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Michele C Balas  
*University of Pennsylvania*

Mary Elizabeth Happ  
*University of Pennsylvania*

Wei Yang

Lakshmipathi Chelluri

Therese S. Richmond  
*University of Pennsylvania*, [terryr@nursing.upenn.edu](mailto:terryr@nursing.upenn.edu)

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## **Abstract**

**BACKGROUND:** We previously noted that older adults admitted to surgical ICUs (SICUs) are at high risk for delirium. In the current study, we describe the association between the presence of delirium and complications in older SICU patients, and describe the association between delirium occurring in the SICU and functional ability and discharge placement for older patients.

**METHODS:** Secondary analysis of prospective, observational, cohort study. Subjects were 114 consecutive patients  $\geq 65$  years old admitted to a surgical critical care service. All subjects underwent daily delirium and sedation/agitation screening during hospitalization. Outcomes prospectively recorded included SICU complication development, discharge location, and functional ability (as measured by the Katz activities of daily living instrument).

**RESULTS:** Nearly one third of older adults (31.6%) admitted to an SICU had a complication during ICU stay. There was a strong association between SICU delirium and complication occurrence ( $p = 0.001$ ). Complication occurrence preceded delirium diagnosis for 16 of 20 subjects. Subjects with delirium in the SICU were more likely to be discharged to a place other than home (61.3% vs 20.5%,  $p < 0.0001$ ) and have greater functional decline (67.7% vs 43.6%,  $p = 0.023$ ) than nondelirious subjects. After adjusting for covariates including severity of illness and mechanical ventilation use, delirium was found to be strongly and independently associated with greater odds of being discharged to a place other than home (odds ratio, 7.20; 95% confidence interval, 1.93 to 26.82).

**CONCLUSIONS:** Delirium in older surgical ICU patients is associated with complications and an increased likelihood of discharge to a place other than home.

## **Keywords**

Activities of Daily Living, Aged, Aged, 80 and over, Cohort Studies, Critical Care, Delirium, Female, Health Status, Hospitalization, Humans, Male, Recovery of Function, Retrospective Studies, Risk Factors, Thoracic Diseases, Treatment Outcome

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## Outcomes Associated With Delirium in Older Patients in Surgical ICUs

Michele C. Balas, PhD, RN, CCRN, Mary Beth Happ, PhD, RN, Wei Yang, PhD, Lakshmipathi Chelluri, MD, MPH, FCCP, and Therese Richmond, PhD, CRNP

<sup>†</sup>From the University of Pennsylvania School of Nursing (Drs. Balas and Richmond), Philadelphia; University of Pittsburgh School of Nursing and Center for Bioethics and Health Law (Dr. Happ), Pittsburgh; Department of Biostatistics and Epidemiology (Dr. Yang), University of Pennsylvania School of Medicine, Philadelphia; and Department of Critical Care Medicine (Dr. Chelluri), University of Pittsburgh School of Medicine, Pittsburgh, PA

### Abstract

**Background**—We previously noted that older adults admitted to surgical ICUs (SICUs) are at high risk for delirium. In the current study, we describe the association between the presence of delirium and complications in older SICU patients, and describe the association between delirium occurring in the SICU and functional ability and discharge placement for older patients.

**Methods**—Secondary analysis of prospective, observational, cohort study. Subjects were 114 consecutive patients  $\geq 65$  years old admitted to a surgical critical care service. All subjects underwent daily delirium and sedation/agitation screening during hospitalization. Outcomes prospectively recorded included SICU complication development, discharge location, and functional ability (as measured by the Katz activities of daily living instrument).

**Results**—Nearly one third of older adults (31.6%) admitted to an SICU had a complication during ICU stay. There was a strong association between SICU delirium and complication occurrence ( $p = 0.001$ ). Complication occurrence preceded delirium diagnosis for 16 of 20 subjects. Subjects with delirium in the SICU were more likely to be discharged to a place other than home (61.3% vs 20.5%,  $p < 0.0001$ ) and have greater functional decline (67.7% vs 43.6%,  $p = 0.023$ ) than nondelirious subjects. After adjusting for covariates including severity of illness and mechanical ventilation use, delirium was found to be strongly and independently associated with greater odds of being discharged to a place other than home (odds ratio, 7.20; 95% confidence interval, 1.93 to 26.82).

**Conclusions**—Delirium in older surgical ICU patients is associated with complications and an increased likelihood of discharge to a place other than home.

### Keywords

aged; complications; critical care; delirium; discharge placement; functional status; intensive care; outcomes; surgery

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Delirium is a potentially debilitating disorder experienced by many older adults admitted to ICUs. Often defined as *acute cognitive dysfunction*,<sup>1</sup> as many as 30 to 62%<sup>2,3</sup> of older patients have an episode of delirium during ICU stay. The elevated risk for delirium in the older

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Correspondence to: Michele C. Balas, PhD, RN, CCRN; balasm@nursing.upenn.edu.

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critically ill population is thought to be due to both intrinsic and extrinsic factors, including preexisting cognitive impairment (dementia), depression, impairments in activities of daily living (ADL), severity of illness, outpatient use of benzodiazepines or narcotics, and a variety of physiologic abnormalities.<sup>4</sup> Once thought to be an “inconsequential” outcome of ICU care,<sup>1</sup> research suggests that delirium in this setting is associated with multiple unfavorable short-term and long-term outcomes including higher ICU and hospital costs,<sup>5</sup> longer ICU and hospital length of stay,<sup>2,6–8</sup> greater use of continuous sedation and physical restraints,<sup>9</sup> increased removal of catheters and self-extubation,<sup>10</sup> and higher ICU and hospital mortality rates.<sup>6,11,12</sup> Delirium is also an independent predictor of mortality at 6 months after hospital discharge in ICU patients receiving mechanical ventilation.<sup>12</sup>

Several factors, such as dementia and dependency for the performance of ADLs, are known to contribute to postoperative complications for older adults.<sup>13</sup> Older adults are also more likely to have conditions affecting surgical utilization rates and outcomes, such as cancer diagnoses, malnutrition, and social isolation.<sup>14</sup> However, no studies to date have specifically examined the effect of delirium on outcomes of older adults admitted to surgical ICUs (SICUs). This is a significant gap, considering people > 65 years old comprise more than one half of the average general surgery practice,<sup>14</sup> consume nearly 60% of all ICU days,<sup>15</sup> and are one of the fastest-growing segments of the US population.

For this reason, we conducted a secondary analysis of a data set that was designed to examine the course of delirium in a cohort of older adults admitted to SICUs. Our first aim was to describe the association between the presence of delirium and complications in older SICU patients. Our second aim was to describe the association between delirium occurring in the SICU and older adults' posthospital functional ability and discharge placement. We hypothesized that there would be a positive association between delirium and SICU complications and that older adults with an episode of delirium during their SICU stay would have decreased functional ability at hospital discharge and would be more likely to be discharged to a place other than home when compared to older adults with no delirium.

## Materials and Methods

Data for the current analyses were derived from a prospective, observational, cohort study that was designed to examine the course of delirium in older SICU patients. While the frequency and trajectory of mental status changes of this sample were described elsewhere,<sup>2</sup> none of the outcome data reported in the present study have been previously published. Study participants were recruited from SICUs at the Hospital of the University of Pennsylvania, a 700-bed, urban, teaching hospital. All consecutive patients  $\geq 65$  years old admitted to the surgical critical care service between August 27, 2004, and December 31, 2004, were considered for study inclusion. The University of Pennsylvania institutional review board approval of the study previously reported<sup>2</sup> included the further statistical analysis included in this article. Written informed consent was obtained from all patients, if capable, and their surrogates. In the event where a patient was not capable of providing informed consent, it was obtained from his/her surrogate and then later obtained when decisional capacity returned.

Enrollment criteria included age  $\geq 65$  years, English speaking, admitted to a SICU, and managed by the surgical critical care service. Participation also required the availability of a surrogate responder who maintained in-person or telephone contact exceeding 4 h/wk with the patient over the previous 5 years. Both the patient and his/her surrogate needed to agree to participate in the study within 24 to 48 h of SICU admission. Exclusion criteria defined *a priori* were recent (within 1 year) CNS injury (defined as head or spinal cord injury, neurosurgical procedure, or cerebral vascular accident); current or past treatment for specific Diagnosis and Statistical Manual of Mental Disorders IV axis 1 psychotic disorders; legal

blindness; deafness; and, because of the frequent postoperative cognitive dysfunction associated with cardiopulmonary bypass, cardiothoracic surgery. Study enrollment flow is illustrated in Figure 1.

Structured interviews with all of the subjects' surrogates were conducted within 24 to 48 h of SICU admission to obtain information regarding demographic data, psychiatric history, preadmission visual, hearing and health status, and prior living arrangements. The use of home health care (HHC) services or any assistive device use to perform ADL was also recorded. The Katz ADL<sup>16</sup> index was used to formally assess the baseline functional ability with a reference point of 1 week prior to current hospitalization. The range of scores for the Katz ADL is 0 to 6, with higher scores reflecting higher levels of function. Subjects were screened for evidence of preexisting dementia with the use of the short form of the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE).<sup>17</sup> The short IQCODE requires informants to recall what their relative/family member's memory/intelligence was like 5 years ago and compare it to their present ability. It consists of 16 questions that are rated on a 5-point scale ranging from 1 (much improved) to 5 (much worse). A cut score of 3.31 achieves a balance of sensitivity (79%) and specificity (82%) for detecting dementia.<sup>17</sup>

Study personnel recorded the APACHE (acute physiology and chronic health evaluation) II scores,<sup>18</sup> admitting service, operative procedures, and also calculated their Charlson comorbidity index (CCI)<sup>19</sup> scores from the medical record. Mechanical ventilation use was recorded daily throughout the hospital stay. Complication occurrence in the SICU was detected by daily review of physician progress notes for 15 commonly encountered complications (eg, pneumonia, urinary tract infection, pulmonary emboli). Study personnel recorded if, and how many, complications the subjects' had each day during the SICU stay.

Subjects underwent daily sedation/agitation and delirium screening between the hours of 10:00 AM and 7:00 PM from study enrollment to hospital discharge. Interrater agreement for delirium and agitation/sedation status was obtained by having the two study personnel responsible for screenings perform their assessments together until 100% agreement on findings was obtained. Level of arousal was measured using the Richmond Agitation-Sedation Scale,<sup>20,21</sup> which rates a patient's level of agitation/sedation on a 10-point scale ranging from -5 (unarousable, not responsive to voice or physical stimulation) to +4 (combative). Delirium in the SICU was diagnosed with the Confusion Assessment Method for the ICU (CAM-ICU).<sup>23,24</sup> The CAM-ICU assesses four features of delirium: (1) acute onset or fluctuating course, (2) inattention, (3) disorganized thinking, and (4) altered level of consciousness.<sup>22,23</sup> To be diagnosed as delirious or CAM-ICU positive, the subject must display features 1 and 2, and either 3 or 4. The CAM-ICU has proven valid and reliable in ICU populations including older adults admitted to medical ICUs.<sup>3</sup> Subjects in this study were coded delirious in the SICU if they had a Richmond Agitation-Sedation Scale score  $\geq -3$  and scored positive on the CAM-ICU.

Within 24 to 48 h of anticipated hospital discharge, subjects' were administered the Katz ADL. At this time, both subjects and nurses were questioned about where and with whom subjects would be discharged and whether they would receive HHC services.

## Data Analysis

Descriptive statistics were used to examine sample characteristics. The baseline characteristics and intrahospital variables between those subjects who were ever rated delirious during their SICU stay and those who never had delirium during this period were compared using Student *t* test for continuous variables and  $\chi^2$  test for categorical variables.

Two multivariable logistic regression models were developed to determine if SICU delirium had an effect on the subjects' functional ability and discharge placement. In these models, the

presence of SICU delirium and covariates, which were chosen based on clinical judgment and previous research studies,<sup>3,4,6–11,14</sup> were the independent and explanatory variables. Covariates included surgical service type, gender, impaired hearing, preadmission Katz ADL score, IQCODE score, mechanical ventilation use, complications, age, and APACHE II and CCI scores. The dependent variable for the functional ability model was a change in the subjects Katz ADL score from hospital admission to discharge (where the probability modeled was 1 (decrease in KATZ ADL score) vs 0 (increase or no change from admission to hospital discharge)). Similarly, multivariate logistic regression was used to determine if SICU delirium affected the subject's likelihood of being discharged to a place other than home (where the probability modeled was 1 [any place other than home] vs 0 [home]). In both models, adjusted odds ratios with 95% confidence intervals (CIs) were calculated. Models were assessed for evidence of multicollinearity and goodness of fit. Statistical significance was defined as a *p* value < 0.05, and all analyses were performed using statistical software (SAS version 9.1; SAS Institute; Cary, NC).

## Results

Demographic and preadmission characteristics of the 114 subjects are presented in Tables 1, 2. The subjects were predominantly older (average age, 75 years), white (85%), and male (59.6%). While most subjects had visual impairment (98.3%) or hearing loss (43.9%), the vast majority were living at home (96.5%) prior to hospitalization. Thirty-three subjects (28.9%) used some type of assistive device to perform the ADL. Only 9.1% of those living at home received HHC services prior to hospitalization. Twenty-one subjects (18.4%) scored  $\geq 3.31$  on the IQCODE (suggesting evidence of preexisting dementia). Severity of illness as measured by APACHE II was  $14.5 \pm 6.7$  on SICU admission. Study subjects had an average CCI score of  $4.5 \pm 2.9$  ( $\pm$  SD). Forty-eight subjects (42.1%) received mechanical ventilation sometime during SICU admission. Thirty-four subjects (29.8%) had delirium sometime during SICU stay. Subjects with SICU delirium were significantly more likely to have preadmission hearing impairment, have an unplanned hospital admission, receive mechanical ventilation, and have higher APACHE II scores than nondelirious subjects (Table 1).

## Complications

Thirty-six subjects (31.6%) had at least one complication during SICU stay. A total of 73 complications were experienced by the sample. Most of the complications were cardiopulmonary, and included cardiac arrhythmias (*n* = 19), pneumonia (*n* = 7), and reintubation (*n* = 7). Subjects with delirium were significantly more likely than nondelirious subjects to have an SICU complication (20 of 34 subjects [59%] vs 16 of 80 subjects [20%]; *p* = 0.001). Complications preceded delirium onset in most subjects who experienced delirium (16 of 20 subjects).

## Discharge Placement

Of the 109 subjects with postdischarge placement information, most (*n* = 74; 67.9%) were discharged directly home (Table 2). The majority of these subjects reported they would be living with their spouse on discharge (70.3%; 52 of 74 subjects). Thirty-three patients (44.6%) discharged home reported they would be receiving HHC services. Thirty-five subjects (32.1%) required some form of postdischarge institutional care. Most of these subjects were discharged to either skilled nursing facilities (*n* = 15) or rehabilitation centers (*n* = 14). Univariate analysis revealed that in addition to SICU delirium, an unplanned admission, hearing loss, assistive device use, lower preadmission functional status, complications, and surgical service type were all significantly associated with discharge placement (Table 3). After adjusting for these variables, only SICU delirium (*p* = 0.003) was associated with discharge to a place other than

home. Delirium occurring in the SICU increased by 7.2 (CI, 1.93 to 26.82) the odds of being discharged to place other than home (Table 4).

### Functional Ability

While 78.1% (89 of 114 subjects) were functionally independent prior to hospital admission, fewer than half (42.2%; 46 of 109 subjects) were fully independent at discharge (Table 2). The Katz ADL category with the greatest percentage decrease from admission to discharge was transferring, followed by dressing and bathing. A total of 4 subjects had an improvement in Katz ADL score from admission to discharge, 50 subjects had no change, and 55 subjects had a decrease. A total of 21 of 31 delirious subjects (67.7%) had a decrease in Katz ADL scores, vs 34 of 78 nondelirious subjects (43.6%) [ $p = 0.023$ ]. Univariate analysis revealed in addition to delirium, surgical service type, an unplanned admission, female gender, and complications were all significantly associated with a decrease in Katz ADL score (Table 3). Only gender was found to significantly predict functional decline in the multiple regression model (Table 4). Female subjects were at a 5.8 (95% CI, 1.96 to 17.20) increased odds of having a decrease in Katz ADL score from admission to hospital discharge. Delirium in the SICU approached significance ( $p = 0.059$ ), increasing the odds of functional decline by 3.4 (95% CI, 0.95 to 12.19).

### Discussion

To our knowledge, this is the first study examining the association of delirium and short-term outcomes of older adults admitted to SICUs. We found that nearly one third of older adults admitted to a SICU had a complication during their ICU stay. There was a strong association between SICU delirium and complication occurrence. Unexpectedly, most subjects in this sample had a complication before delirium was diagnosed. This suggests that ICU complications may serve as a risk factor for delirium. Further study of this area is warranted. This is particularly important as the Centers for Medicare and Medicaid Services consider expanding the list of hospital-acquired conditions for nonpayment. The proposed list for 2009 includes delirium and conditions (*ie*, complications) such as extreme blood sugar derangement, iatrogenic pneumothorax, ventilator-associated pneumonia, and deep vein thrombosis/pulmonary embolism.<sup>24</sup>

We also found that SICU delirium was associated with a decrease in functional ability at hospital discharge and greater likelihood of being discharged to a place other than home. Even after controlling for a number of important variables including age, severity of illness, and mechanical ventilation use, an older adult with SICU delirium was seven times more likely to be discharged to a place other than home. While not statistically significant, delirium increased the odds of functional decline over threefold. It is likely, that if the sample had been larger, this finding would have reached significance. These results are consistent with prior studies of the effect of delirium on hospitalized (non-ICU) older adults' functional ability and discharge placement.<sup>25–28</sup>

Our findings have significant clinical and research implications. First, they support the mounting evidence that delirium is an important, independent prognosticator of poor outcomes in the critically ill older adult. We suggest both routine delirium assessment and the judicious use of sedatives and analgesics (as offered in the SCCM guidelines)<sup>29</sup> be incorporated into the plan of care of all critically ill older adults. We also suggest that strategies intended to decrease the frequency and severity of delirium in hospitalized older adults (*ie*, restraint reduction, early device removal, frequent mobilization, hearing and visual aids, and efforts to improve patient communication through assistive strategies) be implemented in the critical care setting. For example, a study<sup>30</sup> of older patients with femoral neck fracture demonstrated that the application of comprehensive geriatric assessment, management, and rehabilitation decreased

the number of days of postoperative delirium, decreased complications, and shortened length of hospitalization. Similar success has been demonstrated in the Hospitalized Elder Life Program.<sup>31</sup>

Despite the lack of randomized control trials in the ICU setting, there is clearly a need for evidence-based practices to be rigorously employed during the perioperative period. Practical interventions focused on optimal fluid and electrolyte management, nutrition, sleep, and mobility may help reduce delirium and its impact in the ICU.

Our investigation has several limitations. The inclusion of only older, English-speaking surgical patients recruited from a single institution limits generalizability of study findings. We are unable to establish a true “cause/effect” relationship between delirium and the selected outcomes; however, we do provide evidence of the negative effect of SICU delirium on important outcomes. The Katz ADL instrument was selected because of its wide use in the geriatric research literature; however, this instrument is limited by its relatively coarse measure of function. Using surrogates to obtain information regarding the subjects' preadmission health status, functional and cognitive ability, and living arrangements creates the possibility that the surrogates either overestimated or underestimated the older adults' actual status. As with many clinical research studies, the number of covariates measured and examined was limited. It is possible that other factors may impact older adults' short-term outcomes. For example, delirium is treated in diverse ways (*ie*, restraint/sedation/analgescic use), and these different methods of managing delirium have the potential to influence the outcome variables that were assessed. Finally, in our multivariable models SICU delirium was handled as a yes/no event. It is possible our results may have differed if delirium severity was measured or the time-varying aspect of this disorder was considered.

The strengths of this study include its prospective design, the frequency of delirium assessment, and the focus on older SICU patients, a population that had not been studied previously. The study is also strengthened by the use of a wide variety of valid and reliable tools to measure delirium, dementia, agitation and sedation, severity of illness, functional ability, and comorbidities.

In this study of older adults admitted to SICUs, complications were associated with increased incidence of delirium. Delirium significantly increased the likelihood that older adults would be discharged to a place providing higher levels of dependent care. The consequences of SICU delirium are costly from a resource, economic, and social perspective. Clinicians should routinely assess for delirium in the ICU and aggressively manage it. Further research is needed on how to better prepare elders for surgery, elucidate risk factors for delirium in the SICU, and prevent/treat delirium in the acute care setting.

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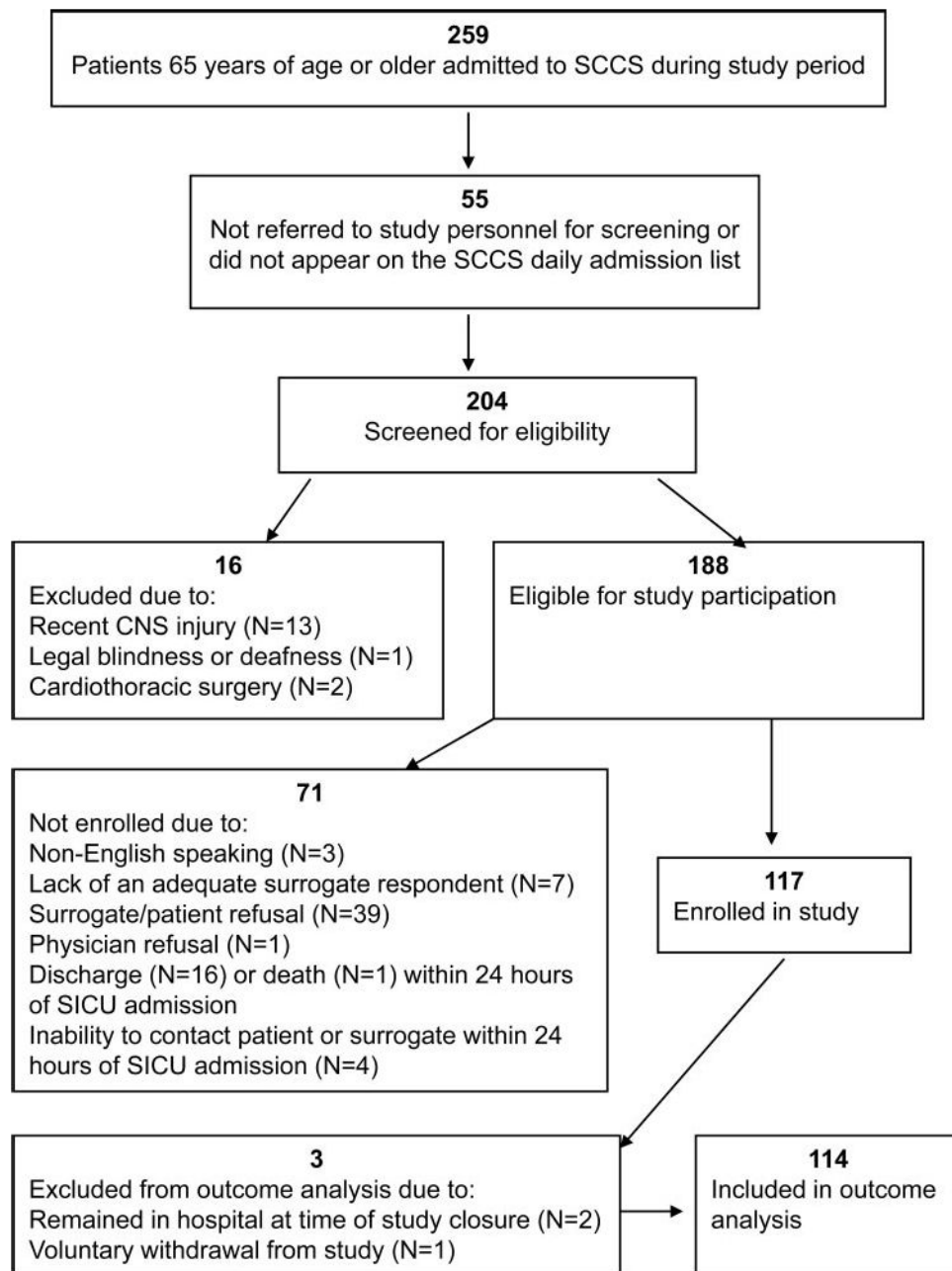


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## Abbreviations

<b>ADL</b>	activities of daily living
<b>APACHE</b>	acute physiology and chronic health evaluation
<b>CAM-ICU</b>	Confusion Assessment Method for the ICU
<b>CCI</b>	Charlson comorbidity index
<b>CI</b>	confidence interval
<b>HHC</b>	home health care
<b>IQCODE</b>	Informant Questionnaire on Cognitive Decline in the Elderly
<b>SICU</b>	surgical ICU



**Figure 1.**  
Flow of study enrollment. SCCS = surgical critical care service.

**Table 1**  
**Characteristics of SICU Study Sample Grouped by Delirium Status\***

Characteristics	Overall Sample (n = 114)	SICU Delirious (n = 34)	SICU Nondelirious (n = 80)	p Value
Age, yr	75.4 ± 6.3	75.5 ± 6.9	75.4 ± 6.0	0.931
Male gender	68 (59.6)	23 (67.6)	45 (56.3)	0.257
Hearing loss	50 (43.9)	21 (61.8)	29 (36.3)	0.012
Visual impairment	112 (98.2)	34 (100)	78 (97.5)	1.000
Admission planned	82 (71.9)	18 (52.9)	64 (80.0)	0.003
Ethnicity (white)	97 (85.1)	28 (82.4)	69 (86.3)	0.593
Currently married	76 (66.7)	21 (61.8)	55 (68.8)	0.469
Assistive device use <sup>†</sup>	33 (28.9)	9 (26.5)	24 (30.0)	0.703
Katz ADL < 5 <sup>‡</sup>	89 (78.1)	24 (70.6)	65 (81.3)	0.208
Admitting service	0.089			
General surgery <sup>§</sup>	42 (36.8)	9 (26.5)	33 (41.3)	
Vascular surgery	40 (35.1)	10 (29.4)	30 (37.5)	
Trauma/emergency surgery	18 (15.8)	9 (26.5)	9 (11.3)	
Other <sup>//</sup>	14 (12.3)	6 (17.6)	8 (10.0)	
IQCODE score ≥ 3.31	21 (18.8)	9 (26.5)	12 (15.0)	0.135
APACHE II	14.5 ± 6.7	17.5 ± 6.6	13.2 ± 6.3	0.001
CCI	4.5 ± 2.9	4.5 ± 2.9	4.5 ± 2.9	0.894
Mechanical ventilation during SICU stay (yes)	48 (42.1)	21 (61.8)	27 (33.8)	0.006

\* Data are presented as mean ± SD or No. (%).

<sup>†</sup> Assistive devices included canes/crutches, walkers, wheelchairs, or shower seats.

<sup>‡</sup> Katz ADL > 5 means independent in five or more ADL.

<sup>§</sup> General surgery category includes colorectal, surgical oncology, and GI surgical services.

<sup>//</sup> Other category includes otorhinolaryngology, oral/maxillofacial, urology, gynecology/oncology, orthopedics, and plastic surgical services.

**Table 2**  
**Functional Ability and Living Arrangements of Study Population \***

Characteristics	Preadmission (n = 114)	Discharge (n = 109)
Residence		
Home	110 (96.5)	74 (67.9)
Living conditions		
Alone	19 (17.3) <sup>†</sup>	6 (8.1) <sup>†</sup>
Spouse	75 (68.2) <sup>†</sup>	52 (70.3) <sup>†</sup>
Child	10 (9.1) <sup>†</sup>	9 (12.2) <sup>†</sup>
Significant other	6 (5.5) <sup>†</sup>	7 (9.5) <sup>†</sup>
HHC/personal assistant	10 (9.1) <sup>†</sup>	33 (44.6) <sup>†</sup>
Nursing home	0 (0)	3 (2.8)
Skilled nursing facility	1 (0.9)	15 (13.8)
Rehabilitation center	1 (0.9)	14 (12.8)
Other	2 (1.8)	3 (2.8)
Katz ADL score <sup>‡</sup>		
6	89 (78.1)	46 (42.2)
5	15 (13.2)	22 (20.2)
4	3 (2.6)	8 (7.3)
3	1 (0.9)	8 (7.3)
2	1 (0.9)	11 (10.1)
1	5 (4.4)	8 (7.3)
0	0 (0)	6 (5.5)
Katz ADL categories		
Bathing independent	102 (89.5)	71 (65.1)
Dressing independent	106 (92.9)	69 (63.3)
Toileting independent	108 (94.7)	80 (73.4)
Transferring independent	108 (94.7)	68 (62.4)
Continence independent	93 (81.6)	86 (78.9)
Feeding independent	114 (100)	98 (89.9)
Katz ADL score	5.5 ± 1.2	4.3 ± 2.0

\* Data are presented as No. (%) or mean ± SD.

<sup>†</sup> Preadmission living conditions and HHC/personal assistant use calculated on 110 subjects reporting being admitted from home; discharge living conditions and HHC use calculated on 74 subjects reporting being discharged home.

<sup>‡</sup> The range of scores for the Katz ADL is 0 (dependent in all ADL) to 6 (independent in all ADL).

**Table 3**  
**Univariate Logistical Analysis of Risk of Discharge to a Place Other than Home and**  
**Decrease in Katz ADL Score in 114 Older Adults Admitted to an SICU**

Variables	Discharged Not Home		Katz ADL Decreased	
	Odds Ratio (95% CI) [Unadjusted]	p Value	Odds Ratio (95% CI) [Unadjusted]	p Value
SICU delirium	6.14 (2.48–15.21)	< 0.0001	2.72 (1.13–6.52)	0.025
Service		0.009		0.014
Trauma	8.00 (2.22–28.83)	0.002	4.21 (1.16–15.23)	0.029
Vascular	1.00 (reference)		1.00 (reference)	
General*	1.11 (0.40–3.12)	0.842	0.78 (0.32–1.91)	0.582
Other†	1.48 (0.37–5.97)	0.580	4.31 (1.03–18.15)	0.046
Admission planned	0.23 (0.09–0.57)	0.002	0.30 (0.12–0.77)	0.012
Nonwhite	0.96 (0.30–2.99)	0.937	0.98 (0.34–2.82)	0.968
Female	2.08 (0.92–4.71)	0.081	3.19 (1.42–7.14)	0.005
Not married	2.02 (0.87–4.72)	0.101	1.49 (0.66–4.37)	0.338
Hearing loss	2.61 (1.15–5.96)	0.022	1.65 (0.77–3.57)	0.201
Living alone	1.34 (0.48–3.77)	0.580	1.14 (0.42–3.06)	0.801
Assistive device use	2.95 (1.23–7.09)	0.016	0.98 (0.42–2.26)	0.953
Pre-Katz ADL < 5	3.34 (1.27–8.77)	0.014		
IQCODE < 3.31	0.60 (0.22–1.66)	0.323	1.54 (0.57–4.19)	0.399
Mechanical ventilation use	1.16 (0.52–2.63)	0.716	0.97 (0.45–2.08)	0.937
Complication, %‡	3.72 (1.55–8.89)	0.003	3.59 (1.47–8.79)	0.005
Age	1.06 (0.99–1.14)	0.068	1.05 (0.99–1.12)	0.137
APACHE II	1.05 (0.99–1.13)	0.119	1.05 (0.99–1.12)	0.125
CCI	0.94 (0.81–1.08)	0.368	1.05 (0.92–1.20)	0.437

\* General surgery category includes colorectal, surgical oncology, and GI surgical services.

† Other category includes otorhinolaryngology, oral/maxillofacial, urology, gynecology/oncology, orthopedics, and plastic surgical services.

‡ The type and number of SICU complications in the study population included cardiac arrhythmias (n = 19), pneumonia (n = 7), reintubation (n = 7), urinary tract infection (n = 6), acute renal failure (n = 6), GI bleeding (n = 6), deep vein thrombosis (n = 5), myocardial infarction (n = 4), suspected adverse drug event (n = 4), sepsis (n = 3), pulmonary emboli (n = 3), cerebral vascular accident (n = 2), and cardiopulmonary resuscitation (n = 1).

**Table 4**  
**Multivariate Analysis of Risk of Discharge to a Place Other than Home and Decrease in Katz ADL Score in 114 Older Adults Admitted to an SICU\***

Variables	Discharged Not Home		KATZ ADL Decreased	
	Odds Ratio (95% CI) [Adjusted]	p Value	Odds Ratio (95% CI) [Adjusted]	p Value
SICU delirium	7.20 (1.93–26.82)	0.003	3.41 (0.95–12.19)	0.059
Service		0.279		0.113
Trauma	4.83 (0.99–23.68)	0.052	2.57 (0.54–12.34)	0.238
Vascular				
General <sup>†</sup>	1.66 (0.46–6.03)	0.444	0.65 (0.21–1.99)	0.448
Other <sup>‡</sup>	1.12 (0.15–8.39)	0.911	4.19 (0.63–27.98)	0.139
Females	2.97 (0.89–9.78)	0.074	5.81 (1.96–17.20)	0.002
Hearing loss	2.47 (0.77–7.89)	0.128	1.63 (0.57–4.61)	0.360
Pre-Katz ADL < 5	1.48 (0.39–5.63)	0.569		
IQCODE < 3.31	1.02 (0.23–4.59)	0.971	3.78 (0.88–16.15)	0.073
Mechanical ventilation use	0.76 (0.20–2.83)	0.677	0.45 (0.14–1.45)	0.183
Complication <sup>§</sup>	1.73 (0.50–5.94)	0.387	1.44 (0.42–5.01)	0.559
Age	1.03 (0.94–1.14)	0.477	1.04 (0.96–1.14)	0.339
APACHE II	1.02 (0.92–1.14)	0.671	1.08 (0.97–1.19)	0.148
CCI	0.99 (0.80–1.21)	0.890	1.08 (0.89–1.31)	0.411

\* C statistic for discharge placement model = 0.83; C statistic for functional ability model = 0.81.

<sup>†</sup> General surgery category includes colorectal, surgical oncology, and GI surgical services.

<sup>‡</sup> Other category includes otorhinolaryngology, oral/maxillofacial, urology, gynecology/oncology, orthopedics, and plastic surgical services.

<sup>§</sup> The type and number of SICU complications in the study population included cardiac arrhythmias (n = 19), pneumonia (n = 7), reintubation (n = 7), urinary tract infection (n = 6), acute renal failure (n = 6), GI bleeding (n = 6), deep vein thrombosis (n = 5), myocardial infarction (n = 4), suspected adverse drug event (n = 4), sepsis (n = 3), pulmonary emboli (n = 3), cerebral vascular accident (n = 2), cardiopulmonary resuscitation (n = 1).