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Developing the TIDieR-Rehab checklist: a modified Delphi process to extend the Template for Intervention Description and Replication (TIDieR) for rehabilitation intervention reporting

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ABSTRACT

Objectives Rehabilitation is essential for supporting the recovery from, and management of, a range of health conditions. However, interventions are often poorly reported in rehabilitation research, hindering advancement of the field. The Template for Intervention Description and Replication (TIDieR) checklist was developed to enhance the reporting of interventions, but does not specifically address the complexities and multifaceted nature of rehabilitation interventions. This study aimed to develop an extension of the TIDieR checklist to support better reporting of rehabilitation interventions.

Design A modified Delphi study overseen by a Steering Committee.

Setting Online.

Participants Rehabilitation experts were purposively sampled for diversity in discipline, practice setting, area of expertise and geographical location.

Methods Participants (n=35) provided both quantitative and qualitative feedback on drafts of the TIDieR-Rehab through online surveys. Quantitative data was descriptively analysed by percentage of agreement, while qualitative data was analysed using conventional content analysis. Quantitative and qualitative findings were subsequently triangulated to facilitate iterative refinement of the TIDieR-Rehab.

Results Consensus was achieved after two rounds of the modified Delphi process. The TIDieR-Rehab checklist comprises seven original, three adapted and 12 new reporting items, and is supported by a supplementary manual. Specific enhancements include more detailed descriptions of the study population (*Who*) and timing of the intervention (*When*), the planned intervention dosage (*How much*, *How challenging* and *Regression/Progression*), person-centred care (*Personalisation*) and negative undesired effects (*Harms*) which were considered critical for the comprehensive reporting of rehabilitation interventions.

Conclusion The TIDieR-Rehab checklist marks a significant advancement in enhancing and standardising the reporting of rehabilitation interventions. By offering a structured format for detailing complex rehabilitation interventions, the TIDieR-Rehab supports improvements in reporting quality to promote research replication and support the translation of research findings into clinical practice. Future research should validate the TIDieR-Rehab checklist across a variety of intervention types and clinical contexts.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ A modified Delphi process was used to develop the TIDieR-Rehab checklist, an extension of the original TIDieR, which supports the comprehensive reporting of rehabilitation interventions.
- ⇒ The TIDieR-Rehab extension includes seven original, three adapted and 12 new items which may facilitate the development, reporting, synthesis and translation of rehabilitation intervention research.
- ⇒ Our findings reveal ambiguity in key concepts underpinning rehabilitation, highlighting the need to develop shared conceptual understandings and a common language to describe rehabilitation interventions.
- ⇒ Survey-based modified Delphi approaches, supported by a Steering Committee, are common practice in health research and the development of reporting quality tools but may limit the depth of participant feedback.
- ⇒ Extensive efforts were made to capture a diversity of perspectives, but some relevant cultural and disciplinary perspectives may not be fully represented in this research.

INTRODUCTION

Beyond medical and surgical interventions, rehabilitation serves as a primary approach in the management of numerous health conditions and mitigation of disability.[1] Rehabilitation is conceptualised as a complex biopsychosocial process where multidisciplinary professionals work in collaboration with a person and their family, with the shared objective of enhancing the person's function, autonomy and societal participation.[1–3] Rehabilitation is commonly operationalised as a personalised, goal-directed, multicomponent package of non-pharmacological interventions, such as targeted activities, education and psychosocial support.[1 2] The efficacy of rehabilitation interventions is often attributed to their 'essential elements' or 'active ingredients' and the underlying processes or pathways through which an intervention is expected to produce its effects.[2 4] Understanding these essential elements and their mechanisms is essential for optimising effectiveness and minimising any negative undesired effects of an intervention.[2 4]

The efficacy of rehabilitation interventions is also thought to be strongly influenced by the dosage of the essential elements.[4 5] *Dosage* encompasses both amount and challenge.[5 6] *Amount* generally refers to the total time invested in the intervention, considering session duration, frequency and overall length of the intervention programme.[5 6] However, there is growing concern that current understandings of 'amount' do not reflect the time spent engaged in the essential elements of the intervention.[5] Relying on session duration to determine amount, which often includes a significant proportion of time spent in non-essential or inactive elements, can potentially obscure our understanding of the efficacy of the essential elements of an intervention.[4 5] *Challenge* has been conceptually defined as a multifaceted, multidimensional and dynamic interaction between the rehabilitation activity or task, the person's ability and their subjective experience and may reflect how 'difficult', 'demanding' or 'effortful' the task is.[5–8] As such, the operationalisation of 'challenge' can vary widely across disciplines, interventions and tasks. Nonetheless, rehabilitation research suggests that challenge, as a critical parameter of dosage, is likely a key driver of rehabilitation efficacy.[6 7]

Incomplete understanding of the essential elements of rehabilitation interventions and their dosage parameters has hampered advancement of the field and slowed translation of research to clinical practice.[4] A key contributor to this gap is the incomplete reporting of rehabilitation interventions in the research literature.[4 5 9–12] In non-pharmacological interventions, like rehabilitation, essential elements which are multidimensional, personalised and often difficult to quantify add significant complexity to intervention reporting.[13–15] Tools such as the Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT),[16] Consolidated Standards of Reporting Trials (CONSORT)[13 17] and the Template for Intervention Description and Replication (TIDieR)[14] have been developed to address such concerns. Existing checklists provide a valuable foundation for improved reporting. However, they are not specific to *rehabilitation* interventions, and thus, the essential elements of rehabilitation interventions and their dosage parameters continue to be under-reported.[4 7 9] This lack of specificity has been noted in other non-pharmacological fields and researchers have subsequently proposed extensions or adaptations to the TIDieR checklist in areas such as public health[18] and telehealth.[19] The Consensus on Exercise Reporting Template (CERT)[20] is a recognised extension of the TIDieR that specifically addresses dosage, but its focus is limited to a single aspect of rehabilitation interventions: exercise. Therefore, current checklists and frameworks may not be applicable to the breadth and complexity of rehabilitation interventions, leading to incomplete reporting or the use of multiple checklists.[21 22]

Without complete and readily available descriptions, rehabilitation interventions cannot be replicated for further evaluation in research or effectively translated to clinical practice. Furthermore, the synthesis and meta-analysis of rehabilitation intervention evidence relies heavily on the precise reporting of essential elements and dosage parameters.[4 5] Inaccurate reporting can significantly undermine evidence synthesis, which is foundational to clinical practice guidelines and the consequent advancement of the field.[5 14] This study describes the modified Delphi process used to develop the TIDieR-Rehab checklist, an extension of the original TIDieR, to enhance the reporting quality of rehabilitation interventions.

METHODS

Design

The aim of this study was to extend an existing research reporting tool (TIDieR) to promote its applicability and relevance to the field of rehabilitation. We drew on the Enhancing the Quality and Transparency of Health Research (EQUATOR) Network guidelines[23] and other relevant recommendations[15 24] to inform the development of the TIDieR-Rehab checklist. A modified-Delphi methodology was deemed an appropriate approach to gather expert feedback in a structured manner, refine the checklist iteratively and achieve consensus.[18] Through successive rounds of online surveys, drafts of the TIDieR-Rehab checklist were presented to individuals with rehabilitation expertise for feedback and iteratively refined until consensus (as defined below) was reached. The TIDieR-Rehab checklist and accompanying supplementary manual[25] were then piloted to inform minor refinements. A multidisciplinary Steering Committee offered guidance throughout the process. The following methods and results are described in accordance with Delphi reporting quality indicators.[26]

Steering Committee

The Steering Committee (n=7) consisted of experts spanning a variety of rehabilitation disciplines including physiotherapy, speech-language therapy, occupational therapy and psychology, and represented different geographical locations (see Acknowledgements). Their role encompassed developing, reviewing, critiquing and piloting iterations of the TIDieR-Rehab checklist and supplementary manual.[24] Furthermore, they provided advice and confirmed consensus decisions, including the termination of survey rounds.

Ethics

Ethical approval for the study was granted by the Auckland University of Technology Ethics Committee (reference: 20/264).

Participants

A target of 30 participants was selected to balance expert representation, efficient consensus-building and active engagement, which aligns with literature that supports a panel size of approximately 30 participants for modified Delphi studies.[15 24 26] Potential participants were actively involved in the design, conduct or reporting of rehabilitation intervention research. Potential participants were identified by reviewing authorship of English language peer-reviewed papers specifically addressing the reporting of rehabilitation interventions or exploring key components of rehabilitation interventions. Purposive sampling was employed to capture a breadth of perspectives, including rehabilitation discipline (eg, physiotherapy, occupational therapy, speech-language therapy, psychology, rehabilitation medicine and nursing), practice setting, area of expertise and geographical location.[15 18 24]

Potential participants were invited to participate via their publicly available work email address and were provided an information sheet that outlined the scope of the study.[18] Those interested in participating were asked to provide consent by copying a consent statement and an expression of agreement to participate into a reply email. Non-responders were sent up to two reminders.[18] Invitations were dispatched in four waves of 50–70 invitations per wave. Following each wave, the research team reviewed the sample against the purposive sampling framework to inform the next wave of invitations.

TIDieR-Rehab development

The first draft of the TIDieR-Rehab checklist was developed through a multiphase process. An appraisal of the existing TIDieR[14] and CERT[20] checklists and expert commentaries[27–30] was undertaken to identify key issues in reporting rehabilitation interventions (refer to online supplemental file 1).[15 24] The TIDieR[14] and CERT[20] checklists were then applied within bodies of rehabilitation literature[31–34] to identify limitations in their practical application. A draft of the TIDieR-Rehab checklist was then developed and presented to the Steering Committee for feedback.[15] In alignment with the modified Delphi methods used in similar studies aiming to enhance established checklists,[14 18 20] this draft was presented in the first survey round.

Survey

Delphi rounds were conducted using an online survey tool (Qualtrics, Provo, UT), where participants received personalised links to provide feedback on the TIDieR-Rehab drafts. Refer to online supplemental file 2 for copies of the surveys.

In round 1, participants reviewed the first draft of the TIDieR-Rehab checklist. For each item, participants were asked to provide quantitative and qualitative feedback. Quantitative feedback indicated agreement with the statement ‘This item should be included in the TIDieR-Rehab checklist’ via a five-point Likert scale ranging from ‘strongly disagree’ to ‘strongly agree’.[18] Qualitative responses were via an optional free comments box in response to the prompt ‘Please provide an explanation of your response in the comments box of each item e.g., suitability, wording, grouping etc.’[18] Items were presented in the intended checklist order to maintain the flow of reporting.[18 20] Participants were also asked, ‘Are there any aspects of intervention reporting you believe were not adequately addressed within this draft checklist?’ and ‘Please provide any other feedback or general comments below’.

Participants who completed round 1 were invited to participate in round 2 to review revisions of the TIDieR-Rehab checklist. In round 2, participants were given a summary of the results from the preceding round.[18] The summary of results indicated which items had achieved consensus and had been retained for inclusion, and which items were adapted, removed or new in response to the previous round’s feedback. For items that had achieved consensus in the previous round, participants were invited to provide qualitative feedback if they did not agree with the consensus using the method described in round 1. Items that had not yet achieved consensus and were subsequently adapted, removed or added were presented alongside a summary of the previous round’s feedback to enable consideration of other participants’ perspectives and facilitate consensus building. In response to these items, participants were asked to provide quantitative and qualitative feedback as described in round 1, except that a four-point Likert scale without the ‘neutral’ option was used to encourage decisive ratings and minimise ambiguity.[35] Participants were also asked if any aspects of intervention reporting were not adequately addressed and to provide general feedback about the TIDieR-Rehab checklist and the supplementary manual through free comment boxes. Survey rounds were continued until consensus was reached. Each survey took up to 30 minutes to complete.

Data analysis

At the end of each round, participant responses were exported from Qualtrics to Microsoft Excel for manual deidentification and analysis.[18] Quantitative responses were descriptively analysed by percentage agreement of each Likert response for each item. Qualitative responses were analysed using an inductive approach to conventional content analysis.[36] Researchers (EG, CM) repeatedly immersed themselves in the data item by item and independently developed inductive qualitative codes. Researchers (EG, CM guided by GA) compared and agreed on codes and then developed subcategories, categories and themes. Quantitative and qualitative data were subsequently triangulated (EG, CM) to determine if data were convergent, complementary or dissonant.[37]

Consensus

Item consensus was determined based on both quantitative and qualitative data. Based on quantitative data, items receiving high agreement (>80% strongly agree and agree responses) were considered for inclusion, items receiving moderate agreement (50%–80%) were considered for adaption and items receiving low agreement (<50%) were considered for exclusion from the checklist.[20] After each round, the research team and Steering Committee reviewed the quantitative, qualitative and triangulated findings to guide iterative development of the checklist and determine consensus for each item. Termination of survey rounds was predefined based on >70% of checklist items reaching high quantitative agreement and the Steering Committee's confirmation to conclude rounds.[38]

Patient and public involvement

None.

RESULTS

Participants

Invitations were sent via email to 270 individuals with expertise in rehabilitation. For a summary of the potential participants invited to contribute to the study, please refer to online supplemental file 3. In total, 35 individuals with rehabilitation expertise consented and participated in round 1 (response rate=13%) and 23 of these 35 participants completed round 2 (response rate=66%). Participants self-identified as researchers (n=30), 'other' professionals (n=3) and journal editors (n=2) and were from various clinical disciplines, including neurological physiotherapy (n=14), musculoskeletal physiotherapy (n=6), other physiotherapy (n=3), rehabilitation medicine (n=4), speech-language therapy (n=4), psychology (n=2), public health (n=1) and occupational therapy (n=1). Participants were situated across 10 different geographical locations, including Australia (n=15), UK (n=6), USA (n=6), New Zealand (n=2), Brazil (n=1), Canada (n=1), France (n=1), Ireland (n=1), Netherlands (n=1) and Norway (n=1).

Modified Delphi rounds

Round 1

Round 1 proposed a first draft of the TIDieR-Rehab checklist with a total of 24 items across 11 sections. Of the 24 items, there were nine original and two adapted TIDieR items[14] and 13 new TIDieR-Rehab items. The numbering of items was also updated to reflect the restructuring of the TIDieR-Rehab extension throughout. Refer to figure 1 for an overview of changes through each round and online supplemental file 4 for a more comprehensive outline of the development of the TIDieR-Rehab items through each round of the modified Delphi process. The quantitative agreement from round 1 is presented in figure 2 and showed 20 out of the proposed 24 items met high agreement for inclusion (>80% strongly agree and agree). The new items that received the strongest agreement were: When and How much—Frequency (94%) and Intervention length (97%); Tailoring—Progression of dosage parameters (94%) and How well—Measurement of engagement/adherence (94%). Notably, the new items describing adverse events within the How well section also received high quantitative agreement and were convergent with positive qualitative feedback. The four items that did not meet high agreement were all newly proposed TIDieR-Rehab items and included: How—Delivery support (77%); When and How much—Work duration (69%); How challenging—Measure and set intensity (77%) and How challenging—Intensity tool (71%).

Qualitative feedback favoured the inclusion of all 24 proposed items in some form and highlighted the need for the TIDieR-Rehab checklist to enhance research and clinical practice. Suggestions and critiques were distributed across original, adapted and new items and broadly pertained to (1) terminology or wording revisions, (2) the structure of items, (3) differences in understanding, (4) relevance and application of rehabilitation concepts to particular disciplines or interventions, (5) the barriers to capturing and reporting item information and (6) the provision of item explanations or rehabilitation examples to aid clarity and usability. The four items which did not achieve high quantitative agreement were frequently accompanied by qualitative feedback which critiqued the terminology and relevance of the underlying concept.

In consultation with the Steering Committee, the triangulated quantitative and qualitative analysis from round 1 was utilised to develop a revised second draft of the TIDieR-Rehab checklist. Additionally, in response to the round 1 analysis, the TIDieR-Rehab supplementary manual was developed as an extension of the original TIDieR checklist guidance[14] to provide explanations of items and rehabilitation specific examples of good reporting. These revisions and additions justified the need for further consensus building through a second survey round.

Round 2

Round 2 proposed the second draft of the TIDieR-Rehab checklist which included 22 items. Of the 22 items, the nine items from round 1 that achieved high quantitative and qualitative agreement were not presented for further quantitative feedback in round 2. The other 13 items, including the reintroduction of one original item, and nine adapted and three new TIDieR-Rehab items, were presented for quantitative and qualitative feedback in round 2. Of the 13 items presented, 11 achieved high agreement (refer to figure 2). The remaining two items bordered on high agreement. That is, the item Who received 78% agreement but received positive qualitative feedback that was dissonant to a disagreement rating and

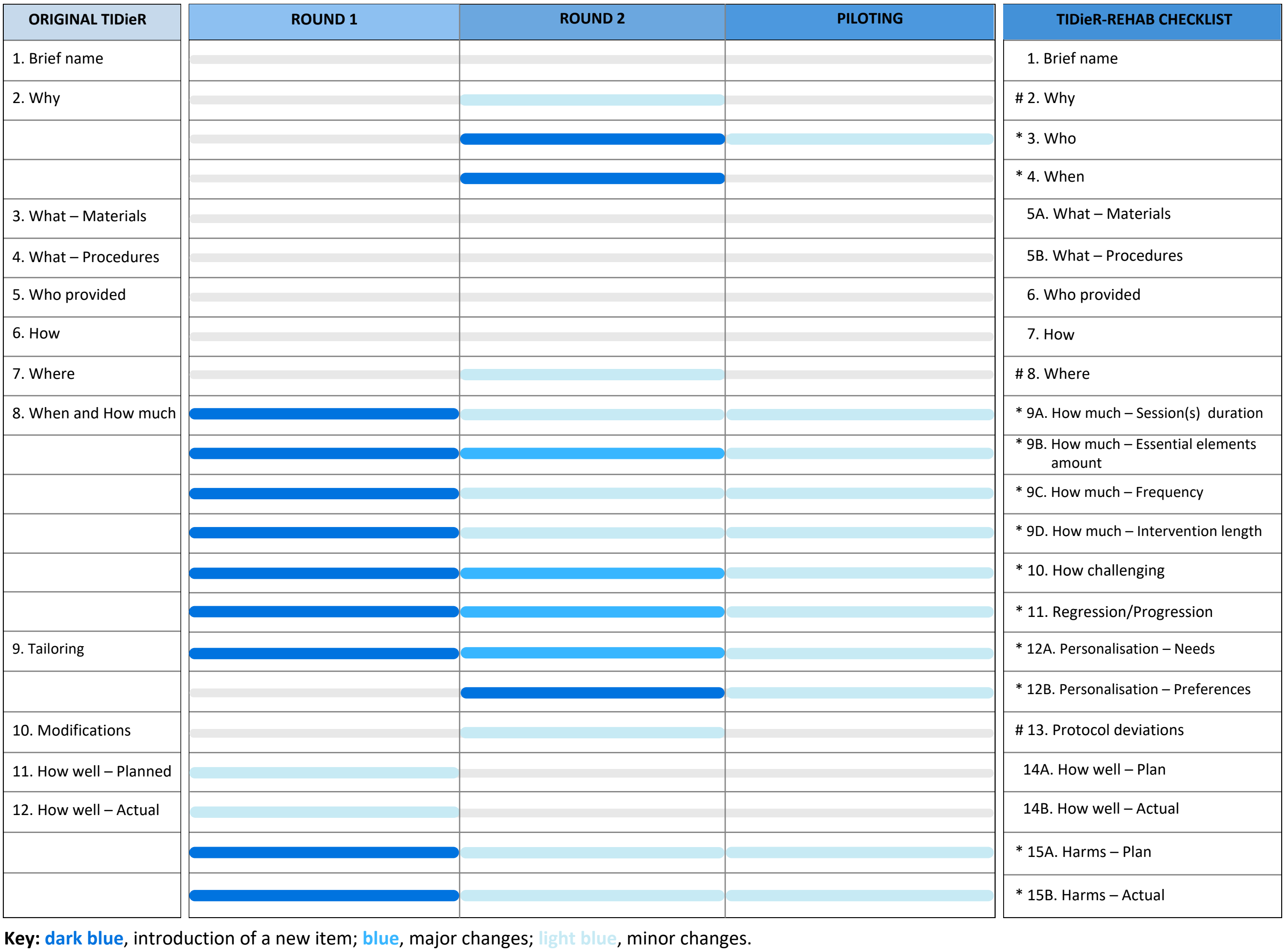

Figure 1 Overview of the iterative development of the TIDieR-Rehab checklist through each stage of the modified Delphi process. *, new item unique to the TIDieR-Rehab checklist; #, adapted original TIDieR item for the TIDieR-Rehab checklist. TIDieR, Template for Intervention Description and Replication

the item Personalisation received 78% agreement but had a missing rating from one participant.

The qualitative responses in round 2 reinforced the high quantitative agreement. The qualitative analysis of rounds 1 and 2 is summarised in table 1. Revisions applied to the second draft of the TIDieR-Rehab checklist as well as the addition of the supplementary manual addressed concerns that had been raised in round 1. For example, revisions to the item How challenging and its supplementary information, which included replacing the term 'intensity' with 'challenging' and providing further explanation and multidisciplinary examples of the challenge concept, were met with high agreement (87%) and largely positive qualitative feedback, supporting the changes and indicating greater shared understanding.

The round 2 responses indicated consensus and informed minor wording and ordering refinements which were reviewed and accepted by the Steering Committee. Based on participant consensus (>70% items reaching high agreement) and Steering Committee endorsement, the modified Delphi process was terminated after the completion of round 2.

Post-survey final checklist

The TIDieR-Rehab was subsequently piloted on randomised controlled trials in two substantive areas of rehabilitation research, treadmill training and upper limb robotic rehabilitation, as part of systematic reviews and meta-analyses.[39 40] This piloting process informed minor refinements, such as reordering of an item and minor amendments to wording and grammar in the supplementary manual (see figure 1 and online supplemental file 4 for details). The 22-item TIDieR-Rehab checklist and supplementary manual were then reviewed and finalised by the Steering Committee. The final TIDieR-Rehab checklist (see table 2) retains seven original and three adapted TIDieR items and presents 12 new items unique to the TIDieR-Rehab. The checklist includes the following sections: 1. Brief name, 2. Why, 3. Who, 4. When, 5. What, 6. Who

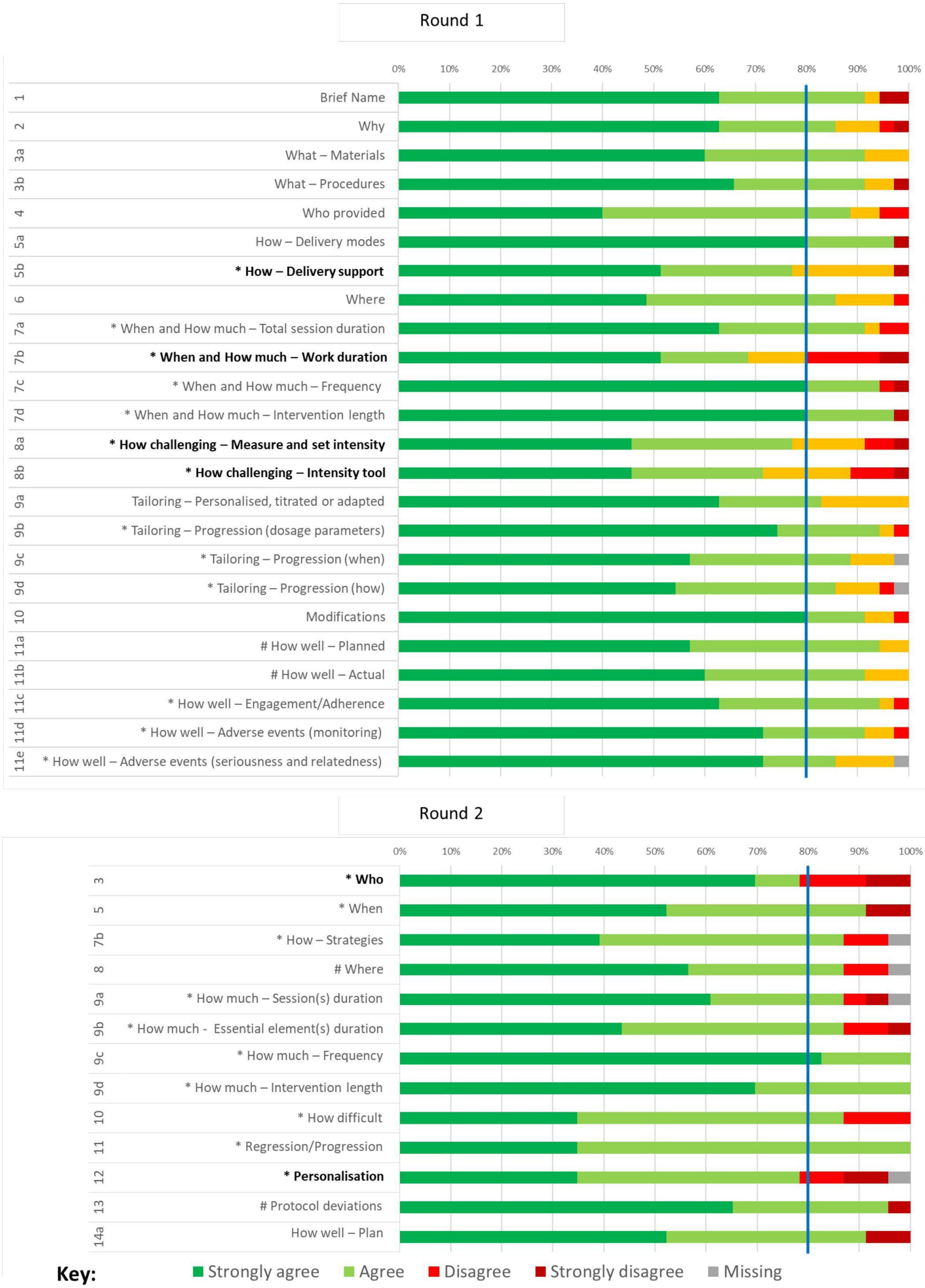

Figure 2 Rounds 1 and 2 Likert results presented in order of the TIDieR-Rehab checklist items. **Bold,** items that did not meet high quantitative agreement. *, new item unique to the TIDieR-Rehab checklist; #, adapted original TIDieR item for the TIDieR-Rehab checklist. TIDieR, Template for Intervention Description and Replication.

Table 1 Qualitative analysis of round 1 and round 2 free comments feedback

Themes	Categories (with example quote)	Subcategories	Codes (simplified)
Refining the TIDieR-Rehab checklist	**Catalysts for revision** ‘I really like this item in some form, but I think it might be helpful to separate difficulty (as a property of the task), from challenge (how difficult a task is for a specific individual), from intensity (the effort being invested). As an analogy, playing a video game at high difficulty is less challenging for an expert than for a novice. But even then, a novice who invests more effort will likely perform better than a novice who invests less’ (Participant 13).	‘Correct’ and clear terminology and phrasing is valued	A different name or word would be more appropriate
			Terms representing different rehabilitation concepts should not be used interchangeably
			Unclear terminology should be clarified with a definition or criteria
			Vague guidance may be deter people from reporting what is actually important
			Clarify if items report on what was ‘planned’ vs what ‘actually’ happened
			Unclear if challenge is ‘subjective’ or ‘objective’
			Unclear boundary between ‘tailoring’ and ‘modification’
			Clarify the term ‘active ingredients’/’essential elements’
			The term ‘intensity’ is poorly understood within rehabilitation literature
			The term ‘dosage’ is poorly understood within rehabilitation literature
		Structure supports understanding	Align the structure with other reporting standards
			Reorder words, items or sections
			Separate this item or section
		Users require guidance	Guiding criteria could inform rationale for parameters and measurements
			An explanation or example would encourage better reporting
			An example would clarify ambiguous rehabilitation concepts
			Guidance is needed to understand ‘when’ to use the checklist
			The TIDieR-Rehab supplementary manual needs provide simplified guidance
		Missing items	An item about [xxx] could be added to the TIDieR-Rehab checklist
			A more holistic consideration of the patient/participant experience is needed
			Explicit consideration of reporting on control/usual care groups is needed
		Unnecessary detail or item	Reporting on this item would be insufficient or meaningless
			Reporting on this item would be too extensive
			Item is repetitive or redundant of other items
			Only some parts of this item are needed
			This aspect of research is important but may be beyond the scope of the TIDieR-Rehab checklist
	Tensions in complete and meaningful rehabilitation intervention reporting ‘This will be highly individualised to the patients’ needs, which means it will often be so broad and facile it is meaningless or so specific that is also meaningless. I think all one can do is to say (the intervention) will be given as appropriate for the patients’ needs. The chances of accurately recording all these aspects of dose and encompassing the need to adapt to individual needs is low. The answer will very often be “it all depends”. And if one really lists all the possibilities, it would be much too long to read’ (Participant 3).	Barriers to reporting on individualised rehabilitation interventions	Not be feasible to collect this data as it would be different for every individual
			Fully reporting individualised rehabilitation interventions would be meaningless
			Concise reporting of individualised interventions requires standardisation, protocols or a word limit
		Misleading reporting	Overly rigorous reporting may limit the support and application of the intervention in alternate forms
			Emphasising the ‘wrong’ components of a rehabilitation intervention may attribute outcomes to incidental/non-essential elements
			Item risks validating a concept that is not yet well understood in rehabilitation
		Questioning multidisciplinary understanding and relevance of some rehabilitation concepts	Item should be optional as it is not applicable to all intervention types
			Item should be optional as it is not applicable to all disciplines
			Item represents a concept that is not well understood in all disciplines

Continued

Table 1 Continued

Themes	Categories (with example quote)	Subcategories	Codes (simplified)
The TIDieR-Rehab checklist and supplementary manual will enhance rehabilitation	**Enhancing rehabilitation research** '[The TIDieR-Rehab is] vital to validity of results, replication from others, analysing key components of the intervention—what makes this intervention work. Thank you for doing this, a very important checklist to ensure the quality of rehabilitation interventions—much needed' (Participant 17).	Research information gathering and evaluation	Item facilitates rehabilitation research identification
			Item facilitates literature review, synthesis and meta-analysis
			Supplementary manual aids clarity and usability of the checklist for exploring rehabilitation research
			Item/checklist may be used to assess or score the completeness of rehabilitation intervention reporting
			The TIDieR-Rehab checklist will clarify rehabilitation concepts
		Research rigour	Item/checklist aids validity
			Item/checklist aids generalisability
			Item/checklist aids transparency and fidelity
			The TIDieR-Rehab checklist may enhance the rigour of rehabilitation
		Future research	Item/checklist aids accurate replication
			The TIDieR-Rehab checklist will inform the feasibility of further rehabilitation research
			The TIDieR-Rehab checklist may reduce rehabilitation research waste
			The TIDieR-Rehab checklist will inform future practice guidelines and ethics
			The TIDieR-Rehab checklist may reveal the aspects of the intervention that contributes to the outcome for further exploration
			The TIDieR-Rehab checklist may contribute to enhanced efficacy of rehabilitation
	Enhancing clinical practice 'I think better description of rehab interventions is really important. I am also aware that filling in checklists is a pain. But I think when people are really mindful about the sorts of things captured in checklists at the start of intervention development, it can help them be really clear with some of these parameters which in rehab tend to be left at clinician's discretion/clinical judgement, so more clarity about this is a good thing' (Participant 24).	Intervention selection	Item/checklist will help clinicians identify which patients/groups are appropriate for the intervention
			This item/checklist informs the clinical rationale for using the intervention
			Greater attention to the multiple aspects of dosage can inform treatment planning and monitoring
			Item/checklist aids prediction of expected outcomes of the intervention
		Intervention translation	Item is essential for responsive and adaptable translation of the intervention
			Item is essential for accurate translation of the intervention
			Clinicians need to understand all aspects of intervention delivery for effective rehabilitation
			Clinicians can use the checklist to determine and improve rehabilitation dosage
			This checklist enables clinicians to gain a better understanding of patient's outcomes and experiences from a rehabilitation intervention
			The TIDieR-Rehab checklist may improve clinical uptake over time

Table 2 The TIDieR-Rehab checklist

SECTION 1. BRIEF NAME	
Item 1.	Provide the name or a phrase that describes the intervention.
SECTION 2. WHY	
# Item 2.	Describe any rationale, theory or goal of the elements essential to the intervention. *Essential elements, also known as 'active ingredients', are the core components of the intervention that are expected to be linked to effects or outcomes of interest*.
SECTION 3. WHO	
* Item 3.	Describe who the intervention is intended for.
SECTION 4. WHEN	
* Item 4.	Describe when the intervention commenced in relation to the onset or stage of the condition and/or other relevant events.
SECTION 5. WHAT	
Item 5A.	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 (for example, online appendix, URL).
Item 5B.	Procedures: Describe each of the procedures, activities and/or processes used in the intervention, including any enabling or support activities.
SECTION 6. WHO PROVIDED	
Item 6.	For each category of intervention provider (for example, psychologist, nursing assistant), describe their expertise, background and any specific training given.
SECTION 7. HOW	
Item 7.	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.
SECTION 8. WHERE	
# Item 8.	Describe the type(s) of environment(s) where the intervention occurred, including any necessary infrastructure or relevant features. *Environments and their features may include the relevant physical, social, cultural, economic, political and/or systemic context(s) of the intervention*.
SECTION 9. HOW MUCH	
* Item 9A.	Session(s) duration: Specify the planned session(s) duration of the intervention.
* Item 9B.	Essential elements amount: Specify the planned session(s) duration and/or repetitions of the essential elements of the intervention. *Essential elements amount refers to the time and/or repetitions, within the total duration of a single session, that is spent 'actively' participating in the core components of the intervention*.
* Item 9C.	Frequency: Specify the planned frequency of the intervention.
* Item 9D.	Intervention length: Specify the planned overall length of the intervention.
SECTION 10. HOW CHALLENGING	
* Item 10.	Describe the approach(es) used to set and monitor the intervention/task challenge level. *Challenge may include the nominal, functional or perceived level of difficulty, effort, physiological intensity or cognitive load of an intervention/task at a given time and may be evaluated using subjective or objective measures*.
SECTION 11. REGRESSION/PROGRESSION	
* Item 11.	Describe the planned regression and/or progression of dosage parameter(s), including when and how. *Dosage parameters refer to the amount (Section 9. How much) and challenge (Section 10. How challenging) of the intervention*.

Continued

Table 2 Continued

SECTION 12. PERSONALISATION	
* Item 12A.	Needs: If supplementary strategies were planned to enable the delivery of the essential elements of the intervention in response to specific individual or group needs, then describe what, why, when and how. *Supplementary strategies refer to intervention adjuncts (for example, physical assistance, verbal cueing, props) that must be used by some individuals or groups to facilitate effective participation in the essential elements*.
* Item 12B.	Preferences: If the intervention was planned to be adapted for personal preferences, then describe what, why, when and how.
SECTION 13. PROTOCOL DEVIATIONS	
# Item 13.	If there were deviations in the intervention protocol during the course of the study, describe the changes (what, why, when and how).
SECTION 14. HOW WELL	
Item 14A.	Plan: 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.
Item 14B.	Actual: If intervention adherence or fidelity was assessed, describe the extent to which the intervention was delivered as planned.
SECTION 15. HARMS	
* Item 15A.	Plan: Describe the monitoring of adverse consequences. *Adverse consequences include any negative, undesired effects related to the intervention, including physical, mental, social and/or spiritual effects*.
* Item 15B.	Actual: Describe any adverse consequences, including the number, seriousness and relatedness to the intervention.

*, new item unique to the TIDieR-Rehab checklist.
#, adapted original TIDieR item for the TIDieR-Rehab checklist.
TIDieR, Template for Intervention Description and Replication.

provided, 7. How, 8. Where, 9. How much, 10. How challenging, 11. Regression/Progression, 12. Personalisation (renamed from Tailoring), 13. Protocol deviations (renamed from Modifications), 14. How well and 15. Harms. The TIDieR-Rehab checklist and supplementary manual are presented in the corresponding paper.[25]

DISCUSSION

This study developed the TIDieR-Rehab checklist and supplementary manual,[25] an extension of the original TIDieR, which aims to enhance the reporting of rehabilitation interventions. Rehabilitation experts reached strong consensus on the checklist items and supplementary manual. Reflecting the unique nature of rehabilitation practice, the TIDieR-Rehab extension introduces reporting requirements and guidance aligned with the current priorities and complexities of intervention reporting within rehabilitation research, emphasising concepts such as dosage, person-centred care and negative undesired effects. The new TIDieR-Rehab items within the *How much*, *How challenging* and *Regression/Progression* sections emphasised the importance experts place on understanding the role of dosage parameters in rehabilitation intervention efficacy.[5–7 10–12] Strong agreement and qualitative feedback on these items reflected the need for structured guidance about how to describe rehabilitation dosage parameters. Items within the *Personalisation* section underscored the centrality of person-centred care in rehabilitation.[3] Furthermore, the adapted *Protocol deviations* section and the new items within the *Harms* section respond to calls for greater clarity on negative undesired effects associated with rehabilitation interventions, which is essential to evaluating their generalisability.[20 41] The TIDieR-Rehab sets a new standard for the reporting of rehabilitation interventions, paving the way for advancements in the field.

The findings from the modified Delphi process with multidisciplinary rehabilitation experts highlight the importance of striving for a shared conceptual understanding and common language to articulate the essential elements and dosage parameters of rehabilitation interventions. Although consensus was rapidly achieved for most items based on quantitative data, the qualitative data revealed ongoing debate surrounding central rehabilitation concepts such as work duration, intensity and engagement. Such debates emerged not only between disciplines but also within them. For instance, in round 1, *How challenging* was originally framed with respect to setting and measuring the 'intensity' of rehabilitation. However, participants raised concerns over the terminology and its relevance. Overall, qualitative findings highlighted the ways conceptual understandings were shaped by both disciplinary perspectives and underpinning bodies of knowledge.[3 5 42] Surfacing these tensions was integral to revisions of the TIDieR-Rehab checklist, particularly the terminology and definitions used, which prompted the development of the TIDieR-Rehab supplementary manual. The TIDieR-Rehab supplementary manual offers nuanced explanations and multidisciplinary examples of item reporting to support a shared understanding of key concepts. Nevertheless, while there was a drive to achieve encompassing definitions of key concepts, participant recommendations informed an option for users of the checklist to determine items as 'non-applicable' to avoid unnecessary reporting of irrelevant items. Given the recognised variation in conceptual understandings within and across rehabilitation disciplines, the findings of this study reinforce the need for improvements in rehabilitation reporting to support the logical, systematic and coherent exploration and explanation of rehabilitation interventions and their effects.[15 22]

The importance of clearly defining person-centred practices as an integral part of rehabilitation is at the core of calls to improve reporting of rehabilitation interventions.[22] Recognising the gap between principles of person-centred care and their implementation in practice,[43 44] the TIDieR-Rehab checklist offers a pragmatic approach, with a dedicated *Personalisation* section, to distinguish person-centred rehabilitation practices in response to patient needs and preferences. Person-centredness was further emphasised in the *How challenging* and *Regression/Progression* sections which delineated these important dosage parameters and are often person-specific. However, the study findings recognised the inherent difficulties associated with describing and reporting personalised interventions, which influenced the items adapted and retained through the modified Delphi process. Furthermore, differences in terminology and conceptual understandings coupled with pragmatic constraints informed the removal and adaptation of proposed items. For example, in round 1, a new item related to adherence and engagement was proposed in the *How well* section; however, despite achieving high quantitative agreement (94%), participants commented on the differences in evaluating the two concepts. This was reinforced by practical concerns raised by the Steering Committee, including an expert in engagement, who questioned the items feasibility. Thus, this item was omitted. Likewise, in round 1, participants questioned the proposed new item *How much—Work duration* for its unclear distinction from *How much—Session duration*. Participants also questioned the practicality of quantifying work and rest durations, and whether this was reporting on planned or actual parameters. Such concerns led to the adaptation of this item's terminology, definition and supplementary information to describe '*Essential elements amount*', and the rewording of all items within the section *How much* to aid clarity. Describing and reporting engagement and work duration may become more feasible as conceptual understandings advance. In addition, technological advances that support the monitoring of engagement in essential elements, such as activity or physiological monitoring, may facilitate more accurate reporting.[42 45]

Documenting the negative undesired effects of rehabilitation is paramount to the advancement of the field. The original TIDieR guidelines did not provide explicit directives for reporting adverse consequences, likely due to coverage in other frameworks such as the CONSORT.[17 20] Current guidelines for safety monitoring and reporting of adverse consequences are primarily focused on medical intervention-related clinical trials.[41] A recent update to the CONSORT framework has proposed that all harms be clearly reported,[46] yet there remains a gap in robust reporting of adverse consequences in non-pharmacological interventions such as rehabilitation.[41] This gap is addressed within the adapted item *Protocol deviations* and new item *Harms* of the TIDieR-Rehab checklist to support greater clarity of the negative undesired effects associated with rehabilitation interventions. Only by clearly defining and understanding negative undesired effects, with respect to the intervention and its proposed theoretical basis, can a fuller understanding of the potential harms be developed. Successful translation of interventions to clinical practice is dependent on such comprehensive understandings of both benefits and risks.[41]

Advancements in clinical trial design and reporting, coupled with a shift to online publishing, have facilitated more rigorous reporting of rehabilitation trial protocols. However, this progress has not been reflected in the reporting of interventions themselves.[9] The TIDieR-Rehab checklist emphasises a systematic approach to the description of rehabilitation interventions. Researchers may use the TIDieR-Rehab checklist to: support the development of rehabilitation interventions, guide intervention reporting in clinical trials and facilitate the synthesis of rehabilitation research evidence. Importantly, by addressing the pitfalls of inadequate reporting, the TIDieR-Rehab checklist supports the identification of knowledge gaps in rehabilitation research, thereby minimising research wastage. In turn, the TIDieR-Rehab checklist may enhance the translation of research findings into practice by guiding the reporting of interventions in clinical practice guidelines, supporting clinicians to evaluate the potential benefits and risks of an intervention, and offering clarity for accurate and effective implementation of interventions in practice. Future research should explore the validity, reliability and usability of the TIDieR-Rehab checklist[25] across a range of different users to gain a better understanding of its applicability. Given the nascent stage of rehabilitation evidence, it is likely that the checklist will require revision as new knowledge emerges.

Limitations

While the TIDieR-Rehab checklist was developed through a rigorous modified Delphi process, there are several limitations which should be acknowledged. First, as opinion-based research, the modified Delphi approach may introduce participant bias, affecting study outcomes.[47] Additionally, although online surveys enable efficient collection of diverse perspectives, this approach may introduce desirability bias and discourage in-depth feedback.[47 48] We attempted to mitigate this issue through the inclusion of free comment boxes and open questions.[18] The study concluded after two rounds of feedback based on predefined consensus criteria which considered both quantitative and qualitative data.[48] Although typical in modified Delphi studies and commonly accepted in health research,[26 49] the absence of formal statistical analysis to assess the stability of the consensus may affect the perceived robustness of the study findings.[48] Furthermore, although consensus criteria were prespecified and documented as part of the ethical review process, the modified Delphi study protocol was not preregistered on a public platform. This would have further enhanced the transparency and trustworthiness of the research findings.[50]

Although this research sought the inclusion of a broad spectrum of participants of varying nationalities, rehabilitation disciplines and professional experiences, there were limitations. While researchers may possess deep insights into rehabilitation intervention reporting, their perspectives may not wholly represent the rehabilitation community, especially clinicians. Additionally, there was a significant representation from the physiotherapy discipline. Discourses on dosage have been prevalent in physiotherapy literature, while other fields like psychology, occupational therapy and speech-language therapy have only recently engaged in such discussions, as evidenced by the under-reporting of dosage parameters in these fields.[10–12] This limitation may have been exacerbated by reliance on literature from the physical rehabilitation field during the development[31–34] and piloting[39 40] of the TIDieR-Rehab checklist. The Steering Committee played a crucial role in capturing a diversity of professional and disciplinary perspectives, yet these may not be fully represented in the research. Furthermore, the recruitment strategy, which focused on authors of rehabilitation research published in the English language, likely resulted in a sample reflecting existing disparities in international research outputs, the origins of the TIDieR checklist[14] and key publications in the field.[2 4 5 9 20 51] Most participants came from high-income Organisation for Economic Co-operation and Development (OECD) countries, with a significant proportion from Australasia. This skew may limit the global applicability of our findings and potentially bias them towards Western worldviews of rehabilitation. Though the TIDieR-Rehab may risk perpetuating such dominance, the introduction of a tool that encourages more precise descriptions of rehabilitation interventions may foster a more considered examination of the underlying assumptions which shape rehabilitation practice globally.

CONCLUSION

This modified Delphi study supported the development of an extension to the original TIDieR which aimed to enhance the reporting of rehabilitation interventions. The TIDieR-Rehab checklist and supplementary manual[25] are grounded in the collective expertise of rehabilitation experts, and reflects critical intervention nuances specific to rehabilitation, including dosage (amount and challenge) and person-centred care. The TIDieR checklist sets a new standard for the reporting of rehabilitation interventions, emphasising systematic documentation and explication of dosage parameters and person-centred practices to promote replicability and synthesis. Recognising the vital need for better reporting of harms, the TIDieR-Rehab also emphasises the importance of documenting both the positive and negative effects of interventions. The findings exposed ongoing debates around core rehabilitation concepts and emphasised the need for a shared understanding of the multifaceted nature of rehabilitation. Furthermore, current challenges in rehabilitation intervention reporting pertaining to the personalised nature of rehabilitation and feasibility of reporting complex nonpharmacological interventions were apparent. The TIDieR-Rehab checklist offers a promising avenue for enhancing the reporting of rehabilitation interventions to promote the minimisation of research wastage, advancement of the field of rehabilitation and translation of research findings to clinical practice.

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