Physical performance testing in post-COVID-19 patients: protocol for a systematic review of psychometric measurement properties

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ABSTRACT

Introduction COVID-19 is an infectious disease that causes severe acute respiratory syndrome. A large variety of exercise capacity tests are used for the evaluation of post-COVID-19 patients, but the psychometric properties of these exercise tests remain underdetermined in this population. This study aims to critically appraise, compare and summarise the psychometric properties (validity, reliability and responsiveness) of all physical performance tests that are used to assess exercise capacity in post-COVID-19 patients.

Methods and analysis This systematic review protocol follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols guidelines. We will include studies with hospitalised adult post-COVID-19 patients (aged 18 years or older and with a confirmed diagnosis of COVID-19). The research will cover randomised controlled trials (RCTs), quasi-RCTs and observational studies published in English and performed in the following settings: hospital, rehabilitation centre, outpatient clinic. We will search the following databases with no date restrictions: PubMed/MEDLINE, EMBASE, SciELO, Cochrane Library, CINAHL and Web of Science. Two authors will independently assess the risk of bias (using the Consensus-Based Standards for the Selection of Health Measurement Instruments Risk of bias checklist) and the certainty of evidence (using the Grading of Recommendations, Assessment, Development and Evaluations). According to the results obtained, data will be meta-analysed or reported narratively.

Ethics and dissemination No ethical approval is required for this publication since it will be based on published data. Results of this review will be disseminated via peer-reviewed publications and conference presentations.

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INTRODUCTION

COVID-19 is a disease that causes SARS-CoV-2, which can cause significant systemic damage to the organism. Symptoms of COVID-19 can include fever, cough, sore throat, dyspnoea, headache and muscle fatigue. In addition, individuals affected by this disease may experience respiratory, physical and psychological impairments.

Some cases may require admission to intensive care units, which can result in prolonged rest, the use of invasive ventilation and/or sedatives. Furthermore, some survivors may experience persistent injury, reduced exercise capacity, loss of autonomy and functionality in daily activities, and declined quality of life.

After the infection, the exercise capacity evaluation with physical performance exercise tests is essential to identify the damage, functional deterioration and to plan the rehabilitation for COVID-19 survivors. Cardiopulmonary exercise testing allows cardiovascular, pulmonary and skeletal muscle systems assessment during exercise-induced stress and the main variable of maximal oxygen uptake reflects the gold standard measure. This assessment has crucial implications on prognosis, follow-up and
mortality. However, logistical factors and high costs can make this assessment challenging to carry out.

Currently, various physical performance tests (figure 1) are being used to evaluate post-COVID-19 exercise capacity in individuals who may suffer from long-term motor, cognitive, psychological or respiratory deficits. Some tests, such as the field-based walking tests, are feasible and an economical alternative for measuring exercise capacity in several populations, including patients with chronic respiratory conditions, such as chronic obstructive pulmonary disease, healthy subjects and elderly patients.

The application of different valid instruments, such as the 6 min walking test (6MWT), incremental endurance shuttle walking test (ISWT), endurance shuttle walking test (ESWT), sit-to-stand (STS), step tests or short physical performance battery (SPPB), can be used to indirectly evaluate lower limb muscle strength, mobility and functional independence. These tests can be used from the intensive care unit to the outpatient setting and can also play a potential role in evaluating rehabilitation, hospital discharge criteria, post-COVID-19 rehabilitation in adults and older adult patients.

A recent systematic review investigated physical performance tests, such as the 6MWT, Timed Up and Go Test, STS protocol, and SPPB, to assess the physical performance outcome of post-COVID-19 patients. It has demonstrated that these tests are effective tools for evaluating and improving the physical function of post-COVID-19 patients during pulmonary rehabilitation.

In a retrospective analysis study with 81 individuals recovering from COVID-19 infection, exercise capacity was assessed by 6MWT in a rehabilitation protocol; only 30% of subjects could perform the predicted values from 6MWT at admission as compared with 57.8% who obtained the values after pulmonary rehabilitation protocol. These authors found good responsiveness in this population’s distance covered in 6MWT. Otherwise, in a study with 41 COVID-19 survivors without pre-existing locomotor disabilities, the skeletal muscle strength function and exercise capacity were evaluated with 1 min STS (1-STS), and they performed only 63% of the predicted normal value, showing functional deterioration of the survivors.

At present, a large variety of exercise capacity tests are used for post-COVID-19 patient evaluation, but the psychometric properties of these exercise tests remain undetermined in this population.

Therefore, this systematic review aims to critically appraise, compare and summarise the psychometric measurement properties (validity, reliability (internal consistency and measurement error), learning effects, repetition of the test, familiarity, responsiveness and interpretability) of all physical performance tests that assess exercise capacity in post-COVID-19 patients. The planned systematic review is unique as it will be the first to synthesise existing evidence on the psychometric properties of physical capacity tests used to assess post-COVID-19 patients. These tests are essential for evaluating patients, setting hospital discharge criteria and designing rehabilitation programmes. The findings of this review could be of great relevance to researchers and to physiotherapists who provide rehabilitative treatments to post-COVID-19 patients.

METHODS AND ANALYSIS

This protocol was prepared following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Protocol guidelines, and the findings will be reported following PRISMA guidelines. This systematic review will follow the Consensus-Based Standards for the Selection of Health Measurement Instruments (COSMIN)
methodology for conducting systematic reviews of psychometric properties, and for the risk of bias. A schematic representation of the study design for this systematic review protocol can be found in figure 2.

Eligibility criteria
We will include studies with patients who were hospitalised with COVID-19, aged 18 years and over, of both genders, with a confirmed diagnosis of COVID-19, without previously known severe neurological or osteoarticular disabilities before the COVID-19 infection. The diagnosis of COVID-19 will be considered the RT-PCR or serological confirmation of disease. We will include randomised controlled trials (RCTs), quasi-RCTs and observational studies (prospective, retrospective, longitudinal or case-control) performed in the following settings: hospital, rehabilitation centre and outpatient clinic. Conference abstracts, dissertations, theses, literature reviews and in vitro studies will be excluded.

Interventions
We will include studies that investigated exercise capacity in post-COVID-19 patients with one of these physical performance protocols: CEPT, field-based walking tests 6MWT, ISWT, ESWT, STS protocols, SPPB and Step test protocols.

Outcome measures
We will include studies that describe psychometric properties (validity, reliability (internal consistency and measurement error), learning effects, test repetition, familiarity, responsiveness and interpretability), and performance of the different protocols of physical performance tests in post-COVID-19 patients assessed at a hospital, outpatient or primary care setting.

Search strategy
We will search the following electronic bibliographic databases: PubMed/MEDLINE, EMBASE, SciELO, Cochrane Library, CINAHL and Web of Science. The search will be limited to English language publications with no date restrictions. To identify relevant studies, we will use a combination of descriptors and Medical Subject Headings that incorporate the primary elements of our research question, including the population and intervention. The initial search strategy will be adapted for each database using Boolean operators such as OR and AND. Online supplemental appendix 1 file containing the search strategy is included in this protocol.

Study selection
Two review authors (LFEoD and VRR) will independently screen titles and abstracts and exclude irrelevant reports. The full text of the remaining studies will be obtained, and the same reviewers will apply predefined inclusion criteria to select studies for inclusion. Reviewers will make decisions blindly and any disagreements will be resolved by a third reviewer (LAM).

The screening process and reasons for exclusion will be recorded using the Rayyan QCRI tool (www.rayyan.ai), and a PRISMA flow chart will summarise the screening process (figure 3).

Data extraction and processing
Data extraction related to measurement properties will be conducted independently by two review authors (LFEoD and VRR) using the COSMIN data extraction form. Disagreements between reviewers will be resolved through discussion with a third reviewer (LAM). Essential information will be extracted from the included studies to complete the checklist boxes. The results will be summarised either quantitatively through pooling or narratively.

Quality assessment of included studies
The COSMIN Risk of bias checklist will be used, and two reviewers (LFEoD and VRR) will independently examine the methodological quality of the studies. In the event of any discrepancies, they will be resolved through discussion, or a third reviewer (LAM) will be involved. Consistent results will be grouped quantitatively or summarised narratively, and then compared against the criteria for good measurement properties, interpreted as very good, adequate, doubtful or inadequate. A results summary table will be created for each measurement
property to evaluate the methodological quality of each study.

Data synthesis and analysis
The quality of the Patient-Reported Outcome Measures (PROMs) will decide whether the results of all available studies per measurement property are consistent. In case of consistent results, it can be quantitatively pooled or narratively summarised and compared against the criteria for good measurement properties to determine whether overall, the measurement property of the PROM is (+), insufficient (−) or indeterminate (?). We will use the Grading of Recommendations Assessment, Development and Evaluation approach to assess the certainty of the evidence of each measurement property. Evidence will be classified as high, moderate, low or very low based on the risk of bias, inconsistency, imprecision and indirectness.

Statistical analysis
To analyse dichotomous data or continuous variables, we will use the OR, relative risk or risk difference, and present them as means, medians and SD. If required, we will use RevMan V.5.3.528 software to perform a meta-analysis for homogeneous studies. In situations where data are missing, we will contact the authors to obtain the necessary information.

Patient and public involvement
No patients or members of the public were involved in the development of the research question and methods of this protocol. We plan to involve healthcare professionals in the review development phases of interpreting the results and writing the review. A closed invitation will be sent to healthcare professionals who provide rehabilitation treatments for post-COVID-19 patients and draft results will be presented to them. We will discuss the clinical implications of these findings and, by agreement, write a series of statements related to the clinical implications. We will use an anonymous voting to confirm agreement with the statements. The agreed statements will be included in the review findings. The same healthcare professionals will also be invited to a face-to-face meeting to comment on the tables, figures and drafts of the manuscript to help us identify effective ways to communicate the findings.

ETHICS AND DISSEMINATION
Since the review will be based on published data, there is no need for ethical approval. The results of the review will be made public through peer-reviewed publications and conference presentations.

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Contributors LFEdN, LAM, RT-C, GAff, EG-S, JV and VRR contributed to the study conception. LFEdN and VRR wrote the protocol, and LAM, GAff, RT-C, JV and EG-S reviewed the protocol. LFEdN and VRR will screen potential studies, extract data and assess the quality of studies. LAM will decide in case of disagreement between researchers. VRR will accompany data synthesis. All authors will approve the final version for publication.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

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REFERENCES


APPENDIX 1

The search strategy


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