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Lessons Learned From a Systematic, Hospital-Wide Implementation of the ABCDEF Bundle: A Survey Evaluation

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OBJECTIVE: We recently reported the first part of a study testing the impact of data literacy training on "assessing pain, spontaneous awakening and breathing trials, choice of analgesia and sedation, delirium monitoring/management, early exercise/mobility, and family and patient empowerment" [ABCDEF [A-F]) compliance. The purpose of the current study, part 2, was to evaluate the effectiveness of the implementation approach by surveying clinical staff to examine staff knowledge, skill, motivation, and organizational resources.

DESIGN: The Clark and Estes Gap Analysis framework was used to study knowledge, motivation, and organization (KMO) influences. Assumed influences identified in the literature were used to design the A-F bundle implementation strategies. The influences were validated against a survey distributed to the ICU interprofessional team.

SETTING: Single-center study was conducted in eight adult ICUs in a quaternary academic medical center.

SUBJECTS: Interprofessional ICU clinical team.

INTERVENTIONS: A quantitative survey was sent to 386 participants to evaluate the implementation design postimplementation. An exploratory factor analysis was performed to understand the relationship between the KMO influences and the questions posed to validate the influence. Descriptive statistics were used to identify strengths needed to sustain performance and weaknesses that required improvement to increase A-F bundle adherence.

MEASUREMENT AND RESULTS: The survey received an 83% response rate. The exploratory factor analysis confirmed that 38 of 42 questions had a strong relationship to the KMO influences, validating the survey's utility in evaluating the effectiveness of implementation design. A total of 12 KMO influences were identified, 8 were categorized as a strength and 4 as a weakness of the implementation.

CONCLUSIONS: Our study used an evidence-based gap analysis framework to demonstrate key implementation approaches needed to increase A-F bundle compliance. The following drivers were recommended as essential methods required for successful protocol implementation: data literacy training and performance monitoring, organizational support, value proposition, multidisciplinary collaboration, and interprofessional teamwork activities. We believe the learning generated in this two-part study is applicable to implementation design beyond the A-F bundle.

KEY WORDS: assessing pain, spontaneous awakening and breathing trials, choice of analgesia and sedation, delirium monitoring/management, early exercise/mobility, and family and patient empowerment bundle compliance; data literacy; bundle care; protocol compliance; staff engagement; staff satisfaction; teamwork in the intensive care unit; team dynamics; gap analysis

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KEY POINTS

Question: What were the strengths and weaknesses of the "assessing pain, spontaneous awakening and breathing trials, choice of analgesia and sedation, delirium monitoring/management, early exercise/mobility, and family and patient empowerment" (ABCDEF [A-F]) bundle implementation approach? How can the Clark and Estes Gap Analysis Framework be used to understand performance gaps and influences in the implementation of evidence-based clinical protocols?

Findings: Survey tool was validated for use in evaluating knowledge, motivation, and organizational resources for A-F bundle implementation.

Meaning: Survey tool may be used for future studies. Data literacy training and performance monitoring, organizational support, value proposition, multidisciplinary collaboration, and interprofessional teamwork activities were drivers of A-F bundle protocol adherence.

The "assessing pain, spontaneous awakening and breathing trials, choice of analgesia and sedation, delirium monitoring/management, early exercise/mobility, and family and patient empowerment" (ABCDEF [A-F]) bundle is an evidence-based protocol used in ICUs to prevent post-ICU syndrome (1). The seminal report by Pun et al (2) showed that improvements in A-F bundle compliance demonstrated significant improvements in patient survival, mechanical ventilation use, coma, delirium, restraint-free care, ICU readmissions, and post-ICU discharge disposition. Furthermore, there was a significant dose-response relationship between higher proportional A-F bundle performance and improvements in clinical outcomes, indicating that even modest improvements in low-level compliance can have clinically meaningful effects on outcomes. Despite these proven clinical benefits, adoption, and compliance with ICU evidence-based protocols like the A-F bundle remains low (3). For example, by the end of the 18-month seminal study describing the ICU liberation campaign, the 76 sites produced an aggregate average full-bundle compliance rate of only 8% (2). In contrast, the Institute of Health Improvement recommends a 95% target compliance for typical bundle care delivery (4). Additional challenges to improving bundle compliance during the pandemic include changes to critical care ICU team composition, shortages of personal protective equipment, reduced bedside access to patients, deep sedation, and use of chemical paralysis, among others (8). Finally, the COVID-19 pandemic, which followed several months after publication of the seminal study, continues to hamper efforts to improve A-F bundle compliance (5–7).

Understanding these challenges, we recently conducted a two-part study of our implementation approach, incorporating data literacy training for A-F bundle implementation across eight ICUs in a quaternary academic medical center (9). Our implementation approach leveraged the Clark and Estes Gap Analysis Framework to design the interventions integrated into our effort to promote A-F bundle adoption (10). The Clark and Estes Gap Analysis Framework uses knowledge, motivational, and organizational (KMO) influences to bridge performance gaps or anticipate and address gaps in implementation design. The first part of the study was a stepped-wedge cluster randomized trial which demonstrated that clinical education, data literacy training, and continuous performance feedback increased and sustained A-F bundle compliance through the COVID-19 pandemic. In addition, the observed increase in bundle compliance was associated with significantly better ICU patient outcomes. The second part of the study, reported herein, evaluated the effectiveness of our implementation methodology that produced the results reported in part 1 (9). Specifically, we aimed to evaluate our implementation approach by eliciting clinical staff feedback in a survey focused on staff knowledge, skill, motivation, and organizational resources.

MATERIALS AND METHODS

This was a prospective observational study paired with the previously reported stepped-wedge cluster randomized implementation of the A-F bundle within four of the eight ICUs at a quaternary care academic medical center (9). Steps of the overall study design are shown in **Figure 1*A***. The University of Southern California Institutional Review Board (IRB) approved the study titled AF Bundle UCC + Tech on December 12, 2019, and waived informed consent requirements

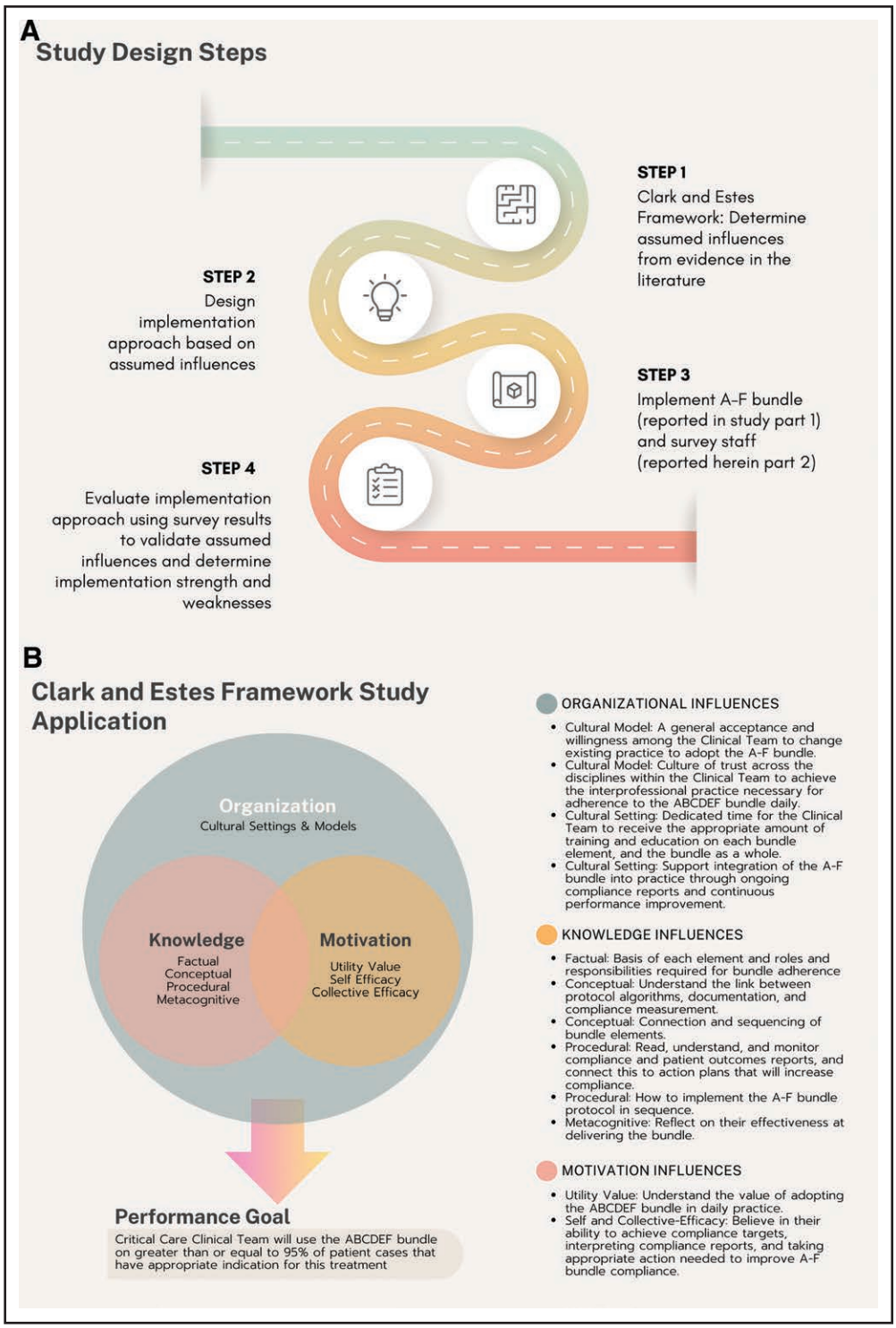

Figure 1. A, Outline of the steps taken to validate assumed influences and determine implementation strengths and weaknesses. **B**, Clark and Estes Gap Analysis Theoretical Framework: Summary of Knowledge, Motivation, Organization Influences on Performance. ABCDEF = assessing pain, spontaneous awakening and breathing trials, choice of analgesia and sedation, delirium monitoring/management, early exercise/mobility, and family and patient empowerment.

for study participants (HS-18-00750). Procedures were followed in accordance with the ethical standards of the IRB on human experimentation and with the Helsinki Declaration of 1975. Participants included all members of the ICU clinical team that had a role in meeting full A-F bundle compliance, including physicians, nurse practitioners, bedside nurses, pharmacists, respiratory therapists, physical and occupational therapists, dieticians, social workers, and case managers. Compliance performance during the study was reported and outlined in the initial article (9).

The overall implementation plan (**SDC Fig. 1**, http://links.lww.com/CCX/B274) was created using the assumed KMO influences described in the available literature (4, 11–37). Assumed influences were defined by a subtheoretical framework within each KMO category (**Fig. 1*B***). The study survey (**SDC Table 1,** http://links.lww.com/CCX/B274) was designed specifically to validate the assumed influences and identify the strengths and weaknesses of the implementation designed based on the assumed influences. For instance, knowledge (K in KMO) is characterized by factual, conceptual, procedural, and metacognitive knowledge types (38). Motivational dimensions (M in KMO) reference utility value, self-efficacy, goal orientation, and attribution-defined motivation influences (10, 39). Organizational influences (O in KMO) relate to cultural models and settings to assess the impact of

the organization's culture on knowledge, motivation, and improvement efforts (10). The assumed influences were the foundation of implementation design decisions. For example, the data literacy training intervention was created to meet the knowledge assumed procedural influence from Figure 1*B* that the "clinical team needed the knowledge to read, understand, and monitor bundle compliance and patient outcome reports, and connect this to action plans."

Survey Design and Administration

A survey was created to both validate the assumed KMO influences (SDC Table 1, http://links.lww.com/CCX/B274) and to gather staff feedback on the implementation approach we used. The survey contained a total of 42 questions with key demographics (role, unit) that addressed: 1) staff knowledge (14), 2) staff motivation (8), 3) organizational influences (17), and 4) one open comment question. Survey questions were derived from literature describing job satisfaction measurement in healthcare (40), the safety climate in healthcare (41), and the technology acceptance model (42–45). Survey questions took a Likert scale format, except for seven questions that followed a CI format. CIs were used to evaluate the assuredness of individuals' belief in their efficacy (46). Bandura (46) defined high confidence as a score of 61–100, and low confidence as 0–60.

The study statistician performed a psychometric review to assess the validity and reliability of the survey questions. The utilization of existing validated tools (40–45) promoted high reliability and validity of the survey tool. Additionally, field tests of the survey tool were performed with the study team and three ICU clinicians (1.M.D., 1.R.N., 1.R.T.) to ensure consistent comprehension of the study questions across individuals. Field tests showed a survey duration of 5 minutes or less.

A census sampling strategy was used to disseminate surveys, eliminating the potential for selection bias. To encourage high response rates and reduce nonresponse bias, survey participants were offered an opportunity to enter a raffle to receive a small prize equivalent to 40 U.S. dollars. The honor system was used to prevent multiple participation if participants did not intend to leave their email to participate in the raffle. The survey was sent electronically via email (Qualtrics XM software version December 2019, University of Southern California's [USC] license, Los Angeles, California) and served as a summative assessment following A-F bundle implementation in four ICUs (9). The survey was kept open for responses between December 5, 2019, and February 27, 2020. During this time email reminders were sent to staff on a biweekly basis, survey participation was discussed in the monthly staff meetings and members of the administrative team rounded the units to obtain live responses on a weekly basis. The multiprong survey engagement strategy was designed to safeguard a high response rate and promote validity of the data.

Exploratory Factor Analysis

The study statistician conducted an exploratory factor analysis for the KMO survey questions separately to understand the degree to which the question posed was related to the intended KMO influence. In other words, the exploratory factor analysis was used to validate that the questions posed in the survey aligned with the KMO category they were designed to answer. Knowledge questions were assessed to understand: 1) staff utilization of the A-F bundle compliance reports and general data management practices, and 2) the degree of confidence a staff member felt in understanding the A-F bundle elements and how to implement them. Motivation questions assessed a single factor (i.e., if an individual was motivated to adhere to the A-F bundle). A negative factor score was due to a negative question. For example, the question "I feel the implementation of the bundle didn't affect patient outcomes" (Q18_3), asks responders to rate the Likert question on the negative end of the scale if they felt positive about this question. Organizational Characteristics questions evaluated: 1) an individual's satisfaction with the A-F training and support needed to implement the bundle, and 2) the A-F bundle's impact on collaboration across the ICU clinical team. A Scree plot was used to determine the number of factors to retain. When the model retained more than one factor, oblique rotation was used. Items factor loading less than 0.5 for all factors were excluded from the final model. All Likert scale format items were rescaled to reflect a CI format (e.g., Likert scale 0–0, 1–20, 2–40, 5–100, etc.). Only participants with complete responses to all survey questions within each KMO were used for exploratory analysis.

Survey Analysis

Survey participants' demographics and survey items were reported as means and SDs for continuous variables, and

frequencies and percentages for categorical variables using Microsoft Corporation (2019) Microsoft Excel. Missing data were excluded from analysis and reported in item response rates. Where results comparisons were made before and after implementation, descriptive statistics were used to compare responses and draw conclusions.

The results of the survey were used to categorize each influence as a strength or weakness of the implementation approach. A high level of agreement, or high confidence was deemed a strength. Conversely, a weakness was determined from high-level-of-disagreement or low confidence, and/or low performance. Level-of-agreement across survey question responses was defined as responding with either strongly agree, agree, or somewhat agree on the Likert scale. Level-of-disagreement included strongly disagree, disagree, and somewhat disagree. The agreement level was the sum of strongly agree, agree, or somewhat agree across all participants and vice versa for disagreement level. In our study, we defined a high level-of-agreement or level-of-disagreement as greater than or equal to 75%. For example, in the knowledge category the level-of-agreement response was greater than 80% for Q9_8 "the skills to read and interpret data reports" (**SDC Fig. 2*A***, http://links.lww.com/CCX/B274) and the CI above 70% for Q17_5 "ability to read and interpret A-F data reports after data literacy training" (**SDC Fig. 2*B***, http://links.lww.com/CCX/B274). Therefore, the implementation approach to include data literacy was deemed a strength of the implementation.

RESULTS

Survey Respondents

Of the 386 ICU clinical staff members surveyed, 319 responded resulting in an 83% response rate (**Table 1**). Detailed survey responses are outlined in SDC Table 1 (http://links.lww.com/CCX/B274) and visualized in **SDC Figures 2–4** (http://links.lww.com/CCX/B274). Item response rate ranged from 69% to 100% across all questions. Nonresponse was characterized by the nature of the intensity of ICU work and busyness of the clinical team. In addition, absence of clinical team due to personal time.

Exploratory Factor Analysis

SDC Table 2 (http://links.lww.com/CCX/B274) includes the KMO factor analysis scores. The closer a factor score was to 1, the higher the relationship that question had to assess the knowledge, motivation, or organization influences underlying factors. Scores greater than or equal to 0.5 indicated the question posed was effective in assessing the relationship of the defined factor to the category. Two questions were excluded from the Knowledge model due to item loading less than 0.5 for compliance reports and implementation knowledge factors. In other words, according to the exploratory factor analysis questions Q9_2 and Q16_12 had a low association with the knowledge category and could not be used to validate the assumed knowledge influences gathered from the literature. Following the same logic, two questions were excluded from the Motivation analysis (Q17_1 and Q18_2). All Organizational Characteristics questions were included in the analysis.

Survey Results

For the knowledge assumed influences, SDC Figure 2*A* (http://links.lww.com/CCX/B274) demonstrates that most participants had a level-of-agreement greater than 80% across the knowledge questions. Importantly, CIs related to knowledge influences (SDC Fig. 2*B*, http://links.lww.com/CCX/B274) showed a 21% increase in confidence between the participants' ability to read and interpret data reports after data literacy training (Q17_4 Median 79; interquartile range [IQR] 55–90; Q17_5 Median 87; IQR 74–95; $p < 0.0001$).

For the motivation assumed influences, **SDC Figure 3*A*** (http://links.lww.com/CCX/B274) demonstrates that most participants responded with a level-of-agreement greater than 80% across the motivation questions. Importantly, CIs related to motivation influences (**SDC Fig. 3*B***, http://links.lww.com/CCX/B274) showed a divergence between participants own performance on the A-F bundle as compared with the clinical team (Q17_1 Median 90, IQR 75–100; Q17_9 Median 80, IQR 61–92; $p < 0.0001$). In other words, individuals were more confident in their own ability to perform the A-F bundle than they were of the clinical team's ability to implement the protocol.

For organization-assumed influences related to collaboration, **SDC Figure 4*A*** (http://links.lww.com/CCX/B274) demonstrates that participants responded with a level-of-agreement greater than 80% across interprofessional collaboration. Notably, participants had a 90%

TABLE 1.
Survey Respondents by Role and Unit

Role/Unit	Survey Respondents	Survey Recipients	Response Rate (%)
Physician	47	64	73
Nurse	153	158	97
Respiratory therapy	84	128	66
Physical/occupational therapy	21	22	95
Nurse practitioner/physician's assistant	6	6	100
Case manager	3	3	100
Social worker	3	3	100
Other	2	2	100
Total	319	386	83
Medical ICU	54	82	66
Cardiac ICU	57	67	85
Surgical ICU	64	82	78
Neuro ICU	72	83	87
Combination (work in more than one of the above units)	72	75	96

level-of-agreement when asked if interprofessional collaboration increased with the A-F bundle implementation. For organization-assumed influences related to training, **SDC Figure 4*B*** (http://links.lww.com/CCX/B274) demonstrates participants responded with a level-of-agreement greater than 85% across all questions. For organization-assumed influences related to support, **SDC Figure 4*C*** (http://links.lww.com/CCX/B274) demonstrates that participants responded with a level of agreement greater than 85% across the two organizational support questions.

Of the 12 KMO influences identified, 8 were categorized as strengths of the implementation, and 4 as weaknesses (**Table 2**). Weaknesses across KMO influences identified the need for bundle team training that emphasizes the conceptual connection of sequencing the bundle and focuses on building trust across the interprofessional team. Strengths across the KMO influences support the implementation approach specifically the need for data and performance monitoring, organizational support, interprofessional collaboration, and demonstrating the value of implementing the A-F bundle as a motivator to reaching compliance.

DISCUSSION

The clinical and economic benefits of the A-F bundle on ICU patients are clear. Decades of evidence have correlated significant improvements in ICU patient outcomes with bundle implementation (2, 12, 13, 19, 36), but the medical community remains challenged in its consistent adoption in everyday ICU practice (3). Our study sought to understand implementation methods crucial to A-F bundle adoption. To accomplish this, we applied the Clark and Estes Gap Analysis Framework to design our A-F bundle approach (10). The framework required the identification of evidence-based assumed influences needed for clinicians to adopt the bundle into daily practice. Our implementation methods were designed to incorporate the assumed influences found in the literature. Following the implementation of the A-F bundle in four ICUs, we assessed the effectiveness of our implementation methods by using a survey tool to both validate the influences and understand the strengths and weaknesses of our approach. Our exploratory factor analysis of the survey validated the survey's utility in this effort. We learned from the survey results that the strengths of our implementation are key methods to integrate into the process of implementing the A-F bundle and that our weaknesses are essential areas to fortify to increase bundle compliance. Based on the strengths and weaknesses of our implementation methods observed in our study, we recommend the following

TABLE 2.
Survey Results: Strength and Weaknesses of the Implementation by Knowledge, Motivation, and Organization-Assumed Influence

Strength	Weakness
Knowledge	
Factual: basis of each element and roles and responsibilities required for bundle adherence Conceptual: understand the link between protocol algorithms, documentation, and compliance measurement Procedural: read, understand, and monitor compliance and patient outcomes reports, and connect this to action plans that will increase compliance Metacognitive: reflect on their effectiveness at delivering the bundle	Conceptual: connection and sequencing of bundle elements Procedural: how to implement the A-F bundle protocol in sequence
Motivation	
Utility value: understand the value of adopting the A-F bundle in daily practice	Self and collective efficacy: believe in their ability to achieve compliance targets, interpreting compliance reports, and taking appropriate action needed to improve A-F bundle compliance
Organization	
Cultural model: a general acceptance and willingness among the clinical team to change existing practice to adopt the A-F bundle Cultural setting: Dedicated time for the clinical team to receive the appropriate amount of training and education on each bundle element, and the bundle as a whole Support integration of the A-F bundle into practice through ongoing compliance reports and continuous performance improvement	Cultural model: culture of trust across the disciplines within the clinical team to achieve the interprofessional practice necessary for adherence to the A-F bundle daily

A-F = assessing pain, spontaneous awakening and breathing trials, choice of analgesia and sedation, delirium monitoring/management, early exercise/mobility, and family and patient empowerment.

approaches be routinely integrated into A-F bundle implementation efforts.

Data Literacy Training and Performance Monitoring

Availability of performance reports combined with data literacy training as a primary intervention was supported by the influences identified from research evidence highlighting compliance measurement as a key driver to sustained adoption of bundles (2, 13, 14, 20, 21, 28, 47). Our clinicians felt strongly that having data and literacy was essential to managing A-F bundle compliance and that compliance reports helped in managing their performance (SDC Fig. 2*A*: Q9_4, 96% level of agreement; Q9_5, 84% level of agreement, http://links.lww.com/CCX/B274). The clinical team also showed a statistically significant increase in their confidence level in reading and interpreting reports following data literacy training (SDC Fig. 2*B*, http://links.lww.com/CCX/B274). Furthermore, our initial study demonstrated the positive impact of data performance monitoring and data literacy training on A-F bundle compliance (9). Thus, the availability of compliance data paired with data literacy training is a key driver to increasing protocol compliance.

Organizational Support

Organizational support for A-F bundle implementation was noted as either a gap or a driver of success in the literature (2, 14, 29). To incorporate this influence in our study, hospital leadership established the A-F bundle as an organizational priority and institutional standard-of-care for all ICU patients. Ongoing

leadership support was needed throughout our implementation which included provisions for adequate ICU staffing to support clinical education and training across the interprofessional team. Our study participants reported a satisfactory level of support from the department and administration during the implementation (SDC Fig. 4*C*: Q16_10 91% level of agreement; Q16_11 87% level of agreement, http://links.lww.com/CCX/B274). We believe having organizational support from the hospital and local unit leadership was necessary for successful A-F bundle adoption.

Value

Understanding the value of a task was identified as a key motivational influence in behavior change theory (39, 48, 49). To impart the value of delivering the A-F bundle in our implementation, we incorporated an institution-specific ICU patient story to highlight the experience of ICU survivors who experienced post-ICU syndrome. The patient story, told directly by the patient via video, was integrated into the role-based training and all communication of the A-F bundle. To further underline value, performance reports included a monthly outcomes analysis demonstrating the impact of A-F bundle utilization on each unit's patient and the organization. Survey respondents confirmed they felt the A-F bundle significantly improved ICU patient outcomes (SDC Fig. 3*A*: Q18_1 88% level of agreement, http://links.lww.com/CCX/B274), indicating the clinical team valued the A-F bundle. We recommend including efforts to establish the value and impact of the A-F bundle for patients in any implementation approach.

Interprofessional Collaboration and Team Training

Care coordination across the ICU interprofessional team is fundamental to the successful adoption of the A-F bundle (2, 13–15, 18, 19, 27, 29, 50). Our survey demonstrated that the A-F bundle implementation improved interprofessional collaboration among the ICU staff (SDC Fig. 4*A*, http://links.lww.com/CCX/B274). However, the lack of bundle team training was recognized as a weakness that needed improvement in our implementation approach. The need for bundle team training was identified when analyzing both survey and bundle compliance results. A statistically significant divergence in the level of confidence between the individual and collective team's performance was observed (SDC Fig. 3*B,* http://links.lww.com/CCX/B274). Individuals felt more confident in performing the A-F bundle daily, than they did of the clinical team adhering to the protocol when it was appropriate for patient care. Furthermore, when comparing full to partial bundle compliance from part 1 of the study, a higher level of compliance was observed for the individual bundle elements (ranging from 62% to 91% in raw compliance numbers) as compared with the full bundle (between 30% and 35% postimplementation) (9). The difference in performance between individual elements and the full bundle suggested that individual team members were more successful in executing single process-of-care bundle elements, as opposed to the more complicated tasks of coordinating delivery of the bundle across disciplines. These results suggest that a deliberate emphasis on teamwork and care coordination is needed to increase bundle compliance, a finding common to other bundle studies (18, 25, 50–52). Our role-based training was considered effective (SDC Fig. 4*B*, http://links.lww.com/CCX/B274) but failed to bring the clinical team together to demonstrate how to coordinate care to consistently deliver the full bundle to all patients. A standard industry approach to teamwork has not yet been identified. Additionally, teamwork curriculum is not currently present in medical education (25, 32). Paris et al (53) suggest task simulation, team task analysis, performance measurement, and feedback to create teams that will collectively improve performance. Feedback from team leaders and peers at a high-frequency rate is a known essential tool for improving team performance (10, 54, 55). Thus, we recommend integrating teamwork, simulation, feedback, and bundle coordination together as a core element of A-F bundle implementation.

Limitations

Our study has several limitations. First, a strength of this article was the high response rate, but we found variation in response rates across the interprofessional team and individual survey questions. Variation in response rates could have been attributed to the number of recipients per role. For example, role groups including physicians, nurses, respiratory therapists, physical and occupational therapists had a large number of recipients ranging from 22 to 158, compared with nurse practitioners, case managers, and social workers with numbers ranging from 3 to 6. A response rate of 100% was more attainable for nurse practitioners,

case managers, and social workers given the small number of individuals needed for survey participation. Additionally, item response rate varied from 69% to 100%, with lower responses found in the CI questions. Second, the survey used was a summative assessment administered at the end of implementation. We asked the participants to reflect on their bundle implementation experiences before receiving interventions post hoc. We did not capture a baseline assessment and compare this to the summative assessment. This may have introduced postintervention bias in participant responses. Third, we asked participants not to share their experiences or results with units that had not received the implementation interventions to avoid treatment diffusion. However, many of the staff practice across several ICUs, making it impossible to isolate a participant's response to their experience on a single unit. Finally, the assumed influences identified in the literature used to design the intervention were by no means a comprehensive set of factors that influence an individual's proclivity to adhere to the A-F bundle. The KMO influences identified in the study should be considered a foundational set of influences that drive an individual's or teams' clinical bundle adoption efforts.

Future Studies

A systematic review of A-F bundle care delivery found that there is limited evidence on the utilization of effective behavior change strategies and the content of implementation approaches (3, 51). The authors recommend an increase in controlled preintervention–postintervention studies with transparency in implementation techniques, and a concerted effort to evaluate behavior change methods. Additionally, incorporating a mixed method study that compares quantitative with qualitative results would enrich study findings. A qualitative aspect of a study focused on A-F bundle implementation would provide a deeper dive into how barriers to bundle performance manifest in daily work and how the ICU staff perceive success or failure in achieving stated bundle goals for each patient.

CONCLUSIONS

Our A-F bundle implementation approach translated to significant improvements in bundle adoption and sustainability through COVID-19. However, our survey evaluation demonstrated additional efforts are needed to ensure execution of all six-bundle elements to achieve full bundle compliance. The role-based training, although positively received, left ambiguity in the process of coordinating care and ensuring that the staff complied with all bundle elements. A multifaceted approach to education and training, with deliberate areas of care coordination and clinical team engagement, is essential to further increase A-F bundle adoption. Our study underlined the key implementation approaches needed to bridge the gap between evidence and practice. We believe these methods can be applied beyond A-F bundle implementation to ensure swift integration in healthcare delivery.

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The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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