TITLE

Patient and family centered actionable processes of care and performance measures for persistent and chronic critical illness: a systematic review

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KEYWORDS

Chronic critical illness; persistent critical illness; quality indicator; process of care; intensive care

**ABSTRACT**

Objective

To identify actionable processes of care, quality indicators, or performance measures and their evidence base relevant to patients with persistent or chronic critical illness and their family members including themes relating to patient/family experience.

Data Sources

Two authors independently searched electronic, systemic review, and trial registration databases (inception to November 2016).

Study Selection: We included studies with an ICU length of stay of ≥7 days as an inclusion criterion and reported actionable processes of care; quality improvement indicators, measures or tools; or patient/family experience. We excluded case series/reports of <10 patients.

Data Extraction: Paired authors independently extracted data and performed risk of bias assessment.

Data synthesis

We screened 13,130 references identifying 114 primary studies and 102 relevant reviews. Primary studies reported data on 24,252 participants; median (IQR) sample size of 70 (32-182). We identified 42 distinct actionable processes of care, the most commonly investigated related to categories of (1) weaning methods (21 studies; 27 reviews), (2) rehabilitation, mobilization, and physiotherapy (20 studies; 40 reviews); and (3) provision of information, prognosis and family communication (14 studies; 11 reviews). Processes with limited evidence were generally more patient-centered categories such as communication, promotion of sleep, symptom management, or family support. Of the 21 randomized controlled trials, only two were considered at low risk of bias across all six domains, while just 2 cohort studies and 1 qualitative study were considered of high quality.

Conclusion

We identified 42 distinct actionable processes of care relevant to patients with persistent or chronic critical illness and their families, with most frequently studied processes relating to weaning, rehabilitation/mobilization, and family communication. Qualitative studies highlighted the need to address psychological needs and distressing symptoms as well as enabling patient communication. Our findings are informative for clinicians and decision-makers when planning high quality patient and family focused care.

Systematic Review Registration - PROSPERO: CRD42016052715

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**INTRODUCTION**

Within intensive care units (ICUs) in developed countries, 5% to 10% of critically ill adults transition from acute critical illness to a state of persistent and in some cases chronic critical illness (1-4). Persistent critical illness is characterized by some degree of clinical instability associated with persistent low intensity inflammation and organ failure (5) that may not be directly attributable to the original reason for ICU admission (6). Patients with chronic critical illness continue to require prolonged ICU stays and, in most cases, a prolonged need for mechanical ventilation (7-9). Incidence rates are increasing, costs to the healthcare budget are estimated to be $25 billion annually in the United States alone, (10) and hospital mortality remains high for these patients (11). With an uncertain disease trajectory, extreme symptom load and profound physical, neuropsychological, and cognitive deficits, patient burden is substantial (8, 12). Family members also experience significant emotional and physical caregiving, and financial burden (13, 14).

Patients with persistent or chronic critical illness require adaption of their clinical management plan and overall goals of care to a focus on rehabilitation, symptom relief, discharge planning, and in some cases, ventilation discontinuation or end-of-life care (15). Realization of these goals requires development and implementation of strategies focused on actionable processes of care, (i.e., those processes over which clinicians and decision-makers have direct control and are able to take action on) that will improve patient and family experience and clinical outcomes (5, 16). However, strategies such as weaning and mobilization protocols, which can be considered actionable processes of care, infrequently include guidance specific to patients with persistent or chronic critical illness (17). Daily checklists, which reinforce delivery of actionable processes of care, are focused entirely on acutely ill patients and thus may not include items likely to be considered important to patients experiencing long ICU stays, such as communication aids, family meetings, and symptom management (18).

Therefore, to inform the development of quality improvement tools for patients with persistent or chronic critical illness and family, we sought to identify actionable processes of care, performance measures, and quality indicators including reports of patient and family experience specific to the management of persistent and chronic critical illness described in the current evidence base.

**METHODS**

We conducted this review according to the Preferred Reporting Items for Systematic Review and Meta-Analyses Protocol (PRISMA-P) guidelines (19) and completed a PRISMA-P checklist. We registered the protocol on the International Prospective Register of Systematic Reviews (PROSPERO) CRD: 42016052715 and previously published our protocol (20).

Study Identification

Using an iteratively developed search strategy (supplementary material) informed by an experienced information specialist, we searched (March 1980 to Nov 2016): MEDLINE, CINAHL, EMBASE, Web of Science, Cochrane Library, PROSPERO, and the Joanna Briggs Institute. We searched major guideline sites (e.g., CMA Infobase, National Guideline Clearinghouse) for clinical practice guidelines and policy documents, websites of relevant professional societies for practice recommendations relevant to our population of interest, and examined reference lists of relevant studies/reviews. We searched http://apps.who.int/trialsearch website for unpublished and ongoing trials.

Inclusion Criteria

Eligible studies had to report on actionable or modifiable processes of care, performance indicators, quality improvement measures or tools, or patient/family experience specific to adults described as persistent critical illness, chronic critical illness, prolonged mechanical ventilation or a study population admitted to a specialized weaning facility, long term acute care hospital (LTACH), or respiratory high dependency unit. Due to recognized variability in definitions (21), we included only those studies using an ICU length of stay of ≥7 days as a study inclusion criterion to reflect the consensus definition used by Medicare and Medicaid in the United States (22). Studies were eligible regardless of study design with the exception of case series/reports of <10 patients. We included observational cohorts that reported on presence of conditions such as polyneuropathy, hypothyroidism or depression as we considered the need to assess for such conditions would comprise an initial step of an actionable care process. We excluded animal-only studies, opinion pieces (e.g., editorials, letters) and for practical reasons, non-English language studies.

Objectives

Our primary objective was to develop a list of evidence-based actionable processes of care to be considered by clinicians and decision-makers for delivery of quality care in daily practice for patients experiencing persistent or chronic critical illness and their family members. Secondary objectives were to identify quality improvement tools, quality indicators or performance measures relevant to our population of interest; and qualitatively derived themes related to patient and family experience.

Study Selection and Data Extraction

Two authors (LR/LI) independently screened abstracts for eligibility. When necessary, a third reviewer (BC or LA) arbitrated consensus. Two authors independently extracted data using a standardized form; a third author (LR) checked all extraction for accuracy. We extracted data on country, care venue type and characteristics, patient characteristics, descriptions of actionable care processes or study interventions dependent on study design, and descriptions of quality indicators and performance measures. We extracted quantitative and qualitative study results including qualitative themes related to patient and family experience. Two investigators (LR/LI) independently reviewed the extracted actionable care processes/interventions to develop a list of categories and independently assigned primary studies to categories. The study team then reviewed and confirmed agreement. We reviewed relevant narrative and systematic reviews and determined actionable processes of care described in these reviews.

Study Quality Assessment

For randomized and quasi-randomized studies, two investigators independently assessed risk of bias using the Cochrane Risk of Bias tool (23). The Scottish Intercollegiate Guidelines Network (SIGN) checklists (24) were used for cohort and case-control studies. We used a modified 2014 Critical Appraisal Skills Programme (CASP) quality assessment tool for qualitative studies (25) and, as this tool does not consider the more conceptual or theoretical aspects of qualitative studies, we also assessed additional criteria outlined by Popay (26).

Data Analysis

We summarized study and patient participant characteristics reported as categorical variables using counts and proportions and continuous variables as medians with interquartile ranges (IQR). We calculated counts and proportions of categories of actionable processes identified in primary studies and relevant reviews. Due to *a priori* anticipated heterogeneity in study design, processes of care, interventions, quality indicators and measures, we did not perform meta-analyses, subgroup or sensitivity analyses, or examine publication bias. For qualitative studies, we generated a table of author reported themes, and subthemes and undertook content analysis of these themes (27, 28) to quantify common categories and themes within these categories leading to identification of additional actionable processes of care. We categorized data using Donabedian’s conceptual framework of structure, process, and outcomes (29).

**RESULTS**

We screened 13,130 references, excluded 12,820 and included 114 primary studies, 102 reviews and 94 abstracts (71 subsequently published as full manuscripts). Search results are presented using a PRISMA study flow diagram.(30) (Figure 1).

*Study and Participant Characteristics*

The 114 primary studies (see supplementary table for bibliography) reported data on 24,251 participants with a median (IQR) sample size of 70 (32-182). Most studies were from North America (48%), were conducted in ICUs (54%) as opposed to other care environments such as LTACHs or specialized weaning centres, were single centre studies (70%), and used a cohort design without a comparator group (37%) (Table 1). We identified 9 qualitative or mixed methods studies reporting themes relating to patient and family experience.

Of the 99 studies including only patient participants, the reported mean (standard deviation (SD)) age ranged from 40 (31) to 79 (32) years, with a median (IQR) of 60% (53%-68%) male participants, and a median (IQR) of 75% (57%-100%) admitted to the participating unit for medical reasons. Of the 42 studies reporting APACHE II (33) scores on admission, mean (SD) scores ranged from 12 (4) to 27 (7). (Supplementary material Table 1 provides unit characteristics/descriptors of individual studies).

*Actionable Processes of Care*

We identified 42 distinct categories of actionable processes of care of relevance to the delivery of care for patients with persistent or chronic critical illness. These comprised 37 from the 114 primary studies, including 3 identified though content analysis of patient and family experience. Five additional categories were reported in narrative reviews only (Table 2; Supplemental material Table 2 for actionable process categories and description of processes from individual studies). Most commonly occurring categories from studies using quantitative methods were: (1) weaning methods; (2) rehabilitation, mobilization, and physiotherapy strategies; and (3) providing information, prognosis, and family communication. Within these three categories, interventions demonstrated to have a positive effect on patient or family outcomes included individualized weaning plans, and respiratory therapist-led weaning protocols including a protocol of tracheostomy collar weaning; exercise training and neuromuscular electrical stimulation; and use of a decision aid for substitute decision makers (Table 3). Other categories reflected clinical features of chronic critical illness including deranged neuroendocrine function, altered brain function and neuropsychiatric disorders, malnutrition, skin breakdown, and increased vulnerability to infection (34). (See Supplementary Table 3 for the intervention or exposure, primary outcomes and main findings for other categories from studies with a control group; Supplementary material Table 4 the 56 studies without a comparator group).

*Actionable Processes of Care arising from Patient and Family Experience*

Using content analysis, from the 9 qualitative studies reporting themes relating to patient and family experience, we found 14 actionable processes of care categories. The most common categories were addressing (1) psychological needs, (2) promoting interprofessional communication/decision-making, (3) enabling patient communication, and (4) symptom management. Three themes not found in quantitative studies for clinicians and decision-makers to consider as actionable processes were (1) promoting patient coping skills through enabling of hope and optimism as well as regain of control; (2) addressing reduced quality of life; and (3) care planning that includes strategies as to how to address unanticipated reversal in clinical recovery. Categories that converged across studies and reviews of interventions, and those from qualitative exploration of patient and family experience related to improving communication with family, enabling patient communication, and management of psychological and symptom distress.

*Risk of Bias and Quality Assessment*

Of the 21 RCTs including three secondary analyses of data relating to long stay ICU patients from primary trials and the 1 non-randomized intervention study, 2 RCTs were considered low risk across all domains (Supplementary Material Figure 1). We considered 14 (63%) to be at low risk of bias for sequence generation, 6 (27%) as unclear and 2 (9%) as at high risk of bias. Eleven (50%) studies were considered at low risk of bias due to allocation concealment, 9 (41%) unclear and 2 (9%) at high risk. Blinding of personnel or participants was only feasible in 6 (27%) trials, 1 (5%) trial was considered unclear risk; 11 (50%) trials blinded outcome assessors, 3 (14%) did not blind, the remainder were assessed as at unclear risk of bias. All but 1 trial were considered at low risk of incomplete outcomes, 10 (45%) at low risk of selective reporting, and 17 (77%) free from other sources of bias.

Of the 33 cohort studies with controls, 2 (6%) were considered to be of high quality, 15 (45%) of acceptable quality, and 16 (48%) of unacceptable quality. Thirteen (39%) were considered to have clear evidence of an association between exposure and outcome, 17 (52%) were considered to have unclear evidence, and 3 (9%) no evidence of an association between exposure and outcome (Supplementary Table 4). We did not perform quality assessment of the 43 studies without a control group. All 9 qualitative studies were assessed as having a logical fit between aims and methods, 7 (78%) reported appropriate recruitment methods and presented clear and detailed statements of findings, 6 (67%) described audio-recording and transcription processes as well as inter-rater discussion. Only 2 (22%) studies considered disconfirming findings or demonstrated reflexive concern. Four (44%) studies demonstrated interpretation of findings at a conceptual and theoretical level (Supplementary Table 5).

**DISCUSSION**

This systematic review identified 42 distinct categories of actionable processes of care for clinicians and decision-makers to consider when providing care to patients experiencing persistent or chronic critical illness and their family members. The most common categories were (1) weaning – methods; (2) rehabilitation, mobilization, and physiotherapy; and (3) provision of information, prognosis, and family communication. Categories that converged across study designs types related to improving family communication, enabling patients to communicate, and management of psychological and symptom distress. We did not identify any quality indicators, measures, or tools to evaluate quality of care or patient/family member experience of care. Only two (35, 36) RCTs were considered at low risk of bias while only 2 (37, 38) cohort studies and 1 qualitative study (39) were considered of high quality.

Based on the numbers of studies within categories in the existing evidence base, implementation of processes of care that focus on weaning, rehabilitation/mobilization, and information sharing/family communication should be considered by clinicians and decision–makers as processes to optimize to enable provision of high quality care. . Likewise, those that converged across study designs should be prioritized; particularly provision of timely, frequent and empathetic communication with families, and alleviation of symptom burden.

Most patients with persistent or chronic critical illness will experience prolonged weaning from ventilation. Weaning protocols are effective for reducing ventilation duration in the broader ICU patient population (40). In this review, we found some evidence of effectiveness for patients with prolonged need for mechanical ventilation. Studies in this review reporting on patient and family experience highlight the need to address the distressing symptoms and psychological impact of weaning failure, which should be considered when designing interventions to facilitate weaning in this patient population. Similarly, most if not all persistently or chronically critically ill patients will require physical rehabilitation strategies, due to profound weakness and muscle atrophy associated with myopathy, neuropathy, and alterations in body composition (5), benefits of which are likely best achieved when commenced early (41).

When comparing our results to the number of studies reporting efficacious or effective actionable processes of care during acute critical illness (11), the 21 RCTs identified in our systematic review highlights the paucity of high level evidence for patients with persistent or chronic critical illness. Although reasons for the current lack of an evidence-base are likely multifactorial, the common strategy of single-center research identified in our review limits the number of potential study participants. It can also lead to a lengthy recruitment period, such as in a landmark trial of tracheostomy collar weaning at a LTACH, which took ten years to accrue 316 participants (42). Of concern is the relatively limited evidence within each category, particularly in patient-centered categories such as communication, promotion of sleep and day/night routines, psychological and social functioning, symptom management, or family support. Furthermore, studies did not reflect person-centred care approaches and the lack of qualitative observational inquiry limits understanding of the influence of the organizational context on care processes and outcomes.

We identified 42 distinct categories of actionable processes of care, which is indicative of the extent of the needs of these patients and their families, and arises from the range of clinical features of persistent or chronic critical illness. However, this presents challenges for clinicians and decision-makers in terms of which processes to prioritize. Furthermore, published studies designed by researchers may not reflect priorities of care of greatest importance from a patient/family member perspective. The lack of quality indicators, measures, or tools to evaluate quality of care or patient/family member experience, developed specifically for patients with persistent or chronic critical illness, may contribute to poor patient/family experience and adverse outcomes. Such strategies are needed to embed actionable processes into routine clinical practice. Rounding or daily goal checklists are strategies shown to improve adherence to evidence based practices enabling a systematic approach to care yet individualizing set goals (18, 43). Tools are needed that address those actionable processes of care most relevant to the needs of patients with persistent critical illness and their families. Subsequent phases of our research program aim to address these gaps.

Informed by Experience Based Co-Design (EBCD) methods (44), a rigorous quality improvement method that involves lived experience, expertise, and knowledge of those using and providing a service, (45), we will conduct interviews with survivors of persistent or chronic critical illness, family members, and clinicians to establish important actionable processes of care from their perspectives. We will develop a short touch-point video using patient and family interview data to inform clinician interviews. To inform development of quality improvement tools including a daily goals checklist we will gain consensus as to the most important actionable processes of care , using a two round Delphi process (46) and modified nominal group technique involving clinicians, ICU survivors and family, (47).

*Strengths and Limitations*

This is the first systematic review of actionable care processes for patients with persistent or chronic critical illness to our knowledge. We used rigorous methods including two author independent citation screening, data extraction, and coding as well as validated tools to assess risk of bias and evidence quality. There are also limitations. First, due to disparate study interventions and designs and small numbers of studies with a control group evaluating a similar intervention, we were unable to perform meta-analyses or appraise the certainty of evidence, i.e., apply the Grading of Recommendations, Assessment, Development, and Evaluation approach (48) or assess publication bias. Additionally, by limiting studies to those that used ≥7 days as an inclusion criterion, it is possible we excluded some studies of potential relevance. However, given our inclusion of 216 studies, it is unlikely we missed other categories of actionable processes of care. Last, our exclusion of non-English language studies could limit generalizability.

**CONCLUSION**

In this systematic review, we identified 42 distinct actionable processes of care relevant to patients with persistent or chronic critical illness and their families. Most frequently studied processes related to weaning, rehabilitation/mobilization, and communication with family. Reports of patient and family experience highlighted the need to address psychological needs and distressing symptoms as well as enabling patient communication. Clinicians and decision-makers should consider our findings to plan high quality patient and family focused care. However, we did not identify relevant quality indicators, measures, or tools to evaluate or facilitate high quality of care or patient/family member experience of carehighlighting the pressing need for such tools and metrics. Our findings also highlight the need for a stronger evidence base for those actionable processes of care deemed most important to improve outcomes and experience of persistent or chronically critically ill patients and their family.

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**Figure Legends**

Figure 1: Citation screening and study selection: Prisma flow diagram