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Prognosis After Emergency Department Intubation to Inform Shared Decision-Making

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OBJECTIVES: To inform the shared decision-making process between clinicians and older adults and their surrogates regarding emergency intubation.
DESIGN: Retrospective cohort study.
SETTING: Multicenter, emergency department (ED)-based cohort.
PARTICIPANTS: Adults aged 65 and older intubated in the ED from 2008 to 2015 from 262 hospitals across the United States (>95% of U.S. nonprofit academic medical centers).
MEASUREMENTS: Our primary outcome was age-specific in-hospital mortality. Secondary outcomes were age-specific odds of death after adjusting for race, comorbid conditions, admission diagnosis, hospital disposition, and geographic region.
RESULTS: We identified 41,463 ED intubation encounters and included 35,036 in the final analysis. Sixty-four percent were in non-Hispanic whites and 54% in women. Overall in-hospital mortality was 33% (95% confidence interval (CI)=34–35%). Twenty-four percent (95% CI=24–25%) of subjects were discharged to home, and 41% (95% CI=40–42%) were discharged to a location other than home. Mortality was 29% (95% CI=28–29%) for individuals aged 65 to 74, 34% (95% CI=33–35%) for those aged 75 to 79, 40% (95% CI=39–41%) for those aged 80 to 84, 43% (95% CI=41–44%) for those aged 85 to 89, and 50% (95% CI=48–51%) for those aged 90 and older.
CONCLUSION: After emergency intubation, 33% percent of older adults die during the index hospitalization. Only 24% of survivors are discharged to home. Simple, graphic representations of this information, in combination with an experienced clinician's overall clinical assessment, will support shared decision-making regarding unplanned intubation. **J Am Geriatr Soc 66:1377–1381, 2018.**

Key words: emergency department; mortality; intubation

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For older adults, whether to undergo intubation and mechanical ventilation is a momentous decision for which they need expert guidance. Because intubation in older adults is a high-risk intervention with uncertain or variable efficacy, shared decision-making may be appropriate.[1] Shared decision-making rests upon a foundation of data on the consequences of available actions. Lack of data on the prognosis of older adults intubated urgently limits clinicians' ability to help them decide what to do at this critical moment.

Emergency intubation of older adults is becoming more frequent and is expected to double between 2001 and 2020.[2,3] Older adults who are intubated may not survive, and when surviving, may have very poor quality of life.[4] More than 70% of older adults with serious illness prioritize quality of life and quality of dying over longevity and consider some health states worse than death,[5] yet 56% to 99% of older adults do not have advance directives available at the time of emergency department (ED) presentation.[6]

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In 2016, the Society of Academic Emergency Medicine Consensus Conference released a consensus statement on the state of shared decision-making in the ED,[7] emphasizing that improving shared decision-making in palliative and end-of-life care is paramount to improving emergency care, but data available to guide shared decision-making in this setting are limited. Small sample size,[8–10] lack of focus on older adults,[11] focus on specific disease groups,[12,13] and lack of inclusion of individuals who died in the ED[15] have been limited prior studies of prognosis after emergency intubation. Data specific to older adults in the ED setting are needed to inform shared decision-making discussions. We analyzed a large national dataset to ascertain in-hospital mortality and discharge dispositions for older adults intubated in the ED.

METHODS

Study Design and Setting

We conducted a retrospective cohort study of older adults, using individuals-level administrative data from Vizient, a consortium of more than 117 academic medical centers and more than 300 affiliated hospitals across the United States representing more than 95% of U.S. nonprofit academic medical centers.[16] Two hundred sixty-two hospitals contributed data, which included demographic characteristics (age, sex, race, ethnicity); procedure codes; *International Classification of Diseases, Ninth Revision*, diagnosis codes; length of stay; and in-hospital mortality. Participating institutions submitted all data monthly, and Vizient reviewed each submission for quality. Partners Healthcare institutional review board approved the study. We followed the Strengthening the Reporting of Observational Studies in Epidemiology guidelines to ensure clear and complete reporting of our study design, conduct, and findings.[17]

Cohort Selection

We included all encounters with intubations in the ED for adults aged 65 and older from January 1, 2008, to December 31, 2015, using the same procedure codes used in prior studies.[2,11] We excluded encounters with evidence of trauma in the admission diagnosis and those with out-of-hospital intubation or cardiac arrest.

Outcomes

Our primary outcome was in-hospital mortality. Secondary outcomes were hospital and intensive care unit length of stay, hospital disposition, and predictors of in-hospital mortality.

Predictors of Interest

Based on prior research, we determined a priori that age,[18] sex, race,[19] comorbidity present on admission (quantified according to the Charlson Comorbidity Index (CCI)),[15] origin (home, nursing home, hospice, another hospital),[20] admission diagnosis,[13,21] and insurance status were potential predictors of mortality.

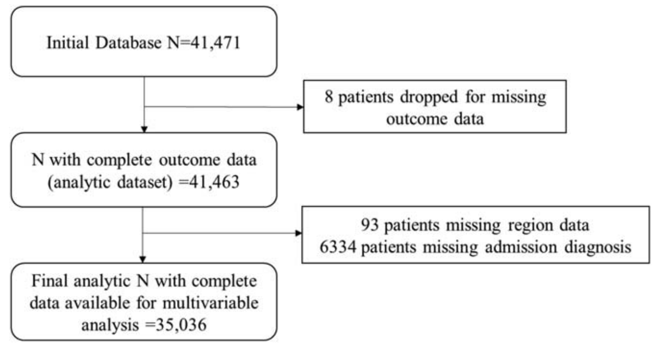

Figure 1. Cohort selection.

Statistical Analysis

In-hospital mortality was our primary outcome. We analyzed the bivariate association between each candidate predictor and this outcome using chi-square analysis. Variables significantly associated with our outcome ($p<.05$) were included in the multivariable logistic regression model: age, race, comorbidity present on admission, origin, admission diagnosis, and geographic region. We categorized admission diagnosis according to a diagnostic grouping approach described previously.[22] We used the 7 most frequent diagnostic categories: sepsis (038*, 995.9*, 785.52), gastrointestinal bleeding (578*), congestive heart failure (428*), pneumonia (507*, 481*, 482*, 483*, 485*, 486*), respiratory failure (518*, 786*, 491*), altered mental status or seizure (780*), and cerebrovascular accident (430*, 431*, 432*, 433*, 434*, 436*, 437*).

We excluded variables that were collinear, defined as variables with the Variance Inflation Factor of greater than 10, in our multivariable model. We tested goodness of fit using the Hosmer-Lemeshow test. We excluded observations with missing variables in the multivariable model but performed a sensitivity analysis in which we included those observations. Stata version 14.1 (StataCorp, College Station, TX) was used to perform all analyses.

RESULTS

Of 41,463 adults who were intubated in the ED (54% female, 64% non-Hispanic white), 6,427 were excluded because of missing variables, leaving 35,036 for the final analysis (Figure 1). The CCI was 3 or greater for 51%. Seventy-five percent came to the ED from home, of whom 27% were discharged to home after the index hospitalization. Twenty-four percent of our cohort were discharged to home. Overall in-hospital mortality was 33%, ranging from 29% (95% confidence interval (CI)=28–29%) in those aged 65 to 74 to 50% (95% CI=48–51%) in those aged 90 and older. Sixty-three percent of survivors were discharged to locations other than home. Median length of stay was 9 days (interquartile range (IQR) 5–15) for survivors, and median time to death was 3 days (IQR 1–8) for decedents. Eighty-four percent of decedents died

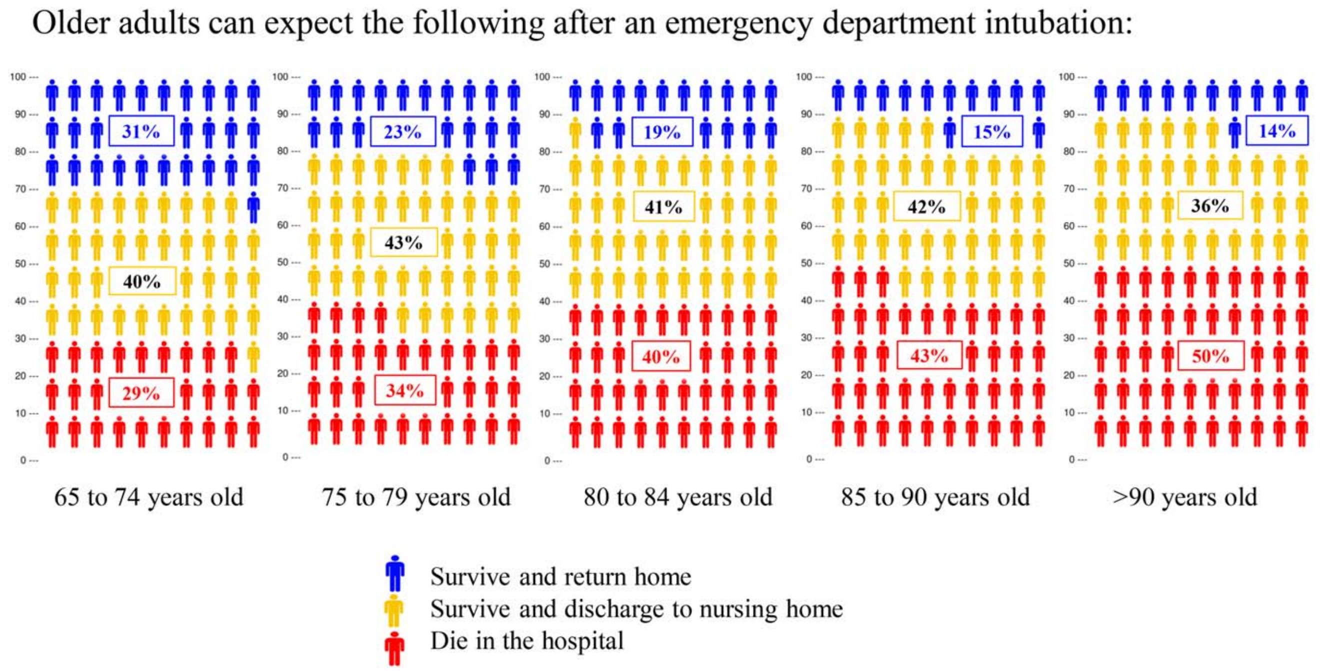

Figure 2. Shared decision-making tool for clinicians.

within 10 days of intubation. Figure 2 is a graphical representation of these data, which will be useful for shared decision-making discussions.

In our multivariable model, no variables were collinear (mean Variance Inflation Factor=1.01), and model fitness was appropriate (Hosmer-Lemeshow test, p=.22). The odds of death were 2.6 times as high for those aged 90 and older as for those aged 65 to 74, controlling for race, admission source, comorbid conditions, admission diagnosis, and geographical region (95% CI=2.4–2.9). The odds of dying in the hospital were 70% higher when arriving from another hospital than when arriving from home (95% CI=1.5–1.9). The odds of death were 1.5 times as high (95% CI=1.4–1.6) for those with a CCI greater than 4 as for those with a CCI of 0, controlling for previously mentioned confounders. Admission diagnoses of cerebrovascular accident (OR=2.4, 95% CI=2.2–2.6) and sepsis (OR=1.5, 95% CI=1.4–1.6) were associated with greater in-hospital mortality than all other admission diagnoses. Black subjects had 20% lower odds of dying in-hospital than white subjects. People from the Midwest had 10% lower odds of dying than those from the Mid-Atlantic. Admission diagnoses of congestive heart failure (OR=0.5, 95% CI=0.4–0.7), respiratory failure (OR=0.5, 95% CI=0.5–0.6), and altered mental status or seizure (OR=0.7, 95% CI=0.7–0.8) were associated with lower odds of dying in the hospital (Table 1.)

Observations missing key variables were excluded from the multivariable analysis: in-hospital mortality (n=8), geographical region (n=93), and admission diagnosis category (n=6,334). Our sensitivity analysis including the missing variables did not change the distribution of independent variables, and p-values and odds ratios did not change in the multivariable analysis, indicating that the missing variables were missing at random and did not influence our analysis.

DISCUSSION

Shared decision-making between clinicians and patients or surrogates depends upon availability of information regarding predicted outcomes. This study demonstrates that 33% of older adults intubated in the ED die in the hospital, with mortality increasing markedly with age, reaching 50% in those aged 90 and older.

Prior studies of postintubation mortality have not focused specifically on older adults,[11] analyzed people with specific diagnosis (e.g., acute respiratory distress syndrome),[13] and used older data.[15] Our study investigated mortality for older adults with various diagnoses who were intubated using a large, recent, nationally representative dataset (2008–15). Our results are confirmatory of findings demonstrated in several previous studies, showing that high in-hospital mortality is common in older adults requiring intubation (20–60%).[13] We focused on how to communicate this baseline risk of mortality to older adults graphically to facilitate shared decision-making.

One-quarter of subjects survived hospitalization and were discharged home. More than half of survivors were discharged to a location other than home. The proportions of survivors discharged to locations other than home ranged from 35% to 43% across age groups. A prior study showed that as many as 13% of survivors would require prolonged mechanical ventilation.[23] Of older adults requiring prolonged mechanical ventilation, 35% will never meet the criteria for weaning from the ventilator and have 65% probability of dying in a long-term care facility, with median survival ranging from 2.1 to 4.4 months.[14] Even if successfully weaned from the ventilator, 40% will have a severe functional disability after hospital discharge unless their baseline functional status was completely normal.[24] Seventy-four percent of older adults would not choose treatment if anticipated survival included severe functional impairment, and many would

Table 1. Demographic and Clinical Predictors of In-Hospital Death in Older Adults Intubated in the Emergency Department: 2008–2015

Predictor	Unadjusted Mortality (95% CI)	In-Hospital Mortality, Point Estimate (95% CI) P-Value	
		Unadjusted	Adjusted[1]
Age			
65–74 (n = 18,901, 46%)	29 (28–29)	Reference	Reference
75–79 (n = 7,708, 19%)	34 (33–35)	1.3 (1.2–1.3) <.001	1.3 (1.2–1.4) <.001
80–84 (n = 6,877, 17%)	40 (39–41)	1.7 (1.6–1.8) <.001	1.7 (1.6–1.8) <.001
85–89 (n = 5,167, 12%)	43 (42–44)	1.9 (1.8–2.0) <.001	1.9 (1.8–2.1) <.001
≥90 (n = 2,810, 7%)	50 (48–51)	2.5 (2.3–2.7) <.001	2.6 (2.4–2.9) <.001
Race			
White (n = 26,471, 64%)	36 (35–37)	Reference	Reference
Black (n = 9,718, 23%)	30 (29–31)	0.8 (0.7–0.8) <.001	0.8 (0.8–0.8) <.001
Other (n = 5,274, 13%)	36 (35–38)	1.0 (1.0–1.1) .60	1.0 (0.9–1.1) .92
Admission source			
Home (n = 30,912, 75%)	34 (33–34)	Reference	Reference
Other hospital (n = 1,748, 4%)	45 (43–47)	1.6 (1.5–1.8) <.001	1.7 (1.5–1.9) <.001
Nursing home (n = 2,832, 6%)	36 (34–38)	1.1 (1.0–1.2) .03	1.0 (1.0–1.1) .12
Other (n = 5,971, 14%)	36 (35–37)	1.1 (1.0–1.2) .004	1.1 (1.0–1.2) .003
Charlson Comorbidity Index			
0 (n = 4,032, 10%)	31 (30–33)	Reference	Reference
1–2 (n = 16,277, 39%)	35 (34–36)	1.2 (1.1–1.3) <.001	1.3 (1.3–1.4) <.001
3–4 (n = 12,730, 31%)	34 (33–35)	1.1 (1.0–1.2) .007	1.2 (1.1–1.3) <.001
≥4 (n = 8,424, 20%)	37 (36–38)	1.3 (1.2–1.4) <.001	1.5 (1.4–1.6) <.001
Admitting diagnosis			
Cerebrovascular accident (n = 3,471, 10%)	54 (53–56)	2.5 (2.3–2.7) <.001	2.4 (2.2–2.6) <.001
Sepsis (n = 3,920, 11%)	43 (42–45)	1.5 (1.4–1.6) <.001	1.5 (1.4–1.6) <.001
Gastrointestinal bleeding (n = 500, 1%)	38 (33–42)	1.1 (1.0–1.4) .15	Excluded
Congestive heart failure (n = 505, 1%)	23 (20–27)	0.6 (0.5–0.7) <.001	0.5 (0.4–0.7) <.001
Pneumonia (n = 1,211, 3.5%)	33 (30–35)	0.9 (0.8–1.0) .13	Excluded
Respiratory failure (n = 11,073, 32%)	26 (25–26)	0.5 (0.5–0.7) <.001	0.5 (0.5–0.6) <.001
Altered mental status, seizure (n = 5,259, 15%)	29 (27–30	0.7 (0.7–0.8) <.001	0.7 (0.7–0.8) <.001
Region			
Mid-Atlantic (n = 7,276, 18%)	35 (34–36)	Reference	Reference
Mid-Continent (n = 8,237, 20%)	36 (34–37)	1.0 (1.0–1.1) .45	1.0 (1.0–1.2) .003
Midwest (n = 9,770, 24%)	33 (32–34)	0.9 (0.9–1.0) .002	0.9 (0.8–0.9) .004
New England (n = 4,809, 12%)	35 (34–35)	1.0 (0.9–1.0) .98	0.9 (0.9–1.0) .59
Southeast (n = 6,307, 15%)	35 (33–36)	1.0 (0.9–1.1) .51	1.0 (1.0–1.1) .20
West (n = 4,971, 12%)	36 (35–38)	1.0 (1.0–1.1) .17	1.0 (0.9–1.1) .66

[1]Age, race, source of admission, Charlson Comorbidity Index, and region were included in the adjusted analysis. The analysis for cause of admission was adjusted for all the above-mentioned variables.
CI = confidence interval.

consider a state of serious functional debility worse than death.[25] Our graphical representation of baseline mortality data combined with clinical information synthesized by an experienced clinician may improve shared decision-making.

Limitations

Use of administrative data is subject to inaccuracy in the coding of diagnoses and procedures. We used the same method as prior similar studies to identify our cohort,[15] yet there may have been nondifferential misclassification if intubations were not coded accurately in the medical records. Our dataset provided information only on discharge location; important post-hospitalization outcomes, including functional status, mortality, and readmission, are unknown. No information was available for individuals in whom intubation was considered but not performed. Several additional clinical parameters, such as pre-ED frailty, acute illness severity, precise admission diagnoses, and ED-based treatment variables, can be strong predictors of mortality after critical illness; the lack of such information in our database was a limitation. It is likely that future studies with these clinical parameters would improve the predictability of our study but would not have its generalizability. Furthermore, we developed our tool to provide a simple, graphical representation of the baseline risk of mortality. Using our tool, experienced clinicians can incorporate acute clinical parameters into their overall clinical assessments during shared decision-making conversations. Our data had a significant number of observations with missing admission diagnoses (n=6,334), but our sensitivity analysis did not reveal any bias attributable to missingness.

CONCLUSION

Clinicians in the fields of primary care, oncology, palliative care, and emergency medicine may find themselves discussing goals of care with patients and their caregivers; whether to undergo intubation should it become indicated is an important consideration. During shared decision-making, individuals aged 65 and older and their surrogates can be informed that, after intubation, the overall chance of survival and discharge to home after the index hospitalization is 24%. There is a 33% chance of in-hospital death and a 67% chance of survival to hospital discharge. The chance of in-hospital death is especially high in individuals aged 90 and older and in those with an admission diagnosis of cerebrovascular accident. Sixty-seven percent of survivors will be discharged to a location other than home. Data presented graphically, combined with experienced clinicians' overall clinical assessment, will be informative during shared decision-making.

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