
REVIEW ARTICLE (META-ANALYSIS)

Psychometric Properties of 2-Minute Walk Test: A Systematic Review



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Abstract

Objective: To systematically review the psychometric evidence on the 2-minute walk test (2MWT).

Data Sources: Electronic searches of databases including MEDLINE, CINAHL, Academic Search Premier, SPORTDiscus, PsycINFO, EMBASE, the Cochrane Library, and DARE were done until February 2014 using a combination of subject headings and free texts.

Study Selection: Studies were included if psychometric properties of the 2MWT were (1) evaluated; (2) written as full reports; and (3) published in English language peer-reviewed journals.

Data Extraction: A modified consensus-based standard for the selection of health measurement instruments checklist was used to rate the methodological quality of the included studies. A quality assessment for statistical outcomes was used to assess the measurement properties of the 2MWT.

Data Synthesis: Best-evidence synthesis was collated from 25 studies of 14 patient groups. Only 1 study was found that examined the 2MWT in the pediatric population. The testing procedures of the 2MWT varied across the included studies. Reliability, validity (construct and criterion), and responsiveness of the 2MWT also varied across different patient groups. Moderate to strong evidence was found for reliability, convergent validity, discriminative validity, and responsiveness of the 2MWT in frail elderly patients. Moderate to strong evidence for reliability, convergent validity, and responsiveness was found in adults with lower limb amputations. Moderate to strong evidence for validity (convergent and discriminative) was found in adults who received rehabilitation after hip fractures or cardiac surgery. Limited evidence for the psychometric properties of the 2MWT was found in other population groups because of methodological flaws.

Conclusions: There is inadequate breadth and depth of psychometric evidence of the 2MWT for clinical and research purposes—specifically, minimal clinically important changes and responsiveness. More good-quality studies are needed, especially in the pediatric population. Consensus on standardized testing procedures of the 2MWT is also required.

Archives of Physical Medicine and Rehabilitation 2014;95:1759-75

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Walk tests are simple, inexpensive, and safe performance-based tests that provide information on functional exercise capacity of individuals when compared with laboratory-based indexes of aerobic capacity such as cycle, treadmill, and step ergometry, which require expensive and cumbersome equipment.¹ Walk tests can be either time-based tests that measure the distance covered in a specific period, such as the 12-minute walk test (12MWT), the 6-minute walk test (6MWT), or the 2-minute walk test (2MWT), or distance-based tests that measure the time taken to complete a set distance, such as the 20-m shuttle test or the 1-mile walk test.²

Among the time-based walk tests, both the 2MWT and 6MWT are modifications of the 12MWT.³ A high correlation has been

demonstrated between the 2MWT and 6MWT and the 12MWT in a group of 30 patients with respiratory conditions.³ Since the introduction of these shorter versions of walk tests in 1982, the 6MWT is the most commonly used and has been thoroughly investigated.^{4,5} Standardized testing guidelines for the 6MWT were developed by the American Thoracic Society in 2002.⁶ There is an argument that some individuals are unable to walk for 6 minutes because of muscle weakness, gait inefficiency, or poor endurance.^{7,8} For individuals with acquired brain injury or cognitive impairment, it may be a challenge to concentrate to complete the 6MWT.^{9,10} Hence, the 2MWT may be a more feasible walk test for these individuals in clinical situations.

The quality of the information provided by the outcome measures depends on the psychometric properties of the outcome measures.¹¹ The main psychometric properties of an outcome

Disclosures: none.

measure are reliability (provides consistent data in repeated measurements), validity (measures what it is intended to measure), and responsiveness (detects changes over time).¹² Reliability refers to the consistency of the measurement of the 2MWT in the absence of real changes within the study participants (test-retest reliability) and among the assessors (intra- and interrater reliability).¹² Validity generally comprises content, construct, and criterion validity.¹³ For a single-item walking test such as the 2MWT, the construct and criterion validity are more relevant.⁵ Construct validity refers to how consistent the measurement of the 2MWT is when compared with predefined hypothesis testing on the score of another instrument or on differences among relevant population groups.¹⁴ Criterion validity demonstrates whether the 2MWT is an adequate reflection of a criterion standard of the same construct.¹⁴ Studies of the psychometric properties of walking tests, such as the 6MWT or 2MWT, traditionally considered maximal exercise tests using the progressive cycle ergometry as the criterion standard, although the walk tests are measuring submaximal functional capacity.¹⁵ Responsiveness refers to the ability of the 2MWT to detect changes over time.¹²

To the author's knowledge, the psychometric properties of the 2MWT have not yet been systematically examined. This lack of knowledge about the psychometric evidence of the 2MWT affects patient management decisions if clinicians are unable to accurately interpret their patients' 2MWT findings.¹¹ The objective of this study was to systematically evaluate the psychometric properties of the 2MWT so that clinicians can make an informed decision about when and for whom to use the 2MWT and about how to accurately interpret the test's findings in clinical practice. The existing research gaps on the 2MWT were also identified.

Methods

Study search and selection

A selection of databases, including MEDLINE (via OVID), EBSCOHost (Academic Search Premier, CINAHL, SPORTDiscus, MEDLINE), PsycINFO, EMBASE (via OVID), the Cochrane Library, and DARE, was used for the literature search. These databases were chosen because they cover a variety of disciplines and integrated information from the fields of biomedical clinical practice and health. A validated search filter for searching studies on measurement properties was used.¹⁶ The phrases "2-minute walk test," "2-minute walk distance," and the common abbreviations (ie, 2MWT and 2MWD) were also entered as keyword searches. Appropriate Boolean symbols and linking terms were used (appendix 1). The bibliographies of key articles were hand searched to ensure that relevant articles were not missed.

The inclusion criteria for the search of this systematic review were studies (1) in which the psychometric properties of the

2MWT were evaluated; (2) written as full reports; and (3) published in English language peer-reviewed journals. Studies were excluded if (1) data were self-reported, and (2) the 2MWT was considered as the criterion standard for another outcome measure of interest.

The titles and abstracts of articles identified in the initial search were first screened against inclusion and exclusion criteria. No authors of included and excluded studies were approached to investigate whether relevant data could be extracted.

Quality evaluation of study methodology and measurement properties

The methodological quality of all the included studies of the 2MWT was assessed using the Consensus-based Standards for the selection of health Measurement INstruments (COSMIN) checklist (http://www.cosmin.nl/cosmin_1_0.html). The COSMIN checklist was originally designed and validated to assess the methodological quality of studies on the measurement properties of health-related, patient-reported outcome measures,¹² but since its development, it has been used to evaluate the methodological quality of studies on performance-based outcome measures.^{5,17,18} The checklist evaluates 9 measurement properties—internal consistency, reliability, measurement error, content validity, structural validity, hypothesis testing (construct validity), cross-cultural validity, criterion validity, and responsiveness—and 2 subchecklists to determine the inter-pretability and generalizability of the studies.¹³ Each property is scored using a 4-point scale with defined response options grading the study as excellent, good, fair, or poor. The overall quality score is the lowest rating of any item within that measurement property (ie, worst score counts).¹³ In each measurement property, there is an item on sample sizes in which 30 participants are considered to be minimally acceptable sample size. The COSMIN checklist was first developed for evaluating psychometric evidence on health-related questionnaires, which would require a larger sample size. This criterion may not apply for psychometric studies of performance-based outcome measures⁵; otherwise, studies with small sample sizes may be rated poor regardless of the good quality of their other methodological aspects. Hence, this criterion on sample size was omitted for assessing the methodological quality of the included studies. The issue of sample sizes would be considered in the best-evidence synthesis for the 2MWT. The quality of statistical findings of the measurement properties of included studies was also rated as positive, indeterminate, or negative¹⁹ (definitions of each rating criterion in appendix 2).

Synthesis of best evidence for measurement properties of 2MWT

The levels of evidence for the overall quality of each measurement property of the 2MWT were synthesized as strong, moderate, limited, conflicting, or unknown by pulling all the data from the included studies²⁰ (definitions for each rating criterion in appendix 3). Similar to the levels of evidence of clinical trials, the synthesis of best evidence depends on the methodological quality of the included studies (ie, the COSMIN score) and the quality and consistency of the statistical findings of each measurement property (ie, positive, indeterminate, or negative), as well as the number of studies examining each measurement property of the 2MWT.

Selection of the studies, data retraction of the characteristics and main findings of the included studies, grading of the included studies using the COSMIN checklist, and best-evidence synthesis

List of abbreviations:

COPD	chronic obstructive pulmonary disease
COSMIN	Consensus-based Standards for the selection of health Measurement INstruments
GVHD	graft-versus-host disease
MCID	minimal clinically important difference
6MWT	6-minute walk test
12MWT	12-minute walk test
2MWT	2-minute walk test
$\dot{V}_{O_2\max}$	maximum oxygen consumption

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