ICU-Induced Disability Persists With or Without COVID-19—This Is a Call for F to A Bundle Action*

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In 2003, a landmark study by Herridge et al (1) demonstrated that young survivors of acute respiratory distress syndrome have persistent functional disability 1 year after discharge from the ICU with muscle wasting, weakness, and low endurance. This study triggered a wake-up call for critical care practitioners to focus recovery on more than patients' survival. Patients expect to return home from the hospital as people restored to community level independence, and instead, long-term disability following an ICU stay persists. Herridge et al (1) followed up with her cohort of ICU survivors 5-year post-discharge and found they still had not recovered physical fitness levels to their age-matched norms, with a median 6-minute walk distance of 436 m (76% of predicted distance); plus ongoing cognitive, psychologic, and financial burdens (2). In 2011, a data synthesis review published in *Critical Care Medicine* found that "ICU care influenced a wide range of long-term patient outcomes, with some impairments persisting for 5–15 years. The review authors concluded that impaired pulmonary function, greater healthcare utilization, and increased mortality are observed in intensive care survivors. Neuromuscular weakness and impairments in both physical function and related aspects of quality of life are common and may be long-lasting" (3). Attempting to mitigate post-ICU disability, the Society of Critical Care Medicine created a stakeholder's conference in 2012 improving the long-term outcomes after critical illness for patients and their families. Thirty-one invited stakeholders participated in the conference. The invited experts presented a summary of existing data, identifying long-term physical, cognitive, and mental health problems after intensive care and the results from studies of interventions to address these problems. Stakeholders provided concerns and strategies for improving care and mitigating these long-term health problems (4). At this conference, they created the term "postintensive care syndrome (PICS)" to capture the wide range of disabling sequelae in one phrase.

In 2007, ICU clinicians pioneered critical care work to prevent PICS by keeping patients awake- including while on mechanical ventilation, and mobilizing out of bed within days of ICU admission. Bailey et al (5) recorded a total of 1,449 activity events in 103 ICU patients with a median Acute Physiology and Chronic Health Evaluation 2 score of 26. The activity events included 233 (16%) sit on bed, 454 (31%) sit in chair, and 762 (53%) ambulate. In patients with an endotracheal tube in place, there were a total of 593 activity events, of which 249 (42%) were

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ambulation. There were less than 1% activity-related adverse events (5). Compelling evidence for early mobility as PICS prevention grew with a randomized-controlled trial published in 2009 by Schweickert et al (6) with their intervention group receiving interruption of sedation and physical and occupational therapies a median of 1.5 days after ICU admission versus the control group at 7.4 days. The "intervention group" mobility was safe and well tolerated, and resulted in better functional outcomes at hospital discharge, a shorter duration of delirium, and more ventilator-free days compared with standard care (6). Patients standing and walking in the ICU decrease their days of delirium and increase their odds of returning home without disability. Keeping ICU patients immobile is harmful. For the past 20 years, evidence describing ICU patient immobility as a source of long-term disability has multiplied (7, 8), prompting Critical Care Medicine Societies to include immobility as a harm to prevent in their clinical practice guidelines (9, 10).

In 2014, the Society of Critical Care Medicine created the ICU Liberation Campaign based on a bundle of implementation strategies known as the "A to F bundle" (11). Applying evidence to practice, clinicians employ the elements of A to F—assessing and treating pain (A), performing spontaneous breathing trials (B), choosing to awaken patients with less or no sedation (C), assessing delirium (D), early mobility (E), and incorporating the family (F), to every eligible patient every day. Using the A to F strategy, the ICU Liberation Collaborative proved in a cohort of over 15,000 adult ICU patients across the United States that long-term disability could be mitigated (11). Similarly, a quality improvement program conducted across seven ICUs in California to establish the A to F bundle as standard ICU care enrolled over 6,000 patients in a 2017 study and concluded that higher A to F bundle compliance was independently associated with improved survival, and more days free of delirium and coma after adjusting for age, severity of illness, and presence of mechanical ventilation (12). Reflecting on this history of ICU-acquired disability and disseminating recommendations for its prevention is important. Adhering to the A to F bundle of care proved that it could improve our patients' lives for years to come.

Then, the COVID-19 pandemic changed everything. Family visitations were suspended, sedation levels increased, rates and duration of delirium grew, and out of bed mobilization practices plummeted (13). In a 2021 worldwide point-prevalence survey of more than 1,200 patients from 135 ICUs, more than 90% of patients receiving mechanical ventilation with or without a COVID-19 diagnosis were kept in bed with no opportunity to mobilize (14). History repeats itself with high levels of disability for survivors of COVID-19 ICU care exacerbated by this lack of A to F bundle preventative care (15). In this issue of *Critical Care Medicine*, Millet et al (16) provides remarkable objective measures describing the level of cardiorespiratory fitness and neuromuscular function of mechanically ventilated ICU survivors after COVID-19. This study is unique among ICU mobility literature for its application of exercise physiology objective measures of survivors' physical fitness. Fifty-six COVID-19 ICU survivors with a mean age of 64.5, an average length of ICU stay of 31.9 days, and a mean length of mechanical ventilation of 22.8 days were tested in an exercise physiology laboratory at 4–8 week post-ICU discharge for cardiopulmonary exercise testing of maximal oxygen uptake (Vo_2max), quality of life, and knee extensor muscular function. The results are profound. Mean Vo_2max for this cohort measured 18.3 mL/kg/min ± 4.5 SD or 49% of predicted values (16).

Interpreting a mean Vo_2max of 18.3 mL/kg/min for a COVID-19 ICU survivor in practical terms illuminates the tragedy described in this important study. Vo_2max is the measure of human power and efficiency, and the larger volume of oxygen represented by the Vo_2max of a professional athlete such as cyclist Lance Armstrong competing in the Tour de France of 80 mL min kg represents a cardiopulmonary system capable of absorbing and processing enough oxygen to bike steep mountain peaks for hours. Compare this 80 mL/kg/min example to a 50-year-old breast cancer patients after adjuvant chemotherapy therapy who has a mean Vo_2max of 22.2 mL/kg/min or 75% of predicted value (17) or patients with advanced heart-failure mean Vo_2max of 16.5 mL kg min (18). Millet (16) provides context in their study for the low aerobic capacity of COVID-19 ICU patients with mention of needed aerobic capacity for performing simple daily tasks such as stair climbing of 5 metabolic equivalents (METS). A MET is a metabolic equivalent or the oxygen capacity cost of any activity. The resting inactive metabolism of a person requires 3.6 mL kg min = 1 MET, walking 3 miles/hr = 3.3 METS, walking 4 miles/hr = 5 METS, and stair climbing = 5 to 6 METS (18–21.6 mL kg min

VO2 needed to complete). Patients now at home trying to live normal lives are required to perform the equivalent of maximal capacity exercise by simply moving around their house. Imagine everyday pushing yourself through a 100% Vo_2max exercise workout—this is the daily life for post-COVID ICU patients as revealed in the exercise physiology laboratory of Millet et al (16).

Exercise physiology research over many years demonstrates lower Vo_2max correlates with all-cause early mortality (19). In the study on post-ICU COVID patients (16), the authors found correlations between low Vo_2max, and indices of reduced muscle strength, plus longer duration of mechanical ventilation, and ICU stay duration. The authors also attribute their findings to the depleting impact of an ICU stay and not something unique to COVID-19 (16). Project the findings of Millet et al (16) onto recent PICS globally conducted surveys, and a public health crisis emerges. Similar to the 2003 findings by Herridge et al (1), a 2021 prospective multicenter cohort study of 2,345 adult ICU survivors found new physical, mental, and/or cognitive problems (PICS), experienced by 50% of recovered patients 1-year after ICU admission (20). Contributing to the ICU induced disability is an established problem established problem- low implementation of A to F protocols (21). In every survey of A to F bundle compliance, looking at individual bundle components, the lowest rates of compliance and protocol development exist at the (E) early mobility and (F) family portions of the bundle as if ICU adoption of the bundle gets off to a great start at the beginning of the alphabet and dwindles as the letters go on.

Full recovery is not impossible. Disabling physical capacity resulting in everyday activities becoming equivalent to exercise stress tests, as in the PICS cohort by Millet et al (16) can be treated and prevented just as it is in healthy people, with increased physical activity and exercise training. Let this study be a call to action and a movement to stop inducing disability. Prevent or mitigate physical incapacity with proven interventions of early mobility in the ICU. Consider embracing an F to A bundle. If motivating (F) family members are present and (E) early mobility is the A to F ICU Liberation bundle element of *greatest* rather than least compliance, patients must have the other elements fulfilled. Patients mobilize out of bed when their pain is controlled (A), they are awake, and the ventilator is adapted to their needs (B&C), with delirium assessed and modified (D). Potentially, all ICU survivors need exercise-based rehabilitation for complete recovery but first give them an opportunity to live without each daily activity representing a maximal effort. Use a F to A ICU Liberation bundle strategy to prevent the astonishing ICU-induced physical disability objectively demonstrated by Millet et al (16).

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Communication Strategies and Patient Care Transitions in the Early ICU Aftercare Period*

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Effective physician-to-physician communication is essential for patient safety, particularly at junctions when patient care transitions between physician teams during hospitalization, such as from intensivists to hospitalists in the early ICU aftercare period. These transitions in care from the ICU to intermediate care areas or wards, represent unique vulnerabilities for patients, often attributed to residual organ damage, complex pharmacologic therapies, and are prone to ICU-acquired deficits (e.g., delirium) (1). Although the Situation-Background-Assessment-Recommendation communication checklist is a familiar verbal and written communication strategy adopted for structured updates in nursing (2, 3), the tradition-based practices of unstructured physician progress notes are receiving more scrutiny in composition and timeliness. Electronic discharge (eDischarge) tools are increasingly embedded within electronic health records (EHRs) to leverage existing patient-specific data entries (i.e., laboratory values, vascular access catheters) and thus potentially offer more complete, accurate, and efficient multidisciplinary documentation relevant to handoff communication (1).

In this issue of *Critical Care Medicine*, Stelfox et al (4) investigate the crucially important step of timely and effective physician-to-physician ICU discharge handoff documentation to communicate clinical priorities for patients entering the early ICU aftercare period. Their intervention of an EHR-enabled structured ICU discharge note replaced a free-form dictation approach in four participating hospitals in Calgary, AB, Canada. The primary outcome measures were

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