Socioeconomic Position and Health Outcomes Following Critical Illness: A Systematic Review

Jennifer R. A. Jones, DPT1,2; Sue Berney, PhD1,2; Bronwen Connolly, PhD1,3,4,5; Jamie L. Waterland, BPT(Hons)1; Linda Denehy, PhD6,7; David M. Griffith, MD8; Jennifer R. A. Jones, DPT1,2; Sue Berney, PhD1,2; Bronwen Connolly, PhD1,3,4,5; Zudin A. Puthucheary, PhD9,10

Objectives: Systematically review evidence examining association between preadmission socioeconomic position and physical function, health-related quality of life and survival following critical illness.

Data Sources: Four electronic databases (MEDLINE, Embase, CINAHL, CENTRAL) and personal libraries were searched. Reference lists of eligible articles were cross-checked.

Data Synthesis: From 1,799 records, 10 studies were included, one examining association of socioeconomic position with health-related quality of life and five with survival. Four studies accounted for socioeconomic position in survival analyses. Patients with lower socioeconomic position were found to have higher ICU, inhospital, 30-day, and long-term mortality and lower 6-month Short Form-12 Mental Component Summary scores. No articles examined socioeconomic position and performance-based physical function. Notable variability in methods of socioeconomic position assessment was observed.

Conclusions: Lower socioeconomic position is associated with higher mortality and lower 6-month Short Form-12 Mental Component Summary scores following critical illness. Effect on performance-based physical function is unknown. We make recommendations for consistent socioeconomic position measurement in future ICU studies. (Crit Care Med 2019; 47:e512–e521)

Key Words: critical care outcomes; critical illness; mortality; quality of life; recovery of function; socioeconomic factors

In the years following critical illness, patients experience poor physical function and health-related quality of life (HRQoL) (1–5). To date no interventions delivered, including physical rehabilitation programs, report sustained improvements in long-term outcomes (6–11). In an attempt to identify factors influencing recovery and response to interventions, rehabilitation trialists have considered the importance of patient characteristics, specifically chronic disease burden (12, 13). It is hypothesized the burden of premorbid health status, exacerbated by acute illness severity (14), results in poorer

Copyright © 2019 by the Society of Critical Care Medicine and Wolters Kluwer Health, Inc. All Rights Reserved.
MATERIALS AND METHODS

Registration
Prior to registration with the International Prospective Register of Systematic Reviews (PROSPERO, CRD42017084114 https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=84114), the Cochrane Database of Systematic Reviews and PROSPERO were searched to ascertain no similar systematic review had been conducted.

Data Sources
Four electronic databases (MEDLINE, 1950–2018, Embase, 1947–2018, CINAHL, 1937–2018, and CENTRAL, July 2018) were searched by one reviewer (J.R.A.J.) with the last search run July 10, 2018. Reference lists of included studies were cross-checked, and authors’ personal files reviewed for additional references.

Search Strategy
One reviewer (J.R.A.J.) developed the search; no restrictions were applied. Search strategies are provided in the Supplemental Digital Content (http://links.lww.com/CCM/E473).

Data Extraction
Data extraction was performed independently in duplicate by two reviewers (J.R.A.J., J.L.W.) using a standardized prepiloted form. Disagreements were resolved by consensus and a third reviewer arbitrated if necessary (D.M.G.).

Data Items
Data extracted included study characteristics, participant characteristics, SEP assessment, outcomes (physical function, HRQoL, survival), and study results (association between SEP and outcomes of interest).

Quality Appraisal
Quality appraisal was completed independently in duplicate by two reviewers (J.R.A.J., B.C.) using standardized checklists for nonrandomized study designs (39). Disagreements were resolved by discussion; a third independent reviewer was not required.

Data Synthesis
Data were descriptively summarized and qualitatively synthesized. Meta-analysis was inappropriate due to the heterogeneity of SEP assessment and mortality time-point assessment variation.

RESULTS

Study Selection
Primary quantitative studies reporting association between preadmission SEP and physical function, HRQoL or survival of adults admitted to ICU were eligible (Table E1, Supplemental Digital Content 1, http://links.lww.com/CCM/E473). One reviewer (J.R.A.J.) initially reviewed search results to remove duplicate and nonrelevant material. Two independent reviewers (J.R.A.J., J.L.W.) then screened remaining titles and abstracts against the eligibility criteria. When there was insufficient information to determine eligibility, full texts were retrieved. One reviewer (J.R.A.J.) retrieved full texts and contacted authors of conference abstracts to determine publication status. Two independent researchers (J.R.A.J., J.L.W.) screened full texts in a similar manner. When consensus on eligibility could not be reached, a third independent reviewer made the final decision (S.B., L.D.).

Copyright © 2019 by the Society of Critical Care Medicine and Wolters Kluwer Health, Inc. All Rights Reserved.
zip codes, resulting in inclusion. In total, 10 studies satisfied the eligibility criteria each evaluating unique cohorts.

Description of Eligible Studies
Included studies were cohort design, conducted in Australia (40, 41), Europe (42, 43), North America (44, 45), and United Kingdom (12, 46–48) (Table 1). Six studies examined the association between SEP and HRQoL (12) or survival (41–43, 46, 48) (Table 1). The remaining four studies accounted for SEP when survival and insurance status (40), alcohol-related ICU admissions (47), racial disparities (45), acute illness severity and comorbidity scores (44) were examined.

Participant Characteristics
The ICU-specific participant characteristics are presented in Table 2. One study did not report these data (45). In the remaining nine studies (12, 40–44, 46–48), participants were admitted to medical, surgical, or mixed ICUs (n = 139,078) and most (53–63%) were male. Seven studies (12, 40, 42–44, 46, 47) reported age for the cohort with similar results observed (mean 57–60/median 62–64 yr).

Assessment of SEP
Assessment of SEP according to domains of SES (40, 41, 43–45) and deprivation (12, 42, 46–48) was equally split (Table 3; and Tables E2 and E3, Supplemental Digital Content 1, http://links.lww.com/CCM/E473). Seven studies used SES (40, 41) or deprivation (12, 42, 46–48) composite indices for the area (e.g., zip code) where the participant resided (Table E4, Supplemental Digital Content 1, http://links.lww.com/CCM/E473). The remaining three studies measured specific SES indicators, namely income (43–45), education (43–45), or occupation (44, 45) for the participant or their residential area (Tables E2 and E4, Supplemental Digital Content 1, http://links.lww.com/CCM/E473).

SEP and Physical Function
No articles were identified specifically examining SEP and performance-based physical function.

SEP and HRQoL
One study reported association between SEP and HRQoL. Lower deprivation was associated with higher Short Form-12 Mental Component Summary (SF-12 MCS) scores at 6 months (β = 1.39 [95% CI, 0.04–2.75]; p = 0.044) but not 12 months (12) (Table 3). Deprivation was not associated with the Short Form-12 Physical Component Summary (SF-12 PCS) (12) (Table 3).

SEP and Survival
Four of five studies (41–43, 46, 48) reported significantly higher ICU (hazard ratio [HR] 1.004 per point of deprivation [95% CI, 1.001–1.006]; p = 0.003 [46]), in-hospital (least vs most deprived adjusted odds ratio 1.19 [95% CI, 1.10–1.28]; p < 0.001 [48]), 30-day (lower 35.7% vs higher income 23.3% adjusted HR 1.99 [95% CI, 1.24–3.21] [43]), and long-term mortality (adjusted HR 1.21 [95% CI, 1.04–1.41]; p = 0.014 [41]) (Table 3) for participants with lower SEP. One study reported no difference in deprivation scores between survivors and nonsurvivors 1 year post ICU discharge (42).

Deprivation and SES were important variables in the relationship between hospital mortality and insurance status (40), acute illness severity and comorbidity scores (44), and 6-month mortality and alcohol dependence (47) (Table 3). When the
relationship between race and post-ICU mortality was examined, lower income and education level were no longer significant predictors when the model included comorbidities (45).

**Quality Appraisal**
One study was deemed “high quality” (12) and the remaining “acceptable” (40–48) (Table E5, Supplemental Digital Content 1, http://links.lww.com/CCM/E473).

**DISCUSSION**
Our systematic review examined association between preadmission SEP and outcomes of adults admitted to ICU and to our knowledge is the first to have done so. Ten articles were included with the majority focusing on survival. Only one study examined HRQoL, and none performance-based physical function. Lower SEP was associated with higher ICU (46), in-hospital (48), 30-day (43), and long-term (41) mortality and lower 6-month SF-12 MCS scores (12). SEP was identified as a key variable in the relationship between mortality and insurance status (40), alcohol dependence (47), acute illness severity, and comorbidity scores (44).

**Significance of Results and Future Directions**
Patients with lower preadmission SEP have higher mortality across the critical illness continuum (41, 43, 46, 48), signaling a social gradient exists. Given similar findings in other patient populations (35, 37), this trend may not reflect the critical illness insult alone. Rather, the poor health trajectory people with lower SEP experience is characterized by gradual accumulation of behavioural, environmental, and psychosocial risk factors prior to the acute insult (31). For example, increased tobacco smoking and lower physical activity (behavioural risk factors) of individuals with lower SEP are associated with higher rates of cardiovascular disease and mortality (poor health trajectory) compared with more socioeconomically advantageous groups.
### TABLE 2. Participant Characteristics

| References                  | Population                                                                 | n      | Age (yr)a | Male, n (%) | Comorbidity Scorea | Illness Severity Scorea |
|-----------------------------|-----------------------------------------------------------------------------|--------|-----------|-------------|---------------------|--------------------------|
| Gayat et al (42)            | Medical, surgical, and mixed medical/surgical ICU survivors requiring >     | 1,570  | 61 (49–73)| 1,000 (63.7)| CCI 3 (1–4)         | SAPS II 46 (34–59);      |
|                             | 24 hr invasive respiratory support ± vasoactive drug support                |        |           |             |                     | SOFA 6 (4–9)             |
| Griffith et al (12)         | Mixed medical/surgical ICU survivors requiring > 48 hr mechanical ventilation | 240    | 60 ± 14   | 137 (57)    | Functional Comorbidity Index 3 ± 2 | APACHE II 20 ± 8         |
| Gabriel et al (40)          | Mixed medical/surgical ICUs                                                 | 33,306 | 64 (50–74)| 21,225 (63.7)| Not reported        | APACHE II 15.9 ± 7.1     |
| Schnegelsberg et al (43)    | Mixed medical/surgical ICU with sepsis or septic shock admission diagnosis  | 387    | 64 (55–74)| 205 (53.0)  | CCI 2c              | SAPS II 40 (30–53); SOFA 5 (3–8) |
| McPeake et al (47)          | Mixed medical/surgical ICU requiring multiple organ support or invasive respiratory support | 580    | 57 (19–90)b | 339 (58.4)  | Not reported        | APACHE II not reported overall cohort |
| Fletcher et al (46)         | Mixed medical/surgical ICU (combined ICU/HDU)                               | 6,937  | 64 (48–75)| 3,948 (56.9)| Not reported        | ICNARC sickness severity score 17.1 ± 9.8 |
| Shippee et al (45)          | Cardiac ICU                                                                  | 4,229* | 50.989 ± 13.829* | 46.4%* | CCI 0.442 ± 0.855* | Not reported |
| Welch et al (48)            | General (nonspecialist) critical care units (ICUs and combined ICU/HDU)    | 78,631 | Not reported overall cohort | 45,312 (57.6) | Not reported | ICNARC physiology score, ICNARC predicted hospital mortality not reported overall cohort |
| Ho et al (41)               | Mixed medical/surgical ICU                                                  | 15,619 | Not reported overall cohort | 9,841 (63.0) | CCI not reported overall cohort | APACHE II not reported overall cohort |
| Norena et al (44)           | Mixed medical/surgical ICU                                                  | 1,808  | 58.8±16.8; 62 (47–72) | 62.6% (60.2–65) | CCI 0.9 ± 1.56; CCI 1 (0–2) | APACHE II 22.6 ± 8.1; APACHE II 22 (17–27) |

APACHE = Acute Physiology and Chronic Health Evaluation, CCI = Charlson Comorbidity Index, HDU = high dependency unit, ICNARC = Intensive Care National Audit and Research Centre, SAPS = Simplified Acute Physiology Score, SOFA = Sequential Organ Failure Assessment.

*a Reported as mean ± so or median (interquartile range).

*b Reported as mean (range).

*c Median, interquartile range not reported.

*d 95% CI.

*e Sample size and participant characteristics reported at baseline only, prior to admission to the ICU.
### TABLE 3. Association Between Socioeconomic Position and Health-Related Quality of Life and Survival

| References          | Deprivation/SES: Measure                              | Relevant Outcome(s) | Resultsa |
|---------------------|------------------------------------------------------|---------------------|----------|
| Gayat et al (42)    | Deprivation: French Deprivation Index                | Survival            | No difference in deprivation score between survivors and nonsurvivors 1 yr post ICU discharge. |
| Griffith et al (12) | Deprivation: Scottish Index of Multiple Deprivation  | Health-related quality of life | Lower deprivation was associated with higher Short Form–12 Mental Component Summary Scores at 6 mo (multivariate regression model includes ICU discharge physical function and nutritional status, $β = 1.39$ [0.04–2.75]; $p = 0.044$) but not 12 mo. No association between deprivation and Short Form–12 Physical Component Score at 6 or 12 mo. |
| Gabriel et al (40)  | SES: Index of Relative Socioeconomic Advantage and Disadvantage | Survival            | SES was independently associated with in-hospital mortality in the multivariable analyses according to 1) individual insurance categories and 2) patients classified as public or compensable. |
| Schnegelsberg et al (43) | SES: education, income | Survival            | Patients with lower income had almost double the 30-d mortality rate than higher income after adjustments for sex, comorbidity, and Simplified Acute Physiology Score II (46/129; 35.7% vs 30/129; 23.3% adjusted HR 1.99 [1.24–3.21]). No significant differences for 180-d mortality according to income or education or 30-d mortality according to education. |
| McPeake et al (47)  | Deprivation: Scottish Index of Multiple Deprivation  | Survival            | After adjustment for deprivation and age, alcohol dependence was associated with an almost two-fold increase in odds of mortality at 6 mo. |
| Fletcher et al (46) | Deprivation: Index of Multiple Deprivation          | Survival            | Increasing deprivation significantly associated with ICU mortality (HR 1.004 per point of IMD score [1.001–1.006] $p = 0.003$). |
| Shippee et al (45)  | SES: education, income                               | Survival            | When the relationship between race and post-ICU mortality was examined, lower income and education level were significant predictors. However, when comorbidities (CCI) were added to the model, education and income were no longer significant predictors of post-ICU mortality. |
| Welch et al (48)    | Deprivation: Index of Multiple Deprivation          | Survival            | Significant increase in hospital mortality as deprivation increased which persisted after adjustment for age, sex, acute severity, medical history, source and reason for admission to critical care, and unit-level IMD quintile (least deprived vs most deprived adjusted OR 1.19 [1.10–1.28]; $p < 0.001$). Increasing deprivation was significantly associated with increasing hospital mortality when stratified by type of admission (nonsurgical, elective surgical, and emergency surgical). Significant associations between hospital mortality and increasing deprivation according to education, employment, health and disability and living environment domains of the IMD. |
| Ho et al (41)       | SES: Index of Relative Socioeconomic Disadvantage    | Survival            | Significantly higher long-term mortality in the lowest SES group which persisted after adjustment for age, ethnicity, comorbidities, acute illness severity, and geographical accessibility to essential services (adjusted HR 1.21 [1.04–1.41]; $p = 0.014$). Socioeconomic status was not significantly associated with in-hospital mortality. |
| Norena et al (44)   | SES: education, employment, income                  | Survival            | Two multivariable linear regression models were constructed to explore the association between patient descriptors and hospital mortality. Both models included age, sex, % postsecondary education, % unemployment rate, and median income and source of admission. Model 1 additionally adjusted for APACHE II score, whereas model 2 additionally adjusted for CCI, from which it was determined that APACHE II and CCI scores were significantly associated with hospital mortality. In both models, % postsecondary education (adjusted OR model 1: 1.018 [1.004–1.033]; $p = 0.013$; model 2: 1.014 [1.002–1.026]; $p = 0.03$), but not median income or % unemployment, was independently associated with hospital mortality. |

**Notes:**
- APACHE = Acute Physiology and Chronic Health Evaluation
- CCI = Charlson Comorbidity Index
- HR = hazard ratio
- IMD = Index of Multiple Deprivation
- OR = odds ratio
- SES = socioeconomic status

*a Results reporting ORs and HRs are presented with (95% CIs).
(49) and potentially stem from health literacy issues or psychological influences. Exploration of the mechanisms contributing to the relationship between SEP and critical illness outcomes is warranted, to assist in elucidating factors in recovery that can be modified with targeted interventions.

One study assessed HRQoL (12), where lower 6-month SF-12 MCS scores for survivors with lower SEP is supported by the higher prevalence of poor mental health in lower SEP groups in epidemiologic studies of general populations (25, 50). Specific to recovery from critical illness, financial distress has a direct effect on anxiety and depression symptoms (51). Given the lower 6-month SF-12 MCS scores for survivors with lower SEP (12) did not persist to 12 months, this may indicate a subgroup more vulnerable to mental health distress during their earlier recovery.

Survivors (52, 53) and their family members (54) experience joblessness and loss of life savings following critical illness and patients who do not return to work within 6–12 months report poorer HRQoL (52). The results of Griffith et al (12) may be attributable to a transient change in patient or caregiver employment status, where survivors with lower SEP experience greater financial (and mental health) distress which could potentially be resolved with return to work plans.

Higher social integration (55) and social support (51) are associated with improved quality of life after critical illness supporting the hypothesis that social relationships can mitigate negative effects of illness. Griffith et al (12) findings may also reflect a subgroup of survivors needing increased social support early in their recovery as lower SEP is associated with social isolation in epidemiologic studies of general populations (56). The role of family and informal caregivers (57, 58) and peer support networks (59–61) is a growing research area, additionally considering SEP in future research on this topic may help decipher how social and economic factors impact recovery from critical illness.

Despite a strong focus on survivorship (62, 63) and growing research on importance of predmission patient characteristics on recovery (4, 12, 13, 16–19), no articles were identified specifically examining SEP and performance-based physical function. Although Griffith et al (12) reported no significant association between SEP and the SF-12 PCS HRQoL questionnaire at 6 and 12 months, this is a patient reported measure rather than a performance measure of function and these results are in contrast to those reported in other populations (32–34). This variation provides sound basis for future examination of SEP and physical function in ICU populations.

Physical inactivity is associated with poor health (64, 65), and lower premorbid physical activity is reported for ICU patients with lower SEP (66). This subgroup may continue on a trajectory of poor health, unless addressed with targeted interventions. The reduced pulmonary rehabilitation completion rates for participants with lower SEP (67) provoke contemplation on alternative healthcare delivery systems for these patients and indeed may be of interest to rehabilitation trialists designing programs for survivors of critical illness.

Critique of Method and SEP Assessment Considerations

This review benefits from robust methods for its conduct in keeping with established guidelines (68), including a registered protocol. Searches were comprehensive and screening, data extraction, and quality appraisal conducted in duplicate.

We defined the eligibility criteria to reflect SEP assessment but did not specify measurement instruments to ensure maximum inclusivity of relevant material in this relatively under-researched area. To this end, we observed notable variability in methods employed across included studies, a well-recognized challenge (25, 26, 69, 70), subsequently limiting data synthesis. Different approaches across international healthcare jurisdictions may contribute to this, but our data were insufficient to explore. Comprehensive assessment including multiple SEP indicators is recommended (21, 26) and adopted in our methods. However, this criterion resulted in the exclusion of seven articles, three not meeting criteria for deprivation, and four assessing a single SEP indicator.

Assessment of SEP needed to be participant specific, resulting in the exclusion of one study where main supporting family member SES was measured. Highlighting the importance of cultural and contextual consideration of SEP assessment in relation to social and financial support of primary caregivers.

Findings of this systematic review are limited to generalization to higher income countries as reflected by the included studies country of origin. In lower and middle-income countries, admission to ICU and recovery from critical illness can be influenced by unique socioeconomic factors, including limitations upon number of ICUs, staff, and resources (71). Higher mortality rates and lower 6-month SF-12 MCS scores for participants with lower SEP in the current review are specific to the United Kingdom (12, 46, 48), Europe (43), and Australia (41). The effect of SEP internationally according to economic profile or healthcare system status (privatized or socialized) remains unknown.

Quality appraisal of included studies was conducted using a standardized checklist, with the majority of acceptable quality. However, quality appraisal was limited as many criteria were deemed “not applicable” in studies which conducted retrospective analyses (40, 41, 43–46, 48), a contributory factor to the overall grading.

Recommendations for SEP Assessment

Examination of SEP and health outcomes following critical illness is an emerging research area; routine and consistent reporting of participant SEP will help advance the field. Including multiple indicators in SEP assessment is recommended with occupation, education, and income reported most frequently (21, 26, 72). In the absence of consensus on SEP assessment, we made recommendations based on the merits of existing measurement instruments (Fig. 2). Implementation of which is at the discretion of the researcher, as different measurement instruments or indeed other SEP indicators may be more appropriate for the research question or study design.
Several SEP-specific occupation classification tools exist but are country specific (73). Therefore, we recommend the International Standard Classification of Occupations (74) according to the 10 major groups (Fig. 2). These data may not be readily available or if limited ability to interview participants or their proxies, occupational status can be simplified to employed or unemployed (28). The major limitation of occupation data is the exclusion of participants not actively participating in the workforce.

We recommend reporting participant education level using the International Standard Classification of Education (ISCED) (75) to enable international comparison. Schnegelsberg et al (43) collected these data from national registries; however, it would not be feasible for researchers to complete the given extensive coding process. Alternatively, ISCED attainment levels (Fig. 2) (75) could be used to structure participant or proxy interviews; however, we acknowledge interviews may be challenging for some trials.

Assessments of participant income that facilitate international comparison are lacking. Despite this, we suggest researchers report these data as a continuous variable, according to predefined categories or metrics appropriate to the dataset (i.e., tertiles, quartiles). The major obstacle in obtaining income data is participants are unwilling or uncomfortable disclosing information (21, 72).

If individual-level assessment is not possible, we recommend using SEP data for the participants’ residential area. Data can be acquired for specific SEP indicators, for example, percent post-secondary education from census tracts (44). Alternatively, composite measures encompassing several SEP indicators can be utilized, for example, deprivation indices according to zip code (12, 42, 46–48). These data are for a geographical area and therefore may over- or underestimate the SEP of the participant. Geographical SEP assessments are also contextual, precluding comparison over time and between countries (22, 26).

**CONCLUSIONS**
The findings of this systematic review, uniquely examining the association between SEP and health outcomes of adults admitted to ICU, signal the presence of a social gradient where patients with lower SEP have worse survival outcomes and lower 6-month SF-12 MCS scores. Effect on performance-based physical function remains unknown. Assessment of SEP lacks consistency. Recommendations for SEP measurement in future research are provided which we anticipate will progress the field by identifying contributing factors and informing healthcare delivery system design.

**ACKNOWLEDGMENTS**
We would like to thank Dr. Winsome Roberts, Social Work, The University of Melbourne for her advice on socioeconomic position assessment. Thank you also to Dr. Nazir Lone, Usher Institute of Population Health Sciences and Informatics, University of Edinburgh for discussion regarding cohort study design classification.

**REFERENCES**
1. Cuthbertson BH, Elders A, Hall S, et al; Scottish Critical Care Trials Group; Scottish Intensive Care Society Audit Group: Mortality and quality of life in the five years after severe sepsis. Crit Care 2013; 17:R70

---

| Recommendations | Implementation |
|----------------|---------------|
| 1. Measure SEP indicators for the participant. | **1.1. Occupation** Use ISCO major groups (74): |
| | 1. Managers |
| | 2. Professionals |
| | 3. Technicians and Associate Professionals |
| | 4. Clerical Support Workers |
| | 5. Services and Sales Workers |
| | 6. Skilled Agricultural, Forestry and Fishery Workers |
| | 7. Craft and Related Trades Workers |
| | 8. Plant and Machine Operators and Assemblers |
| | 9. Elementary Occupations |
| | 0. Armed Forces Occupations |
| Note: If these data are not attainable, can simplify to employed or unemployed. | **1.2. Education** Use ISCED-attainment levels (75): |
| | 0. Less than primary education |
| | 1. Primary education |
| | 2. Lower secondary education |
| | 3. Upper secondary education |
| | 4. Post-secondary non-tertiary education |
| | 5. Short-cycle tertiary education |
| | 6. Bachelor’s or equivalent level |
| | 7. Master’s or equivalent level |
| | 8. Doctoral or equivalent level |
| **2. If individual-level data is not attainable, use SEP data for the participant’s residential area.** | **2.1. Specific SEP Indicators** For example, percent unemployment rate, percent post-secondary education and median income according to census tracts (44). |
| **2.2. Composite measures** Composite measures encompassing several SEP indicators can be utilised, for example deprivation indices according to zip code (12, 42, 46–48). |

**Figure 2.** Summary of recommendations and suggested implementation of socioeconomic position (SEP) assessment for participants with critical illness. ISCO = International Standard Classification of Occupations, ISCED = International Standard Classification of Education.
2. Herridge MS, Tansey CM, Matté A, et al; Canadian Critical Care Trials Group: Functional disability 5 years after acute respiratory distress syndrome. N Engl J Med 2011; 364:1293–1304.

3. Needham DM, Dinglas VD, Morris PE, et al; NIH NHLBI ARDS Network: Physical and cognitive performance of patients with acute lung injury 1 year after initial trophic versus full enteral feeding. EDEN trial follow-up. Am J Respir Crit Care Med 2013; 188:567–576.

4. Ploeh ER, Wozniak AW, Colantuoni E, et al: Physical declines occurring after hospital discharge in ARDS survivors: A 5-year longitudinal study. Intensive Care Med 2016; 42:1557–1566.

5. Lepingayah K, Secondo F, Edbrooke L, et al: Exercise rehabilitation for patients with critical illness: A randomized controlled trial with 12 months of follow-up. Crit Care 2013; 17:R156.

6. McDowell K, O’Neill B, Blackwood B, et al: Effectiveness of an exercise programme on physical function in patients discharged from hospital following critical illness: A randomized controlled trial (the REVIVE trial). Thorax 2017; 72:594–595.

7. Morris PE, Berry MJ, Files DC, et al: Standardized rehabilitation and hospital length of stay among patients with acute respiratory failure: A randomized clinical trial. JAMA 2016; 315:2694–2702.

8. S Poss M, Nordon-Craft A, Malone D, et al: A randomized trial of an intensive physical therapy program for patients with acute respiratory failure. Am J Respir Crit Care Med 2016; 193:1101–1110.

9. Walsh TS, Salisbury LG, Merriweather JL, et al; RECOVER Investigators: Increased hospital-based physical rehabilitation and information provision after intensive care unit discharge: The RECOVER randomized clinical trial. JAMA Intern Med 2015; 175:901–910.

10. Wright SE, Thomas K, Watson G, et al: Intensive versus standard physical rehabilitation therapy in the critically ill (EPICCO): A multi-centre, parallel-group, randomised controlled trial. Thorax 2018; 73:213–221.

11. Griffith DM, Salisbury LG, Lee RJ, et al: RECOVER Investigators: Determinants of health-related quality of life after ICU: Importance of patient demographics, previous comorbidity, and severity of illness. Crit Care Med 2018; 46:594–601.

12. Rothschild AJ, DeNeyle L: Exercise interventions in critical illness survivors: Understanding inclusion and stratification criteria. Am J Respir Crit Care Med 2015; 191:1464–1467.

13. Cuthbertson BH, Wunsch H: Long-term outcomes after critical illness. The best predictor of the future is the past. Am J Respir Crit Care Med 2016; 194:132–134.

14. Orwelius L, Nordlund A, Nordlund P, et al: Pre-existing disease: The best predictor of the future is the past. Crit Care Med 2015; 43:1265–1275.

15. Ferrante LE, Murphy TE, Gahbauer EA, et al: Pre-intensive care unit cognitive status, subsequent disability, and new nursing home admission among critically ill older adults. Ann Am Thorac Soc 2018; 15:622–629.

16. Bagshaw SM, Stefko HT, McDermid RC, et al: An exploratory study of long-term outcome measures in critical illness survivors: Construct validity of physical activity, frailty, and health-related quality of life measures. Crit Care Med 2016; 44:362–369.

17. Brummel NE, Balas MC, Morandi A, et al: Understanding and reducing disability in older adults following critical illness. Crit Care Med 2015; 43:1265–1275.

18. Ferrante LE, Murphy TE, Gahbauer EA, et al: Pre-intensive care unit cognitive status, subsequent disability, and new nursing home admission among critically ill older adults. Ann Am Thorac Soc 2018; 15:622–629.

19. Files DC, Neiberg R, Rushing J, et al: Influence of prehospital function and strength on outcomes of critically ill older adults. J Am Geriatr Soc 2018; 66:525–531.

20. Galobardes B, Shaw M, Lawlor DA, et al: Indicators of socioeconomic position (part 1). J Epidemiol Community Health 2006; 60:7–12.

21. Schneeggselberg A, Mackenhauer J, Nibol H, et al: Impact of socioeconomic status on mortality and unplanned readmission in
Critical Care Medicine

Online Review Articles

Copyright © 2019 by the Society of Critical Care Medicine and Wolters Kluwer Health, Inc. All Rights Reserved.