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Outcomes and Predictions

# The feasibility of measuring frailty to predict disability and mortality in older medical intensive care unit survivors ☆

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ABSTRACT

*Purpose:* To determine whether frailty can be measured within 4 days prior to hospital discharge in older intensive care unit (ICU) survivors of respiratory failure and whether it is associated with post-discharge disability and mortality.

*Materials and Methods:* We performed a single-center prospective cohort study of 22 medical ICU survivors age 65 years or older who had received noninvasive or invasive mechanical ventilation for at least 24 hours. Frailty was defined as a score of ≥3 using Fried's 5-point scale. We measured disability with the Katz Activities of Daily Living. We estimated unadjusted associations between Fried's frailty score and incident disability at 1-month and 6-month mortality using Cox proportional hazard models.

*Results:* The mean (SD) age was 77 (9) years, mean Acute Physiology and Chronic Health Evaluation II score was 27 (9.7), mean frailty score was 3.4 (1.3), and 18 (82%) were frail. Nine subjects (41%) died within 6 months, and all were frail. Each 1-point increase in frailty score was associated with a 90% increased rate of incident disability at 1-month (rate ratio: 1.9, 95% CI 0.7-4.9) and a threefold increase in 6-month mortality (rate ratio: 3.0, 95% CI 1.4-6.3).

*Conclusions:* Frailty can be measured in older ICU survivors near hospital discharge and is associated with 6-month mortality in unadjusted analysis. Larger studies to determine if frailty independently predicts outcomes are warranted.



## 1. Introduction

Older adults (age ≥ 65 years) now comprise almost half of all intensive care unit (ICU) admissions in the United States, receive more intensive treatment than in the past, and survive what were previously fatal critical illnesses [1,2]. However, among the approximately 125,000 older adults who require mechanical ventilation and survive to hospital discharge annually in the United States, almost half are re-hospitalized and 30% to 65% die within 6 months [3,4]. These data demonstrate an urgent need to risk stratify and identify older ICU survivors for interventions aimed at improving their functional dependency, mortality, and/or quality-of-life after hospital discharge.

Existing risk-stratification models for ICU patients were designed to predict in-hospital mortality because the success of intensive care medicine has traditionally been gauged by the proportion of patients alive at hospital discharge [5–7]. While post-hospitalization predictive models exist for older adults hospitalized without intensive care [8], there are no prospectively-derived models explicitly for older ICU survivors. In a prior study of older ICU survivors, we showed that surrogate measures of frailty and disability (older age, length of stay, and skilled-care facility need before or after hospitalization with intensive care) are associated independently with post-discharge

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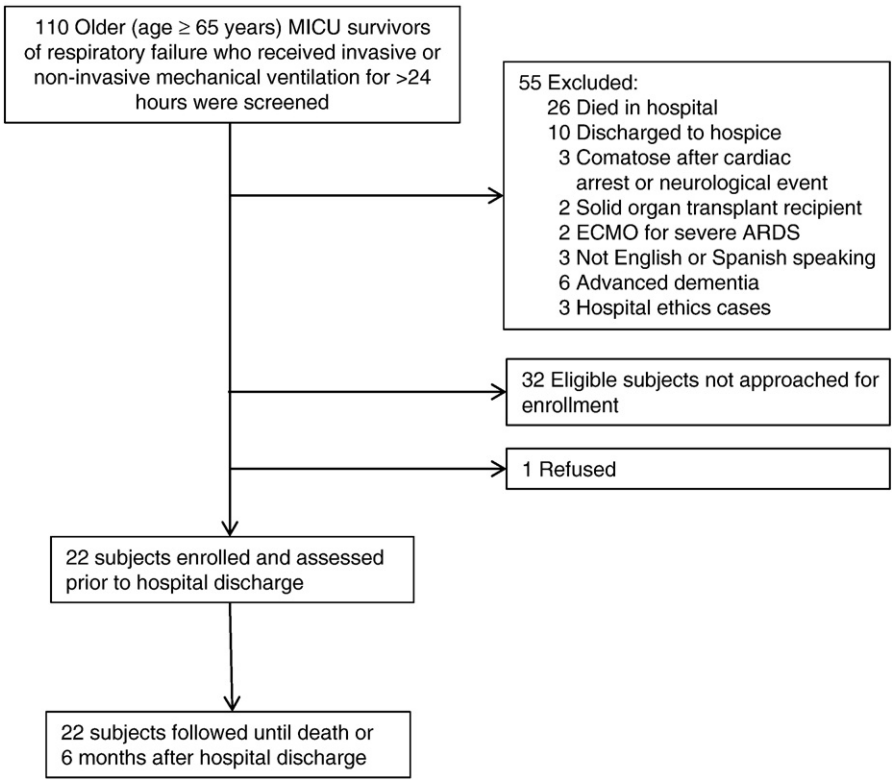


**Fig. 1.** Study subjects.

mortality after controlling for critical illness severity and comorbidities, and account for 35% of a 6-month mortality model's predictive power. Moreover, we found that traditional physiologic variables measured during the first 24 hours of critical illness do not predict post-discharge mortality in older ICU survivors [9]. However, this previous study lacked direct measures of frailty, thus limiting our ability to understand its role in risk stratification and identification of older ICU survivors for post-ICU care.

Physical frailty is a measurable clinical phenotype of increased vulnerability for developing adverse outcomes (e.g., disability and/or mortality) when exposed to a stressor. Fried and colleagues developed one of the most widely adopted measures of physical frailty based upon 5 possible components (weight loss, weakness, slowness, reduced physical activity, and exhaustion) that mark an underlying physiological state of multisystem energy dysregulation. Subjects who have 1–2 or ≥3 components are considered intermediate-frail or frail, respectively [10]. For community-dwelling elders, frailty predicts morbidity and mortality, independent of comorbidities and disability [10–12].

Recent studies of older ICU survivors of mechanical ventilation show that many of these patients develop new deficits or increase the magnitude of pre-existing deficits associated with the frailty syndrome while critically ill, and that these deficits often persist after the critical illness resolves [13,14]. These deficits may include malnutrition, weight loss, muscle wasting, and weakness [13,15,16]. Since all these deficits are parts of Fried's vicious cycle of frailty [10], measuring Fried's frailty components in older ICU survivors may help risk-stratify and identify them for rehabilitative, therapeutic, or palliative interventions aimed at decreasing dependency, mortality, and/or improving quality-of-life after an ICU stay. However, the feasibility of measuring Fried's frailty in such a debilitated sample of older hospitalized adults has not been assessed. Therefore, we undertook a single-center prospective cohort pilot study to test the primary hypothesis that Fried's frailty components could be measured in older ICU survivors of respiratory failure just prior to hospital discharge. We also hypothesized that Fried's frailty index would be associated with both 1-month disability acquired since hospitalization involving intensive care and 6-month mortality in unadjusted analyses.

## 2. Methods

### 2.1. Subjects

Subject inclusion criteria were (1) age ≥65 years and (2) invasive or non-invasive mechanical ventilation for respiratory failure for >24 hours in a Columbia University medical ICU (MICU). Subject exclusion criteria were (1) hospital discharge directly from a MICU, (2) discharge to hospice or home hospice, (3) respiratory failure due to a neurologic diagnosis (intracranial hemorrhage, stroke, or coma after cardiac arrest), (4) solid organ transplant recipient, (5) extracorporeal membrane oxygenation (ECMO) for severe Acute Respiratory Distress Syndrome (ARDS), (6) not English or Spanish speaking, (7) advanced dementia with inability to follow commands, and (8) no surrogate also consenting to participate. The rationale for the inclusion and exclusion criteria is described in the Supplement.

We screened consecutive MICU patients meeting inclusion criteria and determined their eligibility, since one of the aims of this pilot study was to estimate how many patients would be eligible for a larger study. Once screened patients survived the ICU and were transferred to the general wards, we worked with treating physicians to determine whether any met exclusion criteria, and to ascertain whether or not eligible patients lacked capacity to provide informed consent. The method for obtaining subject and/or surrogate informed consent is described in the Supplement.

Our goal was to recruit 24 subjects between February and July 2012. In light of our small sample size, we sought to minimize chance over- or under-enrollment of frail and/or disabled ICU survivors by employing a sampling method to ensure that 50% to 75% of subjects were discharged to post-acute care facilities (institutional data from 2009 indicated that 55% of older ICU survivors were discharged to