Being Physically Active Leads to Better Recovery Prognosis for People Diagnosed with COVID-19: A Cross-Sectional Study

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Abstract: The regular practice of physical activity helps in the prevention and control of several non-communicable diseases. However, evidence on the role of physical activity in mitigating worsening clinical outcomes in people with COVID-19 is still unclear. The aim of this study was to verify whether different levels of physical activity provide protection for clinical outcomes caused by SARS-CoV-2 infection. A cross-sectional study was conducted with 509 adults (43.8 ± 15.71 years; 61.1% female) with a positive diagnosis of COVID-19 residing in Ribeirão Preto, São Paulo, Brazil. Participants were interviewed by telephone to determine the severity of the infection and the physical activity performed. Binary logistic regression was used to indicate the odds ratio (OR) of active people reporting less harmful clinical outcomes from COVID-19. Active people had a lower chance of hospitalization, fewer hospitalization days, less respiratory difficulty and needed less oxygen support. The results suggest that active people, compared to sedentary people, have a lower frequency of hospitalization, length of stay, breathing difficulty and need for oxygen support. These results corroborate the importance of public policies to promote the practice of physical activity, in order to mitigate the severity of the clinical outcomes of COVID-19.

Keywords: pandemic; SARS-CoV-2; physical activity; general health; lifestyle; morbidity; mortality

1. Introduction

The Severe Acute Respiratory Syndrome of the Novel Coronavirus (SARS-CoV-2) has infected more than 525 million people and caused more than 6 million deaths [1]. Among those infected, approximately 80% of cases are asymptomatic or with mild symptoms [2], others may have a fever, fatigue, dry cough, myalgia, nasal congestion, cold, sore throat, diarrhea [3], shortness of breath and anosmia [4], and the others can present with severe or critical symptoms that can lead to death [2]. In addition, socioeconomic, geographic and structural factors [5,6], and personal characteristics including age [7–9] and sex [9,10] can worsen the clinical outcomes of COVID-19. Comorbidities such as diabetes [11,12], obesity [9–13], respiratory diseases [7,10,14,15], cardiovascular [16], cerebrovascular, hepatic [17] and renal dysfunction [17], excessive use of cigarettes [17], cancer diagnosis [18],...
immunodeficiency [19], immunosenescence [20] and a sedentary lifestyle [10,21] may also contribute to more severe COVID-19 clinical outcomes [5,22,23].

Among the risk factors mentioned above, the scientific evidence linking a sedentary lifestyle with chronic diseases and premature death is very well established. In contrast, being physically active is one of the main determinants of health [23], as it reduces the occurrence and severity of metabolic syndrome, type 2 diabetes mellitus, cardiovascular disease, cancer, stress, depression and anxiety. Additionally, active living improves physical fitness and stimulates the human immune system [24,25], potentiating the pathogenic activity of tissue macrophages and increasing the number of immunoglobulins, neutrophils, natural killer cells, cytotoxic T cells, B cells and anti-inflammatory cytokines [26]. Studies have shown that sedentary people who become physically active benefit from an enhanced immune system which makes them less susceptible to infections. Moderate-intensity physical activity has been shown to be effective against respiratory tract infections [26].

Recognizing the known positive effects of physical activity on immunity, inflammation and infection [24,25], we hypothesize that physically active people may be better protected against negative clinical outcomes induced by SARS-CoV-2 infection [4,7,20]. Thus, the objective of the study was to verify whether physically active people are less likely to have a negative clinical outcome in response to a diagnosis of COVID-19 in a large community sample of Brazilian adults.

2. Materials and Methods

2.1. Study Design

A cross-sectional observational study was performed; the data collection process took place between 7 June and 27 December 2020. This manuscript followed the guidelines from the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) [27] and the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) conference list [28].

2.2. Sample, Inclusion and Exclusion Criteria

The sample consisted of adults of both sexes, who had a positive diagnosis of COVID-19. Inclusion criteria were: people ≥ 18 years of age, positive diagnosis for COVID-19, living in Ribeirão Preto, state of São Paulo—Brazil. Exclusion criteria were: presence of any conditions of immunological compromise, prolonged use including the use of corticosteroids and/or chemotherapy, transplant patients, presence of neurodegenerative diseases. The sample size calculation considered a prevalence of hospitalizations for COVID-19 of 10.0%, a precision of 3.5% and a confidence interval of 95%, for a finite population of 33,643 infected during data collection, achieving a sample minimum of 500 to 650 participants. The Power and Sample Size Program® version 3.043 (HyLown Consulting LLC, Atlanta, GA, USA) was adopted for sample size calculation.

2.3. Data Collection

The Municipal Health Department of Ribeirão Preto provided the names, telephone numbers and e-mails of 33,643 people diagnosed with COVID-19. Randomly, using Microsoft Excel®, seven evaluators, trained and supervised by the principal investigator, made 3814 telephone calls. Of this total, after a maximum of three attempts, 647 participants answered the calls. Data from a total of 14 individuals were disregarded, as the participants did not meet the eligibility criteria, and 124 persons did not wish to participate in the study. Thus, 509 people diagnosed with COVID-19 were interviewed and considered eligible (Figure 1).

2.4. Procedures and Ethical Aspects

This study was approved by the Research Ethics Committee of the University of São Paulo at Ribeirão Preto College of Nursing (CEP-EERP/USP) (CAAE n. 39645220.6.0000.5393), following the guidelines that regulate research involving human beings according to
the Resolution of the National Health Council (CNS) 466/12. Subsequently, the project was sent for consideration by the Municipal Health Department of Ribeirão Preto and approved (official letter 462/2020-SMS-RP Research Project Evaluation Commission). This entity provided personal information (name, telephone contact and e-mail) of people diagnosed with COVID-19. The names were randomized to avoid the risk of bias in the study. Participants were contacted by telephone and invited to participate in the study by answering the questionnaire “Profile of the person diagnosed with COVID-19” and the short version of the International Physical Activity Questionnaire (IPAQ). The free Google Forms® tool was used to prepare the forms and ensure that all mandatory questions were answered. The usability and technical functionality of the forms were tested before completing the questionnaire. All information collected and stored was used without identifying the study participants. Incentives were not offered for participation in the study. Before obtaining any clinical information, all participants verbally consented to participate in the study, which is also in accordance with the Declaration of Helsinki.

![Flowchart of study design](image)

**Figure 1.** Flowchart of study design. Patients with coronavirus disease (COVID-19). The figure represents a flow diagram of the study.

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Initially, the researchers designed a pilot version of the questionnaire based on the research goals of the study. Next, the questionnaire was sent to a committee of judges, consisting of three Ph.D. professionals, such as a Kinesiologist, a Nurse, and a Physician, who were familiar with the research objectives of the study. For each question, the specialist responded “I totally disagree”, or “I disagree” or “Indifferent/neutral”, or “I agree” or “I totally agree”. In addition, it was necessary to answer the question “Do you suggest any modification to this question?” Each answer was analyzed by the study researchers, and
when two or more experts marked the same alternative, it was accepted by the researchers. The suggestions for some modifications to the question were also taken into account. This approach is consistent with recommended approaches to the establishment of the content validity of questionnaire surveys [29–32].

The questionnaire had four pages and was grouped into the following parts: Identification (date of the interview, date of birth, gender, and city or state at the time diagnosed with COVID-19), Block 1 (composed of 16 questions about the diagnosis and hospitalization due to COVID-19), Block 2 (contains 17 questions that refer to the period before the diagnosis by COVID-19), Block 3 (has 9 personal questions that refer to the period before the diagnosis by COVID-19), Block 4 (has 8 questions that seek to know how much physical activity was performed in the period before the diagnosis by COVID-19), Block 5 (has 8 questions that seek to know how much physical activity was performed after recovery from COVID-19) [33].

The questionnaire included questions regarding personal information such as weight and height (to calculate body mass index (BMI)), age, sex, profession, family income, education level, marital status, smoking and drinking habits and pre-existing diseases. In addition, addressed the need for hospitalization, how many days a patient remained hospitalized, respiratory difficulties (breathing difficulty is the disorder that can promote the interruption of the respiratory process, causing a feeling of suffocation (dyspnea)) [34], oxygen support, intubation, days intubated and if there was death. Regarding the clinical outcome of death, information was collected through interviews with the family member or closest caregiver. All questionnaire items had the option of “no answer”, “does not apply” and “prefer not to say”. To ensure that all responses were correctly answered and noted, the researcher read what was noted and asked the respondent if it was correct.

2.6. International Physical Activity Questionnaire (IPAQ) Short Version

Physical activity was measured using the Brazilian-validated short version of the International Physical Activity Questionnaire (IPAQ-SV) [32,33]. The IPAQ was applied by asking the participant about the level of physical activity in the week prior to the diagnosis of COVID-19. This instrument assesses the domains and intensity of physical activity—including walking and sitting time that an individual performs as part of their everyday lives. The IPAQ groups and conceptualizes the categories, as follows: (a) Sedentary: does not perform any physical activity for a minimum of 10 continuous minutes during the week; (b) Insufficiently active: practices physical activities for a minimum of 10 continuous minutes per week, but not enough to be classified as active. (c) Active—meets the following recommendations: (a) vigorous physical activity: \( \geq 3 \text{ days/week and } \geq 20 \text{ min/session} \); (b) moderate activity or walking: \( \geq 5 \text{ days/week and } \geq 30 \text{ min/session} \); (c) any added activity: \( \geq 5 \text{ days/week and } \geq 150 \text{ min/week} \). (d) Very active—meets the following recommendations: (a) vigorous activity: \( \geq 5 \text{ days/week and } \geq 30 \text{ min/session} \); (b) vigorous activity: \( \geq 3 \text{ days/week and } \geq 20 \text{ min/session} + \text{ moderate activity and/or walking } \geq 5 \text{ days/week and } \geq 30 \text{ min/session} \). For comparison purposes, in this study, participants were grouped into two groups: sedentary (sedentary and insufficiently active) and active (active and very active) [32].

2.7. Statistical Analysis

Data were entered in Microsoft Excel® and validated using double key data entry and verification. This procedure was used to ensure the highest accuracy and quality of the data collected. The variables sex, range age, family income, education level, BMI and clinical outcomes of COVID-19 were presented by absolute (n) and relative (%) frequency. Clinical outcomes examined dichotomously were: hospitalization, hospitalization days, breathing difficult, oxygen support, intubation, days of intubation and death. Fisher’s exact test was used to verify the association between sedentary/physically active people and clinical outcomes in people diagnosed with COVID-19. Binary logistic regression was adopted to indicate the odds ratio (OR) of the physically active group reporting mitigated
clinical outcomes of COVID-19 when adjusted for confounding variables including, age, family income, education level and BMI. All analyses were performed using SPSS version 20 (IBM Corporation, Armonk, NY, USA), significance level was set to $\alpha \leq 5\%$.

3. Results

A total of 509 individuals participated in the study (women = 61%). Of these, 49.3% were classified as sedentary. The age range was from 18 to 89, with 78% being between 18 and 59 years old and 22% being 60 years old or older. Regarding socioeconomic status and education level, 87% had a family income above BRL 908.00 and 69% had completed high school, respectively. Regarding nutritional status, 72% were overweight or obese. Related to clinical outcomes, 9% required hospitalization, 6.5% were hospitalized for 6 days or more, 7.9% had breathing difficulty, 7.9% required oxygen support, 2% required intubation, 1.8% were intubated for 6 days or more and 1% died (Table 1).

Table 1. Personal characteristics and clinical outcomes of the total sample, and grouped into sedentary and active. Ribeirão Preto, Brazil, 2022.

| Variables and Personal Characteristics | Sedentary = 251 n (%) | Active = 258 n (%) | Total = 509 n (%) |
|----------------------------------------|-----------------------|-------------------|------------------|
| Sex                                    |                       |                   |                  |
| Male                                   | 102 (40.6)            | 96 (37.2)         | 198 (38.9)       |
| Female                                 | 149 (59.4)            | 162 (62.8)        | 311 (61.1)       |
| Age grouping                           |                       |                   |                  |
| 18 to 59 years old                     | 191 (76.1)            | 206 (79.8)        | 397 (78.0)       |
| 60 years or older                      | 60 (23.9)             | 52 (20.2)         | 112 (22.0)       |
| Family income                          |                       |                   |                  |
| Up to 908.00                           | 20 (8.0)              | 45 (17.4)         | 65 (12.8)        |
| Above 908.00                           | 231 (92.0)            | 213 (82.6)        | 444 (87.2)       |
| Level of education                     |                       |                   |                  |
| Higher and postgraduate                | 89 (35.5)             | 69 (26.7)         | 158 (31.0)       |
| Up to full medium                      | 162 (64.5)            | 189 (73.3)        | 351 (69.0)       |
| Normoponderal (up to 24.9 kg/m$^2$)    | 62 (24.7)             | 82 (31.8)         | 144 (28.3)       |
| Overweight or obesity (25 kg/m$^2$ or more) | 189 (75.3)            | 176 (68.2)        | 365 (71.7)       |

| Clinical outcomes                      |                       |                   |                  |
| Hospitalization                        | Yes                    | 31 (12.4)         | 15 (5.8)         | 46 (9.0)          |
| No                                     | 220 (87.6)             | 243 (94.2)        | 463 (91.0)       |
| Hospitalization days                   | 0 to 5 days            | 229 (91.2)        | 247 (95.7)       | 476 (93.5)        |
| 6 days or more                         | 22 (8.8)               | 11 (4.3)          | 33 (6.5)         |
| Breathing difficulty                   | Yes                    | 27 (10.8)         | 13 (5.0)         | 40 (7.9)          |
| No                                     | 224 (89.2)             | 245 (95.0)        | 469 (92.1)       |
| Oxygen support                         | Yes                    | 27 (10.8)         | 13 (5.0)         | 40 (7.9)          |
| No                                     | 224 (89.2)             | 245 (95.0)        | 469 (92.1)       |
| Intubation                             | Yes                    | 8 (3.2)           | 2 (0.8)          | 10 (2.0)          |
| No                                     | 243 (96.8)             | 256 (99.2)        | 499 (98.0)       |
| Intubation days                        | 0 to 5 days            | 244 (97.2)        | 256 (99.2)       | 500 (98.2)        |
| 6 days or more                         | 7 (2.8)                | 2 (0.8)           | 9 (1.8)          |
| Death                                  | Yes                    | 3 (1.2)           | 2 (0.8)          | 5 (1.0)           |
| No                                     | 248 (98.8)             | 256 (99.2)        | 504 (99.0)       |

When we performed Fisher’s exact test, no statistically significant association was found among people aged 18 to 59 years, sedentary and active for all clinical outcomes. However, a statistical significant association was found among people aged $\geq$60 years old, sedentary and active, for the following clinical outcomes: hospitalization, breathing difficulty and oxygen support (Figure 2).

When we performed Fisher’s exact test considering the whole sample (without grouping by age) statistically significant association was found between sedentary and active people for the following clinical outcomes: hospitalization, hospitalization days, breathing difficulty and oxygen support (Figure 3).
When we performed Fisher's exact test, no statistically significant association was found among people aged 18 to 59 years, sedentary and active for all clinical outcomes. However, a statistical significant association was found among people aged ≥ 60 years old, sedentary and active, for the following clinical outcomes: hospitalization, breathing difficulty and oxygen support (Figure 2).

Figure 2. Association between sedentary and active groups, age groups of 18 to 59 years and 60 years and over, and clinical outcomes of COVID-19; (a) hospitalization; (b) hospitalization days; (c) breathing difficulty; (d) oxygen support; (e) intubation; (f) intubation days; (g) death. * p value; ** OR (IC 95%); #: significant difference between sedentary and active.

After analyzing the binary logistic regression, controlling for confounding variables, it was observed that physically active people had a lower chance of hospitalization (OR 0.440; 95% CI 0.225–0.861; p = 0.017), hospitalization days (OR 0.461; CI 95% 0.212–1.000; p = 0.050),
breathing difficulty (OR 0.444; 95% CI 0.217–0.909; \( p = 0.026 \)) and oxygen support (OR 0.446; 95% CI 0.217–0.914; \( p = 0.027 \)). The same did not occur for the clinical outcomes intubation (OR 0.260; 95% CI 0.053–1.273; \( p = 0.097 \)), days of intubation (OR 3.297; 95% CI 0.656–16.573; \( p = 0.148 \)) and death (OR 0.847; CI 0.847–5.257; \( p = 0.858 \)) (Table 2).

Figure 3. Association between sedentary and active groups and clinical outcomes of COVID-19; (a) hospitalization; (b) hospitalization days; (c) breathing difficulty; (d) oxygen support; (e) intubation; (f) intubation days; (g) death. * \( p \) value; ** OR (IC 95%); #: significant difference between sedentary and active.
Table 2. Odds ratio between sedentary and active groups for the occurrence of clinical outcomes of COVID-19. Ribeirão Preto, Brazil, 2022.

| Variables          | Wald  | Odds Ratio | Confidence Interval (95%) | p Value |
|--------------------|-------|------------|---------------------------|---------|
|                    |       |            |                           |         |
| Hospitalization    |       |            |                           |         |
| Sedentary/Active   | 5.649 | 0.440      | 0.225  0.861              | 0.017   |
| Age grouping       | 18.271| 4.148      | 2.160  7.964              | <0.001  |
| Family income      | 0.205 | 0.810      | 0.325  2.017              | 0.651   |
| Level of education | 0.467 | 0.763      | 0.351  1.658              | 0.494   |
| BMI (kg.m²)        | 1.130 | 1.556      | 0.689  3.516              | 0.288   |
| Sedentary/Active   | 3.837 | 0.461      | 0.212  1.000              | 0.050   |
| Age grouping       | 12.256| 0.262      | 0.124  0.554              | <0.001  |
| Family income      | 0.925 | 1.626      | 0.604  4.381              | 0.336   |
| Level of education | 0.018 | 1.062      | 0.442  2.550              | 0.894   |
| BMI (kg.m²)        | 0.662 | 0.679      | 0.268  1.724              | 0.416   |
| Hospitalization days |   |            |                           |         |
| Sedentary/Active   | 4.934 | 0.444      | 0.217  0.909              | 0.026   |
| Age grouping       | 14.969| 3.884      | 1.953  7.723              | <0.001  |
| Family income      | 0.128 | 0.838      | 0.318  2.209              | 0.721   |
| Level of education | 0.823 | 0.676      | 0.290  1.575              | 0.364   |
| BMI (kg.m²)        | 1.816 | 1.876      | 0.751  4.681              | 0.178   |
| Sedentary/Active   | 4.863 | 0.446      | 0.217  0.914              | 0.027   |
| Age grouping       | 17.673| 4.394      | 2.204  8.762              | <0.001  |
| Family income      | 0.114 | 0.846      | 0.320  2.239              | 0.736   |
| Level of education | 0.696 | 0.697      | 0.298  1.628              | 0.404   |
| BMI (kg.m²)        | 1.715 | 1.846      | 0.738  4.619              | 0.190   |
| Breathing difficulty |   |            |                           |         |
| Sedentary/Active   | 2.762 | 0.260      | 0.053  1.273              | 0.097   |
| Age grouping       | 4.973 | 4.568      | 1.202  17.356             | 0.026   |
| Family income      | 0.035 | 1.226      | 0.143  10.485             | 0.853   |
| Level of education | 0.189 | 0.696      | 0.136  3.559              | 0.664   |
| BMI (kg.m²)        | 2.098 | 3.297      | 0.656  16.573             | 0.148   |
| Oxygen support     |       |            |                           |         |
| Sedentary/Active   | 2.098 | 3.297      | 0.656  16.573             | 0.148   |
| Age grouping       | 6.289 | 0.154      | 0.036  0.665              | 0.012   |
| Family income      | 0.011 | 0.891      | 0.102  7.784              | 0.917   |
| Level of education | 0.015 | 1.112      | 0.210  5.881              | 0.901   |
| BMI (kg.m²)        | 0.546 | 0.450      | 0.054  3.743              | 0.460   |
| Intubation         |       |            |                           |         |
| Sedentary/Active   | 2.098 | 3.297      | 0.656  16.573             | 0.148   |
| Age grouping       | 6.289 | 0.154      | 0.036  0.665              | 0.012   |
| Family income      | 0.011 | 0.891      | 0.102  7.784              | 0.917   |
| Level of education | 0.015 | 1.112      | 0.210  5.881              | 0.901   |
| BMI (kg.m²)        | 0.546 | 0.450      | 0.054  3.743              | 0.460   |

4. Discussion

4.1. Main Findings of the Results

The study sought to verify whether physical activity levels are associated with the clinical outcomes of people diagnosed with COVID-19. The results, without age group classification, indicate that a physically active lifestyle has beneficial effects on the clinical outcomes of hospitalization, hospitalization days, breathing difficulty and oxygen support. However, considering the age group between 18 and 59 years, no difference was found between sedentary and active people. For the age group 60 years and over, an association was found between sedentary and active for the clinical outcomes of hospitalization, breathing difficulty and oxygen support. To the best of our knowledge, this is the first study to examine the relationship between meeting or not meeting physical activity recommendations
active versus sedentary) with different COVID-19 clinical outcomes. The relationships between self-reported physical activity and the different outcomes of COVID-19 studied are as follows:

4.1.1. Frequency of Hospitalization

Our results show that physically active people had a lower risk of hospitalization when compared to sedentary people. Other studies have also reported similar results. Sallis et al. [9] through a retrospective study of 48,440 North Americans showed that the probability of survival from COVID-19 among people who were physically active prior to infection was greater when compared to sedentary peers. Chen et al. [12] found that active individuals had a lower frequency of hospitalization when compared to sedentary people.

The lower frequency of hospitalization observed among the physically active subjects in the present study can be explained by the protective effects conferred by the regular practice of physical activity. For example, reduction of comorbidities and stress [25], and improvement in the functioning of the immune system [26,34], with an increase in the expression of natural killer cells [6,35–37], immunoglobulins, anti-inflammatory cytokines, neutrophils, cytotoxic T lymphocyte, immature B lymphocyte and delayed immunosenescence [6,36] have all been reported as outcomes of regular physical activity. Additionally, it is suggested that being physically active can partially neutralize the harmful effect of SARS-CoV-2 binding to the angiotensin-converting enzyme 2 receptor and contribute to the development of a less severe infection, reducing the risk of hospital admission [37,38].

4.1.2. Hospitalization Days

In our study, physically active participants had a shorter hospital stay when compared to sedentary participants. This finding is consistent with the results of a study carried out in South Korea [6]. This association was also shown in other studies [39,40]. So far, there have been no studies on improving the immune system’s response to COVID-19 infection through physical activity. However, there is evidence that regular physical activity prior to infection may decrease the duration and severity of symptoms of viral infections of the respiratory system [41]. Although not conclusive, these results may be related to the levels of cytokines in the body, which play a significant role in immunity and immunopathology [42,43]. Moderate-intensity physical activity performed daily reduces susceptibility to and morbidity from respiratory viral infections by increasing salivary lactoferrin, leukocytes and other immunoprotective agents [38]. People hospitalized for a long time have respiratory and muscle difficulties that can adversely impact recovery time and delay the restoration of their physical condition prior to hospitalization [44].

4.1.3. Breathing Difficulty

Regarding the need for oxygen support, the associations observed in the present study showed that physically active participants need less oxygen support compared to sedentary people. This lower need for oxygen support was also observed in the study by Mistry and Natesan, when they compared sedentary individuals with another who performed moderate-intensity physical activity [44]. In our sample, the sedentary group was more likely to be overweight or obese compared to the active group. A reduced energy expenditure, characteristic of sedentary people and people with a high BMI, has been shown to be associated with serious complications from COVID-19, including sepsis and breathing difficulty [45]. Despite these results, there is still a lack of direct evidence of a causal relationship between physical inactivity and breathing difficulty in people diagnosed with COVID-19.

4.1.4. Oxygen Support

Regarding the need for oxygen support, the associations observed in the present study showed that physically active participants needed oxygen support less frequently than
sédentaire. Cela a également été observé dans une étude antérieure qui a comparé des groupes actifs et sédentaires [44].

La physique activité peut aider à améliorer la réponse du système immunitaire et atténuer l'infection virale. En outre, être physiquement actif peut prévenir et traiter de nombreuses complications associées au COVID-19, notamment en ce qui concerne le système renin-angiotensine [46]. La réduction de la sévérité des infections, spécifiquement dans les poumons, peut diminuer la sévérité des outcomes cliniques, qui peuvent entraîner une nécessité d'appui à l'oxygène [9]. Cependant, d'autres études sont nécessaires pour mieux comprendre les mécanismes liant la physioactivité et la nécessité d'appui à l'oxygène des patients atteints de COVID-19.

4.1.5. Intubation

Dans notre étude, nous n'avons pas observé de différence entre les personnes physiquement actives et sédentaires concernant la fréquence et la durée de l'intubation. Une étude menée en Afrique du Sud a observé que les personnes avec des niveaux de physioactivité modérés à vigoureux avaient une fréquence plus faible d'intubation par rapport à celles ayant des niveaux de physioactivité plus faibles [47]. Il est important de noter que le nombre de participants qui ont été intubés est réduit et des études avec des échantillons plus importants sont nécessaires pour confirmer cette association.

4.1.6. Mortalité

Les preuves récentes indiquent que l'activité physique peut réduire les taux de mortalité du COVID-19 [42]. Bien que certaines études mentionnent que le risque de mortalité ne diffère pas entre les personnes actives et sédentaires, le type d'exercice peut être un facteur important dans ces résultats [48,49]. Certains chercheurs ont observé un risque de mortalité plus faible du COVID-19 chez les personnes qui ont effectué des activités physiques aérobie, musculaires, et aérobie et musculaire de façon concurrente, par rapport aux personnes qui ont effectué des activités physiques aérobie et musculaire de façon infrequente [6]. La même chose s'est produite auprès des personnes insuffisamment actives, activement, et activement et hautement actives par rapport à celles qui étaient inactives [6] et les athlètes par rapport aux non-athlètes [7]. Dans notre étude, nous n'avons pas observé de corrélation statistiquement significative entre les personnes physiquement actives et sédentaires concernant la fréquence des décès. Il est important de souligner que pendant cette recherche, seul le variant B1.617.2 (delta) a été trouvé à Ribeirão Preto. Il n'y avait pas de nouveaux variants de COVID-19, y compris AY.4 (delta), AY.39 (delta), B.1.1.7 (alpha), P.1 (gamma), P.1.4 (gamma), P.1.17 (gamma) et P1.1.12 (gamma), [49] lors de la collecte des données.

Les résultats trouvés peuvent changer au fil du temps en raison de la continuité de la pandémie et de l'adoption de nouveaux variants.

4.2. Limitations de l'étude

Malgré les résultats prometteurs obtenus dans cette étude, certains limitations sont présentes et doivent être considérées. Le design observatoire et transversal de l'étude ne permet pas clairement d'établir une relation cause-effet entre la physioactivité et l'état physique et les outcomes cliniques liés au COVID-19. De plus, dans notre étude, nous n'avons pas pu expliquer l'association entre les outcomes cliniques d'intubation, les jours d'intubation et la mortalité, due à l'échantillon insuffisant de chaque subsample. Dans notre étude, dix patients (2%) de l'ensemble de l'échantillon étaient intubés et cinq (1%) sont décédés. Étant donné que cette étude a été menée parmi les participants d'une seule municipalité, située dans la région sud-est du Brésil, les résultats ne peuvent pas être généralisés immédiatement à d'autres localités ayant des facteurs socioéconomiquest, démographiques et structuraux différents [5]. Comme l'a observé Fisher dans son test exact, l'âge group ≥60 ans est un facteur important qui influence les outcomes cliniques du COVID-19. Cependant, en considérant l'ensemble de l'échantillon et en contrôlant les variables importantes dans un modèle de régression logistique (y compris l'âge group), l'activité physique est resté significatif. Être actif est un comportement qui peut être modifié chaque jour et devrait être intégré dans tous les âges. L'IPAQ, qui est un évaluation de l'activité physique, est un questionnaire auto-rapporté, et une mémoire de passage peut se produire. Par conséquent, les résultats doivent être interprétés avec prudence. Les futures études, avec plus d'âges de subsamples et moins de différence parmi les sujets, sont nécessaires pour éliminer le risque de
bias, confirm causality, and explore the relationship between sedentary and active behavior and clinical outcomes in people diagnosed with COVID-19.

4.3. Strength of Evidence

Our investigation is one of the few to examine physical activity and clinical outcomes of COVID-19 in Brazil using telephone interviews. The present study was conducted prior to the initiation of the COVID-19 vaccination in Brazil, diminishing the risk of bias related to vaccination status. The International Physical Activity Questionnaire used in this study is easy to apply, has been widely used, has been validated in different populations and countries, including Brazil [50,51], and correlates with direct measures of physical activity [52]. Additionally, the questionnaire that verified the personal and clinical characteristics of COVID-19 patients was validated relative to the objectives of this study [52,53].

5. Conclusions

Physically active people have a better clinical prognosis regarding the outcomes of COVID-19, especially with lower frequency of hospitalization, hospitalization days, respiratory difficulty and oxygen support. Our study provides evidence that active behavior is a modifiable risk factor for COVID-19 clinical outcomes. The global effort to encourage the population to adopt a physically active lifestyle, and avoid a sedentary lifestyle, may be a promising strategy for protecting and mitigating the severity of the clinical outcomes of COVID-19.

Author Contributions: E.B.G.G. and A.P.D.S. conceived the study, and participated in its design, coordination and acquisition of data. L.F.M., J.F.C.C., D.C.C., A.d.S.O. and E.M.F. participated in the acquisition of data. A.C.R.V., P.P.A., L.S.L.D.S., M.F.T.J., D.D.A., L.B. and D.R.L.M. participated in the interpretation of the results and editing of the whole manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior—Brasil (CAPES)—Finance Code 001. Brazil. (Proceeding 88882.317622/2019-01).

Institutional Review Board Statement: The study protocol was reviewed and approved by the Ethics Review Board of the University of São Paulo at Ribeirão Preto College of Nursing, Brazil, (CAAE number: 39645220.6.0000.5393), in compliance with human subjects guidelines from the Resolution of the National Council of Health (CNS) 466/12 and the Declaration of Helsinki.

Informed Consent Statement: All subjects signed an informed consent prior to data collection.

Data Availability Statement: The dataset supporting the conclusions of this article is included in the article. Original data are available by request from the authors.

Conflicts of Interest: The authors declare no conflict of interest.

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