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A Review of Multifaceted Care Approaches for the Prevention and Mitigation of Delirium in Intensive Care Units

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Abstract

Objective—The objective of this review is to examine the effectiveness, implementation, and costs of multifaceted care approaches, including care bundles, for the prevention and mitigation of delirium in patients hospitalized in Intensive Care Units (ICUs).

Data Sources—A systematic search using PRISMA guidelines was conducted utilizing PubMed, EMBASE, and CINAHL. Searches were limited to studies published in English from January 1, 1988 to September 30, 2013. Randomized controlled trials and comparative studies of multifaceted care approaches with the reduction of delirium in ICU patients as an outcome and evaluations of the implementation or cost-effectiveness of these interventions were included.

Data Extraction—Data on study methods including design, cohort size, interventions, and outcomes were abstracted, reviewed, and summarized. Given the variability in study design, populations, and interventions, a qualitative review of findings was conducted.

Data Synthesis—Fourteen studies met our inclusion criteria: 6 examined outcomes, 5 examined implementation, 2 examined outcomes and implementation, and 1 examined cost-effectiveness. The majority of studies indicated that multifaceted care approaches were associated with improved patient outcomes including reduced incidence and duration of delirium. Additionally, improvements in functional status and reductions in coma and ventilator days, hospital length of

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stay, and/or mortality rates were observed. Implementation strategies included structured quality improvement approaches with ongoing audit and feedback, multi-disciplinary care teams, intensive training, electronic reporting systems, and local support teams. The cost-effectiveness analysis indicated an average reduction of \$1,000 in hospital costs for patients treated with a multifaceted care approach.

Conclusions—Although multifaceted care approaches may reduce delirium and improve patient outcomes, greater improvements may be achieved by deploying a comprehensive bundle of care practices including awakening and breathing trials, delirium monitoring and treatment, and early mobility. Further research to address this knowledge gap is essential to providing best care for ICU patients.

Keywords

delirium; intensive care units; evidence-based practice; patient care bundles; ventilator weaning

Introduction

Delirium or acute brain dysfunction is a common and severe problem for older, hospitalized adults.¹ Described in the Diagnostic and Statistical Manual of Mental Disorders as an acute confusional state characterized by fluctuating mental status, inattention, and either altered level of consciousness or disorganized thinking, delirium occurs in an estimated 14% to 56% of hospitalized patients and is associated with an in-hospital mortality rate of 25% to 33%.^{1,2} Delirium is more prevalent in Intensive Care Units (ICUs) affecting 35% to 80% of all critically ill patients.³ Patients undergoing mechanical ventilation are particularly susceptible to the condition (with rates as high as 80%), as the analgesics, sedatives, and hypnotics that are frequently used in ICUs to achieve patient comfort are often deliriogenic.^{4,5} ICU-acquired delirium is independently associated with increased cognitive and physical impairment, mortality, hospital length of stay, and health care costs.⁶

Delirium is a complex condition that may be caused or exacerbated by multiple risk factors or combinations thereof. Risk factors can be divided into 3 categories including characteristics of acute illness, patient or host factors, and environmental or iatrogenic factors.⁵ Various multicomponent programs have been designed for ICU and non-ICU settings to address the multifactorial nature of delirium by including elements such as sedation vacations, therapeutic activities, early mobilization, vision/hearing optimization, and sleep enhancement and have shown success in reducing delirium.⁵ However, uptake and use of these multifaceted strategies in day-to-day practice remains low.⁷

“Care bundles” have been advocated as a means to accelerate the adoption of multiple care processes into routine clinical practice, benchmark performance, and improve patient outcomes. A bundle is “a structured way of improving care processes and patient outcomes: a small, straightforward set of evidence-based practices — generally three to five — that, when performed collectively and reliably, have been proven to improve patient outcomes.”^{8,9} The concept of “bundling” therapies has been applied to the management and prevention of complex conditions such as central line infections, ventilator-associated pneumonia, and sepsis to help clinicians reliably deliver evidence-based processes of care.

Studies examining use of care bundles for these conditions have shown improvements in the delivery of care processes and outcomes.¹⁰⁻¹³

The ABCDE bundle has been proposed as an interdisciplinary, multi-component patient safety intervention in ICUs to reduce incidence of delirium by improving collaboration among clinical team members, standardizing care processes, and breaking the cycle of oversedation and prolonged ventilation.^{7,14,15} The bundle consists of coordinated interruptions of sedation and mechanical ventilation (awakening and breathing coordination), delirium monitoring and management, and early exercise/mobility). Recently, the Society of Critical Care Medicine issued guidelines and a bundle for the management of pain, agitation, and delirium (PAD) in the ICU.⁶ The PAD bundle is broader than the ABCDE bundle and includes routine assessment of delirium, guidelines for pharmacologic and non-pharmacologic treatment of PAD, use of daily breathing trials, early mobility and exercise, and strategies to preserve patients' sleep-wake cycles.¹⁴

The objective of this systematic literature review was to examine the effectiveness of multifaceted care approaches including care bundles for the prevention and mitigation of delirium in ICU patients on: 1) improving patient-centered clinical outcomes; 2) care process adoption success; and 3) cost savings.

Methods

A systematic search based on the PRISMA statement guideline was conducted utilizing PubMed, EMBASE, and CINAHL. The following search string was used: ("Intensive Care Unit" [Subject Heading] OR "Critical Care/methods" [Subject Heading]) AND "delirium" [All Fields] AND ("multicomponent" [All Fields] OR "bundle" [All Fields] OR "protocol" [All Fields] OR "strategy" [All Fields] OR "guideline" [All Fields]). Searches were limited to studies on humans and published in English from January 1, 1988 – September 30, 2013. We included randomized controlled trials, clinical trials, or comparative studies of multifaceted care approaches that examined the incidence of delirium in ICU patients as a primary or secondary outcome and evaluations of the implementation or cost-effectiveness of these types of interventions. For inclusion, studies had to demonstrate usage of at least two of the following therapies:

1. daily sedation interruption (spontaneous awakening trial (SAT))
2. daily assessment of patient readiness for extubation (spontaneous breathing trial (SBT))
3. daily sedation monitoring with a validated screening tool
4. daily delirium monitoring with a validated screening tool
5. targeted pharmacological strategies (i.e. protocols for prescription of analgesics and sedatives)
6. non-pharmacological delirium management/mediating strategies (i.e. cognitive stimulation, assistive device use (glasses/hearing aids), sleep preservation)
7. early exercise or mobility protocol

We excluded studies of multifaceted care approaches that compared pharmaceutical treatments for delirium as the primary objective as an analysis of the effectiveness of specific drug therapies was beyond the scope of this study. We also excluded implementation studies that did not examine the effect of implementation of multifaceted care approaches on delivery of care process measures. Data on study methods including design, cohort size, bundle components, treatments, and outcomes were abstracted, systematically reviewed, and summarized into tables. A qualitative review of findings was conducted, as there was great variability in these measures.

The validity and quality of the studies that examined outcome measures pertaining to delirium were evaluated independently by two of the researchers based on the design-specific criteria to assess risk of bias developed by Viswanathan et al. that allows for the evaluation of randomized and non-randomized studies (Table 1).¹⁶ Agreement between reviewers was 94% for individual study components and 100% for overall risk of bias. All disagreements were settled by discussions between the two reviewers. We rated three studies as having high risk of bias due to inability to control for confounders or concurrent interventions, lack of fidelity to the intervention protocol, and inconsistent application of interventions and measures. Studies were not excluded based on risk of bias.

Results

Results of the Literature Search

Searches of PubMed, CINAHL, and EMBASE resulted in the identification of 373 unique records (Figure 1). The title and abstracts of these records were reviewed and reviews, commentaries, letters, and studies not related to the use of multifaceted care approaches for the prevention of delirium were excluded. We examined the full text of the remaining 22 articles and excluded 8 additional studies because they did not examine the impact of multifaceted care approaches on incidence of delirium, did not feature interventions that met our specified inclusion criteria, were reviews or general commentaries, or were related to specific surgical procedures. Of the 14 remaining studies that met our inclusion criteria, 6 studies examined outcome measures related to multifaceted interventions, 5 studies examined implementation strategies, 2 studies examined both outcomes measures and implementation strategies, and one study examined cost-effectiveness.

Effectiveness of Bundled Care Practices on Patient Outcomes

Summaries of the 8 studies that examined outcome measures pertaining to delirium are presented in Tables 2 and 3. Three of the studies were randomized controlled trials (RCTs) and 5 were controlled clinical trials (CCTs) that examined differences in patient outcomes before and after the implementation of multifaceted care approaches. There was great heterogeneity among the studies in terms of intervention components and outcome measures. The majority of studies featured interventions for sedation interruption and management; however, these interventions differed across studies and were combined with various therapies including daily breathing trials, reorientation strategies, early rehabilitation, environmental stimulation, pain assessment, and delirium screening. Adherence to intervention components ranged from 52% to 100%, but overall compliance

was difficult to assess as 5 of the studies did not report adherence for at least one component of the intervention (Table 4). Improvements in outcomes for ICU patients receiving multifaceted care approaches were noted in all studies with the exception of the RCT conducted by Mehta et al., which found that adding daily sedation interruption for mechanically ventilated adults managed with protocolized sedation did not reduce duration of mechanical ventilation or length of ICU stay.¹⁷

Delirium Outcomes—Five of the 8 studies found that multifaceted care approaches were associated with significant reductions in incidence of delirium, duration of delirium, or days patients spent awake and not delirious. Colombo et al. found that adding a re-orientation strategy and environmental, acoustic, and visual stimulation to an ICU process of care that included daily sedation interruption and breathing trials as well as a twice daily delirium assessment reduced the incidence of delirium from 35% to 22% ($p=0.020$).¹⁸ After implementation of a new sedation protocol designed to decrease use of continuous sedative infusions and twice-daily delirium screening, Hager et al. observed a significant increase in the median proportion of ICU days awake and not delirious per patient (0% vs. 19%, $p<0.001$).¹⁹ Needham et al. found that use of a multi-disciplinary team focused on reducing heavy sedation and adding physical and occupational therapists to ICU staffing increased the percentage of days that ICU patients were alert (29% vs. 66%, $p<0.001$) and not delirious (21% vs. 53%, $p=0.003$).²⁰ Similarly, Schweickert et al. found that combining daily interruption of sedation with physical and occupational therapy reduced the duration of delirium in mechanically ventilated patients compared to sedation interruption alone (median 2.0 days vs. 4.0 days, $p=0.02$).²¹ Balas et al. found that implementation of the ABCDE bundle significantly decreased the risk-adjusted odds of developing delirium (OR: 0.55; 95% CI: 0.33-0.93, $p=0.03$) and the percent of ICU days patients spent delirious (50% vs. 33%, $p=0.03$).²² Three studies found no significant differences between treatment and control groups in incidence of delirium.^{17,23,24} Delirium was assessed with the Confusion Assessment Method for the ICU (CAM-ICU) in 6 of the studies,¹⁸⁻²³ and the Intensive Care Delirium Screening Checklist (ICDSC) in 2 of the studies.^{17,24} These tools are the most valid and reliable delirium monitoring tools for adult ICU patients.⁶

Coma/Ventilator Days—Four out of 5 studies that examined ventilator use found that multifaceted care approaches were associated with significant reductions in ventilator days.²¹⁻²⁴ Reductions in coma days or incidence of iatrogenic coma were observed in three of the four studies that examined coma incidence.^{21,23,24}

Length of Stay—In 3 studies, use of multifaceted care approaches for delirium prevention was associated with significant decreases in both ICU and/or hospital length of stay (LOS). Girard et al. observed a 3.8 day reduction in median ICU LOS ($p<0.001$) and a 4.3 day reduction in median hospital LOS ($p<0.001$) in the treatment group.²³ Needham et al. and Skrobik et al. found a 2.1 and 0.97 day reduction in mean ICU LOS ($p=.020$, $p=0.009$) and similar significant reductions in mean hospital LOS for patients in the treatment groups, respectively.^{20,24} Two studies did not report outcomes related to LOS,^{18,19} and three studies found no significant differences in LOS between treatment and control groups.^{22,17,21}

Use of Sedatives and Analgesics—Seven studies examined the effect of multifaceted care approaches on benzodiazepine and narcotic use, and 4 of these studies also examined propofol use. Three studies reported that multifaceted care approaches were associated with significant decreases in the number of patients who received benzodiazepines and narcotics.^{19,20,24} Mehta et al. found that adding daily sedation interruption to a sedation protocol resulted in significant increases in benzodiazepine and narcotic use while Schweickert et al. and Girard et al. found that use of these drugs did not differ significantly between treatment and control groups.^{17,21,23} One of the 4 studies that examined propofol use found a significant decrease in propofol administration after the introduction of a management protocol for analgesia, sedation, and delirium and reorientation strategies.²⁴ Balas et al. found no significant differences in the number of patients treated with or dosing of benzodiazepines, opiates, or propofol after ABCDE bundle implementation.²²

Mortality—Seven studies examined in-hospital or short-term mortality as an outcome measure. Skrobik et al. found that use of a multifaceted management process for delirium was associated with a significant decrease in 30-day mortality risk, while the other studies found no significant differences in in-hospital or short-term mortality between treatment and control groups.²⁴ Girard et al. observed a significant reduction in 1-year mortality (HR: 0.68, $p=0.01$) in patients who received a daily SBT and a SAT compared to patients who only received an SBT.

Functional Status—Three studies examined the effect of multifaceted care approaches on functional status. Schweickert et al. found that patients who were treated with a multifaceted care approach including early physical therapy were significantly more likely to regain functional status at discharge (OR: 2.7, $p=0.02$), and Skrobik et al. found that patients who received a multifaceted intervention were more likely to be able to return home (74.8% vs. 68.2%, $p=0.049$) following hospitalization.^{21,24} Balas et al. found no significant differences in the number of patients who were able to return home following discharge following ABCDE bundle implementation.²²

Safety Outcomes—Four studies reported the effect of implementation of multifaceted care approaches on self-extubations. Girard et al. found that a paired sedation and ventilator weaning protocol led to a significant increase in self-extubation (10% vs. 4%, $p=0.03$); however, the rate of reintubation was similar to the control group indicating that some patients who self-extubated were ready to come off the ventilator.²³ The other 3 studies did not observe significant differences in self-extubation rates between treatment and control groups.^{17,21} In addition, Girard et al., Mehta et al., and Balas et al. found no significant differences between groups in the number of patients requiring tracheostomy.^{17,22,23}

Implementation

A summary of the 7 studies that examined the implementation of multifaceted care approaches for delirium prevention is presented in Table 2. Implementation strategies included structured educational processes, ongoing audit and feedback, and use of multidisciplinary teams of ICU physicians, nurses, pharmacy representatives, delirium experts, and rehabilitation therapists. Of the five studies that examined the effect of the

implementation of multifaceted care approaches on delirium screening, two studies found a significant increase in the percentage of patients that were screened for delirium using the CAM-ICU.^{25,26} Radtke et al. found a significant increase in the frequency of delirium monitoring (1.6 vs. 0; $p < 0.01$) per patient per day.²⁷ One of the five studies that examined differences in use of sedation screening reported a significant increase in sedation monitoring following the implementation of monitoring tools for sedation, pain, and delirium in the ICU and training featuring lectures and instructional videos.²⁷ One of the two studies that examined the effect of implementation strategies on physical therapy or occupational therapy consults reported a significant increase in the number of physical and occupational therapy consults (210 vs. 810; $p < 0.001$).²⁰ In addition Carrothers et al. found that the percentage of ICU patients receiving progressive mobility increased from 0% to 82% following implementation of the ABCDE bundle.²⁵ Of the two studies that examined the effect of ABCDE bundle implementation on performance of SATs and SBTs, one found a significant increase in use of SATs and both found a significance increases in the percentage of patients that underwent a SBT anytime during ICU stay.^{14,22,25}

In one study, nurses reported the most common barriers to implementation of delirium screening instruments were time (31%), physicians (27%), and confidence performing delirium assessments.²⁸ The researchers reported many implementation challenges including difficulties in educating nurses and physicians, lack of physician and nurse compliance, perceptions that administration of the protocol was difficult, and fear of patient harm. Similarly, barriers to ABCDE bundle implementation identified by Balas et al. included fear of adverse events, communication and care coordination challenges, knowledge deficits, workload concerns, and documentation burden.¹⁴ Carrothers et al. found that bundle implementation was facilitated by stable ICU leadership, respiratory and physical therapist staff dedicated to the ICU, existing quality improvement cultures, clinical champions, and hands-on support from nurse champions. Lack of resources, excessive staff turnover, morale issues, lack of respect among disciplines, and lack of knowledge were barriers to implementation.

Cost

Awissi et al. examined the cost-effectiveness of the I-SAVE study conducted by Skrobik et al.²⁹ Although the incidence of delirium remained the same between groups, the mean total costs of an ICU hospitalization (in 2004 Canadian dollars) decreased from \$6,213 in the control group to \$5,280 in the group of ICU patients treated with a sedation, analgesia, and delirium management protocol ($p = 0.022$). The duration of mechanical ventilation was shorter for patients in the treatment group, and the approximately \$1,000 reduction in costs in this group was primarily due to an average one day reduction in LOS. Analgesic, sedative, and antipsychotic drug use was also lower in the treatment group. Cost-effectiveness was calculated by associating the variation of costs and effectiveness measures (proportion of patients within targeted pain, sedation, and delirium goals). Costs were calculated as the sum of acquisition costs of drugs used for sedation, analgesia, or delirium in the ICU and the cost of ICU stay (number of ICU days multiplied by the average 1-day cost of ICU hospitalization for the facility). Nursing time, professional fees, and workload costs were not taken into account.

Discussion

Despite the great variation in interventions and measured and observed outcomes in the studies included in this review, we found evidence that utilizing a multifaceted care process for the prevention and treatment of delirium in ICUs may improve patient outcomes including incidence and duration of delirium, coma days, days spent on a ventilator, hospital length of stay, functional status, and mortality rates. Significant decreases in the use of sedative and analgesics, which are associated with an increased risk of delirium, were observed in several of the included studies.⁷ The majority of the studies included in this review indicated that multifaceted care approaches in the ICU can reduce incidence and duration of delirium. However, 3 of the studies reported no significant differences in incidence or duration of delirium between the treatment and the control groups. Reduction in coma rates, heterogeneity among interventions, differences in the existing standard of care in study ICUs, choice of sedation, and poor adherence to intervention protocols likely contributed to the observed variation in outcomes.

While noting improvements in other outcomes such as coma and ventilator days and LOS, Girard et al. and Skrobik et al. did not observe significant reductions in delirium in the intervention groups. Skrobik et al. suggested that the lack of observed differences in incidence of delirium could be attributed to the reduction in iatrogenic coma in the intervention group which “unmasked” patients with delirium.²⁴ This observation has significant implications for research on prevalence of delirium in ICUs as ICU patients are more susceptible to sedation-induced coma than non-ICU patients, and patients who are sensitive to the effects of sedation may also be more likely to develop delirium. Reducing the number of patients who receive coma-inducing sedation may increase the number of patients with observed delirium. Thus, the number of delirium and coma free days may be a more appropriate primary outcome measure in studies examining prevalence of delirium in ICUs.

The lack of observed reductions in incidence or prevalence of delirium in some of the studies may be attributable to the types of interventions and the treatment received by the control group. For instance, Girard et al. compared a daily SAT plus a daily SBT to the use of a SBT alone.^{23,24} Although the bundle deployed by Skrobik et al. was broader and featured a management protocol for analgesia, sedation, and delirium as well as reorientation treatments, the control group received a pain, sedation, and delirium evaluation every 8 hours, and clinicians may have employed delirium-reducing care strategies based on evaluation results. Contrary to findings of the other studies included in this review, Mehta et al. did not observe significant improvements in delirium or other clinical outcomes in patients who received a multifaceted care approach, but they did observe significant increases in the administration of sedative and analgesics. However, the objective of that study was to compare protocolized sedation with protocolized sedation plus daily sedation interruption, and patients in the control group received protocolized sedation as standard of care.

Choice and dosing of sedation may also mask potential beneficial effects of multifaceted interventions for delirium. In the study conducted by Mehta et al., patients in both the

treatment and control groups received high average daily doses of midazolam (102 mg and 82 mg, respectively $p=0.04$) compared to other studies of daily sedation interruption where average daily doses of midazolam were between 27.5 mg and 58.0 mg.^{18,30} Thus, the high doses of midazolam in general combined with the fact that the intervention group received significantly higher doses of the drug may have offset the effects of sedation interruption.

Adherence to intervention protocols was low in some of the reviewed studies and may have contributed to the lack of observed differences in treatment and control groups in reductions in incidence or prevalence of delirium. In the study conducted by Mehta et al., patients did not receive daily sedation interruption and SBT for 28% and 18% respectively of all eligible study days.¹⁷ In addition 53% of patients missed at least one daily sedation interruption. In the study conducted by Skrobik et al., only 52% of the patients in the intervention group received pharmacological management of analgesia and sedation prescribed by protocol. Although patients in the Mehta et al. study were treated according to a protocol designed to reduce incidence of oversedation, patients in the treatment group received higher and more frequent doses of sedatives, and clinical personnel expressed reluctance to interrupt sedation infusions due to concerns regarding the safety and comfort of the patients. These findings emphasize the need for cultural change in ICUs to facilitate the adoption of new care processes and improve protocol adherence.

Variable effectiveness of interventions can also be related to differing adoption rates of the interventions or contextual factors.³¹ Understanding the organizational factors that facilitate or hinder implementation of new processes of care and how to tailor implementation to overcome barriers is crucial to the widespread adoption of practices to reduce delirium. Despite the abundance of evidence that has been produced over the last 10 years indicating the hazards of delirium and benefits of certain interventions to prevent and mediate this condition, a substantial implementation gap exists between the current state and ideal delirium management practices in ICUs.^{6,7} Several of the studies included in this review noted difficulties in implementation due to clinical staff resistance to change and not understanding the benefit of bundle implementation. This finding is consistent with studies examining implementation of bundles for other conditions and emphasizes the need for ongoing education, continuous measurement and reporting of process and outcome performance.

The studies included in this review had many limitations. Some of the studies lacked methodological rigor. Biases may have been introduced through lack of intervention fidelity, failure to control for confounding factors, and inconsistent measurements. Many of the studies were non-randomized pre-post studies and observed improvements may have been caused by temporal trends or other factors that were not controlled for such as choice and level of sedation and incidence of coma. This review also has several limitations. The study was restricted to English-language publications and risk of bias assessments were performed by only two reviewers. The heterogeneous nature of the interventions and the measured outcomes limited our ability to summarize outcomes across studies and report generalizable findings.

ICU delirium is a common complication of critical care that is associated with increased morbidity, mortality, and health care costs, but is often undiagnosed and untreated. New approaches to the delivery of care in the ICU are needed to counter this threat to patient safety. Although the studies included within this review have several limitations and are difficult to compare due to the heterogeneity of the interventions, reductions in delirium and improved patient outcomes were observed following the implementation of multifaceted care approaches. Greater improvements in ICU care and patient outcomes may be achieved by deploying a standardized, comprehensive bundle of care practices that incorporate awakening and breathing trials, delirium monitoring and treatment, and early mobility, such as the ABCDE or PAD bundles. However, rigorous testing of these bundles is needed to determine their effectiveness. In addition, there is a need for data on factors that promote successful adoption of these care processes and their cost-effectiveness that can be used to facilitate widespread adoption. Future studies must address these gaps in knowledge regarding the prevention and mitigation of delirium.

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Figure 1. Literature Search Results

Table 1

Risk of Bias Assessment

Risk of bias	Criterion	Study Type					Balas ¹⁶	Colombo ¹⁸	Girard ²³	Hager ¹⁹	Mehta ¹⁷	Needham ²⁰	Schweickert ²¹	Skroblik ²⁴
		CCT	CCT	RCT	RCT	CCT								
Selection bias	Was the allocation sequence generated adequately (e.g., random number table, computer-generated randomization)?	NA	NA	Y	Y	NA	NA	NA	Y	NA	NA	NA	Y	NA
	Was the allocation of treatment adequately concealed (e.g., pharmacy-controlled randomization or use of sequentially numbered sealed envelopes)?	NA	NA	Y	Y	NA	NA	Y	Y	NA	NA	NA	Y	NA
	Were participants analyzed within the groups they were originally assigned to?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Did the study apply inclusion/exclusion criteria uniformly to all comparison groups?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Was the strategy for recruiting participants into the study consistent across groups?	Y	Y	Y	NA	Y	Y	NA	NA	Y	Y	Y	NA	Y
Performance bias	Does the design or analysis control account for important confounding and modifying variables through matching, stratification, multivariable analysis, or other approaches?	Y	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	N
	Did researchers rule out any impact from a concurrent intervention or an unintended exposure that might bias results?	N	N	Y	Y	N	N	Y	Y	N	Y	N	Y	N
Attrition bias	Did the study maintain fidelity to the intervention protocol?	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	N
	If attrition (overall or differential non-response, dropout, loss to follow-up, or exclusion of participants) was a concern, were missing data handled appropriately (e.g., intention-to-treat analysis and imputation)?	NA	NA	Y	Y	NA	NA	Y	Y	NA	Y	NA	NA	NA
Detection bias	In prospective studies, was the length of follow-up the same between the groups, or in case-control studies, was the time period between the intervention/exposure and outcome the same for cases and controls?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Were the outcome assessors blinded to the intervention or exposure status of participants?	N	N	N	N	N	N	N	N	N	N	N	Y	N

Risk of bias	Criterion	Study Type					Abbreviations		
		CCT	CCT	RCT	CCT	RCT	Balas ¹⁶	Colombo ¹⁸	Girard ²³
U	Were interventions/exposures assessed/defined using valid and reliable measures, implemented consistently across all study participants?	Y	Y	Y	N	Y	Y	Y	Y
	Were outcomes assessed/defined using valid and reliable measures, implemented consistently across all study participants?	Y	Y	Y	Y	Y	Y	Y	Y
	Were confounding variables assessed using valid and reliable measures, implemented consistently across all study participants?	Y	Y	NA	Y	NA	Y	Y	NA
U	Were the potential outcomes pre-specified by the researchers? Are all pre-specified outcomes reported?	Y	U	U	U	Y	U	Y	Y
	What is the overall risk of bias for the study? (High, Low, Indeterminate)	Low	Low	Low	High	Low	Low	Low	Low
OVERALL RISK OF BIAS		Low	Low	Low	High	Low	Low	Low	Low

Abbreviations: CCT = Controlled Clinical Trial, RCT = Randomized Controlled Trial, Y = Yes, N = No, U = Unknown

Table 2
Summary of Primary and Secondary Measures Reported by Studies Examining Impact of Multifaceted Care Approaches on Patient Outcomes

Outcomes	Study Type							
	Balas ¹⁶	Colombo ¹⁸	Girard ²³	Hager ¹⁹	Mehhta ¹⁷	Needham ²⁰	Schweickert ²¹	Skrobik ¹⁸
Delirium	CCT	CCT	RCT	CCT	RCT	CCT	RCT	CCT
	SD	SD	NS	-	NS	-	-	NS
	NS	-	NS	SD	-	-	SD	-
Days awake and not delirious	SD	-	-	SD	-	SD	-	-
	NS	-	SD	-	-	-	-	SD
Coma Days	NS	-	SD	SD	-	-	-	SD
Ventilator Days	SD	-	SD	-	NS	-	SD	SD
Length of Stay	NS	-	SD	-	NS	SD	NS	SD
	NS	-	SD	-	NS	SD	NS	SD
Sedative/Analgesic Use	NS	-	NS	SD	SI	SD	NS	SD
	NS	-	NS	-	-	-	NS	SD
	NS	-	NS	SD	SI	SD	NS	SD
Mortality	NS	NS	-	-	NS	NS	NS	-
	NS	-	NS	-	-	-	-	SD
	-	-	SD	-	-	-	-	-
Functional Status	-	-	-	-	-	-	SD	-
Patients not able to return home	NS	-	-	-	-	-	-	SD
Safety Outcomes	NS	-	SI	-	NS	-	NS	-
Self-extubation requiring reintubation	NS	-	NS	-	-	-	-	-

Outcomes	Balas ¹⁶	Colombo ¹⁸	Girard ²³	Hager ¹⁹	Mehhta ¹⁷	Needham ²⁰	Schweickert ²¹	Skrobik ¹⁸
	CCT	CCT	RCT	CCT	RCT	CCT	RCT	CCT
Study Type								
Reintubation within 48 hours	NS	-	NS	-	NS	-	-	-
Tracheostomy	NS	-	NS	-	NS	-	-	-

NS = Not significant
SD = Significant decrease
SI = Significant increase
Significance denoted at p 0.05

Table 3
Summary of Studies of Multifaceted Care Approaches with the Reduction of Delirium in ICU Patients as a Primary or Secondary Outcome

Authors (year)	Study Type	N	Intervention	Delirium	Coma/Ventilator ICU/Hospital Days	Sedative/Analgesia Use	Mortality
Balas et al. (2013) ¹⁶	CCT	196	Standard of Care -No policies in the ICU regarding awakening and breathing trials or delirium monitoring/management -Patients not routinely assisted out of bed Intervention ABCDE bundle applied to every ICU patient on a daily basis ABCDE elements include: -Awakening trial (SAT) -Breathing trial (SBT) -Coordination of SAT/STB -Delirium monitoring with CAM-ICU -Early exercise/mobility	Incidence of delirium I: 73 (49%) C: 91 (2%); p=0.02 Duration of delirium I: 2 days (IQR: 1-4) C: 3 days (IQR: 1-6); p=0.52	Coma days I: 2 (IQR: 1-5) C: 2 (IQR: 1-4); p=0.35 Ventilator-free days I: 24 (IQR: 7-26) C: 21 (IQR: 0-25); p=0.04 ICU LOS (days) I: 4 (IQR: 3-5) C: 5 (IQR: 3-8); p=0.21 Hospital LOS (days) I: 11 (IQR: 9-13) C: 13 (IQR: 9-15); p=0.99	Patients receiving benzodiazepine I: 77 (51%) C: 91 (62%); p=0.06 Patients receiving propofol I: 31 (21%) C: 25 (17%); p=0.44 Patients receiving opiates I: 134 (89%) C: 124 (85%); p=0.26	Hospital mortality I: 17 (11%) C: 29 (20%); p=0.09 ICU mortality I: 9.3% C: 16.4%; p=0.07
Colombo et al. (2012) ¹⁸	CCT	314	Standard of Care -Daily sedation interruption-Daily spontaneous breathing trial (SBT) -Delirium assessment with CAM-ICU (2x daily) Intervention Standard of care plus: -Re-orientation strategy -Environmental, acoustic, and visual stimulation	Incidence of delirium I: 22.0% C: 35.5%; p=0.020 Predictors of delirium Reorientation strategy (HR: 0.504; 95% CI: 0.313-0.890; p=0.034) Age (HR 1.034; 95% CI: 1.013-1.056; p=0.001) Sedation with midazolam plus opiate (HR: 2.145; 95% CI 2.247-4.032; p=0.018)	Not Reported	Not compared between intervention and control groups	In-hospital mortality in patients with delirium I: 4.5% C: 6.9%; p=0.907
Girard et al. (2008) ²³	RCT	336	Standard of Care -Daily spontaneous breathing trial (SBT) Intervention Standard of care plus -Daily spontaneous awakening trial (SAT)	Incidence of delirium I: 124 (74%) C: 119 (71%); p=0.66 Duration of delirium I: 2 days (IQR: 0-5) C: 2 days (IQR: 0-6); p=0.50	Coma days I: 2 (IQR: 0-4) C: 3 (IQR: 1-7); p=0.002 Ventilator-free days I: 14.7 (0.9) C: 11.6 (0.9); p=0.02 ICU LOS (days) I: 9.1 (IQR: 5.1-17.8) C: 12.9 (IQR: 6.0-24.2); p=0.01 Hospital LOS (days) I: 14.9 (IQR: 8.9-26.8) C: 19.2 (IQR: 10.3-28); p=0.04	Patients receiving benzodiazepine I: 120 (72%) C: 111 (66%); p=0.25 Patients receiving propofol I: 117 (70%) C: 115 (69%); p=0.88 Patients receiving opiates I: 130 (78%) C: 128 (76%); p=0.87	28-day mortality I: 47 (28%) C: 58 (35%); p=0.21 1-year mortality I: 74 (44%) C: 97 (58%) (HR: 0.68; 95% CI: 0.50-0.92; p=0.01)

Authors (year)	Study Type	N	Intervention	Delirium	Coma/Ventilator ICU/Hospital Days	Sedative/Analgesia Use	Mortality
Hager et al. (2013) ¹⁹	CCT	202	Standard of Care -Sedation protocol utilizing goal-directed sedation Intervention: -Sedation protocol utilizing RASS -Delirium assessment with CAM-ICU (2x daily)	Median proportion of days per patient with delirium I: 38% (IQR: 0-60) C: 20% (IQR: 0-40); p=0.010 Days awake and not delirious (median % ICU days per patient) I: 19% (IQR: 0-50) C: 0% (IQR: 0-18); p<0.001	Coma days (median % ICU days per patient) I: 23% (IQR: 0-50) C: 65% (IQR: 27-100); p<0.001	ICU days per patient with benzodiazepine use I: 22% (IQR: 0-50) C: 70% (IQR: 46-94); p<0.001 ICU days per patient with narcotic use I: 33% (IQR: 10-65) C: 74% (IQR: 50-100); p<0.001	Not Reported
Mehta et al. (2012) ¹⁷	RCT	423	Standard of Care -Continuous opioid and/or benzodiazepine infusions -Protocols sedation Intervention Standard of care plus: -Daily sedation interruption	Incidence of delirium I: 113 (53.3%) C: 113 (54.1%); (RR 0.98, 95% CI, 0.82-1.17; p=0.83)	Days on ventilator I: 7 (IQR: 4-13) C: 7 (IQR: 3-12); (HR 1.08, 95% CI 0.86-1.35, p=0.52) ICU LOS (days) I: 10 (IQR: 5,17) C: 10 (IQR: 6,20); p=.36 Hospital LOS (days) I: 20 (IQR: 10,36) C: 20 (IQR: 10,48); p=.42	Total benzodiazepine dose per patient per day I: 102 mg (326) C: 82 mg (287); p=0.04 Total opiate dose per patient per day I: 550 µg (IQR: 50-1850)	ICU mortality I: 50 (23.4%) C: 52 (24.9%); (RR: 0.94; 95% CI: 0.67-1.32; p=.72) Hospital mortality I: 63 (29.6%) C: 63 (30.1%); (RR: 0.98; 95% CI: 0.73-1.31; p=.89)
Needham et al. (2010) ²⁰	CCT	57	Standard of Care -Repositioning patient in bed every 2 hours -Use of pain & sedation scales -Nurse-titrated sedation protocol -Daily reduction in sedation infusions Intervention -Standardized ICU orders with default activity level = "as tolerated" -Sedation practice changed from continuous infusion to "as needed" bolus doses -Guidelines for PT, OT, & physical medicine and rehabilitation consultation -PT, OT & rehabilitation assistant on staff -Consultations to neurologists for patients with severe or prolonged muscle weakness	ICU Days Alert w/o Delirium I: 243 (53%) C: 61 (21%); p=0.003 ICU Days Alert with Delirium I: 125 (28%) C: 107 (36%)	ICU LOS (days) I: 4.9 (mean) C: 7.0; p=.020 Hospital LOS I: 14.1 (mean) C: 17.2; p=.030	Patients receiving benzodiazepine I: 26 (96%) C: 22 (73%); p=0.030 ICU days with benzodiazepine use I: 150 (50%) C: 118 (26%); p=0.002 Patients receiving narcotics I: 26 (96%) C: 23 (77%); p=0.050 ICU days with narcotic use I: 188 (62%) C: 299 (66%); p=0.650	In-hospital mortality (all-ICU, not limited to patients meeting study inclusion criteria) I: 21% C: 23%; p=.550
Schweickert et al. (2009) ²¹	RCT	104	Standard of Care -Daily interruption of sedation	Hospital days with delirium I: 28% (26) C: 41% (27); p=0.01	Coma days I: 0.0 (IQR: 0.0-0.2) C: 1.0 (IQR: 0.0-3.0); p=0.12 Days on ventilator	Patients receiving benzodiazepine I: 39 (80%) C: 48 (87%); p=0.43 Patients receiving propofol	Hospital mortality I: 9 (18%) C: 14 (25%); p=0.53

Authors (year)	Study Type	N	Intervention	Delirium	Coma/Ventilator ICU/Hospital Days	Sedative/Analgesia Use	Mortality
Skrobik et al. (2010) ²⁴	CCT	1214	-Goal-directed sedation guided by RASS -PT and OT as ordered by physician <u>Intervention</u> -Daily interruption of sedation -Goal-directed sedation guided by RASS -Early exercise and mobilization	<u>Incidence of delirium</u> I: 2.0 days, (IQR: 0.0-6.0) C: 4.0 days, (IQR: 2.0-8.0); p=0.02	I: 3.4 (IQR 2.3-7.3) C: 6.1 (IQR 4.0-9.6); p=0.02 <u>ICU LOS (days)</u> I: 5.9 (IQR 4.5-13.2) C: 7.9 days (IQR 6.1-12.9); p=0.08 <u>Hospital LOS (days)</u> I: 13.5 (IQR 8.0-23.1) C: 12.9 (IQR 8.9-19.8); p=0.93	I: 48 (98%) C: 53 (96%); p=1.0 <u>Patients receiving opiates</u> I: 48 (98%) C: 54 (98%); p=1.0	
			-Evaluation for pain, sedation, and delirium (1 × per 8-hour shift -ICU Delirium Screening Checklist <u>Intervention</u> Standard of Care plus: -Management protocol for analgesia, sedation, and delirium with standardized prescription sheets -Reorientation treatments (music therapy, reassurance)	<u>Incidence of delirium</u> I: 34.2% C: 34.7%; p=0.9 <u>Incidence of subsyndromal delirium</u> I: 24.6% C: 33.0%; p=0.0009	<u>Rate of iatrogenic coma</u> I: 8.7% C: 20.5%; p<0.0001 <u>Days on ventilator</u> I: 5.93 (6.59) C: 7.51 (9.78); p=0.01 <u>ICU LOS (days)</u> I: 5.35 (6.26) C: 6.32 (8.16); p=0.009 <u>Hospital LOS (days)</u> I: 27.1 (29.9) C: 55.0 (97.8); p<0.0001	<u>No benzodiazepine</u> I: 47.4% C: 42.1%; p=0.07 <u>No propofol</u> I: 77.7% C: 69.9%; p=0.003 <u>No opioid</u> I: 36.9% C: 28.7%; p=0.003	<u>30-day mortality risk</u> I: 22.9% C: 29.4%; p=0.009

I = Intervention

C = Control

LOS = Length of stay

Data are reported as mean (SD), median (IQR), or n (%).

Table 4

Adherence to Intervention Components

Study (Reference)	Daily Sedation Interruption (SAT)	Daily Breathing Trial (SBT)	Daily Delirium Assessment	Analgesia, Sedation, and/or Delirium Protocol	Reorientation Strategy	Early Exercise/Physical Therapy
Balas ¹⁶	50% of SATs performed on eligible days	79% of patients received 1 SBT	50% of eligible observations	-	-	75.3% of patients
Colombo ¹⁸	NR	NR	NR	-	NR	-
Girard ²³	95% of eligible patient encounters	72% of eligible patient encounters	-	-	-	-
Hager ¹⁹	-	-	90% of assessments completed	NR	-	-
Mehta ¹⁷	72% of eligible study days for an average patient	82% of eligible study days for an average patient	-	NR	-	-
Needham ²⁰	-	-	76% of patient days	NR	-	93% of patients
Schweickert ²¹	100% study days	96% of days when SBT screens were passed	-	-	-	94% of patients
Skröbik ²⁴	-	-	100% of eligible patients	52% of patients	Unable to assess	-

NR = Not Reported

Summary of Studies Evaluating the Implementation of Multifaceted Care Processes Targeting Delirium in ICU Patients

Table 5

Authors (year)	Study Type	N	Intervention & Implementation Strategies	Outcomes
Balas et al. (2013) ⁸	CCT	328 RNs, NPs, RTs, PharmDs, PTs	<p>Intervention: ABCDE Bundle consisting of daily performance of: -spontaneous awakening trials (SATs) -spontaneous breathing trials (SBTs) -coordination of SATs and SBTs -routine delirium and sedation/agitation screening and management -early progressive mobilization</p> <p>Implementation strategies: -Interdisciplinary ABCDE implementation leaders including unit and staff champions -Educational resources including posters/flyers, resource manuals, in-services, CAM-ICU and RASS pocket cards -Online computer-based ABCDE training module with videos focused on -problems of delirium in ICUs -effects of sedation and ventilator management strategies on delirium -valid techniques for assessing sedation and delirium</p> <p>-Leading ICU delirium expert presentation at grand rounds -Nurse-led 8 hour ABCDE bundle education day -In-services over a 9-month period on how to perform CAM-ICU followed by direct observation until competence achieved -Institutional ABCDE bundle policy -Electronic ABCDE documentation forms embedded in HER -ABCDE performance and outcome data presented to leaders and staff -3 focus group sessions of ICU team members (2 during development of ABCDE policy, 1 six months after policy became standard of care) -Online ABCDE bundle knowledge and impediments survey administered before ABCDE became standard of care and 4 and 9 months following implementation -Comprehensive outcomes-based evaluation of online training program</p>	<p>% of patients that received a continuously infused sedative or opioid medication anytime during ICU stay I: 77.4% C: 70.2%; p=0.26</p> <p>% of patients that had a continuously infused sedative or opioid medication held at least once for a SAT I: 63.6% C: 50.7%; p=0.04</p> <p>SATs performed on eligible days (median % (IQR)) I: 50.0% (33.3-50.0%) C: 33.3% (24.4-52.8%); p=0.18</p> <p>Underwent a SBT anytime during ICU stay I: 84.0% C: 70.7%; p=0.03</p> <p>Percentage of time RASS score documented every 8 hr by bedside nurse I: 68% C: 66.3%; p=0.84</p> <p>% of patients that received physical therapy consults anytime during ICU stay I: 75.3% C: 71.9%; p=0.50</p> <p>% of patients mobilized out of bed at least once during ICU stay I: 66.0% C: 48.0%; p=0.002</p>
Carrothers et al. (2013) ¹⁹			<p>Intervention: ABCDE Bundle consisting of daily performance of: -spontaneous awakening trials (SATs) -spontaneous breathing trials (SBTs) -coordination of SATs and SBTs -choice of sedation-delirium screening and treatment -early progressive mobility</p> <p>Implementation strategies: -Multidisciplinary team -Physician champions -Completion of pre-implementation and post implementation gap analysis -Educational sessions, on-the-job training, train-the-trainer model, super champions, coaching -Onsite support from an improvement advisor with ABCDE content expertise -Collection of quarterly outcome and monthly process data</p>	<p>% of patients receiving SATs I: 81% C: 25%</p> <p>% of patients receiving SBTs I: 67% C: 30%</p> <p>% of patients assessed for delirium I: 0% C: 65%</p> <p>% of patients receiving progressive mobility I: 0% C: 82%</p>
Hager et al. (2013) ¹⁹	CCT	202 patients	<p>Intervention: -Sedation protocol utilizing RASS-Delirium assessment with CAM-ICU (2× daily) Implementation Strategies:</p>	<p>Completion of delirium screening (CAM-ICU) I: 90% C: 90%</p>

Authors (year)	Study Type	N	Intervention & Implementation Strategies	Outcomes
Kastrup et al. (2011) ²⁶	CCT	205 patients	<ul style="list-style-type: none"> -Structured QI process: "4Es" framework (engage, educate, execute, evaluate) -Multidisciplinary QI team (ICU nurse educator, pharmacist, physicians, non-ICU delirium experts) -Education on sedation protocol, tools, & delirium prevention provided to nursing staff, house staff, and attending physicians) -Nurses trained by protocol "super-user" -Nurses not passing quality assurance evaluations were retrained one-on-one until proficient -House staff trained by 2 physicians from QI team and given card with protocol and delirium prevention strategies -ICU attending physicians educated during ground rounds and faculty meetings -RASS and CAM-ICU embedded in EHR -Monthly QI team meetings to identify and resolve barriers -Formal auditing & feedback including surveys of nursing staff -Pharmacists reminded clinicians about protocols daily during rounds <p>Intervention: Technical feedback system to monitor and report the compliance with key performance indicators for sedation, delirium, and pain monitoring and completion of ventilator weaning program.</p> <p>KPIs:</p> <ul style="list-style-type: none"> Sedation evaluation (3 × day) (RASS) Analgesia evaluation (3 × day) (NRS or BPS) Delirium assessment (3 × day) (CAM-ICU) SBT (1 × day); <p>Implementation Strategies:</p> <ul style="list-style-type: none"> -KPIs integrated into SOPs accessible on intranet and at bedside -EHR used to capture medical and care information, lab data, and input from ventilation and monitoring systems -Technical feedback system produced a 24-hr summary report of KPI data divided into three 8-hour nursing shifts -Color-coded report to indicate if KPIs were met accessible via the EHR -Summary of all KPIs reported to physicians and nurses monthly -ICU team instructed on evaluation of sedation and analgesia scores, completion of weaning protocol, accessing the KPI summary, and interpreting results. 	<p>Completion of delirium screening (CAM-ICU)</p> <p>I: 38.4% ± 25.8%</p> <p>C: 0.5% ± 2.1%; p<0.01</p> <p>Completion of sedation evaluation (RASS)</p> <p>I: 65.7% ± 16.9%</p> <p>C: 64.7% ± 15.6%; NS</p> <p>Completion of analgesia evaluation (NRS/BPS)</p> <p>I: 65.6% ± 16.0%</p> <p>C: 61.6% ± 18.5%; p<0.01</p> <p>Completion of weaning protocol</p> <p>I: 41.9% (mean) ± 38.7% (SD)</p> <p>C: 0.27% ± 1.74%; p<0.01</p>
Needham et al. (2010) ²⁰	CCT	57 patients	<p>Intervention:</p> <ul style="list-style-type: none"> -Standardized ICU orders w/default activity level = "as tolerated" -Sedation practice changed from continuous infusion to "as needed" bolus doses -Guidelines for PT, OT, & physical medicine and rehabilitation consultation -PT, OT & rehabilitation assistant on staff -Consultations to neurologists for patients with severe/prolonged muscle weakness <p>Implementation Strategy:</p> <p>Structured QI model including:</p> <ul style="list-style-type: none"> -understanding the problem -multidisciplinary improvement team -all stakeholders identify barriers to change and solutions -using "4Es" framework (engage, educate, execute, evaluate) -Weekly planning meeting with multidisciplinary QI team (ICU, Rehab) -Dissemination of project information through posters, newsletters, conferences, presentations, and patient testimonials. -2 day site visit by field expert -Interdisciplinary training of nurses, PTs, OTs, and respiratory therapists -16 educational sessions for ICU nurses -Ongoing evaluation of project through weekly QI team meetings 	<p>Number of PT and OT Is</p> <p>I: 810 treatments</p> <p>C: 210 treatments; p<0.001</p>

Authors (year)	Study Type	N	Intervention & Implementation Strategies	Outcomes
Pun et al. (2005) ²⁸	CCT	711 patients 64 nurses	<p>Intervention: Sedation scale (RASS) and delirium assessment (CAM-ICU) added to nursing documentation</p> <p>Implementation strategies: Systematic implementation strategy including: -baseline assessment -20 min introductory in-service for all ICU nurses followed by graded, staged educational interventions at regular intervals -Compliance data collected daily with spot checks on random 40% of nurses -Implementation of survey questionnaire</p>	<p>Compliance with delirium monitoring (CAM-ICU) ICU 1: 94.7% ICU 2: 99.7%</p> <p>Compliance with sedation monitoring (RASS) ICU 1: 90.0% ICU 2: 84.0%</p> <p>Barriers to Implementation (n=71 total barriers reported by 55 nurses in a survey) -Time (31%) -Attendings, fellows, or residents (27%) -Confidence in performing delirium assessments (20%)</p>
Radtke (2012) ²⁷	CCT	1,063 patients	<p>Intervention: -Sedation monitoring with RASS -Pain monitoring (NRS or BPS) -Delirium monitoring with delirium detection score (DDS) -Scores documented in data management system -ICU staff trained via Modified Extended Training (2 ICUs) or Local Standard Training (1 ICU)</p> <p>Implementation Strategy: Local Standard Training or Modified Extended Training Local Standard Training: Lectures instructional video handouts bedside teaching Modified Extended Training: -Local support team (2 nurses/1 physician) with monitoring expertise -3 consecutive training cycles of Local Standard Training with enhanced lectures</p>	<p>Frequency of delirium monitoring per patient per day (DDS) ICU 1: Modified Training I: median 1.6 (IQR 0.8,2.0) C: median 0.0 (IQR 0.0,0.1); p<0.01</p> <p>ICU 2: Modified Training I: median 1.3 (IQR 0.9,1.7); C: median 0.0 (IQR 0.0,0.0); p<0.01</p> <p>ICU 3: Local standard training I: median 0.0 (IQR 0.0,0.0); C: median 0.0 (IQR 0.0,0.0); p=0.045 (outliers)</p> <p>Frequency of sedation monitoring per patient per day (RASS) ICU 1: Modified Training I: median 3.0 (IQR 2.0,3.5) C: median 0.0 (IQR 0.0-0.0); p<0.01</p> <p>ICU 2: Modified Training I: median 2.0 (IQR 1.6,2.4) C: median 0.0 (IQR 0.0-0.0); p<0.01</p> <p>ICU 3: Local standard training I: median 0.0 (IQR 0.0-0.0); C: median 0.0 (IQR 0.0-0.0); p<0.01 (outliers)</p> <p>Impact of frequency of delirium monitoring on mortality OR 0.451; 95% CI 0.22-0.924</p> <p>Impact of delirium monitoring on ICU LOS Not Significant</p> <p>Impact of delirium monitoring on ventilation time Not Significant</p>