

# **Older Adult COVID-19 and Osteoarthritis Interactions and Implications 2023: Novel Insights and Projected 2050 Global Osteoarthritis Challenges and Opportunities**

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As a result of their debilitated state and oftentimes multiple preexisting health conditions older adults suffering from chronically painful disabling osteoarthritis of one or more joints were found to acquire a COVID-19 related infection at substantive rates at the height of the pandemic. Unfortunately, even though the COVID pandemic has waned considerably as of 2023, it yet appears this older adult group may still be worse off than they were before December 2019 as well as subject to repeated or novel corona viral variant infections. Moreover, in addition to being more debilitated than desired, emergent COVID-19 vaccines even when applied diligently are not effective in all cases, nor do they systematically prevent the acquisition of other debilitating chronic diseases or their magnification. In light of the many personal challenges exacerbated by COVID-19 it appears pertinent to continue to assess whether this is a topic of immediate concern in an era where the 2050 osteoarthritis worldwide disease projections of more than 1 billion cases is clearly on track. Indeed, the question of whether older adults who may also be more susceptible than healthy age and gender matched adults to infections such as COVID-19 as well as long-COVID disease plus excess degrees of osteoarthritis disability should be targeted systematically before their health limits any treatment impact appears worthy of consideration. To address this question, this mini review briefly explores if indeed there is any need for timely concerted preventive care other than standard practices in 2023 if the goal of reducing osteoarthritis suffering and possible COVID-19 risk and their attendant health care costs in all parts of the world is to be duly realized.

**Keywords:** Corona virus; COVID-19; Disability; Intervention; Osteoarthritis; Prevention**Background**

Strong evidence shows older adults, especially those suffering from one or more pre existing chronic health conditions, such as osteoarthritis, the 11th leading cause of disability globally, and one associated with rapid rates of increasing prevalence [1,2], annual incidence, and years lived with disability, particularly in developed and developing countries [3] may be at high risk for infections such as COVID-19 the novel corona virus or acute respiratory syndrome termed SARS-CoV-2 that emerged in Wuhan, China in December 2019 [4]. While not always fatal, both those older adults with painful incurable disabling osteoarthritis who acquired COVID infections as well as those who did not, now appear to report a lower than desirable life quality experience [5] or have manifested an unanticipated post pandemic decline in multiple dimensions including the life affirming importance of consistent exercise participation and overall functional independence and ability [6, 7]. In addition to that, recent data are emerging that show that in the event older adults have to be hospitalized for COVID-19, they do not routinely attain a desirable level of functional recovery after discharge from the hospital at all readily [8]. At the same time, backlogs in surgical waiting periods manifold in 2019

and 2020 still persist in 2023 [9] and cases with pre-existing osteoarthritis may now be worse off in general, with fatigue and a reduced exercise capacity [10]. Its manifestation as a post viral syndrome comprising physical, emotional, cognitive and various fluctuating prolonged degrees of social impacts has been described as well [11].

Consequently, even though lethal COVID-19 infections are far less prevalent in 2023 than was the case in 2019 and for some time after that, following a vaccine developed to counter this viral infection, new variants that have currently emerged may not be amenable to standard vaccination approaches, nor do all older adults respond to vaccines favorably. At the same time, although there may be no cause effect relationship between COVID-19 and osteoarthritis incidence, a currently published Global Burden of Disease [GBD] report [2] reveals that compared with 2020, cases of osteoarthritis are projected to increase by 74.9% for knee, 48.6% for hand, 78.6% for hip, and 95.1% for other types of osteoarthritis by 2050. In addition, the global age-standardized rate of years lived with disability for total osteoarthritis of 255.0 per 100 000 in 2020, is reportedly a 9.5% increase from 1990. Velek et al. [12] further report an

observed 47% reduction in practitioner consultations for musculoskeletal disorders during the first wave and a 9% reduction during the second wave for hip and knee osteoarthritis complaints. While the long-term impact of this service disruption and others has not yet truly emerged, it can be expected to lead to a greater accumulation of patients with severe osteoarthritis symptoms and more requests for costly joint replacement surgery or narcotics or both.

Unsurprisingly, therefore, even if some vital key health services have been restored since their closures in 2020, older community dwelling adults and others with or without a COVID-19 history who have chronic osteoarthritis of one or more joints are still likely to be more- rather than less- debilitated than in pre pandemic periods due to factors extrinsic to the virus itself, such as hospital service cut backs, provider shortages, provider burnout, and social isolation [6, 7]. Indeed, while data are limited in this regard, one group recently reported that between 2020-2021 the osteoarthritis prevalence in the older observed population in their jurisdiction appeared to increase [13].

Taken together, and even though osteoarthritis is not commonly fatal, it is highly prevalent, and may be associated with more suffering in 2023 than was predicted, hence a rise in opioid related deaths, as well as deaths of older adults with osteoarthritis who were infected with COVID-19. Indeed, older adults who are already suffering joint disability as well as those who are not receiving adequate protection and health opportunities are still likely to have an increased risk of acquiring severe COVID-19 with subsequent higher than desirable case fatality rates and intensive care needs. Infection and vaccine-induced antibody responses and long-term effects of COVID-19 also differ in older adults and are likely to be impacted negatively in the poorly conditioned older adult [14].

It is probable furthermore that due to becoming socially isolated, a proportion of adults suffering from osteoarthritis may have since acquired other chronic health ailments that are directly related to COVID, such as obesity that emerged under lockdown, as well as worse signs of any co existing chronic health conditions such as diabetes, heart disease, and asthma [8], plus the presence of depression and lower physical functioning levels [6]. Survivors of COVID-19 may in addition be extremely de-conditioned, and surgery as a tertiary remedy for those with severe osteoarthritis pain, while somewhat successful, may now pose further added risks of intrinsic as well as acquired infections and further debility, as well as delays, due to its oftentimes elective nature [1]. Returning home from the hospital is also likely to be more challenging than in pre pandemic times [5,15].

In particular, although physical activity is highly promoted for health maintenance among older adults, regardless of disease status, this may yet be too challenging to undertake in instances where services such as regular supervision in gyms, swimming pools, rehab centers, or sports clubs prevail due to funding and personnel shortages. As well, a fair percentage of older adults suffering from chronic pain may feel uncertain about exercising alone in a confined space or in unsafe neighborhoods. Moreover, they may be unfamiliar with technologies that might be helpful, or unable to access these readily, for example if they have limited hand dexterity, or vision, or because they are unable to cover the costs of internet access.

In regards to accessing those basic commodities needed to ensure health and safety, many may encounter additional constraints as a result of being unable to shop for and prepare nutritional foods if they are stiff and sore from their arthritis, or recovering from COVID-19 or both, nor able to stand in line ups for basic necessities, or manipulate packages at self serve payment outlets. Public transport, and transport for older disabled persons is also potentially risky even if available. Moreover, emergent data reveal that the recent COVID-19 pandemic may have further exacerbated the disease burden of the osteoarthritis patient due to possible limitations in accessing adequate or timely medical and surgical treatments.

With increasing life expectancy and the aging of the global population, the cumulative osteoarthritis burden is expected to worsen in its own right, and although not commonly recognized to date as a major health concern by all the extent of osteoarthritis debility and incidence may yet be further influenced by past or future COVID-19 exposures and their multiple unanticipated adverse health and public health consequences. To begin to address the degree of importance of directing attention towards examining the parallel epidemics of COVID-19 and osteoarthritis that may in fact have some common ground [16], this mini review highlights what is now known about their association that has some possible important clinical relevance. In particular, the probable role of timely practical cost-effective efforts to improve population health worldwide, for example by addressing key determinants such as obesity, cardiovascular disease, and injury and their associated inequalities is explored [3].

It builds on both an initial set of observations that prevailed in 2020 [17], and those that have since emerged and continue to emerge in 2023 in an effort to highlight the importance of persistent efforts to prevent and protect against:

1. The projected burgeoning epidemic of debilitating osteoarthritis.
2. The possible resurgence of COVID-19 and its long-term implications for older adults' joint health.

It hypothesizes or predicts that without evidence of any concerted set of current and planned comprehensive public health initiatives or proposed efforts in either realm, and one that embraces multiple health dimensions, and does not rely on interventions that are less prominent or available in many parts of the world, the above-mentioned issues will not only persist but prove highly burdensome in multiple ways in the future, regardless of region.

Drawn largely from the PUBMED, PubMed Central, and Google Scholar databases, it is hoped the current overview can provide the interested reader with a general view of current observations and trends in this regard, as well as what might be implemented meantime. It does not focus on drug, biochemical approaches, invasive technologies or biologic intervention that may yet assist the impacted older adult with osteoarthritis one or more health affirming opportunities. It is limited to non drug, non surgical avenues of intervention and prevention that can be amenable to all, and is construed in the context of the biopsychosocial model of health and health protection approaches, rather than the medical model, all things considered [18]. Moreover, it is limited to a narrative overview in the context of this uncharted topic rather than a systematic analysis.

Articles included were those deemed to reflect how the parallel health conditions of COVID-19 and osteoarthritis in the older adult population may be associated.

Unfortunately, despite the immense burden placed currently and since 2019 on many older adults, as well as exposure to some of the challenges noted above that pertain to many individuals currently suffering from chronic disabling osteoarthritis, the American College of Rheumatology and the European League Against Rheumatism issued guidelines for managing immune-mediated rheumatic diseases during the pandemic. However, these guidelines did not include recommendations for patients with osteoarthritis [19].

## Materials and Methods

To obtain the data for this review, the electronic data sources PUBMED, PubMed Central, and Google Scholar were carefully searched for the time periods 2021-2023, as a prior report covered 2019-2020. Applied were the key words, Corona virus, COVID -19, Older Adults, Osteoarthritis, and Prevention. All forms of study or analysis were deemed acceptable. However, because this is an emerging topic, with few clinically sound prospective analyses, only a narrative summary of the key articles retrieved was implemented. Selected material had to focus on facts relevant to long COVID-19 or osteoarthritis among the older adult, rather than children or adolescents. No drug or basic laboratory studies were included. Excluded too were proposals for future study, vaccine-based studies, biological studies, and non-English based articles. All forms of osteoarthritis were accepted, but no auto immune forms of arthritis and their COVID-19 interactions were sought.

## Results

Many citations concerning COVID-19 and osteoarthritis published in 2022-2023 prevail indicating an immense interest in these health conditions, however, most focus on biological or molecular outcomes, vaccine development, and genetic rather than social disease determinants, with no consensus. Even fewer discuss any envisioned efforts to avert related disabling and oftentimes lethal consequences of either or both these adverse conditions and how some of the complaints in either condition are similar, for example pain and functional capacity declines.

Moreover, almost none put forth some plan to advance either osteoarthritis or COVID-19 prevention specifically, despite the downside of failing to do this. This is despite new calls for concern regarding COVID-19 variants, wherein novel variants and their protein derivatives may more readily induce one or more chronic diseases, as well as vaccine resistance [20]. There are also multiple prevailing limitations in current terms of standard vaccine efficacy, and many consistent pieces of evidence pointing to osteoarthritis as a growing public health concern, affecting millions of people worldwide and where its impact on health can surely lower immunity and raise the risk of novel infections without advanced management approaches [21]. While these commonly include a combination of pharmacologic and non-pharmacologic methods such as exercise and physical therapy, and surgery, these may not prove doable or optimal solutions for many older adults in light of the persistent COVID-19 variant risks. First, this group may be worse off in 2023 than anticipated, because not only were older adults most affected as a group by COVID-19, but when this novel corona virus, was declared a pandemic, all aspects of osteoarthritis treatment, the most prevalent musculoskeletal health disorder

became affected and either closed temporarily or permanently, or slowed down [22]. In addition to accessibility issues, there were additional concerns about the interaction of current medications for osteoarthritis with the virus. This remains a concern because in addition to now having a possible poorer quality of life, patients were clearly impacted negatively, especially if they had or developed severe osteoarthritis. Furthermore, not only was a backlog of joint replacement surgeries created, which may yet take several months or years to address, but surgeons may yet be more challenged due to the poorer than anticipated health status of their clients, both pre and post operatively. In particular, pain increased from mild or moderate in sizeable numbers of cases and walking distance and muscle strength decreased in more patients in the severe-osteoarthritis group [23] and as many as 60% of COVID survivors appear to have experienced long COVID-19 symptoms [24].

Unsurprisingly, despite a lull in acute COVID-19 manifestations, Lauwers et al. [25] note COVID-19 remains a trending topic worldwide due to its immense impact on society. Even though recent trends have shifted from its acute effects towards its long-term morbidity effects, a resurgence of the condition cannot be excluded readily. Moreover, Lauwers et al. [25] hypothesize that COVID-19 known to contribute to age-related perturbations in endothelial and adipose tissue that characterize the early aging process may represent an accelerated aging process, including possible joint and muscle pain that are typical features of joint and muscle aging, or an early osteoarthritis-like phenotype.

Parsirad et al. [26] report that the COVID-19 pandemic has indeed affected the management of chronic musculoskeletal pain, mental health, quality of life and healthcare accessibility in patients with chronic musculoskeletal pain. Of 30 studies this group reviewed, 25 (83%) reported symptom worsening, and 20 (67%) reported reduced healthcare accessibility. Patients were unable to access necessary care services during the pandemic, including orthopedic surgeries, medications, and complementary therapies, leading to worsened pain, psychological health, and quality of life. Across conditions, vulnerable patients reported high pain catastrophizing, psychological stress, and low physical activity related to social isolation. Notably, positive coping strategies, regular physical activity, and social support were associated with positive health outcomes. However, it appeared most of the surveyed patients with chronic musculoskeletal pain had greatly affected pain severity, physical function, and life quality during the COVID-19 pandemic. Moreover, the pandemic significantly impacted treatment accessibility, often preventing necessary therapies.

Turanov et al. [27] showed results that suggested COVID-19 outcomes are not just based on subjective impressions but appear to affect the proteolysis-antiproteolysis system that plays a key role in the pathogenesis of osteoarthritis. Additionally, this can occur even after a long postinfectious state and may cause complications of existing musculoskeletal pathologies.

In this respect, a recent exploratory study clearly showed that the presence of previous rheumatologic conditions before a COVID-19 infection was not a risk factor associated with development of widespread post-COVID pain symptoms that warrants further study [28]. In the interim some forms of osteoarthritis pain may well be increased due to such a widespread post-COVID pain-related outcome [28] and that is observed

in both post COVID hospitalized as well as non hospitalized rheumatologic patients [24], alongside some evidence of post COVID-19 increases in muscle stiffness, a precursor of sarcopenia [29].

In another report Sajjadi et al. [30] recount that the COVID-19 pandemic disrupted clinical research in many medical and surgical fields, resulting in research waste and loss of treatment for patients. It is possible too data on osteoarthritis disability projections are thus inaccurate to some degree because the extent of the pandemic's influence on osteoarthritis as a condition is currently unknown along with results of novel treatment trials.

In a further noteworthy report, Reinbacher et al. [31] show problems with post op joint replacement care-during the first lockdown of the COVID-19 pandemic wherein the COVID-19 pandemic negatively affected both early six-month clinical outcome parameters following elective primary knee joint surgery due to the COVID-19 restrictions placed on usual postoperative care procedures and quality. At the same time, as more becomes known about the two interacting conditions, Huang et al. [32] imply there may also be some linkage between osteoarthritis and COVID-19 at the genetic level that renders a contribution to the oftentimes poor outcomes of COVID-19 and/or osteoarthritis in the older population, for example pain [9].

Another interesting report by Iwatsuki et al. [33] has revealed this topic area should be studied more intently in the future, given that subjects who exhibited dysfunction of the upper limb who increased their time spent on personal computers and cell phones during the COVID-19 lockdowns reported experiencing exacerbations of their hand symptoms even if they were not infected directly. Those cases who wanted to undergo surgery, may also have suffered unduly, if they had to postpone this as a result of COVID-19, and reportedly experienced greater pain, 'jitteriness', and signs of anxious depression. Another prospective analysis by Huzum et al. [34] of possible high worth to pursue in the future is the possible unanticipated connections between oxidative stress and orthopedic conditions such as osteoarthritis; as well as COVID-19. In alluding to some theories on how oxidative stress, metabolism involvement, and even antibiotic resistance might be influenced by either orthopedic conditions or COVID-19, a related long-term impact on the nervous system could not be ruled out as a future post COVID-19 long term rather than an acute infection challenge.

Ragni et al. [35] have also stressed the idea that adults with osteoarthritis who often show a large array of concomitant pathologies, such as diabetes, inflammation, and cardiovascular diseases are indeed those shared with COVID-19 patients and that may therefore increase its post acute or acute disease complications. Moreover, various pharmacological interventions used to reduce osteoarthritis pain, such as anti-inflammatory drugs, over the counter pain killers, corticosteroids, opioids, or other molecules are found to induce a wide array of iatrogenic unwanted health effects, potentially increasing COVID-19 secondary infection incidence or complications.

This aforementioned scenario while not studied to date may be one that could have some bearing on current evidence that at least some older adults suffering from osteoarthritis had a higher corona virus 2019 infection rate and a poorer prognosis after being infected than those who were healthy [36]. Addi-

tionally, scientists have also discovered that COVID-19 infection might well cause certain undesirable pathological changes in the musculoskeletal system, even though the mechanism here is still not fully understood, but some evidence points to shared pathways implicating specific 'hub' genes that may prove valuable to investigate in the future, for example if these can be applied to develop some form of osteoarthritis immunotherapy [37].

## Discussion

With ageing of the population, the development and implementation of novel strategies for care of people aged 60 or more has become a crucial issue. Hence the World Health Organization [WHO] has set up an integrated care plan promoting healthy ageing by maximizing every person's intrinsic and functional capacity to achieve a life of high quality and one that accords with their life goals and personal preferences. This preventive model introduced since 2019, within the framework of the Decade of Healthy Ageing, is focused on reorienting care and social services and promoting continuity of care within a life course perspective, and encourages all health providers to adopt a unified and goal directed personalized orientation to enable its desired outcome [1].

In this context, in parallel with dire 2050 osteoarthritis prevalence predictions, and mindful of the multiple persistent global inequalities and injustices in health opportunities and access, the model aims to foster and address the unmet clinical and social needs that can prevent nursing home admissions for people aged 60 years or above [38].

All things considered, this global WHO initiative does seem imperative in general, as well as in the case of the burgeoning osteoarthritis epidemic in particular, and knowledge that in year-one of the COVID-19 pandemic, the multiple socially isolating and restrictive public health and other negatively impactful directives, while designed to promote good, also inadvertently exacerbated preexisting health-related inequities [39]. In addition, even though osteoarthritis has been studied for more than a century, the 2050 osteoarthritis epidemic projections indicate no break through reversal of this disabling state can be anticipated any time soon. Indeed, the recent COVID-19 pandemic may well have undermined the health status of even healthy aging adults that were not considered in the initial osteoarthritis projects [2]. Also overlooked may have been new evidence that points to a possible gene-based COVID disease-osteoarthritis linkage [36, 37, 40] that is not yet studied or resolved but may yet continue to pose immense current as well as future health concerns to those in the medical field, as well as health policy makers, and economic experts and economies, no matter where older people reside. Moreover, the dual impact of COVID-19 on osteoarthritis disability, as well as the risk of COVID-19 disease may continue to be profound no matter where older people reside and appears to be greater in the older impaired adult already diagnosed as having disabling osteoarthritis.

At the same time, less attention to the fact patients with either of these conditions often show a large array of concomitant pathologies, such as diabetes, inflammation, and cardiovascular diseases that may therefore increase complications fails to highlight the importance of assessing the individual needs of the older adult especially if they are hospitalized [15]. As well attention to the mental health and neurological impacts of the

COVID-19 pandemic, which may be greater than that of the viral infection alone, is remarkably understudied [41, 42]. Additionally, many different osteoarthritis treatments, such as non steroidal anti-inflammatory drugs, over the counter pain killers, corticosteroids, narcotics, or other molecules have a wide array of iatrogenic effects, and their use may have increased in those with advanced disease inadvertently because surgery was delayed with multiple adverse impacts [1,43,44].

In essence, even if what is posted on the data bases reviewed arguably suffers from publication bias, a link or possible association that could heighten the dire 2050 osteoarthritis prevalence projections adversely cannot be ignored. As well, how this will affect susceptibility to viral infections and treatments in older adults with disabling pain is unknown. Based on the knowledge that older adults in many parts of the world can be expected to suffer immense challenges when compared to their western counterparts, it appears reasonable to propose that until more data are forthcoming the idea that efforts to optimize health for all at any age and under all conditions is likely to prove more favorable than ignoring these strategies.

To date therefore, even if biological weapons can be forged in the future, in our view sufficient data support building an improved continuum of health policies to support promoting health promoting institutions, training centers especially for allied health workers, family medicine and geriatric care, social workers, and psychology specialists that is geared to foster health behaviors and positive valid beliefs from the earliest point in time for all. One that can strengthen the public health role in protecting citizens in all spheres, and that fosters functional independence and food systems that can help to nourish citizens' so they can counter infectious agents or recover rapidly from any undue insult. Societal efforts and norms oriented to health promotion and disease prevention rather than a sole reliance on the medical model appear imperative in this regard, as are persistent efforts to reduce or minimize muscle weakness and frailty, obesity, stress, and loneliness among those who are aging. Fostering a sound balance between emotional, psychological, mental, social and physical health attributes by consistently attending to these realms of influence on individuals who are aging regardless of health status are especially encouraged [9].

In the interim, emergent data reveal some support for an interactive role for both COVID-19 as well as osteoarthritis disability protection that should be more carefully explored. Nonetheless careful evaluation followed by a well-designed ongoing tailored integrated effort to enhance the adult's physical, social, as well as psychological wellbeing embracing efforts directed towards the promotion and maintenance of items below is likely to prove beneficial including:

- Healthy nutrition/weight
- Regular exercise
- Stress reduction
- Sleep
- Social support
- Herbal/plant-based remedies for pain/COVID-19 protection
- Controlled breathing practices
- Gardening/outdoor exposure
- Use appropriate assistive devices
- Practice of social distancing, masking, hand washing [44-49]

In addition to providing a personalized holistic care approach, both the formal as well as the informal providers can surely play a sound role in fostering the life quality and optimal wellness of at risk older or aging adults, including those with long COVID-19 disease by employing and implementing carefully guided periodic empathetic actionable communications designed to allay anxiety, reinforce optimism, and foster general as well as behavior specific self-efficacy beliefs and expectations. Pain patterns that are specifically evaluated periodically, and addressed accordingly, along with estimates of muscle strength [10] and knowledge of how the two health conditions examined here can spread or worsen is likely to prove essential as well. Moreover, to avert excess fatigue, declines in physical function, sub-optimal exercise levels, and low life quality perceptions, efforts to optimize patient outcomes following COVID-19 as well as osteoarthritis surgeries that are carefully tailored and integrated according to the patient's age, mental health and social situation are indicated [5, 10]. Advocating for increased investments and a continuum of providing for adequate nutrition access, safe housing and living conditions regardless of health status can surely help support older adults worldwide to attain or maintain their highest health level, thus possibly mitigating preventable health care costs in the future.

To this end, subject to future study, and despite any current review shortcomings and lack of in depth analytic qualitative as well as quantitative and temporal analysis, current data imply that a concerted multipronged interdisciplinary effort implemented sooner, rather than later by an integrated effort of both skilled practitioners as well as their older vulnerable clients as outlined above may greatly foster their overall wellbeing, while empowering the individual to take charge of their health on a daily basis and become an informed and resourceful self-manager and self-advocate. As well, even if generic, this approach may minimize or avert COVID-19 risk as well as osteoarthritis debility to a meaningful degree and in line with WHO goals for healthy aging. Moreover, an early upstream perspective to counter aging adults as well as a proactive approach may save limited personal as well as public health resources. It may also foster a higher chance of disease resistance and/or resilience and recovery trajectories if hospitalized, regardless of vaccine availability, while decreasing the need for COVID-19 hospitalization and possible corticosteroid administration thereafter that holds a possible risk for bone attrition or avascular bone necrosis that can predate, exacerbate, or foster osteoarthritis risk [51]. In addition it may minimize the usage of other pharmacologic approaches as far as many older adults are concerned, which are all possible COVID-19 as well as osteoarthritis analogs, such as falls that can foster pain and a sedentary state of being [52].

In absence of any current and foreseeable options, and to advance this line of endeavor, and avert untold suffering and societal costs, less emphasis on current assumptions and artificially generated data sets, more acceptance of complementary medicine theories and practices, older adult voices, practice based evidence, the need to develop more complimentary safe or novel programs to avert excess pain and stress, including fear based media messages as well as new funding streams, and training of local leadership and allied health personnel are urgently required.

In the meantime, while none of the above basic health affirming and protective recommendations, practices or suggestions

extracted from the body of contemporary thoughts and practices, are at all wide reaching or inclusive, and are largely not validated empirically to any meaningful degree, nor original or targeted in nature, the unintended consequences of COVID-19 and its unknown future ramifications that may partially amplify osteoarthritis prevalence and disability severity and costs, strongly suggests acting now in one or more of these respects is likely to prove highly desirable and valuable. In particular, to avert excess disability among older adults who have osteoarthritis, but limited health resources, as well as COVID-19 survivors who may yet develop osteoarthritis, in accord with the biopsychosocial model of health promotion, the degree to which social determinants rooted in the economic, social, and environmental circumstances of society may impact older adults ability to carry out self-protection actions and behaviors among those at risk for osteoarthritis should be duly and insightfully explored and be addressed accordingly in main-stream community based health centers.

In the interim, and despite a limited evidence base, it appears increasingly apparent some older adult-associated health costs within the society are not inevitable, and attention directed towards their upstream causes that in turn places needed resources and support mechanisms in place accordingly are strongly advocated to foster overall healthy aging for all- and to specifically offset the 2050 osteoarthritis dire predictions. This in our view is not only humane, just, and ethical, but done with great determination and concerted collaborations has the potential to significantly reduce the currently enormous health gap between the 'have' and 'have not' countries, and the associated degree of suffering manifest currently in all aging population, where those most vulnerable to the COVID-19 virus/variants are often those with the more severe osteoarthritis disadvantages, and multiple co existing health conditions found to parallel this disease, especially those that are poorly managed.

## Conclusions

Despite multiple gaps in our understanding and the fact this is a limited overview, it appears safe to conclude:

1. The magnitude of potentially preventable suffering among the older populace in the context of COVID-19 is clearly immense and is compounded in the presence of poor health, including the disease known as osteoarthritis and the mythology that osteoarthritis is incurable and inevitable.
2. Shifting the view from a tertiary care model involving drugs, biologics, and surgery to a primary prevention model that embraces complementary non pharmacologic approaches holds great promise for older adults at risk for COVID-19 as well as osteoarthritis.
3. A failure to act comprehensively in 2023 and beyond will likely produce outcomes far in excess of current 2050 osteoarthritis projections alone.
4. In the interim, osteoarthritis is likely to be worsened directly as well as indirectly by the COVID-19 pandemic in multiple ways, and allied health, medical personnel, and policy makers, are strongly encouraged to work together to foster a brighter perspective as to what can be done to foster life quality and prevent any excess disease burdens in all aging populations, wherever they currently reside.

Indeed, to avert a major health catastrophe, and until some curative remedy emerges, in one or both cases discussed here, carefully construed exercise participation, nutritional, lifestyle, and socially supportive provider communication approaches as

enumerated are recommended. A broader favorable outlook as regards complementary health opportunities here may be especially more helpful than not in efforts to address and limit the immense consequences for society at the individual and economic and social levels of the current pandemic situation.

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