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Identifying barriers to delivering the ABCDE bundle to minimize adverse outcomes for mechanically ventilated patients: A systematic review

Deena Kelly Costa, PhD, RN¹, Matthew White¹, Emily Ginier, MLIS², Milisa Manojlovich, PhD, RN, CCRN¹, Sushant Govindan, MD³, Theodore J. Iwashyna, MD, PhD^{3,4}, and Anne E. Sales, PhD, RN^{4,5}

¹University of Michigan, School of Nursing, Ann Arbor MI

²University of Michigan Taubman Health Sciences Library, Ann Arbor MI

³University of Michigan Medical School, Division of Pulmonary and Critical Care Medicine, Ann Arbor, MI

⁴VA Center for Clinical Management Research, Ann Arbor MI

⁵University of Michigan Medical School, Department of Learning Health Sciences, Ann Arbor MI

Abstract

Background—Improved outcomes are associated with the Awakening, Breathing Coordination, Delirium and Early mobility/exercise (ABCDE) bundle; however, implementation issues are common. As yet, no study has integrated the barriers to ABCDE to provide an overview of reasons for less successful efforts. The purpose of this review was to identify and catalog the barriers to ABCDE delivery based on a widely used implementation framework, and provide a resource to guide clinicians in overcoming barriers to implementation.

Methods—We searched MEDLINE via PubMed, CINAHL, and Scopus for original research from January 1, 2007 to August 31, 2016 that identified barriers to ABCDE implementation for adult intensive care unit (ICU) patients. Two reviewers independently reviewed studies, extracted barriers and conducted thematic content analysis of the barriers, guided by the Consolidated Framework for Implementation Research. Discrepancies were discussed and consensus achieved.

Results—Our electronic search yielded 1908 articles. After applying our inclusion/exclusion criteria, we included 49 studies. We conducted thematic content analysis of the 107 barriers and identified 4 classes of ABCDE barriers: 1) patient-related (i.e. patient instability and safety concerns); 2) clinician-related (i.e. lack of knowledge, staff safety concerns); 3) protocol-related

Corresponding author: Deena Kelly Costa PhD, RN, 400 North Ingalls St, Room 4351, Ann Arbor MI, 48109, dkcosta@umich.edu.

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(i.e. unclear protocol criteria, cumbersome protocols to use); and—not previously identified in past reviews—4) ICU contextual barriers (i.e. interprofessional team care coordination).

Conclusions—We provide the first systematic differential diagnosis of barriers to ABCDE delivery, moving beyond the conventional focus on patient-level factors. Our analysis offers a differential diagnosis checklist for clinicians planning ABCDE implementation to improve patient care and outcomes.

Keywords

quality improvement; mechanical ventilation; intensive care unit

INTRODUCTION

The Awakening, Breathing Coordination, Delirium and Early mobility/exercise (ABCDE) is a complex multi-component bundle of evidence-based practices associated with shorter duration of mechanical ventilation and improved physical function for mechanically ventilated adults.^{1,2} Individual components of the bundle are effective in minimizing adverse outcomes for mechanically ventilated patients.³ Recent data also indicate that bundling the intervention components is associated with an even greater reduction in delirium and ICU length of stay.^{2,4–6} However, despite evidence of the effectiveness of the ABCDE bundle, it is not implemented widely or consistently as recommended.⁷

Many studies have examined the effectiveness of each individual component of the bundle as well as implementation challenges of delivering ABCDE. A handful of prior systematic reviews examined barriers to the implementation of the individual bundle components. For example, Hashem et al. recently published an overview of early mobility that focused on some of the patient-level barriers to the early mobility (E) part of ABCDE, identifying sedation and specific patient tubes and lines as important barriers to mobilization in the ICU.⁸ Another review assessed implementation strategies specific to ICU delirium (D), identifying the most common implementation strategies but focusing on only this single bundle component.⁹ As yet, no systematic review has summarized the barriers to ABCDE delivery as a bundle.

The absence of a synthesis of the barriers to ABCDE delivery hinders two important efforts. First, it provides little guidance for those just initiating an ABCDE effort as to what barriers they should assess in their own institution. Second, we lack a comprehensive “differential diagnosis” that adequately catalogs important barriers and provides a resource to assist in overcoming them. Thus, the purpose of this systematic review was to identify the barriers to ABCDE implementation published in the peer-reviewed literature for adult ICU patients.

We used the Consolidated Framework for Implementation Research (CFIR)¹⁰ as a guide when mapping the identified barriers to ABCDE implementation. The CFIR is a widely used implementation framework, and provides a structured approach to examining barriers to implementation. The five domains of the CFIR include: 1) Characteristics of the Intervention (refers to the actual intervention being implemented); 2) Inner Setting (refers to the social, economic, political and social environment through which the implementation process

proceeds and that will influence implementation); 3) Outer Setting (refers to the economic, social or political context of the organization); 4) Characteristics of Individuals (refers to the people who play an important role in implementation); and 5) Process (refers to the active changes that occur to encourage or discourage implementation of the intervention). The five CFIR domains are further sub-divided into constructs that provide additional clarification to each of the domains. For example, constructs in the Outer Setting domain include “Patient needs and resources,” defined as “the extent to which the patient needs as well as barriers and facilitators to meet those needs are accurately known and integral to the organization” (p.7).¹⁰ For Inner Setting, constructs include culture, structural characteristics, implementation climate and readiness for implementation – which all refer to the environment in which the intervention is being implemented. We catalogued the barriers described as contributing to lack of ABCDE implementation, organized within the CFIR domains.

MATERIALS AND METHODS

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist was used to guide this review.¹¹ PubMed, CINAHL, and Scopus were searched to find articles on barriers to implementing the ABCDE bundle in the ICU. We did not search the grey literature (i.e., conference proceedings, material on web sites, abstracts or policy reports) in this review. Searches were conducted for literature published from January 1, 2007 through August 31, 2016. In order to create a comprehensive search, no language or publication type limits were applied at the search strategy level. The Medline search strategy was conducted in PubMed by combining selected medical subject headings and keywords. The keyword searches were limited to the title and abstract fields to increase specificity. Our search strategy combined the location of our population (Intensive Care, Intensive Care Units) with aspects of ABCDE (Spontaneous awakening trials, Spontaneous breathing trials, Delirium prevention and control, Early Ambulation, Critical Illness/rehabilitation, Early Mobilization) and barriers of ABCDE implementation. A unique search strategy was created for each database to ensure appropriate utilization of keywords and relevant controlled vocabulary terms (i.e., MeSH terms in PubMed/Medline and CINAHL Headings in CINAHL). One example of a full search strategy is included in the online digital supplement (e-Figure 1).

This review was divided into three stages: title and abstract review, full-text article review and data extraction. Each title and abstract was assessed by two team members (DKC & MRW) for relevancy, and was rejected if it did not meet one of the following inclusion criteria: 1) Focused on providers caring for adult ICU patients; 2) Assessed ABCDE bundle implementation; 3) Empirical qualitative or quantitative studies; 4) Identified barriers to ABCDE implementation. After title/abstract review, two reviewers (DKC & MRW) independently reviewed full text for relevancy and excluded articles if they met one of the following exclusion criteria: 1) non-empirical literature (case studies, editorials, opinion pieces); 2) study protocol papers or systematic reviews; 3) pediatric or neonatal patient population; 4) articles related to sepsis or VAP bundle implementation; 5) no elicitation of barriers/facilitators to ABCDE implementation; 6) no evaluation of ABCDE implementation (i.e. only examined patient outcomes, not implementation outcomes); 7) not focused on

adult ICU patients; 8) prevalence or pathophysiology studies; and 9) non-hospital based studies. We focused our review on empirical research that identified barriers to implementation of ABCDE. Case reports were excluded from our review, as they usually describe single site or limited examples, which are not often generalizable. Intervention studies are also rarely reported as case reports. If there was uncertainty about a title/abstract's relevance, it was included in the full-text article review. A third reviewer (MM or AES) resolved any discrepancies or disagreements between the two initial reviewers (DKC and MRW).

Once all full text articles had been reviewed and any disagreements reconciled, two reviewers (DKC & MRW) independently extracted the reported barriers from the included articles for synthesis. We did not limit inclusion based on study design and therefore collected qualitative, quantitative, and mixed method studies of barriers to ABCDE implementation. Identified barriers were extracted from the tables/figures in the full text as well as the discussion section of each article, as applicable. We also recorded the study design (mixed methods/quantitative/qualitative) and whether the study examined the entire ABCDE bundle or one of the individual bundle components. After data extraction, two authors (DKC and MRW) verified data extraction, the study design, and bundle element from each study. Any disagreements or discrepancies were discussed and consensus achieved before proceeding.

Once the list of extracted barriers was assembled, two reviewers (DKC and MRW) independently coded the barriers, categorizing and coding similar barriers together. The goal of this initial coding was to reduce the number of barriers, since many extracted barriers were the same (e.g. team communication and interprofessional team communication). The identified barriers and results of the thematic content analysis serve as the summary measures in this systematic review. We used the CFIR as a guide for coding of the barriers through thematic content analysis¹². Four authors (DKC, MRW, MM and AES) categorized and coded the barriers identified within the CFIR domains – 1) Characteristics of Intervention; 2) Inner Setting; 3) Outer Setting; 4) Characteristics of Individuals; 5) Process. All coding was verified between the reviewers and all authors. Consensus was achieved among all co-authors and any discrepancies were discussed before the coding scheme was finalized. Using the identified barriers within each CFIR domain as well as the domain definitions and the constructs within each domain, we identified a common theme among those listed barriers, domains and constructs. We purposely renamed domains to better reflect the coded barriers and to be more meaningful to clinicians.

RESULTS

Our inclusion/exclusion criteria and flowchart are displayed in Figure 1. We identified 1908 unique citations for review after de-duplication of the search results. After reviewing all titles and abstracts, 1605 titles were excluded by the application of the inclusion/exclusion criteria—leaving 303 articles. 255 articles were excluded after full-text review. We retrieved one article after hand-checking the reference list of the included articles. The final number of included articles was 49.^{13–61}

Of the 49 articles, 4 focused on implementation of the entire ABCDE bundle^{16,19,22,52}, 1 examined Awakening & Early Mobility⁵⁰, 1 examined Awakening, Delirium and Early Mobility²⁹, 11 examined implementation of Awakening^{20,31,36,43–45,48,53,55–57}, 10 examined implementation of delirium monitoring^{25,26,28,37,39,49,51,54,58,59} and 22 assessed Early Mobility implementation^{13–15,17,18,21,23,24,27,30,32–35,38,40–42,46,47,60,61} (see Figure 1). No studies were identified that focused exclusively on either B (spontaneous breathing trials) or C (coordination) implementation. All studies focused on adult ICU patients; however, the patient population and ICU type varied across studies. Most studies used quantitative study designs (n=23), 16 used mixed methods approaches and 10 were qualitative studies (see e-Table 1).

After data extraction, we identified 107 barriers to ABCDE delivery (e-Table 2), which were then further summarized into 4 classes of barriers according to the CFIR domains (Table 1). No barriers were identified that were coded as the 5th CFIR domain - Process. Patient-related barriers to ABCDE delivery (CFIR Outer Setting) were primarily patient instability or safety concerns as well as lack of patient cooperation. Clinician-related barriers (CFIR Characteristics of Individuals) refer to issues such as lack of knowledge about the protocol, clinician preference for autonomy as well as staff safety concerns for example. Protocol-related barriers (CFIR Intervention Characteristics) were inherent problems with the protocol or bundle for implementation, as well as concerns with testing and clarity of the protocol by clinicians. ICU contextual barriers (CFIR Inner Setting) refer to the environment in which care is provided and namely, culture, interprofessional team issues (e.g. lack of support, staffing), physical equipment, and resources. A schematic of the summarized barriers is displayed in Supplementary Figure 1S.

DISCUSSION

Our analysis suggests that the main barriers to ABCDE implementation fall within 4 distinct domains, consistent with the CFIR domains as we renamed them: 1) patient-related; 2) clinician-related; 3) protocol-related; and—not previously identified in past reviews—4) ICU contextual barriers.¹⁰ Implementation interventions aimed at improving ABCDE implementation must address individual clinician and patient-related barriers as well as emphasize the intervention-specific and contextual issues surrounding implementation of a multicomponent clinical intervention such as ABCDE in the ICU.

We provide the first systematic “differential diagnosis” of barriers to implementation of the ABCDE bundle, moving beyond the conventional focus on patient-level factors. Our data may help guide ICU clinicians when beginning ABCDE implementation. While all identified barriers will not be present in every ICU, we identify a range of barriers present. The wide range of barriers identified underscores the complexity of ABCDE delivery but also the need for careful selection of implementation strategies to support more effective implementation. To do so, ICUs should first assess their own unit’s barriers to be able to design implementation interventions that are responsive to the barriers within their own particular context.⁶² Using the barriers within domains we identified as a differential diagnostic checklist, ICUs can assess their units’ barriers and develop ways to overcome the most important barriers they find.⁶³ This approach is frequently used in implementation

research, and uses a wide variety of frameworks, strategies, and behavior change techniques to achieve effective implementation.^{64,65}

One example of how an ICU could potentially use the identified barriers in this review as a differential diagnosis checklist for their specific unit and context, would be to first assess some of the ICU contextual barriers - interprofessional staffing and coordination. A unit could evaluate the interprofessional staffing patterns and the ability of the team to coordinate. For example, are physical therapists (PT) available for mobility? Can PTs coordinate with nurses to conduct early mobility? Does an opportunity exist for the interprofessional team to discuss the process⁶⁶ in delivering ABCDE in the unit? Another set of barriers that could be assessed are protocol-related issues. Before designing an implementation strategy, the ICU interprofessional team could, for example, first clarify and finalize the specific ABCDE protocol for their unit, with input from multiple different clinician types, and even patients and/or families.⁶⁷ Doing so can help minimize concerns with the protocol, belief in its effectiveness or integration into workflow, which were some of the protocol-related barriers we identified. These are just two examples of ways that ICU clinicians could use the identified barriers in our review as a differential diagnosis checklist and begin to assess their own unit's specific barriers to ABCDE implementation. The next step, after assessing their unit's barriers would be to design specific implementation interventions tailored to overcome their unit's barriers, taking into consideration their context, interprofessional team, and capacity for implementation.⁶⁸ This would entail identifying and prioritizing the barriers in their own context and then, developing a tailored implementation plan to overcome the high priority barriers for their setting. Indeed, a recent Cochrane review on factors influencing clinician use of evidence-based guidelines to facilitate ventilator weaning identified that the social and cultural context and environment is critical to effective implementation.⁶⁹

Of note, the majority of studies in this review assessed early mobility implementation (n=22). While early mobility is an important part of the bundle, to continue efforts to improve implementation particularly for complex multi-component clinical interventions such as ABCDE, more attention is needed to understand the barriers to other components of the bundle, such as spontaneous breathing trials and coordination of spontaneous breathing and spontaneous awakening trials. These particular components of the bundle may be more complex in the dynamic ICU environment, and thus require further examination.

Although this is the first study to systematically summarize barriers to ABCDE delivery, there are noted limitations of this work. We note in particular the absence of any reports that identified potential barriers within the fifth CFIR domain, Process; our methodology does not let us distinguish between possible reasons for this. It may be that the process domain rarely causes problems for implementation of ABCDE; but it could also be that previous investigations simply have not looked in that area or did not report on implementation process factors. Many of the studies included in the review did not use systematic frameworks for implementation, which may have limited the ability to elicit barriers related to process, potentially accounting for the absence of identified process barriers. We focused exclusively on studies that reported and evaluated implementation of either one or all components of the ABCDE bundle but we did exclude the grey literature (e.g. conference

proceedings and abstracts), which may have eliminated some studies. However, we do present the most up-to-date search possible. The studies included in this review assessed ABCDE implementation for adult ICU patients but there was variation in patient population and ICU type across studies, which may limit generalizability.

We did not rank or prioritize the identified barriers since the goal of this review was to summarize the existing literature. We acknowledge that lack of ranking and prioritization of the barriers is a noted limitation of our work. However, many barriers to implementation are often context-specific. *A priori* imposing our own prioritization schema on these data would be neglecting the important and influential contribution of ICU contextual factors. We encourage future work to attempt to prioritize barriers across similar settings. We used the CFIR as a guide for coding the summarized barriers, which is one of many different implementation frameworks available.⁷⁰ Due to the nature of the research question and our inclusion of qualitative, quantitative, and mixed methods studies, any reported barrier is a subjective assessment of perceived difficulties implementing ABCDE; this limits our ability to assess risk of bias within and across the individual studies. Similarly, the summary measures cannot be reported as risk ratios or difference in means as done in meta-analyses¹¹ but is a more qualitative thematic coding of the barriers according to the CFIR domains and constructs.

CONCLUSIONS

Implementation of the ABCDE bundle in the ICU is complex and clinicians and administrators face many challenges when striving to provide high quality care to ICU patients. Using the identified barriers catalogued into relevant domains – individual patient- and clinician-related barriers, protocol-related barriers and the ICU context – ICU clinicians can use these domains as a potential differential diagnosis checklist, to assess their unit's specific barriers prior to ABCDE implementation. The next step would involve developing an implementation plan that takes into consideration implementation strategies tailored to their specific ICU context and barriers, to improve implementation of the ABCDE bundle and ultimately, improve patient care and outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Dr. Deena Costa takes responsibility for the content of the manuscript including data and analysis. DKC had full access to all of the data in the study and takes responsibility for the integrity of data and the accuracy of data analysis. MRW, EG, MM, SG, TJI and AES contributed substantially to the study design, data analysis and interpretation and critical revision of the manuscript.

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ABBREVIATION LIST

ABCDE	The Awakening, Breathing Coordination, Delirium and Early mobility/exercise bundle
ICU	intensive care unit
CFIR	Consolidated Framework for Implementation Research

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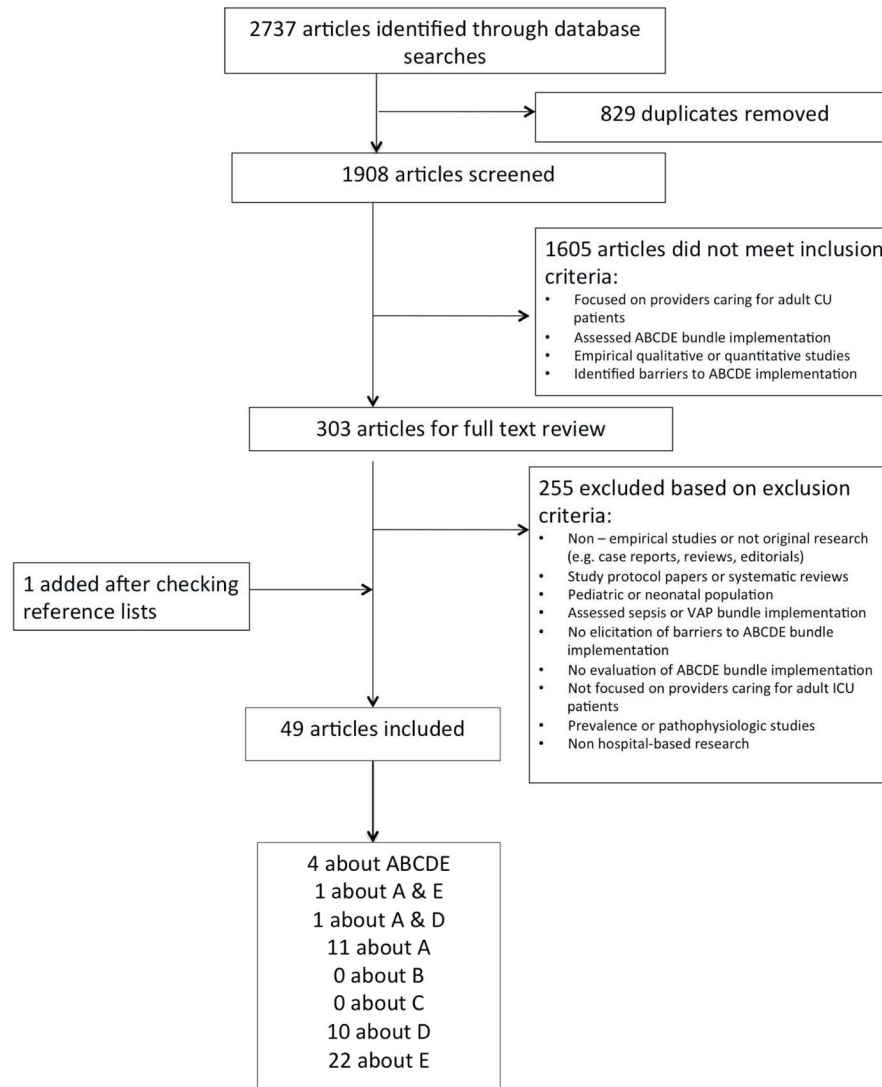


Figure 1.
Flow diagram of literature search results and inclusion/exclusion criteria

Table 1

Identified barriers to ABCDE delivery from literature

1. Patient-related barriers (CFIR Outer setting)	
•	Lack of patient cooperation
•	Patient instability and patient safety concerns (hemodynamics, treatment related adverse events, physiological patient issues)
•	Patient status issues (i.e. diarrhea, fatigue, leaking wound, patient weight or size, confusion/agitation, imminent death)
2. Clinician-related barriers (CFIR Characteristics of individuals)	
•	Lack of knowledge and awareness about protocol
•	Lack of conceptual agreement with guidelines
•	Lack of self-efficacy and confidence in implementing protocol
•	Clinician preference for autonomy (resistance to change, expectation of nurse)
•	Staff and patient safety concerns
•	Perception that rest equals healing
•	Reluctance to follow protocol (previous execution associated with negative outcomes)
•	Lack of confidence that protocol will improve workflow or improve patient outcomes
•	Perceived workload (“hard work”)
•	Staff attitude and lack of buy-in
•	Safety of tubes, catheters and wires
3. Protocol-related barriers (CFIR Intervention characteristics)	
•	Unavailable or cumbersome to use protocols
•	Unclear protocol criteria and agreement or discomfort with guidelines
•	Protocol development cost (time and money to develop)
•	Learning curve (possibility for clinician to test guideline and observe other clinicians use the guideline easily)
•	Lack of clarity as to who is responsible, steps needed to take and expected standards for protocol implementation
•	Lack of confidence in evidence supporting protocol and guideline developer
•	Lack of confidence in reliability of screening tools
4. ICU contextual barriers (CFIR Inner setting)	
•	Culture (safety culture)
•	Interprofessional team care coordination, communication and collaboration barriers
•	Lack of leadership/management
•	Interprofessional clinician staffing, workload and time
•	Lack of interprofessional team support and training/expertise
•	Physical environment, equipment, and resources
•	Staff turnover
•	Low prioritization and perceived importance
•	Competing priorities and need for further planning
•	Scheduling conflicts (i.e. patient off unit, at dialysis, procedure)