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COVID-19 E SEUS IMPACTOS NA APTIDÃO FÍSICA: DA REDUÇÃO DE DANOS À PROMOÇÃO DE SAÚDE

COVID-19 AND ITS IMPACTS ON PHYSICAL FITNESS: FROM HARM REDUCTION TO HEALTH PROMOTION

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Estudo de Revisão

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RESUMO

Ainda que efetivas para mitigar a propagação da doença do coronavírus 2019 (COVID-19), as medidas de isolamento social levaram à redução do nível de atividade física e simultaneamente ao aumento do comportamento sedentário e à mudança no consumo alimentar. Contudo, as ações em saúde foram destinadas aos pacientes com COVID-19 sintomática durante e após a internação, enquanto não foram empreendidas ações em prol da promoção de saúde e da redução de danos e agravos, sobretudo em pessoas com doenças crônicas ou risco cardiovascular aumentado. Nesta revisão narrativa, sumarizamos e analisamos criticamente os efeitos da COVID-19 em diferentes desfechos em saúde, enfatizando a aptidão física. Analisamos possíveis impactos indiretos da pandemia na saúde e oferecemos um debate sobre o papel da telessaúde neste cenário. Conduzimos buscas no *PubMed*, *Cochrane Library*, *Physiotherapy Evidence Database*, Biblioteca Virtual em Saúde e literatura cinzenta, combinando termos relacionados à COVID-19, telessaúde e aptidão física. Em pacientes pós-COVID-19, pode haver persistência de sinais ou sintomas da doença, tais como dispneia. Adicionalmente, a síndrome pós-internação é marcada por disfunções e pela redução da funcionalidade e da qualidade de vida. Em indivíduos em isolamento social, houve mudanças deletérias no estilo de vida, as quais podem resultar em agudização ou desenvolvimento de condições crônicas. Reforçamos a necessidade de ações de redução de danos e estabelecimento de metas de aptidão cardiorrespiratória e promoção de um estilo de vida mais ativo e saudável. Nesse cenário, a telessaúde pode ser uma estratégia em potencial para a manutenção da atividade física.

Palavras-chave: COVID-19. Atividade Física. Comportamento Sedentário. Promoção da Saúde. Telessaúde.

ABSTRACT

Although social distancing policies were necessary to mitigate the spread of the Coronavirus Disease 2019 (COVID-19), it also led to decreased physical activity levels, increased sedentary behavior, and changes in dietary consumption. However, the health actions were destined for patients with symptomatic COVID-19 during or after the hospitalization, while health promotion and harm reduction actions were not implemented especially for subjects with chronic conditions or increased cardiovascular risk. This narrative review summarizes and critically analyzes COVID-19-related effects on different health outcomes, emphasizing physical fitness. We also analyzed the potential indirect pandemic-related effects on health and offered a debate regarding the role of telehealth during this period. We carried out searches on PubMed, Cochrane Library, Physiotherapy Evidence Database, Biblioteca Virtual em Saúde, and Opengrey by combining terms related to COVID-19, telehealth, and physical fitness. Symptoms such as dyspnea can persist in patients post-COVID-19. Additionally, post-discharge syndrome is characterized by dysfunctions, impairment, and reduced quality of life. Subjects in social isolation suffered deleterious changes in lifestyle, which can lead to acute conditions and the development of chronic diseases. Therefore, we reinforce the need for actions on harm reduction, the setting of goals for cardiorespiratory fitness, and the promotion of a more active and healthier lifestyle. In this scenario, telehealth emerged as a potential strategy for the level of physical activity maintenance.

Keywords: *COVID-19. Physical Activity. Sedentary Behavior. Health Promotion. Telehealth.*

INTRODUCTION

Since the start of the global pandemic of Coronavirus Disease 2019 (COVID-19) in March 2020, it has become imperative to discuss the direct and indirect impacts of the pandemic on cardiorespiratory fitness, exercise tolerance, and functional exercise capacity due to both related-disease effects and the decreased physical activity level caused by social distancing policies addressed to mitigate the spread of COVID-19.

Although the literature is still being constantly updated, the quarantine and social distancing policies advocated by epidemiologists and health authorities globally have contributed to reduced incidence and mortality rates of COVID-19, mainly when combined with other preventive strategies (DELEN *et al*., 2020; VOPHAM *et al*., 2020). However, these policies resulted in an enormous challenge, especially in the need to remain physically active in the current pandemic context. Even with the flexibility of the measures, it is rational to expect that the current situation will continue, particularly for those who have comorbidities already identified, as risk factors for severe cases of COVID-19.

Additionally, the emphasis on the preventive and control strategies (social distancing, remote working, and distance learning) and treatment of patients with COVID-19 affected the care delivered for patients with non-communicable chronic diseases (disruption of prevention and treatment activities) (MODESTI *et al*., 2020), reinforcing the role of telehealth and its possibilities to ensure longitudinal care and reduce the service burden during pandemic (CAETANO *et al*., 2020; BOKOLO, 2021; SMITH *et al.*, 2020).

Until March 23rd, 29,729,991 cases of COVID-19 were confirmed and 28,363,966 of them survived the disease in Brazil (BRASIL, 2021). Therefore, delivering care after hospital discharge due to the post-intensive care syndrome (STAM *et al*., 2020) has also been an urgent need due to the length of hospital stay and the physiological repercussions of the disease (ocular, cutaneous, gastrointestinal, renal, cardiac, pulmonary, and neural) (GANDHI *et al*., 2020; LI *et al*., 2020; KIEKENS *et al*., 2020; GULATI *et al*., 2020; LAI *et al*., 2020; BALACHANDAR *et al*., 2020). It is important to highlight that knowledge about the duration of the disease effects has still been developed, especially regarding the long COVID-19, which makes it essential to closely monitor these patients both in clinical practice and research (KIEKENS *et al*., 2020; BALACHANDAR *et al*., 2020; WADE, 2020; RICHARDSON *et al*., 2020). However, literature, as well as government authorities, remains focused on COVID-19 acute care instead of rehabilitation (NEGRINI *et al*., 2020) or harm reduction.

Given the negative repercussions of COVID-19 on the daily lives of people around the world, it is also suggested that the overlap of the pandemics and physical inactivity has the potential to further impact and accelerate the latter with consequences that are still unpredictable (HALL *et al.*, 2020). Although the vaccination campaign has started, including

booster doses, the delayed process and denialism associated with political and economic instability imply additional concern regarding the ongoing pandemic in Brazil and help to explain our alarming and sustained numbers of cases and deaths.

Therefore, our challenge is defining how to deliver care to patients at hospital discharge, elderly individuals or those with comorbidities and healthy subjects in social distancing and/or at remote working, going through the additional challenge of providing care with Brazilian-related social inequalities and disbelief in social distancing policies and other health-related actions. Since the pandemic-related impacts tend to remain for the next several months, we reinforce the need for harm reduction actions and the setting of goals for cardiorespiratory fitness and physical activity. It is also worth noting that we have to reflect on what we learn from pandemics, particularly the pandemic legacies related to physical activity and functioning.

Given this scenario, we aimed to critically review the existing literature not only on the effects of COVID-19 on health status with an emphasis on physical fitness but also on the possible indirect impacts related to the prevention and control strategies to mitigate the pandemic. Last, we also introduce telehealth as a potential strategy to deal with this complex and dynamic situation either in the telerehabilitation of post-COVID-19 or in the health promotion to maintain or increase the amount of daily physical activity despite social distancing and quarantine.

METHODS

We developed a narrative review, whose main purpose was to summarize and critically analyze the known effects of COVID-19 on several health outcomes, especially physical fitness. Secondarily, we intended to identify possible indirect impacts of the pandemic context on health status (particularly physical fitness, level of physical activity and sedentary behavior, and functional exercise capacity) due to social distancing, remote working, and distance learning. At last, we provide a debate about the role of telehealth during the pandemic, and its potential after the end of the COVID-19 pandemic.

Due to the state-of-art of pandemic-related scientific literature, conducting a narrative review seemed appropriate since the existing literature remains scarce and presents several distinctive focuses according to the pandemic phases. Additionally, the expertise of the group of reviewers allowed a critical analysis of the theme and helped to ensure the quality of evidence collection.

We conducted several searches on PubMed, Cochrane Library, Physiotherapy Evidence Database (PEDro), and Biblioteca Virtual em Saúde (BVS), among other electronic databases. The terms were defined after consultation of the Medical Subject Headings (MeSH) and linked through Boolean operators (AND, OR). Although we did not specify any lan-

guage or publication data restriction, we prioritized articles published in Portuguese, Spanish or English over the last two years, especially for those pandemic-related studies.

The findings were analyzed throughout full-text reading and critically summarized in a narrative synthesis.

RESULTS AND DISCUSSION

Several searches in literature were carried out using different combinations between the selected terms, including searches on grey literature. Due to these procedures, the number of citations found per search was not registered. In addition, we updated the narrative synthesis according to the development of scientific literature related to the theme. Last, it is worth mentioning that we considered the relevance, publication date, and level of evidence as the main points to include the studies in our narrative synthesis, implying that we replaced some studies with newer evidence whenever needed. For our final synthesis, we critically analyzed about one hundred and fifty and two hundred studies.

Social distancing and its impact on lifestyle behavior and food intake

Social distancing negatively affected lifestyles worldwide (TISON *et al.*, 2020). According to a Canadian online survey, both active and inactive individuals reduced levels of activity (LESSER *et al.*, 2020). In Spain, both males and females with comorbidities presented lesser levels of moderate-to-vigorous and vigorous-intensity physical activity than before the pandemic (LÓPEZ-SÁNCHEZ *et al*., 2021). In Italy, the literature showed an increased sedentary behavior with a decreased physical activity engagement (MAUGERI *et al.*, 2020; JACOB *et al.*, 2020; GALLÈ *et al.*, 2020), which affects mental well-being (MAUGERI *et al.*, 2020; JACOB *et al.*, 2020; SCHUCH *et al.*, 2020). In China, social distancing altered the physical activity level negatively, but eating behavior positively (RUÍZ-ROSO *et al.*, 2020). An alarming decrease in physical activity was observed in children (MOORE *et al.*, 2020; DUNTON *et al*., 2020). In contrast, Reyes-Olavarría *et al.* (2020) found weight gain associated with increased consumption of alcohol and fried food in addition to behavior-changed physical activity.

Additionally, normal-weight individuals presented more weight gain in comparison to overweight or obese individuals (HE *et al.*, 2020). There was an increased vegetable consumption, but also an increased sugary food and snack consumption associated with inactivity (RUIZ-ROSO *et al.*, 2020), and females had more energy intake when compared to males (GALLO *et al.*, 2020). Ruíz-Roso *et al.* (2020) found high ultra-processed consumption in Latin America during social distancing.

The prevalence of depression and anxiety symptoms was more frequent in individuals with more than 10 h/day in sedentary behavior and less than 30 min/day of moderate-to--vigorous or 15 min/day of vigorous physical activity (SCHUCH *et al.*, 2020). A previous study found that individuals who had depressive symptoms do not meet physical activity recommendations (SCHUCH *et al.*, 2017). Also, the individuals who meet the physical activity guidelines before the pandemic confinement presented low anxiety (LÓPEZ-BUENO *et al.*, 2020). Additionally, outdoor physical activity contributes to psychological well--being, and it is safe when keeping hygiene measures (PARK *et al.*, 2020). Slater, Christiana, and Gustat (2020) proposed short and long-term recommendations to perform physical activity in parks and green spaces, suggesting keeping the parks open and the adoption of open streets or Slow Streets initiatives, as well as emphasizing social distancing instead of social isolation. Slimani *et al.* (2020) found that both being minimally active and increasing physical activity is related to a better quality of life when compared to inactivity.

During the pandemic, several recommendations to maintain physical activity were published. Pitanga *et al.* (2020) briefly suggested how to maintain physical activity in Brazil, including places to practice (mostly outdoors and at home with professional guidance), types of activities (aerobic, strength and balance exercises, stretching, and climbing up and down stairs), intensity (light-to-moderate, avoiding high-intensity exercise) and duration (30-60 min/day). Sedentary behavior was also unrecommended (maximum of 6-8 hours daily, 2-4 hours of screen time, and an increase in breaking up sedentary time) (PITANGA *et al.*, 2020). In a systematic literature review, Bentlage *et al.* (2020) summarized the recommendations to stay active during the pandemic, adding the use of activity trackers to monitor steps per day, the use of rating of perceived exertion scale (≤ 3, moderate effort), relaxation activities, and Exergames. Khoramipour *et al.* (2021) proposed aerobic, resistance, and respiratory training and yoga to prevent social distancing effects, while Schwendinger and Pocecco (2020) provided home-based high-intensity interval training recommendations. Wang *et al.* (2020) recommended aerobic and anaerobic exercise (based on moderate-intensity continuous training and a combination of resistance training with high-intensity interval training) according to 150 min/week, 30 min/day, 10,000 steps/day, and 64-170 steps/minutes for at least 10 minutes for 3-5 days/week. However, the availability of exercise equipment must be considered. Its association with the habit, intention, and planning of physical activity must match the equipment available since it can influence behavior (KAUSHAL *et al.*, 2020).

Paradoxically, the population's interest in the topic of physical activity has increased significantly since the beginning of the pandemic and continues to remain high today (DING *et al.*, 2020). Topics such as 'high-intensity interval training' and 'home-based exercise' were very prevalent in this research. Accordingly, it is necessary to take advantage of the moment of most significant interest in the theme and outline strategies on a large scale

that can at least "hold the line" compared to pre-pandemic population physical activity levels (HALL *et al.*, 2020). It is worth mentioning that home-based exercise must be supervised by experts in the field, particularly for those with a diagnosis of chronic conditions and without previous experience in performing effort.

Cardiorespiratory fitness, exercise tolerance, and functional exercise capacity after COVID-19

As widely described, the main COVID-19 referred symptoms are fever, cough, fatigue, dyspnea, and myalgia (GE *et al.*, 2020), but the laboratory findings may also include bilateral diffuse alveolar damage (GE *et al.*, 2020) and acute cardiac injury (LI *et al.*, 2020). Patients with COVID-19 present a relatively long length of stay in hospital (KIEKENS *et al.*, 2020) with important features for health status and quality of life after discharge, especially related to impaired functioning (KIEKENS *et al.*, 2020; LAU e *et al.*, 2005; BELLI *et al.*, 2020; HALPIN *et al.*, 2021; LI *et al.*, 2020; CURCI *et al.*, 2020).

Regarding patients after hospital discharge from COVID-19, dyspnea and shortness of breath remain (HALPIN *et al.*., 2021; CURCI *et al.*, 2020), and most of the patients were not able even to perform a six-minute walk test (6MWT) (CURCI *et al.*, 2020). Among the physical dysfunctions after COVID-19, 61.4% of the patients presented decreased activity endurance (LI *et al.*, 2020) and 72% reported fatigue (HALPIN *et al.*, 2021). Functioning was also impaired with a dependency to transfer (15%), dressing (24%), toilet use (35%), and bathing (64%) (BELLI *et al.*, 2020).

Brawner *et al.* (2021) observed lower maximal exercise capacity in metabolic equivalent of a task in patients diagnosed with COVID-19 hospitalized compared with those who were not hospitalized and found a reduction of 13% in the odds of hospitalization for each additional metabolic equivalent of task. However, literature still has gaps about the link between cardiorespiratory fitness and COVID-19 related-effects.

Assessing cardiorespiratory fitness is safe and feasible to evaluate individuals critically ill that underwent an intensive care unit (SOMMERS *et al.*, 2019). The test can contribute to the best interpretation of exercise limitation (BENINGTON *et al.*, 2012), as well as establish goals for its enhancement (SMITH *et al.*, 2020). Although there is some concern about the safety to realize CPET, Faghy *et al.* (2020) defend its role in the endemic phase of COVID-19 with proper deliberation about risks and benefits before the test and establishing procedures and strategies to reduce and/or control the transmission in cases of diagnosed COVID-19. Based on previous studies about CPET applied to preoperative assessment, Ahmed (2020) added the potential of cardiorespiratory fitness to stratify risk combined with age and other clinical criteria, or cardiorespiratory fitness estimative through 6MWT as an alternative. Regarding the 6MWT, the literature indicates that it can contribute to

identifying exercise-induced hypoxia in patients with COVID-19 before hospital discharge (FUGLEBJERG *et al.*, 2020).

Wade (2020) suggests an evaluation of the personal concern of the patient, the activity domains (vocational, leisure, and daily living activities), the common symptoms before and after the disease, and additional health problems. Karloh, Matias, and Mayer (2020) reinforce the importance to include motivational strategies in rehabilitation programs to increase the patient's autonomy to perform exercises and maintain an active lifestyle. Zbinden-Foncea *et al.* (2020) gathered several studies that indicate a potential role of high cardiorespiratory fitness as a protective factor against infection, mainly due to reducing inflammatory pathways. Millet and Burtscher (2020) proposed that low cardiorespiratory fitness is a risk factor for viral infection related to mitochondrial function. Similarly, Fernández-Lázaro *et al.* (2020) discussed why physical exercise can be considered an important preventive strategy. Therefore, both prevention strategies and rehabilitation programs must consider exercise prescription to maintain and/or increase cardiorespiratory fitness, the practice of functional activities, psychosocial therapies, and health education to self-management care (WADE, 2020).

In this context, the first plausible step is to shift the focus from current physical activity recommendations from the goal of achieving at least 150 min of moderate to vigorous physical activity per week to "sit less, move more". This recommendation is supported by current evidence that suggests the absence of such an "all or nothing" threshold concerning health benefits (WARBURTON; BREDIN, 2017). Adversely, a 150 min/week threshold can bring an unnecessary barrier, especially for those who want to become more active. The upcoming consensus will likely be based on more lenient recommendations regarding the amount and intensity of physical activity.

Some efforts have been made to help maintain physical activity during the pandemic. There is free online information and tutorials on how to stay active in quarantine with home exercises (ACSM, 2020). Recent research has shown that taking just 4,000 steps a day at any pace improves long-term health (SAINT-MAURICE *et al.*, 2020). This number of steps is entirely feasible in the daily home routine. Another alternative has been reinforcing the performance of home physical exercises with technology through tutorial videos, applications, or guided synchronously by online professionals (PITANGA *et al.*, 2020).

Unfortunately, the implementation of physical activity strategies in public health faces budget limitations, especially in low and middle-income countries. Accordingly, investing in more cost-effective and educational strategies such as mass campaigns and digital ways to persuade concerning beneficial behavior changes are recommended and described as promising globally.

Social inequalities and comorbidities are associated with a worse prognosis of COVID-19 and low levels of physical activity

The profile most affected by COVID-19 was mainly older men with comorbidities (BELLI *et al.*, 2020; LITHANDER *et al.*, 2020; FANG *et al.*, 2020; ROSSI *et al.*, 2020) and at high risk of requiring and remaining in prolonged intubation (HUR *et al.*, 2020). When a high number of comorbidities (especially hypertension and diabetes), high risk of worse prognosis and/or death (LITHANDER *et al.*, 2020; ROSSI *et al.*, 2020; GUAN *et al.*, 2020). Additionally, hypertension, cardiovascular diseases, chronic obstructive pulmonary disease, and sex can increase the risk of exacerbation of COVID-19 (ZHAO *et al.*, 2020). Patients with cardiovascular disease can suffer additional acute cardiac injury and present a large risk of developing more severe COVID-19 and a high risk of death (LI *et al.*, 2020).

However, we must consider that the individuals with social vulnerability present less education, more comorbidities, and less access to health services (PIRES *et al.*, 2020). They also share the home with more relatives and most of them remain working during the pandemic. Natividade *et al.* (2020) found irregular adherence to social distancing policies in Salvador, but the highest adherence was associated with more favorable living conditions. Kopel *et al.* (2020) showed that minority groups were at high risk of infection, as well as commonly presented comorbidities and low socioeconomic status.

Regardless of COVID-19, the prevalence of frailty is high when high social vulnerability (de JESUS *et al.*, 2018) and the caregivers were commonly elderly pre-frail (SANTOS-ORLANDI *et al.*, 2017). In addition, the prevalence of risk factors for cardiovascular disease in Brazil is substantial, including physical inactivity (BRASIL, 2019). Based on the self-report of 1,726 individuals mainly adults and middle-aged from the Southeast region, Vancini *et al.* (2020) found that less physical activity was linked to symptomatic COVID-19 cases. In Rio Grande do Sul, individuals with higher schooling presented more leisure-time physical activity during the pandemic than those with less education (50.9 vs 9.8%), mainly at home (53.5%) or outdoors (38.9%) (CROCHEMORE-SILVA *et al.*, 2020). In contrast, it is important to highlight regional differences since men presented more reduction in physical activity (quantity, intensity, and type) than women in Spain, who proved to be more adaptable to the use of technology and even started to exercise more during pandemic (GARCÍA-TASCÓN *et al.*, 2020).

Although the vaccination started in January 2021, the continental dimension and diversity characteristics among the different regions of our country imply that the sanitation measures, use of face masks, and social distancing policies will remain over the course of the year. Thus, social inequalities, as well as regional aspects, must be a major concern to mitigate the COVID-19 pandemic, especially in Brazil, but also to establish harm reduction actions. Despite the actual status of the pandemic that may be reaching an end soon,

the literature suggests that we will experience other endemics and/or pandemics from now on, which requires us to gather what we learn and be prepared to ensure health from harm reduction to rehabilitation.

Telehealth and the major role of health education and home-based interventions

Due to the possible burden of health-related services, Gutenbrunner *et al.* (2020) argued that rehabilitation must be a priority in the pandemic. Zhu *et al.* (2020) summarized the respiratory rehabilitation for patients with COVID-19, while Smith *et al.* (2020) detailed the home and community-based physical therapy for patients with post-intensive care syndrome. Recently, a consensus for the rehabilitation of patients post-COVID-19 treatment was published (BARKER-DAVIES *et al.*, 2020).

At the beginning of the pandemic scenario, there was a call to action for the implementation and integration of telemedicine in coping the COVID-19, especially to increase its use in the routine of care and, more specifically, to contact and confirm the diagnosis of asymptomatic or symptomatic patients and hence online screening to provide telemonitoring, teleconsultation or referral to the service if needed (OHANNESSIAN *et al.*, 2020). Later, Salawu *et al.* (2020) proposed a multidisciplinary model for telerehabilitation of COVID-19 survivors based on delivery care at home. In addition to protecting the health professionals, telemedicine guarantees the delivery and continuity of healthcare (BOKOLO, 2021; *SMITH et al.*, 2020; BOKOLO, 2020; LÓPEZ; CLOSA; LUCAS, 2020), being constantly discussed regarding advantages and disadvantages (BOKOLO, 2020; LÓPEZ; CLOSA; LUCAS, 2020).

López, Closa, and Lucas (2020) highlight the security, accessibility, perception of the service provided, participation and co-responsibility, and personalized telerehabilitation as the main advantages of telemedicine. The process of telemedicine is composed of the following steps: patient introduction to telemedicine and consent to its use, downloading telemedicine software, registering an appointment that is confirmed by medical staff, teleconsultation, and then telemonitoring (BOKOLO, 2020). However, its use is linked to organizational (availability of funding, adequate training, and workflow integration), technological (data privacy and access, data security and risk, broadband access, and Wi-Fi quality, availability, and infrastructure), and social aspects (licensure requirements, health insurance, and reimbursement policies, lack of regulation and advocacy, patients, and medical practitioners' willingness) (BOKOLO, 2021). The integration of telemedicine with national and international guidelines, the definition of regulations, the training of health professionals to increase the expertise of its use to monitor, educate and communicate with patients, and an integrated data system allowing epidemiological surveillance and research are some of the main challenges that remain regarding telehealth use and implementation (OHANNESSIAN *et al.*, 2020). Smith *et al.* (2020) point to the importance of training

health professionals to deliver telehealth, ensuring the clinical acceptance of its use, and reorganizing the services to include telehealth and systems for service management in the clinical routine, regardless of emergencies such as a pandemic scenario.

Several studies described the implementation of telemedicine services and health informatics support (VILENDRER *et al.*, 2020; MANN *et al.*, 2020; RAMASWAMY *et al.*, 2020). Vilendrer *et al.* (2020) analyzed three health systems according to target patient demographic, patient privacy and hardware, provider hardware and access, software and electronic health records integration, and capabilities (inpatient and family perspectives) and found preliminary positive adoption with video calls or videoconference (*Zoom, Webex, FaceTime*) used for 16.5 minutes in average within one month. Mann *et al.* (2020) observed an 80% decrease in service visits while telemedicine increased from 102.4 to 801.6 video-based telemedicine per day without altering the patients' reported satisfaction. Similarly, Ramaswamy *et al.* (2020) did not find a change in patient satisfaction regarding video visits compared to before and after COVID-19, but less satisfaction during in-person visits was observed when compared to video-based telemedicine during the pandemic. Contreras *et al.* (2020) described the scenario of telemedicine during a pandemic due to its largely and rapidly expansion, especially in the number of video calls, and provided some recommendations for platforms (avoid the use of non-compliant telemedicine platforms for example *Hangouts, Zoom, Skype, FaceTime*), telemedicine interaction and documentation. Additionally, Loeb *et al.* (2020) proposed a triage list for defining in-person visits or telemedicine and a task checklist to launch telemedicine applied to the orthopaedical surgery field, but also added examples of telemedicine technology applications and sheets to individuals involved in the setting visit (patients, office staff, and providers).

Caetano *et al.* (2020) discussed the scope of telehealth, exploring its use against the pandemic and adding its role in information and health education. The authors detailed the initiatives regarding telehealth as proposed by Programa Telessaúde Brasil Redes but showed low and moderate implementation. Although the study presents limitations that must be considered, Macinko *et al.* (2020) pointed out the alarming scenario of the pandemic in Brazil even after several months of policies to control the spread of disease. In addition to significant differences among macro-regions of our country, almost 70% of individuals who reported COVID-19 symptoms did not seek health care due to underestimating the severity of the symptoms, the previous interruption of delivering care, lack of knowledge about the disease diagnosis, and fear of infection that contribute to medical care avoidance (MACINKO *et al.*, 2020).

However, few studies investigated the barriers and challenges of implementation of telemedicine in countries considering the impact of social inequality. In Brazil, access to the internet varies according to country regions, as well as the quality of this access (PNAD, 2021), which is a challenge that must be considered. Additionally, the elderly navigate the

internet less than young and adult people due to a lack of knowledge and/or sharing devices with other family members (PNAD, 2021). Previously study (NISHIJIMA *et al.*, 2017) reported that digital illiteracy largely limited the use of information and communication technologies among the elderly.

The role of health education must be more expressively addressed (WADE, 2020), especially to provide clarification on fake news and to contribute to self-management care and hence avoid the possible burden of rehabilitation services during the reopening phase. It is important to guide and monitor individuals who have fulfilled social distancing, especially to ensure health education for fake news, self-management care (WADE, 2020; WAINWRIGHT; LOW, 2020), and a healthier and more active lifestyle both inside and outside the home.

Telehealth and emerging tendencies applied to promote physical activity and reduce sedentary lifestyle

The costs of physical inactivity in health have already been cautiously evaluated and have shown to be very high annually (DING *et al.*, 2016). Accordingly, the World Health Organization (WHO) published a global strategy to reduce the prevalence of physical inactivity in the world to 15% in 2030 (WHO, 2018). Unfortunately, recent research has shown that if the decline in physical inactivity continues at the current rate, the objective mentioned above will not be achieved (GUTHOLD *et al.*, 2018). Therefore, strategies to reduce physical inactivity should be more conspicuous. In this context, mass campaigns have been considered one of the seven most effective investments to publicize physical activity benefits capable of changing social behavior (BAUMAN, 2018). They play a fundamental role and are among those recommended in the global plan of WHO.

Before the pandemic, Warburton and Bredin (2017) found that the dose-response relationship between physical activity and mortality and the primary and secondary prevention of various health outcomes is curvilinear, with the most notable benefits observed with relatively minor volumes of physical activity. These results emphasize the urgent need to recommend that people become more active in obtaining health benefits and become even more critical in the current pandemic context. The evidence of positive effects of light physical activity and the interruption of sedentary behavior on health is great news when home exercises in less appropriate places are the recommended alternatives to prevent the virus's proliferation.

The effects of campaigns are considered to be modest and require substantial resources (LANKFORD *et al.*, 2014). However, Bauman *et al.* (2001) showed that adults between 25 and 60 years old who were aware of a mass campaign for physical activity were more than twice as likely to increase their activity level by one hour a week compared to those who

were unaware of the campaign. Huhman *et al.* (2005) showed that children aged 9 to 10 years old warned about a mass campaign for physical activity engaged in physical activities in their free time for 34% more time than children unaware of the campaign. A systematic review with meta-analysis indicates that the results are beneficial for improving walking quantity (ABIOYE *et al.*, 2013). As mentioned earlier, the results indicate the potential of campaigns for population changes in physical activity and sedentary behavior.

Paradoxically, the new coronavirus pandemic resulted in a "positive adverse effect" regarding population knowledge about physical activity benefits. With the restrictions imposed, this can be considered the first occasion in which physical activity was recognized, disseminated, and promoted on a global scale, both for home exercises and external physical activities, which were the only ones allowed during much of the initial lockdown (LEVINGER; HILL, 2020).

There is great potential for using mass campaigns to increase physical activity and reduce sedentary behavior on a population scale, taking advantage of the population's willingness to absorb knowledge about physical activity and favorable behavior change. Some points must be considered for the campaigns to have a more significant population impact and more cost-effectiveness. Campaigns must be multicomponent, preferably mixing five or more components and or offering greater intensity to be more effective (STEAD *et al.*, 2019). Additionally, they must be theory-based with building principles such as formative research, audience segmentation, message design, channel placement, and process evaluation.

Social networks such as Facebook, Instagram, and Twitter are becoming increasingly popular. Today, more than 2.9 billion people use social media regularly. The percentage of social network users in the United States increased dramatically from 5% in 2005 to 72% in 2020 (MERCHANT; LURIE, 2020). These numbers are not restricted to developed countries. For example, 140 million Brazilians use social networks. Of these, 94% have a smartphone and 11% already use a smartwatch, and 98% watch videos online. They spent, on average, 9h17min on the internet (BRASIL, 2020). Therefore, there is great potential for this digital medium to also reach people in low- and middle-income countries.

Given the emergence of the new coronavirus pandemic, a substantial increase in screen time was inevitable, especially in the adult population. Personal and professional life has, at various levels, been mediated by social networks. Digital communication media currently play and will certainly continue to play a great potential to leverage health education messages, mass campaigns, patient care, and guidance from health professionals (TANG *et al.*, 2020).

The results of studies that investigated the impact of social networks on physical activity levels indicate that, depending on the characteristics of the personal social network,

can be beneficial. However, they can also have adverse effects on physical activity habits (TANG *et al.*, 2020).

Despite the recognized potential of social networks to intervene in physical activity habits on a large scale, the effects of interventions through social networks are limited and have been investigated in questionable quality studies restricted to Facebook, making it impossible to reach a consensus recommendation on this tool. Ferrer and Ellis (2017) showed that about 87% of the interventions offered reported some change in physical activity behavior, but just a few with significant changes. Although Facebook is the most popular among social networks today, there is evidence that Instagram's reach can be 200 times greater (EDNEY *et al.*, 2018).

In the context of COVID-19, which could be transferred to physical activity, there is the possibility of using data sciences to monitor groups more vulnerable to the disease and greater physical inactivity. With access to data from social networks, it is possible to monitor keywords, giving health authorities subsidies to act. Data mining is also a potential alternative to encourage more healthy physical activity behaviors. For example, this strategy was responsible for identifying in Wuhan that the elderly was a risk group for more severe cases of COVID-19 and made it possible to conduct appropriate health practices at that time (HUANG *et al.*, 2020).

Considering the negative impact of lockdown on adults' and children's mental health, strategies that can result in physical and mental benefits are needed. Physical activity and exercise result in significant positive effects in preventing or alleviating mental illness, including depressive symptoms and anxiety- or stress-related disease (MALM *et al.*, 2019) and present a promising additional treatment option for people with anxiety disorders (KANDOLA *et al.*, 2018). Accordingly, technological strategies that make home exercise sessions less monotonous and outdoor activities, which are already allowed in many countries, are safer.

Gamification (*i.e.*, the use of game elements outside of the game context) has recently been used to propel people to a more physically active lifestyle. Applications containing gamification allow continuous interactions and have a positive impact on users' motivation (RUBIN *et al.*, 2020). Through challenges, users can score points, earn rewards, and be included in rankings.

Regarding outdoor physical activity that is already allowed in many countries, the technology could be used to provide important information about safe and suitable places to practice physical exercises, minimizing the chances of contagion from COVID-19. Virtual fences are relatively new technology and could be designed in public places conducive to outdoor physical exercises. Connected to smartphone applications, for example, they could provide video tutorials on muscle strengthening exercises using the built and natural envi-

ronment. They could also be used to provide information on times and places with fewer crowds, making outside activities safer. Fitness trackers are an excellent tool for reaching the objectives mentioned above.

Among the limitations of social networks, the spread of fake news is the most threatening. There is evidence that almost 30% of the most-watched YouTube videos related to COVID-19 included inconsistent and or false information, unfortunately reaching around 62 million views globally (LI *et al.*, 2020). An essential role of social networks would be to use artificial intelligence to monitor and mitigate the spread of false information. Social media's influence is so strong that the World Health Organization has set up an Information Network for Epidemics to tackle the "infodemic" by correcting and controlling the spread of false information (ZAROCOSTAS, 2020). Unfortunately, access to the internet, especially in low and medium-income countries, is not universal. In remodeling regions of developing countries, access is less than 30%. Also, even with access to the internet, many of the population in low and middle-income countries have inferior schooling, and social media remains unfamiliar. Currently, 46 million Brazilians do not have access to the internet. Of this, 45% reported a lack of access due to the service cost, and 37% reported the lack of a cell phone, computer, or tablet is also one of the reasons (PNAD, 2021).

Combating physical inactivity and sedentary behavior at present is an even more significant challenge than before because, despite the explosion of evidence on the benefits of physical activity in public health, we fail to implement the theory in practice in population terms. It is necessary to seize the moment, considering the most significant interest in the topic during the pandemic, and implement the behavior change necessary to attack a much older pandemic (*i.e.*, physical inactivity and sedentary behavior) which can enhance the harmful effects of COVID-19.

Table 1. Summarized advantages, disadvantages, and main challenges regarding social distancing policies and the use of digital information and communication technologies.

	Social distancing Policies	**Digital information and communication technologies**
Advantages	↓47% transmission (DELEN *et al.*, 2020) ↓29% incidence (VOPHAM *et al.*, 2020) ↓35% mortality (VOPHAM *et al.*, 2020)	delivery and continuity of healthcare (BOKOLO, 2021; SMITH *et al.*, 2020; GIANSANTI, 2020) accessibility (BOKOLO, 2020) participation and co-responsibility (BOKOLO, 2020) personalized intervention (BOKOLO, 2020) *gamification* (RUBIN *et al.*, 2020)
Disadvantages	↑sedentary lifestyle Δ dietary consumption ↑ weight ↓ cardiorespiratory fitness disruption of prevention and treatment activities	lack of regulation and advocacy (BOKOLO, 2021) health insurance accountability (BOKOLO, 2021) need of training health professionals (OHANNESSIAN *et al.*, 2020) device possession access to internet (PNAD, 2021) connectivity (PNAD, 2021) digital literacy (NISHIJIMA *et al.*, 2017)
Challenges	fake news and "infodemic" (ZAROCOSTAS, 2020) maintain physical activity level combat sedentary behavior	social inequalities country dimension population size and density

Source: Prepared by the authors.
↓: decrease; ↑: increase; Δ: change.

FINAL CONSIDERATIONS

The pandemic showed us that technology may support and connect health professionals, supervisors, institutional leaders, politicians, and patients, but its use requires healthcare professional training and integration across both care pathways and health systems. The use of information and communication digital technology must be further discussed due to its advantages and disadvantages, but especially its dependency on the type of device, access to the internet, and digital literacy to ensure knowledge of how to use it.

In Brazil, despite our health professional's competence and commitment, the spread of the disease reaches our population in different ways with regional consequences related to

physical inactivity due to the deep Brazilian socioeconomic inequality and the size of the country. Given this scenario, it is important to highlight the need to address these differences with not only federal but local and specific strategies and actions.

As a complex and dynamic theme, providing health care depends on interdisciplinary and interprofessional efforts, as well as demands the best understanding of the definition of health. Therefore, we argue that health must be prioritized even in a pandemic context, reinforcing the need for preventive strategies and public policies that include not only mitigation of the disease, but also harm reduction strategies and encourage a healthy lifestyle. Finally, it is urgent to seek innovative strategies for people to practice their physical activities at home and in open environments, respecting all health recommendations in each region.

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Conflicts of interest

The authors declare no conflicts of interest.

REFERENCES

PIRES, L. N.; CARVALHO, L.; XAVIER, L. L. COVID-19 e desigualdade: a distribuição dos fatores de risco no Brasil. Disponível em: https://ondasbrasil.org/wp-content/uploads/2020/04/COVID-19-e-desigualdade-a-distribuição-dos-fatores-de-risco-no-Brasil.pdf. Acesso em: 8 mar. 2021.

ABIOYE, A. I.; HAJIFATHALIAN, K.; DANAEI, G. Do mass media campaigns improve physical activity? a systematic review and meta-analysis. **Arch Public Heal.**, v. 71, n. 1, 2013.

AHMED, I. COVID-19 – does exercise prescription and maximal oxygen uptake (VO2 max) have a role in risk-stratifying patients? **Clin Med J R Coll Physicians London**, v. 20, n. 3, p. 282-284, 2020.

BALACHANDAR, V.; MAHALAXMI, I.; SUBRAMANIAM, M.; KAAVYA, J.; KUMAR, N. S.; LALDINMAWII, G.; NARAYANASAMY, A.; REDDY, P. J. K.; SIVAPRAKASH, P.; KANCHANA, S.; VIVEKANANDHAN, G.; CHO, S. Follow-up studies in COVID-19 recovered patients - is it mandatory? **Sci Total Environ.**, v. 729, p. 139021, 2020.

BARKER-DAVIES, R. M.; O'SULLIVAN, O.; SENARATNE, K. P. P.; BALKER, P.; CRANLEY, M.; DHARM-DATTA, S.; ELLIS, H.; GOODALL, D.; GOUGH, M.; LEWIS, S.; NORMAN, J.; PAPADOPOULOU, T.; ROSCOE, D.; SHERWOOD, D.; TURNER, P.; WALKER, T.; MISTLIN, A.; PHILLIP, R.; NICOL, A. M.; BENNETT, A. N.; BAHADUR, S. The Stanford Hall consensus statement for post-COVID-19 rehabilitation. **Br J Sports Med.**, v. 54, n. 16, p. 949-959, 2020.

BAUMAN, A. Addressing population levels of physical activity requires investment beyond the health sector. **Heal Promot J Aust.** 29, p. 10-12, 2018.

BAUMAN, A. E.; BELLEW, B.; OWEN, N.; VITA, P. Impact of an Australian mass media campaign targeting physical activity in 1998. **Am J Prev Med.**, v. 21, n. 1, p. 41-47, 2001.

BELLI, S.; BALBI, B.; PRINCE, I.; CATTANEO, D.; MASOCCO, F.; ZACCARIA, S.; BERTALLI, L.; CATTINI, F.; LOMAZZO, A.; NEGRO, F. D.; GIARDINI, M.; FRANSSEN, F. M. E.; JANSSEN, D. J. A.; SPRUIT, M. A. Low physical functioning and impaired performance of activities of daily life in COVID-19 patients who survived hospitalisation. **Eur Respir J.**, v. 56, n. 4, p. 2002096, 2020.

BENINGTON, S.; MCWILLIAMS, D.; EDDLESTON, J.; ATKINSON, D. Exercise testing in survivors of intensive care-is there a role for cardiopulmonary exercise testing? **J Crit Care.**, v. 27, n. 1, p. 89-94, 2012.

BENTLAGE, E.; AMMAR, A.; HOW, D.; AHMED, M.; TRABELSI, K.; CHTOUROU, H.; BRACH, M. Practical recommendations for maintaining active lifestyle during the covid-19 pandemic: A systematic literature review. **Int J Environ Res Public Health.**, v. 17, n. 17, p. 1-22, 2020.

BOKOLO, A. J. Exploring the adoption of telemedicine and virtual software for care of outpatients during and after COVID-19 pandemic. **Ir J Med Sci.**, v. 190, n. 1, p. 1-10, 2021.

BOKOLO, A. J. Use of Telemedicine and Virtual Care for Remote Treatment in Response to COVID-19 Pandemic. **J Med Syst.**, v. 44, n. 7, p. 132, 2020.

BRASIL. Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e

proteção para doenças crônicas nas capitais dos 26 estados. Disponível em: http://bvsms.saude.gov.br/bvs/publicacoes/vigitel_brasil_2019_vigilancia_fatores_risco.pdf. Acesso em: 8 mar. 2021.

Brasil: os números do relatório Digital in 2020. Disponível em: https://www.pagbrasil.com/pt-br/insights/brasil-os-numeros-do-relatorio-digital-in-2020/. Acesso em: 8 mar. 2021.

BRAWNER, C. A.; EHRMAN, J. K.; BOLE, S.; KERRIGAN, D. J.; PARIKH, S. S.; LEWIS, B. K.; GINDI, R. M.; KETEYIAN, C.; ABDUL-NOUR, K.; KETEYIAN, S. J. Inverse Relationship of Maximal Exercise Capacity to Hospitalization Secondary to Coronavirus Disease 2019. **Mayo Clin Proc.**, v. 96, n. 1, p. 32-39, 2021.

BURTSCHER, J.; MILLET, G. P.; BURTSCHER, M. Low cardiorespiratory and mitochondrial fitness as risk factors in viral infections: Implications for COVID-19. **Br J Sports Med.**, v. 55, n. 8, p. 413-415, 2021.

CAETANO, R.; SILVA, A. B.; GUEDES, A. C. C. M.; PAIVA, C. C. N.; RIBEIRO, G. R.; SANTOS, D. L.; SILVA, R. M. Challenges and opportunities for telehealth during the COVID-19 pandemic: Ideas on spaces and initiatives in the Brazilian context. **Cad Saude Publica.**, v. 36, n. 5, e00088920, 2020.

GUAN, W. J.; LIANG, W. H.; ZHAO, Y.; LIANG, H. R.; CHEN, Z. S.; LI, Y. M.; LIU, X. Q.; CHEN, R. C.; TANG, C. L.; WANG, T.; OU, C. Q.; LI, L.; CHEN, P. Y.; SANG, L.; WANG, W.; LI, J. F.; LI, C. C.; OU, L. M.; CHENG, B.; XIONG, S.; NI, Z. Y.; XIANG, J.; HU, Y.; LIU, L.; SHAN, H.; LEI, C. L.; PENG, Y. X.; WEI, L.; LIU, Y.; HU, Y. H.; PENG, P.; WANG, J. M.; LIU, J. Y.; CHEN, Z.; LI, G.; ZHENG, Z. J.; QIU, S. Q.; LUO, J.; YE, C. J.; ZHU, S. Y.; CHENG, L. L.; YE, F.; LI, S. Y.; ZHENG, J. P.; ZHANG, N. F.; ZHONG, N. S.; HE, J. X. Comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis. **Eur Respir J.**, v. 55, n. 5, p. 2000547, 2020.

CONTRERAS, C. M.; METZGER, G. A.; BEANE, J. D.; DEDHIA, P. H.; EJAZ, A.; PAWLIK, T. M. Telemedicine: Patient-Provider Clinical Engagement During the COVID-19 Pandemic and Beyond. **J Gastrointest Surg.**, v. 24, n. 7, p. 1692-1697, 2020.

Coronavírus Brasil. Disponível em: https://covid.saude.gov.br/. Acesso em: 8 mar. 2021.

CROCHEMORE-SILVA, I.; KNUTH, A. G.; WENDT, A.; NUNES, B. P.; HALLAL, P. C.; SANTOS, L. P.; HARTER, J.; PELLEGRINI, D. C. P. Physical activity during the COVID-19 pandemic: A population-based cross-sectional study in a city of south Brazil. **Cien Saude Colet.**, v. 25, n. 11, p. 4249-4258, 2020.

CURCI, C.; PISANO, F.; BONACCI, E.; CAMOZZI, D. M.; CERAVOLO, C.; BERGONZI, R.; DE FRANCESCHI, S.; MORO, P.; GUARNIERI, R.; FERRILLO, M.; NEGRINI, F.; SIRE, A. Early rehabilitation in post-acute COVID-19 patients: Data from an Italian COVID-19 Rehabilitation Unit and proposal of a treatment protocol. **Eur J Phys Rehabil Med.**, v. 56, n. 5, p. 633-641, 2020.

DE JESUS, I. T. M.; ORLANDO, F. DE S.; ZAZZETTA, M. S. Frailty and cognitive performance of elderly in the context of social vulnerability. **Dement e Neuropsychol.**, v. 12, n. 2, p. 173-180, 2018.

DELEN, D.; ERYARSOY, E.; DAVAZDAHEMAMI, B. No place like home: Cross-national data analysis of the efficacy of social distancing during the COVID-19 pandemic. **JMIR Public Health Surveill.**, v. 6, n. 2, e19862, 2020.

DING, D.; DEL POZO CRUZ, B.; GREEN, M. A.; BAUMAN, A. E. Is the COVID-19 lockdown nudging people to be more active: A big data analysis. **Br J Sports Med.**, v. 54, n. 20, p. 1183-1184, 2020.

DING, D.; LAWSON, K. D.; KOLBE-ALEXANDER, T. L.; FINKELSTEIN, E. A.; KATZMARZYK, P. T.; VAN MECHELEN, W.; PRATT, M. The economic burden of physical inactivity: a global analysis of major non-communicable diseases. **Lancet.**, v. 388, n. 10051, p. 1311-1324, 2016.

DUNTON, G. F.; DO, B.; WANG, S. D. Early effects of the COVID-19 pandemic on physical activity and sedentary behavior in children living in the U.S. **BMC Public Health.**, v. 20, n. 1, p. 1351, 2020.

EDNEY, S.; BOGOMOLOVA, S.; RYAN, J.; OLDS, T.; SANDERS, I.; MAHER, C. Creating engaging health promotion campaigns on social media: Observations and lessons from Fitbit and Garmin. **J Med Internet Res.**, v. 20, n. 12, e10911, 2018.

FAGHY, M. A.; SYLVESTER, K. P.; COOPER, B. G.; HULL, J. H. Cardiopulmonary exercise testing in the COVID-19 endemic phase. **Br J Anaesth.**, v. 125, n. 4, p. 447-449, 2020.

FANG, X.; LI, S.; YU, H.; WANG, P.; ZHANG, Y.; CHEN, Z.; LI, Y.; CHENG, L.; LI, W.; JIA, H.; MA, X. Epidemiological, comorbidity factors with severity and prognosis of COVID-19: A systematic review and meta-analysis. **Aging (Albany NY).**, v. 12, n. 13, p. 12493-12503, 2020.

FERNÁNDEZ-LÁZARO, D.; GONZÁLEZ-BERNAL, J. J.; SÁNCHEZ-SERRANO, N.; NAVASCUÉS, L. J.; DEL RÍO, A. A.; MIELGO-AYUSO, J. Physical exercise as a multimodal tool for COVID-19: Could it be used as a preventive strategy? **Int J Environ Res Public Health.**, v. 17, n. 22, p. 1-13, 2020.

FERRER, D. A.; ELLIS, R. A review of physical activity interventions delivered via Facebook. **J Phys Act Heal.**, v. 14, n. 10, p. 823-833, 2017.

FUGLEBJERG, N. J. U.; JENSEN, T. O.; HOYER, N.; RYRSØ, C. K.; MADSEN, B. L.; HARBOE, Z. B. Silent hypoxia in patients with SARS CoV-2 infection before hospital discharge. **Int J Infect Dis.**, v. 99, p. 100-101, 2020.

GALLÈ, F.; SABELLA, E. A.; FERRACUTI, S.; DE GIGLIO, O.; CAGGIANO, G.; PROTANO, C.; VALERIANI, F.; PARISI, E. A.; VALERIO, G.; LIGUORI, G.; MONTAGNA, M. T.; SPICA, V. R.; DA MOLIN, G.; ORSI, G. B.; NAPOLI, C. Sedentary behaviors and physical activity of Italian undergraduate students during lockdown at the time of COVID−19 pandemic. **Int J Environ Res Public Health.**, v. 17, n. 17, p. 1-11, 2020.

GALLO, L. A.; GALLO, T. F.; YOUNG, S. L.; MORITZ, K. M.; AKISON, L. K. The impact of isolation measures due to covid-19 on energy intake and physical activity levels in australian university students. **Nutrients.**, v. 12, n. 6, p. 1-14, 2020.

GANDHI, S.; SRIVASTAVA, A. K.; RAY, U.; TRIPATHI, P. P. Is the Collapse of the Respiratory Center in the Brain Responsible for Respiratory Breakdown in COVID-19 Patients? **ACS Chem Neurosci.**, v. 11, n. 10, p. 1379-1381, 2020.

GARCÍA-TASCÓN, M.; SAHELICES-PINTO, C.; MENDAÑA-CUERVO, C.; MAGAZ-GONZÁLEZ, A. M. The impact of the covid-19 confinement on the habits of pa practice according to gender (Male/female): Spanish case. **Int J Environ Res Public Health.**, v. 17, n. 19, p. 1-19, 2020.

GE, H.; WANG, X.; YUAN, X.; XIAO, G.; WANG, C.; DENG, T.; YUAN, Q.; XIAO, X. The epidemiology and clinical information about COVID-19. **Eur J Clin Microbiol Infect Dis.**, v. 39, n. 6, p. 1011-1019, 2020.

GIANSANTI, D. The Italian Fight against the COVID-19 Pandemic in the Second Phase:

The Renewed Opportunity of Telemedicine. **Telemed e-Health.**, v. 26, n. 11, p. 1328-1331, 2020.

GULATI, A.; POMERANZ, C.; QAMAR, Z.; THOMAS, S.; FRISCH, D.; GEORGE, G.; SUMMER, R.; DESIMONE, J.; SUNDARAM, B. A Comprehensive Review of Manifestations of Novel Coronaviruses in the Context of Deadly COVID-19 Global Pandemic. **Am J Med Sci.**, v. 360, n. 1, p. 5-34, 2020.

GUTENBRUNNER, C.; STOKES, E. K.; DREINHÖFER, K.; MONSBAKKEN, J.; CLARKE, S.; CÔTE, P.; URSEAU, I.; CONSTANTINE, D.; TARDIF, C.; BALAKRISHNA, V.; NUGRAHA, B. Why rehabilitation must have priority during and after the COVID-19-pandemic: A position statement of the global rehabilitation alliance. **J Rehabil Med.**, v. 52, n. 7, jrm00081, 2020.

GUTHOLD, R.; STEVENS, GA.; RILEY, L. M.; BULL, F. C. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1·9 million participants. **Lancet Glob Heal.**, v. 6, n. 10, e1077-e1086, 2018.

HALL, G.; LADDU, D. R.; PHILLIPS, S. A.; LAVIE, C. J.; ARENA, R. A tale of two pandemics: How will COVID-19 and global trends in physical inactivity and sedentary behavior affect one another? **Prog Cardiovasc Dis.**, v. 64, p. 108-110, 2020.

HALPIN, S. J.; MCIVOR, C.; WHYATT, G.; ADAMS, A.; HARVEY, O.; MCLEAN, L.; WALSHAW, C.; KEMP, S.; CORRADO, J.; SINGH, R.; COLLINS, T.; O'CONNOR, R. J.; SIVAN, M. Postdischarge symptoms and rehabilitation needs in survivors of COVID-19 infection: A cross-sectional evaluation. **J Med Virol.**, v. 93, n. 2, p. 1013-1022, 2021.

HE, M.; XIAN, Y.; LV, X.; HE, J.; REN, Y. Changes in body weight, physical activity and lifestyle during the semi-lockdown period after the outbreak of COVID-19 in China: An online survey. **Disaster Med Public Health Prep.**, v. 14, p. 1-6, 2020.

HUANG, C.; XU, X.; CAI, Y.; GE, Q.; ZENG, G.; LI, X.; ZHANG, W.; JI, C.; YANG, L. Mining the characteristics of COVID-19 patients in china: Analysis of social media posts. **J Med Internet Res.**, v. 22, n. 5, e19087, 2020.

HUHMAN, M.; POTTER, L. D.; WONG, F. L.; BANSPACH, S. W.; DUKE, J. C.; HEITZLER, C. D. Effects of a mass media campaign to increase physical activity among children: Year-1 results of the VERB campaign. *Pediatrics*., v. 116, n. 2, e277-84, 2005.

HUR, K.; PRICE, C. P. E.; GRAY, E. L.; GULATI, R. K.; MAKSIMOSKI, M.; RACETTE, S. D.; SCHNEIDER, A. L.; KHANWALKAR, A. R. Factors Associated With Intubation and Prolonged Intubation in Hospitalized Patients With COVID-19. **Otolaryngol Head Neck Surg**, v. 163, n. 1, p. 170-178, 2020.

JACOB, L.; TULLY, M. A.; BARNETT, Y.; LOPEZ-SANCHEZ, G. F.; BUTLER, L.; SCHUCH, F.; LÓPEZ-BUENO, R.; MCDERMOTT, D.; FIRTH, J.; GRABOVAC, I.; YAKKUNDI, A.; ARMSTRONG, N.; YOUNG, T.; SMITH, L. The relationship between physical activity and mental health in a sample of the UK public: A cross-sectional study during the implementation of COVID-19 social distancing measures. **Ment Health Phys Act.**, v. 19, p. 100345, 2020.

KANDOLA, A.; VANCAMPFORT, D.; HERRING, M.; REBAR, A.; HALLGREN, M.; FIRTH, J.; STUBBS, B. Moving to Beat Anxiety: Epidemiology and Therapeutic Issues with Physical Activity for Anxiety. **Curr Psychiatry Rep.**, v. 20, n. 8, p. 63, 2018.

KARLOH, M.; SOUSA MATIAS, T.; FLEIG MAYER, A. The COVID-19 Pandemic Confronts the Motivation Fallacy within Pulmonary Rehabilitation Programs. **COPD.**, v. 17, n. 4, p. 343-345, 2020.

KAUSHAL, N.; KEITH, N. C.; AGUIÑAGA, S.; HAGGER, M. S. Social cognition and socioecological predictors of home-based physical activity intentions, planning, and habits during the covid-19 pandemic. **Behav Sci (Basel)**, v.10, n. 9, p. 133, 2020.

KHORAMIPOUR, K.; BASEREH, A.; HEKMATIKAR, A. A.; CASTELL, L.; RUHEE, R. T.; SUZUKI, K. Physical activity and nutrition guidelines to help with the fight against COVID-19. **J Sports Sci.**, v. 39, n. 1, p. 101-107, 2021.

KIEKENS, C.; BOLDRINI, P.; ANDREOLI, A.; AVESANI, R.; GAMNA, F.; GRANDI, M.; LOMBARDI, F.; LUSUARDI, M.; MOLTENO, F.; PERBONI, A.; NEGRINI, S. Rehabilitation and respiratory management in the acute and early post-acute phase "instant paper from the field" on rehabilitation answers to the COVID-19 emergency. **Eur J Phys Rehabil Med.**, v. 56, n. 3, p. 323-326, 2020.

KOPEL, J.; PERISETTI, A.; ROGHANI, A.; AZIZ, M.; GAJENDRAN, M.; GOYAL, H. Racial and Gender-Based Differences in COVID-19. **Front Public Heal.**, v. 8, p. 418, 2020.

LAI, C. C.; KO, W. C.; LEE, P. I.; JEAN, S. S.; HSUEH, P. R. Extra-respiratory manifestations of COVID-19. **Int J Antimicrob Agents**, v. 56, n. 2, p. 106024, 2020.

LANKFORD, T.; WALLACE, J.; BROWN, D.; SOARES, J.; EPPING, J. N.; FRIDINGER, F. Analysis of physical activity mass media campaign design. **J Phys Act Heal.**, v. 11, n. 6, p. 1065-1069, 2014.

LAU, H. M. C.; LEE, E. W. C.; WONG, C. N. C.; NG, G. Y. F.; JONES, A. Y. M.; HUI, D. S. C. The impact of severe acute respiratory syndrome on the physical profile and quality of life. **Arch Phys Med Rehabil.**, v. 86, n. 6, p. 1134-1140, 2005.

LESSER, I. A.; NIENHUIS, C. P. The impact of COVID-19 on physical activity behavior and well-being of canadians. **Int J Environ Res Public Health.**, v. 17, n. 11, p. 3899, 2020.

LEVINGER, P.; HILL, K. D. The impact of mass media campaigns on physical activity participation on a global scale: Lessons learned from the COVID-19 pandemic. **J Phys Act Heal.**, v. 17, n. 9, p. 857-858, 2020.

LI, B.; YANG, J.; ZHAO, F.; ZHI, L.; WANG, X.; LIU, L.; ZHAOHUI, B.; ZHAO, Y. Prevalence and impact of cardiovascular metabolic diseases on COVID-19 in China. **Clin Res Cardiol.**, v. 109, n. 5, p. 531-538, 2020.

LI, HOY.; BAILEY, A.; HUYNH, D.; CHAN, J. YouTube as a source of information on COVID-19: A pandemic of misinformation? **BMJ Glob Heal.**, v. 5, n. 5, e002604, 2020.

LI, Y. C.; BAI, W. Z.; HASHIKAWA, T. The neuroinvasive potential of SARS-CoV2 may play a role in the respiratory failure of COVID-19 patients. **J Med Virol.**, v. 92, n. 6, p. 552-555, 2020.

LI, Z.; ZHENG, C.; DUAN, C.; ZHANG, Y.; LI, Q.; DOU, Z.; LI, J.; XIA, W. Rehabilitation needs of the first cohort of post-acute COVID-19 patients in Hubei, China. **Eur J Phys Rehabil Med.**, v. 56, n. 3, p. 339-344, 2020.

LITHANDER, F. E.; NEUMANN, S.; TENISON, E.; LLOYD, K.; WELSH, T. J.; RODRIGUES, J. C. L.; HIGGINS, J. P. T.; SCOURFIELD, L.; CHRISTENSEN, H.; HAUNTON, V. J.; HENDERSON, E. J. COVID-19 in older people: A rapid clinical review. **Age Ageing.**, v. 49, n. 4, p. 501-515, 2020.

LOEB, A. E.; RAO, S. S.; FICKE, J. R.; MORRIS, C. D.; RILEY, L. H.; LEVIN, A. S. Departmental Experience and Lessons Learned With Accelerated Introduction of

Telemedicine During the COVID-19 Crisis. **J Am Acad Orthop Surg.**, v. 28, n. 11, e469-e476, 2020.

LÓPEZ, C.; CLOSA, C.; LUCAS, E. Telemedicine in rehabilitation: Post-COVID need and opportunity. **Rehabilitacion.**, v. 54, n. 4, p. 225-227, 2020.

LÓPEZ-BUENO, R.; CALATAYUD, J.; EZZATVAR, Y.; CASAJÚS, J. A.; SMITH, L.; ANDERSEN, L. L.; LÓPEZ-SÁNCHEZ, G. F. Association Between Current Physical Activity and Current Perceived Anxiety and Mood in the Initial Phase of COVID-19 Confinement. **Front Psychiatry.**, v. 11, p. 729, 2020.

LÓPEZ-SÁNCHEZ, G. F.; LÓPEZ-BUENO, R.; GIL-SALMERÓN, A.; ZAUDER, R.; SKALSKA, M.; JASTRZEBSKA, J.; SBIGNIEW, J.; SCHUCH, F. B.; GRABOVAC, I.; TULLY, M. A.; SMITH, L. Comparison of physical activity levels in Spanish adults with chronic conditions before and during COVID-19 quarantine. **Eur J Public Health.**, v. 31, n. 1, p. 161-166, 2021.

MACINKO, J.; WOOLLEY, N. O.; SEIXAS, B. V.; DE ANDRADE, F. B.; LIMA-COSTA, M. F. Health care seeking due to COVID-19 related symptoms and health care cancellations among older Brazilian adults: The ELSI-COVID-19 initiative. **Cad Saude Publica.**, v. 36, e00181920, 2020.

MALM, C.; JAKOBSSON, J.; ISAKSSON, A. Physical Activity and Sports—Real Health Benefits: A Review with Insight into the Public Health of Sweden. **Sports.**, v. 7, n. 5, p. 127, 2019.

MANN, D. M.; CHEN, J.; CHUNARA, R.; TESTA, P. A.; NOV, O. COVID-19 transforms health care through telemedicine: Evidence from the field. **J Am Med Inform Assoc.**, v. 27, n. 7, p. 1132-1135, 2020.

MAUGERI, G.; CASTROGIOVANNI, P.; BATTAGLIA, G.; PIPPI, R.; D'AGATA, V.; PALMA, A.; DI ROSA, M.; MUSUMECI, G. The impact of physical activity on psychological health during Covid-19 pandemic in Italy. **Heliyon.**, v. 6, n. 6, e04315, 2020.

MERCHANT, R. M.; LURIE, N. Social Media and Emergency Preparedness in Response to Novel Coronavirus. **JAMA.**, v. 323, n. 20, p. 2011-2012, 2020.

MODESTI, P. A.; WANG, J.; DAMASCENO, A.; AGYEMANG, C.; BORTEL, L. V.; PERSU, A.; ZHAO, D.; JARRAYA, F.; MARZOTTI, I.; BAMOSHMOOSH, M.; PARATI, G.; SHUTTE, A. E. Indirect implications of COVID-19 prevention strategies on non-communicable diseases. **BMC Med.**, v. 18, n. 1, p. 256, 2020.

MOORE, S. A.; FAULKNER, G.; RHODES, R. E.; BRUSSONI, M.; CHULAK-BOZZER, T.; FERGUSON, L. J.; MITRA, R.; O'REILLY, N.; SPENCE, J. C.; VANDERLOO, L. M.; TREMBLAY, M. S. Impact of the COVID-19 virus outbreak on movement and play behaviours of Canadian children and youth: A national survey. **Int J Behav Nutr Phys Act.**, v. 17, n. 1, p. 85, 2020.

NATIVIDADE, M. DOS S.; BERNARDES, K.; PEREIRA, M.; MIRANDA, S. S.; BERTOLDO, J.; TEIXEIRA, M. G.; LIVRAMENTO, H. L.; ARAGÃO, E. Social distancing and living conditions in the pandemic COVID-19 in Salvador-Bahia, Brazil. **Cienc e Saude Coletiva.**, v. 25, n. 9, p. 3385-3392, 2020.

NCDs | Physical Inactivity: a global public health problem. *WHO*. Disponível em: http://www.who.int/ncds/prevention/physical-activity/inactivity-global-health-problem/en/. Acesso em: 8 mar. 2021.

NEGRINI, F.; de SIRE, A.; ANDRENELLI, E.; LAZZARINI, S. G.; PATRINI, M.; CERAVOLO, M. G. Rehabilitation and COVID-19: The Cochrane Rehabilitation 2020 rapid

living systematic review. Update as of July 31st, 2020. **Eur J Phys Rehabil Med.**, v. 56, n. 5, p. 652-657, 2020.

NISHIJIMA, M.; IVANAUSKAS, T. M.; SARTI, F. M. Evolution and determinants of digital divide in Brazil (2005–2013). **Telecomm Policy.**, v. 41, n. 1, p. 12-24, 2017.

OHANNESSIAN, R.; DUONG, T. A.; ODONE, A. Global telemedicine implementation and integration within health systems to fight the COVID-19 pandemic: A call to action. **JMIR Public Heal Surveill.**, v. 6, n. 2, e18810, 2020.

PARK, S.; KIM, B.; LEE, J. Social Distancing and Outdoor Physical Activity During the COVID-19 Outbreak in South Korea: Implications for Physical Distancing Strategies. **Asia-Pacific J Public Heal.**, v. 32, n. 6-7, p. 360-362, 2020.

Pesquisa Nacional por Amostra de Domicílios Contínua - PNAD Contínua | IBGE. Disponível em: https://www.ibge.gov.br/estatisticas/sociais/educacao/9173-pesquisa-nacional-por-amostra-de-domicilios-continua-trimestral.html?=&t=o-que-e. Acesso em: 8 mar. 2021.

PITANGA, F. J. G.; BECK, C. C.; PITANGA, C. P. S. Physical activity and reducing sedentary behavior during the coronavirus pandemic. **Arq Bras Cardiol.**, v. 114, n. 6, p. 1058-1060, 2020.

RAMASWAMY, A.; YU, M.; DRANGSHOLT, S.; NG, E.; CULLIGAN, P. J.; SCHLEGEL, P. N.; HU, J. C. Patient satisfaction with telemedicine during the COVID-19 pandemic: Retrospective cohort study. **J Med Internet Res.**, v. 22, n. 9, e20786, 2020.

REYES-OLAVARRÍA, D.; LATORRE-ROMÁN, P. Á.; GUZMÁN-GUZMÁN, I. P.; JEREZ-MAYORGA, D.; CAAMAÑO-NAVARRETE, F.; DELGADO-FLOODY, P. Positive and negative changes in food habits, physical activity patterns, and weight status during covid-19 confinement: Associated factors in the chilean population. **Int J Environ Res Public Health.**, v. 17, n. 15, p. 1-14, 2020.

RICHARDSON, S. J.; CARROLL, C. B.; CLOSE, J.; GORDON, A. L.; O'BRIEN, J.; QUINN, T. J.; ROCHESTER, L.; SAYER, A. A.; SHENKIN, S. D.; VAN DER VELDE, N.; WOO, J.; WITHAM, M. D. Research with older people in a world with COVID-19: Identification of current and future priorities, challenges and opportunities. **Age Ageing.**, v. 49, n. 6, p. 901-906, 2020.

ROSSI, P. G.; MARINO, M.; FORMISANO, D.; VENTURELLI, F.; VICENTINI, M.; GRILLI, R. Characteristics and outcomes of a cohort of COVID-19 patients in the Province of Reggio Emilia, Italy. **PLoS One.**, v. 15, e0238281, 2020.

RUBIN, D. S.; SEVERIN, R.; ARENA, R.; BOND, S. Leveraging technology to move more and sit less. **Prog Cardiovasc Dis.**, v. 64, p. 55-63, 2021.

RUÍZ-ROSO MB, DE CARVALHO PADILHA P, MATILLA-ESCALANTE DC, et al. Changes of physical activity and ultra-processed food consumption in adolescents from different countries during covid-19 pandemic: An observational study. **Nutrients.**, v. 12, n. 8, p. 2289, 2020.

RUIZ-ROSO, M. B.; KNOTT-TORCAL, C.; MATILLA-ESCALANTE, D. C.; GARCIMARTÍN, A.; SAMPEDRO-NUÑEZ, M. A.; DÁVALOS, A.; MARAZUELA, M. Covid-19 lockdown and changes of the dietary pattern and physical activity habits in a cohort of patients with type 2 diabetes mellitus. **Nutrients.**, v. 12, n. 8, p. 1-16, 2020.

SAINT-MAURICE, P. F.; TROIANO, R. P.; BASSETT, D. R.; GRAUBARD, B. I.; CARLSON, S. A.; SHIROMA, E. J.; FULTON, J. E.; MATTHEWS, C. E. Association of Daily Step Count and Step Intensity with Mortality among US Adults. **JAMA**, v. 323, n.

12, p. 1151-1160, 2020.

SALAWU, A.; GREEN, A.; CROOKS, M. G.; BRIXEY, N.; ROSS, D. H.; SIVAN, M. A proposal for multidisciplinary tele-rehabilitation in the assessment and rehabilitation of COVID-19 survivors. **Int J Environ Res Public Health.**, v. 17, n. 13, p. 1-13, 2020.

SANTOS-ORLANDI, A. A. DOS.; BRITO, T. R. P. DE.; OTTAVIANI, A. C.; ROSSETTI, E. S.; ZAZZETTA, M. S.; GRATÃO, A. C. M.; ORLANDI, F. DE S.; PAVARINI, S. C. L. Profile of older adults caring for other older adults in contexts of high social vulnerability. **Esc Anna Nery - Rev Enferm.**, v. 21, n. 1, 2017.

SCHUCH, F.; VANCAMPFORT, D.; FIRTH, J.; ROSENBAUM, S.; WARD, P.; REICHERT, T.; BAGATINI, N. C.; BGEGINSKI, R.; STUBBS, R. Physical activity and sedentary behavior in people with major depressive disorder: A systematic review and meta-analysis. **J Affect Disord.**, v. 210, p. 139-150, 2017.

SCHUCH, F. B.; BULZING, R. A.; MEYER, J.; VANCAMPFORT, D.; FIRTH, J.; STUBBS, B.; GRABOVAC, I.; WILLEIT, P.; TAVARES, V. D. O.; CALEGARO, V. C.; DEENIK, J.; LÓPEZ-SÁNCHEZ, G. F.; VERONESE, N.; CAPERCHIONE, C. M.; SADARANGANI, K. P.; ABUFARAJ, M.; TULLY, M. A.; SMITH, L. Associations of moderate to vigorous physical activity and sedentary behavior with depressive and anxiety symptoms in self-isolating people during the COVID-19 pandemic: A cross-sectional survey in Brazil. Psychiatry Res., v. 292, p. 113339, 2020.

SCHWENDINGER, F.; POCECCO, E. Counteracting physical inactivity during the COVID-19 pandemic: Evidence-based recommendations for home-based exercise. **Int J Environ Res Public Health.**, v. 17, n. 11, p. 3909, 2020.

SLATER, S. J.; CHRISTIANA, R. W.; GUSTAT, J. Recommendations for keeping parks and green space accessible for mental and physical health during COVID-19 and other pandemics. **Prev Chronic Dis.**, v. 17, n. 17, E59, 2020.

SLIMANI, M.; PARAVLIC, A.; MBAREK, F.; BRAGAZZI, N. L.; TOD, D. The Relationship Between Physical Activity and Quality of Life During the Confinement Induced by COVID-19 Outbreak: A Pilot Study in Tunisia. **Front Psychol.**, v. 11, p. 1882, 2020.

SMITH, A. C.; THOMAS, E.; SNOSWELL, C. L.; HAYDON, H.; MEHROTRA, A.; CLEMENSEN, J.; CAFFERY, L. J. Telehealth for global emergencies: Implications for coronavirus disease 2019 (COVID-19). **J Telemed Telecare.**, v. 26, n. 5, p. 309-313, 2020.

SMITH, J. M.; LEE, A. C.; ZELEZNIK, H.; SCOTT, J. P. C.; FATIMA, A.; NEEDHAM, D. M.; OHTAKE, P. J. Home and community-based physical therapist management of adults with post-intensive care syndrome. **Phys Ther.**, v. 100, n. 7, p. 1062-1073, 2020.

SOMMERS, J.; KLOOSTER, E.; ZOETHOUT, S. B.; VAN DEN OEVER, H. L. A.; NOLLET, F.; TEPASKE, R.; HORN, J.; ENGELBERT, R. H. H.; VAN DER SCHAAF, M. Feasibility of Exercise Testing in Patients Who Are Critically Ill: A Prospective, Observational Multicenter Study. **Arch Phys Med Rehabil.**, v. 100, n. 2, p. 239-246, 2019.

STAM, H. J.; STUCKI, G.; BICKENBACH, J. Covid-19 and post intensive care syndrome: A call for action. **J Rehabil Med.**, v. 52, n. 4, jrm00044, 2020.

Staying Physically Active During the COVID-19 Pandemic. Disponível em: https://www.acsm.org/read-research/newsroom/news-releases/news-detail/2020/03/16/staying-physically-active-during-covid-19-pandemic. Acesso em: 8 mar. 2021.

STEAD, M.; ANGUS, K.; LANGLEY, T.; KATIKIREDDI, S. V.; HINDS, K.; HILTON, S.; LEWIS, S.; THOMAS, J.; CAMPBELL, M.; YOUNG, B.; BAULD, L. Mass media

to communicate public health messages in six health topic areas: a systematic review and other reviews of the evidence. **Public Heal Res.**, v. 7, n. 8, p. 1-206, 2019.

TANG, Q.; ZHANG, K.; LI, Y. The important role of social media during the COVID-19 epidemic. **Disaster Med Public Health Prep.**, v. 15, n. 4, e3-e4, 2021.

TISON, G. H.; AVRAM, R.; KUHAR, P.; ABREAU, S.; MARCUS, G. M.; PLETCHER, M. J.; OLGIN, J. E. Worldwide Effect of COVID-19 on Physical Activity: A Descriptive Study. **Ann Intern Med.**, v. 173, n. 9, p. 767-770, 2020.

VANCINI, R. L.; CAMARGO-NETO, L.; DE LIRA, C. A. B.; ANDRADE, M. S.; VIANA, R. B.; NIKOLAIDIS, P. T.; KNECHTLE, B.; GENTIL, P.; PIACEZZI, L. H. V.; LOPES, M. C. B. T.; BATISTA, R. E. A.; VANCINI-CAMPANHARO, C. R. Physical activity and sociodemographic profile of brazilian people during COVID-19 outbreak: An online and cross-sectional survey. **Int J Environ Res Public Health.**, v. 17, n. 21, p. 7964, 2020.

VILENDRER, S.; PATEL, B.; CHADWICK, W.; HWA, M.; ASCH, S.; PAGELER, N.; RAMDEO, R.; SALIBA-GUSTAFSSON, E. A.; STRONG, P.; SHARP, C. Rapid Deployment of Inpatient Telemedicine In Response to COVID-19 Across Three Health Systems. **J Am Med Inform Assoc.**, v. 27, n. 7, p. 1102-1109, 2020.

VOPHAM, T.; WEAVER, M. D.; HART, J. E.; TON, M.; WHITE, E.; NEWCOMB, P. A. Effect of social distancing on COVID-19 incidence and mortality in the US. **medRxiv**. Published online June 12, 2020.

WADE, D. T. Rehabilitation after COVID-19: An evidence-based approach. **Clin Med J R Coll Physicians London.**, v. 20, n. 4, p. 359-365, 2020.

WAINWRIGHT, T. W.; LOW, M. Beyond acute care: Why collaborative self-management should be an essential part of rehabilitation pathways for covid-19 patients. **J Rehabil Med.**, v. 52, n. 5, jrm00055, 2020.

WANG, M.; BAKER, J. S.; QUAN, W.; SHEN, S.; FEKETE, G.; GU, Y. A Preventive Role of Exercise Across the Coronavirus 2 (SARS-CoV-2) Pandemic. **Front Physiol.**, v. 11, p. 572718, 2020.

WARBURTON, D. E. R.; BREDIN, S. S. D. Health benefits of physical activity: A systematic review of current systematic reviews. **Curr Opin Cardiol.**, v. 32, n. 5, p. 541-556, 2017.

ZAROCOSTAS, J. How to fight an infodemic. **Lancet**, v. 395, n. 10225, p. 676, 2020.

ZBINDEN-FONCEA, H.; FRANCAUX, M.; DELDICQUE, L.; HAWLEY, J. A. Does High Cardiorespiratory Fitness Confer Some Protection Against Proinflammatory Responses After Infection by SARS-CoV-2? **Obesity.**, v. 28, n. 8, p. 1378-1381, 2020.

ZHAO, J.; LI, X.; GAO, Y.; HUANG, W. Risk factors for the exacerbation of patients with 2019 novel coronavirus: A meta-analysis. **Int J Med Sci.**, v. 17, n. 12, p. 1744-1750, 2020.

ZHU, Y.; WANG, Z.; ZHOU, Y.; ONODA, K.; MARUYAMA, H.; HU, C.; LIU, Z. Summary of respiratory rehabilitation and physical therapy guidelines for patients with COVID-19 based on recommendations of World Confederation for Physical Therapy and National Association of Physical Therapy. **J Phys Ther Sci.**, v. 32, n. 8, p. 545-549, 2020.