One-Year Report of COVID-19 Impact on Geriatric Patients: a Bio-Psycho-Social Approach

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ABSTRACT

Background

Since December of 2019, coronavirus 19 (COVID-19) has spread rapidly around the world. Our understanding of the infection has grown over the past year, and its impact on older adults is particularly significant. Apart from the direct impacts of COVID-19 infections, it has also led to lockdowns which, in turn, result in isolation and loneliness.

Method

We conducted a literature review of publicly available articles of the COVID-19 pandemic impact on the geriatric population between December 2019 and April 2021, a total of 748 articles.

Results

The review will be presented with the Bio-Psycho-Social model, covering how the biological, psychological, and sociological aspects of health are intertwined and impact older adults. Early studies have also highlighted the prevalence of post-COVID infection symptoms that typically fall under geriatric medicine care. We highlight the bidirectional impact of isolation and COVID-19 infections on geriatric health, as well as discuss pertinent topics such as vaccine efficacy, long-term sequelae of COVID-19 infections, and ageism.

Conclusion

This review seeks to present a one-year report of what is known about COVID-19 and geriatric medicine, as well as provide guidance to practitioners who care for older adults based on the most up-to-date literature.

Key words: COVID-19, geriatric, bio-psycho-social, coronavirus, biological, psychological, sociological

INTRODUCTION

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has devastated the world over the past year. First notified on December 31st, 2019, the World Health Organization officially declared a global pandemic on March 11th, 2020.[1] Since then, there have been over 150 million confirmed cases and 3 million deaths worldwide.[2] In Canada, there have been 1,219,418 confirmed cases, as well as 24,219 deaths as of April 30th, 2021.[3]

Previous studies have indicated one out of every three deaths of older adults are caused by infectious diseases,[4] and the COVID-19 pandemic is certainly no different; the case fatality rate of COVID-19 has been found to grow exponentially with age.[5,6] Older adults were also particularly vulnerable to increasing fear and loneliness.[7] Interestingly, the systemic expression of the angiotensin-converting enzyme 2 (ACE2) receptor, through which the SARS-CoV-2 virus is dependent on to infect cells, has been show to decrease with age among older adults.[8] However, the ACE2 receptor expression has been found to increase with age in the lungs,[6] likely contributing to the severity and mortality in the geriatric population. Building upon the concept of frailty as being defined as accumulation of deficits and comorbidities,[9] it is understandable that older adults are therefore more predisposed to mortality due to strong associations with pre-existing, age-related diseases.[6]

The Bio-Psycho-Social model was proposed by George L. Engel in 1977. Prior to this, there was a dominance of the biomedical model, which excluded the sociological and psychological impacts on health. The Bio-Psycho-Social model, in contrast, utilizes a more holistic approach which illustrates the overlapping domains within health and their interactions.[10] When adapted for use in the health of older adults, they include, but are not limited to, the following aspects: a) Biological—age, comorbidities, immunosenescence, b) Psychological—anxiety, loss of loved ones, cognitive decline, and c) Sociological—isolation, negative stereotypes, ageism.

In preparing this literature review, 749 studies were reviewed on electronic databases and preprint servers (PubMed, Google Scholar, bioRxiv, SSRN), of which 113 English articles were found to be relevant and up-to-date pertaining to the older adult population. Databases were

searched for the key words of "geriatrics," "older adults," "older individuals," "aged," or "aging" to encompass the older adult population. Key words of "COVID-19," "COVID," "coronavirus," and "SARS-CoV-2" were used to search for articles about the COVID-19 pandemic. Articles not addressing both COVID-19 and older adults were excluded, as were articles writing in languages other than English and without dedicated translations. The majority of articles defined the older adult population as age 65 or older, though some studies investigated a smaller subset of age ranges within this population. When articles had opposing views, both the majority consensus and dissenting views were included. Articles included and cited are original research, unless interpretations from secondary sources are deemed relevant. Search dates range from December 31st, 2019 to April 30th, 2021. Given that the Bio-Psycho-Social model describes the three domains as being integrated parts of the whole, the following review will separate findings by the domain in which the primary research goal is characterized.

Biological

Aging is associated with increasing risk factors of disease. In young individuals, aging plays a non-significant role, and disease risk is largely determined by the overlap of genetic and environmental predispositions. As an individual ages, the role of aging increases, overlapping with the genetic and environmental predispositions. At extreme ages, age-related predispositions become the predominant risk factor for disease risk.[11]

The Aging Immune System

The concept of inflammaging vs. immunosenescence in older adults is not new. Inflammaging is defined as the imbalance between pro-inflammatory and anti-inflammatory pathways. Decreased macrophage and T cell activation leads to stunted pro-inflammatory response. On the other hand, decreased anti-inflammatory pathways lead to a low-grade sterile inflammation.[11] Both the innate and adaptive responses within lymphoid and non-lymphoid tissues become impaired.[12] Furthermore, decreased naïve T cells with an associated accumulation of memory T and B cells in circulation are observed,[13] with more cells entering senescence overall.[14] The accumulated and exhausted T cells also preferentially secrete pro-inflammatory INF and TNF factors.[15] In combination, older adults are more predisposed to latent or novel infections, resulting in increased morbidity and mortality.[12]

Impact of Psychological and Sociological Variables

Isolation and loneliness have led to several detrimental outcomes in older adults, and both have been associated with poor sleep quality and physical inactivity.[16] Physical inactivity, in turn, leads to sarcopenia and frailty, and lack of sunlight may translate to lower vitamin D levels, which has been associated with impaired immunity.[17] Worsening age-associated conditions, along with frailty and falls, have also been observed.[18] In particular, older adults living in isolation in nursing homes experienced more falls.[19] Loneliness and social isolation

have also previously been associated with hypertension, cardiac disease, and cardiac-associated deaths.[20-22] In all, the following recommendations have been made for older adults during this time: exercising while taking caution with masks, small amounts of sugar prior to exercising (found to be anti-inflammatory), and caution against binging of foods.[23]

Mortality and Risk Assessment with Infection

After being infected with COVID-19, older adults often have atypical presentations and higher mortality as a result of immunosenescence and multiple age-related comorbid conditions.[24] This is particularly true for those living in nursing homes, making those living in these institutions particularly vulnerable.[19,23,25] Multiple age-related comorbidities have been associated with poorer outcomes such as heart and lung disease, diabetes, dementia, and polypharmacy.[24] Specifically, poor prognosis is linked to male gender, diabetes mellitus,[26-28] hypertension, malignancy,[29] renal disease, obesity,[30] as well as presenting with increased O2 requirements, bilateral chest infiltrates on imaging, and crackles on exam.[31] Severity of infection has been found to be associated with a variety of factors: albumin, D-dimer, onset to hospitalization time,[32] ADL impairment, fever, and increased C-reactive protein.[33] Higher mortality rates were associated with increasing age, frailty, inflammation, renal disease, cardiovascular disease, and cancers; age and frailty were independently associated with higher mortality.[34] Nutritional deficiency was also associated with significantly longer length of stay, higher hospital expenses, poor appetite, heavier disease severity, and more weight change.[35] Linear associations have also been found between clinical frailty score, functional status, and mortality.[36-40] Older adults also have a high risk for developing cardiac injuries due to yet-unknown etiologies;[41] heart failure as a result of cardiac injuries may mimic the symptoms of COVID pneumonia-related dyspnea, but can be differentiated by point-of-care ultrasound (POCUS).[42]

Based on the prognostic factors identified above, several assessment tools have been found to be appropriate for assessing in-hospital mortality in older adults, including ISARIC-4C, COVID-GRAM, qSOFA, lung ultrasound score (LUS), and possibly qCSI and NEWS.[43-45] Furthermore, it has been hypothesized that accurate prognostication of older adults including the three following components are more accurate than the individual components themselves[46]: a) current risk classification systems such as Pneumonia Severity Index (PSI) and CURB-65, b) nutritional status such as utilizing the Geriatric Nutritional Risk Index,[47] and c) functional status with Eastern Cooperative Oncology Group (ECOG) score, Barthel index, or handgrip strength.

Treatment and Risk-Reduction

While disease-modifying medications of COVID-19 have not been specifically studied in the older adult population, certain medications have been demonstrated to impact prognosis. Alterations of gut microbiota have been observed post-infection, likely due to antibiotic use. Targeting the

microbiota has been speculated to help treatment and reduce pro-inflammatory states.[48] The COVIT-TRIAL has demonstrated vitamin D3 supplementation improves survival rates and also decreases severity of illness.[49,50] Older adults who were on vitamin K antagonists have been associated with increased mortality.[51] Diabetic patients on metformin should be monitored for increased disease progression,[52] though studies done in nursing homes without age restriction have found it to reduce 30-day mortality.[53] Patients on angiotensin-converting enzyme (ACE) inhibitor or angiotensin receptor blocker (ARB) prior to infection have better outcomes, and their use should be continued throughout hospitalization.[54] There was also dose-dependent immunosuppressant usage associated with mortality in observational studies.[55]

Rehabilitation

Once older adults have overcome COVID-19 infections, rehabilitation becomes the cornerstone for moving towards their new baseline. Six-week respiratory therapy has been associated with improvements in both respiration and quality of life.[56] Physiotherapy should not only take into account the patient's respiratory symptoms, but also their functional status prior to hospitalization.[57] Malnutrition was a common (57%) consequence, likely driven by multiple processes.[58] Therefore, nutritional status should be targeted for therapy, especially for older adults with diabetes mellitus, low calf circumference, and low albumin.[58] Age, frailty, delirium, dementia, and mental health diagnoses are also associated with higher care needs post-discharge.[34]

Vaccines

Vaccines are seen as the way to bring the pandemic to an end, but many uncertainties are associated with their efficacy in older adults. Immunosenescence was thought to impair the response of the vaccine among this population, similar to what has been observed in other vaccines.[59] Natural immunity developed post-infection was also found to be comparatively less in older adults.[60] To date, there have been limited studies regarding the exact impacts of aging on human immune responses, largely inferring from animal model data.[61] However, unanticipated effectiveness has been observed, especially in the new generation of mRNA vaccines, which does not appear to be limited by the aging biology.[62] In contrast to annual influenza vaccines which do not confer long-term memory and poorly stimulate T cell response, COVID-19 vaccines based on mRNA technology appear to be potent stimulators of CD4 and CD8 T cells.[63,64]

As our understanding of the immune response to COVID-19 increases, it has become clear that humoral response and cellular response play different roles. Humoral responses alone may not be sufficient to prevent severe disease, but potent responses may in fact worsen the outcomes.[65,66] Mutations in the COVID-19 variants have also been speculated to lead to changes in epitopes that may dampen the highly specific B-cell mediated humoral response.[67] Prior studies of the immune response against coronavirus have suggested CD8 T cells may confer cross-reactivity and immunity

against other strains, as well as COVID-19.[68] Previous SARS-infected patients were found to continue having T cell responses 17 years after the initial outbreak.[65,69] Thus, it has been suggested that T cell recruitment is essential in the long-term protection against COVID-19, and should be engaged via vaccines.[70]

A variety of vaccines have been developed against COVID-19, some of which have been studied more than others. In pre-print data studying the efficacy of single dose BNT162b2 and ChAdOx1 vaccines, both vaccines were found to have comparable B cell responses and titres (93% and 87%, respectively). However, the ChAdOx1 vaccine elicited a superior T cell response (30.7% to 12.3%). This difference remains unclear, but may be attributed to the adenovirus vectors.[71] These high single-dose humoral response findings were found to "support" the decision by Canadian and UK governments to delay second doses of the vaccine, allowing for inoculation of more individuals at a time when vaccine supplies were limited. It has also been noted that the second dose of BNT162b2 vaccine induces strong humoral and cellular responses, including responses against variants.[72,73] Interestingly, studies have also found the Bacillus Calmette-Guérin (BCG) vaccine may also train the innate immune response of older adults to reduce the severity of COVID-19 infections.[74]

Psychological

Psychological changes have been associated with both predisposition towards and resulting sequalae of COVID-19 infections. Here, we focus on the following three categories of psychological symptoms of older adults, and associated treatments: delirium, dementia, and mood disorders.

Delirium

Delirium has been identified as a common presentation of older adults with COVID-19 in the emergency department.[75] There are case reports where delirium was the sole symptom.[76] In both hospital and community dwelling older adults, delirium was also more prevalent in those who were frail.[77] While some studies dispute the association with higher mortality,[34] most studies agree that delirium is associated with poorer outcomes and death.[78-80] The most common types of delirium were hypoactive, followed by hyperactive and mixed.[80] Therefore, screening for delirium as a symptom of COVID-19 is suggested.[75] Unfortunately, as part of the treatment of cytokine storm and immune-mediated severe encephalopathy associated with COVID-19 infection, corticosteroids are the medication of choice, which may cause or worsen delirium. Regrettably, no interventional trials have yet to investigate this in the older adult population, and due to this lack of evidence, it is presently recommended that the risks and benefits are evaluated and balanced for each patient.[81] Furthermore, the multidimensional prognostic index (MPI), an assessment tool that encompasses multiple health domains, has been found to be predictive of delirium and death, and has been recommended to be incorporated as part of the comprehensive geriatric assessment (CGA).[82]

Cognitive Impairment

The COVID-19 pandemic has had a negative impact on patients with cognitive impairments and dementia. Their needs were often neglected, and caregiver stress increased in the context of little external support. It has since been recommended that regular contact be made with these families, as well as the distribution of self-help guides to help the patients during times of social distancing.[83] It is expected that long-term impacts may include less stringent follow-up and less frequent medication adjustments in an already vulnerable population.[17] Case reports have also highlighted the progression of mild cognitive impairment and associated mood symptoms as a result of pandemic distancing.[84] In combination with depression, loneliness has resulted in worsening cognition,[85] increasing the incidence of dementia.[86] The cardiorespiratory fitness decline during isolation has also been associated with decline in cognitive functioning.[17] Hence, it is recommended to utilize remote access digital platforms to assess or provide therapy to patients with dementia.[81] One group of patients who are particularly vulnerable are those with dementia living in care homes, which has been associated with mortality, specifically more so in Alzheimer's dementia compared to frontotemporal dementia.[87] This is particularly interesting because frontotemporal dementia patients were less likely to follow COVID-19 preventative measures as a symptom of the disease nature.[88] Moreover, for unknown reasons, both Alzheimer's dementia and Parkinson's disease are associated with increased risk of being infected by COVID-19.[89]

Mood Disorders

Long-term isolation during the pandemic has also been found to result in mood disorders. Thirty-seven per cent (37%) of older adults during the pandemic experienced anxiety and depression,[16,90] and survivors of COVID-19 significantly suffered more.[91] In particular, those with Alzheimer's dementia were also more at risk for developing anxiety and depression.[92] The sudden loss of a loved one may also result in prolonged grief disorder, a new diagnosis recently included in ICD-11 and under consideration for DSM-5, where adaptations to loss are stalled or halted.[93] Previous studies have found that loneliness and isolation are not only associated with suicide attempts and completed suicides in older adults,[94] but also reduced resiliency factors such as self-worth, sense of purpose, and feeling valued.[95] The pandemic has led to a combination of risk factors which increase the risk of suicide, and should be mitigated.[96] Moving forward, resiliency is identified as having an essential role in healthy aging within the post-COVID era.[97]

Treatment

Fortunately, many treatment methods have been studied for mood disorders associated with COVID-19. Yoga has been suggested as a form of exercise to prevent or alleviate mental health symptoms.[98,99] Exergames, defined as physically active video games, have been found to be beneficial for anxiety.[100] For anxiety post-COVID infection, six-week respiratory therapy has been found to improve anxiety, but not depression.[56] As shown for anxiety symptoms, patients who exercised experienced less depression-like symptoms.[101] More specifically, vigorous and moderate-vigorous physical activity was associated with better resilience, positive affect, and fewer depressive symptoms.[102] In patients who experience severe debilitating depression, electroconvulsive therapy should be utilized once the patients swab negative.[103,104] Zoom small groups also significantly improved loneliness, and marginally improved depression. However, the authors recognized that cost will be a major limiting factor.[105] Older adults also have other obstacles in accessing telemedicine including social disparity (which will be discussed further in the sociological section below); frailty and multimorbidity due to physical limitations such as sensory and dexterity impairments, and cognitive deficits are also limiting factors.[106,107] Regardless of the treatment modality, ongoing screening, intervention, and follow up should continue through telemedicine.[108-110]

Geriatric Syndromes Post-Infection

While there is little doubt about the long-term sequelae that patients previously infected by COVID-19 may suffer, it remains to be seen how it may impact the practice of geriatricians. An eye-opening study recently published found one in three patients developed neurocognitive or psychiatric outcomes at six months post-infection. Furthermore, 1 in 50 inpatients and 1 in 500 outpatients infected with COVID-19 also developed dementia,[111] an observation also confirmed by other research groups,[112,113] Similar results have been observed by the same research group at three months post-infection, which also identified bidirectional associations between COVID-19 and dementia,[114] and more severe outcomes.[115] This certainly poses the question whether geriatricians will encounter more post-COVID–infection patients suffering from diseases previously associated with the geriatric population. While longer term studies and observations are required to elucidate this question, early data have suggested that the Montreal Cognitive Assessment (MoCA) is validated for detecting mild cognitive impairment in COVID patients.[112,113,116]

Sociological

Soon after the World Health Organization declared COVID-19 a pandemic, the United Nations Department of Economic and Social Affairs posted an issue brief regarding the impacts of COVID-19 on older persons. Of note, the issues that were highlighted were largely centred on the social implications of the care and well-being of older adults.[117] As the world was struggling with the fallout of COVID-19, the basic needs and rights of older adults were often neglected or overlooked.

Ageism

Ageism, a term coined by gerontologist Dr Robert Butler in 1969, describes the stereotyping and discrimination based upon the age of individuals or groups.[118] That same stereotyping has characterized older adults as "vulnerable," "at risk," and "needy" during the COVID era.[119] These concepts

were commonplace online, where one out of every four tweets about COVID-19 analyzed were identified as being ageist or offensive towards older adults.[120] However, these worrisome trends were also introduced into the policies of governments and institutions. In response to overflowing intensive care units during the early months of COVID-19, Italy utilized policies that worked against older adults, including but not limited to setting age limits for ICU admissions, or further evaluating the comorbidities of older adults prior to ICU admission,[121] and we in Canada are certainly not exempt from utilizing similar policies.[122] The American Geriatric Society has also since then recommended against similar ageist policies,[123] and the United Nations has also called upon governments to include older adults in consultation for policy-making.[117] Colenda et al.[124] have recommended the following four goals to prevent ageist policies: a) make clinical research more inclusive of all ages, such as emergent use of experimental therapies and diagnostic tools; b) engage geriatricians and gerontologists in institutional decisions regarding care, including rationing; c) inform policy and funding with cognizance of the needs of vulnerable populations; and d) emphasize the importance of personalized approaches to older adults that enact respect for autonomy, justice, and beneficence.

Disparities and Inequalities

Older adults are also more vulnerable to disparities in everyday life, which the pandemic has unfortunately magnified. Older adults and those socioeconomically vulnerable have been identified as being disproportionately affected, and once infected, there were also inequalities noted with regard to their medical and social care, as well as their long-term consequences.[125] In Canada, early waves of COVID-19 ravaged older adults living in long-term facilities, demonstrating the dire need for reform;[122,126,127] data from Ontario's Long-Term Care COVID-19 Commission shows that little has been done to mitigate this one year into the pandemic.[128] While internet and digital technologies have connected the world in the current times of social distancing, older adults have also been disproportionately limited in their use,[129,130] leaving them with worse outcomes associated with isolation.

End of Life

End-of-life care is quintessential in the care of older adults with COVID-19, given the higher mortality associated with age. Kunz and Minder[131] have made the following recommendations for palliation when the situation arises: a) consideration of palliation at home or in nursing homes, or allowing for visits of families during visitation ban; b) optimizing of comfort care medications; and c) open discussion regarding advance care planning. Due to social distancing and visitation bans, many patients in early days of COVID-19 were dying alone without the company of their loved ones. It is recommended that exceptions are made for the family members of dying patients by utilizing rapid testing of the caregivers and family where available.[132] It is also important to take into account the end-of-life experience specific to COVID-19 which have shorter dying phases, for which

comfort care medication should be targeted accordingly.[133] Palliative care teams should be involved in the care of these patients and the discussions of advance care planning, as well as any communications with family members who are unable to be at the side of the patients.[132]

CONCLUSION

As the COVID-19 pandemic progresses, our understanding of its impacts evolves daily. This literature review serves as a summary of the research that has been published to date, and highlights many questions that are still yet unanswered. It is quite unfortunate, however, that older adults are underrepresented in randomized controlled trials,[134] and that there is a lack of research investigating the role of comprehensive geriatric assessment.[135] There are still many unknowns due to the lack of high-quality research amongst older adults,[134] such as what the long-term sequelae are, or whether more patients will require care going forward due to developing geriatric syndromes. Nevertheless, there is no doubt that the consequences of COVID-19 will be observed within the geriatric population in years to come, and physicians must be ready with the knowledge to provide care.

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