

Covid-19 frailty impacts and implications

Abstract

Both the presence of the corona virus (COVID-19), plus the widespread prevalence of frailty among older adults are immense current major health concerns in most aging nations. This review examines the association between COVID-19 and its variants on frailty development, as well as its exacerbation of concurrent frailty among older adults and health outcomes. It specifically examines if more comprehensive impactful preventive and rehabilitation efforts are warranted in this regard, if indeed, a fourth or fifth wave of this infectious disease emerges, and vaccines may not prove one hundred percent effective. To this end we examined peer reviewed English language articles published between January 1 2020 and January 31, 2022 concerning frailty relative to COVID-19 regardless of report type. The aim was to identify if specific interventions to offset the risk of incurring both COVID-19, as well as frailty are warranted at this time of widespread repeated lock downs and service closures or delays. In particular, support for an enhanced focus on preventing both COVID-19 infections as well as frailty was examined. Based on available data, we conclude older adults who are in poor health and test positive for COVID-19 are also likely to be frail or to develop excess frailty due to a combination of social and economic factors, as well as cognitive factors. To avert any preventable excess suffering along with the immense social costs experienced by both the affected individual, as well as society, heightened efforts to minimize COVID-19 infection risk, along with frailty prevention approaches appear imperative especially among isolated older adults suffering from osteoporosis, poor nutrition, pain, cognitive challenges, and muscle weakness.

Keywords: COVID-19, corona virus, frailty, infection, intervention, mortality, older adults, omicron, prevention, prognosis

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Introduction

Over the past three years, the world has been beset by endless problems and multiple premature cases of mortality caused by the novel corona virus COVID-19 [SARS-CoV-2]-a multi-organ infectious disease characterized by a high level of contagion, inflammation and high catabolic consequences,^{1,2} now evolving into the subsequent albeit slightly less lethal Delta, and Omicron current COVID-19 variants. At the same time, even though many experience only mild disease manifestations, most affected remain older adults with multiple health conditions,³ high levels of chronic inflammation, immune system declines and those who become or are frail with associated decreased anti-stress ability.^{2,4-6} Moreover, according to some, it is just as likely that the annual incidence of frailty a condition associated with declining function and increasing vulnerability to stress² and common among older adults will continue to rise as a result of COVID-19 associated factors, such as its probable impact on advancing sarcopenia (bone and muscle mass losses)¹ and increasing rather than decreasing functional deterioration and disability plus life expectancy and possible increases in frailty prevalence.⁷ In addition, current data to this effect may not have included or accounted for the fact that social isolation may be a very potent frailty antecedent in its own right. Data do not account furthermore for other possible associated COVID-19 - related complications such as poor sleep patterns, increases in sedentary activity, inflammation, and higher chronic pain levels that are possibly unrelieved in the absence of needed but now curtailed ongoing health services, especially among the frail.³

Indeed, since the onset of the corona virus pandemic that began in Wuhan, China in early 2020, older individuals, living either in the community or an institution already infected by COVID-19, appear likely to be negatively impacted in many respects, not only

by infection effects, but by possible persistent vulnerability to these viral infections as well as declines in health especially if they are frail or pre frail. This includes, but is not limited to an increased risk for premature mortality, as well as atypical vaccine responses in some cases,³ and possible higher vaccine-related fatality rates.⁵ Infection risk and its oftentimes dire consequences in turn, can undoubtedly induce frailty transitions that may significantly heighten COVID-19 risk.

Given that the COVID-19 pandemic, even if waning, is still likely to induce immense suffering, while placing an immense overall burden on public health care systems and service providers for some time to come, it appears more insights into whether preventive approaches to counter frailty, which is not necessarily age-induced,³ along with more concerted efforts to reduce the risk of COVID-19 infections among vulnerable older adults appears warranted as suggested by Hussein et al.³ and Maltese et al.⁸

Moreover, in consideration of multiple disabling orthopaedic problems alone, such as falls and fractures, along with COVID-19 associated bone fragility implications, plus pain, that can all perpetuate frailty, as well as increasing stress vulnerability, establishing whether more timely and comprehensive integrated efforts to prevent, avert, or reverse frailty and its negative impacts on multiple body systems, including the immune system in vulnerable older adults appears strongly indicated.

Accordingly, this review sought to examine the extent of support for the idea that more intense preventive strategies against frailty, as well as COVID-19 infections and their long-term effects among the 'at risk' elderly living in the community are warranted, as discussed by Maltese et al.⁸

It also sought evidence as to whether there is agreement that

averting premature as well as excess frailty in vulnerable older adults populations will tend to reduce the high risk for COVID-19 infections and their oftentimes associated negative outcomes.

To this end, articles that discussed frailty and its bidirectional association with COVID-19 and published since 2020 were sought. Since COVID-19 is prevalent in some form in almost all parts of the globe as of January 2022, and its variants appear readily transmissible and highly infectious, ideas linked to thoughts on how to mitigate the current and possible future wave of excess deaths and suffering among older adults was specifically sought.

Rationale

The frail elderly who are generally at high risk for infections, when compared to the younger adult or non frail populations,³ may not only develop a more severe form of COVID-19 and a different response to COVID-19 vaccination than anticipated,^{3,9} but they may become depressed, have sleep challenges, and fears of the future, among other negative health determinants.¹⁰ As well, both sarcopenia as well as frailty may ensue or be heightened inadvertently in the face of those public health efforts designed to mitigate COVID-19, such as isolation.^{10,11} They may also suffer more adverse COVID-19 consequences as well in face of any overall failure to identify and investigate frailty in its entirety if hospital resources need to be directed towards contagion control, nursing shortages prevail, and mental health services are curtailed.¹⁰ These include, but are not limited to: an increased risk of all-cause mortality, COVID-19 severity, intensive care unit admissions, plus a need for mechanical ventilation.

In addition, frail older adults returning home from the hospital may still be at risk for a cumulative negative impact as a result of their exposure to a bout of COVID-19 disease due to persistent fears and anxiety, probable muscle mass as well as bone mass losses, along with muscle fat gains¹¹ if home services and therapies are persistently curtailed or restricted.

Since the COVID-19 epidemic does not appear to be abating, and those older adults who are at risk for frailty caused by a decrease in physical activity and/physical ability or those who are already frail may experience worse than desirable outcomes both in the hospital as well as the home environment, it appears efforts to examine some current findings specifically concerning frailty and COVID-19 in the face of increasing exposures of many in all societies to the variants known as Omicron and Delta will prove insightful.

Method and procedures

To fulfil the aims of the present report, all pertinent full length published studies in the English language detailing the impact of COVID-19 on frailty in the **PUBMED, PubMed Central, WEB of SCIENCE and GOOGLE SCHOLAR** data bases over the time periods January 1 2020 - January 31 2022, using the key words 'COVID-19, corona virus, COVID, and frailty, frailty syndrome, or fragility'. The focus was on identifying any emergent themes and evidence of a need for more preventive efforts in this regard, especially from an orthopedic viewpoint. Items selected for review were those discussing the impact of COVID-19 disease on frailty, fragility fractures, desired changes to hospital procedures or recommended changes in the future, as well the present, plus the impact of COVID-19 on frailty. To provide a comprehensive summary of the available research findings, only a descriptive and narrative approach was deemed feasible.

Results

The current search showed that while the role of multiple factors implicated in frailty onset and its adverse outcomes, such as coronary artery disease are topics that are quite extensively reported, considerably less data describing the association between the various SARS-CoV-2 variants, including the Omicron variant, currently prevails. This is despite the widespread presence and infection potency of the Omicron variant among older adults who may already be at a heightened for excess mortality.⁵ In general though, there appears to be some support for a generally negative impact of COVID-19 on the prevailing health status of the older adult, regardless of their physical disposition, including a probable irreversible downward spiraling of frailty or a heightened frailty state and its multiple adverse consequences.¹² At the same time, and as outlined by Hoffman et al.¹³ findings indicate that available vaccines are not only very unlikely to be effective against the specific most currently common Omicron COVID-19 variant, as a whole, but specifically among the frail elderly where the processes involved in vaccination are often highly challenging and may prove harmful.⁵ At the same time, those who are frail may also face multiple other health challenges that may be expected to increase their vulnerability to severe COVID-19 infections.

This impact is not an isolated one in that according to Andres-Estaban et al.¹⁴ this group found 13.39% of their admitted COVID-19 patients were indeed clearly in a pre-frail state and 17.32% were already frail. In addition to shorter hospital stays, and less frequent ICU admissions, the presence of frailty appeared to be accompanied by high mortality and delirium rates, a finding generally supported in a current meta analysis of frailty and the probable impacts of COVID-19 in multiple other venues.¹⁵

At the same time, it appears safe to say that regardless of data source or venue, older adults deemed frail, including those who may exhibit cognitive and/or psychological frailty, along with those may suffer increasing signs of physical frailty due to social isolation and subsequent loneliness in its own right may suffer significantly.¹⁶ As well, those frail elders with poor bone health and who may sustain fragility fractures at higher than normal rates, are also likely to experience a higher 30-day post-surgical mortality rate than the norm, if surgery is indicated, especially if they are COVID-19 positive. At the same time, those long-term medical regimens that are essential to the wellbeing of the older adult, such as osteoporosis management, may be discontinued or greatly disrupted in response to public health safety rulings with highly adverse results.¹⁷

In this regard, while the literature focuses on the physical effects of COVID-19 infections, the effects of lock downs and other COVID-19 safety procedures on infection risk, as well as on general wellbeing and safety are less well articulated. Moreover, the influence of multiple morbidities, as well multiple medications, and severe pain and its association with frailty, as well as a heightened COVID-19 risk are poorly documented topics at present, despite their importance in the context of providing vulnerable older adults with optimal management strategies and services that are strongly advocated.¹⁸⁻²⁰

In this respect, Nanduri et al.²¹ recently concluded that there is a clear need for continuous efforts to mitigate the risk as well as the consequences of COVID-19, in addition to vaccinations that can possibly optimize a protective immune response. As well, more attention to the role of self-imposed house bound restrictions,²² muscle weakness, fatigue, and environmental safety factors, as well as inflammation, and the importance of persistent efforts to participate

in physical exercises and outdoor activities appears desirable.^{19,23–26} Alternately, a persistent lack of insightful timely preventive approaches will undoubtedly foster an immense degree of unpredictable yet possible preventable suffering, including the heightening of any prevailing age-associated disease, as well as immense neurological and cognitive health challenges, plus a possible heightened infection risk among the frail elderly, including COVID-19 survivors.^{2,27}

Consequently, as outlined by Abbaticola and Antonelli-Incalzi,¹² not only is geriatric medicine now being faced with a new ‘worldwide enemy’, namely COVID-19, but together with older age, hypertension and Type 2 Diabetes, and infection associated cognitive and physical health degenerative correlates a novel syndrome of high clinical importance warranting immediate attention, namely, the “COVID Spiraling Frailty Syndrome” appears to have emerged.

Indeed, the strong cumulative impact of COVID-19 on the heightening of age-associated diseases as well as neurological and cognitive health challenges including its impact on physical function, mobility, systemic inflammatory states, and neural-degeneration may predictably result in both a reduced ability to function physically and independently, plus unanticipated declines in life quality,^{28,29}

along with greater frailty, a greater risk of traumatic falls, and higher hospital admissions for fragility fractures.²² As well, anticipated post COVID-19 consequences include slower than desirable surgical recovery rates, if surgery is required, an increased risk of re-infections, future falls and second or multiple fractures, even if timely surgery and rehabilitation strategies for restoring functional recovery post-surgery are available.

It also appears that SARS-CoV-2 associated with hyper-inflammatory involvement tends to exacerbate immune system aging processes, endothelial damage, and myofibrillar breakdown as well as muscle degradation, while fostering a heightened catabolic state of wellbeing. Moreover, an associated decline in physical activity due to weakness, coupled with lock-downs, and excess bed rest, plus systems that place little value on older adults,²² is likely to intensify the magnitude of any ensuing acute or chronic physical frailty or associated sarcopenic process as well as immense suffering unless carefully construed timely multi-modal comprehensive intervention efforts are forthcoming.^{1,22,30} To garner a sense of the diverse viewpoints and issues embedded in the current literature that surely warrants attention both in the present time as well as for some time to come Table 1 below presents selected highlights thereof.

Table 1 Selected findings from current 2020-2022 literature on frailty and COVID-19 associations and implications

Authors	Type of report	Key finding
Abattecola and Antonelli-Incalzi ¹²	Commentary	Frailty, a “syndrome characterized by a clinical state is one of increasing individual vulnerability to developing an increased dependency and/or a heightened risk of premature mortality when exposed to a stressor” This syndrome should be considered as a constantly evolving one and only reversible if recognized and appropriate timely intervention is applied.
Andrew et al. ³¹	Evidence based discussion	Strong and coordinated surveillance and research focused on long term care homes and their frail residents is indicated. These efforts should include widespread frailty assessments that utilize feasible and readily available recognized tools.
Aw et al. ³²	Cohort study of 667 inpatients at one site	Frailty is associated with all cause mortality in older inpatient adults, aged 65 years or higher and suffering from COVID-19.
De Smet et al. ³	Single center observational retrospective study	Despite their negative prognosis, even the oldest and most severely frail patients may benefit from hospitalization for COVID-19, if sufficient resources are available.
Greco et al. ³⁴	Nested case [n=76] control [n=76] study of COVID-19 in institutional care	COVID-19 can accelerate the aging process of institutionalized older adults in terms of physical performance and frailty by around 20%.
Hagg et al. ³⁵	Single center observational study	In addition to age, level of frailty is a useful predictor of short-term COVID-19 outcomes in geriatric patients.
Hewitt et al. ³⁶	Observational cohort study of 1564 COVID-19 cases mean age 74 years conducted at 10 hospitals	In a large hospitalized COVID-19 patient population, COVID-19 disease outcomes were more strongly predicted by frailty than either age or co-morbid disease status.

Table Continued

Authors	Type of report	Key finding
Knopp et al. ³⁷	Cohort study 217 cases	COVID-19 may present without cardinal symptoms as well as implicate a possible role for age-related changes in immunity in mediating the relationship between frailty and mortality.
Kodama et al. ³⁸	Retrospective study	<p>The observed increase in the rate of the transition of elderly individuals to the social frailty group during COVID-19 may have been due to the implementation of the prevailing stay-at-home order countermeasures.</p> <p>The increased prevalence of depressive symptoms associated with the stay-at-home order could also have influenced the increase in the prevalence of social frailty.</p>
Ma et al. ⁹	Prospective cohort study of 114 hospitalized adults with COVID-19 60 years or older	Frailty heightened the risk of developing severe COVID-19 disease and should be assessed routinely among at risk older adults using a clinician friendly assessment approach.
Maltese et al. ⁸	Systematic review-May 2020	<p>Frailty was only investigated in regards to its association with overall mortality, hospital contagion, intensive care unit admission rates, and disease phenotypes in the few observational studies retrieved.</p> <p>Specific interventions as regard frailty or its impact on COVID-19 treatments have not yet been evaluated.</p>
Owen et al. ³⁹	Retrospective observational study	All-cause mortality at 30 days rose from 9 (not frail) to 33% (severely frail) in the COVID-negative cohort but was around 60% for all frailty categories in the COVID-positive cohort.
Pranata et al. ¹⁵	Meta analysis and dose-response related review	COVID-19 is stronger indicator of mortality than frailty. Increases in frailty as identified by the Clinical Frailty Scale were associated with increase in mortality in a linear fashion.
Pan et al. ⁴⁰	Discussion	<p>Frail patients have reduced reserve to respond to stressors; it is therefore necessary to also prevent these patients from exposure to the virus</p> <p>Further research is required to understand the value of frailty assessments in the community and their role in triaging patients and preventing unnecessary admissions to hospital.</p>
Poco et al. ⁴¹	Longitudinal observational study	<p>Atypical COVID-19 presentations are common in frail and older hospitalized patients.</p> <p>Providers should be aware of unspecific disease manifestations during the management and follow-up of this population.</p>
Shinohara et al. ⁴²	Community based prospective cohort study conducted in Japan with (n=1953)	<p>Transition rate from non-frailty to frailty over 6 months was 9.8% in these older adults</p> <p>The observed increase in frailty could be associated with COVID-19 countermeasures.</p>
Wanhella et al. ⁴	Review	While biomarkers of ageing and frailty may predict COVID-19 severity, socio-economic factors such as access to adequate health care remaining may influence COVID-19 outcomes significantly.

In short as outlined by Brigauglio et al.²² high numbers of older adults may suffer from frailty, which is known to be associated with disability, traumatic falls, and hospital admission, and may also predict worse than desirable COVID-19 outcomes [Belelli; Kow], a lower vaccine impact,³ and a higher risk of severe disease.⁹ Also

predicted are higher than desirable mortality rates³⁶ and a higher need for care services post hospitalization.³ As well, a host of adverse short term and possibly long-term outcomes after COVID-19 exposure³⁵ may ensue or interact as per Figure 1 and especially in the face of:

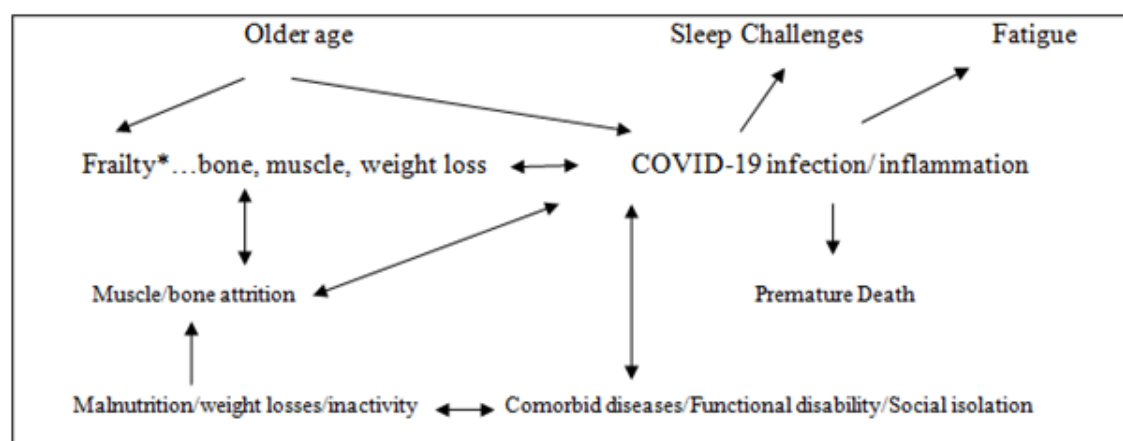
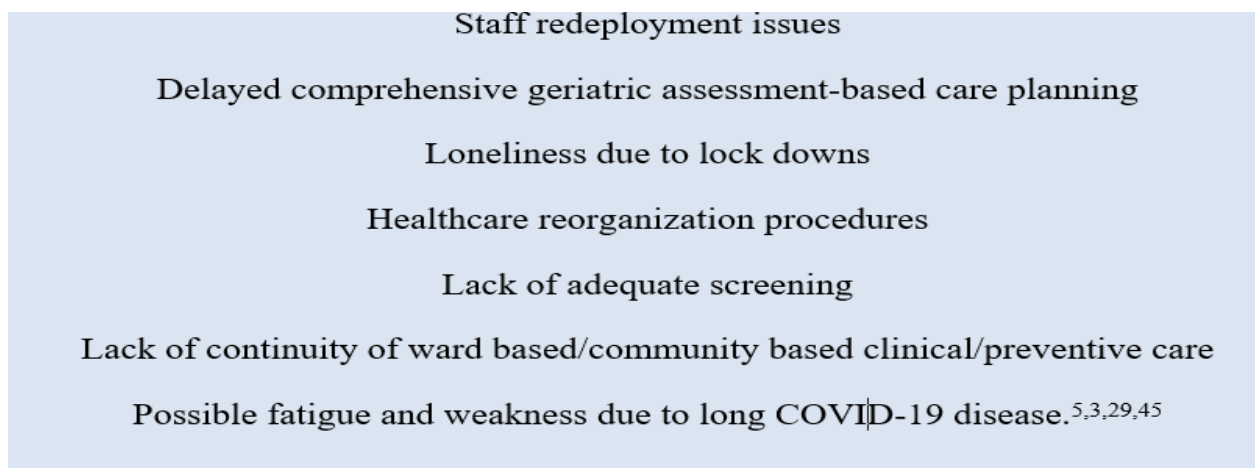


Figure 1 Possible bi-directional interactions of COVID-19 and frailty that may induce multiple adverse health outcomes among the elderly and implying a strong need for screening sooner rather than later, plus integrated multi level, personalized interventions.^{2,23,44-46}

In sum, the COVID-19 pandemic has clearly engendered multiple possible adverse health outcomes for many older adults that warrant attention.^{6,29,36,44-46} This includes but is not limited to enhancing available community based safety strategies to counter COVID-19 where vulnerable adults are located,³ novel vaccination strategies and their application to the frail elderly of higher ages, and possible novel policy related protocols and mandates in long-term care facilities.⁵ In addition, future frailty research approaches are clearly imperative in this regard⁴⁷ especially to expand upon the hypothesized attributes and aging interactions depicted in Figure 1 and how these negative interactions might be mitigated or averted.

Discussion

While frailty in its own right is one of the most serious public health challenges facing aging nations, the advent of COVID-19 since 2019 has rendered many older frail or pre frail adults at high risk for COVID-19 infections, along with a heightened risk of premature

mortality, as well as multiple adverse health consequences among survivors even if they were previously in reasonably sound health. This is especially evident among undernourished, underweight, malnourished, and isolated older adults suffering from sarcopenia,²² reduced muscle strength and endurance, and those with a reduced ability to function physically and cognitively.² Indeed, as outlined in available cohort studies where frailty was assessed using the Clinical Frailty Scale, even though frailty may be viewed as a continuum, rather than a definitive state,⁶ a Frailty Scale value higher than five is found to accurately predict a higher mortality risk and use of mechanical ventilation after any COVID-19 disease onset, even though this was not the observation of Owen et al.³⁹ Other scales indicate frailty is associated with longer hospital stays and more severe forms of the disease, and that the extent of this association may be influenced in a dose response manner by the type and/or severity or presence of one or more concurrent chronic health issues.⁶ Additionally, the indirect health effects caused by the pandemic among frail adults, where their immune system might already be compromised, and which did not

prevail to any degree in pre pandemic times, are being shown to have an increasingly negative impact on the health status of older people, even if they recover or remain uninfected.⁴⁸ As well, the long-term effects of COVID-19 on cognitive wellbeing, accelerated aging, and the development or exacerbation of age associated chronic diseases, plus physical function post COVID-19 infection remains to be uncovered. However, based on what is observed, it is predicted that the unrecognized or poorly treated older frail adults will in all likelihood succumb to higher than desirable rates of severe COVID-19 disease as well as lethality,² thus placing an excess demand on an already overburdened array of health services.⁶

In this regard, Osuafor et al.⁴⁹ found older frail adults compared to non-frail patients to also be more likely to present with atypical symptoms including new or worsening confusion (45.1% vs 20.8%, $p < 0.001$) as well as a higher likelihood of dying (66% vs 16%, $p = 0.001$). Older age, being male, presenting with high illness acuity and high frailty were independent predictors of death and a dose-response association between frailty and mortality was observed. In addition, it is observed that frailty not only increases the risk for acquiring COVID-19,⁵⁰ but among those who survive the corona virus disease, those older adults who are frail are frequently found to incur high rates of post recovery morbidity⁵¹ and disability. At the same time, they may not only be at high risk for excess mortality rates^{33,52,53} as well as cognitive challenges, but also for systemic inflammatory changes that may lead to dementia and possible stroke.²

Hence, while the causes of COVID-19 remain obscure, there is growing evidence that multiple devastating outcomes other than the presence of infection may persist, even in the face of vaccinations to counter this. This is especially exacerbated in the face of frailty as observed by Kow et al.⁵⁴ who demonstrated a significant association between frailty status (regardless of degrees of frailty) and a higher odds of mortality, plus significant associations between increasing levels of frailty and a higher hazard of mortality. This increased risk of mortality, also noted by Pranata et al.¹⁵ which spanned the continuum of frailty in patients with COVID-19, was deemed partially as a consequence of a possible lack of allocation of desirable resources and failed screening and intervention opportunities due to COVID-19 restrictions, and that needs to be addressed in the future. The impact of COVID-19 on frailty development is also being evidenced as time ensues.

At the same time, persistent uncertainties in addition to isolation strategies, mixed messages, along with multiple service reductions, or services given by infected or unskilled personnel, in the face of shortages and clinic closures, along with few visible efforts to address the overlapping physical, cognitive, economic, and social challenges among the vulnerable frail elderly clearly continue to heighten COVID-19 risk even though the current Omicron variant is deemed less lethal as a whole than earlier variants. Frailty may also partly explain consistent high rates of falls that continue to occur in the home, and that may require hospitalization due to a hip fracture,²⁵ with its disabling and high mortality association, along with possible unwanted exposure to the COVID-19 virus, consequent to exposure to unvaccinated workers, and possible overall lack of well designed comprehensive care, and staff shortages.

Indeed, multiple authors now agree that if frailty is not addressed in its own right, relative to COVID-19 as well as health optimization in general, it is expected many older adults, will not only succumb to possible respiratory insufficiency and multi organ failure but to frailty itself as a reactive condition, especially in the face of suboptimal social

connectedness opportunities and resources.⁵⁵ Those who recover may also be expected to suffer a long-term negative impact when they return home where they may still be at risk for COVID-19,⁴⁹ pain, weakness, falls, and fracture injuries if they do not receive carefully construed tailored care, and if they remain socially isolated or perceive to be alone or in need of interpersonal interactions.⁵⁵

Thus, while not all groups concur,^{39,56} many show COVID-19 as being a potentially potent independent determinant of increased 30-day mortality rates. Moreover, while not well studied, those older frail adults with multi morbidities and pre existing or emergent bone fragility diagnoses do appear to be more likely than not to be impacted severely and possibly irreversibly in the face of COVID-19 infections,⁵⁷ and related public health measures, hence warrant more attention.⁴⁶

As well, and bearing in mind the multi-factorial origin of frailty, even those who were deemed non frail at the start of the COVID-19 pandemic, as well as those who acquired COVID-19 infections may exhibit signs of frailty, along with a possible heightened risk of osteoporotic fragility fractures, and more intense manifestations of medical health issues and complications, especially if isolated in the home.^{58,59}

To this end, and to counter the persistence of excess rates of frailty among older adults living in the community, and who are found to incur excess mortality rates if COVID-19 positive, a call for concerted efforts to improve diagnostic accuracy, and to better detect surges in virus infections,⁶⁰ and vaccine specificity and efficacy,⁶¹ as well as efforts to obtain a comprehensive picture of all aspects of the older adult in question if they are hospitalized has been put forth.⁴⁶

As well, the importance of early timely support and more resource allocation to aging adults towards ongoing supportive programs that can embrace and harness their abilities and motivation to age optimally, coupled with a personalized well conceived holistic intervention approach designed to heighten protective wellbeing, cognitive, social, and safety needs appears warranted.^{46,54}

Moreover, intense tailored regimens that can simultaneously counter frailty as well as COVID exposure and severity are strongly indicated, regardless of viral status, especially if they target those with multiple comorbid health conditions, those with diabetes, sarcopenia, impaired cognition, and depression, among other age associated negative health correlates. In addition provision of the following may warrant attention:

- a) Periodic infection/environmental safety and resource assessments
- b) Education concerning stress management and infection safety procedures
- c) Medication and food delivery, home care services
- d) Social support
- e) Recommendations for addressing social isolation and/or care disruption.
- f) Ongoing psychological/osteoporosis management approaches as indicated
- g) Adequate protein intake and diets/dietary access
- h) Sleep hygiene education
- i) Encouragement to pursue modest regular multi-component exercise activities

- j) Possible vitamin C, D and calcium supplementation
- k) Periodic health assessments and timely targeted integrated health promotion efforts

Source: [2,7,10,11,30, 46, 47,58,62–64]

In addition to the above practical ideas, more evidence based ideas and attention to the upstream factors that induce both frailty, as well as COVID-19 may prove insightful.^{47,65,66}

Conclusion

Since the onset of the COVID-19 pandemic, the significance of frailty as a key predictor of adverse outcomes has been consistently highlighted. In addition, non frail elders who succumb to COVID-19 and survive may become frail or enter a pre frail state. Until more research is forthcoming, and despite the lack of a well defined research data base and numerous interpretations of frailty within this data base it appears safe to conclude that:

Frailty among the elderly continues to result in excess health care costs as well as immense personal costs to society. Moreover, these costs have compounded in the wake of the COVID-19 pandemic and appear poised to increase further as the consequences of long term COVID-19 begin to emerge, and vaccines are showing limited efficacy among frail elderly adults, and in light of novel COVID-19 variants.

To avert the debilitating costly outcomes of currently hospitalized or institutionalized frail older adults, especially those with a parallel COVID-19 diagnosis, more timely upstream preventive efforts against both COVID-19 as well as frailty among at risk elders living in the community are strongly indicated.

In turn to reduce the impact of COVID-19 and its variants and their generally adverse outcomes, efforts to strengthen immune functioning and avert cognitive declines and social isolation as far as this is possible are indicated.

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Conflicts of interest

The authors have no conflicts of interest to declare.

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