentz, R. J., DeBoisblanc, B. P., Griffith, M. (2018). A Multicenter Randomized Trial of a Checklist for</p>	<p>Between July 22, 2015, and July 19, 2016, all patients (> 18 years of age) undergoing endotracheal intubation. Of 318</p>	<p>This article compared a written, verbally performed, preintubation checklist with usual care regarding lowest arterial oxygen</p>	<p>A multicenter trial in which 262 adults undergoing endotracheal intubation were randomized to a written, verbally</p>	<p>There was no difference between the checklist and usual care in procedure duration, number of laryngoscopy attempts, or severe life-threatening procedural complications.</p>	<p>Among critically ill adults undergoing endotracheal intubation by operators in training, the verbal</p>

<p>Endotracheal Intubation of Critically Ill Adults. <i>Chest</i>, 153(4), 816–824. doi.org/10.1016/J.CHEST.2017.08.1163</p> <p>Multicenter trial, level III</p>	<p>critically ill adults intubated during the study period, 267 were enrolled and randomized to either checklist or usual care. For five patients, the planned operator changed to a Certified Registered Nurse Anesthetist after randomization, leaving a total of 262 patients analyzed.</p>	<p>saturation or lowest systolic BP experienced by critically ill adults undergoing endotracheal intubation.</p>	<p>performed, preintubation checklist (checklist) or no preintubation checklist (usual care). The outcomes were lowest ASPO2 and systolic BP between the time of procedural medication administration and 2 min after endotracheal intubation.</p> <p>Limitations included randomization of the unblinded intervention occurred at the patient level, which could allow operators to learn the checklist and then contaminate any subsequent usual care intubations with the intervention</p>	<p>Strengths included a lengthy trial period in order to properly evaluate the use of a checklist.</p> <p>Only evaluating results in one hospital is a weakness of this study.</p>	<p>performance of a preprocedural checklist increases adherence to recommended preparatory steps but does not decrease procedural complications or improve clinical outcomes compared with usual care in tertiary care, academic ICUs.</p>
<p>Nakstad, A. R., Heimdal, H. J., Strand, T., & Sandberg, M. (2011). Incidence of</p>	<p>Prehospital RSI performed by HEMS physicians in Norway</p>	<p>Examined the incidence of hypoxia in patients who were</p>	<p>Prospective, observational data collected.</p>	<p>A total of 122 prehospital intubations were performed during the study period. SpO2</p>	<p>This study demonstrates that prehospital</p>

<p>desaturation during prehospital rapid sequence intubation in a physician-based helicopter emergency service. <i>American Journal of Emergency Medicine</i>, 29(6), 639–644. https://doi.org/10.1016/j.ajem.2010.01.013</p> <p>Prospective, observation, level IV</p>	<p>collected over a 12month period. ONLY utilized cases requiring drug assisted intubations. A total 2621 patients examined. Of those, only 122 prehospital intubations performed.</p>	<p>intubated by physicians in a helicopter emergency service (HEMS) in Norway. Hypoxia was defined as SPO2 values below 90% or a decrease of more than 10% of initial SPO2 was below 90%.</p>	<p>No limitations identified in this article.</p>	<p>data were available for 101 (82.8%) patients.</p> <p>This study presents a hypoxemia rate of 11.1% in trauma patients and 10.5% in medical cases.</p> <p>Physicians perform most of the prehospital RSIs in many European countries. It is reasonable to assume that the level of training of the intubator will influence the success rate.</p>	<p>RSI performed by physicians working in HEMS is a safe procedure for both medical and trauma patients, with an incidence of adverse effects comparable with in-hospital findings.</p> <p>Inadequate preoxygenation and initial SpO2 values below 90% increase the risk for severe hypoxic episodes during the procedure.</p>
<p>Sherren, P. B., Tricklebank, S., & Glover, G. (2014). Development of a standard operating procedure and checklist for rapid sequence induction in the critically ill. <i>Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine</i>, 22(1), 41. https://doi.org/10.1186/s13049-014-0041-7</p>	<p>Prospective review of eighteen RSIs over a three-week period on the intensive care units in November 2013. Of the patients undergoing RSI, 38.9% suffered an adverse event. Although this rate was comparable to those published in the literature, the authors</p>	<p>Non-systematic review of literature pertaining to key components of RSI preparation and management.</p>	<p>The standard operating procedure (SOP) consists of a RSI equipment set-up sheet, pre-RSI checklist and failed airway algorithm. The SOP should improve RSI preparation, crew resource management and first</p>	<p>The use of the evidence-based components of this SOP, along with the corresponding checklist and RSI kit dump sheet, will improve RSI planning, team dynamics and equipment availability. This standardized approach to RSI in the critically ill may reduce the incidence of adverse events and improve patient outcomes.</p> <p>No weakness identified however there was no statistical data supporting the use of RSI checklist in minimizing adverse events.</p>	<p>This article supports the use of RSI checklist as well as supports a RSI checklist in preparing equipment as well as development for failed airway algorithm.</p>

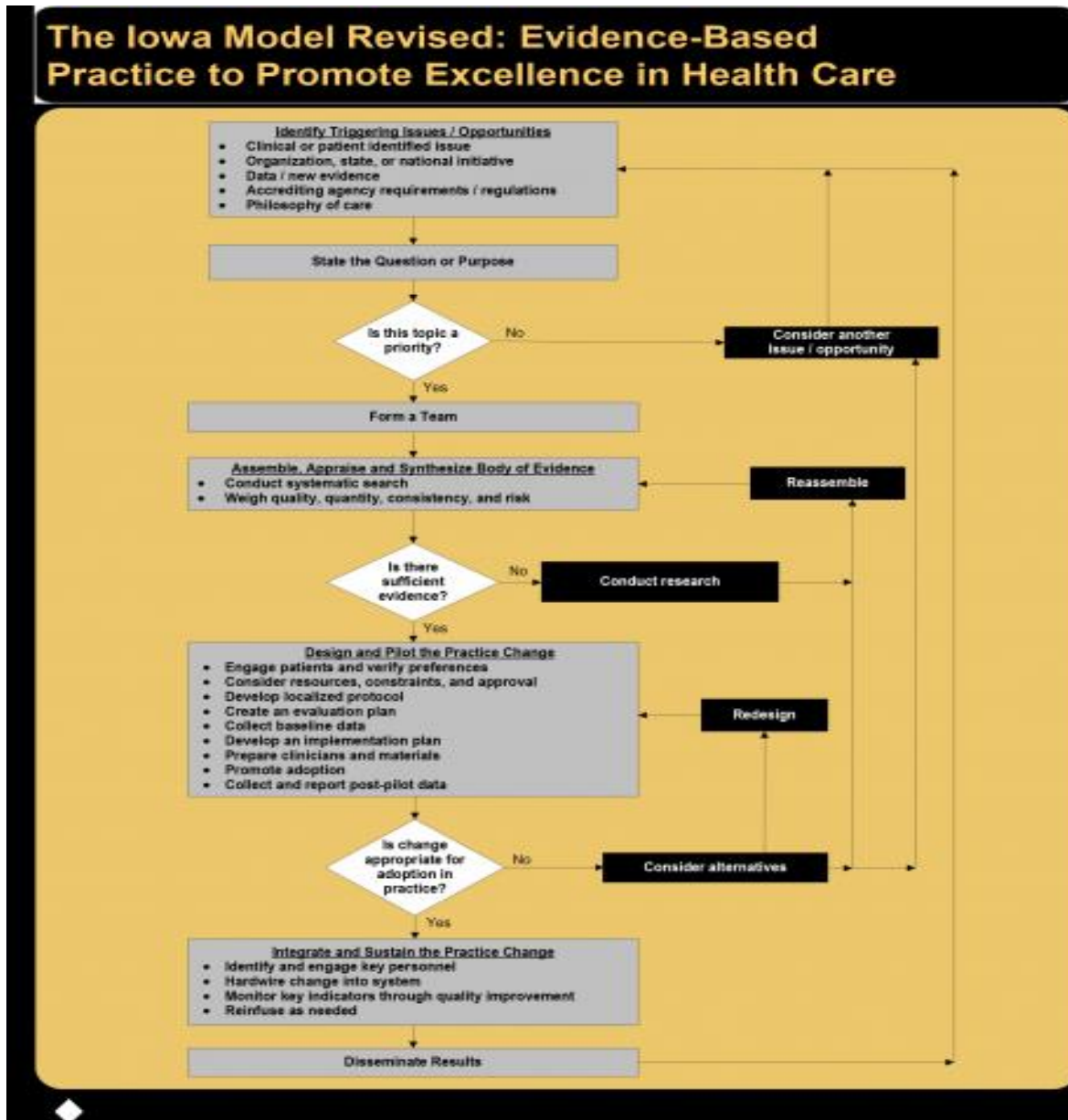
<p>Non-systematic review of literature, level V</p>	<p>felt it necessary to undertake this quality improvement initiative.</p>		<p>pass intubation success while minimizing adverse events.</p> <p>Limitations: Not all components are based on a high grade of evidence, it is hoped that the cumulative effect of the interventions will improve the processes of care and patient outcomes.</p>		
<p>Smith, K. A., High, K., Collins, S. P., & Self, W. H. (2015). A Preprocedural Checklist Improves the Safety of Emergency Department Intubation of Trauma Patients. <i>Academic Emergency Medicine</i>, 20(3), 222–230. https://doi.org/10.1111/acem.12717</p> <p>Systematic review, level III</p>	<p>141 trauma patients were intubated, including 76 in the prechecklist period and 65 in the postchecklist period.</p>	<p>A preprocedural intubation checklist was developed and then implemented in a prospective pre-/postinterventional study in an academic trauma center ED. Intubation-related complication included oxygen desaturation, emesis, esophageal intubation, hypotension, and cardiac arrest</p>	<p>The proportions of trauma patients older than 16 years who experienced intubation-related complications during the 6 months before checklist implementation and 6 months after implementation were compared.</p> <p>Limitations: Evaluating whether educational efforts</p>	<p>Implementation of a preintubation checklist for ED intubation of trauma patients was associated with a reduction in intubation-related complications, decreased paralysis-to-intubation time, and improved adherence to recognized safety measures.</p> <p>One strength of this article is utilizing the prechecklist as well as a postchecklist.</p> <p>A weakness of this article is only studying trauma patients. It would be beneficial to identify if a checklist is applicable to medical patients who require intubation.</p>	<p>This article supports the use of a checklist prior to RSI as well as documented statistical data to support the use of RSI checklist.</p>

			<p>alone could achieve similar results. Also, adherence to the checklist was not perfect in the postchecklist period; clinicians used the checklist in 83% of these intubations. Discussions with our clinicians suggested that the checklist was not used in some cases because of a perceived lack of time.</p>		
<p>Thomassen, O., Brattebo, G., Softeland, E., Lossius, H. M., & Heltne, J. K. (2010). The effect of a simple checklist on frequent pre-induction deficiencies. <i>Acta Anaesthesiologica Scandinavica</i>, 54(10), 1179–1184. https://doi.org/10.1111/j.1399-6576.2010.02302.x</p> <p>Systematic review, level III</p>	<p>Study was performed in the anesthesia and intensive care department of an 1100-bed tertiary teaching hospital.</p> <p>Final checklist contained 26 items. During a period of 13 weeks, the checklist was used in 502 (61%) of a total of 829 inductions.</p>	<p>A substantial proportion of anesthesia related adverse events are preventable by identification and correction of errors in planning, communication, fatigue, stress, and equipment. The aim of this study was to develop and implement a pre-induction checklist in order to identify and solve</p>	<p>A checklist was developed in a stepwise manner using a modified Delphi technique, literature search, expert’s opinion, and a pilot version, and then implemented in a clinical environment during a 13-week</p>	<p>It is applicable to develop, introduce, and use a pre-induction checklist even in a hectic and stressful clinical environment. The checklist identified and reduced a surprisingly large number of missing items required in a standard induction protocol.</p> <p>One strength of this article is the large volume of intubations as well as the mandatory use of the checklist.</p> <p>A weakness of this article is the length of items that are on the checklist. this can negatively affect the use of a checklist due to extensive items on the checklist.</p>	<p>This article identifies the use of a checklist to determine preventable errors such as planning or communication that can negatively affect patients who require intubation.</p>

		problems before induction of anesthesia.	study period. The checklist was mandatory, but emergency cases were excluded.		
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Appendix C:

Iowa Model



Adapted from Cullen, L., Hanrahan,

K., Farrington, M., DeBerg, J., Tucker, S., & Kleiber, C. (2018). Evidence-based practice in action: *Comprehensive strategies, tools and tips from the University of Iowa Hospitals and Clinics*. Indianapolis, IN: Sigma Theta Tau International.

**Appendix D:
Timeline**

Task	January	February	March	April	May
Planning & Development	X				
Training		X			
Implementation into daily practice			X	X	
Results presented to local providers					X