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Long-term recovery after critical illness in older adults

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Abstract

Purpose of Review—The population is aging, and recent epidemiologic work reveals that an increasing number of older adults are presenting to the intensive care unit (ICU) with preexisting geriatric syndromes. In this update, we discuss recent literature pertaining to the long-term recovery of older ICU patients and highlight gaps in current knowledge.

Recent Findings—A recent longitudinal study demonstrated that the incidence of frailty, disability, and multimorbidity among older ICU patients is rising; these geriatric syndromes have all previously been shown to impact long-term recovery. Recent studies have demonstrated the impact of social factors in long-term outcomes after critical illness; for example, social isolation was recently shown to be associated with disability and mortality among older adults in the year after critical illness. Socioeconomic disadvantage is associated with higher rates of dementia and disability following critical illness impacting recovery, and further studies are necessary to better understand factors influencing this disparity. The COVID-19 pandemic disproportionately impacted older adults resulting in worse outcomes and increased rates of functional decline and social isolation. In considering how to best facilitate recovery for older ICU survivors, transitional care programs may address the unique needs of older adults and help them adapt to new disability if recovery has not been achieved.

Summary—Recent work demonstrates increasing trends of geriatric syndromes in the ICU, all of which are known to confer increased vulnerability among critically ill older adults and decrease the likelihood of post-ICU recovery. Risk factors are now known to extend beyond geriatric syndromes and include social risk factors and structural inequity. Strategies to improve post-ICU recovery must be viewed with a lens across the continuum of care, with post-ICU recovery programs targeted to the unique needs of older adults.

Keywords

long-term recovery; older adults; geriatric syndromes; post-ICU syndrome

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Introduction

By 2040 the number of Americans aged 65 years or older will be 80.8 million, a doubling of the older adult population in the United States since 2000 [1], when more than half of intensive care unit (ICU) days were already contributed by older adults [2]. As the population ages, we expect to see an increase in the number of older adults in the ICU as well as a shift towards the “oldest old;” indeed, a longitudinal study found that the proportion of ICU admissions among patients aged 85-94 had increased from 14.1% to 20.1% between 1996-2010 alone [3]. The vast majority (88%, according to the same study) of older adults survive their ICU hospitalization and must then begin the journey of long-term recovery in function and cognition, very often with vulnerability factors that pose additional challenges to recovery. Indeed, nearly half of older ICU survivors will not achieve functional recovery (defined as a return to their pre-ICU functional baseline) within 6 months of critical illness [4]. The COVID-19 pandemic highlighted many of these challenges to recovery due to its disproportionate impact on older adults [5]. In this review, we provide an update on the science of long-term recovery after critical illness among older adults.

Geriatric Syndromes in the ICU: Increasing Trends Over Time

Geriatric syndromes include conditions such as frailty, disability, multimorbidity, and cognitive impairment, which confer increased vulnerability to adverse outcomes among older adults [6]. It is well-established that the presence of one or more geriatric syndromes before ICU admission is associated with poorer long-term outcomes among older ICU survivors, including disability, mortality, and a loss of functional independence [7, 8, 9, 10, 11]. Using data from the Health and Retirement Study, Cobert and colleagues recently evaluated epidemiologic trends in geriatric syndromes among older adults admitted to the ICU between 1998 and 2015 [12**]. The study found that the adjusted prevalence of disability increased from 15% to 24%, frailty increased from 37% to 45%, and multimorbidity increased from 54% to 72%. The increasing prevalence of geriatric syndromes among older adults admitted to the ICU highlights the pressing need to integrate geriatrics principles and management concepts into critical care medicine education and practice [13*, 14].

Frailty

The association of frailty with increased in-hospital and long-term mortality is well-established among adult ICU patients [15], and among older ICU patients, frailty is additionally associated with increased disability and incident nursing home admission, signaling a loss of independence [7, 8, 16]. Recent literature on frailty has also underscored its impact during the pandemic. The COPE Study Collaborators leveraged an existing network of 10 clinical centers in the United Kingdom (U.K) and one in Italy that had experience in collecting frailty data using the Clinical Frailty Scale (CFS) [17] to investigate the prevalence of frailty and its association with outcomes among hospitalized COVID patients [18*]. At each site, the frailty assessment was overseen by a team that included a geriatrician, intensivist, and emergency medicine physician. Among the 1564 enrolled

patients, approximately half were frail (772, 49.4%), and worsening frailty was associated with time to death and 7-day mortality. Although this study was not limited to older adults, most participants were older (median age 74 years, interquartile range [IQR] 61-83). The association of frailty with higher 30-day mortality among critically ill older adults with COVID was confirmed by the COVIP study investigators in a prospective multicenter study of 1346 adults aged ≥ 70 [19*].

One knowledge gap that had not previously been addressed was whether frailty is associated with persistent critical illness or chronic critical illness. In a recent retrospective study of adults admitted to 168 ICUs in Australia and New Zealand, Darvall and colleagues sought to answer this question in the 269,785 patients with complete CFS scores, using a primary outcome of persistent critical illness, defined as an ICU stay of ≥ 10 days [20*]. Each one unit increase in the CFS was associated with increased odds of developing persistent critical illness (adjusted odds ratio 1.08, 95% CI 1.06-1.1). In a different study, the same group demonstrated that addition of frailty scores to the APACHEIII score at ICU admission modestly improves discrimination for mortality in a cohort of adult ICU patients [21].

Studies in the last decade have stressed the influence of pre-hospitalization frailty on mortality and morbidity, but less is known about frailty after the ICU. Using CFS scores measured in the ICU and at 3 and 12 months among a cohort of 567 adults with a median age of 61 years (IQR 51-70), Brummel and colleagues demonstrated that frailty (defined as a CFS ≥ 5) was newly acquired in 61% of participants [22]. In a subsequent study, Baldwin and colleagues characterized post-ICU frailty subtypes using pre-ICU frailty, post-ICU frailty phenotype, and serum biomarkers in a prospective cohort study of 185 older survivors with acute respiratory failure [23*], and tested associations between frailty subtypes and functional recovery. Five frailty subtypes were identified with a 49% recovery rate across subtypes. The three subtypes with the slowest recovery were characterized by greater systemic inflammation and anabolic hormone deficiencies at hospital discharge.

Despite the widespread use of frailty measures in ICU research, and the implications of frailty for the long-term recovery potential of older ICU patients, the feasibility of implementation of routine frailty screening in clinical practice remains uncertain. Although the Clinical Frailty Scale remains the most widely used frailty measure in ICU research, a systematic review assessed the interrater reliability of CFS across ICU frailty studies and found that most studies relied on proxies for scoring, and reliability of measurements was not usually assessed [24]. Surkan and colleagues conducted a single-center observational study that compared CFS scores of patients between geriatricians and intensivists and found an interrater reliability of 0.29, suggesting that the CFS is inconsistent and operator-dependent [25]. Even groups that have successfully evaluated frailty across large swaths of the population have had high levels of missingness in frailty data collected in the ICU [20*, 21]. Given the strong link between frailty and short- and long-term outcomes among critically ill older adults, future work should determine whether routine frailty assessments upon ICU admission by clinicians are feasible and reliable, or whether more objective measures of baseline vulnerability, such as baseline functional status, should be used instead.

Functional Status and Preventing In-Hospital Functional Decline

Baseline functional status and pre-ICU functional trajectories are important determinants of post-ICU outcomes [10, 26] and new literature published during the pandemic has highlighted the centrality of functional status in predicting outcomes among critically ill older adults. In a prospective international study of older adults (age ≥ 70 years) hospitalized with COVID, the COVIP study investigators demonstrated the association of baseline disability in activities of daily living (ADL) with 3-month mortality, whether operationalized as a continuous variable or any disability [27*]. Participants with both frailty (defined as a CFS score ≥ 5) and any ADL disability had the highest mortality (72% at 3 months) in the cohort. Another study evaluated the association of mild and moderate COVID and mobility and physical function among 51,338 community-dwelling adults (41.9% older adults), and found that adults with a confirmed or probable COVID diagnosis had greater odds of worsening ability to engage in household activity (OR 1.89, 95% CI, 1.11-3.22) or participate in physical activity (OR 1.91, 95% CI, 1.32-2.76) compared to adults without a COVID diagnosis during the same period [28*]. Of note, the majority (94.2%) of participants diagnosed with COVID were not hospitalized.

Up to 65% of critically ill survivors suffer weakness, loss of muscle mass, and polyneuropathy; and among hospitalized older adults there is a high prevalence of acute and chronic sarcopenia [29]. As such, the prevention of in-hospital functional decline remains a top priority among older adults in the hospital and ICU. In a meta-analysis evaluating 60 trials investigating physical rehabilitation among adult ICU patients, Wang and colleagues found that physical rehabilitation focused on functional exercises up to 5 days per week improved physical function at the time of discharge [30]. While this study did not exclusively assess physical rehabilitation among older adults, it considered the dose and type of rehabilitation in its evaluation. Among hospitalized older adults, Martínez-Velilla and colleagues conducted a multicenter, randomized controlled trial of an exercise intervention among patients aged 75 and older [31*]. The exercise intervention included twice daily physical rehabilitation sessions of 20 minutes' duration, 5-7 days per week, compared to usual care (which did include physical rehabilitation). The exercise intervention significantly improved the two primary outcomes, both of which were functional outcomes: the score on the Short Performance Physical Battery (SPPB) and ADLs as measured with the Barthel Index.

Multimorbidity and Polypharmacy

Multimorbidity, the coexistence of two or more chronic conditions, is a recognized geriatric syndrome that is heterogenous in phenotype and outcome [32]. In 2008, 62% of older adults had multimorbidity [33], and the prevalence of multimorbidity among older ICU patients continues to rise [12**]. McPeake and colleagues conducted a matched cohort study of 3,112 mostly older adults in the non-ICU and ICU setting [34*]. The study found that ICU survivors had higher hospital readmission rates in the year following critical illness. Additionally, multimorbidity was strongly associated with long-term mortality (hazard ratio [HR] 2.17; 95% CI 1.51-3.13) compared to no comorbidities.

Multimorbidity often leads to polypharmacy, defined as the long-term use of five or more prescribed drugs. A recent population-wide cohort study assessed preadmission polypharmacy prior to ICU admission among 23,844 mostly older adults admitted to ICUs across Scotland [35*]. The study found that polypharmacy was present in nearly 30% of all patients, and that polypharmacy patients were more likely to be older (median age 66, IQR 55-75). In the multivariable analysis, including adjustment for multimorbidity, polypharmacy was associated with a 22% relative increase in the hazard of one-year emergency hospital readmission (adjusted HR 1.22, 95% CI 1.16-1.28).

Given the prevalence of multimorbidity in older patients and the accompanied downstream effects, Blum and colleagues conducted a cluster randomized control trial of inpatient wards in four European countries inclusive of more than two thousand older adults with multimorbidity (3 chronic conditions) and polypharmacy (5 long-term medications) to assess the outcomes of a structured pharmacotherapy optimization intervention [36*]. The study found that five out of six participants experienced inappropriate prescribing, and 62% of the intervention group were able to implement medication changes. Although the intervention reduced polypharmacy and inappropriate prescribing, it did not significantly reduce drug-related hospital admissions at one year. Future work will need to evaluate similar interventions among older ICU patients to see if a reduction in polypharmacy can improve long-term outcomes.

Delirium and Cognitive Impairment

Long-term cognitive impairment has shown to persist in a quarter of patients up to a year after critical illness, with a longer duration of delirium associated with poor cognitive outcomes [37]. During the COVID-19 pandemic, Kennedy and colleagues found that delirium was the primary symptom in 28% of 817 older adults presenting to the emergency department with COVID and the sixth most common presenting sign or symptom [38]. During the pandemic, delirium was further perpetuated in hospitalized older adults due to restriction of visitors, masked faces and muffled voices affecting communication, and prolonged periods of social isolation [39*].

One evidence-based approach for delirium prevention is the Hospital Elder Program (HELP) [40]. The program was designed for hospitalized older adults and emphasizes strategies to prevent or reduce delirium including frequent orientation, therapeutic activities, pain control, and vision and hearing enhancement. In a cluster randomized trial of six surgical floors at a hospital in China, older adults admitted for a scheduled elective surgery who received the HELP program had a lower incidence of post-operative delirium within 7 days post-procedure than those who did not receive the program (2.6% [n=4] intervention vs. 19.4% [n=25] control; relative risk 0.14, 95% CI 0.05-0.38). Implementation of the exact program may be challenging in the ICU, but similar principles can be adopted. For example, hearing impairment is associated with lack of functional recovery among older adult ICU survivors and can perpetuate delirium, yet is recognized as a modifiable factor [41*]. Future work should evaluate the feasibility and effectiveness of the HELP program and other geriatric models of care in the ICU [42*].

Given the risk of long-term cognitive impairment after critical illness, particularly for older ICU survivors, Palakshappa and colleagues evaluated the rate of screening for and diagnosis of cognitive impairment among older adults in post-ICU outpatient clinical care using data from the Medicare Annual Wellness Visit (AWV) at their clinical center [43*]. Among 696 older adults followed for one year after critical illness, 172 (24.7%) completed the AWV, and the cumulative incidence of cognitive impairment detected at the AWV was only 3.4%. These findings suggest a large burden of unrecognized cognitive impairment and highlight the need to develop feasible and sustainable screening modalities for post-ICU cognitive impairment.

Social Isolation

Social isolation is the objective state of having few social relationships, while loneliness is the subjective feeling of isolation [44]. Prior to the COVID-19 pandemic in the United States, one quarter of older adults were socially isolated and 43% reported loneliness [45]. Though exact numbers are not known, the COVID-19 pandemic increased the number of older adults in social isolation due to global bans on social interaction [46]. In a longitudinal cohort study using nationally representative data from the National and Aging Trends Study (NHATS) prior to the pandemic, Falvey and colleagues evaluated the association of social isolation with disability and mortality over the year after critical illness among older adults. Worsening social isolation was associated with an increased risk of post-ICU disability and mortality, such that the most severely socially isolated older adults experienced a 50% higher disability burden and 119% higher hazard of death in the year after critical illness [47*].

Future work in this area should focus on three key areas: screening for social isolation, interventions to treat social isolation, and the role of the healthcare system in screening and intervening upon social isolation. As stated by the National Academy of Medicine [45], healthcare systems remain a relatively untapped partner in this area; yet, contact with the healthcare system may represent the only opportunity for socially isolated persons to be identified. Some studied interventions include virtual and in-person social support groups, weekly phone check-in phone-calls for isolated older adults, and a “Geriatric Buddy Program” [48*, 49*]. Additionally, hearing impairment, which is common among older adults, is associated with limited social engagement and may represent an additional target for intervention [50*].

Socioeconomic Disadvantage

In 2019, a systemic review of ten studies found patients with socioeconomic disadvantage had higher mortality across critical illness continuum; the authors advocated for inclusion of socioeconomic demographics in future critical care studies [51]. In a recent longitudinal study, Jain and colleagues evaluated the association of individual-level socioeconomic disadvantage, represented by dual-eligibility for Medicaid and Medicare, with the three outcomes of the post-ICU syndrome: physical function (operationalized as disability in ADLs), cognitive function, and mental health symptoms [52*, 53]. Socioeconomic disadvantage was associated with a 28% increase in disability and 9.8-fold greater odds of

developing probable dementia in the year after critical illness. Another innovative study by Falvey and colleagues assessed neighborhood-level socioeconomic disadvantage using the Area Deprivation Index [54*]. Authors found that increased socioeconomic neighborhood deprivation was associated with increased disability among older adults during the year after critical illness.

The COVID-19 pandemic has drawn sharp attention to structural inequity in our health care system [55*]. Although many studies have evaluated associations with important short-term outcomes, including a Scottish study demonstrating the association of socioeconomic deprivation with higher rates of ICU admission and increased 30-day mortality [56], less has been published on associations with long-term recovery among older adults who have survived a critical illness with COVID. This will undoubtedly be a focus of work in the coming months and years, and studies should evaluate long-term outcomes among the most vulnerable older adults as well as interventions to reduce disparities in long-term recovery.

Illnesses and injuries after critical illness

Gill and colleagues conducted a prospective study of 209 adults aged 70 years or older that found that illnesses and injuries leading to hospitalizations and emergency department (ED) visits are common in the year following critical illness [57*]. Of the events analyzed, hospitalizations were significantly associated with a lower likelihood of functional recovery; additionally, hospitalizations and ED visits were associated with episodes of functional decline over the year after critical illness. Functional status is dynamic, however, and older adults have the potential to recover from an episode of functional decline due to illness or injury. This study highlights the need for older ICU survivors to maintain access to care during the vulnerable post-ICU period to prevent illnesses and injuries that may present additional barriers to recovery. Unfortunately, access to health care services during the COVID-19 pandemic was particularly difficult for older adults. In a study of a home-based primary care program for older adults which shifted to telehealth visits during the pandemic, Kalicki and colleagues found that 65% of patients were not able to attend healthcare encounters due to barriers including advanced dementia, vision and hearing impairment, or other cognitive impairments [58*]. Other studies evaluating barriers to telemedicine use among older adults found that older adults faced challenges including difficulty with platform use, language barriers, lack of desire to meet virtually, and lack of caregiver assistance [59*, 60].

Post-ICU Recovery and Transitional Care Programs

Despite a growing interest in post-ICU clinics, these remain relatively uncommon in the United States. Transitional care programs may be better suited to older adults who are more likely to have mobility limitations and a higher existing burden of clinic visits, which may affect their ability or willingness to attend a post-ICU clinic.

In a multi-center randomized control trial, Taylor and colleagues implemented the Sepsis Transition and Recovery (START) program in middle-aged and older adults with suspected sepsis [61*]. The program included best practices of post-sepsis care including screening

for new impairments, anticipation and mitigation of health deterioration, and palliative care when appropriate. The intervention group had a reduced primary composite outcome of 30-day mortality or rehospitalization compared to usual care, and the effect remained in a subgroup analysis of older adults (age ≥ 65). Major and colleagues conducted a feasibility study of a home-based rehabilitation program called REACH (Rehabilitation After Critical illness and Hospital Discharge). REACH tailored exercises by physical and occupational therapists to improve ability in ADLs and increase muscle strength [62*]. The study showed that an early individualized home-based rehabilitation program was feasible for survivors of critical illness and improved satisfaction and adherence. Future work should build on these studies by developing and testing comprehensive home-based programs that are designed to address the unique needs of older adults during post-ICU recovery. Moreover, future work should evaluate whether these programs are most effective among vulnerable older adults, such as those with frailty, as frailty is associated with gaps in care coordination [63*].

Caregivers of Older ICU Survivors

Caregivers are essential stakeholders in the ICU recovery process, particularly for older adults [64]. Sevin and colleagues conducted semi-structured interviews with 20 caregivers of ICU survivors and found two major themes: unmet needs of caregivers and poor transitions of care [65*]. Caregivers found that during post-discharge period there was fragmentation of care resulting in undue burden on caregivers. A cross-sectional study surveyed eighty caregivers of community-living older adults and found that a higher degree of frailty among older adults was correlated with higher levels of overall burden among caregivers [66*]. Findings in these studies reveal the pitfalls in transitions of care and elucidate the need for a comprehensive care pathway with support for both caregivers and older ICU survivors.

Perceptions of Recovery

When discussing long-term recovery after critical illness, it is essential that we consider both objective measures of recovery and patient perceptions of recovery. Thurston and colleagues interviewed 35 adult ICU survivors and found that among survivors who described themselves as recovered, there were themes of acceptance of illness, strong support from social networks, and dedication to goals of recovery including active involvement with rehabilitation [67]. Another cross-sectional study evaluated self-perceived long-term recovery and satisfaction among older ICU survivors who had been admitted for abdominal sepsis and found that though survivors may report incomplete recovery following critical illness, they were still satisfied with their level of function [68*]. These findings highlight the potential of adapting to new disability or impairments after critical illness for the approximately half of older ICU survivors who will not achieve functional recovery after critical illness. Although we (as a field) should keep working across the continuum of ICU care to improve the likelihood of functional recovery for older adults, we can also help older ICU survivors adapt to new impairments.

Conclusion

Recent epidemiologic work has demonstrated the rising trend of geriatric syndromes (disability, frailty, and multimorbidity) among older adults admitted to the ICU, highlighting the need for attention to these factors during ICU care and adaptation of geriatric models of care in the ICU. Aside from geriatric syndromes, social isolation and socioeconomic disadvantage are additional factors that contribute to baseline vulnerability and adversely affect long-term recovery among older ICU survivors (figure 1). The impact of these factors on long-term recovery were highlighted during the COVID-19 pandemic, which disproportionately affected older adults. Transitional care programs after discharge may be uniquely suited to older ICU survivors; however, there are many opportunities across the continuum of ICU and post-ICU care for future work to improve the long-term recovery of older ICU survivors.

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This nationally representative study evaluated the association of individual-level socioeconomic status with the three post-ICU syndrome domains (physical function, cognitive function, and mental health) following critical illness. The study showed that socioeconomically disadvantaged individuals are at greater risk for decline in function and cognition after an ICU hospitalization than their more advantaged counterparts.
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This study demonstrated the association between neighborhood socioeconomic disadvantage (measured using the Area Deprivation Index) with post-ICU disability burden over the year after critical illness among older adults.
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- 57*. Gill TM, Han L, Gahbauer EA, et al. Functional Effects of Intervening Illnesses and Injuries After Critical Illness in Older Persons. *Crit Care Med.* 2021;49(6):956–66. [PubMed: 33497167] This observational study examined the impact of intervening illness one year following critical illness among 209 older adults and found that illnesses or injuries leading to hospital readmissions or emergency visits led to adverse functional outcomes. This study suggests that more efforts should be in place to identify and prevent illness and injury after critical illness.
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- 59*. Mao A, Tam L, Xu A, et al. Barriers to Telemedicine Video Visits for Older Adults in Independent Living Facilities: Mixed Methods Cross-sectional Needs Assessment. *JMIR Aging.* 2022;5(2):e34326. [PubMed: 35438648] This study used mixed methods including surveys and semi-structured interviews of community-dwelling older adults to understand barriers to tele-medicine. Results showed that barriers included technology difficulties, hearing impairment, language barriers, and lack of desire to see providers virtually.
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assess the effectiveness of an interdisciplinary rehabilitation program designed for adults with post-intensive care syndrome. The study found that the home-based rehabilitation program was feasible and resulted in positive feedback from patients and health care workers.

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Key points:

1. Recent epidemiologic work has demonstrated the rising trend of geriatric syndromes (disability, frailty, and multimorbidity) among older adults admitted to the ICU, highlighting the need for attention to these factors during ICU care and adaptation of geriatric models of care in the ICU.
2. Social and structural factors, such as social isolation and socioeconomic disadvantage, are associated with a decreased likelihood of long-term recovery after critical illness among older adults.
3. The COVID-19 pandemic disproportionately affected older adults and exacerbated many of the factors (social isolation, delirium, etc.) associated with poor long-term outcomes after critical illness.
4. Transitional care programs may be uniquely suited to facilitating the post-ICU recovery of older adults, and attention should be paid to preventing recurrent illnesses and supporting caregivers.

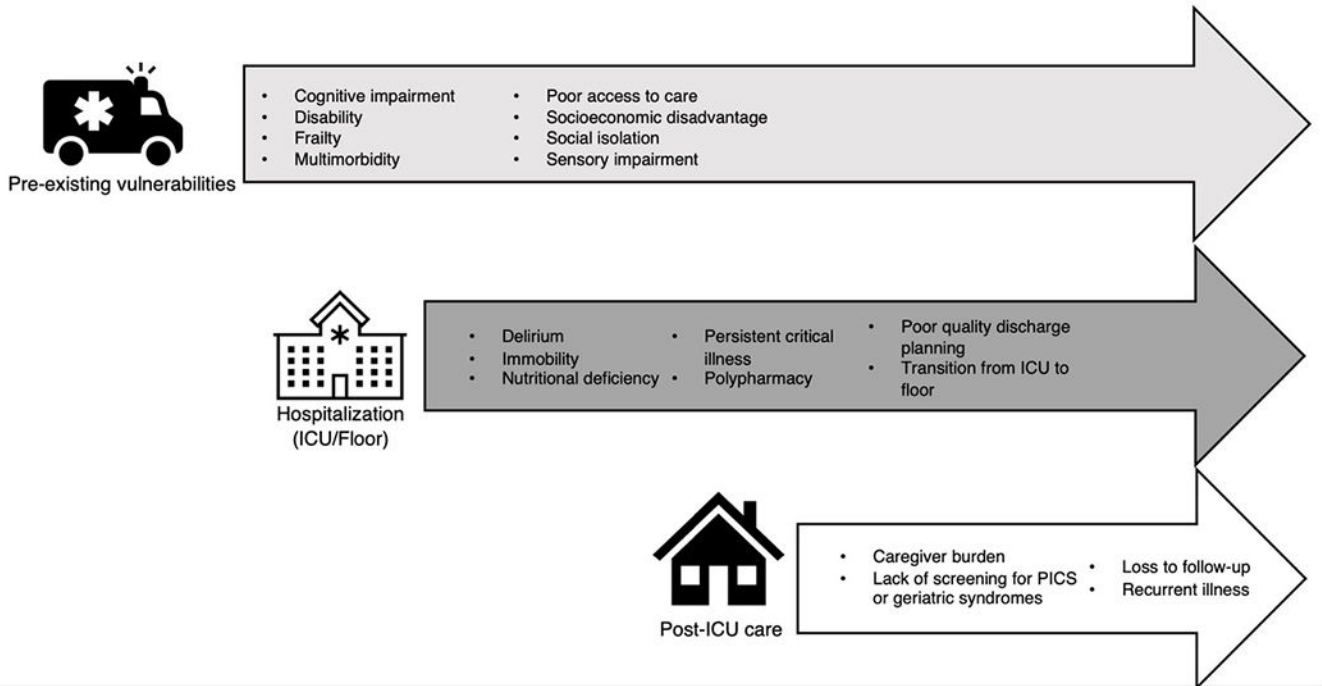


Figure. Barriers to long-term recovery for older ICU survivors across the continuum of critical illness.

The bulleted lists present factors associated with a lower likelihood of long-term recovery and barriers to long-term recovery after a critical illness among older adults. The arrows represent time across the continuum of critical illness.

Source: Original