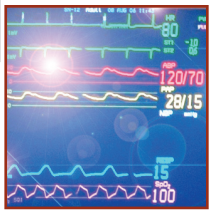

Utility of Screening for Cognitive Impairment at Hospital Discharge in Adult Survivors of Critical Illness

By Gerardo Eman, MD, Amber Marsh, BA, Michelle Ng Gong, MD, MS, and Aluko A. Hope, MD, MSCE

Background Few studies have explored the utility of screening for cognitive impairment near hospital discharge in intensive care unit survivors.
Objectives To explore baseline and hospitalization characteristics associated with cognitive impairment at hospital discharge and the relationship between cognitive impairment and 6-month disability and mortality outcomes.
Methods Hospital disability status and treatment variables were collected from 2 observational cohort studies. Patients were screened for cognitive impairment at hospital discharge using the Montreal Cognitive Assessment (MoCA)–Blind, and telephone follow-up was conducted 6 months after discharge to assess vital and physical disability status.
Results Of 423 patients enrolled, 320 were alive at hospital discharge. A total of 213 patients (66.6%) were able to complete the MoCA near discharge; 47 patients (14.7%) could not complete it owing to cognitive impairment. In MoCA completers, the median (IQR) score was 17 (14-19). Older age (β per year increase, –0.09 [95% CI, –0.13 to –0.05]) and blood transfusions during hospitalization (β, –1.20 [95% CI, –2.26 to –0.14]) were associated with lower MoCA scores. At 6-month follow-up, 176 of 213 patients (82.6%) were alive, of whom 41 (23.3%) had new severe physical disabilities. Discharge MoCA score was not significantly associated with 6-month mortality (adjusted odds ratio, 1.03 [95% CI, 0.93-1.14]) but was significantly associated with risk of new severe disability at 6 months (adjusted odds ratio, 0.85 [95% CI, 0.76-0.94]).
Conclusion Assessing for cognitive impairment at hospital discharge may help identify intensive care unit survivors at higher risk of severe physical disabilities after critical illness. (*American Journal of Critical Care.* 2022; 31:306-314)

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With the technological advances that have occurred in treatments available in the intensive care unit (ICU), most critically ill adults now survive critical illness.[1] The challenges of surviving critical illness include high rates of cognitive, physical, and emotional impairment that affect survivors' quality of life.[2] The term *post–intensive care syndrome* was coined to increase the recognition of morbidity challenges across these health domains in ICU survivors.[3]

Cognitive impairment in ICU survivors, conceptualized within the World Health Organization's International Classification of Functioning, Disability and Health, can be characterized as a loss, reduction, or deviation in any domains of cognitive functioning such as executive function, memory, attention, visuospatial skills, or processing speed.[4]

Recent guidelines have suggested that early and serial screening of ICU survivors across the post–intensive care unit syndrome health domains is crucial for developing rehabilitation and other treatment plans for ICU survivors.[4] Comprehensive neuropsychological testing, which has been the criterion standard approach for assessing long-term cognitive impairment in survivors of critical illness, is time-intensive, requires specialized training, and can be performed only in a small minority of survivors.[5] The Montreal Cognitive Assessment (MoCA) and its simplified version adapted for telephone use, the MoCA-Blind, have been recommended as core outcome measures for clinical research in survivors of acute respiratory distress syndrome.[4,6]

Despite these recommendations for early screening of ICU survivors, little research has been conducted on the utility of early screening for cognitive impairment in survivors of critical illness, with much of the research on cognitive impairment in this population focused on the elucidation of hospital factors related to long-term cognitive impairment months after discharge.[7] To establish the potential utility of "functional reconciliation" using serial cognitive assessment tools starting early in the recovery pathway in survivors of critical illness, several knowledge gaps remain. An understanding of which critically ill adults can complete a cognitive assessment near hospital discharge is needed. Demographic and hospital treatment variables associated with cognitive impairment and the prognostic validity of cognitive impairment as assessed by such evaluation tools near hospital discharge have not been previously described.

To address these knowledge gaps, we merged data from 2 prospective cohort studies to address 3 research aims. First, we aimed to identify factors related to being able to complete the MoCA tool near hospital discharge in adult survivors of critical illness. Second, we examined baseline and hospital treatment variables associated with cognitive impairment near hospital discharge. Third, we examined the association between MoCA scores at hospital discharge and 6-month mortality and severe disability outcomes in ICU survivors.

> Screening of ICU survivors is crucial for developing rehabilitation and other treatment plans.

Methods

Study Design and Population

We conducted post hoc analyses using data from 2 observational cohort studies. The first study, called FRAIL-STOOP, was previously described[8]; briefly, it involved adult patients aged 50 years or older who were admitted to medical or surgical ICUs between January 2016 and July 2017. The second study, called CAMINANDO, involved adults aged 18 years or older with acute respiratory failure admitted between July 2018 and December 2019; acute respiratory failure was defined by the need for critical care consultation and the acute need for invasive mechanical ventilation, high-flow nasal cannula therapy, or noninvasive mechanical ventilation. Both cohorts excluded patients who were admitted for an elective surgical procedure, those whose death was imminent, and those who were being discharged from the hospital. In both cohorts, we obtained written informed consent from

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either the patient or their surrogate decision maker. Both studies were approved by the institutional review board at the Albert Einstein College of Medicine.

Baseline Demographics and Other Covariates

Research coordinators administered a baseline questionnaire to the patient and/or the surrogate asking about demographics and prehospital disability status using a modified Katz Index of Independence in Activities of Daily Living (ADL),[9,10] instrumental ADL,[11] and markers of frailty.[12] In the first cohort, the patients' surrogate or designated caregiver was asked to complete the short form of the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE), with an IQCODE score greater than 3.3 considered to indicate a high risk of cognitive impairment.[13] In the second cohort, the patient's surrogate was asked to complete the Alzheimer's Dementia 8, a brief screening survey in which a score of greater than 2 was considered to indicate a high risk of dementia.[14] Scores on the Charlson Comorbidity Index[15] and the Sequential Organ Failure Assessment,[16] a measure of the severity of organ dysfunction within 24 hours of index admission, were abstracted from the electronic medical record data.

Within a few days of hospital discharge, the MoCA-Blind was administered by trained research coordinators.

Within 3 days of ICU admission, study investigators used information from the medical records and the baseline questionnaire to assess the patient's prehospital frailty using the Clinical Frailty Scale (CFS).[17] The CFS is a judgment-based frailty assessment tool with scores ranging from 1 to 9, with 1 to 3 indicating fit or robust; 4 indicating vulnerable, and 5 or greater indicating frail.

Patients were followed through the hospital course, and hospital treatment variables such as the use of invasive mechanical ventilation, continuous sedation, pressors, or new renal replacement therapy were collected via medical record review.

Assessments at Hospital Discharge

Within a few days of hospital discharge, the MoCA-Blind, a previously validated adaptation of the MoCA tool for telephone use, was administered by trained research coordinators. Before administering the tool, the research coordinators assessed whether the patient could follow at least 3 of 5 simple commands: open (close) your eyes; look at me; open your mouth and put out your tongue; nod your head; raise your eyebrows when I have counted up to 5.[18] If patients were not able to complete the MoCA, the research coordinators sequentially classified the reason into 1 of 5 categories: cognitive impairment (eg, the patient's mental status precluded following simple commands); physical impairment (the patient's physical symptoms precluded MoCA testing); refused/declined; left the hospital before completion of the MoCA; other. At hospital discharge, the research coordinators also collected information on the patient's disability status at that time by interviewing the patient or surrogate or, if that was not feasible, by asking the clinical team or, as a last resort, reviewing the medical record.

Posthospital Outcomes

We administered telephone follow-up interviews to hospital survivors and/or their surrogates to assess vital and physical disability status at 6 months after hospital discharge. To assess physical disability, we asked patients and/or surrogates about ADL after hospital discharge. New severe physical disability was identified in patients who had reported impairments in less than 5 of the 7 ADLs at baseline but reported impairments in 5 or more ADLs at 6 months.[19]

Statistical Analysis

We used the χ^2 test, Student t test, or 1-way analysis of variance or their nonparametric equivalents to describe the characteristics of the study participants by whether they could complete the MoCA at hospital discharge. In those survivors who completed the MoCA, we described baseline and hospital treatment factors related to cognitive impairment using either the Wilcoxon rank sum test or 1-way analysis of variance. We used multivariable linear regression models to capture a parsimonious descriptive model of cognitive impairment at hospital discharge using MoCA score as the outcome variable. Potential correlates included baseline characteristics, hospital treatment variables, and discharge characteristics. We minimized overfitting by first exploring relationships between the potential correlates before manually entering 1 to 4 variables at a time into the multivariable model. Variables were retained in the final model based on their impact on the R^2 and the magnitude of their association with MoCA scores. We used multivariable logistic regression to capture the association between MoCA score at hospital discharge and 6-month mortality and disability outcomes. In these models, continuous MoCA score was the exposure variable, and the 2 binary outcomes of interest were 6-month mortality and new severe disability. We used

Stata, version 16 (StataCorp), for all statistical analyses. The level of statistical significance was set at P less than .05.

Results

Baseline Characteristics

The Figure shows the flow of study participants from enrollment through follow-up 6 months after hospital discharge. The study population consisted of 423 adults across the 2 observational cohort studies, 320 of whom survived to hospital discharge. Table 1 shows the baseline and hospital treatment factors in the study population by whether the MoCA screening tool could be completed near hospital discharge.

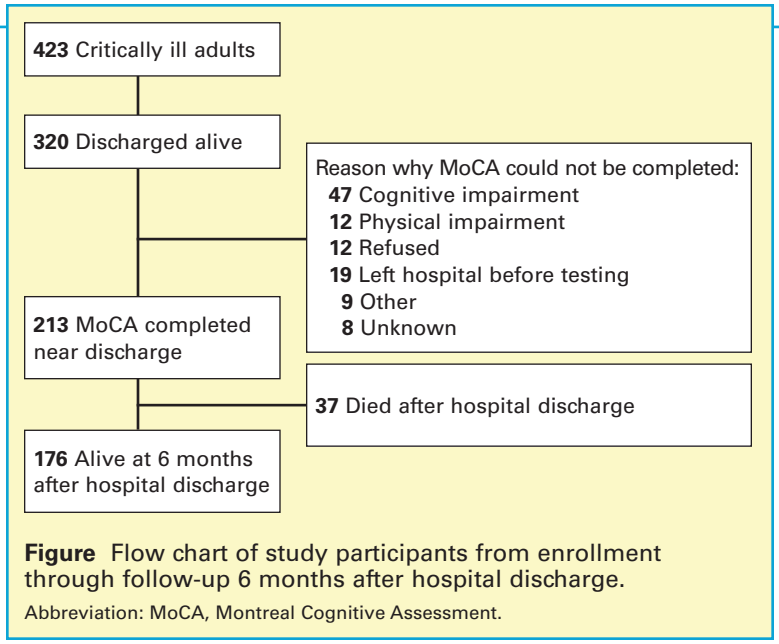

Figure Flow chart of study participants from enrollment through follow-up 6 months after hospital discharge.

Abbreviation: MoCA, Montreal Cognitive Assessment.

Screening for Cognitive Impairment at Hospital Discharge

Patients who did not complete the MoCA screening tool at hospital discharge were significantly older (mean [SD] age, 68.6 [12.7] vs 63.5 [11.4] years; $P<.001$) and more likely to have a dementia diagnosis (8% vs 5%, $P=.04$) but not more likely to screen positive for prehospital cognitive impairment using either the IQCODE or the Alzheimer's Dementia 8 (26.2% vs 21.1%, $P=.31$; Table 1). Although patients who did not complete MoCA screening presented with lower body mass index on hospital admission (mean [SD] body mass index, 29.1 [8.5] vs 31.6 [10.9]; $P=.04$), this difference was no longer statistically significant after adjusting for age. Patients who did not complete the MoCA at hospital discharge were more likely to have had prolonged mechanical ventilation (median [IQR] ventilator days, 10 [3-28] vs 3 [2-5]; $P<.001$) and had more ADL impairments at hospital discharge (median [IQR] number, 6 [2-7] vs 2 [0-5]; $P<.001$).

Some important differences were found in baseline characteristics of the survivors who completed MoCA screening (n = 213) between the 2 patient cohorts. Compared with participants from the FRAIL-STOOP cohort, participants from the CAMINANDO cohort were significantly less likely to have comorbidity scores greater than 0 (39.5% vs 56.8%, $P=.01$); more likely to have surrogates reporting prehospital cognitive impairment (29.6% vs 15.9%, $P=.02$), and more likely to be frail (CFS score > 4) (56.8% vs 40.2%; $P=.02$).

Cognitive Impairment at Hospital Discharge

Scores on the MoCA for the 213 survivors who completed the assessment ranged from 2 to 22, with a median (IQR) score of 17 (14-19). Most patients performed near perfectly on the orientation domain of the MoCA: 156 of 213 (73.2%) of the sample scored 6 of 6, and 42 of 213 (19.7%) scored 5 of 6. The 2 domains with the lowest performance scores in the study population were delayed recall and attention. The median (IQR) number of correct spontaneous recalls of the 5 words in the MoCA was 3 (1-4). Of the 6 possible points in the attention domain of the MoCA, the median (IQR) score was 4 (3-5) (Table 2).

We found few correlates of cognitive impairment at hospital discharge that were independent of age and the cohort indicator. As shown in Table 3, on average the MoCA scores were significantly lower per 1-year increase in age (β, −0.09 [95% CI, −0.13 to −0.05]; $P<.001$), and patients in the CAMINANDO cohort had lower average MoCA scores compared with the FRAIL-STOOP cohort (β, −4.06 [95% CI, −5.19 to −2.92]; $P<.001$). Prehospital cognitive impairment was associated with lower MoCA scores at hospital discharge (β, −1.65 [95% CI, −2.98 to −0.31]; $P=.02$) in age-adjusted models, but this effect was no longer present after adjustment for recruitment cohort. Exposure to blood transfusions during hospitalization was associated with lower MoCA scores at hospital discharge independent of the other important correlates (β, −1.20 [95% CI, −2.26 to −0.14; $P=.03$). Other hospital treatment–related variables such as the need for pressors or the use of continuous sedation during the ICU stay (Table 1) were not independently associated with MoCA scores and thus were not included in the final descriptive model.

Cognitive Impairment as Predictor of 6-Month Outcomes

Of the 213 survivors who completed the MoCA tool at hospital discharge, 37 (17.4%) died before

Table 1
Baseline and hospital treatment factors in the study population by whether MoCA screening tool could be completed near hospital discharge

Factor	Total (N=320)	MoCA completed (n=213)	MoCA not completed (n=107)	*P*
Baseline characteristics				
Age, mean (SD), y	65.3 (12.1)	63.5 (11.4)	68.6 (12.7)	<.001
Female sex, No. (%)	175 (54.7)	122 (57.3)	53 (49.5)	.19
Education level of high school or below, No. (%)	208 (65.0)	133 (62.4)	75 (70.1)	.18
Race/ethnicity, No. (%)				.07
White non-Hispanic	53 (16.6)	27 (12.7)	26 (24.3)	
Black or African American	127 (39.7)	88 (41.3)	39 (36.5)	
Hispanic	121 (37.8)	85 (39.9)	36 (33.6)	
Other	19 (5.9)	13 (6.1)	6 (5.6)	
English as language preference	224 (70.0)	151 (70.9)	73 (68.2)	.62
Charlson Comorbidity Index, No. (%)				.78
Low risk for 1-y mortality (0)	161 (50.3)	106 (49.8)	55 (51.4)	
Mild-severe risk for 1-y mortality (≥1)	159 (49.7)	107 (50.2)	52 (48.6)	
Body mass index,[a] mean (SD)	30.8 (10.2)	31.6 (10.9)	29.1 (8.5)	.04
Dementia diagnosis, No. (%)	13 (4.1)	5 (2.3)	8 (7.5)	.04
Prehospital cognitive impairment,[b] No. (%)	73 (22.8)	45 (21.1)	28 (26.2)	.31
Prior hospitalization in the year before admission, No. (%)	193 (60.3)	133 (62.4)	60 (56.1)	.27
CFS score on admission, No. (%)				.07
Fit (1-3)	80 (25.0)	49 (23.0)	31 (29.0)	
Vulnerable (4)	85 (26.6)	65 (30.5)	20 (18.7)	
Frail (≥5)	155 (48.4)	99 (46.5)	56 (52.3)	
CFS score, median (IQR)	4 (3.5-6)	4 (4-6)	5 (3-6)	.37
Prehospital impairments in ADL, median (IQR)	1 (0-6)	1 (0-6)	0 (0-5)	.05
SOFA score on hospital day 1, median (IQR)	5 (3-8)	5 (3-8)	6 (3-8)	.26
Primary hospital diagnosis, No. (%)				.02
Sepsis	43 (13.4)	24 (11.3)	19 (17.8)	
Acute respiratory failure	138 (43.1)	102 (47.9)	36 (33.6)	
Gastrointestinal bleeding	18 (5.6)	12 (5.6)	6 (5.6)	
Cirrhosis/hepatic failure	11 (3.4)	8 (3.8)	3 (2.8)	
Cardiovascular disease	12 (3.8)	10 (4.7)	2 (1.9)	
Neurological disease (stroke and/or seizures)	53 (16.6)	26 (12.2)	27 (25.2)	
Other	45 (14.1)	31 (14.6)	14 (13.1)	
Hospital care processes and outcomes				
Intubated, No. (%)	166 (51.9)	104 (48.8)	62 (57.9)	.12
Ventilator days, median (IQR)	4 (2-11)	3 (2-5)	10 (3-28)	<.001
Tracheotomy, No. (%)	27 (16.3)	5 (4.8)	22 (35.5)	<.001
Continuous sedation, No. (%)	164 (51.3)	100 (46.9)	64 (59.8)	.03
Vasoactive drugs, No. (%)	114 (35.6)	71 (33.3)	43 (40.2)	.24
New renal replacement therapy, No. (%)	32 (10.0)	23 (10.8)	9 (8.4)	.50
Blood transfusions, No. (%)	129 (40.3)	78 (36.6)	51 (47.7)	.08
Impairments in ADL at hospital discharge, median (IQR)	4 (0-7)	2 (0-5)	6 (2-7)	<.001
Hospital length of stay, median (IQR), d	15 (9-26)	14 (9-21)	21 (10-39)	<.001

Abbreviations: ADL, activities of daily living; CFS, Clinical Frailty Scale; MoCA, Montreal Cognitive Assessment; SOFA, Sequential Organ Failure Assessment.

[a] Calculated as weight in kilograms divided by height in meters squared.
[b] Risk of prehospital cognitive impairment was assessed by using the short Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE; high risk, >3.3) or the Alzheimer's Dementia 8 screening tool (high risk, >2)

6-month telephone follow-up. Of the 176 survivors who were alive at 6 months after discharge, 41 (23.3%) had new severe disability based on their ADL at 6 months compared with baseline (Table 4). Among the survivors who completed the MoCA tool at discharge, MoCA score was not significantly associated with 6-month mortality (adjusted odds ratio, 1.03 [95% CI, 0.93-1.14]; $P = .55$), but a higher MoCA score at hospital discharge was significantly associated with lower risk of new severe disability at 6 months (adjusted odds ratio, 0.85 [95% CI], 0.76-0.94; $P = .002$).

Of the 107 hospital survivors who could not complete a MoCA assessment at hospital discharge, 47 (43.9%) could not complete it because of cognitive impairment. Of these 107 survivors, 28 (26.2%) died before 6-month follow-up; of the 79 who were alive at 6 months, 30 (38.0%) had new severe disability based on their ADL at 6 months compared with baseline. When we conducted sensitivity analyses of the MoCA assessment at discharge that included the 47 patients who could not complete the tool because of cognitive impairment as a MoCA score of 0 (total n = 260), we found similar correlates of MoCA scores at hospital discharge, except that the cohort indicator was no longer an important correlate and the severity of ADL disability at hospital discharge was associated with worse MoCA score (β, −2.57 [95% CI, −3.56 to −1.59]; $P < .001$; see Supplemental Table, available online only at ajcconline.org).

Discussion

Summary of Results

In a large cohort of critically ill adults, we found that around the time of hospital discharge, about 30% of survivors could not complete a screening assessment for cognitive impairment, mostly because of physical or cognitive impairment at the time of the assessment. At this early time point in the trajectory of recovery, we also found that about 47% of the survivors who completed a cognitive assessment scored at a level consistent with severe cognitive impairment. We found that the patient's age, level of disability at hospital discharge, and whether they received a blood transfusion during the hospitalization were factors related to the level of cognitive impairment. Importantly, cognitive impairment at this early time point was not associated with the risk of death 6 months after discharge in hospital survivors but was associated with the risk of new severe disability at 6 months after hospital discharge. These data suggest that screening for cognitive impairment at hospital discharge in ICU survivors may be an important prognostic enrichment strategy for posthospital interventions aimed at improving physical disability in ICU survivors.

Table 2
Distribution of scores on the Montreal Cognitive Assessment near hospital discharge for 213 adult survivors of critical illness

Domain category	Range	Median (IQR)	≥ Median in %
Attention	0-6	4 (3-5)	64.3
Language	0-3	2 (1-3)	72.3
Abstraction	0-2	2 (1-2)	70.0
Delayed recall	0-5	3 (1-4)	53.3
Orientation	0-6	6 (5-6)	73.2
Total score	2-22	17 (14-19)	52.6

Table 3
Final model describing correlates of cognitive impairment as assessed via the Montreal Cognitive Assessment at hospital discharge (n = 213)

Correlate	Beta coefficient	95% CI	*P*
Age, per 1-year increase	−0.09	−0.13 to −0.05	<.001
CAMINANDO vs FRAIL-STOOP cohort	−4.06	−5.19 to −2.92	<.001
Blood transfusion while in hospital	−1.20	−2.26 to −0.14	.03
Severity of ADL disability at hospital discharge	0.83	0.17-1.49	.01
SOFA total score, per unit increase	−0.05	−0.17 to 0.08	.45

Abbreviations: ADL, activities of daily living; CAMINANDO, cohort of adult patients ≥ 18 years old with acute respiratory failure admitted between July 2018 and December 2019; FRAIL-STOOP, cohort of adult patients ≥ 50 years old who were admitted to medical or surgical intensive care units between January 2016 and July 2017; SOFA, Sequential Organ Failure Assessment.

Table 4
Relationship between Montreal Cognitive Assessment (MoCA) scores at hospital discharge and 6-month outcomes in intensive care unit survivors

Variable	Mortality	New severe disability
No. of patients	213	176
No. of events (%)	37 (17.4)	41 (23.3)
Odds ratio (95% CI)		
Unadjusted	0.98 (0.90-1.06)	0.90 (0.82-0.97)
Adjusted[a]	1.03 (0.93-1.14)	0.85 (0.76-0.94)

[a] Adjusted for age, an indicator variable capturing recruitment cohort, Sequential Organ Failure Assessment score, blood transfusion during the hospital stay, severity of impairment of activities of daily living at hospital discharge, race/ethnicity, and sex. In sensitivity analyses, when the MoCA scores at discharge include the 47 people who could not complete the MoCA because of cognitive impairment as a score of 0, the effect estimates are similar (adjusted odds ratio [95% CI], 1.00 [0.94-1.04] for mortality and 0.90 [0.86-0.95] for new severe disability).

Comparison With Previous Studies

The high prevalence of cognitive impairment around the time of hospital discharge in our study

sample is consistent with the considerable literature documenting cognitive impairment in the months after hospital discharge after critical illness.[2,20,21] In a recent study of 300 critically ill adults from 1 tertiary care center, prevalence of cognitive impairment around the time of hospital discharge was similarly high as measured with the MoCA-Blind, which has been shown to be feasible in ICU survivors.[22] The lack of association between level of cognitive impairment and 6-month mortality in our sample of ICU survivors differed from what we expected given the literature showing the impact of delirium on long-term morbidity and mortality in other ICU cohorts.[23] The unexpected finding may be due to type II error and may be worth exploring in a larger sample. This study extends the literature on ICU survivors with the finding of a strong association between cognitive impairment at hospital discharge and new severe disability, a result that is consistent with the growing literature showing the interconnection between the brain and physical disability outcomes.[24] Previous studies have shown that delirium and acute brain dysfunction in the hospital are associated with posthospital disability outcomes in adult ICU survivors.[23,25]

There may still be a role for developing and validating a post-ICU–specific cognitive assessment tool.

Our results not only underscore the feasibility of a simple cognitive assessment tool at hospital discharge in critically ill adults but also provide insight into how survivorship bias affects these early cognitive assessments. When we examined those who had completed the MoCA, we found that worse disability was associated with better MoCA scores, but in our sensitivity analysis in which we included the patients who were unable to complete the MoCA owing to cognitive impairment, we found that disability at hospital discharge was associated with worse MoCA scores. Although we found few hospital factors related to MoCA scores, the hypothesis-generating association found between blood transfusion during hospitalization and early cognitive impairment is worth exploring in future studies. Previous studies have shown an association between blood transfusion and posthospital disability,[26] and some studies have shown a possible relationship between iron stores, anemia, and cognitive function in adult outpatient women.[27] Another plausible biological explanation for this association is that transfusion induces neuroinflammation and cognitive impairment.[28]

Implications for Public Health and Clinical Practice

Given the emerging consensus that early identification of cognitive impairment in ICU survivors is important,[4] our results suggest that such assessments are feasible in most survivors and that the inability to complete a screening test may provide important prognostic data. Nevertheless, the fact that a significant percentage of adults cannot complete cognitive assessments at this time point suggests that there may still be a role for developing and validating a post-ICU–specific cognitive assessment tool that could be used longitudinally in a larger proportion of ICU survivors. The effectiveness of comprehensive cognitive rehabilitation in adult ICU survivors has not been definitively shown, but such therapies are standard in adult survivors of traumatic brain injury. These results suggest that cognitive impairment assessment could be used to develop physical or occupational therapy interventions in ICU survivors. How cognitive impairment affects ICU survivors' capacity to participate in posthospital rehabilitation interventions and accommodate their disabilities after critical illness should be explored in future research.

Strengths and Limitations

Although we merged 2 cohorts and found that the cohort indicator was an important correlate of cognitive outcome at hospital discharge, our analyses together with our sensitivity analyses provide generalizable insights into the utility of assessing cognition at hospital discharge. The factors that we found to be associated with cognitive impairment at hospital discharge cannot be used for clinical prediction but rather were meant to be descriptive and hypothesis-generating. In particular, the association between blood transfusion during hospitalization and cognitive impairment is biologically plausible and worthy of further exploration. Because both cohorts did not complete a detailed assessment for delirium or coma during the hospital stay, we could not adjust for this important mediator of cognitive outcomes. We did not have other measures of cognitive impairment with which to triangulate our primary cognitive assessment tool. Although previous studies have measured the reliability of the MoCA tool in critically ill adults, we did not specifcally measure reliability as part of this study. In addition, although we attempted to assess for prehospital cognitive impairment, the 2 cohorts used different methods to do this.

Conclusion

Although most ICU survivors in our study population completed a simple cognitive assessment at

hospital discharge, survivors who were unable to complete it were severely physically or cognitively impaired at the time of assessment. The development and validation of novel cognitive assessment tools that could be completed by a larger proportion of ICU survivors are an important avenue of investigation. In our study population, the level of cognitive impairment at hospital discharge was associated with the risk of new physical disabilities after critical illness. Future research could focus on developing approaches to integrate cognitive assessment at the hospital discharge time point as a potential prognostic enrichment strategy for rehabilitation interventions geared toward improving disability outcomes after critical illness.

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CE 1.0 Hour Category C

Notice to CE enrollees:

This article has been designated for CE contact hour(s). The evaluation demonstrates your knowledge of the following objectives:

1. Assess for cognitive impairment in survivors of critical care illness.
2. Explore the utility of the Montreal Cognitive Assessment as a tool to screen for cognitive impairments in survivors of critical illness.
3. Identify baseline and hospitalization characteristics associated with cognitive impairment at hospital discharge.

To complete the evaluation for CE contact hour(s) for this article #A223143, visit www.ajcconline.org and click the "CE Articles" button. No CE evaluation fee for AACN members. This expires on July 1, 2024.

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Supplemental Table

Final model describing correlates of cognitive impairment as assessed via MoCA at hospital discharge when patients who could not complete MoCA at discharge because of severe cognitive impairment are included as MoCA score of 0 (n=260)

Correlate	Beta coefficient	95% CI	*P*
Age, per 1-year increase	–0.014	–0.21 to –0.08	<.001
CAMINANDO vs FRAIL-STOOP cohort	0.02	–1.76 to 1.80	.98
Blood transfusion while in hospital	–1.89	–3.58 to –0.20	.03
Severity of ADL disability at hospital discharge	–2.57	–3.56 to 1.59	<.001
SOFA total score, per unit increase	–0.05	–0.25 to 0.15	.62

Abbreviations: ADL, activities of daily living; CAMINANDO, cohort of adults ≥ 18 years old with acute respiratory failure admitted between July 2018 and December 2019; FRAIL-STOOP, cohort of adult patients ≥ 50 years old who were admitted to medical or surgical intensive care units between January 2016 and July 2017; MoCA, Montreal Cognitive Assessment; SOFA, Sequential Organ Failure Assessment.