



# The importance of standard operating procedures in physical fitness assessment: a brief review

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## Abstract

**Background** Physical fitness status is a key aspect of health and, consequently, it is important to create and adopt appropriate interventions to maintain or improve it, and assess it using valid measures. While in other testing contexts, standard operating procedures (SOPs) are commonly and widely adopted, in physical fitness testing, a variety of unstandardized testing protocols are proposed.

**Aims** The topic of this review was to evaluate the existing literature on SOPs in physical fitness assessment and to provide guidelines on how SOPs could be created and adopted.

**Method** The electronic databases PubMed, Web of Science and Scopus were screened and original, peer-reviewed studies that included SOPs, related to physical fitness, were recorded.

**Results** After the inclusion and exclusion criteria screening, a total of six studies were included and these were critically and narratively analyzed.

**Conclusions** Standard operating procedures are rarely adopted in the field of physical fitness and a step by step guide has been provided in this manuscript. In the future, it is suggested to follow protocols as a routine, because this is the only way to generalize and contextualize findings.

**Keywords** Sport science · SOP · Protocol · Physical activity · Sports health · Physical education

## Abbreviations

PF Physical fitness  
SOPs Standard operating procedures  
WHO World Health Organization

## Introduction

The World Health Organization (WHO) [1] states that Governments should promote and protect people's health via a properly designed health promotion program, as it is cheaper compared to medical intervention or treatment,

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hence limiting healthcare costs [2, 3]. Unfortunately, in the past years, a rise in overweight and obese children has been observed [4], increasing both, cardiovascular and metabolic risk factors [5]. Furthermore, by 2050, it is anticipated that at least one in five people will be over 60 years old [6], thus programs to guarantee a “Healthy Ageing” are required [6].

Recently, an increasing number of valid and useful fitness disciplines and high-intensity protocols have been suggested as interventions [7]. In addition, the American College of Sports Medicine [8] proposed intervention guidelines to improve health. In parallel, protocols for the evaluation of physical fitness (PF), which is composed of health- and skill-related attributes [9], have also evolved. These protocols are especially focalized on health-related components (cardiorespiratory endurance, muscular strength, flexibility, and body composition), because they have important positive effects on the human body [7]. Field-testing protocols based on fitness evaluation batteries adopted for children and adolescents, such as the AVENA study [10], the FITNESSGRAM [11], the HELENA study [12], and the ASSO project [13] also exist. Furthermore, laboratory test for cardiorespiratory [14, 15], muscle strength [16], and flexibility [16] components are valid and widely adopted. Also, field test for cardiorespiratory [17–19], muscle strength [20], and flexibility [21, 22] were proposed. Unfortunately, these studies tend to use variations in testing procedures and none of them adopted Standard Operating Procedures (SOPs) even if in the literature, the use of SOPs, is suggested [23, 24].

Standard Operating Procedures are documents that provide details of a process to allow the correct repetition of all steps [23, 24], they are adopted in many disciplines [23] in which standardization is required, such as nuclear power plants, aviation, offshore oil industry, hospital emergency care, and emergency response services [25], in an ergonomic environment [26], or in the management and recommendation for diagnosis and treatment of pathologies [27]. Using SOPs in the research field would allow for better comparison between studies and the creation of normative data. Moreover, the use of SOPs makes studies safer, preventing misconduct, mistreatment or potential legal or ethical issues, especially in children [28]. The knowledge of the “what” and the “how” aspects is fundamental for the success and the safety of the activities [25].

The extensive use of SOPs and their importance in many fields could be a practical and feasible approach also in the PF environment to create a common direction in research and in everyday life. For this reason, the objective of this review was to evaluate what exists in the PF literature related to SOPs and to provide guidelines on SOPs creation and use.

## Methods

Electronic databases PubMed, Web of Science and Scopus were screened to collect studies for this review. The following keywords groups were matched with the Boolean operator “AND” (i.e. standard operating procedure AND sport):

Group 1: standard operating procedure, standard operating procedures; SOP.

Group 2: sport; fitness, physical activity; physical performance, physical education, sport evaluation, sport test, fitness evaluation; fitness test.

The studies were included if they were related to Sport Sciences field and if SOPs were included in their evaluation. No limitations on the age of the participants or related to physical, cognitive or mental disorders were adopted. Concerning the intervention, manuscripts were included only if the topic was related to physical fitness. No limitation on the comparators and outcomes were adopted. Only studies original and peer-reviewed were included. Abstracts, opinion articles, citations, scientific conference abstracts, books or book reviews, statements, editorials, letters, and commentaries were excluded.

## Results

Six studies adopted or created SOPs in PF assessment. Half of these studies included are guidelines for populations related to a medical environment, such as people with inflammatory arthritis [29] or with chronic respiratory disease [30, 31].

The SOPs adopted in two studies [30, 31] are for the 6-min walk test, the incremental shuttle walks test and the endurance walk. To our knowledge, only one study, represented by two publications, explicitly adopted SOPs in the context of PF testing. This study was a multi-country gender-sensitized, health and lifestyle program targeting physical activity, sedentary time and dietary behaviors in men [32, 33]. The studies [32, 33] stated that SOPs were created to ensure quality and consistency during the data collection and analysis across the participating countries [32, 33].

A review article [34] investigated vertical jumps in physically active adolescents. This article aimed to study if there was a protocol commonly adopted and, if there was none, to review the common aspects between the protocols revised. There was not a protocol commonly adopted and SOPs were created for the countermovement jump and the squat jump tests [34]. A summary of guidelines for SOPs creation and use is illustrated in Fig. 1.

**Step 1: creation of the task force**

Task force expert of the field

multinational and a multidiscipline

**Step 2: performance of a review of literature**

<i>Sub-step</i>	<i>What to study</i>
identify the most common procedure	Validity, reliability and learning effect
Identify or create a SOP	Relation of the test to clinical outcomes
	Safety of the testing procedure
	Possible effects of the protocol on performance

**Step 3: Standard Operating Procedure creation**

<i>Before</i>	<i>During</i>	<i>Immediately after</i>	<i>After</i>
Standardize: -participant assessment and preparation. -equipment adopted. -measurements. -test location.	-Know how to do. -Know what to do. -Adopt same procedure -Know the reasons for any changing of the protocol	-Management of the recovery (active or passive). -Management of the period between the tests	-Standardize the data management (especially if a multidisciplinary and multinational team is involved).

SOP: Standard Operating Procedure creation

Fig. 1 Step by step description for the creation of a Standard Operating Procedure

**Discussion**

In the PF literature, SOPs are rarely adopted, consequently, from the studies included, guidelines related to SOPs are summarized in Fig. 1 and will be discussed. The focus of this review is on the procedure followed by the authors to create SOPs rather than SOPs themselves. Mainly from the procedure of Holland and colleagues [30, 31], but also considering the other studies that adopted SOPs in PF [29, 32–34] a three steps process as guidelines to create SOPs has been suggested. The first step should be a creation of a multinational and multidisciplinary team of experts in the field to consider different possible aspects. Indeed, health promotion is a complex and multifaceted concept with implications on physical, mental

and social well-being [1]. The second step consists in the performance of a review of the literature to analyze what other authors adopted and how they proceeded, during this phase, the task force should identify the most common procedure or create SOPs (see step 3) [30, 31, 34]. Important aspects of this step are how the protocol could affect performance, but also its reliability (obtaining the same results if the test is repeated), its validity (the correspondence between the test and the purpose for which it was created), and its feasibility (how easy it is to implement) [16, 35–37]. These aspects have to be considered especially in field tests that usually are less reliable than laboratory tests [38]. A potential learning effect has to be counted, because when a task is repeated, there is an improvement in performance efficacy [39, 40]. Furthermore, it would

be useful to evaluate the relationship between test performance and clinical outcomes, with an in-depth analysis of the protocol characteristics and the scientific literature related to the topic.

The third step is the creation of SOPs and the aspects to consider are the protocol, the equipment and the measurements adopted, as well as testing location [30, 31, 34]. A standardized procedure before data collection, from the participant preparation and baseline assessments to the preparation of the investigators (with appropriate training about the instructions to give to participants and the behaviors to adopt) [30, 31, 34], is required not only in clinical studies but also in systematic reviews and meta-analysis for which it is suggested to register the procedure before the study [41–43]. During the test is important for administrators to know what to do and how, and also to know the indications for stopping a test. Furthermore, following a procedure helps ill-informed and inexperienced researchers to avoid problems related to possible risks [28]. Immediately after, recovery management needs to be documented (active or passive) as well as the time between the tests due to its influence on the performance [44, 45]. Finally, it is crucial to standardize the data management process, especially if a multidisciplinary and multinational team is involved and if the work is managed remotely. It would be ideal to try the procedure several times to reduce the difference between theory and practice.

One important limitation of SOPs is whether the protocol is personalized according to participants' characteristics. Indeed, if a specific population such as elite athletes, or people with disabilities is studied, the test could be task-specific or accessible to that population. Using a protocol in high-level athletes created for sedentary people does not help coaches and athletes to know the limits. Otherwise, in the health promotion context, according to us, it is fundamental to follow SOPs.

Limitations of this review include the few Sport Sciences studies found that explicitly mentioned using SOPs, making it impossible to write a systematic review and meta-analysis. Future studies should start to create or follow SOPs in Sport Sciences field, especially for PF field tests.

## Conclusion

In conclusion, the creation of SOPs in the PF field, especially in a health promotion context, is necessary and these procedures standardized should be systematically adopted in future investigations. Only in this way, it will be possible to generalize easily the findings and contextualize the results with the existing literature.

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**Code availability** Not applicable.

## Declarations

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** Not applicable.

**Informed consent** Not applicable.

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