Incidence of frailty and factors associated with functional deterioration in oldest old during the covid-19 pandemic: A cohort study

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Abstract

Objective: To assess the incidence of frailty in oldest old during the covid-19 pandemic and to evaluate the associations between the domains of the Clinical-Functional Vulnerability Index (IVCF -20) and frailty. *Methods:* A cohort study of 64 non-frail oldest old was conducted. Participants were evaluated at two timepoints: at baseline up to one year before the onset of the pandemic; and at follow-up, with an average interval between the two timepoints of 15 months. Frailty was assessed using the VS – Frailty (baseline) and remote application of the IVCF-20 (follow-up). *Results:* Mean participant age was 88.7±5 years and the incidence of frailty was 20.6%. Frail participants exhibited greater dependence shopping (p<0.001), controlling their own money (p<0.001) and doing housework (p=0.010), as well as bathing alone (p=0.041). Cognitive decline was more prevalent in the frail individuals. The presence of despondency sadness or hopelessness proved high (92.3%) and was associated with frailty (p<0.001). On the multivariate analysis, frailty was associated with worsening forgetfulness (RR=2.39; 95%CI 1.27-4.46), loss of interest and pleasure in performing activities (RR=4.94; 95%CI 1.98-12.35) and fecal/urinary incontinence (RR=2.40; 95%CI 2.91-1.53). *Conclusions:* The incidence of frailty among the oldest old during the pandemic was high. Results showed that multiple domains were affected, reinforcing the need for broad evaluation of older individuals as a whole, especially in atypical periods such as the pandemic.

Keywords: Frailty. Aged 80 and over. Telemedicine. Covid-19.

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INTRODUCTION

The oldest old, individuals aged ≥80 years, is the fasting growing age group worldwide and, in Brazil, represents around 15% of the older population[1]. While most projections consider age only, the population does not age homogenously, where older individuals have different degrees of vitality or frailty[2].

Level of vitality depends on homeostatic reserve and the body´s ability to cope with negative health events[2]. In this respect, age is a risk factor for loss of vitality and frailty, but not a determinant of this outcome[2]. Healthy aging can be defined as preservation of global functioning of older adults, supported by autonomy (cognition, mood and behavior) and independence (mobility and communication)[3] which enable well-being in aging[4].

Thus, the dynamic of aging is complex, involving a balance of the individual´s intrinsic capacity, the environment, and interaction between these two, shaped by resiliience[4]. Adverse situations, such as the emergence of the novel coronavirus[5], can disrupt this dynamic.

The covid-19 pandemic was officially declared in March 2020, with ensuing recommendations for social distancing and lockdowns[6]. Although the same environment can affect older adults differently and in highly disparate ways[6], social distancing and lockdown measures can have secondary impacts on the health of the population. These affects include psychological factors with worsening of anxiety and depressive symptoms associated with social disconnection, in addition to life-style changes, such as reduced level of physical activity, which can influence physical health and have a negative impact on functioning[8]. All of these changes can contribute to the development of frailty[9,10] on a broader level, particularly in the oldest old who are at higher risk of becoming frail. However, to date, most related studies have been conducted in developed countries and fail to stratify older adults into sub-age groups.

The primary measure of the multidimensional aspect of health of older adults is the Comprehensive Geriatric Assessment (CGA), a tool for identifying and managing frail older people[11]. However, the instrument takes a long time to apply and must be administered by specialized teams [12]. Moraes et al.[12] devised the shorter Clinical-Functional Vulnerability Index-20 (IVCF-20), an instrument for detecting clinical-functional vulnerability[12]. This screening is carried out by means of a questionnaire scale which uses the CGA as a reference standard. The index, similarly to the CGA, is designed to collect information on the indicators age, self-rated health, activities of daily living, cognition, mood, mobility, communication and multiple comorbidities[12].

Therefore, based on the hypothesis that lockdown and social distancing can contribute to the development of frailty in non-frail older adults, the objective of the present study was to assess the incidence of frailty during the covid-19 pandemic and evaluate the associations between the domains of the IVCF-20 and the development of frailty.

METHOD

A cohort study of oldest old treated at the Healthy Aging Clinic of the Jenny de Andrade Faria Institute of the Clinical Hospital from the Federal University of Minas Gerais, Brazil, was conducted. The clinic is part of the Referral Center for Older Adults. The study involved two assessment timepoints: baseline – between March 2019-2020; and follow-up – between November 2020 and October 2021, with an average interval between timepoints of 15 months.

The inclusion criteria were: older adults of both genders, aged ≥80 years, and non-frail 12 months before the onset of the pandemic, defined as March 2020 according to the WHO declaration[6]. Centenarians were included irrespective of their functional status, being considered examples of healthy aging[13]. Older adults who did not possess a telephone to allow remote contact and data collection were excluded from the study.

Frailty at baseline was classified according to the multidimensional frailty model of Moraes et al.[14] under which Clinical-Functional Classification is categorized on the Visual-Analogue Scale of Frailty (VS–Frailty). With this model, older people are classified into categories (1-10) based on the progressive reduction in vitality associated with increase in frailty[14]. Non-frail older individuals

are classified into the 1-5 category. The use of this method is consistent with the WHO International Classification of Functioning with an emphasis on functioning[14].

During follow-up, given the social distancing and lockdown down measures in place and discontinuation of elective visits at the clinic, frailty was assessed by applying the IVCF–20 (https://www.ivcf20.org) remotely. This instrument was chosen for its ease of application in remote form. The questionnaire was applied over the telephone by previously trained researchers.

Of the total eligible patients (134), 68 could not be contacted: 13 because they did not possess a telephone and 55 because the number registered was not the patient´s or the call did not go through. There were no cases of death due to infection by covid-19. The final sample is depicted in Figure 1:

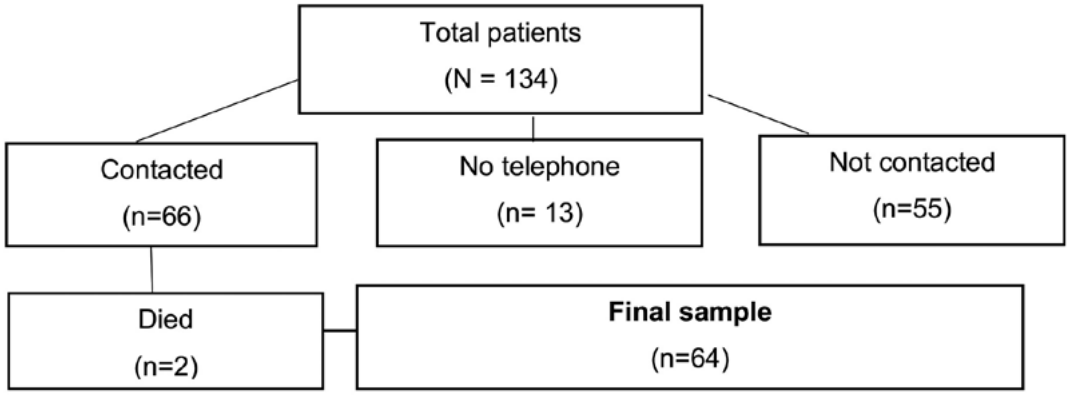

Figure 1. Sample selection based on total number of patients enrolled at Healthy Aging Clinic, 1 year prior to covid-19 pandemic.

The IVCF–20 comprises 20 items divided into 8 domains, namely: age (1 item); self-rated health (1 item); functional disabilities, subdivided into basic and instrumental activities of daily living (4 items); cognition (3 items); mood (2 items); mobility, subdivided into reach, grasp, and pincer grip, aerobic capacity and/or muscle strength including unintentional weight loss, body mass index (BMI), calf circumference and gait speed, and fecal/urinary incontinence (6 items); communication, which includes vision and hearing (2 items); and multiple comorbidities, including polypathologies, polypharmacy and recent hospitalization (1 item).

Owing to the fact the questionnaire was applied over the telephone, the mobility domain did not include the calculation of BMI, measurement of calf circumference or timings of gait speed, as per adaptations for remote application[15]. Each domain has specific scoring with maximum of 40 points. A total score in the 0-6 points range indicates the respondent has low clinical-functional vulnerability and is likely robust. A score of 7-14 points suggests the respondent is at risk of becoming frail (pre-frail), while a score of ≥15 points suggests the individual is frail (high clinical-functional vulnerability)[12]. Robust older adults are individuals who are independent for all basic and instrumental ADLs, irrespective of having diseases or otherwise. Individuals at risk of becoming frail retain their independence but have chronic conditions that predict functional decline, such as multiple comorbidities, sarcopenia or mild neurocognitive disorder. Frail individuals exhibit functional decline[2].

On the statistical analysis, the normality of the continuous variables was checked using the Kolmogorov-Smirnov test. Continuous variables displaying a normal distribution were expressed as mean and standard deviation, whereas categorical variables were expressed as absolute number and percentage. Categorical variables were compared

using Pearson´s chi-square test or Fisher's Exact test, depending on the proportion of expected frequencies <5. Development of frailty was determined based on change in functional status between baseline and follow-up. Although two different methods (VS-Frailty and IVCF-20) were used for comparing functional status, they have a high positive correlation, given that both are designed to identify older individuals who are frail[12].

The Poisson Regression model with robust variance was employed to explore the relationship of change in functional risk (worsening or stable risk of vulnerability) with the categories of the IVCF-20. Predictor variables with a p-value of <20% ($p<0.20$) on the bivariate analysis were added one by one into a multivariate regression model using the forward method. Non-significant variables were excluded and a new variable included reiteratively until inclusion of all variables. The procedure was repeated until all variables present in the model were statistically significant ($p<0.05$). The Hosmer-Lemeshow test was used to check the goodness-of-fit of the final model. The relative risk (RR), with a 95% confidence interval (95%CI), was used as the measure of effect. For all statistical analyses, a level of significance of $p<0.05$ was adopted. Given that the sample could not be calculated *a priori* because the number of patients enrolled and contactable by telephone was pre-defined, analysis of the power of the tests (post-hoc) was performed using the G*Power 3.1 software, where a minimum power of 80% was defined.

The study was approved by the Research Ethics Committee of the University (CAAE: 80295616.1.0000.5149 and approval permit no: 2422800).

RESULTS

The final sample comprised 64 older adults, of which 40 (62.5%) were female. Participants had a mean age of 88.7 ±5 years and 27 (42.2%) were nonagenarians or centenarians. Three individuals (4.7%) became infected by the coronavirus during the study period, 2 of whom became frail following the infection. However, none of these patients died as a result of SARS-COV-2. One year prior to the pandemic, 98.4% of participants were non-frail and only 1 (1.6%) individual (a centenarian) was frail.

Frailty incidence during the pandemic was 20.6% (13 individuals) (Table 1).

Comparison of the IVFC-20 regarding development of frailty (Table 2) revealed no group differences only for the variables falls ($p=0.092$) and reach, grasp and pincer grip (inability to raise arms above shoulder level ($p=0.052$) and inability to handle/hold small objects ($p=0.289$). Test power was high for variables exhibiting statistical significance, except for the variables no longer bathes alone or does domestic chores (0.34 and 0.73, respectively).

The analysis of Poisson Regression of robust variance exploring the association of frailty (presence or otherwise) with the IVCF-20 domains revealed a 2.39 times greater frailty incidence in individuals who experienced worsening of forgetfulness, 4.94 greater in those reporting loss of interest/pleasure in activities, and 2.4 times greater incidence in participants with fecal/urinary incontinence (Table 3).

Table 1. Development of frailty of oldest old during SARS-COV-2 pandemic. Belo Horizonte, Brazil 2020 – 2021.

Frailty status	Baseline	Follow-up	Frailty incidence
	N (%)	N (%)	N (%)
Non-frail	63 (98.4)	50 (78.1)	+13 (20.6)
Frail	1 (1.6)	14 (21.8)	

Table 2. Comparison of oldest old developing and not developing frailty, by domain and respective items of IVCF-20, during covid-19 pandemic. Belo Horizonte, Brazil 2020 – 2021.

IVCF-20 domains	Developing frailty (n=13)	Not developing frailty (n=51)	p-value*
Age			
≥ 85 years	13 (100%)	33 (64.7%)	0.013[a]
Self-rated health			
Fair or poor	8 (61.5%)	7 (13.7%)	< 0.001[a]
Dependence for IADLs			
No longer does shopping	8 (61.5%)	6 (11.8%)	< 0.001[a]
No longer controls money	5 (38.5 %)	3 (5.9%)	< 0.001[a]
No longer does domestic chores	4 (30.8%)	3 (5.9%)	0.010[b]
Dependence for BADLs			
No longer bathes alone	2 (15.4%)	1 (2.0%)	0.041[b]
Cognition			
Forgetfulness perceived by others	9 (69.2%)	8 (15.7%)	< 0.001[a]
Recent worsening of forgetfulness	6 (46.2%)	3 (5.9%)	< 0.001[a]
Forgetfulness impacting daily activities	6 (46.2%)	1 (2.0%)	< 0.001[a]
Mood			
Despondency, sadness or hopelessness	12 (92.3%)	15 (29.4%)	< 0.001[a]
Loss of interest/pleasure in activities	9 (69.2%)	4 (7.8%)	< 0.001[a]
Mobility			
Inability to raise arms above shoulder level	5 (38.5%)	4 (7.8%)	0.052[a]
Inability to handle small objects	1 (7.7%)	1 (2.0%)	0.289[b]
Aerobic capacity – weight loss	6 (46.2%)	9 (17.6%)	0.030[a]
Walking difficulties	6 (46.2%)	4 (7.8%)	0.001[a]
Falls	4 (30.8%)	6 (11.8%)	0.092[b]
Fecal/urinary incontinence	9 (69.2%)	9 (17.6%)	<0.001[a]
Communication			
Vision problems	7 (53.8%)	6 (11.8%)	0.001[a]
Hearing problems	7 (53.8%)	10 (19.6%)	0.003[a]
Multiple comorbidities	8 (61.5%)	15 (29.4%)	0.031[a]

*Chi-squared test; [a]: test power ≥0.80; [b]: test power <0.80. IVCF: Clinical-functional vulnerability index; IADLs=Instrumental Activities of Daily Living; BADLs=Basic Activities of Daily Living

Table 3. Poisson Regression analysis with robust variance for development of frailty during covid-19 pandemic. Belo Horizonte, Brazil 2020 – 2021.

Explanatory variables	RR	95%CI	p-value
Worsening of forgetfulness			
No	1		
Yes	2.39	1.27 – 4.46	0.006
Loss of interest/pleasure in activities			
No	1		
Yes	4.94	1.98 - 12.35	0.001
Fecal/urinary incontinence			
No	1		
Yes	2.40	2.91 - 1.53	<0.001

CI = Confidence Interval; Goodness-of-fit =1.00

DISCUSSION

The present study shows deterioration for several functional domains in the sample of older adults investigated. Taken together, the speed of the declines observed (20% frailty incidence within the space of just 15 months), the temporal link with the pandemic and biological plausibility, strongly suggest that these outcomes are secondary effects of the covid-19 pandemic. Interestingly, the low rate of infection by Sars Cov-2 (4.7%) in the population studied also suggests that the infection itself (direct effect of pandemic) was not the root cause of this process of worsening frailty.

The most notable domains affected were those related to cognition (recent worsening of forgetfulness), mood (loss of interest or pleasure engaging in previously enjoyable activities) and fecal/urinary incontinence. These findings contradict the popular belief that declines in older adults during lockdown chiefly involved mobility. Studies conducted globally have shown these impacts[8,9,16,17], but scant data are available on the oldest old population in Brazil.

In the present study, the Clinical-Functional Vulnerability Index (IVCF-20) was applied for its high correlation with the multidimensional evaluation of older people[2], revealing that around 20% of the older adults assessed became frail during the study period. A previous longitudinal study conducted in Japan found a frailty incidence of 16% in community-dwelling older adults (mean age 73 years) who were robust prior to the pandemic. The study found that lockdowns and low level of physical activity contributed to greater frailty in these individuals[16].

In another study, involving a Chinese cohort, around 12% of older adults who were non-frail before the pandemic became frail during the outbreak[17]. The study found that the change in frailty transition status was associated with presence of multimorbidity and psychological distress. However, the age of the study population averaged 70 years, and frailty was evaluated using the criteria of Fried et al.[18], which are not multidimensional, covering physical aspects only.

In the present study, the population assessed was older, a factor which might explain the high incidence of frailty detected. Although age is not a determinant of frailty[19], it is a relevant predisposing factor, particularly in the oldest old[20]. Nevertheless, a 2019 meta-analysis of individuals aged ≥60 years reported an annual frailty incidence of 4.0%, as measured using the Fried et al.[18] criteria, with this rate rising to 7.0% when other frailty criteria were taken into account[21]. In another study[22], also determining incidence but stratifying by age, the frailty rate was 22.6% in Europeans aged >85 years over a 4-year period, classified using criteria of Fried et al[18]. Hence, the frailty incidence found in the present study population was relatively high, given the short timeframe of only 15 months.

Moreover, the study employed an instrument which includes questions that encompass all functional domains and not just physical aspects, an important point given that deterioration in cognition and mood were found to be associated with functional decline.

Also, a high percentage of individuals who developed frailty exhibited a worsening of mood. Approximately 92% of older adults reported sadness, despondency or hopelessness. Loss of interest and pleasure in activities was the variable which showed the strongest association with subsequent development of frailty. This finding is consistent with other studies investigating mental health during the pandemic[23,24], albeit higher in magnitude.

In a previous cross-sectional study assessing psychological aspects of older people seen at a geriatrics service who were dependent for some activities found that 70% of individuals experienced low mood at least some of the time after social isolation[25]. Some studies, one involving a Chinese cohort[17] and another in a Japanese population[26], also found increased psychological distress in individuals who become frail and greater depressive symptoms attributed to social isolation, respectively. Those older adults with depressive symptoms were more prone to cognitive decline and decreased performance of ADLs[26]. It is believed that the conflicting information conveyed by official health channels in Brazil may have negatively impacted mental health.

Cognitive decline was also evident as a characteristic in the group of older adults who became frail. Studies prior to the pandemic had showed a relationship between social isolation and cognitive function. In a 2-year cohort study involving over 2,000 healthy older people on the Cognitive Function and Ageing Study-Wales, social isolation was associated with cognitive reserve, and individuals with greater reserve also had greater cognitive function[27]. The same study found an association of social isolation with orientation, expression and perception, but not with memory or attention. This finding contradicts the results of a 2019 study of a sample that included 10,000 participants from the English Longitudinal Study of Aging (ELSA)[28] showing that social isolation was associated with memory decline in older adults, consistent with the present study in which cognition was assessed by questions focused on memory only.

Memory is related with capacity for execution, motor ability and functional activity, and is deemed one of the most complex domains[29]. Consequently, memory deficits have a negative impact on functioning in older people. Social isolation implies lower social interaction and, hence, lower cognitive stimulation among older individuals who, besides having lower cognitive reserve, encounter difficulties maintaining social contact using other channels of communication that are not face-to-face.

Fecal/urinary incontinence, another domain assessed on the IVCF-20, is a common condition in the older population that is associated with functional decline and frailty[30]. In the present study, the incidence of frailty was associated with incontinence, although urinary incontinence was not distinguished from fecal incontinence. Previous evidence shows that functional disability is a risk factor for urinary incontinence in older adults[30], but also a consequence of this problem.

In a study of non-institutionalized participants from The Irish Longitudinal Study on Ageing (TILDA)[30] without severe cognitive impairment, urinary incontinence was associated with ADL limitations, and also associated with loneliness and depressive symptoms. In another cross-sectional study[31], assessing community-dwelling older adults with urinary or fecal incontinence, these conditions were found to be associated with worse mental health and reduced social interaction.

In the present study, older adults exhibited cognitive decline, but the relation between incontinence and cognitive ability appears to be bi-directional[32]. Fecal/urinary incontinence has hitherto not been investigated in the literature as a possible secondary effect of the pandemic on the health of older people. However, incontinence is known to be a multifactorial condition involving physical issues (such as use of medications), as well as aspects related to mood and cognition.

Another important finding of the study pertains to sensory losses. Hearing and vision deficits are associated with worse functioning, even though this variable was not retained in the multi-causal model. A Japanese cohort study revealed greater dependence in ADLs among participants with hearing difficulty[33]. This factor was measured by self-report, as was the case in the present study. In a recent review, frailty risk was greater in older people with hearing loss, while a 4-year cohort study showed that hearing impairment was associated with higher risk of frailty[35]. Older individuals with hearing impairment also have less social interaction, possibly influencing other domains (e.g. cognition) and further increasing the risk of frailty.

The present study has several strengths, including the assessment of non-frail oldest old using an easily applied instrument for assessing functioning remotely, a critical factor during the pandemic. Moreover, although the sample was not calculated *a priori*, the power of the tests was high for the majority of the associations displaying significant differences between individuals who developed frailty and those who did not. However, the study has some limitations, such as the use of two different instruments for assessing frailty, and the absence of variables related to multi-causality of the outcome that might have better elucidated the risk factors for developing frailty. Another limitation was the fact that some participants did not possess a telephone, precluding contact. Finally, the information was collected by self-report, although many studies have used this method, including during the pandemic, yielding satisfactory results.

It is important to bear in mind that other factors, besides the covid-19 pandemic, may have influenced the functioning of the participants during the period studied. However, given the group assessed was healthy prior to the pandemic and undergoing treatment at a referral center, even throughout the pandemic (remotely in this case), social isolation imposed by the pandemic is believed to be the main factor driving the functional decline observed.

CONCLUSION

The incidence of frailty in the oldest old during the pandemic proved high. More than one domain was impacted, highlighting the need for broad assessment of older individuals as a whole, particularly during atypical periods such as the recent pandemic.

The study provided a picture of the health status of the older adults followed during a period when access to health services was impacted due to lockdown measures, which also served to ensure delivery of care interventions to those most in need of treatment. In addition, these results underscored the role of mental health aspects in this population, having implications for planning interventions to improve psychological care in this group.

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