Appendix

Association between Socioeconomic Disadvantage and Decline in Function, Cognition, and Mental Health after Critical Illness among Older Adults: A Cohort Study

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Appendix Table 1. Sensitivity of adjusted association between dual-eligibility and cognitive decline following ICU hospitalization to adjustment for time between hospital discharge and post-ICU NHATS interview.

Model	Odds Ratio for the Adjusted Association Between Dual-eligibility and Post-ICU Cognitive Decline (95% CI)
Main model*	9.79 (3.46, 27.65)
Model including time between hospital discharge and post-ICU NHATS interview as covariate[†]	8.76 (3.07, 25.01)

*Derived from multivariable logistic regression model including covariates of ordinal age, pre-ICU possible dementia, education, sex, race, hospital length of stay in days, living alone, use of mechanical ventilation, multimorbidity, and depression.
[†]Derived from multivariable logistic regression model including covariates in the main model except omitting mechanical ventilation and multimorbidity and including time between hospital discharge and post-ICU NHATS interview in days since the main model did not converge with the addition of this time.

Appendix Table 2. Sensitivity of adjusted association between dual-eligibility and cognitive decline following ICU hospitalization to the competing risk of death.

Imputational Approach for 90 ICU Hospitalizations where Follow-up was Truncated by Death	Number of ICU hospitalizations with Post-ICU Probable Dementia	Odds Ratio for the Adjusted Association Between Dual-Eligibility and Post-ICU Cognitive Decline (95% CI)
Main model (reference, no imputation)	48	9.79 (3.46, 27.65)
Imputation method (assumption) for hospitalization with decedents		
Model-based (MAR)	95	4.06 (1.30, 12.67)
All assumed to have probable dementia (MNAR)	138	2.61 (0.99, 6.87)
None assumed to have probable dementia (MNAR)	48	10.56 (4.05, 27.56)

Derived from multivariable logistic regression model with adjustment for ordinal age, pre-ICU possible dementia, education, female sex, nonwhite race, hospital length of stay in days, living alone, mechanical ventilation, three or more chronic conditions, and depression. Abbreviations: CI = confidence interval, MAR = missing at random, MNAR = missing not at random, ICU = Intensive Care Unit

Participants who die between hospital discharge and their next interview are censored by death from providing post-discharge values. In longitudinal analyses there is the potential risk of bias in the estimated association of an exposure (dual-eligibility) with an outcome (post-discharge probable dementia) due to death of participants during follow-up. In order to evaluate for potential bias due to the competing risk of death, we conducted sensitivity analyses wherein we impute the missing outcome values of decedents under different scenarios. The outcome of post-discharge probable dementia from decedents is the only variable imputed in these sensitivity analyses. We impute these decedent outcomes under both missing-at-random (MAR) and missing-not-at-random (MNAR) conditions. The MAR imputations draw from all model variables and the MNAR imputations set the outcomes of the decedents to fixed values. The MNAR outcomes are imputed as “no probable dementia” and “probable dementia” for all decedent outcomes. The MAR values are the mix of “no probable dementia” and “probable dementia” predicted by the imputational model. This approach is explained in the cited reference (46). The association of dual-eligibility only loses significance under an extreme condition, i.e., wherein all of the decedents would have developed cognitive decline had they not died, but the direction of the association is maintained. The direction and association of the results are maintained in all other scenarios, demonstrating robustness of the results to the competing risk of death.

Appendix Table 3. Sensitivity of adjusted association between dual-eligibility and cognitive decline following ICU hospitalization to proxy-reporting of dementia status.

Imputational Approach for 29 ICU Hospitalizations where Dementia Status was Reported by Proxy	Number of ICU hospitalizations with Post-ICU Probable Dementia	Odds Ratio for the Adjusted Association Between Dual-Eligibility and Post-ICU Cognitive Decline (95% CI)
Main model (reference, no imputation)	48 (22 from proxy)	9.79 (3.46, 27.65)
Imputation method (assumption) for hospitalizations with proxy-reporting of dementia status		
Model-based (MAR)	51 (25 from proxy)	8.58 (2.27, 32.43)
No proxy-reported results assumed to have probable dementia (MNAR)	26 (0 from proxy)	8.52 (2.18, 33.29)
All proxy-reported results assumed to have probable dementia (MNAR)	55 (29 from proxy)	6.73 (2.04, 22.13)

Abbreviations: ICU = intensive care unit, MAR = missing at random imputation; MNAR = not missing at random imputation, CI = confidence interval.

Appendix Table 4. Sensitivity analyses to evaluate adjusted association between all three outcomes and dual-eligibility accounting for A) differences in indications for ICU hospitalization that can be expected to have different outcomes by excluding hospitalizations with specific conditions including 1) musculoskeletal conditions, 2) chronic diseases with waxing and waning courses such as chronic obstructive lung disease (COPD) and congestive heart failure (CHF), 3) stroke, 4) acute neurologic conditions including traumatic brain injury, intracerebral hemorrhage, and status epilepticus; B) adjusting for additional factors including 1) ICU hospitalizations in the year prior to the index hospitalization categorized as yes/ no, 2) rehospitalization to the ICU between the index hospitalization and post-ICU NHATS interview categorized as yes/ no, 3) multimorbidity defined as ≥4 chronic conditions categorized as yes/ no, and 4) ICU length of stay (LOS) instead of hospital LOS as a covariate characterized as a continuous variable, 5) census region categorized as Northeast, Midwest, South, and West with Northeast as the reference; 6) type of ICU admission categorized as general/ medical, coronary, and surgical, trauma, burn or others; and 7) discharge destination categorized as discharged to home without any services, home with home health services, or facilities including skilled nursing facilities, intermediate care facilities, inpatient rehabilitation facilities, nursing facilities, and long-term acute care hospitals; and C) stratifying ICU admissions by 1) census region, 2) type of ICU admission, and 3) discharge destination.

Sensitivity Analysis Condition	Function		Cognition		Mental Health	
	n	Incidence Rate Ratio for adjusted association between dual-eligibility and post-ICU disability (95% CI)	n	Odds Ratio for adjusted association between dual-eligibility and cognitive decline (95% CI)	n	Incidence Rate Ratio for adjusted association between dual-eligibility and post-ICU PHQ-4 (95% CI)
Main model (reference)	641	1.28 (1.00, 1.62)	458	9.79 (3.46, 27.65)	519	1.33 (0.99, 1.79)
Sensitivity Analysis Excluding Hospitalizations for Specific Conditions						
Musculoskeletal conditions	606	1.34 (1.05, 1.71)	434	12.26 (3.88, 38.70)	490	1.35 (1.02, 1.79)
COPD and CHF	579	1.25 (0.98, 1.59)	421	8.73 (3.34, 22.82)	479	1.38 (0.99, 1.92)
Stroke	611	1.32 (1.02, 1.71)	428	12.04 (3.71, 39.13)	490	1.37 (1.04, 1.81)
Acute neurologic conditions	616	1.29 (1.00, 1.67)	447	10.16 (3.59, 28.75)	500	1.39 (1.06, 1.84)
Sensitivity analysis Adding Covariates to the Main Model						
Prior ICU hospitalization	641	1.27 (1.00, 1.63)	458	10.32 (3.69, 28.84)	519	1.33 (1.00, 1.79)
Rehospitalization to ICU	641	1.28 (1.02, 1.62)	458	10.59 (3.59, 31.26)	519	1.33 (1.00, 1.79)
Multimorbidity ≥ 4 chronic conditions	641	1.28 (1.00, 1.65)	458	10.19 (3.60, 28.89)	519	1.28 (0.94, 1.75)
ICU Length of Stay	641	1.26 (0.98, 1.62)	458	11.13 (3.66, 33.82)	519	1.35 (1.00, 1.81)

Region	641	1.37 (1.07, 1.75)	458	10.01 (3.46, 28.99)	519	1.31 (0.98, 1.75)
ICU Type	641	1.28 (0.99, 1.64)	458	9.93 (3.36, 29.38)	519	1.35 (1.00, 1.82)
Discharge Destination	641	1.29 (1.01, 1.66)	458	7.10 (2.31, 21.82)	519	1.29 (0.95, 1.77)
Sensitivity Analysis Stratifying by Region, ICU type, and Discharge Destination						
Region						
Northeast	*	*	*	*	68	1.11 (0.63, 1.96)
Midwest	184	1.83 (1.25, 1.67)	*	*	*	*
South	255	1.13 (0.67, 1.91)	*	*	208	1.28 (0.77, 2.13)
West	117	1.50 (1.07, 2.09)	*	*	*	*
ICU Type						
General/ Medical	423	1.42 (1.06, 1.92)	*	*	334	1.19 (0.90, 1.56)
Coronary	147	0.82 (0.41, 1.63)	*	*	123	1.13 (0.61, 2.10)
Others	*	*	*	*	*	*
Discharge Destination						
Home	239	0.94 (0.56, 1.58)	*	*	217	1.40 (0.92, 2.12)
Home with home health	152	1.44 (0.98, 2.11)	*	*	133	1.05 (0.74, 1.50)
Facility	250	1.18 (0.83, 1.68)	*	*	169	1.24 (0.66, 2.33)

*Model did not converge because of small sample size within strata or did not appear to fit well even when it did converge.

Online Supplement

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Supplement Methods

Description of assessment of dementia status in NHATS

The measurement of dementia was performed in NHATS interviews using a well-validated algorithmic approach detailed in the technical papers (30, 31). Briefly, if a diagnosis of dementia made by a physician was reported by participant or proxy, the participant was categorized as having probable dementia. Proxy respondents not reporting a diagnosis who gave answers to the AD8 questionnaire that met criteria for likely dementia (a score of 2 or higher) were also classified as probable dementia. For all others where the participant was available and able to participate in cognitive performance testing, score cut points applied to cognitive tests were used. Supplement Table 2 details the tests used for each domain of the cognitive performance testing and outlines the range and cutoff thresholds for classifying the scores. Supplement Table 3, adapted from the NHATS technical paper, describes the application of this approach for classifying dementia status. Statistical code provided by NHATS investigators was used to assign the dementia status in our cohort (72).

Approach to Missing Data

We used the SAS procedure MI to perform multiple imputations (n=5) of missing covariate and outcome data under the assumption of missing at random (MAR) and using fully conditional specifications. All missing explanatory and outcome values were imputed by drawing from a pool of variables that included outcomes and covariates from each model, as well as a broad range of factors such as demographics, follow-up time, geriatric conditions, and indicators of physical, cognitive, and mental health. The imputation process was further informed by the survey design parameters (i.e., cluster, stratum and weights) corresponding to each observation. Variables that had missing values and were multiply imputed are listed in Supplement Tables 5 and 6. For the outcome of function, we performed multiple imputation on pre- and post-ICU interviews that were missing responses to at least one of the seven questions that compose this outcome. If all 7 of 7 components were missing, the observations, although used to inform imputation, were not included in the analytic sample. For the outcome of cognition, pre- and post-ICU interviews with missing dementia status were excluded and these data were not imputed. For the outcome of mental health, we imputed individual PHQ-2 and GAD-2 scores for pre- and post-ICU interviews with missing responses to either component that comprised this outcome. If responses to all 4 questions were missing, these observations were excluded from the analytic samples.

Supplement Table 1. STROBE Statement - checklist of items that should be included in reports of observational studies.

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2	Retrospective analysis of a longitudinal cohort study.
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2	After accounting for sociodemographic and clinical characteristics, dual-eligibility was associated with a 28% increase in disability after ICU hospitalization (incidence rate ratio:1.28; 95% CI:1.00,1.64); and nearly 10-fold greater odds of transitioning to probable dementia (odds ratio:9.79; 95% CI:3.46,27.65). Dual-eligibility was not associated with symptoms of depression and anxiety following ICU hospitalization (incidence rate ratio:1.33; 95% CI: 0.99,1.79).
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4	Disparities by race, insurance, and socioeconomic status that widely plague our healthcare system have been described in short-term mortality and readmissions from conditions such as pneumonia, sepsis, and acute respiratory failure (12-15). Socioeconomically disadvantaged persons age ≥ 65 years who meet thresholds of low income and assets may qualify for Medicaid in addition to Medicare (16, 17). These persons are classified as "dual-eligible" for Medicare and Medicaid. Dual-eligible beneficiaries are known to have greater chronic disease burden, and worse health outcomes for many conditions compared to non-dual-eligible Medicare beneficiaries (17-21). In a state-level study of ICU survivors, dual-eligibility was associated with a 9% greater risk of 1-year mortality compared to Medicare with supplemental insurance (22). However, it is not known whether dual-eligible seniors are at increased risk of impairments after ICU survivorship than non-dual-eligible beneficiaries.
Objectives	3	State specific objectives, including any prespecified hypotheses	5	Using a longitudinal study of Medicare beneficiaries with comprehensive, annual geriatric assessments, our objective was to evaluate whether socioeconomic disadvantage is associated with decline in function, cognition, and mental health following ICU hospitalization.

Methods				
Study design	4	Present key elements of study design early in the paper	5	Data were drawn from the National Health and Aging Trends Study (NHATS), a longitudinal, nationally representative survey of community-dwelling Medicare beneficiaries ages ≥65 living in the contiguous United States (23).
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5	The initial sample was drawn from Medicare enrollment database on September 30, 2010 with oversampling of non-Hispanic Blacks and the oldest age groups (24). The survey collected information on demographics, living arrangement, health conditions, disability, and cognitive status through annual in-person interviews starting in 2011. If a participant was not available for interview, a proxy knowledgeable about their health was interviewed. For participants who died between initial and follow-up rounds, a last month of life interview was conducted with the proxy. We used data from rounds 1-8 (2011-2018) for the 2011 cohort.
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	8-9	We restricted our sample to the first ICU hospitalization in the interval between annual NHATS interviews with an ICU length of stay of ≥1 day (n=1,500). After excluding participants who were not community-dwelling (n=433), admitted from a nursing home or spent ≥100 days in a nursing home between pre-ICU interview and ICU hospitalization (n=70), and those with missing data on race (n=8), 989 ICU admissions remained for consideration. Of these, 332 ICU hospitalizations were excluded because of in-hospital death (n=106), discharge to hospice (n=56), follow-up interview completed >365 days after discharge (n=73) or missing the entire follow-up interview (n=97). Of the 657 ICU admissions where participants survived to discharge and had follow-up interview data, we excluded participants with maximal impairment at baseline in each outcome domain (i.e., the participant could not get any worse). This implied a pre-ICU count of disabilities of 7/7 for function (n=16), baseline dementia status of probable dementia for cognition (n=109), and pre-ICU PHQ-4 score 12/12 for mental health (n=6). Interviews completed by proxy because of participant death following hospital discharge were missing information on dementia status and PHQ-4 score and consequently excluded for cognition and mental health (n=90 and n=132, respectively).
		(*b*) *Cohort study*—For		Not applicable

		matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case		
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7	<u>Assessment of Function</u> During the in-person interviews, participants or proxies were asked about the need for help in activities of daily living including four self-care activities (eating, bathing, using the toilet, and dressing) and three mobility activities (getting outside, getting around inside one's home, getting out of bed). Disability was characterized as the need for help or inability to perform these activities. For participants who died during follow-up, function was ascertained from the last month of life interview wherein the proxy was asked if in the last month of life, the participant needed help or was unable to complete the aforementioned activities. Our outcome for function was the count of disabilities on a scale of 0-7 assessed in the interview following discharge from ICU hospitalization (hereafter post-ICU interview) (27, 28). We used the count of disabilities in the interview preceding ICU hospitalization (hereafter pre-ICU interview) as the measure of baseline function. <u>Assessment of Cognition</u> We used the validated NHATS classification scheme for dementia status that defined "probable" dementia as one of the following: (a) self- or proxy-reported physician diagnosis of dementia; (b) score of ≥2 on the 8-item Alzheimer's Disease-8 Dementia Screening interview of proxy respondents (30); or (c) scores of ≤1.5 standard deviations (SD) on ≥2 cognitive tests in the domains of memory (scale:0-20, cutoff

				≤ 3), orientation (scale:0-8, cutoff ≤ 3), and executive function (scale:0-5, cutoff ≤ 1) (30, 31). SDs were derived from cognitive test scores of NHATS self-respondents (32). Scores of ≤1.5 SD in one domain were classified as "possible" dementia. A detailed description of cognitive assessment is provided in the appendix (Supplement Methods and Supplement Tables 2-4). Based on prior literature, we used the NHATS narrow dementia definition of probable vs no or possible dementia (32, 33) and defined our outcome as transition from no/possible dementia pre-ICU dementia to probable post-ICU dementia. <u>Assessment of Mental Health</u> Symptoms of depression and anxiety were assessed using the Patient Health Questionnaire for Depression and Anxiety (PHQ-4), which includes a depression subscale (PHQ-2) and an anxiety subscale [Generalized Anxiety Disorder (GAD-2)] (34, 35). PHQ-4 has excellent reliability and construct validity as a measure of depression and anxiety in the general population (34). NHATS participants were asked "over the last month, how often have you (a) had little interest or pleasure in doing things; (b) felt down, depressed, or hopeless; (c) felt nervous, anxious, or on edge; (d) been unable to stop or control worrying". Each item was scored on a 4-point scale from "not at all"(0), "several days"(1), "more than half the days"(2) to "nearly every day"(3). Each subscale score ranges from 0-6, the total score ranging from 0-12. Our outcome for mental health was the total post-ICU PHQ-4 score in the post-ICU interview with pre-ICU PHQ-4 score as the baseline measure. <u>Ascertainment of dual-eligible status</u> Our primary exposure, dual-eligibility, was assessed using the dual Medicare-Medicaid status indicator in the Medicare Master Beneficiary Summary File, recorded at any time during the 12 months prior to ICU hospitalization.
Data sources/ measurement	8*	For each variable of interest, give	8	Variables included in models for all outcomes were age categorized into five groups: 65-74, 75-79, 80-

		sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group		84, 85-89, and ≥90 years (36), sex (37), non-White race or ethnicity (non-Hispanic Blacks, Hispanics, American Indian, Alaska Native, Asian, Native Hawaiian, Pacific Islander, and other race as self-reported in NHATS); living alone, less than a high school education (4, 38), multimorbidity (defined as ≥3 self-reported chronic conditions, of a possible 9) (39), mechanical ventilation (40, 41) as a dichotomous variable, and hospital length of stay as a continuous variable. In addition, we included the baseline status, i.e. count of disabilities, no or possible dementia, and PHQ-4 score during the pre-ICU interview for the outcomes of function, cognition, and mental health, respectively. Finally, we included risk factors for decline in specific outcome domains, specifically frailty (ordinal, scale of 0-5) for function, (5) and depression (dichotomous) for cognition (42). For function and mental health, we added rural residence (vs urban) as a covariate. The model for cognitive decline did not converge when rural residence was included.
Bias	9	Describe any efforts to address potential sources of bias	9-11	For missing values of covariates and outcomes, we generated five imputations using PROC MI in SAS Version 9.4 based on an assumption of missing-at-random (Supplement Methods and Supplement Tables 5, 6). To account for variation in timing of hospitalization relative to pre and post ICU interviews, we included the number of days between hospital discharge and the post-ICU interview as an offset in the Poisson models. Unlike the Poisson models which can incorporate follow-up time as offset in model calculations, logistic regression models consider it as a separate covariate. The logistic regression model of cognitive decline did not converge with the addition of follow-up time as a covariate, thereby precluding its inclusion in this model. We performed a sensitivity analysis with the time interval forced in as a covariate in the model with exclusion of some covariates in the main model. For all models, there were instances where a minority of patients contributed multiple observations. To account for this, we used generalized estimating equations with an exchangeable covariance structure chosen by its minimization of quasi-likelihood under the independence model criterion.

Study size	10	Explain how the study size was arrived at	8-9	We restricted our sample to the first ICU hospitalization in the interval between annual NHATS interviews with an ICU length of stay of ≥1 day (n=1,500). After excluding participants who were not community-dwelling (n=433), admitted from a nursing home or spent ≥100 days in a nursing home between pre-ICU interview and ICU hospitalization (n=70), and those with missing data on race (n=8), 989 ICU admissions remained for consideration. Of these, 332 ICU hospitalizations were excluded because of in-hospital death (n=106), discharge to hospice (n=56), follow-up interview completed >365 days after discharge (n=73) or missing the entire follow-up interview (n=97). Of the 657 ICU admissions where participants survived to discharge and had follow-up interview data, we excluded participants with maximal impairment at baseline in each outcome domain (i.e., the participant could not get any worse). This implied a pre-ICU count of disabilities of 7/7 for function (n=16), baseline dementia status of probable dementia for cognition (n=109), and pre-ICU PHQ-4 score 12/12 for mental health (n=6). Interviews completed by proxy because of participant death following hospital discharge were missing information on dementia status and PHQ-4 score and consequently excluded for cognition and mental health (n=90 and n=132, respectively).

Supplement Table 2. Domains of cognitive performance testing used in NHATS interview if a participant was available and able to perform the test.

Domain Name	**Measure**	**Score Range (cutoff = mean-1.5 SD)**
Memory	Immediate word recall	0-20 (≤3)
	Delayed word recall	
Orientation	Date recall	0-8 (≤3)
	Naming president or vice-president	
Executive functioning	Clock-drawing test	0-5 (≤1)

Supplement Table 3. Scheme for classification of probable, possible, and no dementia using reported diagnosis, AD-8 questionnaire, and scores in the three domains of cognitive performance testing.

Dementia Classification		**Probable Dementia**		**Possible Dementia**	**No Dementia**
Criteria	Diagnosis Reported	Met AD8 criteria if no diagnosis reported (proxy only)	≤ 1.5 SDs below mean in at least 2 domains	≤ 1.5 SDs below mean in 1 domain	All others

Supplement Table 4. Frequency of participants diagnosed with dementia by each method in the cohort for the outcome of cognitive decline.

Method of Dementia Diagnosis	Overall cohort	Dual-eligible	Non-dual-eligible
Physician diagnosis	8 (1.8%)	2 (2.5%)	6 (1.6%)
AD-8	17 (3.7%)	10 (12.5%)	7 (1.8%)
Performance testing	23 (5.0%)	11 (13.8%)	12 (3.2%)
No dementia	410 (89.5%)	57 (71.2%)	353 (93.4%)

Supplement Table 5. Model covariates with missing data that were multiply imputed for each analytic sample.

Covariate	Function	Cognition	Mental Health
Education	1	0	0
Living situation	1	1	1
Frailty score	20	11 (NA*)	13 (NA*)
Pre-ICU ADL score	1	0 (NA*)	0 (NA*)
Pre-ICU PHQ-2 score	11 (NA*)	5	8
Pre-ICU PHQ-4 score	13 (NA*)	6 (NA*)	10
Pre-ICU GAD-2 score	5 (NA*)	1 (NA*)	4

*NA = Not applicable because the covariate was not included in the model for the outcome.

Supplement Table 6. Items that were multiply imputed due to missingness in the 7-item functional outcome measure of count of disabilities.

Number of ADL items missing	Number of ICU hospitalizations (n)
1	3
2	4
3	15
4	1
5	0
6	0

n represents the number of ICU hospitalizations for which the imputation was performed in the cohort for function (total n = 23).

Supplement Table 7. Characteristics of ICU hospitalizations contributed by older adults for each outcome domain.

Characteristic*	**Function**	**Cognition**	**Mental Health**
Sample n	641	458	519
Weighted n	3,767,695	2,791,233	3,118,513
Age, mean (S.D.), years	81.1 (7.2)	80.0 (7.2)	80.5 (7.2)
Age groups by years, no. (%)			
65-74	129 (20.1)	109 (23.8)	116 (22.4)
75-79	143 (22.3)	113 (24.7)	121 (23.3)
80-84	160 (25.0)	106 (23.1)	123 (23.7)
85-89	123 (19.2)	80 (17.5)	97 (18.7)
≥ 90	86 (13.4)	50 (10.9)	62 (12.0)
Female, no. (%)	329 (51.3)	246 (53.7)	276 (53.2)
Race, no. (%)			
Non-Hispanic White	457 (71.3)	336 (73.4)	370 (71.3)
Non-Hispanic Black	134 (20.9)	93 (20.3)	111 (21.4)
Hispanic	29 (4.5)	16 (3.5)	23 (4.4)
Others[†]	21 (3.3)	13 (2.8)	15 (2.9)
Education, no. (%)			
Less than high school	185 (28.9)	116 (25.3)	144 (27.8)
Living situation, no. (%)			
Lives alone	232 (36.2)	168 (36.8)	186 (35.9)
Rural residence, no. (%)	174 (27.2)	125 (27.3)	140 (27.0)
Multimorbidity ≥3 chronic conditions[‡], no. (%)	430 (67.1)	300 (65.5)	343 (66.1)
Frequency of self-reported chronic conditions, no. (%)			
Diabetes	231 (36.2)	169 (37.0)	187 (36.1)

Hypertension	517 (80.7)	371 (81.0)	420 (80.9)
Stroke	49 (7.7)	28 (6.1)	37 (7.1)
Heart disease	255 (40.2)	182 (39.9)	203 (39.3)
Arthritis	464 (72.4)	327 (71.4)	373 (71.9)
Heart attack	78 (12.2)	54 (11.8)	61 (11.8)
Osteoporosis	175 (27.3)	125 (27.3)	148 (28.5)
Lung disease	179 (28.0)	129 (28.2)	142 (27.4)
Non-skin cancer	118 (18.5)	84 (18.4)	91 (17.6)
Frailty (Range 0-5)[¶], Median (IQR)	2.0 (1.0, 3.0)	2.0 (1.0, 3.0)	2.0 (1.0, 3.0)
Pre-ICU count of disabilities[**](Range 0-6), Median (IQR)	0.0 (0.0, 1.0)	0.0 (0.0, 1.0)	0.0 (0.0, 1.0)
Pre-ICU PHQ-4[††] (Range 0-11), Median (IQR)	1.0 (0.0, 4.0)	1.0 (0.0, 3.0)	1.0 (0.0, 3.0)
Pre-ICU PHQ-2[‡‡] (Range 0-6), Median (IQR)	1.0 (0.0, 2.0)	1.0 (0.0, 2.0)	1.0 (0.0, 2.0)
Pre-ICU GAD-2[§§] (Range 0-6), Median (IQR)	0.0 (0.0, 2.0)	0.0 (0.0, 2.0)	0.0 (0.0, 2.0)
Pre-ICU Dementia Status, no. (%)			
No dementia	457 (71.3)	377 (82.3)	374 (72.1)
Possible dementia	90 (14.0)	81 (17.7)	81 (15.6)
Probable dementia	94 (14.7)	0 (0)	64 (12.3)
Time interval between pre-ICU NHATS interview and ICU hospitalization, Median (IQR), days	178.0 (99.0, 272.0)	195.5 (117.0, 283.0)	196.0 (111.0, 286.0)
ICU Length of Stay[§], Median (IQR), days	2.0 (1.0, 4.0)	2.0 (1.0, 3.0)	2.0 (1.0, 4.0)

Hospital Length of Stay[§], Median (IQR), days	6.0 (3.0, 9.0)	5.0 (3.0, 9.0)	5.0 (3.0, 9.0)
Mechanical ventilation[‖], no. (%)	59 (9.2)	36 (7.9)	41 (7.9)
Time interval between ICU hospitalization and post-ICU NHATS interview, Median (IQR), days	182.0 (103.0, 267.0)	168.0 (93.0, 249.0)	171.0 (92.0, 252.0)

Abbreviations: ICU = Intensive Care Unit, SD = Standard Deviation, CI = Confidence Interval, IQR = Interquartile Range, PHQ-4 = 4-item screening questionnaire for depression and anxiety or Patient Health Questionnaire-4, PHQ-2 = 2-item screening questionnaire for Depression or Patient Health Questionnaire-2, GAD-2 = 2-item screening questionnaire for Generalized Anxiety Disorder. Pre-ICU refers to values obtained from the NHATS assessment prior to ICU hospitalization.

The unit of observation is ICU hospitalization.

[*]Values represent characteristics for the unweighted sample.

[†]Includes American Indian, Alaska Native, Asian, Native Hawaiian, Pacific Islander, and other race as self-reported in the NHATS interview.

[‡]Multimorbidity defined as ≥ 3 of 9 self-reported chronic conditions (diabetes mellitus, hypertension, stroke, heart disease, arthritis, heart attack, osteoporosis, lung disease, and non-skin cancer)

[§]Ascertained from hospitalization record in linked Medicare claims data.

[‖]Ascertained from linked Medicare claims data using ICD-9 CM (96.7x) and ICD-10-PCS (5A1935Z,5A1945Z,5A1955Z) codes for mechanical ventilation.

[¶]Frailty score is derived from the composite of 1 point for each of the five frailty criteria (range 0-5): weight loss, muscle weakness, exhaustion, slow gait speed, and low physical activity.

[**]Count of disabilities was characterized as the need for help or inability to perform four activities of daily living (eating, bathing, using the toilet, and dressing) and three mobility activities (getting outside, getting around inside one's home, getting out of bed). Participants with maximal score of 7/7 were excluded.

[††]PHQ-4 score: Sum of the responses to all four items in the screening for depression and anxiety questionnaire, our outcome for mental health. Response for each question ranged from 0-3;the total score ranged from 0-12. Participants with maximal score of 12/12 were excluded.

[‡‡]PHQ-2 score: Sum of the responses to two items in the screening for depression questionnaire. Response for each question ranged from 0-3; the total score ranged from 0-6.

[§§]GAD-2 score: Sum of the responses to two items in the screening for anxiety questionnaire. Response for each question ranged from 0-3;the total score ranged from 0-6.

Supplement Table 8. Distribution of primary discharge diagnoses for ICU hospitalizations of participants who survived to discharge and were included in subsamples for function, cognition, and mental health outcomes (n=657).

Condition Category	Frequency n (%)	Examples of Diagnoses
Acute conditions		
Infectious	102 (15.5)	Streptococcal septicemia, pneumococcal septicemia, *Klesibella pneumoniae* pneumonia, empyema, urinary tract infections, cellulitis
Endocrine, metabolic, or electrolyte disorders	12 (1.8)	Diabetic hyperketotic hyperosmolar state, neurohypophysis disease, hyposmolality, hyperpotassemia, Syndrome of Inappropriate Antidiuretic Hormone (SIADH)
Neurologic	51 (7.8)	Grand mal status, metabolic encephalopathy, compression of brain, toxic encephalopathy, altered mental status, subarachnoid hemorrhage, intracranial hemorrhage, epilepsy, stroke
Cardiovascular	133 (20.2)	Acute myocardial infarction, ST elevation myocardial infarction, AV block complete, paroxysmal atrial tachycardia, atrial fibrillation, acute systolic heart failure, dissection of thoracic aorta, deep venous thrombosis of extremity
Respiratory	23 (3.5)	Spontaneous pneumothorax, pulmonary collapse, acute respiratory failure, food/ vomit pneumonitis, traumatic pneumothorax or hemothorax
Gastrointestinal	57 (8.7)	Ulcer esophagitis with bleed, acute stomach ulcer with hemorrhage, duodenal ulcer with hemorrhage, melena, intestinal obstruction, cholecystitis, pancreatitis, gastroenteritis, cholangitis
Renal	13 (2.0)	Acute kidney failure, reaction to indwelling urinary catheter
Musculoskeletal	41 (6.2)	Fracture, disc degeneration, spinal claudication, complication of prosthesis
Hematologic	7 (1.0)	Hemorrhage or hematoma complicating procedure, anemia, neutropenia
Chronic conditions with acute complications		
Cardiovascular	134 (20.4)	Malignant hypertension, hypertensive heart disease with heart failure, acute on chronic systolic heart failure, acute or chronic systolic or diastolic heart failure, aortic stenosis and insufficiency

Respiratory	16 (2.4)	Chronic bronchitis with acute exacerbation, bronchiectasis w acute exacerbation, acute and chronic respiratory failure
Gastrointestinal	13 (1.9)	Chronic stomach ulcer with hemorrhage, chronic stomach ulcer with perforation, other esophagitis, cholelithiasis, chronic cholecystitis, liver cirrhosis, persistent vomiting
Neoplastic	35 (5.3)	Malignant neoplasms
Neurologic	20 (3.0)	Parkinson's disease, Alzheimer's disease, Cerebral thrombosis without stroke

Supplement Table 9. Demographic characteristics of ICU hospitalizations contributed by ICU survivors who were not discharged to hospice and had follow-up interviews within a year of hospital discharge (n=657) versus those excluded due to absence of follow-up interviews (n=170).

Characteristic	**ICU Survivors with follow-up interviews**	**ICU Survivors without follow-up interviews**
Sample n	657	170
Age, mean (S.D.), years	81.1 (7.2)	79.9 (7.2)
Female, no. (%)	339 (51.6)	82 (48.2)
Race		
Non-Hispanic White	464 (70.6)	114 (67.1)
Non-Hispanic Black	141 (21.5)	40 (23.5)
Hispanic	30 (4.6)	8 (4.7)
Others[†]	22 (3.4)	8 (4.7)
Education		
Less than high school	194 (29.6)	60 (35.3)
Living situation, no. (%)		
Lives alone	234 (35.7)	70 (41.2)

The unit of observation is ICU hospitalization. [†]Includes American Indian, Alaska Native, Asian, Native Hawaiian, Pacific Islander, and other race as self-reported in the NHATS interview.

Supplement Table 10. Demographic characteristics of ICU hospitalizations contributed by older adults included in the analysis of the cognitive decline (n=458) versus those excluded due to missing dementia status in proxy interviews because of participant death (n=90).

Characteristic	**ICU Survivors included in the cohort for cognitive decline**	**ICU Survivors not included in the cohort for cognitive decline because of proxy interviews due to participant death**
Sample n	458	90
Age, mean (S.D.), years	80.1 (7.2)	82.2 (6.7)
Female, no. (%)	246 (53.7)	37 (41.1)
Race		
Non-Hispanic White	336 (73.4)	66 (73.3)
Non-Hispanic Black	93 (20.3)	16 (17.8)
Hispanic	16 (3.4)	5 (5.6)
Others[†]	13 (2.8)	3 (3.3)
Education		
Less than high school	116 (25.3)	25 (27.8)
Living situation, no. (%)		
Lives alone	168 (36.8)	32 (35.6)

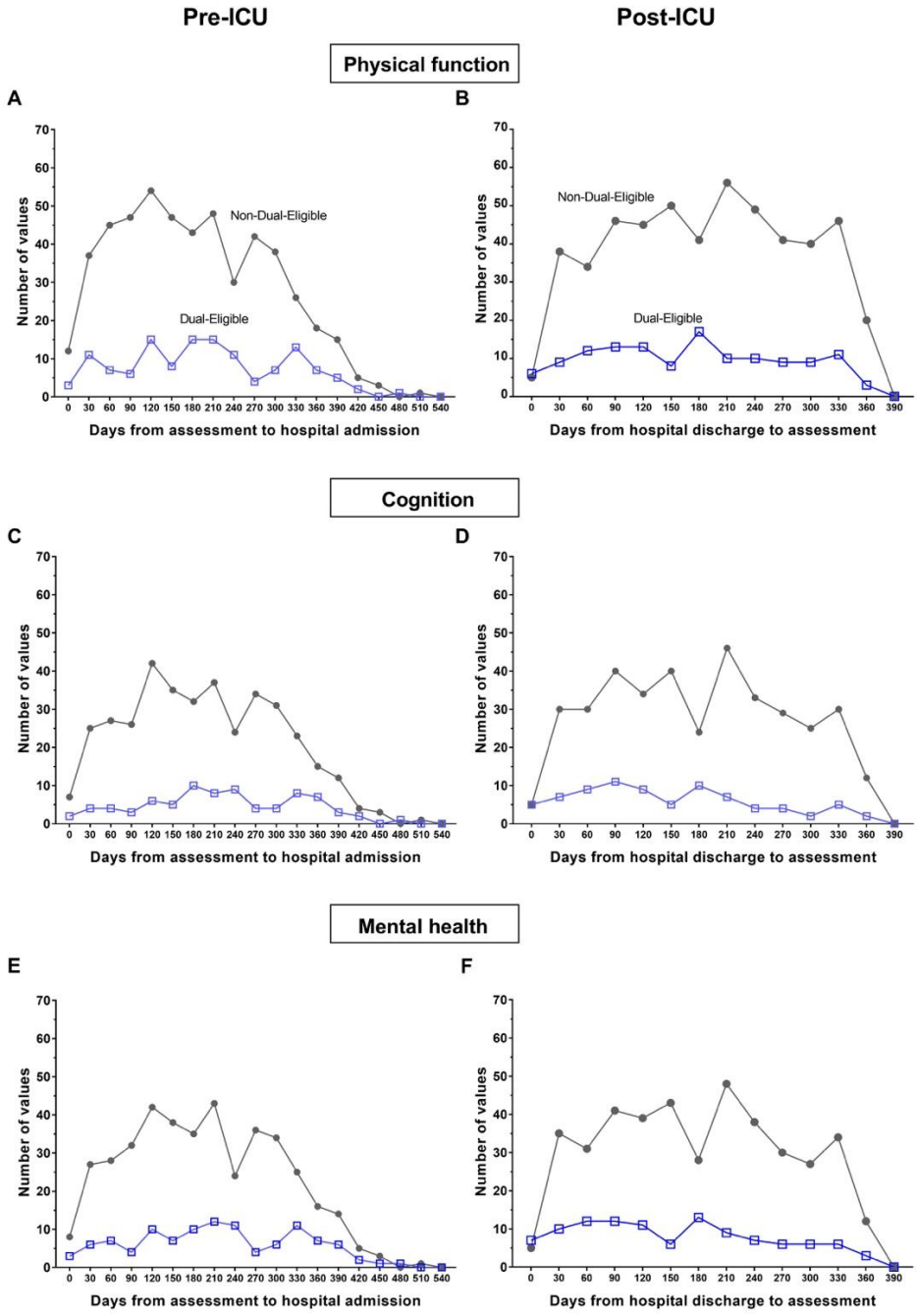
The unit of observation is ICU hospitalization. [†]Includes American Indian, Alaska Native, Asian, Native Hawaiian, Pacific Islander, and other race as self-reported in the NHATS interview.

Supplement Table 11. Demographic characteristics of ICU hospitalizations contributed by older adults included in the analysis of the mental health outcome (n=519) versus those excluded due to missing PHQ-4 score in proxy interviews because of participant death (n=132).

Characteristic	**ICU Survivors included in the cohort for mental health**	**ICU Survivors not included in the cohort for mental health because of proxy interviews due to participant death**
Sample n	519	132
Age, mean (S.D.), years	80.4 (7.2)	83.6 (6.7)
Female, no. (%)	276 (53.2)	60 (45.4)
Race		
Non-Hispanic White	370 (71.3)	91 (68.9)
Non-Hispanic Black	111 (21.4)	29 (22.0)
Hispanic	23 (4.4)	7 (5.3)
Others[†]	15 (2.8)	5 (3.8)
Education		
Less than high school	144 (27.7)	44 (33.6)
Living situation, no. (%)		
Lives alone	186 (35.9)	46 (34.8)

The unit of observation is ICU hospitalization. [†]Includes American Indian, Alaska Native, Asian, Native Hawaiian, Pacific Islander, and other race as self-reported in the NHATS interview.

Supplement Figures 1A-F. Distribution of time between index hospitalization and pre- and post-ICU NHATS interview for each of the three cohorts for the outcome of function (1A, 1B), cognition (1C, 1D), and mental health (1E, 1F).



Values on the x-axis represent the mid-point of 30-d intervals, for e.g., 30 refers to the interval between 15-44 days, 60 to the interval between 45-74 days, and so on.

References:

72. Spillman BC, Skehan ME**.** SAS programming statements for construction of dementia classification in the National Health and Aging Trends Study. Addendum to NHATS Technical Paper #5. Baltimore: Johns Hopkins University School of Public Health.; 2013.