Society of Critical Care Medicine's International Consensus Conference on Prediction and Identification of Long-Term Impairments After Critical Illness

Mark E. Mikkelsen, MD, MSCE[1]; Mary Still, MSN, RN, ANP-BC[2]; Brian J. Anderson, MD, MSCE[1]; O. Joseph Bienvenu, MD, PhD[3]; Martin B. Brodsky, MD, ScM[3,4]; Nathan Brummel, MD[5]; Brad Butcher, MD[6]; Alison S. Clay, MD[7]; Hali Felt, MFA; Lauren E. Ferrante, MD[8]; Kimberley J. Haines, PhD[9]; Michael O. Harhay, PhD[1,10]; Aluko A. Hope, MD[11]; Ramona O. Hopkins, PhD[12–14]; Megan Hosey, PhD[3,4]; Catherine "Terri" L. Hough, MD[15]; James C. Jackson, PsyD[16]; Annie Johnson, ACNP-BC[17]; Babar Khan, MD[18,19]; Nazir I. Lone, MBBS, MD, MPH[20]; Pamela MacTavish, MSc[21]; Joanne McPeake, PhD[21]; Ashley Montgomery-Yates, MD[22]; Dale M. Needham, MD, PhD[3,4]; Giora Netzer, MD[23]; Christa Schorr, DNP, RN, NEA-BC[24]; Becky Skidmore, BA, MLS[25]; Joanna L. Stollings, PharmD[26]; Reba Umberger, PhD, RN[27]; Adair Andrews, RN, MATD[28]; Theodore J. Iwashyna, MD, PhD[29]; Carla M. Sevin, MD, PhD[16]

[1]Division of Pulmonary, Allergy, and Critical Care Medicine, Department of Medicine, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA.

[2]Department of Nursing, Emory University Hospital, Atlanta, GA.

[3]Department of Psychiatry and Behavioral Science, School of Medicine, Johns Hopkins University, Baltimore, MD.

[4]Division of Pulmonary & Critical Care Medicine, Department of Physical Medicine & Rehabilitation, School of Medicine, Johns Hopkins University, Baltimore, MD.

[5]Division of Pulmonary, Critical Care, and Sleep Medicine, Department of Medicine, The Ohio State University Wexner Medical Center, Columbus, OH.

[6]Department of Critical Care Medicine, University of Pittsburgh Medical Center, Pittsburgh, PA.

[7]Division of Pulmonary, Allergy, and Critical Care Medicine, Duke University School of Medicine, Durham, NC.

[8]Section of Pulmonary, Critical Care, and Sleep Medicine, Department of Medicine, Yale School of Medicine, New Haven, CT.

[9]Department of Physiotherapy, Western Health, Sunshine Hospital, Melbourne, VIC, Australia.

[10]Palliative and Advanced Illness Research (PAIR) Center, Philadelphia, PA.

[11]Department of Medicine, Division of Critical Care Medicine, Montefiore Medical Center, Bronx, NY.

[12]Division of Pulmonary and Critical Care Medicine, Department of Medicine, Intermountain Medical Center, Murray, UT.

[13]Psychology Department and Neuroscience Center, Brigham Young University, Provo, UT.

[14]Center for Humanizing Critical Care, Intermountain Health Care, Murray, UT.

[15]Department of Medicine, Division of Pulmonary, Critical Care and Sleep Medicine, Harborview Medical Center, University of Washington, Seattle, WA.

[16]Department of Medicine, Division of Allergy, Pulmonary, and Critical Care Medicine, Vanderbilt University Medical Center, Nashville, TN.

[17]CCRN Mayo Clinic, Rochester, MN.

[18]Division of Pulmonary/Critical Care, Allergy and Occupational Medicine, Department of Medicine, Indiana University School of Medicine, Indianapolis, IN.

[19]Regenstrief Institute Inc., Indianapolis, IN.

[20]Department of Anesthesia, Critical Care and Pain Medicine, Usher Institute, The University of Edinburgh, Scotland, United Kingdom.

[21]Glasgow Royal Infirmary, NHS Greater Glasgow and Clyde, Scotland, United Kingdom.

[22]Division of Pulmonary, Critical Care and Sleep Medicine, Department of Medicine, University of Kentucky, Lexington, KY.

[23]Division of Pulmonary and Critical Care Medicine, Department of Epidemiology and Public Health, University of Maryland School of Medicine, Baltimore, MD.

[24]Critical Care Department, Cooper University Hospital, Camden, NJ.

[25]Independent Information Specialist, Ottawa, ON, Canada.

[26]Department of Pharmaceutical Services, Vanderbilt University Medical Center, Nashville, TN.

[27]Department of Acute and Tertiary Care, College of Nursing, University of Tennessee Health Sciences Center, Memphis, TN.

[28]Society of Critical Care Medicine, Mount Prospect, IL.

[29]Department of Medicine, Division of Pulmonary & Critical Care, University of Michigan, Ann Arbor, MI.

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Background: After critical illness, new or worsening impairments in physical, cognitive, and/or mental health function are common among patients who have survived. Who should be screened for long-term impairments, what tools to use, and when remain unclear.
Objectives: Provide pragmatic recommendations to clinicians caring for adult survivors of critical illness related to screening for postdischarge impairments.
Participants: Thirty-one international experts in risk-stratification and assessment of survivors of critical illness, including practitioners involved in the Society of Critical Care Medicine's Thrive Post-ICU Collaboratives, survivors of critical illness, and clinical researchers.
Design: Society of Critical Care Medicine consensus conference on post-intensive care syndrome prediction and assessment, held in Dallas, in May 2019. A systematic search of PubMed and the Cochrane Library was conducted in 2018 and updated in 2019 to complete an original systematic review and to identify pre-existing systematic reviews.
Meeting Outcomes: We concluded that existing tools are insufficient to reliably predict post-intensive care syndrome. We identified factors before (e.g., frailty, preexisting functional impairments), during (e.g., duration of delirium, sepsis, acute respiratory distress syndrome), and after (e.g., early symptoms of anxiety, depression, or post-traumatic stress disorder) critical illness that can be used to identify patients at high-risk for cognitive, mental health, and physical impairments after critical illness in whom screening is recommended. We recommend serial assessments, beginning within 2–4 weeks of hospital discharge, using the following screening tools: Montreal Cognitive Assessment test; Hospital Anxiety and Depression Scale; Impact of Event Scale-Revised (post-traumatic stress disorder); 6-minute walk; and/or the EuroQol-5D-5L, a health-related quality of life measure (physical function).
Conclusions: Beginning with an assessment of a patient's pre-ICU functional abilities at ICU admission, clinicians have a care coordination strategy to identify and manage impairments across the continuum. As hospital discharge approaches, clinicians should use brief, standardized assessments and compare these results to patient's pre-ICU functional abilities ("functional reconciliation"). We recommend serial assessments for post-intensive care syndrome-related problems continue within 2–4 weeks of hospital discharge, be prioritized among high-risk patients, using the identified screening tools to prompt referrals for services and/or more detailed assessments. (*Crit Care Med* 2020; XX:00–00)
Key Words: critical illness; cognitive impairment; mental health; physical activities; post-intensive care syndrome

Each year, with advances in care delivery, millions of patients survive critical illness. Unfortunately, after critical illness, new or worsening impairments in physical, cognitive, and/or mental health function are common among survivors (1–4). In 2010, a stakeholders' conference was convened by the Society of Critical Care Medicine (SCCM) to improve long-term impairments experienced by survivors of critical illness (5). To increase awareness of the long-term consequences of critical illness, the term "post-intensive care syndrome" (PICS) was recommended to describe these impairments (5).

In 2012, SCCM held a second stakeholders meeting which engaged representatives of professional organizations, health systems, patient advocates, and professionals with experience and expertise in post-ICU patient care (6). At the second meeting, it was recognized that "a substantial but unknown proportion of survivors of a critical illness are at risk of developing mental health, cognitive, and/or physical impairments" (6). To improve long-term outcomes, participants concluded that "systematic recognition of mental health, cognitive, and/or physical impairments related to PICS is required during transitions of care settings across the continuum of critical illness and recovery" (6). Barriers to practice were identified and included the need to develop educational information for providers that included PICS risk factors and triggers to refer survivors for additional medical care.

At ICU discharge, as a result of the impact of the acute illness and the hazards of bed rest and hospitalization, nearly all survivors of critical illness experience impairments in one or more PICS domains. At 3 and 12 months, 64% and 56% of survivors experience one or more new post-intensive care problems, respectively, and co-occurrence is common (3). As such, prediction, risk-stratification, and screening remain vitally important areas to improve the long-term outcomes of survivors of critical illness.

This report summarizes the findings of a consensus conference convened by SCCM on May 21, 2019, in Dallas, Texas. The purpose of the conference was to provide pragmatic recommendations to clinicians caring for adult survivors of critical illness related to screening for long-term impairments in cognition, mental health, or physical health as a means to improve long-term outcomes. The conference was organized around three fundamental questions related to posthospital discharge assessments for adult survivors of critical illness. First, who should be screened for these often inter-related impairments? Second, what screening tools should be used? Third, when should these assessments be performed?

METHODS

Meeting

As part of SCCM's Thrive initiative, SCCM approved the plan for an international consensus conference on prediction and identification of long-term impairments after critical illness in September 2017. Two co-chairs were appointed (M.E.M., M.S.). The co-chairs worked within and outside of Thrive to identify experts to participate in the workshop.

Thrive, designed to accelerate survivor recovery by partnering with and learning from survivors of critical illness, began in 2015 and was supported through 2020. In addition to its educational and research missions, Thrive was designed to support survivors clinically. To achieve its clinical and research missions, Thrive implemented and then studied its two international post-ICU collaboratives: one focused on peer support to survivors of critical illness and the other on post-ICU clinics (7–10). The

practical clinical experience of these collaboratives confirmed that fundamental questions regarding screening for long-term impairments after critical illness require attention. Outside of the collaboratives, issues of survivorship are rarely addressed (11), further supporting the need for pragmatic guidance.

Participants

To achieve the stated goals, we convened a multidisciplinary conference of 31 international experts in risk-stratification and assessment of survivors of critical illness. Participants, 52% of whom were female, included practitioners involved in the Thrive Post-ICU Collaboratives, survivors of critical illness that included use of mechanical ventilation, and clinical researchers. Clinician perspectives included physicians, nurses, advanced practice providers, neuropsychologists, pharmacists, and rehabilitation experts. Physician representation was diverse and included those trained in medicine, surgery, anesthesiology, psychiatry, and physical medicine and rehabilitation.

Consensus Approach

In this consensus statement, we followed the methods of consensus established by the National Institutes of Health (12) and adapted for use in critical care medicine (13). As used in prior consensus statements (14, 15), we employed a four-step process. First, as detailed above, we formulated three questions related to posthospital discharge assessments for adult survivors of critical illness to guide who should be screened for long-term impairments, what tools should be used, and when should screening be performed. Second, beginning in May 2018, 1 year prior to the conference, we worked with a medical librarian (B.S.) to conduct a comprehensive literature search, described in detail below and in the appendices.

Third, at the conference, held on May 21, 2019, in Dallas, Texas, experts delivered presentations, followed by discussion and deliberations to collectively answer the inter-related questions (for the conference agenda and other Appendices for details of individual background work, see **Appendix A**, Supplemental Digital Content 1, http://links.lww.com/CCM/F794). We began the Dallas conference with insights from two survivors of critical illness.

Finally, we reviewed summary statements, informed by the presentations and deliberations, to arrive at recommendations. We used Twitter polls to provide the summary statements and as a means to poll the group. We maintained anonymity throughout the polling process to prevent dominant voices from driving a false impression of consensus. Strong recommendations from the group required 80% agreement among participants; those achieving 60% agreement are reported here and categorized as weak recommendations. As context, 70% agreement was used to achieve consensus in the core outcome measures for clinical research (16).

Recognizing the paucity of randomized clinical trials data to guide recommendations, participants were instructed to use the totality of their professional judgment, not just the published literature, in guiding their deliberations. For similar reasons, formal guideline development methodology (e.g., Grading of Recommendations, Assessment, Development, and Evaluation [GRADE] methodology) was not used in this meeting.

Clinical Questions

To address our first question ("Can We Predict PICS?"), we conducted a new systematic review to examine whether we can predict cognitive, mental health, or physical impairments in adult survivors of critical illness (16). Because we anticipated a limited ability to predict PICS, we also sought to identify which survivors are most likely to have impairments in cognition, mental health, or physical health after critical illness. In this complementary question, we identified and systematically reviewed 17 preexisting systematic reviews and recent original research to identify risk factors associated with impairments after critical illness. At the conference, we summarized and discussed these systematic reviews (17) (**Appendices B** and **C**, Supplemental Digital Content 1, http://links.lww.com/CCM/F794) (18–50). Risk factors were categorized, for each domain, as before, during, and after the ICU.

After the presentations and discussion, conference attendees were asked to recommend risk factors that would trigger interventions and screening assessments for cognitive, mental health, and physical impairments. Experience from the clinical care of survivors emphasized the potential importance of social aspects of recovery and highlighted the limitations of current knowledge about in-ICU practices and experiences as risk factors.

We then addressed our third question, "How and when should we screen for long-term cognitive, mental health, and physical impairments in survivors of critical illness?" The discussions of recommendations for specific tools, and the modes and timing of their administration, were framed by reviews of the recent extensive consensus process around core outcomes sets for trials, ongoing research, and clinical experience within the Thrive Post-ICU Clinic Collaborative.

To converge on recommendations, the group reviewed the history and results of the core outcomes set for clinical research among survivors of acute respiratory failure (16). In that three-round modified Delphi consensus approach, which engaged international experts, patients/families, and other stakeholders, the Hospital Anxiety and Depression Scale (HADS) (51) and the Impact of Events Scale-Revised (IES-R) (52) reached an a priori consensus threshold as recommended measures for mental health status. During the PICS prediction and identification conference in Dallas, we additionally reviewed more recent literature that demonstrated that the shorter, six-item Impact of Event Scale-6 (IES-6) was a reliable and valid screening tool for post-traumatic stress disorder (PTSD) symptoms in acute respiratory distress syndrome (ARDS) survivors, when compared to the original, 22-item IES-R and a reference-rater semi-structured diagnostic interview for PTSD (53).

In the work to define a core outcomes set for clinical research (16), the Montreal Cognitive Assessment (MoCA) test (54) and the 6-minute walk test received the highest scores as screening measures for cognition and physical function,

respectively, but did not achieve the threshold for consensus in the modified Delphi approach. The EQ-5D and SF-36 (55, 56), which incorporate physical function measures, reached a priori consensus as measures of quality of life, but not for physical function, per se.

At the meeting in Dallas, review of the core outcomes set for clinical research (16) was followed by a presentation of original research which sought to validate the Healthy Aging Brain Care Monitor Self Report as a PICS screening tool (57), followed by a presentation related to screening based on the clinical experience of the Thrive Post-ICU Clinic Collaborative (9, 10). See also **Appendix D** (Supplemental Digital Content 1, http://links.lww.com/CCM/F794).

RESULTS

Patient Perspective Conceptual Framework

To improve long-term outcomes after critical illness, survivors encouraged attendees to consider post-ICU assessments for impairments within a broader disabilities framework that accounts for an individual's health status and trajectory prehospitalization, social determinants of health, and goals which may evolve. Survivors emphasized that the road to recovery, for some, has no end. For those survivors, learning to live with enduring impairments is an important part of rehabilitation.

As PICS exists on a continuum without a defined endpoint, patient participants proposed a core commitment, one shared by ICU survivors and the clinicians who care for them postdischarge, to be that of longitudinal, iterative assessments. Rather than focus on assessment at a single time point, the serial sustained assessment framework prioritizes the need for repeated and dynamic assessments aligned with important patient-centered events, both anticipated and unanticipated.

Examples of anticipatable events, within a framework of multiple visits at key timepoints, include hospital discharge and the end of paid medical leave for those who were employed. In the serial sustained assessment framework, this would suggest a prehospital discharge assessment to determine the need for postacute care services and a second visit. A goal of the second visit, scheduled prior to the end of any employment-based medical disability benefits, would be to discern whether a patient was able to return to work and, if not, direct them to a social worker or another appropriate person who could discuss next steps and resources, such as Social Security Disability Income or employer-sponsored short-term disability. Other potential triggers for assessment include changes (decline and improvement) or plateaus in ability levels, major life or critical illness-related anniversaries, and struggles related to new disabilities.

Serial sustained assessment after critical illness has several potential benefits. First, as return to employment is a challenge after critical illness (58), one associated with long-term psychosocial health (58, 59), the longitudinal framework has the potential to more effectively prepare survivors to reengage in society. Second, a commitment to serial assessments by clinicians and their health systems could prove therapeutic and mitigate the abandonment and social isolation that survivors often experience (60, 61). Finally, survivors' needs may be more timely recognized and addressed and complications (e.g., rehospitalizations) averted through a deliberate, coordinated, longitudinal approach to postdischarge care.

Meeting Outcomes and Recommendations

Informed by our literature review, including the new systematic review (17), there was consensus that the existing tools, as well as clinical judgment, are insufficient to reliably predict PICS-related problems. There also was consensus that the heterogeneity across studies, particularly in statistical reporting, outcome definition, and time horizon, complicated comparisons and synthesis of the literature.

While we could not reliably predict PICS-related problems, using 17 preexisting systematic reviews (Appendix C, Supplemental Digital Content 1, http://links.lww.com/CCM/F794), we identified patients at high-risk for long-term cognitive, mental health, and physical impairments after critical illness in whom screening is recommended (**Tables 1** and **2**). By functional domain, risk-stratification variables were categorized as before (e.g., preexisting impairment), during (e.g., duration of delirium), and after critical illness (e.g., early symptoms of anxiety, depression, or PTSD).

In **Tables 3** and **4**, we summarize the recommended screening tools to detect long-term cognition, mental health, and physical function. Specifically, the MoCA (54) and HADS (51) were strongly recommended as screening tools for cognition, anxiety, and depression, respectively. The IES-R (52), IES-6 (53), 6-minute walk (66–68), and/or EuroQol-5D-5L, a health-related quality of life measure (55), were recommended, weakly, as screening tools for PTSD and physical function, respectively. We strongly recommended that an assessment of selected patients for PICS problems should occur within 2–4 weeks after discharge and serial assessments for PICS problems should occur with important health and life changes.

As summarized in **Supplemental Table 1** (Supplemental Digital Content 2, http://links.lww.com/CCM/F795), we also reaffirmed the core domains of PICS, including physical, cognitive, and mental health status, along with social health/return to social roles (100% agreement), agreed that prediction of post-ICU problems and anticipatory guidance is a task ICU clinicians should try to take on (92% agreement), yet agreed that there is no generally accepted method to predict who will develop new post-ICU problems (80% agreement).

DISCUSSION

While new knowledge of the sequelae of critical illness and critical care is growing, pragmatic recommendations to clinicians caring for adult survivors of critical illness remain scarce. In convening this international, multidisciplinary consensus conference of patients, clinicians, and researchers, SCCM sought to synthesize the state-of-the-art of prediction and identification of long-term impairments in cognition, mental health, and physical health after critical illness.

TABLE 1. Patients at High-Risk for Long-Term Cognitive, Mental Health, and Physical Impairments After Critical Illness in Whom Screening Is Recommended

Functional Domain	Before Critical Illness	During Critical Illness	After Critical Illness
Cognition	Preexisting cognitive dysfunction	Incidence and duration of delirium	
		Sedation (benzodiazepines)	
		Sepsis	
		Shock	
		Hypoxia	
		Acute respiratory distress syndrome	
		Life support[a]	
Mental health	Preexisting mental health problems (anxiety, depression, or post-traumatic stress disorder)	Memories of frightening experiences in ICU	Early symptoms of anxiety, depression, or post-traumatic stress disorder
Physical	Preexisting functional disability		
	Frailty		
	Preexisting cognitive impairment		

[a]Life support (e.g., invasive mechanical ventilation) was identified as a key risk factor for post-ICU problems (weak recommendation, 72% agreement).

TABLE 2. Recommendations Related to Factors to Risk-Stratify Who Should Be Assessed for Long-Term Impairments After Critical Illness

Statements Related to Post-Intensive Care Syndrome Prediction and Assessment	Agreement, %
Cognition	
Patients with preexisting cognitive impairment (recognized or not) before the ICU will have those problems afterward	92
Key risk factors for post-ICU cognitive impairment are delirium, benzodiazepines, sepsis, hypoxia, acute respiratory distress syndrome, and shock	80
Mental health	
Key risk factors for mental health problems are prior anxiety or depression, memories of frightening experiences in the ICU, and early symptoms of anxiety, depression, or post-traumatic stress disorder	92
Patients with preexisting mental health problems (recognized or not) before the ICU will have those problems afterward	76
Absence of social support across the illness is a key risk factor for mental health problems post-ICU	75
Physical	
Patients with preexisting physical impairment (recognized or not) before the ICU will have those problems afterward	84
Key risk factors for post-ICU functional disability are pre-ICU functional disability, pre-ICU cognitive impairment, and frailty	80
Social	
Social determinants of health could be key factors for post-ICU mental health problems; these have not been adequately researched, but should be	100
Religiosity and spirituality could be key factors for post-ICU mental health recovery; these have not been adequately researched, but should be	85

Strong and weak recommendations, respectively, defined as agreement of 80% and 60%.

TABLE 3. Recommended Screening Tools to Detect Long-Term Cognition, Mental Health, and Physical Function

Domain	Screening Test	Comments	Recommendation
Cognition	Montreal Cognitive Assessment (MoCA) (54, 62–64)	Mild cognitive impairment defined as a score of 18–25, moderate as 10–17, and severe as less than 10	Strong
Anxiety	HADS (51, 62)	A score of 8 or greater on the anxiety or depression subscale is used to identify symptoms of clinically significant anxiety or depression	Strong
Depression	HADS (51, 62)		Strong
Post-traumatic stress disorder	IES-R (52) or the abbreviated IES-6 (53, 65)	The optimal screening threshold has been established as 1.6 (IES-R) (62) or 1.75 (IES-6) (53)	Weak
Physical function	6-min walk (66–68) and/or EuroQol-5D-5L (55)	Can be evaluated as a percent predicted against available normative data	Weak
		Includes assessments of mobility, self-care, and usual activities, in addition to pain and anxiety/depression	Weak

HADS = Hospital Anxiety and Depression Scale, IES-6 = Impact of Event Scale-6, IES-R = Impact of Events Scale-Revised.

TABLE 4. Recommendations Related to Screening Tools and Timing to Identify Long-Term Impairments After Critical Illness

Statements Related to PICS Screening	Agreement, %
General comments	
An assessment of selected patients for PICS problems should occur early (e.g., 2–4 wk after discharge)	95
Serial assessments for PICS problems should occur with important health and life changes	90
Cognition	
A default assessment for cognitive problems can be the MoCA or MoCA-blind	88
Mental health	
A default assessment for anxiety and depression can be the Hospital Anxiety and Depression Scale	94
A default assessment for post-traumatic stress disorder can be the Impact of Events Scale-Revised or the six-item Impact of Event Scale-6	76
Physical	
A default objective assessment for physical problems can be the 6-min walk test and/or the EuroQol-5D-5L	67

MoCA = Montreal Cognitive Assessment, PICS = post-intensive care syndrome.
Strong and weak recommendations, respectively, defined as agreement of 80% and 60%.

Key Outcomes

In summary, there was agreement that prediction of post-ICU problems and providing anticipatory guidance to survivors of critical illness are tasks ICU researchers and clinicians should take on. There was agreement that the broad framework of PICS remains useful for organizing an approach to caring for these patients, albeit with an increasing emphasis on the social aspects of their recovery.

There is no one best tool that can be systematically applied to identify patients with, or at risk for, PICS. Individualized clinical judgment in the context of team-based care remains the foundation here, as with other aspects of clinical care. There remains an urgent need to refine and test the comparative effectiveness of varying strategies to meet the care of diverse survivors of critical illness.

While awaiting the results of such research and practice innovation to improve outcomes of survivors of critical illness, we recommend that assessment for PICS should occur early (e.g., within 2–4 wk of hospital discharge), continue along the path of recovery (i.e., serial, sustained assessments), be prioritized among the high-risk patients identified, and use the identified screening tools (Tables 1–4). Herein, the serial, sustained assessments would guide and inform the patient's care plan, in concert with rehabilitation specialists, to address the identified problems.

Functional Assessments Across the Care Continuum

We focused our recommendations on fundamental questions related to posthospital discharge assessments. Combined with

recommendations from the second stakeholder conference to improve long-term outcomes (6), clinicians now have an approach to assess survivors of critical illness across the continuum of care.

In the ICU, consistent with the recommendation that "prediction of post-ICU problems and anticipatory guidance is a task ICU clinicians should try to take on," providers should obtain an assessment of a patient's pre-ICU functional abilities as part of their admission history and physical examination (e.g., independent, needs assistance, dependent) (6). This pre-ICU functional assessment should be documented in the history and physical, to serve as a reference for post-ICU clinicians, and communicated during handoff as the patient transitions out of the ICU (**Fig. 1**).

As hospital discharge approaches, clinicians should use brief, standardized assessments and compare these results to patient's pre-ICU functional abilities. This concept, described as "functional reconciliation" to mirror the established practice of "medication reconciliation," was previously recommended as a care coordination strategy to more effectively identify and manage impairments across the continuum (6). Practically, this approach is intended to inform the discharge decision for whether to refer the patient for postacute care, such as a long-term acute care facility, skilled nursing facility, inpatient rehabilitation, home health, or outpatient rehabilitation.

At-risk patients should be assessed for PICS-related problems within 2–4 weeks after discharge, with serial assessments occurring with important health and life changes (Tables 3 and 4). Prior systematic reviews identified preexisting problems in cognition, mental health, and/or physical function as risk factors for functional decline after critical illness, highlighting the need to incorporate "functional reconciliation" into practice. As detailed in Table 1, we also identified risk factors "during" critical illness, such as incidence and duration of delirium, sepsis, ARDS, and memories of frightening experiences in the ICU, and "after" critical illness (e.g., early symptoms of anxiety, depression, or PTSD), that can be ascertained through review of a well done discharge summary and direct questioning to identify patients at risk for PICS.

In high-risk patients, defined as survivors with one or more of the risk factors included in Table 1, screening should be conducted using the recommended tools (Tables 3 and 4), with positive findings prompting referrals for services and/or more detailed assessments, as indicated. With the exception of the 6-minute walk, given the pandemic, it is notable that each screening tool can be administered via telemedicine to facilitate timely referral.

While the core domains of PICS have remained consistent, the recommended approach is consistent with the emerging understanding that PICS is not a static set of problems, but rather a chronic illness that starts in, or even before, the ICU and changes through the ICU stay and after discharge. Thus, serial assessments and flexible interventions are likely required to meet the needs of patients recovering from critical illness.

Strengths and Limitations

We engaged an international, multidisciplinary panel of clinical and research experts. Our deliberations were informed by patient perspectives, practical experience from leaders of the Thrive Post-ICU Clinic and Peer Support Collaboratives, the expertise of leading researchers, a systematic review of prior research, and a novel systematic review. Nevertheless, we acknowledge as a limitation that these recommendations are based on expert opinion, a modest literature base, and did not use formal GRADE methodology. Although we included PICS experts providing care to survivors as part of the Thrive Collaboratives, we did not include the perspectives of outpatient providers not involved in the Collaboratives. Because most survivors receive care outside of the growing Thrive network, ongoing partnership with organizations representing these important stakeholders is needed.

Our focus on pragmatic, clinically relevant recommendations to improve long-term outcomes built upon the foundation of the first two SCCM stakeholder meetings.

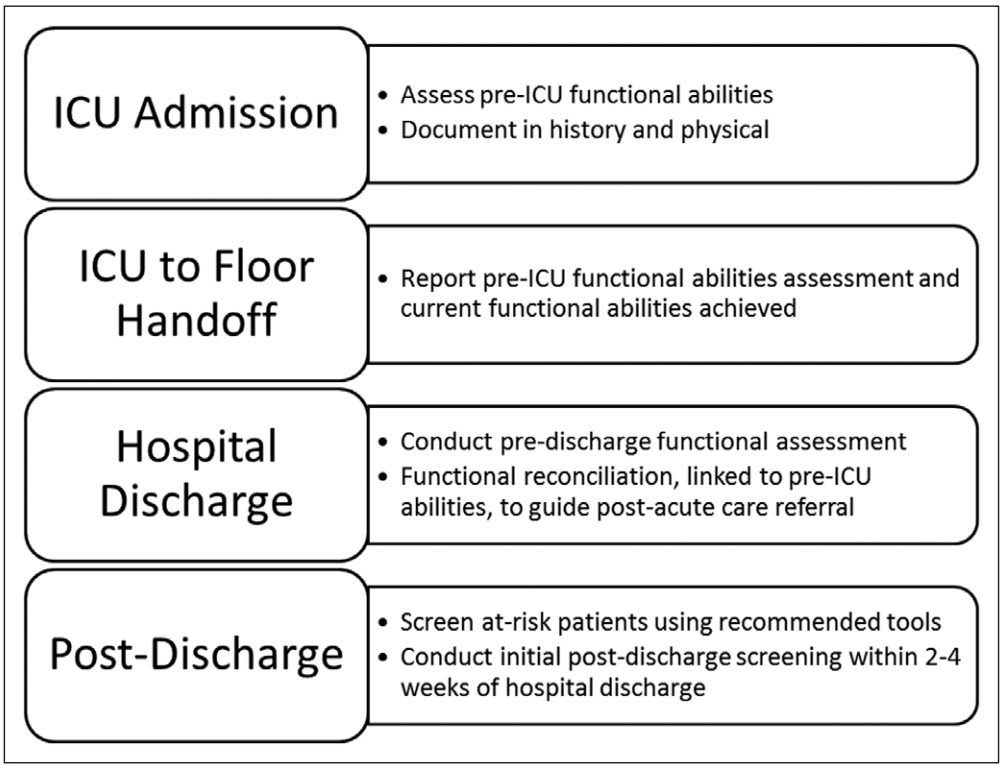

Figure 1. Recommended approach to functional assessments across the continuum of critical illness and recovery.

While the findings of this report can be used to inform a future research agenda, which was not the primary objective of this meeting. However, we acknowledge the importance of addressing the research gaps in terms of PICS prediction and identification and have provided recommendations to advance the science in the field herein and in the appendices and accompanying manuscripts. Although we did not address it at this time, implementation of the recommendations may benefit from the design and dissemination of standardized educational tools and related resources (i.e., documentation and communication tools). As one resource, we recommend the survey instrument database created as part of the core outcomes set (16, 62). The database provides information for each of the recommended screening tools, including a description of the instrument, administration and scoring information, and details regarding requirements and fees, if applicable (62). Studies designed to examine implementation of these recommendations, including feasibility, acceptability, sustainability, and fidelity, will be needed, in addition to studies designed to examine whether these recommendations result in improvement in long-term outcomes for survivors. Last, while research data suggests clinicians should anticipate improvement over time among survivors after discharge (60, 61, 63), consistent with the patient perspective provided in Dallas, each survivor's journey will be unique.

CONCLUSIONS

Combined with recommendations from the second SCCM stakeholder conference to improve long-term outcomes, clinicians now have an approach to assess survivors of critical illness across the continuum of care. Postdischarge, we recommend that serial assessments for PICS-related problems begin early (i.e., within 2–4 weeks of hospital discharge), be prioritized among high-risk patients, using the identified screening tools.

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For information regarding this article, E-mail: mark.mikkelsen@uphs.upenn.edu

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