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 Lale ÖZİŞİK

Hacettepe University Faculty Of Medicine,  
Department of Internal Medicine, Ankara, Türkiye

## REVIEW

# FROM ACUTE RESPIRATORY INFECTION TO FUNCTIONAL DISABILITY: TRAJECTORIES OF POST-ILLNESS FUNCTIONAL DECLINE IN OLDER ADULTS

## ABSTRACT

Acute respiratory infections are a leading cause of hospitalization and mortality among older adults, yet their long-term functional consequences remain underrecognized. As survival improves in aging populations, functional decline has emerged as a critical outcome that extends beyond the acute phase of illness.

This review introduces a novel host-centric, trajectory-based framework derived from disablement models that conceptualizes acute respiratory infections as biological stressors interacting with baseline vulnerability. Within this framework, the “trajectory concept” is employed to map heterogeneous recovery patterns in which frailty, multimorbidity, and pre-existing functional impairment outweigh pathogen-specific effects in determining long-term disability.

Drawing on evidence from pneumococcal disease, influenza, respiratory syncytial virus, and COVID-19 in adults aged  $\geq 65$  years, we identify key biological and clinical mediators, including immunosenescence, inflammaging, acute sarcopenia, delirium, and hospitalization-associated disability that link acute illness to sustained functional loss. Trajectory analyses reveal patterns ranging from rapid recovery to persistent or progressive disability and identify the early post-discharge period as a critical and potentially modifiable window.

Reframing acute respiratory infections as systemic triggers of functional decline shifts clinical priorities from survival to disability prevention. Integrated care models, centered on vaccination, geriatric-informed acute care, comprehensive geriatric assessment, and structured rehabilitation, are essential to preserve independence in ageing populations.

**Keywords:** Respiratory Tract Infections; Disability Evaluation; Frailty; Functional Status; Aged; Subacute Care.

## Correspondence

Lale ÖZİŞİK  
Phone : +903123053029  
e-mail : lale.ozisik@hacettepe.edu.tr

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## INTRODUCTION

The global demographic shift toward an aging population represents a significant public health challenge in the twenty-first century. By 2050, the global population of adults aged 65 years and older is projected to reach 2.1 billion, with the fastest growth in middle-income countries such as Turkey (1). As this shift occurs, population ageing is rapidly reshaping the clinical consequences of acute illnesses. Biological aging leads to a decline in physiological reserves, known as homeostenosis, and increases vulnerability to acute stressors, including acute respiratory infections (ARIs) (2, 3). Among older adults, ARIs are associated with substantially higher rates of hospitalization, complications, and mortality than in younger individuals. Furthermore, advances in acute care and vaccination have shifted focus to outcomes beyond the acute phase of illness (3, 4).

Traditional evaluations of ARIs have primarily focused on short-term outcomes, including in-hospital mortality, intensive care unit (ICU) admission, and length of stay. Although these outcomes are important, they fail to capture the health domains that are particularly significant to older adults. For many patients, survival following an acute infection marks the beginning of a new phase characterized by a trajectory of functional decline, cognitive impairment, and a loss of independence. Functional status has emerged as a critical outcome, frequently providing a more accurate prediction of long-term prognosis, institutionalization, and mortality than disease-specific severity indices (3, 5, 6).

Post-illness recovery trajectories in older adults are heterogeneous, ranging from a transient decline with gradual functional recovery to sustained or progressive functional and cognitive impairments (5). Recent evidence indicates that these outcomes are predominantly influenced by host-related vulnerabilities, including frailty, multimorbidity, and baseline health status, rather than by the specific pathogen involved (3).

Functional impairment is a strong predictor of rehospitalization, long-term care (LTC) placement, and mortality, and it imposes a substantial burden on caregivers and healthcare systems in aging populations (6). Framing ARIs as potential triggers of functional decline aligns infectious disease management with geriatric priorities that focus on preserving independence and quality of life.

This review synthesizes current evidence on the trajectories of post-illness functional decline in adults aged 65 years and older following influenza, respiratory syncytial virus (RSV), pneumococcal disease, and coronavirus disease 2019 (COVID-19). It examines the epidemiological burden, underlying mechanisms, and physical, cognitive, and psychosocial consequences, and discusses implications for clinical practice, geriatric rehabilitation, and preventive strategies.

## ACUTE RESPIRATORY INFECTIONS IN OLDER ADULTS: SCOPE AND BURDEN

*Streptococcus pneumoniae*, influenza virus, RSV, and SARS-CoV-2 are the primary causes of acute respiratory infections (ARIs) that are associated with severe outcomes in older adults, highlighting the significant disease burden within this population (Table 1) (3, 7-14).

### Pneumococcal Disease and Community-Acquired Pneumonia

Pneumococcal disease, which most frequently manifests as community-acquired pneumonia, remains a major cause of hospitalization among older adults and is the leading contributor to disability-adjusted life years (DALYs) attributable to lower respiratory infections (LRIs) globally (15). In 2023, LRIs were responsible for approximately 1.2 million deaths among adults aged 70 years and older worldwide (8). Recent studies indicate that limitations in activities of daily living (ADL) at discharge are independently associated with increased risks of rehospitalization and mortality among older pneumonia survivors (16).



**Table 1.** Epidemiological Burden and Post-Acute Functional Decline Associated with Major Respiratory Pathogens in Older Adults.

Pathogen	Global Mortality / Burden-Older Adults	Post-Acute Functional Decline	Key Clinical Insight
<i>S. pneumoniae</i> (8, 9)	25.3% of LRI deaths globally	30–60% poor recovery over 6 months.	Leading contributor to DALYs in older populations.
Influenza (3, 10)	70–85% of flu deaths in high-income nations	18–23% persistent decline within 1 month	Frailty is a strong risk modifier for catastrophic decline.
COVID-19 (11)	80% of deaths are in older adults	40–50% experience decline at 3 months	Higher post-acute health loss compared to seasonal influenza.
RSV (12–14)	74,000 in-hospital deaths	1/3 fail to return to baseline at 6 months	Frailty, diabetes, or pre-existing impairment are strong risk modifiers

COVID-19, coronavirus disease 2019; RSV, respiratory syncytial virus; LRI, lower respiratory tract; DALY, disability-adjusted life years

### Influenza

Globally, influenza causes up to 650,000 respiratory deaths annually (17). Hospitalization rates increase with advancing age, particularly after 75 years. Influenza-associated morbidity extends beyond acute episodes, contributing to health loss across multiple organ systems, including the pulmonary, cardiovascular, hematological, metabolic, and neurological systems, as well as long-term loss of independence (18). It is increasingly recognized as a trigger of functional decline (3).

### COVID-19

The COVID-19 pandemic has highlighted the increased vulnerability of older adults to respiratory infections. COVID-19 is a multisystem disease that affects nearly all organ systems (19). Recent evidence indicates that SARS-CoV-2 infection results in a greater burden of health loss during the post-acute phase than during the acute phase. Furthermore, SARS-CoV-2 is associated with higher health losses than seasonal influenza in both phases of the illness (18). One year post-hospitalization, symptomatic older COVID-19 survivors, developed 1.27 more

functional disabilities on a 15-point scale than at baseline (20).

### RSV

RSV infections in older adults are projected to reach 800,000 annual hospitalizations in high-income countries by 2025 (12). RSV infection in older adults is often associated with longer hospital stays and higher ICU admission rates than influenza B, while overall hospitalization and mortality rates among adults aged 60 years and older are comparable to those observed with influenza (12, 13). Clinical cohort studies indicate that RSV infection in hospitalized older adults is associated with an acute decline in both ADLs and instrumental activities of daily living (IADLs) (14). These findings highlight that RSV is an under-recognized contributor to post-infectious disabilities in later life.

Across all major respiratory infections, hospitalization is a critical inflection point in the pathway toward disability in older adults. As survival improves in aging populations, post-infectious functional impairment is expected to constitute an increasing proportion of the overall disease burden (6).

## CONCEPTUAL FRAMEWORK OF POST-ILLNESS FUNCTIONAL DECLINE

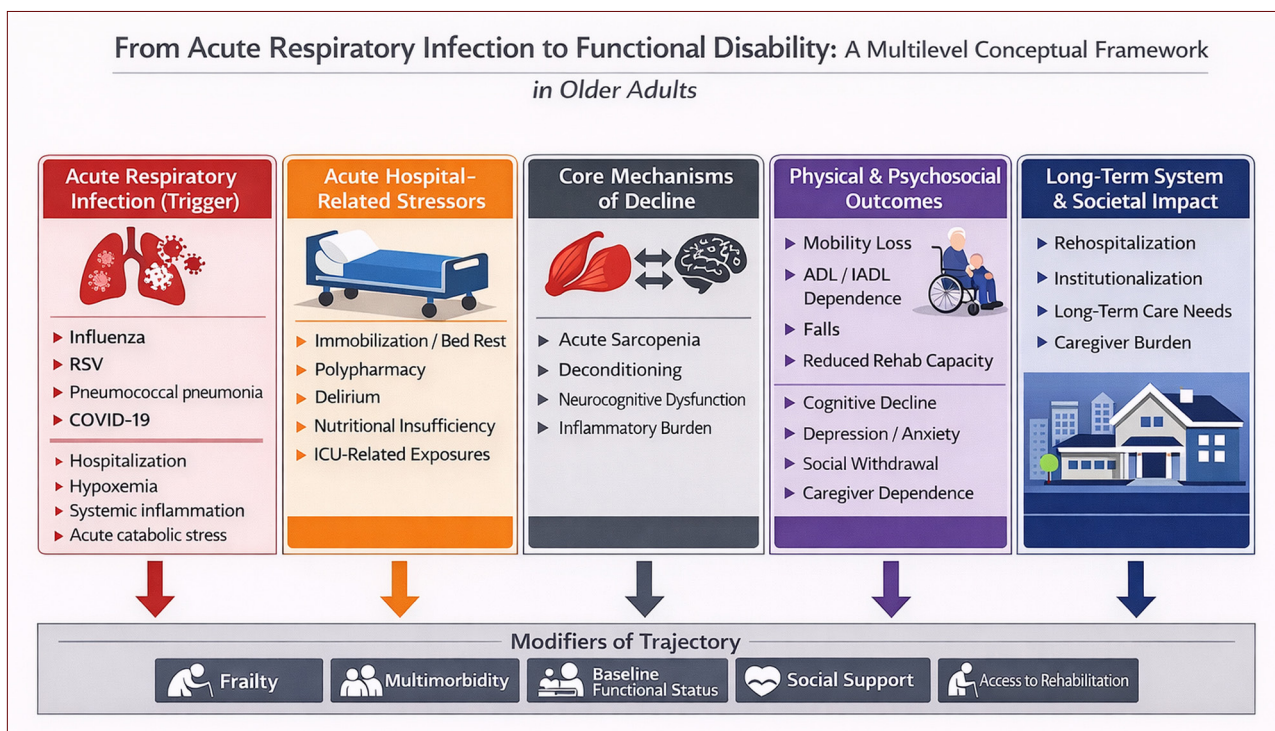
Post-illness functional decline in older adults can be conceptualized as a dynamic process in which an acute respiratory infection serves as a health stressor initiating a cascade of impairments that may lead to persistent disabilities. Figure 1 illustrates a proposed conceptual framework connecting acute respiratory infection, baseline vulnerability, hospitalization-related stressors, and subsequent functional and societal outcomes in older adults.

### The Disablement Process (Nagi–Verbrugge–Jette Model)

The disablement process provides a foundational framework for understanding how ARIs lead to functional disabilities in older adults. Originally,

this model described a dynamic progression from pathology to impairment, functional limitation, and ultimately disability (21). Within this framework, ARIs function as pathological triggers that accelerate the disablement process, rather than merely as transient health insults.

In older adults, infection-related impairments, such as hypoxemia, systemic inflammation, and neuromuscular dysfunction, frequently progress to functional limitations, including mobility, difficulty with transfers, and impaired self-care. When the compensatory capacity is exceeded, these limitations manifest as overt disabilities, which are typically measured by declines in ADLs and IADLs. The model emphasizes that disability is not an inevitable consequence of aging but rather the result of interactions between acute stressors and baseline vulnerability.



**Figure 1.** From Acute Respiratory Infection to Functional Disability: A Multilevel Conceptual Framework in Older Adults  
ADL, activities of daily living; IADL, instrumental activities of daily living; RSV, respiratory syncytial virus; ICU, intensive care unit; COVID-19, coronavirus disease 2019



## **Baseline Vulnerability and Functional Reserve**

Baseline vulnerability is a key determinant of post-illness functional outcomes in older adults. Frailty, multimorbidity, cognitive impairment, and pre-existing functional limitations reduce physiological and functional reserves, limiting the capacity to tolerate and recover from acute stressors. Among these factors, frailty represents the most integrative construct, capturing cumulative deficits across biological, functional, and social domains (2, 22).

Frailty plays a central role in the disablement framework as a trajectory modifier that limits recovery and amplifies post-infectious functional decline (2). It interacts bidirectionally with multimorbidity to synergistically deplete physiological reserves, explaining why similar ARIs precipitate catastrophic or persistent disability, while others do not (23). Additionally, ARIs frequently exacerbate chronic conditions such as heart failure, diabetes, or chronic obstructive pulmonary disease (COPD), accelerating decline through mechanisms of inflammation and organ dysfunction (2, 16, 24). As an effect modifier, frailty substantially strengthens the association between multimorbidity and disability (2, 23).

Individuals with preserved reserves may recover functional independence despite substantial physiological stress, whereas those with limited reserves may transition to dependency after relatively moderate insults. This vulnerability gradient explains the pronounced heterogeneity in functional outcomes observed after ARIs (6, 22).

## **Hospitalization-Associated Disability**

Hospitalization is a pivotal stage in the disablement process and serves as an independent risk factor for functional decline. Approximately one-third of older adults acquire new limitations in their daily living activities during hospitalization, a phenomenon known as hospitalization-associated disability (HAD) (22). HAD arises from the combined effects

of reduced mobility, prolonged bed rest, acute systemic inflammation, delirium, nutritional deficits, and iatrogenic factors including polypharmacy, excessive sedation, and indwelling devices. These stressors disproportionately affect individuals with limited baseline physiological reserves, thereby intensifying functional decline during acute care.

Older adults who develop delirium during hospitalization face an increased risk of persistent disability and loss of independence for months after discharge, irrespective of the underlying infection (25). In this conceptual framework, delirium serves as both an indicator of vulnerability and a contributor to subsequent impairment.

## **Functional Decline as a Clinical and Prognostic Endpoint**

Functional decline should be recognized as a primary clinical and prognostic endpoint, rather than a secondary outcome. Reductions in ADLs and mobility are strongly associated with rehospitalization, LTC placement, and mortality among older adults with respiratory infections (10, 20).

This integrative framework provides a foundation for examining the biological mechanisms underlying functional decline and heterogeneous recovery trajectories observed after ARIs in older adults.

## **BIOLOGICAL AND PHYSIOLOGICAL MECHANISMS DRIVING FUNCTIONAL DECLINE**

### **Immunosenescence, Inflammaging, and Metabolic Dysregulation**

Age-related immune dysregulation, defined by immunosenescence and chronic low-grade inflammation (inflammaging), establishes a biological environment in which acute infections provoke exaggerated and sustained inflammatory responses (24, 26). During ARIs, acute cytokine surges superimposed on this pro-inflammatory

baseline resemble a senescence-associated secretory phenotype (SASP), which contributes to multisystem dysfunction and delayed recovery. Additionally, the interaction between pre-existing inflammaging and infection-induced dysregulation of the tryptophan–kynurenine pathway, mediated by indoleamine 2,3-dioxygenase, may exacerbate mitochondrial dysfunction and neurotoxicity, thereby accelerating the transition from acute illness to prolonged functional disability. This pathway has been implicated in post-acute infection syndromes, providing a mechanistic link between acute inflammation, muscle fatigue, and persistent functional impairment (27).

### **Acute Sarcopenia, Immobility, and Catabolic Stress**

Hospitalization due to ARIs is frequently associated with acute sarcopenia, driven by systemic inflammation, endocrine catabolism, nutritional deficits, and muscle disuse (28-30). Even short periods of bed rest can result in significant declines in muscle strength and aerobic capacity among older adults, often reducing them below critical functional thresholds (28, 29). In this population, an increased inflammatory burden and poor nutritional markers are correlated with diminished functional recovery (28, 30). In the context of ARIs, symptoms such as dyspnea, hypoxemia, and fatigue further restrict activity, perpetuating a cycle of inactivity, weakness, and dependency.

In addition to peripheral muscle loss, ARIs negatively affect respiratory muscle function, including diaphragmatic strength and coordination. Age-related reductions in the respiratory reserve, known as presbycnea, increase susceptibility to prolonged dyspnea, and impair cough effectiveness and secretion retention. These factors limit physical activity and contribute to ongoing deconditioning during recovery (31).

Sarcopenic dysphagia constitutes an additional pathway through which infection leads to adverse

outcomes, including recurrent aspiration and increased mortality (32). Furthermore, gut dysbiosis exacerbates systemic inflammation and muscle catabolism, reinforcing the gut–muscle axis, which may further hinder recovery in older adults (33).

Moreover, patients with severe ARIs may require intensive care, where the risk of ICU-acquired weakness (ICU-AW) is high and has major consequences for physical recovery. ICU-AW is characterized by symmetric neuromuscular dysfunction associated with critical illness and its management, which leads to persistent functional impairment after discharge (34). In addition to muscle weakness, many ICU survivors develop post-intensive care syndrome (PICS), which encompasses physical, cognitive, and mental health impairments that are closely linked to long-term prognosis (35). These mechanisms are particularly pronounced in patients requiring intensive care, where ICU-AW and PICS contribute substantially to prolonged physical, cognitive, and psychological impairments (34, 35).

### **PHYSICAL FUNCTIONAL DECLINE**

Physical functional decline is one of the most common and clinically significant sequelae of ARIs in older adults. Importantly, physical decline seldom occurs in isolation and is closely linked to cognitive vulnerability, mood disturbances, and social determinants, which collectively shape recovery trajectories.

### **Decline in Mobility, Activities of Daily Living, Instrumental Activities, and Falls**

ARIs often lead to a significant decline in physical function among older adults, most notably affecting ADLs, IADLs, mobility, and balance. Loss of independence in ADLs and IADLs is a primary indicator of post-illness disability. Studies of hospitalized older adults with pneumonia, influenza, RSV, or COVID-19 report that 30–60% experience new or worsened limitations in ADLs or IADLs at discharge or during early follow-up, with many



failing to achieve full recovery (3, 10, 18, 20, 36). Even minor reductions in mobility or self-care capacity are associated with an increased risk of rehospitalization, LTC placement, and mortality (6, 10).

Additionally, factors such as acute illness-related weakness, deconditioning, orthostatic hypotension, polypharmacy, and impaired balance increase fall risk during and after hospitalization. These factors frequently result in a shift from independent ambulation to the need for assisted mobility (18, 29).

### **Rehabilitation Needs and Recovery Trajectories**

Consequently, ARIs markedly increase the demand for post-acute rehabilitation and supportive services. Trajectory analyses of cohorts with pneumonia and COVID-19 indicate that baseline frailty, the extent of mobility loss, and access to rehabilitation are critical determinants of recovery patterns (18, 20). Many older adults require inpatient or home-based rehabilitation following discharge, and a subset transition to long-term care when their baseline physical function is not fully regained (6, 20).

Geriatric rehabilitation programs incorporating progressive resistance training, balance exercises, and task-oriented ADL training result in significant improvements in mobility and independence compared with standard care (37). Notably, patients with delirium or mild cognitive impairment can achieve substantial functional recovery through individualized, interdisciplinary rehabilitation, demonstrating that cognitive vulnerability does not necessarily limit rehabilitation benefits (38).

## **COGNITIVE AND PSYCHOSOCIAL SEQUELAE**

### **Delirium, Post-Illness Cognitive Decline, and Mood Disorders**

In addition to physical impairments, ARIs are associated with significant cognitive and

psychosocial sequelae. Post-infectious cognitive decline occurs frequently, particularly in patients who experience delirium, hypoxemia, or critical illness during hospitalization. Delirium is a strong predictor of long-term functional and cognitive decline following ARIs and is consistently associated with sustained cognitive impairment and functional dependence for months after discharge, regardless of the type of infection. Acute brain dysfunction reflects the convergence of neuroinflammation, hypoxemia, metabolic disturbances, and sleep disruptions (25, 39). Older adults who develop delirium are at increased risk of requiring institutional care after discharge (6).

Depression and anxiety commonly develop after hospitalization for ARIs, often resulting from prolonged symptoms, loss of independence, and social withdrawal (20, 40). Reduced mobility and increased functional dependence further exacerbate social isolation, worsen mental health outcomes, and impede recovery trajectories (41).

### **Loss of Social Functioning and Caregiver Burden**

Social isolation is both a consequence and a driver of post-illness decline (42). Older adults recovering from respiratory infections often have decreased social engagement due to physical limitations, cognitive impairment, fear of contagion, or diminished confidence. During the COVID-19 pandemic, infection control measures and extended isolation intensified these effects, resulting in a measurable decline in social participation and functional status among older adults (43).

Functional decline after ARIs often extends beyond the patient and imposes a substantial burden on caregivers. Increased caregiving demands are associated with emotional distress, reduced caregiver health, and a higher likelihood of patient institutionalization (40).

Cognitive impairment, mood disorders, social isolation, and caregiver burden interact with physical

decline to influence the likelihood of recovery or the persistence of disability.

### TRAJECTORIES OF FUNCTIONAL DECLINE AND RECOVERY IN OLDER ADULTS

Functional outcomes after ARIs in older adults are most accurately conceptualized as trajectory-based processes that reflect the timing, rate, and persistence of functional change rather than binary states of recovery or non-recovery. Trajectory-based analyses offer a more clinically meaningful framework by capturing longitudinal patterns of changes in function, cognition, and independence (44, 45).

The literature describes two complementary yet conceptually distinct frameworks: one addresses the initiation of disability (disability onset trajectories), and the other examines the evolution of function after discharge (recovery trajectories). Integrating these approaches provides a more complete understanding of post-ARI functional outcomes (Table 2) (18, 45).

#### Disability Onset After ARI

Using monthly assessments of community-dwelling older adults, Gill et al. identified two primary subtypes of disability onset, catastrophic

and progressive, and two additional patterns, accelerated and persistently severe disability (45). Hospitalization is a major precipitant of catastrophic and accelerated disability, supporting the hypothesis that acute medical events, including ARIs, are significant triggers of functional collapse in vulnerable individuals (45).

#### Post-Discharge Recovery Trajectories

Disability onset patterns are conceptually distinct from the post-acute recovery trajectories that describe the evolution of function after discharge. Trajectory analyses of older adults hospitalized with pneumonia consistently identify three primary pathways: rapid recovery, partial recovery, and persistent disability.

Comparable trajectories have also been reported for ARIs. Approximately 20% of older adults hospitalized with influenza or other acute respiratory illnesses experience persistent or catastrophic functional decline shortly after discharge (3). In COVID-19 cohorts, sustained functional impairment and worsening frailty at 3 months closely resemble the outcomes seen after non-COVID pneumonia when accounting for baseline vulnerability (20).

Prospective trajectory analyses of older adults hospitalized for pneumonia, influenza, RSV, or

**Table 2.** Disability onset patterns and recovery trajectories in older adults following acute illness

Dimension	Pattern	Key features
Disability onset	Catastrophic	Sudden functional decline (<1 month)
	Progressive	Gradual functional decline (over months)
Recovery trajectory	Rapid recovery	Return to baseline function
	Partial recovery	Recovery of basic ADL, persistent IADL dependence
	Persistent disability	Sustained ADL dependence, LTC risk
Key modifiers	—	Frailty, baseline function, delirium, hospitalization-related exposures, multimorbidity, polypharmacy, rehab access

ADL, activities of daily living; IADL, instrumental activities of daily living; LTC, long-term care



COVID-19 indicate that only a minority achieved full functional recovery within 6 months. Instead, a substantial proportion of patients experience poor recovery trajectories marked by sustained impairment in ADLs or progressive disability (3, 17, 18, 20).

These findings support a host-centric framework, suggesting that ARIs act as prototypical stress tests rather than primary determinants of the recovery trajectory. Baseline frailty, pre-existing functional limitations, and in-hospital delirium were among the strongest predictors of unfavorable outcomes (6). A trajectory-based perspective identifies a potentially modifiable vulnerable period within the first 30–90 days after discharge, during which targeted geriatric interventions may improve long-term functional outcomes (18).

## **HEALTH SYSTEM AND SOCIETAL IMPLICATIONS**

Persistent post-illness functional decline leads to increased health system utilization, greater demand for long-term care, and higher societal costs. As the population ages and survival rates from severe infections improve, these downstream effects increasingly contribute to the overall disease burden.

### **Rehospitalization, Healthcare Utilization, Long-Term Care, and Institutionalization**

Functional decline following ARIs has significant consequences for patients, healthcare systems, and society. Functional impairment is a strong predictor of rehospitalization among older adults. Evidence has consistently shown that new or worsening ADL limitations at discharge independently increase the risk of 30-day and 6-month readmissions after hospitalization for pneumonia, influenza, RSV, and COVID-19 (3, 10, 17, 20). Rehospitalization further accelerates functional decline, resulting in a cycle of recurrent admissions and sustained use of healthcare services, including rehabilitation and mental health services (6, 45).

A major system-level consequence of post-ARI disabilities is the transition to LTC. Older adults who do not recover their baseline functions after pneumonia or COVID-19 experience high rates of institutionalization. For example, 10–20% of older European COVID-19 patients require higher levels of care at discharge (20). Similar transitions toward dependency have been observed following severe influenza and RSV hospitalization (3, 17, 41).

### **Economic Burden and Health Inequities**

The economic burden of post-infectious disability is substantial (7). Functional decline increases healthcare expenditures by lengthening inpatient stays, increasing the use of rehabilitation services, expanding home care needs, and increasing the frequency of LTC placement. Cost analyses show that disability-related expenses often surpass those of the acute infectious episode, particularly when long-term care is necessary (4, 7). As populations age, disabilities related to ARIs are expected to become a major driver of healthcare spending.

However, these impacts are not equally distributed. Globally, approximately 46% of individuals aged 60 and older experience functional disability (1). Older adults in lower socioeconomic regions are more likely to face delayed recovery, institutionalization, and unmet care needs after ARIs, reinforcing existing health inequalities (9). Therefore, addressing post-infection functional decline is both a clinical priority and a matter of health equity.

## **PREVENTION AND MITIGATION STRATEGIES**

### **Vaccination as Disability Prevention**

Vaccination against influenza, pneumococcal disease, RSV, and COVID-19 is increasingly recognized as a strategy to prevent not only mortality but also post-infectious disability. Vaccines

indirectly protect the functional status of older adults by reducing the incidence and severity of infections and hospitalization rates (4, 8, 15, 46). Observational studies have indicated that vaccination is associated with a lower risk of severe disease, ICU admission, prolonged hospitalization, and subsequent functional decline in older adults (3, 8, 12). Positioning vaccination as a means of disability prevention aligns infectious disease prevention with the geriatric goal of preserving independence.

### **In-Hospital and Transitional Interventions**

Hospital-based interventions are essential to mitigate functional decline. Early mobilization programs decrease hospitalization-associated disability, enhance mobility at discharge, and reduce length of stay (22). Delirium prevention protocols, including orientation, sleep promotion, vision and hearing optimization, and medication review, significantly lower the incidence of delirium and subsequent cognitive and functional impairments (25). Optimizing nutrition, avoiding unnecessary fasting, and initiating early protein supplementation can prevent acute sarcopenia and facilitate recovery (28). Additionally, minimizing polypharmacy, especially the use of sedatives, anticholinergics, and medications associated with orthostatic hypotension, reduces the risk of delirium, falls, and mobility impairment (23, 39).

The implementation of Comprehensive Geriatric Assessment during or shortly after discharge improves functional outcomes and reduces preventable readmissions by identifying medical, cognitive, and social needs (23). Systematic functional assessments at discharge are critical for guiding post-acute care and preventing unrecognized disabilities (10, 22).

### **Post-Acute and Technology-Assisted Rehabilitation**

Post-acute rehabilitation is essential for functional recovery after ARIs. The complexity of geriatric patients necessitates individualized, interdisciplinary

rehabilitation approaches that integrate medical stabilization with functional recovery, particularly in resource-constrained settings (47). Comprehensive geriatric rehabilitation improves mobility, ADL performance, and the likelihood of returning home (37). Emerging technologies, including tele-rehabilitation, virtual reality-assisted exercise, and inspiratory muscle training, show promise in extending access to rehabilitation and sustaining gains after discharge, particularly for patients with mobility or geographic barriers (18, 28). These approaches may be especially valuable in aging societies with constrained rehabilitation capacity.

### **FUTURE DIRECTIONS AND CLINICAL IMPLICATIONS**

Future research should incorporate functional endpoints alongside traditional outcomes such as mortality and length of stay. Declines in ADLs, mobility loss, and transitions in frailty are patient-centered outcomes that more accurately reflect long-term prognosis in older adults (5, 6). Trajectory-based longitudinal studies are necessary to characterize heterogeneous recovery patterns and to identify modifiable inflection points (18).

Integrated care models that connect acute care, rehabilitation, primary care, and social services are essential. Incorporating comprehensive geriatric assessment into infectious disease pathways may mitigate disability, reduce rehospitalization, and improve equity in outcomes in aging populations (4, 23).

### **CONCLUSION**

Acute respiratory infections often represent turning points in the functional health of older adults. For many individuals, survival from pneumonia, influenza, RSV, or COVID-19 marks the beginning of a trajectory toward disability.

This review demonstrates that within the geriatric population, functional status is a stronger predictor of survival and quality of life than multimorbidity



alone. Recognizing ARIs as triggers of functional decline supports a “functional-first” clinical approach in which the preservation of mobility, independence, and cognitive function is prioritized alongside survival. Vaccination, geriatric-informed hospital care, and timely rehabilitation are essential strategies to interrupt pathways that lead to disability.

For clinicians, researchers, and policymakers, these findings highlight that preventing and mitigating post-infectious functional decline is essential for broadening the focus of care beyond survival alone toward the preservation of autonomy, thereby sustaining healthy aging and resilient healthcare systems in the context of demographic transition.

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