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2.1 contact hours will be awarded for this activity. A contact hour is 60 minutes of instruction. This is a Learner-Paced Program. Vindico Medical Education does not require submission of quiz answers. A contact hour certificate will be awarded 4 to 6 weeks upon receipt of your completed Registration Form, including the Evaluation portion. To obtain contact hours:

1. Read the article "Transitions Experienced by Older Survivors of Critical Care" by Michele C. Balas, PhD, RN, APRN-BC, CCRN; Claudia Chaperon, PhD, APRN-NP; Joseph H. Sisson, MD; Steven Bonasera, MD; Melody Hertzog, PhD; Jane Potter, MD; Delayne Peterson, PA-C; Wendy McVay, APRN-NP; Jackie Gorman, PA-C; and William J. Burke, MD on pages 14-25, carefully noting the tables and other illustrative materials that are provided to enhance your knowledge and understanding of the content.
2. Read each question and record your answers. After completing all questions, compare your answers to those provided at the end of the quiz.
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Activity Objectives

1. Identify the prevalence of intensive care unit (ICU) placement and mortality for older adults.
2. Identify the incidence of delirium for older adults in ICUs.
3. Discuss potential negative outcomes associated with ICU placement.
4. Describe variables that significantly influence outcomes following discharge from an ICU.
5. Discuss implications for nursing practice.

Author Disclosure Statement

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Commercial Support Statement

All authors and planners have agreed that this activity will be free of commercial bias. There is no commercial support for this activity. There is no non-commercial support for this activity.

ABSTRACT

The transition from hospital to home is complicated for older adults who experience a serious or life-threatening illness. The specific aims of this prospective, observational cohort study were to determine the number of older adults who experience a change in their functional ability and residence after an intensive care unit (ICU) stay and to explore risk factors for functional decline and new institutionalization at hospital discharge. We found high rates of unrecognized preexisting cognitive impairment, delirium, complications, functional decline, and new institutionalization in this sample ($N = 43$). A number of variables were associated with functional decline or new institutionalization, including narcotic agent use ($p = 0.03$), ICU complications ($p = 0.05$), comorbidities ($p = 0.01$), depression ($p = 0.05$), and severity of illness ($p = 0.05$). We identified device self-removal, admission type, and ICU delirium as also potentially associated with these outcomes ($p \leq 0.25$). There are a number of important and potentially modifiable factors that influence an older adult's ability to recover after a critical illness.

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Transitions Experienced by Older Survivors of Critical Care

Older adults comprise a large percentage of patients treated in intensive care units (ICUs) throughout the United States, with patients 65 and older accounting for more than half (55.8%) of all ICU days (Angus, Kelley, Schmitz, White, & Popovich, 2000). The vast majority of these patients will experience at least one episode of delirium sometime during their hospital stay (Balas et al., 2007; McNicoll et al., 2003). Older survivors of critical care will also encounter numerous other challenges as they transition from hospital to home, including newly acquired cognitive dysfunction, reduced physical function, increased psychological distress, and altered quality of life (Ehlenbach et al., 2010; Khouli et al., 2011; Milbrandt, Eldadah, Nayfield, Hadley, & Angus, 2010). To date, surprisingly few studies have explored how common treatments and conditions experienced in the ICU influence older adults' ability to recover after a critical illness.

LITERATURE REVIEW

Chronological age plays an important role in the ability to recover from a serious or life-threatening illness. Age-related changes to the immune, renal, neurological, and other body systems not only render older adults less able to respond to stressors and maintain homeostasis (Milbrandt et al., 2010) but also predispose older adults to several commonly encountered ICU diagnoses such as sepsis and acute respiratory failure (Casey & Balas, 2011). The frequency of chronic conditions, disability, and residence in institutional settings such as nursing homes also increases with advanced age (U.S. Administration on Aging, 2010), further challenging older adults' ability to survive a serious illness.

While there is some indication that survival rates of older ICU patients are improving (Lerolle et al., 2010), long-term mortality rates in this population remain high. For example, a recent study reported one third of adults 65 and older admitted to an ICU die within 6 months of hospital discharge (Khouli et al., 2011). More important, research suggests older adults who survive any ICU stay experience substantial alterations in their health status, functional ability, and quality of life, and are more likely to require admission to postacute care facilities (Balas, Happ, Yang, Chelluri, & Richmond, 2009; de Rooij et al., 2008; Khouli et al., 2011; Montuclard et al., 2000). Despite these findings, many older survivors of critical illness will eventually return to living at home and consider their quality of life satisfactory or good after hospital discharge (Chelluri, Grenvik, & Silverman, 1995; de Rooij et al., 2008; Kaarlola, Tallgren, & Pettilä, 2006).

While acknowledged as important, chronological age is not the sole determinant of outcomes after a critical illness. Previous research suggests a number of variables that are present prior to, or at the time of, hospital admission influence older adults' recovery. The most important prognostic factors in the critically ill older adult population consistently include severity of illness, nature and extent of comorbidities, and admitting diagnosis (Kaarlola et al., 2006; Khouli et al., 2011; Kleinpell, 2003). It remains an unfortunate reality that many of these risk factors are preexisting and not particularly amenable to nursing intervention.

There is growing recognition that a number of common, potentially modifiable treatments and conditions experienced in the ICU setting may affect older adults' ability to successfully transition from hospital to home. Delirium, which occurs in more than two thirds of patients receiving mechanical ventilation (Ely et al., 2001, 2004), is associated with multiple unfavorable outcomes in older adults, including greater likelihood of discharge to a place other than home (Balas et al., 2009), substantial functional decline (Balas et al., 2009), higher 1-year mortality (Pisani et al., 2009), and long-term neurocognitive impairment (Jackson et al., 2003). While not studied specifically in the older adult population, ICU practices that focus on the reduction of sedative medications, early liberation from mechanical ventilation, delirium monitoring and management, and the use of early mobility protocols also appear to be influential in fostering recovery (Morandi, Brummel, & Ely, 2011; Pandharipande, Banerjee, McGrane, & Ely, 2010; Schweickert et al., 2009; Vasilevskis, Ely, et al., 2010; Vasilevskis, Pandharipande, Girard, & Ely, 2010).

Other aspects of the critical care environment may influence older adults' successful transition from hospital to home. Application of physical restraints, injudicious administration of psychoactive medications, and frequent use of multiple tubes and catheters may predispose older adults to injury. To date, uncertainty exists as to how these and other factors influence critically ill older adults' outcomes. A clearer understanding of the natural history of critical illness in this population may serve to guide future research and clinical interventions aimed at decreasing the occurrence and duration of delirium.

PURPOSE

The aims of this study were to (a) determine the number of older adults who experience a change in their functional ability and place of residence after an ICU stay, and (b) explore correlates and risk factors of functional decline and new institutionalization at hospital discharge among critically ill older adults.

METHOD

Design and Setting

This study used a prospective, observational design to obtain information about a cohort of critically ill older adults (N = 43). We recruited study participants from a large, university-affiliated medical center in the midwestern United States. The medical center's Institutional Review Board (IRB) reviewed and approved the research protocol. Study personnel screened all consecutive patients 65 and older who were admitted to the institution's academic medical or surgical critical care service (CCS). Each participant's legally authorized representative provided written informed consent for the person to participate in the study. While in the ICU, each participant, if able, provided his or her assent to participate in the study. Once discharged from the ICU, each participant, if able, provided his or her written informed consent to participate in the study.

Sample

Inclusion criteria for the study were age 65 and older, admission to an ICU, and management by the institution's medical or surgical CCS. Because we anticipated many potential participants would be intubated and/or mechanically ventilated, we also required the availability of an English-speaking surrogate who was

willing to participate. We screened all surrogates to determine whether they maintained sufficient contact with the participant, which we defined as any in-person or telephone contact with the participant exceeding 4 hours per week during the past 5 years.

Five categories of patients were excluded from participation:

- Those with recent (within 1 year) central nervous system injury (defined as head or spinal cord injury, neurosurgical procedure, or cerebral vascular accident).
- Patients who were currently, or anytime in the past, treated by a physician for the following Axis I psychotic disorders (i.e., psychosis not otherwise specified, schizophrenia, and schizoaffective, delusional, or bipolar disorder), as defined by the *Diagnostic and Statistical Manual of Mental Disorders,* fourth edition, text revision (American Psychiatric Association, 2000).
- Those who are legally blind or deaf.
- Non-English-speaking individuals.
- Patients undergoing cardiothoracic surgery.

Individuals who are legally blind and deaf were not eligible to participate because completion of the tool used to detect delirium requires patients to be able to visually identify various items for future recall and to hear and respond to instructions given by the test administrator. Participants with the aforementioned neurological or psychiatric disorders were not eligible for participation because of the confounding effect it would cause in distinguishing a diagnosis of new onset delirium from preexisting cognitive impairment. While there were no participant enrollment restrictions based on race or ethnic origin, considering the number of assessments and forms used in the study, the IRB believed it would be unduly burdensome and costly to use translators for non-English-speaking participants. Therefore, we did not enroll non-English-speaking participants, or their surrogates, in the research. Finally, patients undergoing cardiothoracic surgery were ineligible because the frequent postoperative "cognitive dysfunction" experienced

TABLE 1

CHARACTERISTICS OF THE SAMPLE (*N* = 43)

Characteristic	Mean (*SD*, range)
Age	75.3 (6.6, 65 to 89)
	***n* (%)**
Men	24 (56)
Women	19 (44)
Marital status	
Married	26 (61)
Divorced	7 (16)
Widowed	9 (21)
Never married	1 (2)
Surrogate relationship	
Current spouse	19 (44)
Child/significant other living with participant	7 (16)
Child/significant other who spends 4 or more hours per week with participant	17 (40)
Cognitive impairment	
Per surrogate	2 (5)
Per chart review	2 (5)
Short IQCODE score ⩾3.31	16 (37)
Past history or treatment of depression	
Per surrogate	11 (26)
Per chart review	11 (26)
Past history or treatment for anxiety/other psychiatric condition	
Anxiety per surrogate	7(16)
Other per surrogate	0 (0)
Mechanical ventilation	
Present at ICU admission	12 (28)
Used anytime during ICU stay	17 (40)
Days used, range	
0	26 (61)
1	4 (9)
2	2 (5)
3	2 (5)
4 to 25	8(18)
57	1 (2)

Note. IQCODE = Informant Questionnaire on Cognitive Decline in the Elderly; ICU = intensive care unit.

TABLE 2

COMPLICATIONS AND MEDICATIONS DOCUMENTED DURING INTENSIVE CARE UNIT (ICU) STAY (*N* = 43)

Characteristic	*n* (%)
Number of complications	
0	9 (21)
1	9 (21)
2	10 (23)
3	6 (14)
4	4 (9)
5	2 (5)
6	1 (2)
7	2 (5)
Complication	
Cardiac arrhythmia	23 (54)
ICU delirium	23 (54)
Acute kidney injury	18 (42)
Sepsis	15 (35)
Pneumonia	9 (21)
Urinary tract infection	7 (16)
Gastrointestinal bleed	6 (14)
Re-intubation	5 (12)
Deep vein thrombosis	3 (7)
Cardiopulmonary resuscitation	2 (5)
Pneumothorax	2 (5)
Pulmonary emboli	2 (5)
Myocardial infarction	1 (2)
ICU device self-removal	12 (28)
Total episodes of device self-removal, *n*	17
Types of devices self-removed by participants, *n*	
Nasogastric/nasointestinal tubes	7
Central venous access device	2
Endotracheal tube	1
Peripheral intravenous access	1
Other[a]	6

by this group is often attributed to surgical techniques specific to this type of surgery (i.e., hypothermia, cardiopulmonary bypass).

Sample Size Calculation

We planned this exploratory study to identify potential correlates of decline in functional ability and change in residence in the critically ill older adult population. A future, fully powered study will involve developing multivariable logistic regression models, for which the current study serves as a screening step. Following recommendations by Hosmer and Lemeshow (2000), screening begins with assessment of the univariate relationship of each predictor with each outcome. With dichotomous predictors, a chi-square test of significance of this relationship is equivalent to the likelihood ratio test of the coefficient in a single-predictor logistic regression. For chi square, a conventional medium effect size is w = 0.3. As suggested by Hosmer and Lemeshow (2000), a liberal alpha level of 0.25 was used in calculations, with no adjustment for multiple tests. Type I error in this situation will be inflated, but we feel that is acceptable at this exploratory stage of research to avoid prematurely eliminating potentially important predictors. For a medium effect as defined above, the recruited sample size of 43 would have power ⩾0.80 for testing a single predictor.

Data Collection

Intake Interviews and Data Collection. Study personnel conducted standardized, in-person or telephone interviews with each participant's surrogate within 24 to 48 hours of the participant's ICU admission to obtain information regarding each patient's preadmission physical, functional, and cognitive ability. These interviews contained questions regarding the participant's past medical/surgical/psychiatric history, demographic data, the surrogate-participant relationship, and the participant's living arrangements prior to hospitalization. We also asked if, prior to hospitalization, the older adult experienced any type of sensory impairment, used assistive devices, or received assistance with their activities of daily living (ADLs) from a home health care agency or personal assistant.

As a way of quantifying the participant's baseline functional status, we administered the Katz Index of Independence in Activities of Daily Living (Katz ADL; Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963), a tool frequently used among older adults in a variety of care settings (Wallace & Shelkey, 2007). We

asked each participant's surrogate to reflect on the participant's functional ability 1 week prior to hospitalization. The range of scores for the Katz ADL is 0 to 6, with lower scores reflecting lower levels of function.

Finally, we assessed the presence of preexisting cognitive impairment by information obtained from the surrogate using the short form of the Informant Questionnaire on Cognitive Decline in the Elderly (Short IQCODE; Jorm, 1994). The Short IQCODE, specifically designed for proxy administration, is composed of 16 questions that ask the "informant," typically a family member or significant other, to reflect on the patient's past (over the past 5 years) and current cognitive functioning. We defined preexisting cognitive impairment as being present if the participant received a score of 3.31 or higher on this tool. In prior studies, this cut-off point indicated a balance of sensitivity (79%) and specificity (82%) for detecting dementia (Jorm, 1994).

Study personnel also reviewed each participant's medical record to obtain additional medical and demographic data of interest, including the use of substances such as alcohol or drugs, that may affect cognition. We measured severity of illness using the Acute Physiology and Chronic Health Evaluation tool (APACHE II; Knaus, Draper, Wagner, & Zimmerman, 1985). The APACHE II score, which ranges from 0 to 71, is derived from 12 routine physiological measurements that occur during the first 24 hours of ICU admission, information about past medical history, and age. Higher APACHE II scores are associated with more severe disease and higher risk of death. The nature and extent of the participant's comorbidities were quantified using the Charlson Comorbidity Index (CCI; Charlson, Pompei, Ales, & MacKenzie, 1987). The CCI contains 19 conditions, each assigned a weighted score of 1 to 6; total scores range from 0 to 37. All data collection instruments have established psychometric properties in the older adult population.

TABLE 2 (CONTINUED)

COMPLICATIONS AND MEDICATIONS DOCUMENTED DURING INTENSIVE CARE UNIT (ICU) STAY (*N* = 43)

Characteristic	*n* (%)
Intravenous medication use	
Narcotic agents	
Any of those below	30 (70)
Morphine	24 (56)
Fentanyl (Duragesic® and others)	13 (30)
Hydromorphone (Dilaudid® and others)	8 (19)
Benzodiazepines	
Any	18 (42)
Lorazepam (Ativan®)	10 (23)
Midazolam (Versed®)	13 (30)
Hypnotic agent	
Propofol (Diprivan®)	5 (12)
Antipsychotic medication use	
Any	6 (14)
Quetiapine (Seroquel®)	4 (9)
Haloperidol (Haldol®)	3 (7)
Other	
Diphenhydramine (Benadryl® and others)	2 (5)
Temazepam (Restoril® and others)	1 (2)

[a] *Includes arterial lines, wound managers, disconnected blood transfusions, and two devices at once.*

ICU Interviews and Data Collection. Patients were screened for delirium daily during their ICU stay. The presence or absence of delirium was determined with the Confusion Assessment Method for the ICU (CAM-ICU; Ely et al., 2001). This valid and reliable tool assesses for four diagnostic features of delirium in ICU patients (Vanderbilt University Medical Center, United States Department of Veterans Affairs, 2011), including (1) acute onset or fluctuating course of mental status changes, (2), inattention, (3) disorganized thinking, and (4) altered level of consciousness. Participants were coded as having delirium if they displayed both features 1 and 2 and either 3 or 4.

We also performed daily chart reviews. We recorded mechanical ventilation use, code status, complication development, device utilization, any occurrence of device self-removal, physical restraint use, and whether or not the participant received one-to-one care. We detected complication occurrence through daily review of the physician's progress notes for 15 commonly encountered complications. Whether or not a complication occurred (and how many) was recorded. Finally, we recorded the type and daily amount of medications that

TABLE 3

PREADMISSION AND DISCHARGE FUNCTIONAL ABILITY AND RESIDENCE OF PARTICIPANTS

Characteristic	At Preadmission (*N* = 43)	At Discharge (*n* = 34)
Katz ADL mean score (*SD*)	4.8 (1.7)	2.7 (1.9)
Katz ADL score, *n* (%)		
6	22 (51)	5 (15)
5	9 (21)	2 (6)
4	3 (7)	4 (12)
3	1 (2)	6 (18)
2	6 (14)	5 (15)
1	1 (2)	8 (24)
0	1 (2)	4 (12)
Katz ADL category, *n* (%)		
Feeding independently	41 (95)	26 (77)
Continence independently	35 (81)	21 (62)
Transferring independently	35 (81)	16 (47)
Toileting independently	34 (79)	13 (38)
Dressing independently	31 (72)	8 (24)
Bathing independently	29 (67)	8 (24)
Receiving home health care, *n*	6	
Residence, *n* (%)		
Home	35 (81)	10 (28)[a]
Rehabilitation center	3 (7)	5 (14)[a]
Nursing home	2 (5)	2 (6)[a]
Skilled nursing facility	1 (2)	8 (22)[a]
Other[b]	2 (5)	11 (31)[a]
Live alone, *n*	10	5

Note. Katz ADL = Katz Index of Independence in Activities of Daily Living (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963); scores range from 0 to 6, with lower scores reflecting lower levels of function. Percentages may not total 100 due to rounding.

[a] n = 36; [b] Includes swing bed hospital (i.e., a hospital or critical access hospital participating in Medicare that has approval from the Centers for Medicare & Medicaid Services to provide either acute or skilled post-acute care services), hospice, and assisted living.

may affect mental status (e.g., narcotic, sedative, and/or antipsychotic agents).

Post-ICU Interviews and Data Collection. Study personnel continued to follow participants daily after discharge from the ICU. Delirium screening, record review, and interviews were similar to those performed while the participants were in the ICU. However, in those patients able to speak, the short version of the CAM (CAM-SV; Inouye et al., 1990) was used to screen for delirium in the post-ICU period. Within 24 to 48 hours prior to hospital discharge, study personnel administered and recorded the results of the Katz ADL and CAM-SV. Where participants would be living after hospital discharge, whether they would be living alone or with others, and whether they would be receiving any type of home health services were also noted. We collected data over a period of 5 months.

Data Analysis

We calculated descriptive statistics (frequencies/percentages or means/standard deviations) for all variables. We considered a change in functional ability as any difference in Katz ADL score from admission to hospital discharge. We then categorized patients as either (a) having decreased in their functional ability (with death during hospitalization included and coded as a decline) or (b) having remained the same or increased in their functional ability. We defined new institutionalization at hospital discharge as any non-home placement (with death during hospitalization included and coded as a non-home placement) for patients who had been living at home prior to admission. We identified potential predictors of functional decline and new institutionalization based on a review of the literature and clinical experience. We obtained descriptive statistics for each predictor by category of outcome variable (e.g., functional decline, no decline). For categorical predictors, we calculated the proportion of patients in each of these categories who had the characteristic or treatment; for continuous predictors, we computed means and standard deviations for those in each outcome category. We entered each identified variable into separate simple logistic regression analyses predicting either functional decline or new institutionalization. We obtained estimates of odds ratios (OR) and 95% confidence intervals (CI) from each analysis. Because this work is exploratory, we identified predictors having p values ≤ 0.25 (Hosmer & Lemeshow, 2000) as worthy of further study.

RESULTS

Participants were predominately men (56%), age 75.3 (*SD* = 6.6 years), Caucasian (86%), and currently married (61%). Surrogate re-

TABLE 4

UNIVARIATE LOGISTICAL ANALYSIS RESULTS

	Katz ADL Decline			Discharge Not to Home		
Variable	**OR**	**95% CI**	***p* Value**	**OR**	**95% CI**	***p* Value**
POTENTIALLY MODIFIABLE						
ICU complication	5.40	1.00, 29.05	0.05	6.13	1.03, 36.45	0.05
Device self-removal	3.67	0.39, 33.72	0.25	5.00	0.54, 46.22	0.16
Narcotic agent use	3.00	0.61, 14.86	0.18	6.88	1.27, 37.34	0.03
Benzodiazepine use	2.65	0.46, 15.15	0.27	1.72	0.35, 8.37	0.51
ICU delirium	2.44	0.49, 12.01	0.27	3.56	0.71, 17.76	0.12
ICU restraint use	1.29	0.26, 6.37	0.75	0.92	0.19, 4.22	0.91
MV use	0.91	0.17, 4.77	0.91	0.71	0.15, 3.31	0.66
NON-MODIFIABLE						
Hearing impairment	4.43	0.25, 79.73	0.31	3.13	0.18, 55.88	0.44
CCI score	1.21	0.91, 1.61	0.19	3.75	1.34, 10.50	0.01
APACHE II score	1.12	0.98, 1.28	0.09	1.14	0.99, 1.29	0.05
Age	1.03	0.91, 1.16	0.65	1.02	0.90, 1.15	0.76
Marital status	0.88	0.18, 4.33	0.87	0.39	0.67, 2.25	0.29
Admission type	0.58	0.11, 2.99	0.52	4.50	0.48, 41.99	0.19
IQCODE score	0.52	0.11, 2.51	0.42	0.89	0.18, 4.48	0.89
Live alone	0.42	0.08, 2.25	0.31	1.29	0.21, 7.76	0.78
Depression	0.19	0.03, 0.99	0.05	1.29	0.21, 7.76	0.78

Note. Katz ADL = Katz Index of Independence in Activities of Daily Living; OR = odds ratio; CI = confidence interval; ICU = intensive care unit; MV = mechanical ventilation; CCI = Charlson Comorbidity Index; APACHE II = Acute Physiology and Chronic Health Evaluation tool; IQCODE = Informant Questionnaire on Cognitive Decline in the Elderly.
We were unable to calculate antipsychotic agent use because all patients who received an antipsychotic agent while in the ICU either died or experienced functional decline at hospital discharge.

sponders were most often the participants' current spouse (44%) (**Table 1**). While the medical CCS managed the majority of participants in this study (93%), 40% of the sample had surgery either prior to, or sometime during, their ICU stay. Twelve (28%) participants required mechanical ventilation at the time of ICU admission, and 17 (40%) received mechanical ventilation sometime during their ICU stay (**Table 1**). The time spent on mechanical ventilation ranged from 0 to 57 days. Most admissions were unplanned (70%), and almost all participants were "full-code" status at ICU admission (93%).

The mean APACHE II score on ICU admission was 23.3 (*SD* = 6.9, range = 12 to 36), which correlates with a 40% estimated risk of death. Most participants in this study had multiple comorbid conditions, with a mean CCI score of 4.5 (*SD* = 3.4, range = 0 to 13). Few participants were ever treated in the past for alcohol (7%) or drug abuse (0%) problems. There was a moderate incidence of past diagnosis or treatment for depression (26%) and anxiety (16%) in this sample (**Table 1**). Preadmission sensory impairment was common, with 54% of the sample reporting hearing loss and 86% reporting visual impairment. On average, participants were in the ICU for 7 days (*SD* = 11 days, range = 1 to 70) and in the hospital for 14 days (*SD* = 6 days, range = 1 to 98). One participant (2%) died in the ICU, and 5 (12%) died during the post-ICU period.

When interviewed, only 2 surrogates (5%) reported that their family member/significant other had been previously diagnosed or treated for dementia or Alzheimer's disease. The same number of participants had these diagnoses recorded in their medical records. When we analyzed the IQCODE results, 16 participants (37%) scored 3.31 or higher, indicating the possible presence of preexisting cognitive impairment (**Table 1**). More than half (54%) of the sample had an episode of delirium during their ICU stay (**Table 2**) and 13% were discharged from the hospital with evidence of delirium.

TABLE 5

DESCRIPTION OF RISK FACTORS, FUNCTIONAL ABILITY, AND DISCHARGE PLACEMENT

	Percentage of Participants with Correlate or Risk Factor (Categorical)			
	Katz ADL Decline	No Decline	Discharge Not to Home	Discharge to Home
Variable	**(*n* = 32)**	**(*n* = 8)**	**(*n* = 26)**	**(*n* = 9)**
POTENTIALLY MODIFIABLE				
ICU complication	84.4	50	88.5	55.6
Narcotic agent use	75	50	84.6	44.4
ICU delirium	59.4	37.5	64	33.3
Benzodiazepine use	46.9	25	46.2	33.3
ICU restraint use	43.8	37.5	42.3	44.4
MV use	40.6	42.9	36	44.4
Device self-removal	34.4	12.5	38.5	11.1
Antipsychotic agent use	15.6	0	11.5	0
NON-MODIFIABLE				
Sensory impairment	96.9	87.5	96.2	88.9
Marital status	59.4	62.5	57.7	77.8
IQCODE score ⩾3.31	34.4	50	30.8	33.3
Admission type	25.8	37.5	36	11.1
Live alone	20	37.5	26.9	22.2
Depression	15.6	50	26.9	22.2
	Mean (*SD*) on Correlate or Risk Factor (Continuous)			
Age	75.7 (6.5)	74.5 (7.3)	5.6 (3.5)	1.2 (1.3)
APACHE II score	24.2 (7)	19.1 (6.9)	24.8 (7.2)	19.0 (6.1)
CCI score	4.8 (3.3)	3.0 (3.9)	74.7 (6.7)	73.9 (6.2)

Note. Katz ADL = Katz Index of Independence in Activities of Daily Living; ICU = intensive care unit; MV = mechanical ventilation; IQCODE = Informant Questionnaire on Cognitive Decline in the Elderly; APACHE II = Acute Physiology and Chronic Health Evaluation tool; CCI = Charlson Comorbidity Index.

Thirty-four participants (79%) experienced at least one complication during their ICU stay (**Table 2**). Nine participants (21%) had one complication, 10 (23%) had two complications, 6 (14%) had three complications, and 9 (21%) experienced between four and seven complications. The most common complications included cardiac arrhythmia, acute kidney injury, sepsis, and pneumonia.

Older adults in this study were frequently exposed to physical restraints, one-to-one care, and numerous medications while in the ICU. Physical restraints, most often wrist, were used in the care of 18 (42%) patients. Time spent in physical restraints ranged from 1 to 42 days. Nine participants (21%) had "sitters" (one-to-one care) stay with them sometime during their ICU stay. Time spent with a sitter ranged from 1 to 5 days. Despite the relatively high use of physical restraints and one-to-one care, 12 participants (28%) self-removed a catheter or tube (most often nasogastric and nasointestinal tubes) during their ICU stay. Thirty participants (70%) received an intravenous narcotic agent, 18 (42%) received an intravenous benzodiazepine, 5 (12%) received the short-acting hypnotic propofol (Diprivan®), and 6 (14%) received an antipsychotic agent (**Table 2**).

Older survivors of critical care experienced substantial declines in their functional ability and were at risk for new institutionalization (**Table 3**). Thirty-five (81%) older adults were admitted to the hospital from home. These patients most often lived with others, usually their spouse. Only 10 of the 36 participants (28%) for which discharge information was available returned home. The remainder required nursing home, skilled nursing facility, rehabilitation, or subacute care placement. Univariate analysis revealed that narcotic agent use (OR = 6.88; CI = 1.27; 37.34, $p = 0.03$), ICU complication (OR = 6.13; CI = 1.03, 36.45; $p = 0.05$), comorbidities (OR = 3.75; CI = 1.34, 10.50; $p = 0.01$), and severity of illness (OR = 1.14; CI = 0.99, 1.29; $p = 0.05$) were all significantly associated with increased odds of being discharged to a place other than home (**Tables 4 and 5**). The occurrence of ICU delirium (OR = 3.56; CI = 0.71, 17.76; $p = 0.12$), device self-removal (OR = 5.00; CI = 0.54, 46.22; $p = 0.16$), and an unplanned admission (OR = 4.50; CI = 0.48, 41.99; $p = 0.19$) were identified as variables potentially influencing discharge placement (**Tables 4 and 5**).

Prior to hospital admission, 21 participants (49%) used some type of assistive device to perform their ADLs. Common assistive devices used by study participants included walkers, wheelchairs, and canes. Despite the use of assistive devices, 22 (51%) older adults scored a 6 on their preadmission Katz ADL (mean = 4.8, *SD* = 1.7), indicating they were relatively independent with their ADLs prior to hospi-

talization (**Table 3**). At discharge, only 5 of 34 (15%) participants were scored as fully independent with their ADLs (Katz ADL mean = 2.7, *SD* = 1.9). Overall, participants declined a mean of 2.2 points (*SD* = 1.8) in their Katz ADL score. We consider the decline clinically significant, considering each category of this tool represents a fundamental ADL.

The occurrence of an ICU complication increased the odds of experiencing a decline in functional ability by 5.40 (CI = 1.00, 29.05; $p = 0.05$) (**Tables 4 and 5**). A past diagnosis of depression significantly decreased the odds of experiencing a decline in functional ability at hospital discharge (OR = 0.19; CI = 0.03, 0.99; $p = 0.05$). The use of an intravenous narcotic agent (OR = 3.00; CI = 0.61, 14.86; $p = 0.18$), severity of illness (OR = 1.12; CI = 0.98, 1.28; $p = 0.09$), device self-removal (OR = 3.67; CI = 0.39, 33.72; $p = 0.25$), and CCI score (OR = 1.21; CI = 0.91, 1.61; $p = 0.19$) were identified as variables potentially influencing participants' discharge functional ability (**Tables 4 and 5**).

DISCUSSION

Critically ill older adults experience a number of challenges as they transition from hospital to home. We found that despite high severity of illness and multiple comorbidities, relatively few older adults experienced an ICU or hospital death. Unfortunately, this high survivorship was often accompanied by considerable changes in their functional ability and residence. A substantial number of older adults in this study also experienced a complication sometime during their ICU stay. Alarmingly, many of our participants experienced five or more complications while hospitalized. While many of these complications were relatively "benign" and few resulted in death, we found their occurrence to be associated with significantly higher odds of functional decline and new institutionalization.

Several reports suggest hospitalized older adults are at increased risk of experiencing untoward events during their hospital stay. For example, a 1-month study of a national randomized sample of 780 hospitalized Medicare beneficiaries found that 13.5% experienced an adverse event during their hospital stay and an additional 13.5% experienced events during their hospital stay that resulted in temporary harm (Office of Inspector General, U.S. Department of Health and Human Services, 2010). Forty-four percent of these adverse events and temporary harm events were deemed clearly or likely preventable, suggesting a continued focus on patient safety and quality care in the ICU setting is warranted.

We found a number of variables were associated with functional decline and new institutionalization in this sample of critically ill older adults. Factors present at admission that affected these outcomes included severity of illness, an unplanned admission, and nature and extent of comorbidities. These variables have long been acknowledged as important prognostic indicators in the critically ill older adult population (Chelluri et al., 1995; Knaus et al., 1985). In this study, a past medical history of depression appeared to be associated with less likelihood of experiencing functional decline. One possible explanation for this finding is that we relied solely on surrogate interviews and medical chart reviews when recording a "past" diagnosis of depression, rather than actively screening critically ill older adults for this important and potentially treatable condition. We believe this finding warrants further investigation. While some of these preadmission factors do not appear to be modifiable, these findings suggest future research should include them as covariates in risk-screening models.

We also found potentially modifiable variables, such as the development of ICU delirium, use of intravenous narcotic agents, complications, and device self-removal, were associated with older adults' ability to recover after a serious illness. Delirium and weakness are conditions influenced by illness, as well as aggravated by other treatment modalities commonly used in the ICU setting, such as sedation and mechanical ventilation (Vasilevskis, Ely, et al., 2010). Our findings suggest multicomponent, interdisciplinary approaches, such as the recently proposed ABCDE bundle that specifically target ICU acquired delirium and weakness (Morandi et al., 2011), may be particularly useful when caring for critically ill older adults.

Finally, many older adults in this study experienced depression, anxiety, and sensory impairment before ICU admission. These older adults also had preexisting cognitive impairment that was often unreported by their significant others and medical team. While the high prevalence and lack of health care provider awareness of preexisting cognitive impairment in this population has been previously reported (Balas et al., 2007; Pisani, Redlich, McNicoll, Ely, & Inouye, 2003), to date it remains unclear as to how this impairment affects outcomes. For example, Pisani et al. (2005) found no significant difference in ICU readmission rates, discharge location, ICU or hospital mortality, or use of ICU interventions between patients with and without dementia. However, it is increasingly recognized that critical illness imposes a much greater likelihood of cognitive decline, even in those older adults without cognitive impairment at baseline (Ehlenbach et al., 2010).

LIMITATIONS

This study has several important limitations. First, we included only a small sample of mainly Caucasian, English-speaking adults 65 and older. We conducted the study at a single institution and included only those critically ill older adults managed by either the academic medical or surgical CCS. Patients managed by physicians in private practice, but admitted to an ICU, were not eligible to participate because of logistical constraints. The above factors limit the generalizability of the study findings. Reliance

KEYPOINTS

Balas, M.C., Chaperon, C., Sisson, J.H., Bonasera, S., Hertzog, M., Potter, J.,...Burke, W.J. (2011). **Transitions Experienced by Older Survivors of Critical Care.** *Journal of Gerontological Nursing, 37*(12), 14-25.

1. Older adults who experience a serious illness develop a number of potentially modifiable conditions that threaten their successful transition from hospital to home.
2. The development of delirium in the intensive care unit, use of intravenous narcotic agents, complications, and device self-removal are associated with functional decline and new institutionalization in the critically ill older adult population.
3. There is an urgent need for the development of nurse-led, interdisciplinary, multicomponent interventions targeted at the identified risk factors for suboptimal patient outcomes.

on surrogates to obtain information on preadmission physical, functional, and cognitive ability, while often necessary in this population, may affect the accuracy and quality of the data. Finally, we relied on physicians' daily progress notes to document the occurrence of ICU complications. Because we did not establish a formal definition, or a set of predefined diagnostic criteria of what constituted a complication, it is possible we either overestimated or underestimated the frequency of these conditions.

IMPLICATIONS FOR NURSES

Nurses play a fundamental role in optimizing critically ill older adults' ability to successfully transition from the ICU to home. We have identified a number of important and potentially modifiable factors that nurses should consider when caring for this extremely vulnerable population. One of the most critical implications for practice is for clinicians to understand that a number of interrelated factors that occur in the ICU setting (e.g., medication use, complications, delirium, device self-removal) have the potential to influence older adults' ability to recover after a critical illness. Knowing that many older adults survive an ICU stay despite being severely ill and having multiple comorbidities on admission may help all members of the ICU team develop an appreciation for the fact that chronological age, while important, is not the sole determinant of outcomes.

The fact that nearly all patients in this sample had some form of visual or hearing impairment suggests health care providers need to ensure assistive devices are not only available but also accessible while their patients are in the ICU. Corrective devices such as eyeglasses and hearing aids may not only facilitate communication, but also help older adults correctly interrupt the often-chaotic ICU environment. Finally, the high rates of often-unrecognized preexisting cognitive impairment in this sample suggests providers may want to consider implementing rehabilitative strategies specifically focused on preventing any further neurological decline.

CONCLUSION

Older survivors of critical care frequently experience a decline in their functional ability and are at risk for new institutionalization. We identified a number of variables present at hospital admission that were associated with these outcomes, including severity of illness, nature and extent of comorbidities, unplanned admission, and depression. Other potentially modifiable factors that occur during an ICU stay were associated with older adults' functional ability and placement at discharge, including narcotic use, ICU complications, device self-removal, and delirium. These findings suggest there is a need for development of interventions aimed at reducing the identified risk factors and further research on the role of these interventions on critically ill older adults' transition from hospital to home.

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Dr. Bonasera discloses receiving a technology transfer award for most promising new invention from UNeMED, as well as a patent submission (Application # PCT/US2011/53715) on which he is listed as a co-inventor. (Licensing rights will be held by UNeMED.) He also discloses a grant from the Alzheimer's Association's Everyday Technologies for Alzheimer's Care (ETAC) initiative, ETAC-11-206024. Dr. Balas, Dr. Chaperon, Dr. Sisson, Dr. Hertzog, Dr. Potter, Ms. Peterson, Ms. McVay, Ms. Gorman, and Dr. Burke have no relationships to disclose.

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CNE ACTIVITY

Earn 2.1 Contact Hours

HOW TO OBTAIN CONTACT HOURS BY READING THIS ISSUE

Instructions: 2.1 contact hours will be awarded for this activity. A contact hour is 60 minutes of instruction. This is a Learner-Paced Program. Vindico Medical Education does not require submission of quiz answers. A contact hour certificate will be awarded 4 to 6 weeks upon receipt of your completed Registration Form, including the Evaluation portion. To obtain contact hours:

1. Read the article "Transitions Experienced by Older Survivors of Critical Care" on pages 14-25, carefully noting the tables and other illustrative materials that are provided to enhance your knowledge and understanding of the content.
2. Read each question and record your answers. After completing all questions, compare your answers to those provided at the end of the quiz.
3. Type or print your full name, address, and date of birth in the spaces provided on the registration form.
4. Indicate the total time spent on the activity (reading article and completing quiz). Forms and quizzes cannot be processed if this section is incomplete. All participants are required by the accreditation agency to attest to the time spent completing the activity.
5. Forward the completed form with your check or money order for $20 made payable to JGN-CNE. All payments must be made in U.S. dollars and checks must be drawn on U.S. banks. Quizzes are accepted up to 24 months from date of issue.

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Objectives: After studying the article, "Transitions Experienced by Older Survivors of Critical Care" in this issue, the participant will:

1. Identify the prevalence of intensive care unit (ICU) placement and mortality for older adults.
2. Identify the incidence of delirium for older adults in ICUs.
3. Discuss potential negative outcomes associated with ICU placement.
4. Describe variables that significantly influence outcomes following discharge from an ICU.
5. Discuss implications for nursing practice.

1. Patients 65 and older account for _____ of all intensive care unit (ICU) days.

A. more than one quarter.
B. more than one third.
C. more than one half.
D. more than two thirds.

2. According to a study by Khouli et al., _____ of adults 65 and older admitted to an ICU die within 6 months of hospital discharge.

A. one quarter.
B. one third.
C. one half.
D. two thirds.

3. Research suggests older adults who survive any ICU stay experience substantial alterations in their:

A. health status.
B. functional ability.
C. quality of life.
D. All of the above.

4. Delirium occurs in more than _____ of patients receiving mechanical ventilation.

A. one third.
B. one half.
C. two thirds.
D. three quarters.

5. In the study conducted by the authors, functional status, a significant variable at baseline and prior to discharge, was measured using the:

A. Lawton Scale.
B. Katz Index of Independence in Activities of Daily Living.
C. SPICES tool.
D. Barthel Index.

6. In this study, what percentage of the participants experienced at least one complication during their ICU stay?

A. 21%
B. 34%.
C. 63%.
D. 79%.

7. Among the two most common complications found in this study were:

A. cardiac arrhythmia and acute kidney injury.
B. sepsis and urinary tract infection.
C. urinary tract infection and deep vein thrombosis.
D. acute kidney injury and re-intubation.

Earn 2.1 Contact Hours

8. Of the variables studied, which of the following significantly influenced the odds of experiencing a decline in functional ability?

A. Severity of illness.
B. Occurrence of an ICU complication.
C. Use of an intravenous narcotic agent.
D. Comorbidities.

9. The odds of being discharged to a place other than home increased significantly with:

A. severity of illness.
B. occurrence of ICU delirium.
C. unplanned admission.
D. device self-removal.

10. Which of the following implications for nurses were identified by the authors?

A. Recognition that a number of factors have the potential to influence older adults' ability to recover after a critical illness.
B. Recognition that chronological age, while important, is not the sole determinant of outcomes after a critical illness.
C. Ensuring that assistive devices such as eyeglasses and hearing aids are accessible for older adults in the ICU.
D. All of the above.

CNE Answers
December 2011

1. C	**3. D**	**5. B**	**7. A**	**9. A**
2. B	**4. C**	**6. D**	**8. B**	**10. D**

CNE REGISTRATION

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I authorize my credit card to be charged $20 for this activity.

Signature _____

Name on card _____

EVALUATION

(Must be completed for contact hour certificate to be awarded.)

	YES	NO
1. The content of the article(s) was accurately described by the learning objectives:	❒	❒

- Identify the prevalence of intensive care unit (ICU) placement and mortality for older adults.
- Identify the incidence of delirium for older adults in ICUs.
- Discuss potential negative outcomes associated with ICU placement.
- Describe variables that significantly influence outcomes following discharge from an ICU.
- Discuss implications for nursing practice.

2. The content met my educational needs.	❒	❒
3. The program content was relevant to my nursing practice.	❒	❒

4. How much time was required to read the article and take the quiz? 125 150 175 200 225 (minutes)
5. Please list topics that you would like to see future activities address:

_ _____

_____

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