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Why do we fail to deliver evidence-based practice in critical care medicine?

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Abstract

Purpose of review—The use of evidence-based practices in clinical practice is frequently inadequate. Recent research has uncovered many barriers to the implementation of evidence-based practices in critical care medicine. Using a comprehensive conceptual framework, this review identifies and classifies the barriers to implementation of several major critical care evidence-based practices.

Recent findings—The many barriers that have been recently identified can be classified into domains of the consolidated framework for implementation research (CFIR). Barriers to the management of patients with acute respiratory distress syndrome (ARDS) include ARDS under-recognition. Barriers to the use of the awakening and breathing coordination, delirium monitoring/management, and early exercise/mobility (ABCDE) bundle for mechanically ventilated patients and the sepsis bundle include patient-related, clinician-related, protocol-related, contextual-related, and intervention-related factors. Although these many barriers can be classified into all five CFIR domains (intervention, outer setting, inner setting, individuals, and process), most barriers fall within the individuals and inner setting domains.

Summary—There are many barriers to the implementation of evidence-based practice in critical care medicine. Systematically classifying these barriers allows implementation researchers and clinicians to design targeted implementation strategies, giving them the greatest chance of success in improving the use of evidence-based practice.

Keywords

acute respiratory distress syndrome; consolidated framework for implementation research; implementation science; mechanical ventilation; sepsis

INTRODUCTION

Implementation science is the ‘scientific study of the mechanisms by which evidence-based health-care interventions are adopted or not adopted in clinical and community settings’ [1].

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Conflicts of interest

There are no conflicts of interest.

One goal of implementation science is to understand the facilitators of and barriers to the adoption of evidence-based practices. Acquiring knowledge of which specific facilitators and barriers are involved in a specific evidence-based practice's use or nonuse in a specific real-world setting allows for the design and testing of context-specific implementation strategies to improve adoption.

There are many reasons why evidence-based practice is not successfully translated into clinical practice. Through the conceptual frameworks and models that have been developed, implementation science provides a systematic way of identifying potential barriers to adoption of evidence-based practices. Conceptual frameworks provide a common vocabulary and classification scheme for implementation researchers to identify barriers [1]. According to Nilsen, there are three aims of the use of frameworks in implementation science: describing the implementation process, explaining the factors that influence implementation outcomes, and evaluating implementation [2]. There are more than 100 conceptual frameworks that have been developed to achieve these aims, categorize implementation strategies, and guide the evaluation of implementation efforts [1–5].

The primary goal of this review is to evaluate recent advances in the literature on barriers to the delivery of evidence-based practice in critical care medicine, using the scaffolding of one conceptual framework to elucidate common themes.

CONSOLIDATED FRAMEWORK FOR IMPLEMENTATION RESEARCH

One prominent conceptual framework is the consolidated framework for implementation research (CFIR) [6]. CFIR is a comprehensive collection of constructs based on many previous theories. These constructs are grouped into five domains, comprising the intervention, context, and process [6,7]:

1. Intervention: characteristics of the evidence-based practice being implemented in a specific setting, including core and adaptable components
2. Outer setting: economic, political, and social context of an organization within which implementation occurs
3. Inner setting: structural, political, and cultural contexts of the implementation process, including networks and communications
4. Individuals: characteristics and behavior of the people involved with the intervention and process
5. Process: the change required to achieve implementation

Each of these CFIR domains contains several constructs. For example, intervention includes constructs such as stakeholders' perceptions of the quality and strength of evidence in the intervention, the intervention's relative advantage over alternative practices, and its adaptability, trialability, and complexity. Inner setting includes such constructs as the structural characteristics, culture, and implementation climate of an organization, and the networks and communications channels within the organization. Individuals include the knowledge and beliefs about the intervention [6].

A systematic review recently evaluated the use of CFIR [8▪]. This review found that CFIR has been meaningfully used in 26 studies. There was wide variation in the design of the included studies, and CFIR constructs from all five domains were used. Twenty-three (88%) studies used CFIR during or after implementation to identify facilitators and barriers to implementation.

In discussing the recent literature on why critical care clinicians fail to deliver evidence-based practice, this article relies on the structure of the CFIR framework. Although the studies discussed below may not have followed the CFIR framework, linking their findings with CFIR domains and constructs allows for a systematic examination of the barriers to the use of evidence-based practice. The remainder of this article presents the most important recent literature on a topic-by-topic basis, with connections to the CFIR domains and constructs.

MANAGEMENT OF ACUTE RESPIRATORY DISTRESS SYNDROME

Acute respiratory distress syndrome (ARDS) is a syndrome of severe acute hypoxemia and pulmonary edema from inflammatory lung injury. ARDS has high prevalence [10% of intensive care unit (ICU) admissions] and mortality of 35–46% [9,10▪▪]. There is substantial evidence that low tidal volume ventilation is a highly effective therapy for ARDS, lowering mortality by 20–25% [11–13]. Indeed, low tidal volume ventilation has recently been given a strong recommendation in a multisociety clinical practice guideline [14▪]. In addition, there is some evidence that prone positioning, neuromuscular blockade, and higher positive end-expiratory pressure (PEEP) improve outcomes in ARDS patients [15–17].

Despite the strength of this evidence, the use of low tidal volume ventilation in clinical practice is as low as 19% of ARDS patients [18–23]. Previous surveys explored some of the barriers to low tidal volume ventilation use by ARDS Network (ARDS-Net) clinicians (physicians, nurses, and respiratory therapists); they identified physician unwillingness to relinquish ventilator control, failure to recognize ARDS, perceptions of contraindications, and other organizational, attitudinal, and knowledge barriers to low tidal volume ventilation use [24,25].

The Large Observational Study to Understand the Global Impact of Severe Acute Respiratory Failure (LUNG SAFE) was an international study of ARDS epidemiology and outcomes in 459 CUs across 50 countries [10▪▪]. Although the primary outcome was to establish the ICU incidence of ARDS (0.48 cases/ICU bed over 4 weeks, or a period prevalence of 10.4% of ICU admissions), a secondary outcome was to assess ARDS recognition. Site investigators were prompted to consider ARDS as a possible cause of each patient’s hypoxemia, both on day 1 of study entry and when patients exited the study; ARDS recognition was affirmed if a clinician answered positively to either question. ARDS was under-recognized; clinicians correctly diagnosed ARDS in only 60.2% of all ARDS patients. Factors that were associated with increased recognition included severe ARDS, higher nurse-to-patient and physician-to-patient ratios, younger patient age, lower predicted body weight, and pneumonia and pancreatitis. Concomitant cardiac failure and absence of a risk factor were associated with lower recognition. ARDS recognition itself was associated with

increased PEEP and greater use of neuro-muscular blockade and prone positioning, and a marginal lowering of tidal volume.

ARDS recognition is a multicomponent process, requiring knowledge of the definition of ARDS and structures and processes that allow the information necessary to diagnose ARDS to reach the clinician. Consequently, ARDS under-recognition as a barrier to effective treatment of ARDS could result from CFIR individual domain constructs such as individual knowledge and inner setting constructs such as organizational structural characteristics and communications.

BUNDLED MANAGEMENT OF MECHANICALLY VENTILATED PATIENTS

The use of multicomponent bundles that contain evidence-based practices is prominent in critical care medicine, focusing on such conditions as early sepsis management, prevention of ventilator-associated pneumonia, and basic ICU processes of care [26–28]. One area that has received recent attention is bundled care for the management of mechanically ventilated patients, particularly bundles that contain a protocolized process of liberation from mechanical ventilation, the prevention of agitation and delirium, and early mobilization. The primary driver of this approach has been the awakening and breathing coordination, delirium monitoring/management, and early exercise/mobility (ABCDE) bundle [29,30]. The components of the ABCDE bundle are interventions that individually have been shown to improve outcomes in mechanically ventilated patients [31–34], and implementation of the bundle itself leads to shorter mechanical ventilation duration and length of stay, increased mobilization, and reduction in delirium [35,36].

Despite this evidence, components of the ABCDE bundle have had limited adoption in clinical practice [37]. Several recent studies have examined the facilitators and barriers to ABCDE implementation or implementation of individual ABCDE components. Costa *et al.* [38▪▪] conducted a systematic review to identify barriers to ABCDE implementation (both the full bundle and individual components) and classify them according to CFIR domains. They identified 107 barriers from 49 studies. These barriers were then classified into four of the CFIR domains: outer setting (patient-related barriers, e.g., lack of patient cooperation, clinical instability and status), individuals (clinician-related barriers, e.g., lack of knowledge or confidence, attitude, and other clinician perceptions and concerns), intervention (protocol-related barriers, e.g., lack of clarity with protocol or responsibility), and inner setting (contextual barriers, e.g., communication or coordination barriers, lack of leadership, or low prioritization). No CFIR process barriers were identified. This study provides evidence that barriers to ABCDE implementation exist across multiple constructs and domains, and give implementation researchers and clinicians a valuable roadmap to improve use of this complex practice.

The second study was a survey by Boehm *et al.* [39▪▪] of clinicians focusing on the relationship between provider attitudes toward the ABCDE bundle and organizational domains. Three hundred fifteen surveys were included (response rate of 25%). Multiple factors were associated with less difficulty performing the bundle and improved provider confidence and perceived safety and strength of evidence, including (with CFIR domains):

protocol attributes (intervention), role clarity (inner setting and individuals), training/comprehension (inner setting and individuals), coordination (inner setting, individuals, and process), peer advocates (process), and teamwork (inner setting and process). Many of these factors can be attributed to the organizational aspects of care delivery; an intervention such as the ABCDE bundle is necessarily inter-professional and collaborative, and organizations are uniquely equipped to address any deficiencies related to these topics that may lead to low use in clinical practice.

Jordan *et al.* [40▪] conducted a qualitative evidence review of 11 studies that reported on the facilitators and barriers to implementation of protocols for ventilator weaning. Many barriers were identified, and can be grouped into three themes: barriers related to clinician knowledge and personal values and priorities (CFIR individuals), barriers related to practical arrangements for care such as ICU structure, resources, and staffing (CFIR inner setting), and professional practice such as training and experience, perceived confidence, and inter-professional relationships (CFIR individuals, inner setting, and process). This study emphasizes the clear need for protocols, such as ventilator weaning protocols, to account for the multidisciplinary social and cultural environment in which they are implemented.

Two studies have investigated the early mobilization component of managing ventilated patients. Bakhru *et al.* [41▪] conducted a survey of almost 1500 ICU leaders (mainly nursing leaders) in several countries (64% response rate) on structural and organization characteristics that could affect early mobilization implementation. Potential facilitators of early mobilization included CFIR inner setting characteristics such as multidisciplinary rounds, daily patient goals, dedicated physiotherapists, and higher nurse staffing ratios. Dubb *et al.* [42▪] conducted a review of 40 studies reporting barriers to early mobilization, finding 28 barriers. These barriers encompassed CFIR outer setting (e.g., patient-related barriers such as condition and symptoms), inner setting (e.g., barriers such as ICU culture and structural issues such as resources, staffing, and protocol), individuals (e.g., attitudes), and process (e.g., planning and coordination).

BUNDLED MANAGEMENT OF SEPSIS

The primary evidence-based practice guidelines for sepsis management derive from the Surviving Sepsis Campaign [43▪]. These guidelines have been transformed into a multicomponent bundle of care practices, early implementation of which has become an important issue as it has been associated with lower mortality [44,45]. Recently, the state of New York mandated the use of sepsis protocols; increased protocol implementation and sepsis bundle compliance were associated with lower mortality [46▪,47]. Despite this evidence, compliance with the 3 and 6-h components of the sepsis bundle has been reported as low as 19 and 36%, respectively [26].

Tarrant *et al.* [48▪▪] investigated the barriers to implementation of a slightly different sepsis bundle, the UK-based ‘Sepsis Six’ bundle. They conducted about 300 h of observations at six hospitals and interviewed clinicians, identifying what strategies were being used to implement Sepsis Six. The implementation strategies that were employed included education, staff motivation, and prompting; however, completing the bundle was difficult.

The authors suggest that while Sepsis Six seems to be a simple intervention, it involves a complex, interdependent set of tasks that were prone to mistakes a multiple levels. These barriers can best be classified as CFIR intervention barriers.

Matthaeus-Kraemer *et al.* [49▪▪] conducted focus groups consisting of 29 critical care clinicians at five hospitals to investigate barriers to early recognition and management of severe sepsis and septic shock. The main barriers identified in this study were related to multidisciplinary communication, patient handover (e.g., poorly coordinated hand-overs among clinicians or time-consuming hand-overs), knowledge, and resource barriers — these barriers can be classified in the CFIR inner setting and individuals domains.

One goal of the Surviving Sepsis bundle is the early administration of appropriate antibiotics [43▪]. Although shorter time to antibiotic administration is itself associated with lower mortality, achieving early administration is difficult [50–52]. Almalki *et al.* [53▪▪] conducted a survey of 63 surgical ICU nurses on perceived barriers to antibiotic administration within 1 h of sepsis recognition. The primary perceived barrier was lack of availability of antibiotics in the unit, and communication barriers were also identified (CFIR inner setting).

CONCLUSION

There are many barriers to the implementation of evidence-based practice in critical care medicine. As discussed above, there is a growing interest in identifying these barriers in many different aspects of critical care, from management of ARDS to weaning from mechanical ventilation to sepsis. Although it may be difficult to observe similarities in barriers when comparing individual studies, the use of a conceptual framework such as CFIR allows implementation researchers to classify barriers into major domains and themes. As Table 1 [10▪▪,38▪▪,39▪▪,40–42▪,48▪▪,49▪▪,53▪▪]demonstrates, the recent literature has identified a multitude of barriers that fall within all five CFIR domains, although most studies have investigated barriers in the inner setting and individuals domains. Having a systematically derived catalog of barriers allows implementation researchers and clinicians to design and evaluate implementation strategies that are targeted correctly, allowing for the greatest chance of success in improving the adoption of evidence-based practice.

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KEY POINTS

- The use of evidence-based practices in real-world critical care medicine is frequently inadequate.
- Recent literature has identified many barriers to evidence-based practices, particularly for low tidal volume ventilation in patients with ARDS and the use of bundles to manage sepsis and mechanically ventilated patients.
- The CFIR can be used to classify barriers into domains based on common themes, including intervention, outer setting, inner setting, individuals, and process.
- Barriers to implementation of evidence-based practices in critical care include factors in all five CFIR domains, although most of the recent barriers are limited to the inner setting and individuals domains.
- Systematically classifying these barriers allows implementation researchers and clinicians to design targeted implementation strategies, giving them the greatest chance of success in improving the use of evidence-based practices.

Table 1

Classification of recently identified barriers to implementation of evidence-based practice in critical care

Article	Clinical topic	Facilitators/barriers/not barriers	CFIR domain
LUNG SAFE [10▪▪]	Low tidal volume ventilation for ARDS	Barrier: ARDS under-recognition	Inner setting and individuals
Costa *et al.* [38▪▪]	ABCDE bundle for ventilated patients	Barriers: patient-related, clinician- related, protocol-related, and contextual	Intervention, outer setting, inner setting, and individuals
Boehm *et al.* [39▪▪]	ABCDE bundle for ventilated patients	Not barriers: protocol attributes, role clarity, training, coordination, peer advocates, and teamwork	Intervention, inner setting, individuals, and process
Jordan *et al.* [40▪]	Ventilator weaning protocols	Barriers: clinician knowledge, values and priorities, practice care arrangements, and professional practice	Individuals, inner setting, and process
Bakhru *et al.* [41▪]	Early mobilization for ventilated patients	Facilitators: multidisciplinary rounds, daily goals, physiotherapists, and higher staffing ratios	Inner setting
Dubb *et al.* [42▪]	Early mobilization for ventilated patients	Barriers: patient-related, ICU culture and structure, attitudes, planning, and coordination	Outer setting, inner setting, individuals, and process
Tarrant *et al.* [48▪▪]	Sepsis Six bundle	Barriers: bundle complexity	Intervention
Matthaeus-Kraemer *et al.* [49▪▪]	Early recognition/management of sepsis	Barriers: poor communication, patient handover, knowledge, and resources	Inner setting and individuals
Almalki *et al.* [53▪▪]	Early antibiotic administration	Barrier: unavailability of antibiotics and communication	Inner setting

ABCDE, awakening and breathing coordination, delirium monitoring/management, and early exercise/mobility; ARDS, acute respiratory distress syndrome; CFIR, consolidated framework for implementation research; ICU, intensive care unit.