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Review Article

Intrinsic Capacity, COVID-19 infection and its long-term complications in older adults: a narrative review

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Abstract

***Background*:** In the field of healthy aging, covid-19 is associated with a decrease in functional abilities of the body and serious diseases in the elderly. Regular assessment of intrinsic capacity (IC) factors provides an opportunity to better understand an individual's functional abilities and vulnerabilities in the context of a pandemic. In this study, while describing IC and post-acute COVID-19 syndrome (PACS), we also describe the relationship between these two variables to improve the health of the elderly in the epidemic situation.

***Methods*:** We searched PubMed, MEDLINE, Scopus, and Web of Science for relevant peer-reviewed articles in English using the keywords Intrinsic Capacity, COVID-19, Post-COVID- 19 syndrome, Post-Covid-19 complications, long-Covid-19, elderly, and PACS until September 17, 2023. We have summarized the information for awareness about the IC, covid-19 and its long-term complications.

***Results*:** The aging global population is leading to a shift from disease-centered to function-centered healthcare. The WHO introduced IC, which combines physical and mental abilities. Early COVID-19 effects impact IC factors like vitality, locomotion, cognition, and psychology. Long-term COVID-19 complications, persisting for up to three months post-acute infection, can heighten vulnerability in older adults with reduced IC. Reduced IC may worsen COVID-19 severity by diminishing immune responses, increasing complications, and susceptibility. This could lead to more severe symptoms and accelerated aging. Pandemic-related reduced mobility and social isolation further harms IC components. Understanding this relationship is vital for tailored elderly care amidst COVID-19 challenges.

***Conclusion*:** The reduced IC, especially in the conditions of pandemic diseases such as the COVID-19, can seriously threaten the health of the elderly. Therefore, IC is suggested as a suitable index to determine the vulnerability of people, regardless of chronological age, especially in pandemic conditions.

Keywords: Intrinsic Capacity, COVID-19, Post-COVID-19 syndrome, Elderly.

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Introduction

Intrinsic Capacity (IC) encompasses the entirety of an individual's physical and mental capabilities, as well as their interactions with the relevant environmental factors that determine their functional ability. It plays a crucial role in healthy aging. Functional ability refers to the entire range of health-related characteristics that enable individuals to engage in activities that hold value to them and promote healthy aging. This includes the ability to meet basic needs, learn, make sound decisions, maintain mobility, establish and nurture social relationships, and contribute to the well-being of family, friends, and society as a whole (1). Functional ability relies on an individual's IC, the external environment (comprising all external factors that shape a person's life context), and their interaction (2). The IC framework encompasses five domains: Locomotion, Vitality, Cognitive function, Psychological well-being, and Sensory abilities (including hearing and vision) (1) (Figure 1).

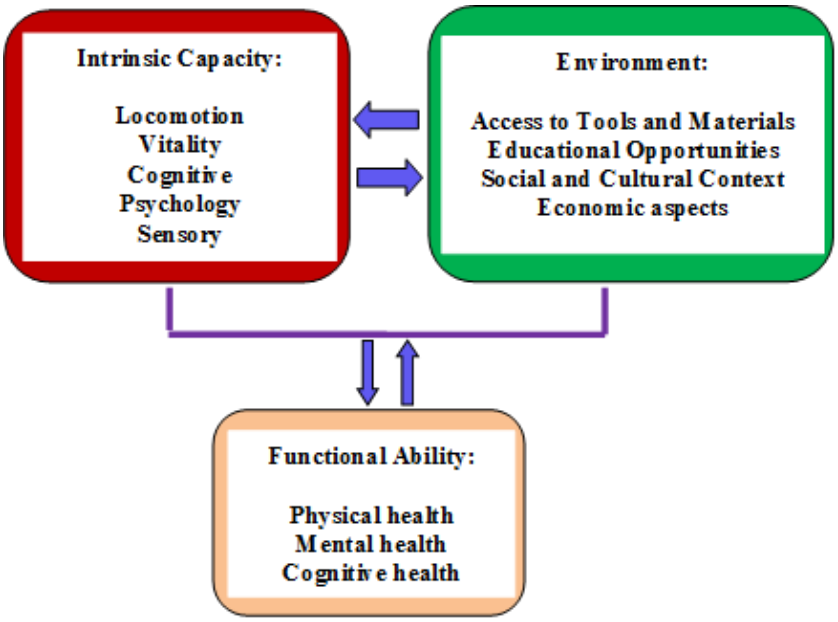

Figure 1. Determinants of healthy ageing

It's important to note that IC is a lifelong process that is influenced by an individual's health status and functioning over the course of their life, rather than being solely impacted by transient pathological factors. In other words, changes in IC likely begin earlier in life and manifest their effects on health in later years (3-5). IC is considered to be at the core of activities of daily living (ADL) (4). This construct serves as a strong predictor of an elderly person's future dependence on care. Several studies have demonstrated that the five domains of IC independently predict mortality and care dependency among older adults (5).

IC formation

The global rise in the aging population has necessitated a shift from disease-centered approaches to performance-oriented approaches in addressing the challenges of aging (6). Aging is an inevitable process, encompassing a trajectory of organ and functional growth from birth to a subsequent decline until death. The rate and nature of this decline are influenced by personal factors such as lifestyle choices, socioeconomic status, environmental conditions, and societal changes.

The concept of successful aging was initially introduced by Rowe and Kahn approximately two decades ago. It entailed disease prevention, maintenance of high levels of physical and mental function, and active engagement with life (7). With the increase in life expectancy today, the prevalence of risk factors associated with chronic diseases is expected to rise. This can have a significant impact on the functional abilities of elderly individuals, potentially leading to a decline in activities of daily living (ADL). ADL refers to the fundamental elements of independent living, including bathing, eating,

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dressing, maintaining continence, and transferring and mobility (6). In response to these challenges, the World Health Organization (WHO) published a report on aging and health in 2015, introducing the concept of IC (IC) as a means to define healthy aging (8-10).

The utilization of IC (IC) as the basis for a comprehensive healthcare program has led to the development of evidence-based guidelines on integrated care for older people, known as ICOPE, in 2017. A comprehensive healthcare program offers a desirable solution for integrating healthcare services and treatments, while also aiming to reduce costs, particularly in the case of chronic diseases (11-12). Current evidence indicates that many elderly individuals, especially those with multiple coexisting conditions and frailty, often receive fragmented care. As a result, this group frequently encounters numerous health and functional challenges, primarily stemming from issues related to poor integrated care rather than the underlying co-morbidities. These circumstances make it difficult to provide adequate care for these patients, which, alongside the adverse consequences of their conditions, diminish their quality of life (QoL) and increases healthcare expenditures (13).

In general, populations tend to experience a decline in IC starting from middle adulthood, although this trajectory is not uniform for most individuals. Rather, it signifies multiple declines and potential improvements over time. In populations where mortality largely occurs in old age, the majority of individuals face significant declines towards the end of life. However, maintaining certain mental or physical capacities at around 80 years of age implies having more IC than what is typically observed in much younger individuals. Therefore, relying solely on chronological age is insufficient to identify individuals who are at risk of experiencing negative health events. The variations in IC arise from the disparities between individuals in terms of developmental conditions during growth and old age. Lifestyle factors, injuries, accidents, as well as health and social interventions at different stages of life, significantly influence the trajectories of IC (8) (Figure 2).

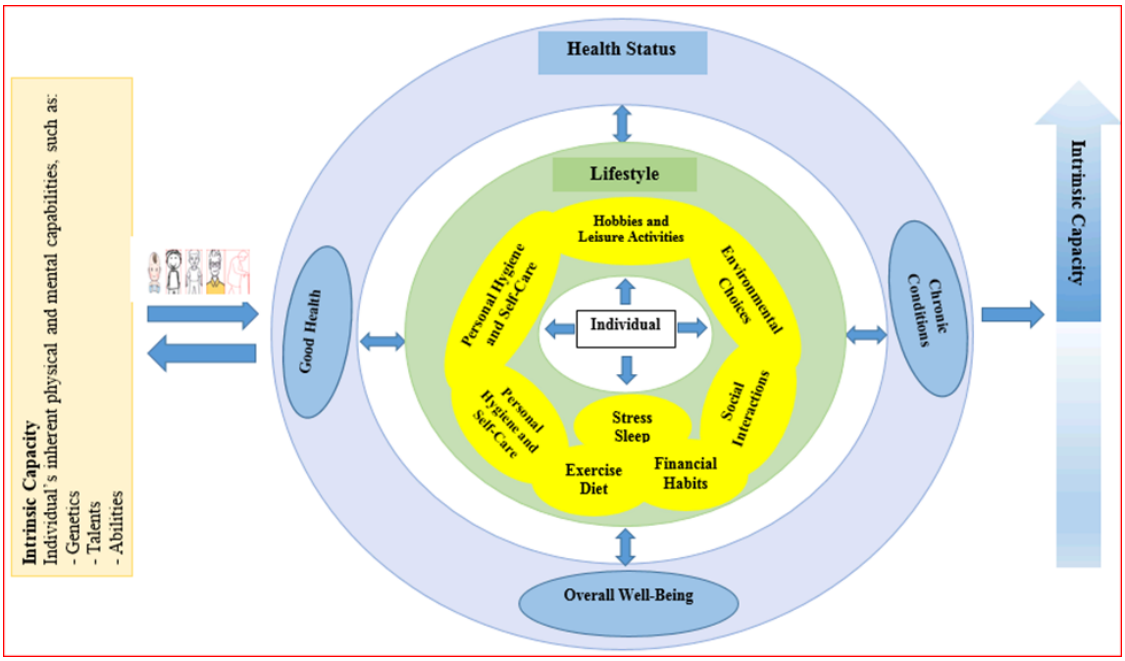

Figure 2. A lifetime approach to healthy aging

While the WHO model suggests that changes in IC likely begin earlier in life, the loss of activities of daily living (ADL), which is typically observed during a significant decline in functioning, indicates a substantial deficiency in IC in previous years. Consequently, this model holds great potential for promoting behavior modification towards healthy lifestyles. By increasing awareness of the potential reduction of disability and empowering individuals to maintain their functional abilities, the model can support efforts to maintain and improve IC (4).

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Early identification of a decrease in IC and functional and cognitive abilities among the elderly plays a crucial role in facilitating the planning and implementation of interventions by healthcare teams aimed at preserving IC and overall functioning. Improving nutrition and increasing physical activity are two essential strategies for enhancing IC and delaying the progression of frailty. Evidence suggests that focusing on IC is more effective than solely addressing specific chronic diseases. Providing the elderly with an appropriate environment can enable them to achieve peak health at any stage of their lives. Consequently, during the later years, they can experience higher QoL while reducing the burden on society (14).

The role of IC in health and disease

The WHO defines healthy aging as a process that goes beyond the absence of disease and seeks to enhance and maintain an individual's functional ability. This shift in focus emphasizes the importance of IC instead of solely addressing disability and frailty. Frailty is a common clinical syndrome among older adults, and it is associated with an increased risk of adverse health outcomes, including falls, disability, hospitalization, and mortality. Disability and frailty are two fundamental concepts linked to old age that are often closely connected to IC and share many similarities (15) (Table 1). Incorporating frailty and IC into healthcare models is crucial for healthcare providers to better understand the complex health needs and priorities of older adults. The integration of these concepts in future healthcare models is of great importance (12, 15). In fact, IC can be considered as an evolved form of frailty, providing a more comprehensive understanding of an individual's functional abilities and vulnerabilities as they age.

Table 1. Comparison of frailty and intrinsic capacity

	Frailty	Intrinsic capacity
Definition	Progressive decline of physiological systems conferring increased vulnerability to stressors and exposing to the risk of adverse health outcomes	Composite of all mental and physical capacities
When	Geriatric condition	After the age corresponding to the median of the local life expectancy at birth
Time dimension	Cross-sectional assessment	Longitudinal assessment for tracking trajectories
Characteristics	Defined by deficits and abnormalities	Defined by reserves and residual capacities
Original purpose	Developed for addressing the unmet clinical needs of the older person	Developed to inform about public health strategies in the promotion of healthy aging
Interventions	Comprehensive geriatrics assessment, possibly within a network of integrated care	Comprehensive intervention based on integration of care and social services

Integrating frailty and IC can help address frailty's weaknesses, including the stigma surrounding age-related disabilities. Studies have shown that IC is independently associated with frailty, particularly the vitality domain (12, 15). Optimizing IC, especially vitality and mobility, can help prevent frailty (16). Decreased IC is associated with adverse outcomes in old age, such as falls, decreased abilities, increased dependency, and hospitalization. Conversely, a high IC score is linked to a reduced risk of one-year mortality (1, 3, 12).

The five domains of IC encompass a person's overall level of functioning, representing their whole system. These domains, excluding sensory, play a crucial role in determining an individual's functional recovery after experiencing health challenges, either collectively or independently. Sensory capacity, achieved through hearing and vision, serves as a vital means of communication between individuals and

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their environment, significantly impacting their social interactions. It is evident that individuals with better sensory capacity tend to exhibit higher levels of independence and psychosocial well-being. Mobility and activity, one of IC's dimensions, holds substantial importance in enhancing the health of older adults, as it enables the maintenance of independence in daily activities and the continuation of an active lifestyle. Despite the fact that a quarter of elderly individuals face difficulties in performing daily tasks after retirement, with 10% becoming completely disabled and dependent, maintaining independence and avoiding reliance on others contribute to satisfaction, reduced physical dependence, and the development of a positive self-control attitude (2, 17).

The promotion of physical activities in the elderly serves the purpose of mitigating disabilities, vulnerabilities, age-related biological changes, chronic diseases, and mental health issues. Cowper et al. concluded that regular exercise enhances both physical and mental functions in older adults (17). Regular assessment of biological age using constructs like IC can provide valuable insights into individual functional trajectories and vulnerabilities, even in the face of catastrophic events such as the COVID-19 pandemic (3).

COVID-19

SARS-CoV-2, a member of the coronavirus family, emerged in 2019, causing the global pandemic COVID-19 (15, 17). This crisis has significantly impacted physical and mental health, and QoL, which has challenged the proper paths of health and aging (18). Remarkably, it's the third major pandemic virus, following SARS in 2002 and MERS in 2012 (19, 20). The virus spreads mainly through close contact, aerosols, and respiratory droplets during talking, breathing, coughing, or sneezing (21). COVID-19's clinical spectrum ranges from asymptomatic and mild to severe, with most cases being mild (18). In a minority of patients, typically 5-10 days after symptoms appear, it can progress to Acute Respiratory Distress Syndrome (ARDS) and multi-organ failure, often resulting in death (19, 22).

Post-Covid syndrome

Shortly after the initial COVID-19 wave, it became evident that certain patients didn't fully recover from their acute infection, experiencing persistent physical and neuropsychological complications years later. These manifestations were thought to be linked to the virus, disease-related effects, or the overall epidemic situation. The term "Long COVID" was coined in 2020 by affected patient groups to describe this condition. Subsequently, the medical literature introduced various terms to characterize clinical conditions following COVID-19, such as Long-COVID, persistent post-COVID syndrome, post-acute COVID-19 syndrome, or post-COVID condition. To streamline terminology, both the CDC and WHO proposed the broader use of "post-COVID conditions" to encompass health issues persisting for at least 4 weeks after the acute infection. In contrast, the National Institute for Health and Care Excellence (NICE) suggested the term "prolonged COVID." This term is commonly employed to describe symptoms that persist or arise after acute COVID-19, when no other cause can be identified. It encompasses both ongoing symptomatic COVID-19 (lasting from 4 to 12 weeks) and post-COVID-19 syndrome (lasting 12 weeks or more). These symptoms are not limited to patients discharged from the hospital but also affect individuals in the community who did not require inpatient care (23, 24). Larijani et al. categorized COVID-19 manifestations into four distinct phases based on time:

1. Acute Phase: This initial phase encompasses the first three weeks from the onset of COVID-19 symptoms.
2. Ongoing Phase: In this stage, COVID-related symptoms persist for a duration ranging from 4 to 12 weeks following the initial onset of symptoms.
3. Post COVID-19 Phase: Symptoms associated with COVID-19 emerge up to 24 weeks after the initial onset, characterizing this phase.
4. Persistent COVID-19: During this phase, COVID-19-related symptoms endure for more than 24 weeks following the initial onset of symptoms (25).

Long COVID has significant medium and long-term health impacts, with hospitalized COVID-19 patients in the United States requiring ongoing medical care and facing higher readmission and mortality rates. Post-COVID-19 infections can lead to diverse organ injuries, notably in the brain, and trigger neuro-inflammation, causing long-term musculoskeletal problems, cognitive issues, and psychological distress. A general decline in the QoL persists for up to one year post-infection (26). Type 2 diabetes (T2DM) has a complex relationship with COVID-19, exacerbating its severity and increasing

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mortality when uncontrolled (27). Additionally, new diabetes cases have been reported post-coronavirus infection (28). The WHO and CDC have reported that in 60-70% of cases, the most common post-COVID symptom is severe fatigue, which significantly interferes with daily activities and resembles myalgic encephalomyelitis or chronic fatigue syndrome (29). A study identified the three primary debilitating symptoms of "prolonged COVID" as fatigue, weakness, and cognitive dysfunction (29). Additionally, some studies have shown other symptoms, including post-traumatic stress disorder, anxiety, memory changes (both immediate and delayed memory), and cognitive impairment (30, 31).

Shortness of breath, often accompanied by cough and non-specific chest pain, can also manifest as a symptom of this disorder. In the realm of neurocognition, individuals may experience decreased concentration, brain fog, headaches, persistent anosmia, and ageusia (23, 24, 32, 33). Anxiety and depression symptoms, as well as sleep disorders, are highly common. Other reported manifestations include hair loss, arthralgia, myalgia, tachycardia, gastrointestinal rhythm disturbances, dizziness, muscle pain, and joint pain. Over 50 different symptoms have been documented, typically ranging from mild to moderate, yet significantly impacting individuals' QoL. Reports from our country indicate that 64.2-79% of patients continue to experience at least one symptom 4-24 weeks after the initial onset of the disease, with nervousness and fatigue being the most prevalent (25). It's noteworthy that prolonged COVID can affect any patient, irrespective of the initial infection's severity, including asymptomatic individuals. However, there appears to be an increased risk associated with the severity of the acute infection (34).

Aging and COVID-19

Advanced age represents a significant risk factor for severe COVID-19 and increased mortality (35). This susceptibility in older individuals can be attributed to various aging-related factors, including cellular senescence, chronic inflammation, and genomic instability, all contributing to declining cellular function. Cellular senescence, a hallmark of aging, leads to the secretion of pro-inflammatory and tissue-remodeling factors, known as the senescence-associated secretory phenotype (SASP). The SASP induces secondary cellular senescence in nearby cells, creating a pro-inflammatory environment that disrupts effective immune responses. Immunosenescence, the age-related decline in immune function, is a primary factor rendering older individuals more vulnerable to infections (36). Physiological changes associated with aging, such as reduced lung capacity, diminished respiratory ability, and decreased mucus clearance, further increase vulnerability to respiratory infections (37). Additionally, older adults, especially those over 65, often contend with age-related chronic health conditions, including high blood pressure, cardiovascular diseases, diabetes, chronic kidney diseases, cancer, and respiratory diseases, all of which are associated with more severe COVID-19 outcomes (38). Given these factors, it is imperative to prioritize and implement tailored care for older adults, taking into account their individual circumstances and health conditions.

The COVID-19 pandemic has underscored the heightened risk of mortality in the elderly, particularly those aged 80 and above. A study conducted in Wuhan revealed a strong correlation between the risk of acute respiratory distress syndrome and death in elderly individuals due to COVID-19 (39). Extensive global evidence consistently points to age as the most critical risk factor for severe COVID-19 disease and its associated adverse health outcomes. Data from the CDC has indicated higher rates of hospitalizations, ICU admissions, and deaths from COVID-19 among older adults compared to younger individuals. Epidemiological data has demonstrated that individuals over 80 years old face a significantly elevated risk of death compared to their younger counterparts (40). In Italy, the COVID-19 outbreak primarily affected people over the age of 50, with mortality rates of 18.5% for those aged 70-79 and 25% for individuals over 80 (41). Studies by Davies and colleagues, using mathematical modeling with data from various countries, have revealed age-dependent effects on the transmission and control of COVID-19 epidemics. Their research estimated that individuals under 20 years old had approximately half the susceptibility to infection compared to adults over 20. Clinical symptoms appeared in around 21% of infections in people aged 10 to 19, a figure that rose to 69% in those over 70 (42). In Iran, similar findings were observed, with positive rRT-PCR results increasing with age, reaching 34.9% in individuals over 65 compared to other age groups (43).

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The increase in hospital mortality due to COVID-19 is strongly correlated with age, with the highest in-hospital mortality rate observed in the 80-year-old age group at 27.3% (44). A study in the United States further highlighted that one in four survivors over the age of 65 experienced health conditions attributed to previous COVID-19 infections. These conditions encompass kidney failure, thromboembolic events, cerebrovascular disease, type 2 diabetes, muscle and nerve disorders, as well as mental health issues including mood disorders, anxiety, and other mental conditions (18). Age-related physiological changes in the respiratory system can contribute to the increased severity of COVID-19 in the elderly (40, 45, 46). Researchers have suggested that age-related declines in immune system function may also play a role in adverse health outcomes among older COVID-19 patients (21, 35). A comparison of COVID-19 pneumonia in young and elderly patients indicated that disease progression and the risk of death are three times higher in the older age group (19). A cohort study conducted in Iran further validated age as a prognostic factor for in-hospital mortality from COVID-19. The study highlighted that patients with pre-existing chronic pulmonary, cardiovascular, and diabetes conditions experienced the highest in-hospital mortality rates due to COVID-19. Breathlessness, fever, blood pressure issues, and gastrointestinal symptoms were identified as the most common causes of death in this group (44).

Relationship of IC and Covid-19

Exploring IC components can provide crucial insights into understanding an individual's functional abilities and vulnerabilities during the COVID-19 outbreak. These components are closely interconnected and form a dynamic environment, which the COVID-19 pandemic particularly threatens, especially in older adults. The pandemic has compromised short-term and long-term outcomes, ultimately affecting health and well-being. The early impact of the COVID-19 outbreak is associated with IC factors such as health status (vitality), mobility (functional abilities and physical activities), and cognitive and psychological well-being (including depression, anxiety, nervousness, suicidal feelings, and life satisfaction) (47). National-level public health restrictions, including lockdowns and social distancing, have significantly altered the living environment for older individuals. Social participation serves as a stimulus for increasing physical activity and cognitive functions. Reduced or limited social interaction negatively impacts cognitive, psychological, and physical functions in older individuals, especially those who require regular assistance with daily tasks and constant caregiving from their relatives (48). Moreover, due to COVID-19 restrictions, access to various public services, including social and entertainment facilities, healthcare, and shopping, has been notably reduced. The internet and digital technologies have played a crucial role in providing access to these services and maintaining connections with family, friends, and the community. However, older individuals often lack the necessary digital skills to fully utilize these resources.

A study conducted in the Baltic Countries revealed that elderly participants experienced a decline in cognitive and psychological health during the COVID-19 outbreak (11). However, it's important to note that chronological age may not accurately reflect an individual's true vulnerability. Chronological age is an imperfect measure of biological age, which directly encompasses immune and other changes that influence a person's prognosis with COVID-19. While chronological age is commonly used in research to assess an individual's risk for age-related conditions and diseases, it's not the most accurate indicator of overall health because the rate of aging varies among individuals. Biological age, on the other hand, is an emerging metric that reflects the pace of an individual's aging and is closely related to IC. Biological age is determined by epigenetic alterations and DNA methylation, which indicate how well and effectively an individual's body functions and whether they are susceptible to age-related diseases. Unlike chronological age, which increases at a uniform rate for everyone, biological age varies depending on various factors, including genetics and lifestyle choices such as diet and exercise habits (49). Research has demonstrated the predictive power of biological age in assessing disease risk. For instance, for every 5 years that a woman's biological age exceeds her chronological age, her risk of breast cancer increases by 15% (50). Furthermore, studies have shown that epigenetic clocks, which measure biological age, are better at predicting all-cause mortality in later life compared to chronological age (51). These findings highlight the strong connection between epigenetic clocks and the processes underlying biological aging.

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Indeed, extensive data on biological age or IC can potentially help overcome the limitations associated with relying solely on chronological age and provide a more comprehensive understanding of individual vulnerability, regardless of their age. This multidimensional assessment of elderly individuals based on their functional capacity can be valuable for clinicians, especially in situations where resources are scarce. To explore these effects further, let's briefly describe how COVID-19 poses a threat to the elderly, both those infected and uninfected by SARS-CoV-2. While evidence in this area is limited, changes in the five domains of IC may occur after contracting the viral infection of COVID-19, and these changes are as follows:

Locomotion domain

The domain of locomotion is significantly impacted by the measures implemented during the COVID-19 pandemic. Quarantine and restrictions have limited mobility opportunities, which can have several consequences:

1. Accelerated Muscle Decline (Sarcopenia): Extended periods of staying at home and reduced physical activity can accelerate the age-related decline in skeletal muscle mass, a condition known as sarcopenia. This can result in increased disability and dependence on care among older individuals, negatively affecting their capacity for mobility.
2. Immobilization in COVID-19 Patients: COVID-19 patients, particularly those who require hospitalization, may be required to remain immobile for extended durations. This immobility can lead to muscle atrophy and weakness, making it challenging for these individuals to regain their mobility after recovery (3).

Maintaining mobility is crucial for the overall well-being and independence of older adults. Addressing these challenges and promoting safe physical activity and rehabilitation for COVID-19 patients, as well as strategies to prevent sarcopenia in those under quarantine, are important considerations in managing the impact of the pandemic on the locomotion domain of IC.

Cognitive domain

The cognitive domain is profoundly impacted by isolation measures during the COVID-19 pandemic, particularly in older individuals, and here's why:

1. Lack of Cognitive Stimulation: Isolation, especially for elderly individuals, can lead to a lack of cognitive stimulation. Social interactions, mental engagement, and various activities that promote cognitive health may be limited, potentially contributing to cognitive decline.
2. Onset of Depressive Symptoms: Isolation and the associated loneliness can lead to the onset of depressive symptoms, which can further exacerbate cognitive issues. Depression can impact concentration, memory, and overall cognitive function.
3. Delirium in Isolated COVID-19 Patients: COVID-19 units designed for isolation can be especially harmful to the elderly, particularly those with cognitive impairment. Prolonged isolation in a hospital setting can lead to delirium, a state of acute confusion and disorientation. Delirium is often underdiagnosed but can have severe consequences for cognitive function.
4. Improper Management of Delirium: Inadequate management of delirium can facilitate a person's cognitive decline and negatively impact their overall health status. It's crucial to recognize and address delirium promptly to prevent its long-term cognitive effects (3, 4).

Managing the cognitive domain during the COVID-19 pandemic involves finding creative ways to provide cognitive stimulation for isolated individuals, addressing depressive symptoms, and ensuring proper care for those experiencing delirium. These measures are essential to mitigate the potential cognitive decline in older adults, particularly those with pre-existing cognitive impairments.

Psychological domain

The COVID-19 pandemic has indeed brought about substantial changes in the lives and daily routines of the elderly, leading to various emotional and mental health challenges. The psychological toll of COVID-19, including isolation, fear, and grief, can impact cognitive and psychological well-being in both infected and uninfected individuals. Anxiety, depression, and cognitive changes may be more pronounced in older adults. Here's a closer look at some of these effects:

1. Mood Impact: The pandemic has disrupted social connections and daily activities for older individuals, leading to changes in mood. Isolation, fear of illness, and uncertainty about the future can contribute to heightened stress, anxiety, and depressive symptoms among the elderly.

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2. Increased Demand for Mental Health Services: The heightened emotional stress and mental health challenges brought about by the pandemic have led to an increased demand for mental health services. Many individuals, including COVID-19 patients, require support to cope with the psychological toll of the disease and the associated disruptions in their lives.
3. Direct Impact on COVID-19 Patients: COVID-19 patients themselves may experience mental health issues directly due to the illness. The physical symptoms, fear of severe illness and uncertainty about recovery can lead to anxiety and depression.
4. Effect on Sleep Patterns: Mental health disorders resulting from isolation can disrupt sleep patterns. Insomnia and other sleep disturbances may become more common among the elderly during the pandemic, contributing to feelings of fatigue and muscle exhaustion.
5. Social Participation: Social distancing measures and lockdowns have significantly altered the social environment, leading to reduced social interaction. This can have detrimental effects on cognitive, psychological, and physical functions, especially in older individuals who rely on social support (11).

Addressing these mental health challenges is crucial to ensure the well-being of older individuals during the pandemic. Providing access to mental health services, fostering social connections through technology, and promoting strategies to manage stress and anxiety can help mitigate the emotional toll of COVID-19 on the elderly population.

Vitality domain (Health Status)

The vitality domain is closely linked to the physiological and biological changes associated with old age, and many of these changes, particularly immune and inflammatory alterations, likely play a significant role in the increased vulnerability of elderly individuals to COVID-19. However, COVID-19 infection, particularly in its severe forms, can directly impact an individual's ability to maintain optimal physiological balance and affect these biological reserves. COVID-19 can lead to a significant impact on an individual's overall health status. Even after recovery from the acute illness, some individuals may experience lingering health issues that affect their vitality and energy levels (36). Malnutrition is a common and dangerous complication of COVID-19 infection in elderly patients for two main reasons:

1. Underestimation of Malnutrition: Malnutrition was often overlooked and underestimated in older individuals under normal circumstances. COVID-19 infection can exacerbate existing nutritional deficiencies, which may have been previously undetected.
2. Inflammatory Cascade: COVID-19 infection can trigger a cascade of inflammation in the body. This inflammatory response can lead to reduced appetite, altered taste and smell sensations, and difficulty in swallowing, all of which contribute to malnutrition in elderly patients.

Furthermore, elderly individuals who are isolated at home due to pandemic-related restrictions may experience additional vitality impairments because these restrictions can limit their regular access to nutritious food. Ensuring that older adults have access to adequate nutrition and addressing malnutrition is crucial for maintaining their vitality and overall health during the COVID-19 pandemic. Addressing the nutritional needs of older individuals, especially those with COVID-19, is essential to support their vitality and resilience against the disease. This may involve nutritional assessments, dietary interventions, and strategies to enhance food access and intake, all aimed at improving the nutritional status and overall well-being of elderly individuals.

Sensory domain

Sensory disorders, including vision and hearing impairments, are prevalent among the elderly and have a significant impact on their QoL. The COVID-19 pandemic has introduced additional challenges related to these sensory deficits. COVID-19 can also affect sensory perception, particularly in terms of anosmia (loss of smell) and ageusia (loss of taste). These sensory changes can impact an individual's overall well-being and QoL. Here's how the pandemic has affected sensory disorders in older individuals:
1. Reduced Access to Clinics: COVID-19 has led to the suspension of many outpatient clinics and healthcare facilities, limiting the possibility for older individuals to receive corrective treatments or interventions for sensory deficits. Routine eye and ear check-ups and access to hearing aids or vision correction may have been disrupted.
2. Impact on QoL: Sensory impairments, when left unaddressed, can significantly impact an individual's QoL. Vision and hearing deficits can lead to communication difficulties, social isolation, and a

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decreased ability to engage with the surrounding environment.

3. Secondary Effects on IC: The reduction in sensory function can contribute to limitations in other domains of IC. For example, older individuals may experience reduced mobility due to the fear of falling, depression stemming from worsening communication with their environment, and cognitive decline as a result of social isolation (3).

Addressing sensory disorders is crucial for maintaining the overall well-being and functional capacity of older adults. Strategies to mitigate the impact of sensory impairments during the pandemic include telehealth options for virtual consultations, home-based vision or hearing exercises, and providing assistive devices to improve communication and mobility. Ensuring older individual's access necessary healthcare, including for sensory deficits, is crucial for preserving their IC and QoL.

Conclusion

The understanding of IC and its relationship with COVID-19 is essential. Here are key takeaways: 1. Lifelong Impact of IC: IC is shaped by an individual's lifelong health trajectory, not just by temporary factors. Its effects become more evident in later years, highlighting the importance of considering long-term health. 2. Tailored Interventions: IC assessment guides personalized preventive and therapeutic interventions, moving beyond traditional paradigms. It accounts for an individual's unique characteristics and health history. 3. Post-COVID Assessment: IC evaluation in COVID-19 survivors helps address consequences, prevent future infections, and guide post-COVID care, particularly in older adults. 4. Health Indicator: IC serves as an indicator of overall health, crucial in challenging conditions like pandemics. It offers a holistic view of one's capacity to function and adapt. A comprehensive assessment of IC domains in older adults, both before and after COVID-19 infection, can provide valuable insights into their functional abilities and vulnerabilities. Therefore, incorporating IC into health care assessments and interventions, particularly for older adults, can enhance our understanding of their health and well-being. This information allows health professionals to consider a more personalized and holistic approach to health care that takes into account a person's unique life experiences and health trajectory. This approach is valuable not only during the Covid-19 pandemic, but also in promoting healthier aging and improving long-term health outcomes.

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