

ORIGINAL ARTICLE

## “ACTIVE AGE”: virtual cognitive-motor-dual-task training on emotional aspects of women during the COVID-19 pandemic

“ATIVA IDADE”: treino de dupla-tarefa cognitivo-motora virtual em aspectos emocionais de mulheres durante a pandemia de COVID-19

“EDAD ACTIVA”: entrenamiento virtual de tarea doble cognitivo-motora sobre aspectos emocionales de mujeres durante la pandemia de COVID-19

Submitted on: 04/04/2025  
Reviewed and: 04/08/2025  
Approved on: 13/08/2025  
Available online: 01/05/2026

e-20320

Soraia Fernandes das Neves<sup>1</sup>  Ruth Ferreira Galduróz<sup>2</sup> 

<sup>1,2</sup> Federal University of ABC (UFABC), São Bernardo do Campo, SP, Brazil

Corresponding Author: Soraia Fernandes das Neves - [soraia.glisoi@ufabc.edu.br](mailto:soraia.glisoi@ufabc.edu.br)

### ABSTRACT

**Introduction:** the COVID-19 pandemic forced the implementation of social distancing measures, resulting in isolation and an increase in physical, eating, and emotional disorders. Elderly individuals and women were particularly affected, showing high levels of stress, anxiety, and depression. Online interventions emerged as alternatives to mitigate these impacts, with cognitive-motor dual-task (DT) training being a possibility to improve emotional and physical aspects. **Objective:** to assess the impact of a virtual cognitive-motor DT program on the emotional aspects of women aged 40 to 70 during the COVID-19 pandemic as well as the viability of the 100% remote. **Methodology:** the pilot study "ACTIVE AGE" used a pre-test/post-test design with a single group (n=31). After online recruitment, participants followed a protocol consisting of 36 sessions over 12 weeks. Shapiro-Wilk normality tests and the non-parametric Wilcoxon test were applied, with  $p < 0.05$  and effect size (r) calculation. **Results:** significant reductions were observed in anxiety ( $p=0.02$ ) and depression ( $p=0.04$ ) scores, with moderate effect sizes. Changes were noted in some DASS-21 scores, which shifted from mild anxiety and depression classifications to normal ranges. **Conclusion:** virtual cognitive-motor DT training proved effective in reducing negative emotional symptoms in adult and elderly women during the pandemic, highlighting the potential of remote interventions. The study suggests the need for strategies to increase adherence and overcome technological barriers, especially in developing countries.

**Keywords:** COVID-19. Mental Health. Telehealth. Women. Aged.

### RESUMO

**Introdução:** a pandemia de COVID-19 forçou a implementação de medidas de distanciamento social, resultando em isolamento e aumento de distúrbios físicos, alimentares e emocionais. Pessoas idosas e mulheres foram particularmente afetadas, apresentando altos níveis de estresse, ansiedade e depressão. Intervenções online surgiram como alternativas para mitigar esses impactos, sendo o treino de dupla-tarefa (DT) cognitivo-motora uma possibilidade para a melhora de aspectos emocionais e físicos. **Objetivo:** avaliar o impacto de um programa de DT cognitivo-motora virtual nos aspectos emocionais de mulheres entre 40 e 70 anos durante a pandemia de COVID-19, bem como a viabilidade do formato 100% remoto. **Metodologia:** o estudo piloto "ATIVA IDADE" utilizou um design pré-teste/pós-teste em grupo único (n=31). Após o recrutamento online, as participantes realizaram um protocolo composto por 36 aulas durante 12 semanas. Foram aplicados os testes de normalidade de Shapiro-Wilk, não-paramétrico de Wilcoxon, adotando-se  $p < 0,05$  e cálculo do tamanho do efeito (r). **Resultados:** redução significativa nos escores de ansiedade ( $p=0,02$ ) e depressão ( $p=0,04$ ) com tamanho de efeito moderado. Observou-se mudança em alguns escores da DASS-21, que passaram de uma classificação de ansiedade e depressão leve para normalidade. **Conclusão:** o treino de DT cognitivo-motora virtual mostrou-se eficaz na redução de sintomas emocionais negativos em mulheres adultas e idosas durante a pandemia, destacando o potencial das intervenções remotas. O estudo sugere a necessidade de estratégias para aumentar a adesão e superar barreiras tecnológicas, principalmente em países em desenvolvimento.

**Palavras-chave:** COVID-19. Saúde Mental. Telessaúde. Mulheres. Pessoas idosas.

### RESUMEN

**Introducción:** la pandemia de COVID-19 obligó a la implementación de medidas de distanciamiento social, lo que resultó en aislamiento y un aumento de trastornos físicos, alimentarios y emocionales. Las personas mayores y las mujeres fueron particularmente afectadas, presentando altos niveles de estrés, ansiedad y depresión. Surgieron intervenciones en línea como alternativas para mitigar estos impactos, siendo el entrenamiento de doble tarea (DT) cognitivo-motora una posibilidad para mejorar aspectos emocionales y físicos. **Objetivo:** evaluar el impacto de un programa de DT cognitivo-motora virtual en los aspectos emocionales de mujeres entre 40 y 70 años durante la pandemia de COVID-19 así como la viabilidad del formato 100% remoto. **Metodología:** el estudio piloto "ACTIVA EDAD" utilizó un diseño de pre-prueba/post-prueba con un grupo único (n=31). Tras el reclutamiento en línea, las participantes realizaron un protocolo compuesto por 36 sesiones durante 12 semanas. Se aplicaron las pruebas de normalidad de Shapiro-Wilk, la prueba no paramétrica de Wilcoxon, con un valor de  $p < 0,05$  y cálculo del tamaño del efecto (r). **Resultados:** se observó una reducción significativa en los puntajes de ansiedad ( $p=0,02$ ) y depresión ( $p=0,04$ ), con un tamaño del efecto moderado. Se notaron cambios en algunos puntajes de la DASS-21, que pasaron de una clasificación de ansiedad y depresión leve a la normalidad. **Conclusión:** el entrenamiento de DT cognitivo-motora virtual resultó eficaz en la reducción de síntomas emocionales negativos en mujeres adultas y mayores durante la pandemia, destacando el potencial de las intervenciones remotas. El estudio sugiere la necesidad de estrategias para aumentar la adhesión y superar las barreras tecnológicas, especialmente en países en desarrollo.

**Palabra Clave:** COVID-19. Salud Mental. Telesalud. Mujeres. Persona de Edad.

## INTRODUCTION

In March 2020, the 2019 coronavirus (COVID-19) was declared a pandemic by the World Health Organization (WHO) due to the rapid and lethal spread of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) worldwide<sup>1</sup>. To contain the spread of the disease, it was necessary to implement strategies that promoted “social distancing.” Although essential, this measure led to population isolation, and its consequences could be observed in disorders such as physical inactivity, eating disorders, and mental health issues<sup>2,3</sup>.

Some individuals are more susceptible to the impacts of isolation on mental health than others. Older adults, for example, are one such group. A recent scoping review reported that social isolation had emotional and psychological well-being impacts on older adults, including feelings of worry, stress, anxiety, fear, frustration, boredom, depression, sleep disturbances, and suicidal ideation<sup>4</sup>. Considering that older adults often rely on some type of support to carry out basic and instrumental activities of daily living, it is reasonable to assume that many experienced difficulties in essential areas such as nutrition, hygiene, sleep, and healthcare. Significant impacts were also observed in individuals with preexisting mental illnesses, alcoholism, and substance use, since in these cases, in-person follow-up and support networks of professionals, family members, and friends are extremely important<sup>5</sup>.

Some studies have described elevated levels of stress, anxiety, depression, and post-traumatic stress symptoms among women<sup>6,7</sup>. In addition to these aspects, cultural, social, and even biological factors can heighten mental health disorders in women. Issues related to pregnancy, postpartum, and breastfeeding during the pandemic; domestic violence; financial problems; task overload (domestic, work-related, and family responsibilities); and the absence of support networks such as daycare centers, schools, community centers, friends, and relatives further increased stress, anxiety, and depression among women of different age groups<sup>8</sup>.

Online interventions were adopted as measures to mitigate the consequences of social isolation. Throughout the pandemic, telehealth medical services enabled the follow-up of people with chronic and psychiatric conditions, as well as general outpatient care. Especially for older adults, this type of intervention provided many benefits, such as better medication adherence, improvements in overall health, and enhanced quality of life<sup>9</sup>. In addition to medical consultations, various online home-based physical activity programs were introduced. Some combined body and mind practices<sup>10</sup>, others focused on dance<sup>11</sup>, and some included cognitive components such as memory training and exercises for older adults<sup>12</sup>.

Recent studies have evaluated the use of cognitive-motor dual-task (DT) training in older adults with Alzheimer’s disease and Parkinson’s disease through telerehabilitation and observed improvements in cognition, functional mobility, and reductions in anxiety symptoms<sup>13,14</sup>. We believe that similar benefits could also be observed in adults and older individuals without preexisting conditions, especially in situations of isolation or limited access to healthcare services. This could be a promising strategy to improve both mental and physical aspects in these populations.

The objective of this study was to evaluate the impact of a virtual cognitive-motor dual-task (DT) program on the emotional aspects of women aged 40 to 70 during the COVID-19 pandemic, as well as to assess the feasibility of a fully remote format.

## METHODS

### Participants

This pilot study described the results of an extension project entitled “*ATIVA IDADE*” conducted during the COVID-19 pandemic at the Federal University of ABC (UFABC). It was designed as a pre-test/post-test study of a group submitted to cognitive-motor dual-task (DT) training in a virtual environment, with assessments carried out at two time points: baseline (one week before the beginning of the study) and post-intervention (one week after the last class). All participants followed the same protocol consisting of three weekly classes over 12 weeks.

### Recruitment and Sample

Participants were recruited through virtual platforms (Facebook and Instagram) as well as WhatsApp, by means of posts containing eligibility criteria, an email address and contact number, and a registration link. Additionally, flyers were distributed in Primary Health Units (UBS), leisure centers, and community centers in São Bernardo do Campo. Recruitment occurred between December 2020 and March 2021. After accessing the registration link or contacting the research team via email, participants received a link to a sociodemographic and clinical questionnaire to be completed on Google Forms. This questionnaire was used to determine participants’ eligibility. All applicants received a response email informing them about their inclusion or exclusion from the study, along with detailed instructions regarding the start of the intervention.

A total of 79 applications were received from men and women aged between 18 and 80 years over a two-month period. The mandatory inclusion criteria for participants were based on the theoretical framework described in the introduction of this article, such as the increase in emotional symptoms and task overload among women during the pandemic, and the higher vulnerability of the elderly population due to social distancing. The greater demand and adherence of women to health promotion and self-care activities were also taken into account. Therefore, the inclusion criteria adopted in this study were: 1) Female sex; 2) Age between 40 and 70 years; 3) Absence of decompensated chronic diseases such as Systemic Arterial Hypertension (SAH) and Diabetes Mellitus (DM); 4) Access to the internet and electronic devices (TV, computer, cell phone, or tablet); 5) Preserved ambulation without the need for walking aids; 6) Absence of neurological disorders; 7) Absence of untreated neuropsychiatric disorders.

The exclusion criteria were: 1) Failure to complete either the pre- or post-intervention assessments; 2) Older adults over 70 years of age, due to the increased risk of falls during home-based cognitive-motor dual-task exercises (a safety measure given the uncertainty regarding supervision).

### Procedures

This study was approved by the Research Ethics Committee for Human Subjects, under opinion no. 4.260.171, CAEE: 28534819.2.0000.5594, dated 09/04/2020. After dissemination and registration through the link made available on social media, participants were contacted by the researchers, who sent them the Informed Consent Form (ICF) as well as the assessment scales.

## Measures

To assess sociodemographic and clinical aspects, a questionnaire developed by the researchers containing 12 questions was applied. To evaluate symptoms of anxiety, stress, and depression, the *Depression, Anxiety and Stress Scale* (DASS-21) was used, aiming to screen affective-emotional symptoms. Composed of 21 questions, the scoring is based on a four-point Likert scale, ranging from 0 (did not apply to me) to 3 (applied very much), referring to feelings in the previous week. Questions 1, 6, 8, 11, 12, 14, and 18 form the stress subscale. Questions 2, 4, 7, 9, 15, 19, and 20 form the anxiety subscale. Questions 3, 5, 10, 13, 16, 17, and 21 form the depression subscale. For the final score, the values of each subscale were summed and multiplied by two to correspond to the original DASS-42 scoring system<sup>15</sup>.

## Intervention Protocol

The sessions were held virtually, three times per week: one synchronous (via Google Meet) lasting one hour, and two asynchronous (via YouTube) lasting 20 minutes each. Class links were shared via WhatsApp. The sessions included physical exercises consisting of warm-up, muscle stretching, cardiorespiratory conditioning, muscle strengthening, and balance training, combined with cognitive tasks involving language, attention, memory, visuospatial skills, and executive functions. In addition to the activities, participants completed weekly cognitive challenges to increase engagement and interaction among them. The progression of activities occurred weekly according to the group's performance (for both physical exercises and cognitive tasks).

## Statistical Analysis

Demographic characteristics of the sample, descriptive data, age, and educational level were described using mean and standard deviation. Statistical analyses were performed using IBM® SPSS® Statistics, version 24. To verify data distribution (assumptions of normality, homoscedasticity, and linearity), the Shapiro-Wilk test was applied. Since the data violated normality assumptions, the Wilcoxon Signed Rank test was used to assess the sample at different time points (pre- and post-intervention). The effect size ( $r$ ) of the Wilcoxon test was calculated for the  $p$ -value of each analyzed variable. A significance level of  $p \leq 0.05$  was adopted for all analyses.

## RESULTS

After dissemination through electronic media, 79 individuals enrolled in the virtual cognitive-motor dual-task (DT) training. Of these, 12 were excluded for being male and 36 for not completing the virtual DASS-21 questionnaire at either the pre- or post-intervention time points. Thus, 31 participants were included in this study.

The sociodemographic characteristics (age and education), as well as the initial and final DASS-21 scores of the participants included in the study, are presented in Table 1.

**Table 1.** Sociodemographic characteristics and DASS-21 pre- and post-intervention.

Variable	Mean and SD (n=31)	Mean and SD Pre (n=31)	Mean and SD Post (n=31)
Age	58,93 ± 8,17		
Education	15,97 ± 3,09		
Anxiety		8,83±9,70	5,03±6,51
Stress		13,80±13,81	9,42±10,17
Depression		9,35±10,28	6,58±8,49

\*SD: standard deviation; DASS-21: Depression, Anxiety, and Stress Scale.

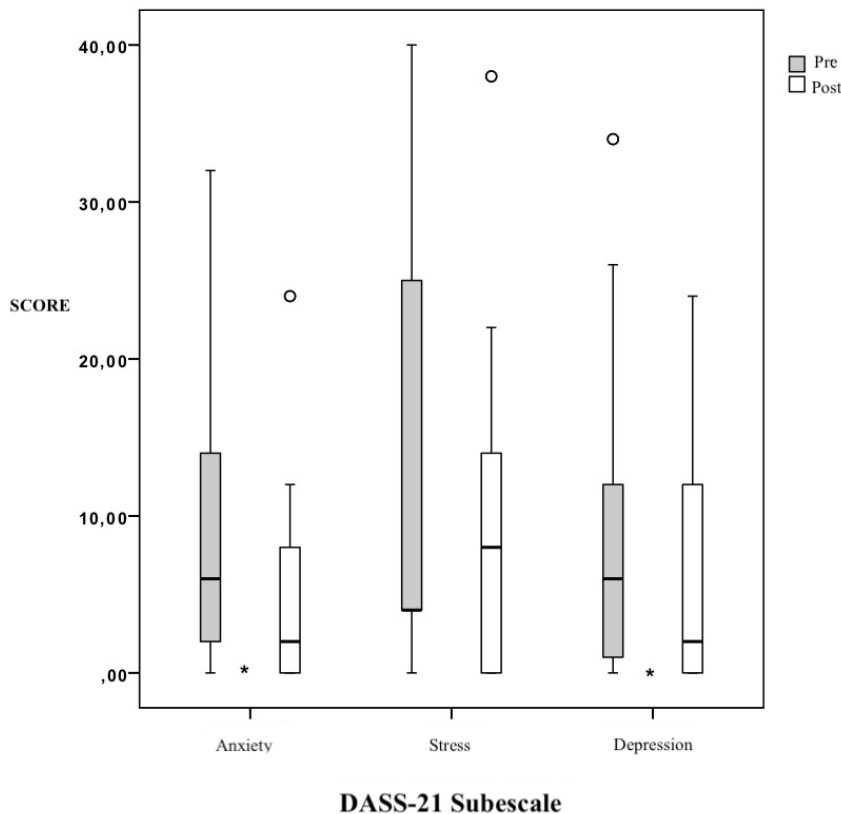
The Shapiro-Wilk normality test was applied, and the variables age ( $W=0.82$ ;  $p=0.00$ ), education ( $W=0.90$ ;  $p=0.01$ ), pre-intervention DASS anxiety ( $W=0.81$ ;  $p=0.00$ ), pre-intervention DASS stress ( $W=0.84$ ;  $p=0.00$ ), and pre-intervention DASS depression ( $W=0.83$ ;  $p=0.00$ ) did not present a normal distribution.

For the final DASS-21 score, the values of each subscale were summed and multiplied by two to correspond to the original DASS-42 scoring system, as described in the Methods section. According to the test scores, stress values between 0–10 represent normality; 11–18 indicate mild alteration; 19–26 indicate moderate alteration; 27–34 indicate severe alteration; and 35–42 indicate extremely severe alteration. For anxiety, values between 0–6 represent normality; 7–9 indicate mild alteration; 10–14 indicate moderate alteration; 15–19 indicate severe alteration; and 20–42 indicate extremely severe alteration. For depression, values between 0–9 represent normality; 10–12 indicate mild alteration; 13–20 indicate moderate alteration; 21–27 indicate severe alteration; and 28–42 indicate extremely severe alteration<sup>15</sup>.

At baseline, the sample presented mean scores corresponding to mild alteration for anxiety and stress and normality for depression. A reduction in the mean scores was observed across all measures, with both anxiety and stress falling into the normal range. These results have clinical relevance when considering the pandemic scenario in which participants were inserted. The lower the DASS-21 score, the better and closer to normal the emotional aspects will be, and consequently, the better the quality of life.

The effects of the 100% virtual cognitive-motor dual-task (DT) training are shown in Figure 1.

**Figure 1.** Differences in anxiety, stress and depression scores post-intervention.



\* $p < 0.05$ . a. Based on positive ranks.

The Wilcoxon test showed a significant difference for anxiety scores ( $Z = -2.45$ ;  $p = 0.02$ ), suggesting that the intervention had a positive effect. The effect size calculation revealed a medium effect, with  $r = -0.43$ , indicating that the magnitude of the difference between measurements was considerable. A significant difference was also observed for depression scores ( $Z = -2.09$ ;  $p = 0.04$ ). The effect size calculation revealed a medium effect, with  $r = -0.37$ , indicating that the magnitude of the difference between measurements was considerable. For stress scores, no significant differences were observed ( $Z = -1.61$ ;  $p = 0.11$ ).

## DISCUSSION

This pilot study, conducted as part of the extension project entitled “*ATIVA IDADE*”, enabled the development and implementation of a fully remote cognitive-motor dual-task (DT) training program during the COVID-19 pandemic in Brazil. The participant sample consisted of women with a mean age of 58 years and 16 years of education (higher education completed), similar to another study carried out in the same period<sup>16</sup>. The literature suggests that factors such as female sex and older age may increase the impact on health and social well-being during periods of isolation, which could also explain the greater demand for this profile in the present study<sup>12,17,18</sup>.

The possibility of connecting with others through devices such as televisions, tablets, computers, or smartphones is an important strategy when addressing mental health. Remote interventions, such as the one proposed in this study, have demonstrated direct benefits for

mental health, positively impacting cognition and functionality. Remote interventions have also proven efficient for health education actions, particularly in times of isolation, when the risk of misinformation can increase levels of anxiety and stress in the face of uncertainty<sup>19</sup>. Another advantage of remote interventions is the possibility of providing access to specific populations when mobility and conditions for access may be impaired or limited, such as: aging with functional decline or lack of support networks; heavy workloads and lack of time for body-mind practices that promote well-being; or the overload of responsibilities, which is very common among economically active women.

Despite numerous benefits, factors such as the need for in-person assistance or supervision, larger screens, and computer use have been identified as limitations for carrying out remote activities<sup>20</sup>. In a recent systematic review on coping strategies among older adults during the COVID-19 pandemic, issues such as limited technical skills in using new technologies and fear of sharing personal information on social media platforms were also reported<sup>21</sup>. The issue of digital exclusion and the high percentage of older adults worldwide who still do not use the internet must be considered when proposing virtual activities<sup>22</sup>. These findings could help explain, for instance, the high-education profile of participants enrolled in this study (due to greater ability to use digital tools) and the loss of participants who did not complete the baseline and final questionnaires.

Among the interventions proposed for managing emotional issues during the pandemic are isolated physical or cognitive stimulation programs, as well as multicomponent programs. No remote cognitive-motor DT training programs similar to the one proposed in this study were found. Isolated physical protocols were offered through mobile applications, including high-intensity interval training (HIIT) with or without associated yoga<sup>23</sup>; through encouragement and monitoring of physical activity and reduction of sedentary time<sup>16</sup>; and through tele-exercise with live and remote transmission<sup>24</sup>.

In the physical program proposed by Puterman et al.<sup>23</sup>, adherence ranged from 64% to 75% in the group combining HIIT and yoga, while in the isolated activities (HIIT or yoga), adherence decreased over the weeks. A significant reduction in depressive symptoms was also observed over six weeks in all groups performing physical exercise when compared to the control group (usual activities). The higher the baseline depressive symptoms, the greater the weekly effects of the practices.

Ibrahim et al.<sup>25</sup> proposed a four-week virtual follow-up of exercises in two groups of older adults. Outcomes of well-being, mental health, physical activity, social participation, and social networks were assessed, with a 23% dropout rate during the intervention. High levels of anxiety and depression were observed at baseline (likely related to the COVID-19 pandemic). No significant changes were found in anxiety and depression scores pre- and post-intervention, although final scores were lower.

Isolated cognitive stimulation programs were generally aimed at older adults with cognitive impairment or dementia, requiring the presence of a caregiver or family member to facilitate access to digital tools, which limited comparison with the present study<sup>20,12</sup>. Despite methodological differences, virtual intervention promoted improvement in global cognitive functions (Cohen's  $d = 0.26$  for the MoCA test) and a reduction in depression scores assessed by the GDS-15 (Cohen's  $d = 0.97$ ). This finding is consistent with the reductions in DASS-21 scores observed in this study. Adherence throughout the 14-week intervention was 100% of participants.

Goodman-Casanova et al.<sup>12</sup> used a TV-based assistive technology called *TV-AssistDem*, which offered physical exercise videos, video calls with friends and family, and cognitive and memory exercises. For participants who lived with others, health status was considered excellent (96%), with maintenance of overall well-being and sleep quality. For older adults living alone, lower well-being ( $p=0.002$ ), greater presence of negative feelings

such as anxiety ( $p=0.048$ ), and sleep disturbances ( $p=0.03$ ) were observed. The group using *TV-AssistDem* performed more memory exercises than the control participants ( $p<0.001$ ). Having a support network was essential both for adherence and for better emotional and sleep quality outcomes.

The results of this pilot study highlight the potential benefits of remote interventions, specifically cognitive-motor dual-task (DT) training, for emotional aspects, especially in times or situations of isolation. It is important to consider that technological and social limitations may affect adherence and the outcomes of these practices. The personalization of interventions, as well as continuous support for participants, are important aspects that should be further developed.

### Study Limitations

Although the results presented are promising, some limitations must be considered. The small number of participants and the high educational level of the sample hinder the generalization of the results, particularly when considering disparities in access to digital tools among people from different socioeconomic and educational backgrounds. In addition, the absence of a control group limits the comparison of the intervention effects with other practices or isolation conditions. Future studies with larger samples and control groups are necessary to better understand the benefits of remote interventions and their implications for the physical and emotional aspects of more diverse populations, especially those with difficulties accessing digital technologies.

### CONCLUSION

The “*ATIVA IDADE*” study contributed to the literature by demonstrating that virtual cognitive-motor dual-task (DT) interventions can be effective in improving emotional aspects, specifically the anxiety and depression components assessed by the DASS-21 scale, in adult and older women during periods of social isolation. However, the implementation of such interventions on a large scale requires attention to technological and access barriers. Future research should explore strategies to increase adherence and include different populations to ensure that the benefits of these interventions can be widely applicable.

### ACKNOWLEDGMENTS

This work was supported by the Coordination for the Improvement of Higher Education Personnel – Brazil (CAPES). The authors also acknowledge the Pro-Rector of Extension and Culture of UFABC (PROEC).

### REFERENCES

1. Organização Mundial da Saúde. Discurso de abertura do Diretor-Geral da OMS da Organização Mundial da Saúde no briefing para a mídia sobre COVID-19 [documento na Internet].2020. [citado em 04 de janeiro de 2024].Disponível em: <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-março-2020>.

2. Passos L, Prazeres F, Teixeira A, Martins C. Impact on Mental Health due to COVID-19 pandemic: cross-sectional study in Portugal and Brazil. *Int J Environ Res Public Health*. 2020; 17(18):6794. doi: <https://doi.org/10.3390/ijerph17186794>.
3. Heinberg LJ, Kristine S. Social Isolation and Loneliness during the COVID-19 pandemic: impact on weight. *Current Obesity Reports*. 2021;10(3):365-370. doi: <https://doi.org/10.1007/s13679-021-00447-9>.
4. Rodrigues NG, Han CQY, Su Y, Klainin-Yobas P, Wu XV. Psychological impacts and online interventions of social isolation amongst older adults during COVID-19 pandemic: A scoping review. *J Adv Nurs*. 2022; 78(3): 609-644. doi: <https://doi.org/10.1111/jan.15063>.
5. Jain A, Bodicherla KP, Raza Q, Kamal Kant, S. Impact on mental health by “Living in Isolation and Quarantine” during COVID-19 pandemic. *J Family Med Prim Care*. 2020;9(10):5415-5418. doi: [https://doi.org/10.4103/jfmpe.jfmpe\\_1572\\_20](https://doi.org/10.4103/jfmpe.jfmpe_1572_20).
6. Wang C, Pan R, Wan X, Tan Y, Xu L, Ho CS, Ho RC. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int J Environ Res Public Health*. 2020;17(5):1729. doi: <https://doi.org/10.3390/ijerph17051729>.
7. Pontes ARL, Costa PA, Araújo TO, Pascoal FFS, Andrade LDF, Leano HAM. Sofrimento mental de mulheres em isolamento social durante a pandemia de COVID-19. *Rev Enferm Atual*. 2023;97(4). doi: <https://doi.org/10.31011/reaid-2023-v.97-n.4-art.1851>.
8. Almeida M, Shrestha AD, Stojanac D, Miller JL. The impact of the COVID-19 pandemic on women’s mental health. *Archives of Women’s Mental Health*. 2020;23:741-748. doi: <https://doi.org/10.1007/s00737-020-01092-2>.
9. Haimi M, Gesser-Edelsburg A. Application and implementation of telehealth services designed for the elderly population during the COVID-19 pandemic: a systematic review. *Health Informatics Journal*. 2022;28(1),14604582221075561. doi: <https://doi.org/10.1177/14604582221075561>.
10. Banskota S, Healy M, Goldeberg E. 15 smartphone apps for adults to use while in isolation during the COVID-19 pandemic. *Western Journal of Emergency Medicine*. 2020;21(3). doi: <https://10.5811/westjem.2020.4.47372>.
11. Humpries A, Tasnim N, Rugh R, Patrick M, Basso JC. Acutely enhancing affective state and social connection following an online dance intervention during the COVID-19 social isolation crisis. *BMC Psychol*. 2023;11:13. doi: <https://doi.org/10.1186/s40359-022-01034-w>.
12. Goodman-Casanova JM, Dura-Perez E, Guzman-Parra J, Cuesta-Vargas A, Mayoral-Cleris F. Telehealth home supporting during COVID-19 confinement for community-dwelling older adults with mild cognitive impairment or mild dementia: survey study. *Journal of Medical Internet Research*. 2020;22(5), e19434. doi: <https://doi.org/10.2196/19434>.
13. Menengiç KN, Yeldan I, Çinar N, Sahiner T. Effectiveness of motor-cognitive dual task exercise via telerehabilitation in Alzheimer’s disease: an online pilot randomized controlled

study. *Clin Neurol and Neurosurgery*. 2022;223, 107501.doi: <https://doi.org/10.1016/j.clineuro.2022.107501>.

14. Domingos J, Dean J, Fernandes JB, Godinho C. An online Dual-Task cognitive and motor exercise program for individuals with Parkinson disease (PD3 Move Program): acceptability study. *JMIR Aging*. 2022;5(4):e40325. doi: <https://doi.org/10.2196/40325>.

15. Lovibond SH, Lovibond PF. Manual for the depression anxiety stress scales. Sydney: Psychology Foundation; 2004. 42p.

16. Greenwood-Hickman MA, Dahlquist J, Cooper J, Holden E, McClure JB, Mettert KD, Perry SR, Rosenberg DE. “They’re Going to Zoom It”: A Qualitative Investigation of Impacts and Coping Strategies During the COVID-19 Pandemic Among Older Adults. *Front Public Health*. 2021;9, 679976. doi: <https://doi.org/10.3389/fpubh.2021.679976>.

17. Pfefferbaum B, North CS. Mental health and the COVID-19 pandemic. *New England Journal of Medicine*. 2020;383(6):510-512.doi: <https://doi.org/10.1056/NEJMp2008017>.

18. Xiong J, Lipsitz O, Nasri F, Lui LMW, Gill H, Phan L, Chen-Li D, Iacobucci M, Ho R, Majeed A, McIntyre RS. Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *Journal of Affective Disorders*. 2020;277:55-64. doi: <https://doi.org/10.1016/j.jad.2020.08.001>.

19. Brooks SA, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet*.2020;395:912-920. doi: [https://doi.org/10.1016/S0140-6736\(20\)30460-8](https://doi.org/10.1016/S0140-6736(20)30460-8).

20. Hui EK, Wong GHY, Tischler V. Virtual individual cognitive stimulation therapy in Hong Kong: A mixed methods feasibility study. *Geriatric Nursing*. 2022;47:125-134. doi: <https://doi.org/10.1016/j.gerinurse.2022.07.010>.

21. Ahmadi A, Allahverdipour H, Valiee S, Pashazadeh F, Ghassab-Abdollahi N, Abdoli F, Matlabi H. COVID-19 stress and coping strategies among older adults: a systematic review of qualitative evidence. *BMC Psychol*. 2023;11:333. doi: <https://doi.org/10.1186/s40359-023-01382-1>.

22. Seifert A, Cotten SR, Xie B. A double burden of exclusion? Digital and social exclusion of older adults in times of COVID-19. *The Journals of Gerontology: Series B*. 2020;76(3):99-103. doi: <https://doi.org/10.1093/geronb/gbaa098>.

23. Puterman E, Colmeias B, Mazara N, Grishin N, Webster J, Hutton S, Koehle MS, Liu Y, Beauchamp MR. COVID-19 Pandemic and Exercise (COPE) trial: a multigroup pragmatic randomised controlled trial examining effects of app-based at-home exercise programs on depressive symptoms. *BMJ Journal*. 2021;56(10):546-552.doi: <https://doi.org/10.1136/bjsports-2021-104379>.

24. Wilke J, Mohr L, Yuki G, Bhundoo AK, Jiménez-Pávon D, Laiño F, Murphy N, Novak B, Nuccio S, Ortega-Gómez S, Pillay JD, Richter F, Rum L, Sanchez-Ramírez C, Url D, Vogt L, Hespanhol L. Train at home, but not alone: a randomised controlled multicentre trial assessing

the effects of live-streamed tele-exercise during COVID-19 related lockdowns. *BMJ Journals*. 2022;56(12):667-675. doi: <https://doi.org/10.1136/bjsports-2021-104994>.

25. Ibrahim A, Chong MC, Khoo S, Wong LP, Chung I, Tan MP. Virtual group exercises and psychological status among community-dwelling older adults during the COVID-19 pandemic - A feasibility study. *Geriatrics (Basel)*. 2021;6(1):31. doi: <https://doi.org/10.3390/geriatrics6010031>.