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MULTIDISCIPLINARY CARE BUNDLES IN HOSPITALIZED PATIENTS: A SYSTEMATIC REVIEW OF IMPACTS ON CLINICAL OUTCOMES, PATIENT SAFETY, AND QUALITY OF CARE

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Abstract

Background: Care bundles, small sets of evidence-based practices implemented together, are widely used to improve safety and outcomes for hospitalized adults. However, bundle components, implementation strategies, and measured outcomes vary across clinical domains. **Objective:** To synthesize recent evidence on multidisciplinary care bundles (ICU liberation/ABCDEF; ventilator-associated pneumonia [VAP] bundles; central line–associated bloodstream infection [CLABSI] bundles; sepsis bundles; transition-of-care bundles), and report their impact on patient-centered outcomes, safety events, and quality metrics. **Methods:** We conducted a PRISMA-aligned review of nine primary studies (2022–2025) spanning randomized trials, cohort and before–after designs, multicenter surveillance, and system-wide implementations. Outcomes included mortality, mechanical ventilation (MV) duration, ICU/hospital length of stay (LOS), VAP and CLABSI rates, delirium, health-related quality of life (HRQoL), and bundle compliance. **Results:** ABCDEF bundle programs increased bundle compliance and were associated with reductions in next-day mortality, MV duration, and ICU LOS. VAP bundles reduced VAP incidence and prolonged time-to-VAP in high-compliance groups. A multicenter CLABSI study reported an incidence of =4.2/1000 line-days with moderate bundle adherence; risk increased with prolonged ICU stay and multiple catheters. A transition-of-care bundle improved HRQoL through 180 days. Across studies, implementation success hinged on protocols, multidisciplinary teamwork, data feedback, and education. **Conclusions:** Multidisciplinary bundles improve meaningful outcomes when delivered with high fidelity and supportive implementation infrastructure. Targeted strategies to boost compliance, especially awakening/breathing trials, early mobility, subglottic suction, and protocolized CVC care, appear pivotal.

Keywords: Care Bundles; ABCDEF; ICU liberation; Ventilator-Associated Pneumonia; CLABSI; Sepsis Bundle; Transition of Care; Compliance; Quality Improvement; Outcomes.

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INTRODUCTION

Care bundles consolidate several evidence-based actions into coordinated routines to reduce harm and improve recovery in hospitalized patients. In critical care, the ABCDEF ("ICU Liberation") bundle organizes pain assessment/management, coordinated spontaneous awakening and breathing trials, light/non-benzodiazepine sedation, delirium prevention/management, early mobility, and family engagement to mitigate delirium, immobility, and prolonged ventilation while supporting survivorship [1].

Ventilator-associated pneumonia (VAP) bundles integrate head-of-bed elevation, oral care, subglottic secretion drainage, endotracheal cuff pressure control, sedation/ventilation weaning protocols, and hand hygiene to lower VAP risk [2].

Outside the airway domain, pressure-injury bundles and fall-prevention programs similarly standardize nursing-sensitive practices to reduce adverse events and length of stay [3–5].

Transitional-care bundles at discharge coordinate education, written plans, and multidisciplinary handovers to support recovery and reduce unplanned utilization [6]. Despite strong conceptual rationale, implementation remains challenging. Adoption varies by context, resources, and team readiness; compliance is often incomplete; and documentation rarely captures fidelity. These issues contribute to heterogeneity in effect sizes across hospitals and studies [3–5].

Structured implementation strategies, protocols, staff training, audit/feedback, and local champions, are repeatedly linked to higher bundle adherence and better outcomes [4,5]. This review synthesizes contemporary evidence from multiple clinical domains, ICU liberation (ABCDEF), VAP prevention, central-line care (CLABSI prevention), sepsis bundles, and transition-of-care bundles, to address two questions: (1) What impacts do multidisciplinary bundles have on patient-centered outcomes (mortality, LOS, MV duration, delirium, infection rates, HRQoL)? (2) Which implementation features are associated with success (protocols, literacy with data, feedback, and team design)? Given the diversity of bundles and outcomes, we present a structured narrative synthesis emphasizing design, compliance, and effect patterns relevant to hospital quality and safety teams.

Our intent is to guide practical adoption by highlighting components and strategies that robustly associate with improved outcomes while acknowledging variability and measurement gaps [1–6].

METHODS

Protocol and eligibility. We conducted a systematic review aligned with PRISMA reporting standards. Eligible studies were published in the period from 2022 to 2025, evaluating multidisciplinary care bundles for hospitalized adults. We included randomized, quasi-experimental (stepped-wedge, before–after), cohort, and cross-sectional studies if they (i) examined a prespecified bundle (ABCDEF/ICU Liberation;

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VAP prevention; central-line care; sepsis bundles; transition-of-care); and (ii) reported at least one clinical or quality outcome (mortality, MV duration, ICU/hospital LOS, delirium, VAP/CLABSI incidence, HRQoL, or bundle compliance).

We excluded pediatric-only settings and single-component interventions. Because our focus was breadth across hospital domains, we permitted multicenter surveillance and system-wide implementation reports. One meta-analysis focused on pressure-injury bundles was retained as contextual evidence regarding bundle effects on nursing-sensitive outcomes (analyzed qualitatively to avoid double counting).

Data items and outcomes. We extracted study design, setting, sample frame, bundle components, implementation supports (protocols, education, data feedback), fidelity/compliance, and outcomes: mortality, MV duration, ICU/hospital LOS, delirium, VAP incidence, CLABSI incidence per 1000 line-days, HRQoL (EQ-5D-5L), and time-to-infection. Where reported, we captured absolute or relative differences and p-values.

Risk of bias and synthesis. We appraised internal validity qualitatively by design class (randomized vs. before–after), multicenter scope, and objective outcome ascertainment. Because bundle components and outcomes varied substantially across clinical domains, we conducted a structured narrative synthesis and tabulated study features and main findings (Tables 1–2).

We highlight consistency of directionality, presence of compliance gradients, and whether protocolized implementation and data feedback coincided with stronger effects. No meta-analysis was attempted due to heterogeneity.

Primary questions. (1) Do bundles improve outcomes (mortality, MV duration, LOS, delirium, VAP/CLABSI, HRQoL)? (2) Which implementation elements (protocols, multidisciplinary teamwork, education, data literacy and feedback) are associated with better compliance and outcomes?

RESULTS

Study overview

Nine studies spanning ICU and surgical transition contexts met inclusion. Designs included: a stepped-wedge randomized implementation trial of ABCDEF plus data-literacy training [10]; a large healthcare-system, multicenter ICU Liberation program [11]; a 54-country survey of ABCDEF implementation factors [12]; two VAP bundle evaluations (24-month longitudinal cohort; retrospective cohort) [7–8]; a multicenter CLABSI bundle surveillance cohort [9]; a nationwide cohort examining bundle-performance associations in very old sepsis patients [13]; and a single-center before–after transition-of-care bundle after major emergency abdominal surgery [14].

One nursing meta-analysis summarized pressure-injury prevention bundles [15]. Table 1 summarizes study characteristics; Table 2 presents principal outcomes.

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Table 1: Characteristics of included studies

Study	Country/Setting	Design	Population	Bundle focus / key components	Compliance / Fidelity
Hoang 2024	Vietnam, tertiary ICU	24-month longitudinal cohort	170 MV patients	10-item VAP bundle (hand hygiene; HOB 30–45°; oral care; sedation stops; circuit & cuff management; subglottic suction; daily SBT/extubation assessment; early mobilization; ulcer/DVT prophylaxis)	Mean item-level compliance high (oral hygiene 99.4%); full bundle compliance 1.8%
Sekihara 2023	Japan, single ICU	Retrospective cohort	Intubated ≥48h	10-item VAP prevention bundle	Overall compliance 77%; ≥75% vs <75% groups compared
Rajandra 2025	Malaysia, 3 hospitals	Prospective multicenter	862 ICU pts; 997 CVCs	CVC care bundle (insertion/maintenance)	Overall compliance =65%
Brown 2022	USA, 8 ICUs	Stepped-wedge cluster randomized	Adult ICU admissions	ABCDEF + staff education + data literacy training + weekly performance reports	Bundle compliance rose from 9% to 16% (education) to 21% (after DL training)
Barr 2024	USA, 34 hospitals	Prospective cohort (system rollout)	1,914 MV pts (11 ICUs), plus spread to 28 hospitals	ABCDEF bundle (with EHR integration, leadership support)	Sustained element-level performance; system compliance exceeded study ICUs
Haruna 2025	54 countries, 135 ICUs	Cross-sectional (secondary analysis)	664 ICU patients	ABCDEF implementation assessment	Bundle completion rare; protocols & team approach linked to higher implementation
Kim 2024	South Korea, 20 hospitals	Prospective cohort (registry)	11,981 sepsis pts (3,733 ≥80y)	Sepsis bundle elements (1h/3h/6h); appropriate empiric antibiotics	Higher adherence associated with survival differences in very old; vasopressor timing relevant
Kokotovic 2025	Denmark, surgical hospital	Before–after	667 major emergency abdominal surgeries	Transition-of-care bundle (standardized coordination, written materials, multidisciplinary meetings)	Implemented on Jan 1, 2023; utilization across cohort
Demir 2025	Multi-country	Systematic review & meta-analysis	29,572 pts across 9 studies	Pressure-injury prevention care bundles (≥3 components)	Implementation strategies varied; adherence ranged; pooled effects reported

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Table 2: Principal outcomes

Study	Main outcomes
Hoang 2024	VAP incidence 12.9% (16.54/1000 vent-days); high-compliance group had markedly longer time-to-VAP (46.7±5.0 vs 10.3±0.7 days; p<0.001). Full-bundle completion was rare despite high component-level adherence.
Sekihara 2023	VAP lower when overall compliance ≥75% vs <75% (15.8% vs 24.1%, p=0.018); among lagging items, daily extubation assessment differed significantly (8.3% vs 25.9%, p=0.011).
Rajandra 2025	CLABSI 4.16/1000 central-line days; predominant organisms Gram-negative (78.3%); risk factors included prolonged ICU stay (AOR=1.99), surgery (AOR=2.02), multiple catheters (AOR=3.17). Emphasized surveillance and strict bundle adherence.
Brown 2022	Education to compliance 9% to 16% (p<0.0001); +data-literacy/weekly feedback to 21% (p=0.03). Full ABCDEF compliance associated with lower next-day ICU/hospital mortality, higher next-day extubation; delirium frequency unchanged; effects sustained through COVID-19 onset.
Barr 2024	Bundle implementation reduced ICU LOS by 0.5 days (p=0.02), MV duration by 0.6 days (p=0.01), and risk of ICU LOS ≥7 days by 18.1% (p<0.01). Delirium monitoring improved and delirium prevalence decreased (p=0.02); mobility/family engagement lagged.
Haruna 2025	Across income strata, overall ABCDEF implementation was low; multidisciplinary teams and protocols promoted Elements A (pain) and C (sedation); mechanical ventilation associated with lower mobility element performance; tailored strategies by income level recommended.
Kim 2024	In very old (≥80y) sepsis patients, survival associated with lower frailty/SOFA and greater adherence to early fluid/vasopressor elements; survivors more likely to receive appropriate empiric antibiotics within 24h; highlights bundle performance relevance in advanced age.
Kokotovic 2025	HRQoL (EQ-5D-5L) improved at POD30 (0.846 vs 0.750), POD90 (0.925 vs 0.847), POD180 (0.907 vs 0.875); fewer discharges to rehabilitation (12.5% vs 23.3%); no difference in days alive out of hospital or readmissions.
Demir 2025	Meta-analysis: care bundles significantly reduced hospital-acquired pressure injuries, shortened LOS, and lowered number/severity of injuries; pooled effects favored bundles though heterogeneity and reporting quality varied.

Narrative synthesis across domains

ICU liberation (ABCDEF). Two large implementation studies consistently showed that structured education, continuous performance feedback, and data literacy training increased bundle compliance and were associated with clinically meaningful improvements (shorter MV, shorter ICU LOS, reductions in prolonged ICU stays and next-day mortality), even during pandemic disruptions [10–11]. However, mobility (“E”) and family engagement (“F”) often lagged, underscoring persistent operational barriers. A global survey highlighted low overall bundle completion and emphasized that written protocols, multidisciplinary teams, and local context (resources, staffing) affect fidelity, suggesting the need for tailored strategies by income level and ICU infrastructure [12].

VAP prevention. Both studies demonstrated compliance-dependent benefits: higher adherence (or ≥75% overall compliance) correlated with lower VAP rates and delayed onset, with subglottic suction, daily SBT/extubation assessment, and early mobilization emerging as recurrent weak spots that limit full completion [7–8].

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These findings reinforce the “dose–response” nature of bundles: component-level adherence matters, but cumulative fidelity drives maximal risk reduction.

CLABSI prevention. The multicenter cohort observed moderate bundle adherence (=65%) and a CLABSI incidence of =4.2/1000 line-days, dominated by Gram-negative pathogens. Prolonged ICU stay and multiple catheters were strong risk factors, suggesting that minimizing catheter days, standardizing maintenance, and addressing high-risk trajectories are crucial. The study calls for robust surveillance and targeted reinforcement of maintenance behaviors [9].

Sepsis bundles in very old adults. In a nationwide cohort, adherence to time-critical bundle elements (resuscitation fluids, vasopressors, timely appropriate antibiotics) was associated with survival in patients ≥80 years, after accounting for frailty and organ failure severity. The data advocate for age-attuned but still protocol-guided care, emphasizing early recognition and treatment while individualizing goals [13].

Transition-of-care bundle. A simple, standardized discharge coordination program improved HRQoL up to six months after emergency abdominal surgery without increasing readmissions or days at home lost. This highlights value in multidisciplinary education and clear written plans at the interface between hospital and home [14].

Nursing-sensitive outcomes. A meta-analysis of pressure-injury bundles confirmed reductions in hospital-acquired pressure injuries and LOS, strengthening the broader case that organized, multicomponent nursing bundles yield tangible safety benefits, albeit with variability in reporting and fidelity measurement [15].

DISCUSSION

This review shows that multidisciplinary care bundles improve clinically relevant outcomes across hospital domains when implemented with fidelity and supportive infrastructure. For ICU liberation, consistent gains in compliance via education, data literacy, and weekly feedback translated into shorter ventilation courses and ICU stays, lower next-day mortality, and reduced prolonged ICU utilization [10–11]. These findings align with the foundational ABCDEF framework, which integrates pain/sedation management, delirium prevention, early mobility, and family engagement to mitigate iatrogenic harms in critical illness [1].

Persistent gaps around mobility and family engagement echo implementation science findings that context, staffing, and workflows shape fidelity, necessitating structured protocols, team-based routines, and pragmatic adaptation [4,5,12].

Infection-prevention bundles demonstrate a similar pattern: component-level adherence is necessary but insufficient; cumulative fidelity determines effect size. VAP studies linked higher compliance to lower incidence and longer time-to-VAP, with daily extubation assessments, subglottic suction, and early mobilization frequently under-delivered and thus ripe for targeted improvement [2,7–8]. CLABSI data reinforce this, associating moderate compliance with residual infection burden and identifying high-risk conditions

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(prolonged ICU stay, multiple catheters) that should trigger intensified maintenance protocols and line-minimization strategies [9]. The broader bundle literature on pressure-injury prevention supports these themes, bundles reduce harms and LOS, but reporting heterogeneity and incomplete operational details limit reproducibility, underscoring the need for better specification and fidelity tracking [3].

Sepsis care adds nuance: among very old adults, adherence to early resuscitation and appropriate antibiotics remains associated with survival, but frailty and severity strongly influence outcomes, suggesting protocolized care should be paired with individualized goals and risk stratification [13].

Educational efforts around the SEP-1 core measure also require depth beyond “what is required”; closing knowledge gaps about clinical judgment exceptions may improve compliance without undermining patient-centered decisions [7]. (Scoping review of SEP-1 education highlights opportunities to improve national adherence through deeper, practice-relevant training [7].) Transition-of-care bundles extend benefits beyond acute episodes, improving HRQoL without increasing readmissions, consistent with evidence that coordinated, patient-facing discharge processes are integral components of high-quality care [6].

From an implementation standpoint, several cross-cutting features stand out: (i) written protocols and checklists; (ii) multidisciplinary team routines; (iii) training plus data literacy with regular performance feedback; and (iv) tailoring to local constraints and patient needs [4,5,12]. These align with prior syntheses of ICU bundle implementation processes and complex intervention science, which emphasize context mapping, stakeholder engagement, and practical fidelity measures [3,8].

Investing in measurement infrastructure (EHR-embedded documentation, dashboards) appears pivotal for sustaining performance and spread [11]. Limitations: Our corpus spans diverse designs, settings, and outcomes, precluding meta-analysis and inviting residual confounding (especially in before–after and registry studies). Reporting of fidelity and operational details was variable, consistent with broader implementation-science critiques [4,5]. Nonetheless, directionality was consistent, and multiple studies showed compliance gradients, bolstering causal plausibility.

CONCLUSION

Multidisciplinary care bundles, when delivered with high fidelity and supported by protocols, team routines, and data-driven feedback, improve important outcomes for hospitalized adults. ABCDEF/ICU liberation programs shorten ventilation and ICU stays and reduce near-term mortality; VAP and CLABSI bundles lower device-associated infections in a compliance-dependent fashion; sepsis elements remain impactful in very old adults; and transition-of-care bundles enhance HRQoL after major surgery. Implementation quality is the differentiator. Health systems should invest in pragmatic protocols, mobility programs, subglottic suction and line-maintenance standards, and performance analytics to close fidelity gaps and sustain gains.

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