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Rethinking Critical Care: Decreasing Sedation, Increasing Delirium Monitoring, and Increasing Patient Mobility

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Abstract

Background/Methods—Sedation management, delirium monitoring, and mobility programs are key features of recent evidence-based critical care guidelines and care bundles, yet implementation in the intensive care unit (ICU) remains highly variable. The Institute for Healthcare Improvement's Rethinking Critical Care (IHI-RCC) program was established to reduce harm of critically ill patients by decreasing sedation, increasing monitoring and management of delirium, and increasing patient mobility. It involved one live case study and five iterations of an in-person seminar over 33 months (March 2011 to November 2013) that emphasized

interdisciplinary teamwork and culture change. IHI-RCC has involved over 650 participants from 215 organizations. This report describes a convenience sample of five participating organizations chosen in advance of knowing their clinical outcomes.

Results—Qualitative descriptions of the changes tested at each of the five case study sites are provided, demonstrating the necessary teamwork, improved processes, and increased reliability of daily work. These sites all worked to implement the Richmond Agitation Sedation Scale (RASS) and Confusion Assessment Method for the ICU (CAM-ICU) within the context of a bundled interventional care plan; they then tracked length of stay in the ICU and duration of mechanical ventilation, which are reported.

Discussion—Changing critical care practices requires an interdisciplinary approach addressing cultural, psychological, and practical issues. The IHI-RCC program is based on testing changes on a small scale, building highly effective interdisciplinary rounds, frequent data feedback to the frontline, and use of in-person demonstrations. Key lessons are emerging about effectively caring for critically ill patients in light of data about the harm of over-sedation, unrecognized and unaddressed delirium, and immobility.

Keywords

Critical Care; Psychology; Delirium; Sedation; Mechanical ventilation; Rehabilitation; Patient Safety; Quality Improvement; Mobility

BACKGROUND

Evidence-based pain and sedation management, delirium monitoring and management, and mobility programs are increasingly cited as key elements in the attainment of improved intensive care unit (ICU) outcomes.^{1,2,3,4,5,6,7,8,9} Over-sedation and lack of effective sedation management that result in overuse of medications are predictors of ICU delirium,^{11,10,11,12,13} which itself is an independent predictor of long-term cognitive impairment.¹⁴ The length of time patients require mechanical ventilation and stay in the ICU, and degree of long-term physical disability and cognitive impairment, relate directly to how patients' pain, agitation, delirium, and mobility are managed.^{15,16,17,18}

As critically ill patients occupy higher percentages of total hospital beds¹⁹ in the United States and beyond, it is increasingly important to determine mechanisms to deliver better care. Quality improvement projects will help clinicians understand the successes and pitfalls of implementing current evidence-based recommendations, including the Society of Critical Care Medicine (SCCM) Pain, Agitation, and Delirium (PAD) guidelines published in January 2013¹⁵ and evidence-based ICU bundles such as the ABCDE^{33,20} (Awakening and Breathing Coordination, Choice of sedatives, Delirium identification and management, and Early exercise and mobility). An example of an innovative approach to enhance adoption of evidence-based steps on an institutional level across ICUs was the use of an "ICU Command Center" which was staffed by experienced ICU RNs. The Command Center nurses would actively review participating ICUs' electronic medical records and active footage of patient care and call patients' nurses at the bedside in real time to enhance reliability and compliance.²¹

Many consider improving mobility the most challenging part of rethinking critical care, as it involves the greatest shift in culture and daily processes. Of note, improving mobility follows reducing sedation in a natural sequence: increasing patient activity requires patients to be alert and interactive rather than sedated. Significantly reducing exposure to sedatives and analgesics also decreases length of time on the ventilator, ICU and hospital length of stay, and mortality.^{18,22,23} Despite the availability of the PAD guidelines, many ICUs and their providers have varying compliance²⁴ and lack the awareness, processes, and resources to reliably implement recommended practices.²⁵

The Institute for Healthcare Improvement's (IHI) Rethinking Critical Care (IHI-RCC) in-person seminars were designed to replicate powerful changes proven in other health care settings to incorporate human factors and change culture.^{26,27,28,29,30,31,32,33} This report describes a convenience sample of five participating organizations to gain insights about their successes and challenges in making these changes. Prior to attending the IHI-RCC in 2011, Samaritan Hospital described its ICU system this way: *"Ventilated patients in the ICU received continuous infusions of narcotics and benzodiazepines. Patients were being sedated to the level of immobility and unconsciousness. Levels of sedation were so deep there was no opportunity for spontaneous awakening assessments in most. Limb movement was limited to passive range of motion provided by nursing staff, without Physical Therapy involvement. The Respiratory Therapists had a limited role in determining the patient's ability to wean. The term 'delirium' was rarely used."* This is not an uncommon characterization of many critical care units today.

METHODS

In March 2011, IHI held a Rethinking Critical Care "live case study" at Intermountain Healthcare (IHC) in Salt Lake City, UT. Participants saw newly published evidence put into action: ventilated patients awake and ambulating. Faculty described their practices for titration of pain and sedation management, liberation from mechanical ventilation, delirium monitoring, and early mobility for critically ill patients. They highlighted the interconnectedness of these key areas. The introduction of the ABCDE bundle^{12,23,34} led to greater interest in teaching this interconnectedness, though the ABCDE bundle was not a mandatory piece of the IHI-RCC. Following the live case study, IHI developed a two-day seminar (run five times) that included follow-up through an active listserv connecting participants with faculty for ongoing learning and trouble-shooting. The live case study and five in-person seminars over 33 months involved over 650 participants from 215 organizations. We report on a convenience sample of five hospitals/health systems that attended the live case study and/or the first seminar held November 2011. These sites were chosen in the summer of 2012 (in advance of knowing their clinical outcomes) because it was apparent they were enthusiastic not only about the process of culture change, but also about measuring and reporting their results. Each of these five sites made it clear they would expend the extra effort of partnering to document the process of improvement (pitfalls and successes) as well as outcomes.

Aims

Teams identified goals based on those that were cited in the literature. Evidence-based goals range from improved process measures (e.g., use of Confusion Assessment Method for the ICU [CAM-ICU], percentage of patients mobilized) to improved outcome measures (e.g., ICU Average Length of Stay [ALOS], Average Time on Ventilator [ALOSV]). Faculty taught that it was crucial to adapt aims to fit local expertise and the evolution of local critical care work and QI initiatives. The use of the ABCDE bundle was emphasized. All the teams set goals to decrease ALOS and ALOS. An example of focused process improvements included Rapid City Regional Hospital's utilization of a structured approach to objectively evaluate and improve delirium management. Additionally, St. Luke's Treasure Valley utilized the RASS score to monitor and reduce sedation and set targets to improve mobility.^{22,35,36}

At the IHI-RCC seminars, organizational teams learned the evidence base for changing critical care practices related to sedation, delirium, and mobility, along with practical change ideas; and used the Model for Improvement (MFI)³⁷ to guide progress through Plan-Do-Study-Act (PDSA) cycles to test changes iteratively. Although there was no formal follow-up with participants, the IHI team stayed connected with them via listserv. Data reported here represent a pre- and post-implementation view for each organization's efforts.

CASE STUDY DESCRIPTIONS AND QUALITATIVE RESULTS

Case Study 1: Rapid City Regional Hospital

Getting Started—Rapid City Regional Hospital is a 417-bed community hospital in South Dakota, with 27 adult ICU beds in three ICUs and a transitional unit. These ICUs are a “mixed” model, with the MICU being “open” but with the presence of intensivists who round daily. After attending the live case study in Utah, the adult ICU assistant nursing director presented the key points and learning to the ICU Committee and vice president of patient care. They began with literature review and establishment of a multidisciplinary team committed to reducing risks for critically ill patients by initiating progressive early mobility, including the full ABCDE bundle.^{12,25} The team consisted of ICU leadership, respiratory therapy (RT), and physical therapy (PT). To garner senior leadership support, they developed a business proposal to include the addition of two full-time employees from PT and RT departments. With spontaneous awakening and breathing trials (SAT and SBT) already in place, they tested two additional elements of the ABCDE bundle,^{18,38} **C**hoice of sedatives and **D**elirium identification and management, then spread these two elements over five months. They then tested and spread another element, **E**arly exercise and mobility, over four months. They also implemented widespread education for physicians, nurses, PT, RT, pharmacists, and other support staff.

Sedation Management—The team revised ICU admission order sets to address pain management, decrease sedation, and suggest sleep-promoting medication. With ICU clinical pharmacist input, analgesia (also known as analgo-sedation³⁹) was recommended as first line for sedation, and benzodiazepines were deleted from the order set. Clinical quality rounds review appropriateness of pain and sedation medications. Analgo-sedation use increased

during this time period, due to increased awareness among clinicians (and a national propofol shortage). Use of fentanyl for analgo-sedation increased 87 percent, and use of dexmedetomidine increased five-fold in the first six months. Additionally, the team changed the default Richmond Agitation Sedation Scale (RASS) target from -1 to -2, to 0 to -1, with the goal of keeping ventilated patients more alert and awake.

Delirium Management—Rapid City focused on implementation of the CAM-ICU in all adult ICUs. This assessment is done each shift and as needed based on changes in patient status. The mobility team conducted one-on-one and group education prior to the “go-live” date for each ABCDE component, and real-time education during daily rounds. After implementation, the team did spot checks on actual RASS score compared to target RASS, and documentation of the CAM-ICU. In the first six months, actual RASS met target RASS 81 percent of the time, and the CAM-ICU was documented 61 percent of the time. Because of this, mobility rounds were increased to daily, as possible, with the Assistant Director of the ICU facilitating rounds and doing staff education as needed. The Delirium-Agitation orders, originally designed for acute hyperactive delirium tremens patients, were updated to include other patients who screen positive for delirium on the CAM-ICU tool

Mobility—This was the most challenging aspect of the ABCDE work. The team developed, refined, and tested early mobility criteria and standard orders for all patients in the medical ICU, the pilot unit. A mobility team was formed, consisting of PT, RT, occupational therapy, and nursing (not all were present at each mobilization; other institutions varied this team composition). The team participated in daily mobility rounds, using guidelines adapted from a published program called Progressive Mobility Continuum to assess patients’ daily mobility plans.²⁵ The team also provided surveillance plans and data collection tools. Daily team updates and nurse-led quality rounds became standard. At times, a mobility nurse was scheduled on the units to help with mobility. As mobility spread to other ICUs, they adapted the order sets to the new environments. The team saw up to 16 patients daily in the ICUs and transitional unit. Monthly meetings with the mobility team leadership and champions were implemented as part of a “checks and balances” system. Monthly updates on progress, process concerns, barriers, and possible solutions were reported during these meetings by individual disciplines. Data reports were included in these meetings using an “Activity/incident collection tool” which monitors whether patients met criteria; what types of artificial airways, if any, were in place; pre- and post-activity status; what type of activity was completed; and whether any incidents occurred (e.g., extubation, line dislodgment, severe hypotension, etc.). The data reports were an essential feedback mechanism for refining processes and for bringing data back to the ICU committee, the vice presidents, and the Quality Board.

Case Study 2: Mission Hospital

Getting Started—Mission Hospital, part of the Mission Health system in Asheville, North Carolina, is a 730-bed regional tertiary hospital with 62 ICU beds in five ICUs. These ICUs are an “open” model, although medical surgical ICUs are “mixed” with a mandatory intensivist consult. There are walking rounds five days per week, and on the weekends charge nurses use a checklist with bedside nurses to confirm reliability of processes like

ventilator bundle. In addition to their work in the IHI-RCC, Mission had other intensive coaching engagement with IHI. Having already tested spontaneous SAT in one unit with good results, they enlisted five adult ICU units to test different parts of the ABCDE bundle, with the goal of standardizing and spreading the changes over a two-year period in service of reducing the potential adverse sequelae of an ICU stay for their patients. Units were chosen for the discovery phase according to their strengths and emergence of early adopters in each area of improvement. Similarly, the decision of where to spread each change next was based on the strength of the receiving unit and its progress with current implementation. Each ICU formed an implementation team, and used the Model for Improvement (MFI) to conduct small tests of change. These teams comprised a combination of nurse managers, physician champions, administrative sponsors, case managers, nurse educators and clinical nurse specialists, pharmacists, PT, RT, staff nurses, QI advisors, infection control specialists, and nursing unit supervisors. They met regularly and collaborated via monthly calls and quarterly site visits to share ideas, successes, struggles, and data, and to “show and tell.” They credit top-down leadership support, frontline-driven testing using PDSA cycles, and restructured multidisciplinary rounds as key. They tested many changes to improve rounding: shortening time spent rounding, standardizing information shared, and generating daily goals of care. These rounds are the “final backstop” for reliable execution of ABCDE. The full work of the ABCDE was spread among the five units systematically over the course of two years.

Sedation Management—The team restructured the order set with three sections – analgesia, sedation, and delirium – with new enteral medication options for each. This order set drove the standardized daily SAT. The physician champion for this work led the education about intermittent sedation. Additionally, the team standardized SBT elements. Early focus on the “low-hanging fruit” – “ABC” of the ABCDE – provided successes to build on for the more challenging delirium and mobility work.^{18,23,34,36,38} There was an increased focus at rounding on setting appropriate daily goals of care for each patient. Work was needed to standardize and streamline rounds to make them manageable from a time and workload perspective. Rounding tools have been adapted by each unit based on variations in population cared for. Rounding provided an opportunity to discuss the use of enteral medications with the bedside nurse, case manager, and pharmacist.

Delirium Management—Changing delirium management required re-evaluation of current assessment tools. A multidisciplinary team from the five ICUs, along with the information technology department, collaborated to determine the best sedation-analgesia scale and delirium assessment tools. The team formulated an education plan and added documentation into the electronic medical record. The team chose the pilot ICU to test the RASS and CAM-ICU and a data collection tool. An educator conducted one-on-one education with each staff member, who had to demonstrate competence with a patient. Physician education was also needed and took many forms, including email, staff meetings, and prompts at rounding. As the process spread, additional testing led to adding exclusion criteria, specifically for brain injury and stroke. Physicians also received additional education about less-obvious hypoactive delirium. An ICU-specific delirium management plan gave clinicians tools necessary to manage acutely delirious patients. These tools include

directives for noise prevention, sleep protection, pain management, mobility reminders, hearing aids and glasses, and a pharmacology section with recommendations to providers.⁵

Mobility—Mobility efforts focused on collaboration between pilot unit nursing staff and PT. This pilot unit was chosen due to passion for early mobilization. PT assisted in nursing education events regarding technique, safety, screening, and patient progress. Through PDSA testing, nurses developed mobility objectives and initial exclusion criteria (e.g., comfort care patients). Mobility was added to the multidisciplinary rounding tool, and case managers helped maintain this focus. A pyramid tool was created for auditing purposes, with progression from the lowest level of mobility (passive range of motion) to the highest level (ambulation). This tool was abandoned due to being too time-consuming for nursing; instead, nursing unit supervisors and charge nurses documented ambulation in the shift audit tool, listing barriers to identify learning needs. In addition, the pilot unit set an initial goal for their patients to collectively ambulate one mile, and then five. Spread to other units included a short lecture from the pilot unit leadership and hands-on mobility training with PT. Nurses continue to collect mobility data via the rounds checklist.

Case Study 3: St. Luke's Treasure Valley

Getting Started—St. Luke's Treasure Valley in Idaho has two hospital campuses: Boise, a regional hospital with 430 beds including 33 ICU beds in 2 ICUs; and Meridian, a 167-bed community hospital with 14 ICU beds in one ICU. They have "open" ICUs, with presence of critical care-trained intensivists and daily multidisciplinary rounding. A member of the VHA Critical Care Innovation Network for five years, St. Luke's used its attendance in the IHI seminar to accelerate practice changes. Following the seminar, staff meetings and communication forums focused on providing updates on evidence-based changes. These efforts helped ignite the desire to transform the culture.^{25,40}

Sedation Management—St. Luke's revised the existing analgesia/sedation order set and the companion algorithm to reflect the SCCM PAD guidelines. Lorazepam was eliminated as a pre-printed option. These proved to be key to the success of improving mobility and delirium management.

Delirium Management—Critical care nurses are central to the success of an effective delirium management program.²⁰ Although St. Luke's had used the CAM-ICU^{41,55} since 2007, they provided refresher education to ensure effective use and interpretation. In addition to removing Lorazepam, they added Dexmedetomidine, which is superior to commonly used sedation agents in reducing the amount of sedation and opioids often related to delirium,^{42,43,44} and added haloperidol as an additional agent to treat delirious patients, while awaiting data from ongoing trials of antipsychotics for delirium.

Mobility—In 2010, St. Luke's participated in the VHA Critical Care Innovation Network Mobility Initiative collaborative, and focused on providing fundamental education to staff regarding the consequences of immobility and effective strategies for early mobility. During this collaborative, members completed and adopted the Progressive Mobility Continuum.²⁵ The subsequent work with IHI provided further necessary strategies. Using Intermountain

Healthcare's mobility model, St. Luke's was able to make a successful business case to leadership supporting dedicated PT resources. This involved the analysis of literature to determine key metrics that would help to objectively evaluate the opportunity at St. Luke's while defining the outcome goals for the proposed business case. The goal was to identify the opportunity with respect to both improved clinical outcomes and resulting cost savings. The core of the business case was centered around the IHI Triple Aim, as this model was central to the organization's global improvement strategy.⁴⁵ Based on well-documented outcomes from Schweickert et al., Morris et al., and Lord et al., they incorporated benefits of early mobility into the three key features of the Triple Aim: better care, better health and lower cost.^{8,9,29} Early mobility demonstrated lower cost by reducing hospital and ICU ALOS; better health through improved functional independence, walking distance and physical functioning/muscle strength; and better care through reduced mechanical ventilation. The implementation of ICU early mobility was also congruent with the concepts of the accountable care organization (ACO) model, by not only providing for enhanced acute care outcomes but also returning the patient back to the community with a higher degree of functional status.⁴⁶

Case Study 4: Orlando Health

Getting Started—Orlando Health is an eight-hospital system in central Florida. Four adult hospitals were involved in this work, with a total of 1,446 beds, including 78 ICU beds in six units. Their ICUs are “closed” with use of critical care-trained intensivists. Multidisciplinary rounding occurs seven days a week. This team chose to focus their initial efforts on delirium monitoring and management by creating training videos for physicians about the use of CAM-ICU and RASS.^{47,48}

Delirium Management—Initially, the team tested completion of CAM-ICU and RASS as a pharmacist-driven process, but competing responsibilities made this unsustainable. Next, they developed a training video to initiate physician-driven CAM-ICU performance and documentation in physician progress notes. This was done as a physician-driven rather than nurse-driven process because of concern about the additional burden of another scoring system for nursing at that time; because they wanted to develop physician expertise; and because it was easier to change the physician documentation system. Eventually, this was transitioned to include a nurse-driven process (changing from Riker to RASS and using CAM-ICU) following a lengthy EMR change process, and physician documentation of CAM-ICU remains in place. The video features six scenarios addressing various facets of delirium detection and treatment. The scenarios were developed by the medical director and filmed within two consecutive hours, with no preparation required by the clinician-actors, using existing equipment in a patient simulation area. ICU clinicians acted as assessors and patients. These patient case videos can be used individually or sequentially, with seven minutes' running time. CAM-ICU documentation changes and training video use (by more than 450 clinicians) were evaluated at 16 months post-implementation.

Video scenarios established the clinician-actors as local experts and allowed for simultaneous testing across settings. Unexpectedly, a “fame factor” for clinicians featured in the videos generated and sustained interest and extended dialogue. These clinicians became

early adopters, and Orlando Health plans to pursue the use of self-developed training videos in additional settings.

Case Study 5: Samaritan Hospital

Getting Started—Samaritan Hospital is a 215-bed community hospital in Troy, New York, with 12 ICU beds in one ICU. This is a “mixed” ICU where hospitalists round on all patients and the majority are admitted to hospitalist service with an intensivist consult. Samaritan focused efforts with a strong physician champion, a part-time paid intensivist, who attended the IHI-RCC. They formed a steering committee to oversee three interdisciplinary work groups led by critical care nursing staff: sedation, delirium, and mobility. They submitted recommendations, order sets, and protocols to the steering committee. A whiteboard on the unit was updated with the groups’ progress along with education updates. Signs were placed in patient room with reminders about CAM-ICU scoring. Electronic documentation was changed to reflect CAM-ICU and RASS. A new model for multidisciplinary rounds was tested and implemented; the ICU Medical Director now leads rounds from room to room three days a week with the interdisciplinary team rather than in a central room, with patient and family participation encouraged. There is an increased focus on interdisciplinary care-planning that helps plan timing for activities like mobility and sedation interruption. The team includes the ICU Medical Director, nursing director, clinical nurse specialist, RT, PT, dietician, discharge planner, pharmacist, speech therapy, and nursing staff.

Sedation Management—The team shared literature on the effects of continuous sedation on ventilated patients, and replaced the Ramsey scale with the RASS.^{1,15,34,35,48} Physician and nursing champions led the work, providing profession-specific education. Using PDSA cycles, the team tested ventilator sedation orders and revised them many times to focus on intermittent sedation medication options, limiting continuous sedation options. The team standardized options for pain, delirium, and sedation medications. The pharmacy provides data feedback on use of continuous infusions and intermittent sedation.

Delirium Management—Delirium screening was new in the ICU. They introduced the CAM-ICU tool and developed documentation in the electronic flow sheet. A key step was involving the Chair of Psychiatry to standardize delirium treatment choices.

Mobility—A physical therapist leads the mobility team, and PT is included on multidisciplinary rounds for all patients. The team was instrumental in the development and implementation of aggressive mobilization and is consulted on all ventilated patients. Focusing on ventilated patients created a halo effect, increasing mobilization for all critical care patients.

QUANTITATIVE RESULTS

Rapid City's (Case Study 1) ICU ALOS showed a 16% relative improvement (RI) (3.2 days pre vs. 2.7 post) and a 5% RI in ALOS (4.2 days pre vs. 4.0 days post) in the Medical ICU (Figure 1). The ALOS data is for all ICU patients, not just ventilated patients. Rapid City

has not seen as substantial of an improvement in ALOS, but notes higher acuity levels on their units, with some prior ICU-level patients now being cared for on step-down units.

Mission's (Case Study 2) ICU ALOS showed a 6% RI (3.2 days pre vs. 3.0 days post), which reflects the entire ICU population (Figure 2). Additionally, their ALOS showed a more substantial RI of 16% (3.7 days pre vs. 3.1 days post).

St. Luke's (Case Study 3) ICU ALOS for ventilated patients showed a 15% RI (3.9 days pre vs. 3.3 days post) and a 25% RI in ALOS (4.4 days pre vs. 3.3 days post) (Figure 3). Additionally, the percentage of patients with a RASS score of 0 to -1 improved from 26 to 73%, and the percentage of patients mobilized improved from 66% to 82% (Figure 4).

Orlando Health's (Case Study 4) ICU ALOS showed a 29% RI (4.3 days pre vs. 3.1 days post) in all ICU patients (Figure 5), and ALOS a 23% RI (7.5 days pre vs. 5.8 days post) (Figure 6). CAM-ICU and RASS compliance increased from 0% to 37–46%.

Samaritan (Case Study 5) like Rapid City, has noted higher acuity levels in their ICU likely impacting ICU LOS and ALOS. Despite this, they were still able to show a 10% RI in ICU ALOS (2.2 days pre vs. 2.0 post) and a 4% RI in ALOS (3.6 days pre vs. 3.5 days post) (Figure 7).

DISCUSSION

These organizations were deeply engaged in the work of “rethinking critical care,” and describe it as tremendously rewarding yet very challenging because ultimately success requires a change in *culture*. The IHI-RCC faculty noted that key barriers at the outset were perceived lack of resources and equipment, fear of patients off sedation, and thinking that perfect protocols were needed to start. Strong champions were needed to shepherd the work on a daily basis until culture change took hold. This work was challenging; some teams who attended the seminar desired to make this change but were unable to take effective action on return to their organizations. Anecdotally, some of the common challenges to making this culture change included a lack of leadership, lack of understanding regarding the clinical evidence, and lack of prioritization of these challenges to align necessary improvement resources.⁴⁹ The organizations highlighted in this article addressed an array of cultural issues, learning needs, and logistical details.⁵⁰ Key lessons include the importance of testing changes on a small scale, feeding back data regularly, providing sufficient education, and building will through seeing the work in action.²⁵ Work is needed to increase reliability, moving away from reliance on human factors. Participating organizations cited high-functioning interdisciplinary rounds as a key feature in driving other success factors: planning future tests of change, sharing progress, building teamwork, and setting patient goals for the day.

Testing on a Small Scale

Instead of large-scale implementation, these organizations began by testing changes on a small scale (using the MFI and PDSA) to lessen the potential negative impact, adapt to the environment, and increase staff buy-in. Early on in their efforts, **Samaritan** noted an event

(without injury) while attempting to mobilize a bariatric ventilated patient. Diligence and candor prevented this from slowing down their efforts. Instead, they conducted discussions about patient selection for mobility and equipment needs. The “one-patient, one-time” testing environment made these adjustments possible, rather than throwing the proverbial baby out with the bathwater. The IHI-RCC emphasized starting with easier patients first – the ones about whom there was the least amount of argument. It was additionally found that picking the “right” first patients was complemented by ensuring that the clinicians selected for early testing were chosen based on their stated passion and buy-in for the work at hand.

Data Feedback and Education

Frequent feedback of data and education of clinicians have been essential to maintaining will and reliability. During the active stages of process improvement, teams found regular feedback of data among the improvement team a useful strategy for maintaining engagement. Examples included information regarding continuous sedation vs. bolus, ALOS, ALOSV, percent of time RASS actual met RASS target, number and type of mobility events, and use of the CAM-ICU tool. **Samaritan** noted the challenges of maintaining engagement of rounding physicians who are new to the unit or are working at non-rounding times. The use of intermittent sedation required constant reinforcement. **Rapid City** faced challenges with reluctance to change practice. Turnover and communication lapses were additional challenges. Education and reeducation have been keys to overcoming these challenges, along with persistence about doing the right thing. Data feedback helped with buy-in and squelched fear when staff became aware of outcomes.

All sites recommended focusing on interrelatedness of ABCDE, while testing the changes piece by piece to avoid overwhelming staff and physicians. At **Mission**, it was complex to tackle all aspects at once, yet staff learned the value of teamwork and understanding process improvement. All data were available on a shared drive among their five units.

Across the board, barriers included dealing with individuals resistant to change, sometimes referred to as traditionalists, as well as computer documentation issues. These individuals met one-on-one with physician champions at **Mission** to have their concerns heard and questions answered. Relating positive experiences from their co-workers in their presence and returning to the evidence base has been critical. Issues that slowed the processes at some centers included adjusting the nursing documentation to include the RASS, CAM-ICU, and contraindications for spontaneous awakening and breathing trials, along with adjusting the Analgesia, Sedation, and Delirium order sets. (See Table 1: Barriers and Strategies.)

Seeing Is Believing

At **St. Luke's**, seeing was believing: having an opportunity for colleagues to see peers at another hospital mobilizing critically ill patients. Overcoming current culture, especially addressing uninformed beliefs, was a significant challenge. Perceptions changed over time as staff saw more and more patients dangling their legs over the edge of the bed, standing, and eventually walking, with a shift from “we can’t” to “how can we?” At **Orlando**, one staff member noted, “CAM-ICU is easy to do, but difficult to explain. It’s sort of like

explaining to someone how to tie their shoes. Once you get it, it's easy, but getting there takes longer with some people."

Limitations

Several limitations are important to mention. The IHI-RCC participants, especially those five chosen *a priori* for inclusion in this report, were early adopters with high commitment. As such, there is an inherent selection bias from participation in the program to begin with and agreeing to be a case site for this report. Their experiences may not be generalizable to organizations with deeper challenges of will and less improvement experience. We do not know the results of the other participants. While the five organizations included here revised processes to change sedation practices, only one (Samaritan) reported data on sedative drips and bolus dosing; none reported the overall quantity (e.g., dose) of sedation use. Regarding selection of the sites for this manuscript, we did not know the outcomes of these five organizations prior to selection, and it was explicitly stated in our planning that we anticipated reporting positive *and* negative outcomes. While metric definition was congruent among all organizations, there were limitations in the data submission that made statistical analysis not possible.

CONCLUSION

For those who engage deeply, the IHI-RCC program, and similar quality improvement programs that focus on process and human factors, lead to culture change, which in turn leads to demonstrable qualitative and quantitative results. These five organizations have shown improvement in ICU outcomes and are deepening their efforts to increase reliability.

As a bookend to the baseline description of Samaritan's ICU system before participating in IHI-RCC at the start this article, here is a story from Rapid City's ICU today: *"One of our mobility champions in the MICU had been taking care of a very critically ill woman who had been intubated and on Continuous Renal Replacement Therapy (CRRT) for acute kidney injury. By her third day, the mobility team had her standing, out of bed, and marching in place right next to her CRRT machine. This was something we thought we would never see, but we did it!"*

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Figure 1.

This figure represents the ALOS and ALOSv data for Rapid City's (Case Study 1) MICU ICU and includes 6 months pre-implementation and 18 months post-implementation data. A linear trend line represents each metric and demonstrates gradual improvement pre- vs. post-implementation.

Figure 2.

This figure represents the ALOS and ALOS data for Mission's (Case Study 2) ICU and includes 6 months pre-implementation and 18 months post-implementation data. A linear trend line represents each metric and demonstrates slight improvement in ALOS and more substantial improvement in ALOS pre- vs. post-implementation.

Figure 3.

This figure represents the ALOS and ALOS V aggregate data for St. Luke's (Case Study 3) 3 ICUs and includes 6 months pre-implementation and 18 months post-implementation data. A linear trend line represents each metric and demonstrates substantial improvement pre- vs. post-implementation in both ALOS and ALOS V.

Figure 4.

This figure represents two metrics: percent of patients at RASS goal of 0 to -1, and percent of patients with a daily mobility event. It is aggregate data for St. Luke's (Case Study 3) three ICUs. The RASS metric demonstrates substantial improvement in the percent of patients meeting the target RASS score. The mobility metric shows modest improvement.

Figure 5.

This figure represents the ALOS data for Orlando Health (Case Study 4) ICU and includes 3 months pre-implementation and 3 months post-implementation data. A linear trend line represents each metric and demonstrates substantial improvement pre- vs. post-implementation in both ALOS.

Figure 6.

This figure represents the ALOS data for Orlando Health (Case Study 4) ICU and includes 3 months pre-implementation and 12 months post-implementation data. A linear trend line represents the metric and demonstrates improvement pre- vs. post-implementation in ALOS.

Figure 7.

This figure represents the ALOS and ALOSv data for Samaritan (Case Study 5) ICU and includes 6 months pre-implementation and 18 months post-implementation data. A linear trend line represents each metric and demonstrates slight improvement pre- vs. post-implementation in ALOSv. See each figure of definition of pre and post implementation data periods ALOS = Average Length of Stay ALOSv = Average Length of Stay on the Ventilator RASS = Richmond Agitation Sedation Scale

Table 1**Barriers and Strategies**

<u>Barrier</u>	<u>Strategy to overcome barrier</u>
Resistance to change	<ul style="list-style-type: none"> • Designate physician leaders/champions • Involve multidisciplinary bedside clinicians to exert positive influence on a daily basis • Provide continuous feedback to team regarding outcome data • Address concerns around mobility and safety • Test changes on a small scale
Lack of resources & equipment	<ul style="list-style-type: none"> • Create organization-specific business case based on outcomes in the literature
Lack of knowledge & process	<ul style="list-style-type: none"> • Educate the multidisciplinary team regarding the rationale and evidence for: <ul style="list-style-type: none"> – Effective sedation and delirium management – Early ICU mobility • Utilize evidence-based tools to standardize assessment processes • Partner with another hospital that has ICU mobility, sedation, and delirium management experience with demonstrated success
Sustaining the improvement	<ul style="list-style-type: none"> • Use multidisciplinary rounds • Continually reinforce the standard • Incorporate into already established processes
Oversedation	<ul style="list-style-type: none"> • Use the RASS scale • Revise order sets and use an algorithm to effectively reduce overuse of analgesic and anxiolytic medications
Delirium	<ul style="list-style-type: none"> • Use CAM-ICU tool to screen all patients on a routine schedule (usually every shift) • Use non-pharmacologic nursing interventions • Reduce/minimize use of deliriogenic medications