Resilience in Survivors of Critical Illness in the Context of the Survivors' Experience and Recovery

Jason H. Maley¹, Isabel Brewster², Iris Mayoral², Renata Siruckova², Sarah Adams², Kelley A. McGraw³, Angela A. Piech³, Michael Detsky^{4,5}, and Mark E. Mikkelsen^{1,6,7}

¹Department of Medicine; ⁶Pulmonary, Allergy, and Critical Care Division, Department of Medicine; and ⁷Center for Clinical Epidemiology and Biostatistics, Perelman School of Medicine at the University of Pennsylvania, ²School of Nursing, University of Pennsylvania, and ³Medical Intensive Care Unit, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania; and ⁴Interdivisional Department of Critical Care, University of Toronto, and ⁵Division of Respiriology, Department of Medicine, Mount Sinai Hospital/University Health Network, Toronto, Ontario, Canada

Abstract

Rationale: Post-intensive care syndrome (PICS), defined as new or worsening impairment in cognition, mental health, or physical function after critical illness, is an important development in survivors. Although studies to date have focused on the frequency of these impairments, fundamental questions remain unanswered regarding the survivor experience and the impact of the critical illness event on survivor resilience and recovery.

Objectives: To examine the association between resilience and neuropsychological and physical function and to contextualize these findings within the survivors' recovery experience.

Methods: We conducted a mixed-methods pilot investigation of resilience among 43 survivors from two medical intensive care units (ICUs) within an academic health-care system. We interviewed survivors to identify barriers to and facilitators of recovery in the ICU, on the medical ward, and at home, using qualitative methods. We used a telephone battery of standardized tests to examine resilience, neuropsychological and physical function, and quality of life. We examined PICS in two ways. First, we identified how frequently survivors were impaired in one or more domains 6–12 months postdischarge. Second, we identified how frequently survivors reported that neuropsychological or physical function was worse.

Measurements and Main Results: Resilience was low in 28% of survivors, normal in 63% of survivors, and high in 9% of survivors. Resilience was inversely correlated with self-reported executive dysfunction, symptoms of anxiety, depression, and post-traumatic stress disorder, difficulty with self-care, and pain ($P < 0.05$). PICS was present in 36 survivors (83.7%; 95% confidence interval, 69.3–93.2%), whereas 23 survivors (53.5%; 95% confidence interval, 37.6–68.8%) reported worsening of neuropsychological or physical function after critical illness. We identified challenges along the recovery path of ICU survivors, finding that physical limitations and functional dependence were the most frequent challenges experienced in the ICU, medical ward, and on return to home. Spiritual and family support facilitated recovery.

Conclusions: Resilience was inversely correlated with neuropsychological impairment, pain, and difficulty with self-care. PICS was present in most survivors of critical illness, and 54% reported neuropsychological or physical function to be worse, yet resilience was normal or high in most survivors. Survivors experienced many challenges during recovery, while spiritual and family support facilitated recovery.

Keywords: critical care; survivorship; resilience; cognitive impairment; quality of life

(Received in original form November 25, 2015; accepted in final form March 5, 2016)

Supported in part by the National Institutes of Health, National Heart, Lung, and Blood Institute (NIH NHLBI) Loan Repayment Program, Bethesda, Maryland (M.E.M.) and the National Institutes of Health, National Institute of Nursing Research (NIH NINR; R01 NR016014 01) (M.E.M.).

Author Contributions: Conception and design: M.E.M., M.D., R.S., S.A., A.A.P. Data collection: J.H.M., M.E.M., R.S., K.A.M., I.B., I.M., S.A., A.A.P. Analysis and interpretation of the data: J.H.M., M.E.M. Drafting of the manuscript: J.H.M., M.E.M. Critical revision of the article for important intellectual content: J.H.M., M.E.M., R.S., K.A.M., I.B., I.M., S.A., A.A.P., M.D.

Correspondence and requests for reprints should be addressed to Mark E. Mikkelsen, M.D., M.S.C.E., Pulmonary, Allergy, and Critical Care Division, Perelman School of Medicine, University of Pennsylvania, Gates 05.042, 3400 Spruce Street, Philadelphia, PA 19104. E-mail: mark.mikkelsen@uphs.upenn.edu

Ann Am Thorac Soc Vol 13, No 8, pp 1351–1360, Aug 2016

Copyright © 2016 by the American Thoracic Society

DOI: 10.1513/AnnalsATS.201511-782OC

Internet address: www.atsjournals.org

An estimated 5.7 million patients are admitted to intensive care units (ICU) each year (1). Because of advances in critical care, the majority of critically ill patients survive. Cognitive, psychiatric, and physical impairment appear to be common after critical illness (2–8), leading to the notion that survivorship will be the defining challenge of modern-day critical care (9).

Post-intensive care syndrome (PICS), defined as new or worsening impairment in cognition, mental health, or physical function after critical illness (10), has been foreshadowed as a “hidden public health disaster” (11). Neuropsychological and physical impairment have been associated with medication nonadherence (12), an inability to return to work (13), decreased quality of life (3, 4, 14), and functional disability (2). If unrecognized, these impairments could undermine long-term health and health-related quality of life.

To date, studies have focused on the frequency of impairments and reduced health-related quality of life among survivors (2–8). Although critically important, as our understanding of the burden of impairments matures and we begin to focus on restoring health and facilitating recovery, it is imperative that we better understand the experience of survivors and the impact of the critical illness event on survivors’ resilience and recovery. Resilience, a modifiable psychological trait, relates to one’s ability to adapt and adjust (15). Resilience, in the context of cancer survivorship, has been associated with health and psychosocial outcomes (16, 17). Among survivors of critical illness, survivors’ resilience, and the association between resilience and neuropsychological and physical function, has not been studied.

Related, as the qualitative experience of survivors of critical illness have focused on severe sepsis and acute respiratory distress syndrome (18, 19), it is largely unknown what challenges survivors face during recovery and what factors facilitate recovery. This contextual knowledge is essential as we design health care to meet the needs of survivors by bolstering their resilience and mitigating the risk of PICS.

In a mixed-methods study, we examined resilience and neuropsychological and physical function in survivors of critical illness. We hypothesized that resilience would be low among survivors of critical illness given the anticipated

burden of neuropsychological and physical impairment. We hypothesized that impairments would frequently coexist, and that resilience would be associated with neuropsychological and physical function. To contextualize survivors’ resilience and long-term outcomes, and to improve care coordination and facilitate recovery, we conducted a qualitative study to understand the challenges experienced by survivors from ICU admission to home and the factors that facilitated recovery.

Methods

Study Design and Population

We conducted a mixed-methods investigation to examine the long-term outcomes of survivors of critical illness and to understand the recovery experience. We contacted survivors from two medical intensive care units (MICUs) affiliated with the University of Pennsylvania Health System: the Hospital of the University of Pennsylvania (HUP, Philadelphia, PA) and Penn Presbyterian Medical Center (PMC, Philadelphia, PA). The HUP MICU is a 24-bed unit with approximately 1,600 annual admissions, and the PMC MICU is a 12-bed unit with approximately 950 annual admissions. Approximately 28% of patients admitted to the HUP MICU, and 18% of those admitted to the PMC MICU, die or transition to hospice during the hospitalization.

Survivors were contacted by phone 6–12 months after a hospitalization that included a MICU admission between January and May, 2014. The target population included survivors with a MICU length of stay of at least 2 days

who were not discharged to hospice. Eligible subjects were identified using a previously validated administrative clinical database (20). The study was reviewed and approved by the institutional review board with the use of verbal informed consent (protocol #820066).

Eligible subjects were contacted via telephone, using contact information provided during the index hospitalization. The battery and the survey were administered by trained investigators, each of whom had demonstrated competency after a mock interview with the lead investigator (M.E.M.). We contacted eligible subjects by phone on at least two occasions. If we were unable to contact the subject after multiple, separate attempts (21), we considered the patient lost to follow-up. At enrollment, each interviewer obtained verbal informed consent before administering the test battery and interview survey, using a standardized script.

Data Collection

We assessed survivors’ neuropsychological and physical function, resilience, and health-related quality of life, using a telephone battery of standardized instruments (Table 1) (22–31). As a telephone-based assessment, we selected instruments that permitted us to identify self-reported impairments in neuropsychological and physical function.

Although identifying impairment after critical illness is an important aim regardless of the temporal relationship to critical illness, to understand the impact of the critical illness event on survivors’ lives, we also sought to examine whether survivors viewed their function as worse (PICS-worse). Accordingly, after

Table 1. Long-term outcomes measured in survivors of medical critical illness

Domain	Instrument	Range	Reference(s)
Cognition	Health Utilities Index-3 (HUI-3) cognitive questions	See METHODS	22
Anxiety	Hospital Anxiety and Depression Scale	0–21	23
Depression	Hospital Anxiety and Depression Scale	0–21	23
Post-traumatic stress disorder	Post-Traumatic Stress Syndrome 10-Questions Inventory	7–70	24
Resilience	Connor-Davidson Resilience Scale (CD-RISC 10)	0–40	25, 26
Mobility/social interaction	Life-Space Questionnaire	See METHODS	28, 29
Quality of life	EuroQoL (EQ-5D-5L)	VAS 0–100	31

Definition of abbreviation: VAS = visual analog scale.

completing the instruments, survivors were asked to describe their mental health and physical function as better, worse, or the same compared with before their ICU stay. In survivors who self-reported that they were “somewhat” forgetful or worse, or having at least “a little difficulty” with thinking and solving day-to-day problems in response to the cognitive questions from the Health Utilities Index-3 (HUI-3) (22), follow-up questions were asked to determine whether these difficulties were the same, better, or worse compared with before their ICU stay. Health-related quality of life was assessed with the EuroQol 5D-5L survey (31). The use of the HUI-3 was limited to assessing self-reported cognitive function.

We designed and administered an original questionnaire to assess challenges faced by patients during care transitions from the ICU to home. We asked survivors to identify the three most significant challenges that they faced during each of the following periods: while in the ICU, transitioning to the medical ward, and transitioning to home. To understand factors that facilitated recovery, survivors were asked what helped in their recovery. To capture saliency (32), we ranked the frequency of the three elicited responses to understand survivors’ recovery experience. Open-ended responses were recorded on the case report form and were not audiotaped.

Long-Term Outcomes

Resiliency was measured with the Connor–Davidson Resiliency 10-Item Scale, given its favorable psychometric properties among available resilience scales, and was categorized according to established population-based norms (25–27). High resiliency was defined as 1 standard deviation above the population mean (≥ 38), normal as 27–37, and low resiliency as 1 standard deviation below the population mean (≤ 26) (25, 26). Accordingly, the expected rate of low and high resilience among those tested should be 16%, respectively.

The presence of PICS was identified in two ways. First, we identified how frequently survivors were impaired in one or more of the following domains: cognition, mental health, or physical function (10). A score of 8 or greater on the anxiety or depression subscale of the Hospital Anxiety and Depression Scale (HADS) was used to

identify symptoms of clinically significant anxiety or depression (23, 33). A Post-Traumatic Stress Symptoms 10-Question Inventory (PTSS-10) score of 35 or greater defined impairment related to post-traumatic stress disorder (PTSD) (24). Cognitive impairment was defined as present if the survivor self-reported being “somewhat forgetful” or worse or having more than “a little difficulty” in his or her ability to think and solve day-to-day problems (22). Functional impairment, assessed using the mobility domain of the EuroQol 5D-5L survey (31), was defined as present in survivors reporting moderate problems or worse in walking (34). Second, as impairment may have predated critical illness and to further understand survivors’ resilience, we separately identified how frequently survivors reported that their cognition, mental health, or physical function was worse after critical illness (PICS-worse).

The Life Space Questionnaire, with responses ranging from activity restricted to one’s home, porch, yard, neighborhood, town, or beyond within the past week, was

used as a complementary assessment of mobility (28–30). Further, as a surrogate for social interaction that predicts neuropsychological function (28–30), we included this measure to contextualize survivors’ post-critical illness experience. The life space assessment was not used to define physical impairment.

Data Analysis

We summarized categorical data using counts and percentages, and continuous variables using means and standard deviations or medians and interquartile ranges, depending on the observed distribution. We used a Student *t* test or Wilcoxon rank-sum test to compare continuous variables and the χ^2 test or Fisher exact test to compare categorical variables across groups. We used the Spearman correlation coefficient to examine the association between resilience and self-reported cognitive function (memory problems and executive dysfunction), anxiety, depression, PTSD, mobility, difficulties with self-care or usual activities, and pain.

Figure 1. Flow diagram of study cohort. **Incapacitated* included two hearing-impaired survivors, two cognitively impaired survivors, two survivors in hospice, and one in a nursing home.

For qualitative analysis of the open-ended responses, two investigators (J.H.M., M.E.M.) blinded to subject characteristics independently categorized the responses, by question, into themes. The investigators then met to discuss the assigned themes until reaching consensus on the identified themes, and to confirm that thematic saturation had been achieved. Subsequently, statements were recategorized accordingly and themes are presented according to the frequency encountered. The sample size for the survivor cohort was not calculated *a priori*; rather, we concluded the pilot study at the time that saturation appeared to have been achieved.

Results

Patient Characteristics

Of 409 survivors of critical illness discharged between January and May, 2014, we contacted 159; 45 consented and 43 survivors completed interviews (Figure 1). Eligible patients who were not contacted were not contacted because their eligibility window had elapsed. The 43 survivors who

comprise the survivor cohort were contacted a median of 8 months postdischarge (interquartile range, 6–10; range, 5–12). Interviews were completed over approximately 30 minutes.

In general, survivors were middle-aged females with one or more hospitalizations in the prior year. During the hospitalization, 46% received mechanical ventilation, 44% were coded as having sepsis, and 35% were coded as having shock. At discharge, despite lengthy hospitalizations (median, 14 d; interquartile range, 7–24), 84% were discharged home. Compared with eligible survivors not interviewed, there was no significant difference regarding sociodemographics, comorbid conditions, acute conditions during the index hospitalization (e.g., use of mechanical ventilation), or ICU or hospital length of stay (Table 2).

Qualitative Analysis of Semistructured Questions Related to Recovery Experience

Patients reported physical weakness, cognitive impairment, mental health issues, and difficulties with eating and communication as

the most significant challenges faced while in the ICU (Table 3). When transitioning to and while on the medical floor, dependence on others, symptoms (e.g., pain, dyspnea), and ongoing physical weakness and mental health issues were the most significant challenges reported. Related to the transition home, physical limitations, their impact on performing activities of daily living, lingering symptoms and mental health issues, and difficulties scheduling and coordinating follow-up appointments were identified challenges to recovery. Finally, patients reported that spiritual and family support, information and reassurance provided by clinicians, receipt of postdischarge services, and a positive outlook facilitated recovery. No additional themes emerged from the last five survivors interviewed.

Long-Term Outcomes

Cognition, mental health, and physical function. Self-reported impairment was common, with 58% of survivors reporting symptoms of anxiety, depression, and/or PTSD; 56% reporting physical impairment; and 56% reporting some degree of memory problems or difficulty with thinking clearly or solving problems (Table 4). Among survivors reporting symptoms of psychiatric impairment, 24% had symptoms limited to one domain, 32% had symptoms in two domains, and 44% had symptoms in all three domains.

We found that 36 survivors (83.7%; 95% confidence interval [CI], 69.3–93.2%) met criteria for PICS, defined as self-reported impairment in cognition, mental health, or physical function. The frequency of PICS ranged from 90.9% at HUP (20 of 22) to 76.2% at PMC (16 of 21). Among 43 survivors, 24 (55.8%; 95% CI, 39.9–70.9) were impaired in at least two of the PICS domains, and 14 (32.6%; 95% CI, 19.1–48.5) were impaired in all three PICS domains.

Using the “PICS-worse” approach, we found that 23 survivors (53.5%; 95% CI, 37.6–68.8%) reported worsening of neuropsychological or physical function after critical illness. Specifically, as shown in Table 4, 42% of survivors reported that physical function was worse after critical illness; 46 and 50% of survivors reported that their memory or ability to think or solve day-to-day problems were worse after critical illness, respectively; and 28% reported that their mental health was worse after critical illness.

Table 2. Characteristics of survivor cohort interviewed, compared with eligible survivors not interviewed and who were discharged during the same period (January–May 2014)

Variable	Survivors Interviewed (n = 43)	Survivors Not Interviewed (n = 366)	P Value
Age, yr	59 ± 15	59 ± 16	0.98
Male sex, no. (%)	18 (41.9)	186 (50.8)	0.27
Race, no. (%)			
White	14 (32.6)	152 (41.5)	0.57
Black	25 (58.1)	178 (48.6)	
Asian	0 (0)	7 (1.9)	
Other	4 (9.3)	29 (7.9)	
Marital status			
Married	16 (37.2)	156 (42.6)	0.68
Single/never married	20 (46.5)	145 (39.6)	
Divorced/separated/widowed	7 (16.3)	65 (17.8)	
No. of hospitalizations in prior year			
0	20 (46.5)	159 (43.4)	0.84
1–5	18 (41.9)	170 (46.4)	
>5	5 (11.6)	37 (10.1)	
Charlson comorbidity score	2 (1–4)	3 (1–5)	0.11
Mechanical ventilation during ICU stay	20 (46.5)	175 (47.8)	0.87
Sepsis during hospitalization	19 (44.2)	175 (47.8)	0.65
Shock during hospitalization	15 (34.9)	132 (36.1)	0.88
Length of ICU stay, d	5.1 (2.5–11.3)	4.4 (2.8–7.7)	0.87
Length of hospital stay, d	14.1 (6.9–24.1)	11.7 (7.0–20.3)	0.33
Discharge to home	36 (83.7)	272 (74.3)	0.18

Definition of abbreviation: ICU = intensive care unit.

Categorical variables are presented as counts and percentages; continuous variables are presented according to their observed distribution (means and standard deviation for normally distributed variables and medians and interquartile ranges for nonnormally distributed variables).

Table 3. Challenges related to and facilitators of recovery as reported by survivors, categorized by theme

Location	Theme	Patients Reporting [n (%)]	Examples
Recovery Challenges across the Continuum of Care			
Intensive care unit	Physical weakness	21 (48.8)	"Being in the MICU was scary. I was afraid I would not wake up. I was too weak to make it to the bathroom and [...] all over the floor. I felt really embarrassed but everyone was incredibly kind and professional."
	Cognition	15 (34.9)	"In the beginning, in the ICU, I was very confused and couldn't communicate with people."
	Mental health, including anxiety, fear, and nightmares	15 (34.9)	"I can't remember 2 wk of my ICU stay, which is a challenge. [It's] hard to get used to the idea that you needed help, that you were essentially handicapped."
	Difficulties with eating or communication	8 (18.6)	
	Symptoms, including pain, dyspnea, and insomnia	6 (14.0)	
Medical ward	Other*	6 (14.0)	
	Dependence, including inability to feed one's self	14 (32.6)	"Feeling weak. I didn't even have the strength to feed myself."
	Symptoms, including pain, dyspnea, insomnia, and loss of appetite	14 (32.6)	"Trying to move and ambulate. Trying to remember what happened. Dealing with the pain."
	Physical weakness	12 (27.9)	"Overcoming the loneliness of being in the hospital."
	Mental health, including anxiety, fear, PTSD, loneliness, abandonment, and difficulty coping	12 (27.9)	"Floor nurses and doctors don't have as much time to spend with you and can't really spend the same time listening to the patient to figure out what is wrong. It makes the patient less involved in their care."
After discharge	Cognition	4 (9.3)	
	Difficulties with communication	4 (9.3)	
	Other†	4 (9.3)	
	Physical weakness	21 (48.8)	"Everything was a challenge. I had no strength to do anything."
	Symptoms, including pain, fatigue, dyspnea, insomnia, and loss of appetite	11 (25.6)	"Doing everyday things [at home] was hard without help constantly there."
	Difficulty with activities of daily living	11 (25.6)	"I felt like I was never going to be myself again, feeling depressed, I would have liked to have had more support from physicians like psychiatrists to talk to."
	Mental health, including anxiety, stress, depression, memory problems, and request for access to mental health services	9 (20.9)	"I could have used an explanation of the hospital stay. I'm still confused about what happened, and that is concerning to me."
	Difficulty scheduling and coordinating follow-up appointments	6 (14.0)	"Home care nurses are not provided enough information about the hospital stay. They should be in touch with my PCP and specialists. [The] discharge information is really vague. I wish people would spend more time going over it with patients."
	Substance rehabilitation	3 (7.0)	
	Other‡	6 (14.0)	
Facilitators of Recovery			
	Support (spiritual, family)	13 (30.2)	"While in the hospital, the chaplain who came was extremely helpful. And the fact that he kept coming back meant a lot."
	Information, engagement, and reassurance provided by staff	10 (23.2)	"My religious faith was very helpful."
	Postdischarge services (physical therapy, home nursing)	9 (20.9)	"You have to have support from family and friends, otherwise it's very hard to recover."

(Continued)

Table 3. (Continued)

Location	Theme	Patients Reporting [n (%)]	Examples
	Staying positive	8 (18.6)	"In the ICU, they treated my wife like one of the team. That was very important to me. They often invited her to rounds."
	Other [§]	3 (7.0)	"I liked feeling like I was part of the decision-making." "Physical therapists were really helpful in getting me up and moving at the hospital and rehab." "Stay positive. Be motivated." "After surgery, a woman came in and asked if I would like to hear some music. They brought guitars into my room and played music. I found it to be incredibly uplifting."

Definition of abbreviations: ICU = intensive care unit; MICU = medical intensive care unit; PCP = primary care physician; PTSD = post-traumatic stress disorder. *In the ICU, other responses included feeling embarrassed (n = 2), guilty (n = 1), abandoned (n = 1), anesthesia awareness (while paralyzed) (n = 1), and addiction-related challenges (n = 1).

[†]On the medical ward, other responses included an inability to recover (n = 2) and withdrawal symptoms (n = 2).

[‡]After discharge, other responses included difficulties with new equipment (n = 2), medication side effects (n = 1), urinary incontinence (n = 1), and difficulties speaking (n = 1).

[§]Other factors that aided recovery included music (n = 1), mindfulness practice (n = 1), and Caring Bridges to keep family and friends updated (n = 1).

Resilience and Health-Related Quality of Life

Despite these impairments, resilience was low in 28% of survivors, normal in 63% of survivors, and high in 9% of survivors. As shown in Table 5, resilience was moderately and inversely correlated with self-reported executive dysfunction; symptoms of anxiety, depression, and PTSD; difficulty with self-care; and pain. In contrast to reported rates of physical impairment, but consistent with the observed resilience scores, most survivors had been outside of their town (63%, 27 of 43) or neighborhood (16%, 7 of 43) in the past week, leaving 14% (6 of 43) confined to the neighborhood and 7% (3 of 43) to home.

In general, health-related quality of life was slightly below established population norms (31). Specifically, 58% of survivors reported moderate problems or worse in walking, 35% reported moderate problems or worse in washing or dressing, 51% reported moderate problems or worse in performing usual activities, 42% reported moderate pain or discomfort or worse, and internally consistent with the HADS, 51% reported being moderately anxious or depressed or worse.

Discussion

We conducted a mixed-methods study of survivors of medical critical illness to better understand the experience of survivors and the impact of the critical illness event on survivors' resilience and recovery. In

this pilot investigation of resilience, we examined the association between resilience and long-term neuropsychological and physical function and complemented these data with the results from qualitative analyses detailing the survivors' experience from the ICU to home.

We confirmed that most survivors report cognitive, psychiatric, or physical impairment consistent with PICS 6–12 months postdischarge, with alarmingly high rates in survivors from two MICUs. The frequency of impairments observed was consistent with studies that have focused on cognition (7, 35), mental health (33, 36–39), and physical function (8, 36). We found that co-occurrence of long-term neuropsychological and physical impairment was common, as more than one-half of the survivors reported impairment in two or more domains and one-third reported impairment in all three.

Relevant to how the critical illness event impacts survivors' lives, 54% of survivors reported that long-term neuropsychological or physical function was worse after critical illness. This novel observation is notable for two reasons. First, it supports the notion that critical illness is frequently a life-altering event, as nearly one-half of survivors reported declines in cognitive and physical functioning and nearly one-quarter reported a decline in mental health. Second, our approach revealed a potential gap between the number of survivors with

apparent neuropsychological or physical impairment and the number who reported their functional abilities as worse after critical illness. Consistent with studies of survivors of severe sepsis (38, 39), one explanation for the observed gap is that preexisting functional impairment is common. An alternative explanation that warrants further investigation is that survivors may not recognize or may not self-report declines in functional abilities. Whether attributable to critical illness or not, these impairments, if unrecognized or undermanaged, could threaten a meaningful recovery.

We found that resilience was low in 28% of survivors, in contrast to expected rates of 16% based on population norms or the select population of lung transplantation candidates and recipients (40). However, contrary to our hypothesis, and in spite of the frequency and co-occurrence of functional impairments, resilience was normal or high in 72% of survivors. In fact, potentially reflecting the concepts of post-traumatic growth or thriving (41, 42), 21 and 23% of survivors reported that physical function and mental health were better after critical illness, respectively. Further, despite the functional limitations observed, travel within one's life space appeared largely intact, as nearly four of five survivors had traveled outside of their neighborhood or town in the past week.

As a dynamic, multidimensional, and potentially modifiable neuropsychological trait associated with the ability to adapt and

Table 4. Resilience, long-term physical and neuropsychological outcomes, and health-related quality of life in 43 critically ill survivors

Variable	Survivors (n = 43)	Worse [n (%)]
Resilience		
Resilience score	29 (25–34)	
Resilience		
Abnormal (≤ 26)	12 (27.9)	
Normal (27–37)	27 (62.8)	
Highly resilient (≥ 38)	4 (9.3)	
Physical Function		
Mobility		
I have no problems walking	10 (23.3)	18 (41.9)*
I have slight problems walking	8 (18.6)	
I have moderate problems walking	17 (39.5)	
I have severe problems walking	6 (14.0)	
I am unable to walk	2 (4.6)	
Cognition		
Cognitive impairment, no. (%)	24 (55.8)	
Memory		11 (45.8) [†]
Able to remember most things	19 (44.2)	
Somewhat forgetful	15 (34.9)	
Very forgetful	8 (18.6)	
Unable to remember anything at all	1 (2.3)	
Executive dysfunction		8 (50.0) [†]
Able to think clearly and solve problems	27 (62.8)	
Having a little difficulty	8 (18.6)	
Having a great deal of difficulty	8 (18.6)	
Unable to think or solve problems	0 (0.0)	
Mental Health		
Psychiatric symptoms	25 (58.1)	
Anxiety score	7 (4–11)	
Positive screening test, no. (%)	19 (44.2)	12 (27.9)*
Depression score	4 (3–10)	
Positive screening test, no. (%)	17 (39.5)	
Post-traumatic stress score	32 (20–41)	
Symptoms of PTSD, no. (%)	19 (44.2)	
Health-Related Quality of Life		
Health-related quality of life, EuroQol		
Descriptive score (5–25) [‡]	11 (8–15)	
Visual analog scale (0–100)	70 (50–80)	

Definition of abbreviations: PTSD = post-traumatic stress disorder.

*All survivors were asked to describe whether their physical function and mood and mental health, compared with before their ICU stay, were better, worse, or the same. For example, it was asked: "To the best of your ability, compared with before your ICU stay, would you describe your physical function, meaning your ability to walk, as: better, worse, same." For physical function, 20.9% stated they were better and 37.2% stated they were the same. For mood and mental health, 23.3% stated they were better and 48.8% stated they were the same.

[†]For survivors reporting difficulties with memory or thinking, a follow-up question was asked to examine trajectory. For example, in those self-reporting they were somewhat forgetful, it was asked: "To the best of your ability, compared with before your ICU stay, would you describe your ability to remember things as: better, worse, same." For survivors reporting difficulties with memory, 4.2% stated they were better and 50.0% stated they were the same. For survivors reporting difficulties with thinking, 50.0% stated they were the same after the ICU stay.

[‡]Greater score represents more perceived problems in dimensions assessed.

adjust (25–27), the trajectory of resilience in survivors warrants further investigation in longitudinal studies. These studies will need to be designed to more fully explore the multiple dimensions of resilience, which include personal characteristics, relationships, community, and spiritual influences (25–27), in addition to

examining what factors modify resilience (e.g., sociodemographics, cultural differences, social support). Further, because resilience was inversely correlated with self-reported executive dysfunction, symptoms of anxiety, depression, PTSD, pain, and difficulty performing self-care, future studies should examine the degree to which

resilience is responsive to care management and/or rehabilitation to mitigate cognitive and physical impairment (43–46), mood disorders (47), and chronic pain (48, 49). Effective strategies, which are desperately needed, could simultaneously bolster survivors' resilience and mitigate the risk of PICS.

To contextualize survivors' resilience and self-reported long-term outcomes, we interviewed survivors to understand the challenges faced during the hospitalization and postdischarge. Survivors revealed that they face diverse challenges along the road to recovery. Difficulties with physical weakness and cognition dominated the patient-reported challenges while in the ICU. The ABCDEF bundle, which encourages assessment for and management of pain, agitation, and delirium; the pairing of spontaneous awakening and breathing trials; the implementation of early mobilization; and family engagement, is a recommended strategy to mitigate the risk of neuropsychological and physical impairment (50–53).

While prior work on the patient experience in the ICU has focused on symptoms, such as thirst or hunger, our design enhances our understanding in this area by asking patients to share challenges encountered during recovery as well as factors that facilitated recovery. Consistent with the work of Field and colleagues (54), survivors revealed that fear, anxiety, and the stress of impaired communication were additional challenges encountered in the ICU that frequently continued on the ward. These findings complement work by Puntillo and colleagues that focused on patients at high risk of dying in the ICU that suggested that focused symptom assessment could lead to targeted interventions to more effectively relieve suffering (55). Finally, the frightening recollection of awakening paralyzed in the ICU, as shared by one survivor, serves as a testament to the importance of these types of investigations to understand the patient experience so as to improve patient care.

During the recovery phase that spanned the medical ward to home, dependence on others, disabling and enduring symptoms (e.g., pain, insomnia), ongoing physical impairments and mental health issues, and difficulties scheduling and coordinating follow-up appointments were identified as major challenges. These sentiments, paired with our finding that physical therapy was beneficial to the

Table 5. Correlations between resilience, neuropsychological and physical health, and health-related quality of life

	Memory Problems	Executive Dysfunction	Anxiety	Depression	PTSS-10	Mobility	Self-Care	Usual Activities	Pain/Discomfort
Resilience	−0.20	−0.34*	−0.49[†]	−0.47[†]	−0.53[†]	−0.23	−0.32*	−0.26	−0.33*

Definition of abbreviation: PTSS-10 = Post-Traumatic Stress Symptoms 10-Question Inventory.

Data presented in boldface signify significant correlations.

For correlations, higher scores in cognitive function, mental health, and health-related quality of life measures reflect greater difficulties.

* $P \leq 0.05$.

[†] $P \leq 0.001$.

[‡] $P \leq 0.01$.

recovery to some, suggest that there are significant unmet needs in terms of enduring physical impairments postdischarge. Given the salutary benefits of physical and occupational therapy on neuropsychological and physical function (43, 44), ongoing rehabilitation should have a central role in a survivor's recovery plan. When paired with cognitive rehabilitation, the potential to further improve mental and physical health (53), and reduce chronic pain (56), exists and requires further investigation.

Using the interviews as a blueprint to facilitate recovery, and in line with the construct of resilience and our findings, survivors reported spiritual and family support as facilitators to recovery. To augment existing support networks, peer support is another potentially valuable intervention (57, 58) that could complement a redesign of multidisciplinary follow-up care that aims to better support survivors and their family and caregivers. Consistent with the qualitative experience of survivors of acute respiratory distress syndrome and sepsis (18, 19, 59), clinicians have a profound therapeutic impact on survivors during recovery in terms of their ability to reassure, educate, rehabilitate, prepare, and support survivors for life after critical illness. The ICU diary is one novel strategy to personalize this process and improve long-term neuropsychological health (60, 61).

There are several potential limitations to our study. We interviewed a limited number of survivors from two MICUs from a single academic health center in the Philadelphia area who were living at home. Survivors of surgical critical illness, survivors from community settings and other regions, survivors with shorter ICU stays, and survivors too disabled to reside at home, may differ in terms of PICS prevalence and their qualitative experience. Although limited in sample size, our mixed-methods study was able to address

knowledge gaps in our understanding of critical care survivorship as intended. Our survivor cohort was similar to other established cohorts (7, 8) in terms of sociodemographics, comorbid conditions, and ICU course. When compared with eligible survivors not interviewed, the survivors interviewed did not differ significantly regarding sociodemographics, comorbid conditions, acute conditions during the index hospitalization, or length of stay. However, we acknowledge that the cohort studied may not represent general ICU survivors worldwide, and confirmatory studies are required.

Although self-report of functional abilities aligns with performance in general (62), future studies designed to examine the association between resilience and performance (rather than self-reported functional abilities) are necessary. Further, although our correlation analyses revealed potentially important associations between resilience and neuropsychological and physical function, we did not adjust for multiple comparisons. Related, more robust neuropsychological assessments, examining performance in a multitude of cognitive domains and using approaches that map to the *Diagnostic and Statistical Manual of Mental Disorders* to identify mental health disorders, are warranted in confirmatory studies.

To capture the voice of more survivors, future studies should be designed to enroll patients at the time of the index hospitalization and to identify the preferred means of contact (e.g., mobile phone number). Without longitudinal data between hospital discharge and the time of the interview, it is plausible that other events explain the impairments identified, and the rates of symptom remission and functional recovery require direct examination. Also, although our results are consistent with the existing literature (18, 19, 59), we acknowledge the potential for recall bias

regarding our qualitative analyses. Specifically, the ordering of the interview, with objective assessments followed by open-ended questions, may have resulted in a framing bias in terms of responses elicited. Further, recall may have been impaired in survivors with self-reported cognitive impairment. Our design was limited to a maximum follow-up of 12 months. Future studies, designed to examine survivors' experience over a longer time horizon, may identify continued recovery. Last, open-ended responses were recorded on the case report form and were not audiotaped, potentially limiting our ability to identify themes and to be able to report more examples. Further, a more iterative process and additional patients may have elucidated additional themes.

Conclusions

We found that resilience was inversely correlated with neuropsychological impairment and important aspects of quality of life such as chronic pain and difficulty with self-care. Yet, despite frequent self-reported impairments, resilience was normal or high in nearly three of four survivors. This pilot study highlights that additional work is required to better understand critical care survivorship and the resilience of survivors in particular as we aim to improve care coordination and facilitate recovery for this growing population. ■

Author disclosures are available with the text of this article at www.atsjournals.org.

Acknowledgment: The authors thank Michael Sims (Penn Presbyterian Medical Center) and Barry Fuchs, Cheryl Maguire, Stephanie Maillie, and Jessica Fuller (Hospital of the University of Pennsylvania), all of Philadelphia, Pennsylvania, for support of our work.

References

- Wunsch H, Angus DC, Harrison DA, Collange O, Fowler R, Hoste EAJ, de Keizer NF, Kersten A, Linde-Zwirble WT, Sandiumenge A, et al. Variation in critical care services across North America and Western Europe. *Crit Care Med* 2008;36:2787–2793, e1–e9.
- Iwashyna TJ, Ely EW, Smith DM, Langa KM. Long-term cognitive impairment and functional disability among survivors of severe sepsis. *JAMA* 2010;304:1787–1794.
- Hopkins RO, Weaver LK, Pope D, Orme JF, Bigler ED, Larson-LOHR V. Neuropsychological sequelae and impaired health status in survivors of severe acute respiratory distress syndrome. *Am J Respir Crit Care Med* 1999;160:50–56.
- Hopkins RO, Weaver LK, Collingridge D, Parkinson RB, Chan KJ, Orme JF Jr. Two-year cognitive, emotional, and quality-of-life outcomes in acute respiratory distress syndrome. *Am J Respir Crit Care Med* 2005;171:340–347.
- Mikkelsen ME, Christie JD, Lanken PN, Biester RC, Thompson BT, Bellamy SL, Localio AR, Demissie E, Hopkins RO, Angus DC. The Adult Respiratory Distress Syndrome Cognitive Outcomes Study: long-term neuropsychological function in survivors of acute lung injury. *Am J Respir Crit Care Med* 2012;185:1307–1315.
- Ehlenbach WJ, Hough CL, Crane PK, Haneuse SJ, Carson SS, Curtis JR, Larson EB. Association between acute care and critical illness hospitalization and cognitive function in older adults. *JAMA* 2010;303:763–770.
- Pandharipande PP, Girard TD, Jackson JC, Morandi A, Thompson JL, Pun BT, Brummel NE, Hughes CG, Vasilevskis EE, Shintani AK, et al.; BRAIN-ICU Study Investigators. Long-term cognitive impairment after critical illness. *N Engl J Med* 2013;369:1306–1316.
- Jackson JC, Pandharipande PP, Girard TD, Brummel NE, Thompson JL, Hughes CG, Pun BT, Vasilevskis EE, Morandi A, Shintani AK, et al.; Bringing to Light the Risk Factors and Incidence of Neuropsychological Dysfunction in ICU Survivors (BRAIN-ICU) Study Investigators. Depression, post-traumatic stress disorder, and functional disability in survivors of critical illness in the BRAIN-ICU study: a longitudinal cohort study. *Lancet Respir Med* 2014;2:369–379.
- Iwashyna TJ. Survivorship will be the defining challenge of critical care in the 21st century. *Ann Intern Med* 2010;153:204–205.
- Needham DM, Davidson J, Cohen H, Hopkins RO, Weinert C, Wunsch H, Zawistowski C, Bemis-Dougherty A, Berney SC, Bienvenu OJ, et al. Improving long-term outcomes after discharge from intensive care unit: report from a stakeholders' conference. *Crit Care Med* 2012;40:502–509.
- Angus DC. The lingering consequences of sepsis: a hidden public health disaster? *JAMA* 2010;304:1833–1834.
- Hinkin CH, Hardy DJ, Mason KI, Castellon SA, Durvasula RS, Lam MN, Stefaniak M. Medication adherence in HIV-infected adults: effect of patient age, cognitive status, and substance abuse. *AIDS* 2004;18:S19–S25.
- Rothenhäusler HB, Ehrentauf S, Stoll C, Schelling G, Kapfhammer HP. The relationship between cognitive performance and employment and health status in long-term survivors of the acute respiratory distress syndrome: results of an exploratory study. *Gen Hosp Psychiatry* 2001;23:90–96.
- Mikkelsen ME, Shull WH, Biester RC, Taichman DB, Lynch S, Demissie E, Hansen-Flaschen J, Christie JD. Cognitive, mood and quality of life impairments in a select population of ARDS survivors. *Respirology* 2009;14:76–82.
- Charney DS. Psychobiological mechanisms of resilience and vulnerability: implications for successful adaptation to extreme stress. *Am J Psychiatry* 2004;161:195–216.
- Rosenberg AR, Syrjala KL, Martin PJ, Flowers ME, Carpenter PA, Salit RB, Baker KS, Lee SJ. Resilience, health, and quality of life among long-term survivors of hematopoietic cell transplantation. *Cancer* 2015;121:4250–4257.
- Min JA, Yoon S, Lee CU, Chae JH, Lee C, Song KY, Kim TS. Psychological resilience contributes to low emotional distress in cancer patients. *Support Care Cancer* 2013;21:2469–2476.
- Cox CE, Docherty SL, Brandon DH, Whaley C, Attix DK, Clay AS, Dore DV, Hough CL, White DB, Tulskey JA. Surviving critical illness: acute respiratory distress syndrome as experienced by patients and their caregivers. *Crit Care Med* 2009;37:2702–2708.
- Gallop KH, Kerr CEP, Nixon A, Verdian L, Barney JB, Beale RJ. A qualitative investigation of patients' and caregivers' experiences of severe sepsis. *Crit Care Med* 2015;43:296–307.
- Jones TK, Fuchs BD, Small DS, Halpern SD, Hanish A, Umscheid CA, Baillie CA, Kerlin MP, Gaieski DF, Mikkelsen ME. Post-acute care use and hospital readmission after sepsis. *Ann Am Thorac Soc* 2015;12:904–913.
- Dinglas VD, Huang M, Sepulveda KA, Pinedo M, Hopkins RO, Colantuoni E, Needham DM; NIH NHLBI ARDS Network. Personalized contact strategies and predictors of time to survey completion: analysis of two sequential randomized trials. *BMC Med Res Methodol* 2015;15:5.
- Horsman J, Furlong W, Feeny D, Torrance G. The Health Utilities Index (HUI): concepts, measurement properties and applications. *Health Qual Life Outcomes* 2003;1:54.
- Zigmond AS, Snaith RP. The Hospital Anxiety and Depression Scale. *Acta Psychiatr Scand* 1983;67:361–370.
- Weisaeth L. Torture of a Norwegian ship's crew: the torture, stress reactions and psychiatric after-effects. *Acta Psychiatr Scand Suppl* 1989;355:63–72.
- Connor KM, Davidson JRT. Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). *Depress Anxiety* 2003;18:76–82.
- Campbell-Sills L, Forde DR, Stein MB. Demographic and childhood environmental predictors of resilience in a community sample. *J Psychiatr Res* 2009;43:1007–1012.
- Windle G, Bennett KM, Noyes J. A methodological review of resilience measurement scales. *Health Qual Life Outcomes* 2011;9:8.
- Barnes LL, Wilson RS, Bienias JL, de Leon CF, Kim HJ, Buchman AS, Bennett DA. Correlates of life space in a volunteer cohort of older adults. *Exp Aging Res* 2007;33:77–93.
- James BD, Boyle PA, Buchman AS, Barnes LL, Bennett DA. Life space and risk of Alzheimer disease, mild cognitive impairment, and cognitive decline in old age. *Am J Geriatr Psychiatry* 2011;19:961–969.
- Byles JE, Leigh L, Vo K, Forder P, Curryer C. Life space and mental health: a study of older community-dwelling persons in Australia. *Aging Ment Health* 2015;19:98–106.
- EuroQol Group. EuroQol—a new facility for the measurement of health-related quality of life. *Health Policy* 1990;16:199–208.
- Auriemma CL, Lyon SM, Strelec LE, Kent S, Barg FK, Halpern SD. Defining the medical intensive care unit in the words of patients and their family members: a freelist analysis. *Am J Crit Care* 2015;24:e47–e55.
- Bienvenu OJ, Colantuoni E, Mendez-Tellez PA, Shanholtz C, Dennison-Himmelfarb CR, Pronovost PJ, Needham DM. Cooccurrence of and remission from general anxiety, depression, and posttraumatic stress disorder symptoms after acute lung injury: a 2-year longitudinal study. *Crit Care Med* 2015;43:642–653.
- Jolley SE, Parsons EC, O'Mahony DS, Caldwell ES, Clermont G, Angus DC, Hough CL. Discharge destination as a surrogate marker for mortality and functional status in patients with acute lung injury at six months post-ICU stay [abstract]. *Am J Respir Crit Care Med* 2013;187:A4479.
- Wilcox ME, Brummel NE, Archer K, Ely EW, Jackson JC, Hopkins RO. Cognitive dysfunction in ICU patients: risk factors, predictors, and rehabilitation interventions. *Crit Care Med* 2013;41(9, Suppl 1):S81–S98.
- Desai SV, Law TJ, Needham DM. Long-term complications of critical care. *Crit Care Med* 2011;39:371–379.
- Davydow DS, Gifford JM, Desai SV, Needham DM, Bienvenu OJ. Posttraumatic stress disorder in general intensive care unit survivors: a systematic review. *Gen Hosp Psychiatry* 2008;30:421–434.
- Iwashyna TJ, Netzer G, Langa KM, Cigolle C. Spurious inferences about long-term outcomes: the case of severe sepsis and geriatric conditions. *Am J Respir Crit Care Med* 2012;185:835–841.

- 39 Davydow DS, Hough CL, Langa KM, Iwashyna TJ. Symptoms of depression in survivors of severe sepsis: a prospective cohort study of older Americans. *Am J Geriatr Psychiatry* 2013;21:887–897.
- 40 Feder A, Southwick SM, Goetz RR, Wang Y, Alonso A, Smith BW, Buchholz KR, Waldeck T, Ameli R, Moore J, *et al.* Posttraumatic growth in former Vietnam prisoners of war. *Psychiatry* 2008;71:359–370.
- 41 Nugent NR, Sumner JA, Amstadter AB. Resilience after trauma: from surviving to thriving. *Eur J Psychotraumatol* 2014;5:10.3402/ejpt.v5.25339.
- 42 Cohen DG, Christie JD, Anderson BJ, Diamond JM, Judy RP, Shah RJ, Cantu E, Bellamy SL, Blumenthal NP, Demissie E, *et al.* Cognitive function, mental health, and health-related quality of life after lung transplantation. *Ann Am Thorac Soc* 2014;11:522–530.
- 43 Schweickert WD, Pohlman MC, Pohlman AS, Nigos C, Pawlik AJ, Esbrook CL, Spears L, Miller M, Franczyk M, Deprizio D, *et al.* Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial. *Lancet* 2009;373:1874–1882.
- 44 Hopkins RO, Suchyta MR, Farrer TJ, Needham D. Improving post-intensive care unit neuropsychiatric outcomes: understanding cognitive effects of physical activity. *Am J Respir Crit Care Med* 2012;186:1220–1228.
- 45 Jackson JC, Ely EW, Morey MC, Anderson VM, Denne LB, Clune J, Siebert CS, Archer KR, Torres R, Janz D, *et al.* Cognitive and physical rehabilitation of intensive care unit survivors: results of the RETURN randomized controlled pilot investigation. *Crit Care Med* 2012;40:1088–1097.
- 46 Brummel NE, Jackson JC, Girard TD, Pandharipande PP, Schiro E, Work B, Pun BT, Boehm L, Gill TM, Ely EW. A combined early cognitive and physical rehabilitation program for people who are critically ill: the Activity and Cognitive Therapy in the Intensive Care Unit (ACT-ICU) trial. *Phys Ther* 2012;92:1580–1592.
- 47 Wunsch H, Christiansen CF, Johansen MB, Olsen M, Ali N, Angus DC, Sørensen HT. Psychiatric diagnoses and psychoactive medication use among nonsurgical critically ill patients receiving mechanical ventilation. *JAMA* 2014;311:1133–1142.
- 48 Battle CE, Lovett S, Hutchings H. Chronic pain in survivors of critical illness: a retrospective analysis of incidence and risk factors. *Crit Care* 2013;17:R101.
- 49 Kyranou M, Puntillo K. The transition from acute to chronic pain: might intensive care unit patients be at risk? *Ann Intensive Care* 2012;2:36.
- 50 Pandharipande P, Banerjee A, McGrane S, Ely EW. Liberation and animation for ventilated ICU patients: the ABCDE bundle for the back-end of critical care. *Crit Care* 2010;14:157.
- 51 Morandi A, Brummel NE, Ely EW. Sedation, delirium and mechanical ventilation: the “ABCDE” approach. *Curr Opin Crit Care* 2011;17:43–49.
- 52 Balas M, Buckingham R, Braley T, Saldi S, Vasilevskis EE. Extending the ABCDE bundle to the post-intensive care unit setting. *J Gerontol Nurs* 2013;39:39–51.
- 53 Girard TD, Kress JP, Fuchs BD, Thomason JW, Schweickert WD, Pun BT, Taichman DB, Dunn JG, Pohlman AS, Kinniry PA, *et al.* Efficacy and safety of a paired sedation and ventilator weaning protocol for mechanically ventilated patients in intensive care (Awakening and Breathing Controlled trial): a randomised controlled trial. *Lancet* 2008;371:126–134.
- 54 Field K, Prinjsa S, Rowan K. “One patient amongst many”: a qualitative analysis of intensive care unit patients’ experiences of transferring to the general ward. *Crit Care* 2008;12:R21.
- 55 Puntillo KA, Arai S, Cohen NH, Gropper MA, Neuhaus J, Paul SM, Miaskowski C. Symptoms experienced by intensive care unit patients at high risk of dying. *Crit Care Med* 2010;38:2155–2160.
- 56 Morley S, Eccleston C, Williams A. Systematic review and meta-analysis of randomized controlled trials of cognitive behaviour therapy and behaviour therapy for chronic pain in adults, excluding headache. *Pain* 1999;80:1–13.
- 57 Mikkelsen ME, Iwashyna TJ, Thompson C. Why ICU clinicians need to care about post-intensive care syndrome. *Critical Connections* 2015; 14:4. Available from: <http://www.sccm.org/Communications/Critical-Connections/Archives/Pages/Why-ICU-Clinicians-Need-to-Care-about-Post-Intensive-Care-Syndrome.aspx>
- 58 Mikkelsen ME, Jackson JC, Hopkins RO, Thompson C, Andrews A, Netzer G, *et al.* Peer support as a novel strategy to mitigate post-intensive care syndrome. *AACN Adv Crit Care* 2016;27:221–229.
- 59 Lee CM, Herridge MS, Matte A, Cameron JI. Education and support needs during recovery in acute respiratory distress syndrome survivors. *Crit Care* 2009;13:R153.
- 60 Jones C, Bäckman C, Capuzzo M, Egerod I, Flaatten H, Granja C, Rylander C, Griffiths RD; RACHEL Group. Intensive care diaries reduce new onset post traumatic stress disorder following critical illness: a randomised, controlled trial. *Crit Care* 2010;14:R168.
- 61 Garrouste-Orgeas M, Coquet I, Périer A, Timsit JF, Pochard F, Lancrin F, Philippart F, Vesin A, Bruel C, Blot Y, *et al.* Impact of an intensive care unit diary on psychological distress in patients and relatives. *Crit Care Med* 2012;40:2033–2040.
- 62 Coman L, Richardson J. Relationship between self-report and performance measures of function: a systematic review. *Can J Aging* 2006;25:253–270.