

CLINICAL COMMENTARY

IMPROVING THE REPORTING OF THERAPEUTIC EXERCISE INTERVENTIONS IN REHABILITATION RESEARCH

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ABSTRACT

The foundation of evidence-based practice lies in clinical research, which is based on the utilization of the scientific method. The scientific method requires that all details of the experiment be provided in publications to support replication of the study in order to evaluate and validate the results. More importantly, clinical research can only be translated into practice when researchers provide explicit details of the study. Too often, rehabilitation exercise intervention studies lack the appropriate detail to allow clinicians to replicate the exercise protocol in their patient populations. Therefore, the purpose of this clinical commentary is to provide guidelines for optimal reporting of therapeutic exercise interventions in rehabilitation research.

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INTRODUCTION

Scientific reporting requires adequate and detailed explanation of research methodology for both study replication (reliability) and quality (validity). Rehabilitation research that explores or reports on therapeutic exercise intervention protocols often lacks a detailed description of the interventions used. In contrast, basic science research publications tend to have more precise reporting and highly detailed methodological descriptions, typically conducted within a well-controlled environment. Surprisingly, many authors of rehabilitation research lack the detail to adequately describe the exercise intervention for replication in their research methods, sometimes only using generic terms such as “stretching and strengthening” to describe their intervention. This lack of detail in intervention reporting contributes to a “worldwide waste in research funding”.^{1, p.1} Furthermore, a lack of detailed intervention limits the evaluation and interpretation of systematic reviews and meta-analyses, as well as the replication of research methods. Therefore, the purpose of this clinical commentary is to describe guidelines for optimal reporting of therapeutic exercise interventions in rehabilitation research.

STANDARD REPORTING GUIDELINES

Reporting guidelines have been recommended by scientific journals in order for authors to include the necessary details of all facets of a study. The EQUATOR Network (Enhancing the Quality and Transparency of Health Research; www.equator-network.org) promotes these guidelines in order to improve accuracy and completeness of reporting, which aids in research quality and repeatability. As of Janu-

ary 1 2015, 28 rehabilitation journals have agreed to require authors to use several specific guidelines to report research methods and findings.² Of note, *The International Journal of Sports Physical Therapy (IJSPT)* requires authors to use checklists from established reporting guidelines based on their study design such as “CONSORT” for randomized controlled trials (RCT) or “STROBE” for cohort studies (Table 1). These guidelines often include “checklists” for authors to use to ensure that several key items are addressed, unique to publication type. Requiring checklist review as part of journal submission improves the numbers of items reported in articles,³ thereby providing more study details and completeness of reporting.

INTERVENTION GUIDELINES

While standard reporting guidelines focus on making sure that specific components of specific study designs are included, these guidelines often provide minimal reporting requirements for the intervention component. For example, CONSORT lists “interventions” as one of 22 items to address, asking authors to provide “precise details of the intervention intended for each group and how and when they were actually administered”.^{4, p.663} The SPIRIT guidelines provide recommendations for describing interventions specifically within protocols.⁵ While SPIRIT also requires an intervention description as one of 33 items, it does require more specific reporting guidelines, adding detail on modifications, adherence, and concomitant interventions to the description. Such general instruction about the reporting of therapeutic interventions often leaves researchers uncertain of exactly how much to report; in addition, the level of detail desired by a journal is not clear.

Table 1. Current Reporting Requirements from IJSPT	
Original Research	CONSORT (Consolidated Standards of Reporting Trials) STARD (Studies Reporting Diagnostic Accuracy) STROBE (Strengthening the Reporting of Observational Studies in Epidemiology)
Systematic Review/Meta Analysis	PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)
Clinical Commentary/Current Concepts	Checklist for Clinical Commentary-Current Concepts Review
Case Reports	Checklist for Case Report Focusing on Unique Pathological Presentation Checklist for Case Reports Focusing on Differential Diagnosis Checklist for Case Reports Focusing on Innovative Intervention

True implementation of evidence-based practice requires clinicians to be able to replicate the research methods of a study with their own clinical population. For example, if a clinical trial demonstrates a clinically important outcome in a relevant population for a clinician, the same intervention would need to be applied in that clinician's setting in order to determine whether similar results can be achieved in a different clinical population. Perhaps Hoffman et al. stated it best: "Without a complete published description of the intervention, clinicians and patients cannot reliably implement interventions that are shown to be useful, and other researchers cannot replicate our build on research findings".^{6, p. 1}

Detailed descriptions of therapeutic exercise interventions are also important for researchers performing systematic reviews and meta-analyses. Insufficient detail in the description of interventions does not allow researchers to combine results of multiple studies into a meta-analysis due to potential lack of homogeneity. In their systematic review on post-operative rehabilitation after meniscectomy, Reid et al^{17, p. 48} noted, "The lack of detail in conjunction with the types of intervention provided meant that quantitative analysis was unable to be performed. Similarly, a qualitative comparison across the programmes was challenging." Poor description of the utilized interventions ultimately limits the usefulness of such reviews. For example, Crossley et al in their review of patellofemoral pain interventions noted, "the lack of detailed description of the exercise therapy interventions limits the translation of the research findings into clinical practice."^{8, p.5}

Case report research often suffers from lack of clarity in reporting of interventions, especially on first submission for publication. Lack of detail regarding intervention makes peer review of case report research difficult and ultimately inhibits creative sharing of ideas for practice. The authors of this commentary believe that it is imperative that case report research describing innovative or combination interventions provide abundant clarity and detail regarding the interventions that were used so that such research can be analyzed for implementation in practice and inform the design of future research.

Hoffman and colleagues¹ found that only 39% of non-pharmacological interventions (including surgery,

rehabilitation, etc.) were adequately described. Interestingly, pharmaceutical interventions have better intervention reporting than non-pharmacological interventions (67% vs. 29%, respectively)⁹ such as education and surgery. Furthermore, Schroter et al¹⁰ reported that a majority (57%) of interventions in clinical trials could not be replicated or clinically implemented based on the authors' description of the treatment. As rehabilitation scientists and researchers, we must improve the quality of reporting. The IJSPT is committed to leading this initiative and supporting "new" guidelines for standardized reporting of therapeutic exercise interventions.

PHYSICAL THERAPY INTERVENTION REPORTING GUIDELINES

Physical therapy interventions are often multimodal, complex, and individualized. They include modalities, manual therapy techniques, education, and therapeutic exercise. Unfortunately, only general descriptions of exercise interventions tend to be provided in research protocols, which allows for individuality and variability between clinicians and patients. However, such generality in description of interventions leads to a lack of detail available in a publication to allow for replication or implementation in a real-life clinical setting, thereby limiting translation into practice. Explicit reporting of therapeutic exercise interventions is important not only for researchers and clinicians, but also for journal reviewers who must assess the quality of articles in the peer-review process that occurs before consideration for publication. A lack of detail in intervention reporting may also be wasteful: the money and resources spent on performing the research would essentially be lost without effective clinical implementation. Most importantly, however, incorrect implementation of an intervention because of a lack of detail may actually cause harm to patients.

In physical therapy literature, Gianolo et al¹¹ found that less than 20% of RCTs investigating lower back pain rehabilitation reported the necessary details to transfer research into practice. In a recent review of 200 physical therapy RCTs in the PEDro database, Yamato et al¹² found 77% of articles reported more than half of intervention description checklist items for the experimental groups, while only

25% reported more than half of the items for the control group. They noted the most common intervention description item missing from all 200 RCTs was modification of intervention during the trial, both for experimental and control groups. Yamato and colleagues¹² further noted that physical therapy RCTs described interventions simply with the name of the developer (Pilates, McKenzie, etc), which is not an adequate explanation of the intervention. Obviously, physical therapists would not be able to replicate these interventions based on inadequate descriptions in the literature.

A particularly common practice is for authors to simply use exercise names unique to a clinic or exercise developer. Obviously, only using an exercise name without appropriate detail and description prevents replication or integration of the intervention protocol in clinic practice. This is particularly difficult for international audiences, who may not understand “jargon-laden” exercise names.

Until recently, there were no widely accepted guidelines for reporting interventions in the literature. In 2006, Toigo and Boutellier¹³ provided a list of important descriptors specific to resistance exercise training based on factors leading to distinct muscular adaptations (Table 2). These 13 factors are important to identify in both planning and reporting a resistance exercise intervention.

Schroter et al¹⁰ first provided a checklist of minimal details needed to assess the quality of descriptions of treatments (Table 3). The checklist items are based on how clear authors were in providing detail on the setting, recipient, provider, procedure, materials, intensity, schedule, and missing sessions.

Table 2. Descriptors for resistance training interventions (modified from Toigo & Boutellier¹³)

Descriptor	Example
Load magnitude	75% 1RM
Number of repetitions	6
Number of sets	1
Rest in-between sets (seconds or minutes)	None
Number of exercise interventions (per day or week)	2 per week
Duration of the experimental period (days or weeks)	10 weeks
Fractional and temporal distribution of the contraction modes per repetition and duration (seconds) of one repetition	10 s shortening 10 s isometric 4 s lengthening
Rest in-between repetitions (seconds or minutes)	None
Time under tension (seconds or minutes)	96 + 10 s
Volitional muscular failure	Yes
Range of motion	100%
Recovery time in-between exercise sessions (hours or days)	72 hr
Anatomical definition of the exercise	Yes, must be included

The authors then reviewed 51 trials published in [BMJ](#) for checklist items. They found that over half of the articles did not include sufficient detail for clinicians or researchers to implement or replicate clinical research findings.

In 2014, the Template for Intervention Description and Replication (TIDieR) guidelines and checklist were established by extending from the minimal recommendation of CONSORT and SPIRIT in order to improve the “completeness of reporting, and ultimately the replicability, of interventions”.^{6, p. 1}. Following the EQUATOR Network methodology for developing reporting guidelines, the authors established a committee, generated checklist items, and performed a Delphi consensus survey of 74 “authors of research on describing interventions, clinicians,

Table 3. Interventions Checklist (modified from Schroter et al.¹⁰)

Setting	Is it clear <i>where</i> the intervention was delivered?
Recipient	Is it clear <i>who is receiving</i> the intervention?
Provider	Is it clear <i>who delivered</i> the intervention?
Procedure	Is the <i>procedure</i> (including the sequencing of the technique) of the intervention sufficient clear to allow replication?
Materials	Are the <i>physical or informational materials</i> used adequately described?
Intensity	Is the <i>dose/duration of individual sessions</i> of the intervention clear?
Schedule	Is the <i>schedule (interval, frequency, duration, or timing)</i> of the intervention clear?
Missing	Is there anything else <i>missing</i> from the description of the intervention? If yes, what?

authors of existing guidelines, clinical trialists, methodologists or statisticians with expertise in clinical trials, and journal editors”.^{6, p. 2} Once consensus was reached, the 13 checklist items were presented and piloted with 26 researchers authoring intervention study papers, resulting in the acceptance of 12 final items. Simply put, the TIDieR checklist helps authors answer the questions, “Why, What, Who, How, Where and When” regarding an intervention (Table 4). In addition, when using the “PICO” (Population, Intervention, Comparison, Outcome) mnemonic of a RCT, the TIDieR guidelines provide the “Intervention” and “Comparison” elements. Researchers can download the checklist and find more details on TIDieR at www.equator-network.org/reporting-guidelines/tidier.

TIDieR has been recommended specifically for physical therapy intervention studies. The *Journal of Orthopedic and Sports Physical Therapy* endorses the TIDieR checklist, and includes it in the editorial policy.¹⁴ Alvarez et al¹⁵ recommended the use of TIDieR in manual therapy publications. Delahunt et al¹⁶ authored reporting guidelines specifically for groin pain in athletes, endorsing and recommending the TIDieR with CONSORT and STROBE guidelines for RCTs and observational studies, respectively. Physical therapists provide a broad range of interventions, including manual therapy, modalities, and therapeutic exercise prescription. While physical therapy-related journals recognize the importance of requiring several forms of guidelines to encourage authors to provide detail, none are specific to detail related to therapeutic exercise intervention.

Table 4. TIDieR checklist (Adapted from Hoffmann et al.⁶)

Item	Item Number	Item
Brief Name	1	Provide the name or a phrase that describes the intervention
Why	2	Describe any rationale, theory, or goal of the elements essential to the intervention
What	3	Materials: Describe any physical or informational materials used in the intervention, including those provided to participants or used in intervention delivery or in training of intervention providers. Provide information on where the materials can be accessed (such as online appendix, URL)
	4	Procedures: Describe each of the procedures, activities, and/or processes used in the intervention, including any enabling or support activities
Who provided	5	For each category of intervention provider (such as psychologist, nursing assistant), describe their expertise, background, and any specific training given
How	6	Describe the modes of delivery (such as face to face or by some other mechanism, such as internet or telephone) of the intervention and whether it was provided individually or in a group
Where	7	Describe the type(s) of location(s) where the intervention occurred, including any necessary infrastructure or relevant
When and how much	8	Describe the number of times the intervention was delivered and over what period of time including the number of sessions, their schedule, and their duration, intensity, or dose
Tailoring	9	If the intervention was planned to be personalised, titrated or adapted, then describe what, why, when, and how
Modifications	10	If the intervention was modified during the course of the study, describe the changes (what, why, when, and how)
How Well	11	Planned: If intervention adherence or fidelity was assessed, describe how and by whom, and if any strategies were used to maintain or improve fidelity, describe them
	12	Actual: If intervention adherence or fidelity was assessed, describe the extent to which the intervention was delivered as planned

EXERCISE INTERVENTION GUIDELINES

It is important to note that TIDieR is **not** specific to exercise interventions, making it globally applicable for any clinical intervention study. The general recommendations of TIDieR are not adequate to provide all necessary details of an exercise intervention; therefore, an international panel of exercise experts published recommendations in [Physical Therapy](#) for researchers reporting on exercise interventions in.¹⁷ The Consensus on Exercise Reporting Template (CERT) was also developed and published following Delphi survey methodology using exercise experts. The experts used the EQUATOR Network recommendations to reach consensus on key exercise descriptors that would “encourage transparency, improve trial interpretation and replication, and facilitate implementation of effective exercise interventions into practice”.^{17, p.1514}

The CERT is a 16-item checklist consisting of seven categories: materials, provider, delivery, location, dosage, tailoring, and compliance. The CERT is consistent with TIDieR domains and headings (what, who, how, etc), and is compatible with both CONSORT and SPIRIT statements. Authors of clinical intervention studies should use established reporting guidelines and checklists (CONSORT, STROBE, etc) based on the study design (See Table 1), and include the TIDieR checklist, as well as the CERT if an exercise intervention was included. Furthermore, if an author references an exercise program or protocol published in the literature, they should (at a minimum) cite the source and provide detail in an Appendix, as well as any specific modifications that have been made to the program or protocol altering it from the published protocol. If the original source did not clearly provide TIDieR or CERT required items, it is recommended to include those checklists at the time of manuscript submission.

While the CERT is specific to exercise interventions, therapeutic exercise programs delivered in the physical therapy clinic may need even more detail for clinical implementation or replication. The column added by the authors of this commentary to the original CERT checklist in Appendix 1 provides further guidance on reporting therapeutic exercise intervention within the context of the CERT checklist. Because many physical therapy interventions

include both in-clinic and home exercise programs, it is important to include details on both interventions.

CONCLUSION

If the goal of clinical research is to provide evidence-based, real world interventions, clinicians must rely on detailed information provided in publications on therapeutic exercise programs in order to translate research into practice. Research is not beneficial to the clinician or patient if it cannot be replicated in the clinic. Interventions cannot be validated if they cannot be replicated. Systematic reviews on the efficacy of clinical interventions are limited without specific details of an intervention. The inability to properly replicate research findings is wasteful, and may actually harm patients.

Journals often require authors follow specific guidelines when reporting specific types of studies, but these generally do not provide specific guidance on detailing the therapeutic interventions utilized within a study. Recently, guidelines and checklists have been recommended for reporting interventions in the clinical literature. A specific guideline for exercise intervention reporting (CERT) can be used to provide necessary detail on exercise interventions in physical therapy research, which will benefit researchers, clinicians, and patients. [The International Journal of Sports Physical Therapy](#) now requires all applicants to use the TIDieR checklist, or the Modified CERT checklist (Appendix 1) if exercise interventions are included in a manuscript.

REFERENCES

1. Hoffmann TC, Erueti C, Glasziou PP. Poor description of non-pharmacological interventions: analysis of consecutive sample of randomised trials. *BMJ*. 2013;347:f3755.
2. Chan L, Heinemann AW, Roberts J. Elevating the quality of disability and rehabilitation research: mandatory use of the reporting guidelines. *Arch Phys Med Rehabil*. 2014;95(3):415-417.
3. Hopewell S, Ravaud P, Baron G, Boutron I. Effect of editors' implementation of CONSORT guidelines on the reporting of abstracts in high impact medical journals: interrupted time series analysis. *BMJ*. 2012;344:e4178.
4. Altman DG, Schulz KF, Moher D, et al. The revised CONSORT statement for reporting randomized trials: explanation and elaboration. *Ann Intern Med*. 2001;134(8):663-694.

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5. Chan AW, Tetzlaff JM, Gotzsche PC, et al. SPIRIT 2013 explanation and elaboration: guidance for protocols of clinical trials. *BMJ*. 2013;346:e7586.
 6. Hoffmann TC, Glasziou PP, Boutron I, et al. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. *BMJ*. 2014;348:g1687.
 7. Reid DA, Rydwanski, J., Hing, W., White, S. The effectiveness of post-operative rehabilitation following partial menisectomy of the knee. *Phys Ther Reviews*. 2012;17(1):45-54.
 8. Crossley KM, van Middelkoop M, Callaghan MJ, Collins NJ, Rathleff MS, Barton CJ. 2016 Patellofemoral pain consensus statement from the 4th International Patellofemoral Pain Research Retreat, Manchester. Part 2: recommended physical interventions (exercise, taping, bracing, foot orthoses and combined interventions). *Br J Sports Med*. 2016;50(14):844-852.
 9. Glasziou P, Meats E, Heneghan C, Shepperd S. What is missing from descriptions of treatment in trials and reviews? *BMJ*. 2008;336(7659):1472-1474.
 10. Schroter S, Glasziou P, Heneghan C. Quality of descriptions of treatments: a review of published randomised controlled trials. *BMJ Open*. 2012;2(6).
 11. Gianola S, Castellini G, Agostini M, et al. Reporting of Rehabilitation Intervention for Low Back Pain in Randomized Controlled Trials: Is the Treatment Fully Replicable? *Spine (Phila Pa 1976)*. 2016;41(5):412-418.
 12. Yamato TP, Maher CG, Saragiotto BT, Hoffmann TC, Moseley AM. How completely are physiotherapy interventions described in reports of randomised trials? *Physiotherapy*. 2016;102(2):121-126.
 13. Toigo M, Boutellier U. New fundamental resistance exercise determinants of molecular and cellular muscle adaptations. *Eur J Appl Physiol*. 2006;97(6):643-663.
 14. Yamato T, Maher C, Saragiotto B, et al. The TIDieR Checklist Will Benefit the Physical Therapy Profession. *J Orthop Sports Phys Ther*. 2016;46(6):402-404.
 15. Alvarez G, Cerritelli F, Urrutia G. Using the template for intervention description and replication (TIDieR) as a tool for improving the design and reporting of manual therapy interventions. *Man Ther*. 2016;24:85-89.
 16. Delahunt E, Thorborg K, Khan KM, Robinson P, Holmich P, Weir A. Minimum reporting standards for clinical research on groin pain in athletes. *Br J Sports Med*. 2015;49(12):775-781.
 17. Slade SC, Dionne CE, Underwood M, et al. Consensus on Exercise Reporting Template (CERT): Modified Delphi Study. *Phys Ther*. 2016;96(10):1514-1524.

Appendix 1. Modified Consensus on Exercise Reporting Template (CERT) for Therapeutic Exercise Interventions. Last column has been added to the original CERT from Slade et al¹⁷ by the authors of this commentary

Item Category	Item No.	Abbreviated Item Description	Therapeutic Exercise Detail
WHAT: materials	1	Type of exercise equipment	Provide equipment manufacturer, city, state, country, if appropriate, and appropriate copyright
WHO: provider	2	Qualifications, teaching/supervising experience, and/or training of the exercise instructor	If exercise program is administered by multiple therapists, provide detail on how each therapist was trained in the intervention
HOW: delivery	3	Whether exercises are performed individually or in a group	If group exercise, note the size of the group
	4	Whether exercises are supervised or unsupervised	Note if exercise is 'direct' one-on-one or indirect supervision
	5	Measurement and reporting of adherence to exercise	Provide exercise log in appendix, or specify method for both in-clinic and home program compliance recording
	6	Details of motivation strategies	Note behavioral strategies to improve compliance with home exercise program (See #10)
	7	Decision rules for progressing the exercise program	Provide criteria for progression of each exercise both in the clinic and in home program (See #13)
	8	Each exercise is described so that it can be replicated (eg, illustrations, photographs)	Provide detailed instructions (including cues and modifications) for each exercise, including patient booklets in a table, appendix, or supplement. Avoid using only exercise names as descriptors.
	9	Content of any home program component	Provide details on how home program was instructed, delivered, and progressed throughout intervention (Note # 1, 5, 7, 8, 11, 13, 14, 15)
	10	Non-exercise components	Include education (posture, ergonomics, modalities) in appendix or where materials can be accessed
	11	How adverse events that occur during exercise are documented and managed	Reported and addressed in limitations or future research considerations
WHERE: location	12	Setting in which exercises are performed	Note which exercises were performed in clinic and/or home
WHEN, HOW MUCH: dosage	13	Detailed description of the exercises (eg, sets, repetitions, duration, intensity)	Compliments #7, and provide progression rules for individual exercises, including the home exercise program. Do not simply refer to the protocol based on the name of the developer.
TAILORING: what, how	14	Whether exercises are generic ("one size fits all") or tailored to the individual	If tailored, detail how decisions are made for choosing/progressing exercises, including options for therapist. Provide algorithm or flow chart for tailored exercises.
	15	Decision rules that determines the starting level for exercise	Provide how specific sets, repetitions, resistances are determined initially, including the home program
HOW WELL: planned, actual	16	Whether the exercise intervention is delivered and performed as planned	Define markers of "success" (compliance, outcomes)