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# Core Outcome Sets developed for research relevant to physiotherapy interventions: A systematic review

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# Abstract

### Background

A Core Outcome Set (COS), defined as the agreed minimum set of outcomes to be measured and reported in all clinical trials for a particular condition, could help address outcome heterogeneity across studies and lack of consideration of what matters to patients. This study aimed to identify all COS developed for research relevant to physiotherapy interventions, evaluate whether their development met minimum standards, and classify the recommended outcomes to provide a reference point for future comparisons.

### Methods

The COMET database was searched to identify relevant published and ongoing COS related to physiotherapy interventions. Two investigators independently screened the articles for inclusion, followed by independent data extraction of included COS and evaluation of the COS according to the Core Outcome Set-STAndards for Development (COS-STAD). For each included COS, the core outcomes were categorised using the COMET taxonomy.

### Results

The scope of the COS was specified in all the included studies (N = 31), with most COS applicable to rheumatological conditions and physical rehabilitation interventions. Around 40% (n = 13) were developed with participation from more than one region of the world. Patients participated in the development process in two thirds of COS studies (n = 21, 68%) with health care professionals participating in almost all included studies (n = 30, 97%). Aspects of the consensus process were decided a priori in 26% (n = 8, for consensus definition and criteria for including, dropping or adding outcomes) and 32% (n = 10, for scoring process) of studies. All COS included at least one life impact outcome, and emotional functioning outcomes were more prominent in COS that included patient input.

### Conclusion

This review highlights the need for improvement in the development of COS, particularly in relation to increasing global involvement, patient participation, and reporting of the consensus process during COS development.

Systematic review registration number: PROSPERO CRD42025620018


# Introduction

In clinical trials, outcomes play an important role in identifying the difference in effect between interventions. Identifying suitable outcomes is a key factor in determining whether the intervention of interest could be utilised for providing evidence-informed practice in different healthcare conditions.(1)

When formulating a robust research question in a clinical trial, the essential components are the population, intervention, comparator and the outcomes (PICO format), further demonstrating the significance of choosing appropriate outcomes of interest.(2)

One of the greatest challenges in systematic reviews and meta-analysis is the inability to combine results due to heterogeneity of outcomes reported in different studies(3), leading to research waste.(4) Furthermore, researchers may not choose outcomes that are of key importance to all stakeholders e.g., patients who have the health condition and/or their caregivers.(5)

In recent years there has been increasing interest in the standardisation of outcomes to be evaluated in studies for a given health condition. The Core Outcome Measures in Effectiveness Trials (COMET) Initiative was formed in 2010, aiming to minimise the heterogeneity, inconsistency and outcome reporting bias by promoting the development and implementation of Core Outcome Sets (COS).(6) A COS is an agreed standard set of outcomes that should be measured and reported as a minimum in all clinical trials in specific areas of health or healthcare (7) and a Core Outcome Measurement Set (COMS) addresses 'how' each core outcome should be measured.(8) Checklists for COS protocols,(9) development standards (10), and reporting studies (11) have been produced to support methodological rigour across COS production.

Physiotherapy is a research-active profession that aims to develop, maintain and restore an individual's movement and functional ability.(12) Using COS to reduce heterogeneity and improve outcome reporting has been highlighted in two recently published Cochrane reviews of physiotherapy interventions for ankle fractures(13) and complex regional pain syndrome.(14) Furthermore, COS targeted at relevant interventions have also been developed e.g. the PRACTICE COS.(15)

Given the growing focus on the application of COS to physiotherapy interventions, the aim of this systematic review is to identify all COS developed for research relevant to physiotherapy interventions and assess them according to the minimum standards for COS development, which will serve as a reference point for future comparisons.

Objectives

1. To identify published and ongoing COS developed for research relevant to physiotherapy interventions.
2. To evaluate the included COS using the Core Outcome Set-STAndards for Development (COS-STAD).
3. To describe the participation of stakeholders in the development of identified COS.
4. To classify the identified COS using the COMET outcome classification taxonomy. (16)
5. To describe and compare the core outcome domains recommended across the identified COS.

# Methods

The protocol for this systematic review was registered in advance on PROSPERO (https://www.crd.york.ac.uk/PROSPERO/view/CRD42025620018). The review is reported using the PRISMA checklist. (Additional file: Appendix 1)

**Searches**: We searched the COMET database (www.comet-initiative.org) to identify COS related to physiotherapy interventions. This living database is a freely accessible searchable repository of all published and ongoing COS development studies. Published COS studies are identified from: an annually updated systematic review (17–25); through citation alerts from key COMET papers; and database alerts (Google Scholar and Scopus) using the key words “Core outcome sets” and “Core outcome”. Ongoing COS development studies are prospectively registered by COS developers and added into the COMET database following a review for eligibility by the COMET team. The initial search was performed in December 2024 and later updated in June 2026. We used the advanced search filter in the COMET database to limit results by study type (‘COS for clinical trials or clinical research’ - study classification type defined by COMET) and intervention (classification based on specific intervention characteristics reported in the original COMET systematic review of COS).(17) Selected intervention types included: Physiotherapy, Exercise, Rehabilitation, Pulmonary rehabilitation, Physical, Nonpharmacological, Non-surgical, Management of care, Mechanical ventilation, Multimodal therapy, Complementary and alternative medicine therapy, Complex interventions, Compression therapy, Disease modification treatments, Education/Self-management, Intensive care, Palliative care, Prevention, Operative and non-operative management. This methodological approach of identifying relevant COS solely from the COMET database was followed in other subject areas such as obstetrics and gynaecology (26), rare genetic diseases (27) and cancer (28).

**Eligibility criteria**

We identified all studies that reported the development of COS for research related to physiotherapy interventions. We included studies with participants from all age groups with any health condition. We excluded studies where the COS applied solely to clinical practice.

For the purpose of this review, our defined physiotherapy intervention types were adapted from the World Physiotherapy guidance document.(12) This included therapeutic exercise, functional training, manual therapy techniques (including mobilisation or manipulation), airway clearance techniques, integumentary repair and protection techniques, electrotherapeutic modalities, physical agents and mechanical modalities, patient related instructions. We included COS developed specifically for any physiotherapy intervention as listed above, irrespective of the health condition studied. COS developed for health conditions where physiotherapy could be utilised as an intervention; however, were excluded if any of the physiotherapy interventions were not clearly defined in the COS.

A detailed PRISMA flowchart is found as Fig. 1. [Insert Fig. 1 here]

**Screening**

Following the COMET database search, ten studies were initially screened by two experts in physiotherapy (FD, BC) to confirm application of eligibility criteria, and any disagreements were resolved through discussion. Remaining search results were then screened independently by two reviewers (LVT, SLG). All records were managed in EndNote.

**Data extraction**

Data relating to the identified COS including the scope of the COS (see Table 1), participating stakeholders, consensus methods, health outcomes included in the final COS, publication details and countries represented in the author team were extracted into Microsoft Excel by LVT and verified independently by SLG and SD.

Table 1
Scope of a core outcome set illustrated using an example.

| Scope | Example from PRACTICE COS (15) |
|---|---|
| Settings where this COS can be applied | Research and clinical trials. |
| Health condition covered by the COS | Critical illness. |
| Population applicable to the COS | Adults (age ≥ 18 years) who have experienced critical illness. |
| Interventions applicable to the COS | Physical rehabilitation interventions (mobilisation, exercise or adjuncts such as cycling or electrical muscle stimulation), delivered across any stages of continuum of recovery. |

PRACTICE - Physical rehabilitation core outcomes in critical illness, COS – Core outcome set.

**COS-STAD assessment**: Minimum standards assessment was completed independently and in duplicate by two reviewers (LVT and SLG) using the COS-STAD criteria,(10) an 11-item checklist comprising three domains (Additional file: Appendix 2) namely:

1. Scope specification (items 1 to 4)
2. Stakeholder participation (items 5 to 7)
3. Consensus process (items 8 to 11)

There was 96% agreement between the reviewers on COS-STAD assessment. Minor discrepancies in the judgements were resolved through discussion.

**Data synthesis**

All core outcomes identified in the included COS were classified by LVT according to the COMET taxonomy (16) and independently verified by SD (expert in outcome domain classification). Minor

discrepancies were resolved through discussion. Outcomes were classified into one of the following areas

1. Mortality/survival
2. Physiological/clinical
3. Life impact
4. Resource use
5. Adverse events/effects

We further classified the life impact area into specific domains: functioning (which includes physical, social, role, emotional/wellbeing, cognitive sub-domains), global quality of life, delivery of care, and personal circumstances. This taxonomy was found to be sufficiently comprehensive and granular for classification of patient outcomes in a large number of research studies in a wide range of health conditions. (29)

## Patient and public involvement:

We did not involve patients or members of the public in the design or conduct of this review.

## Results

We included 31 published studies reporting the development of 33 COS for research involving physiotherapy related interventions (Fig. 1). Characteristics of included COS are reported in Table 2. [Insert Table 2 here]

**Table 2:** Characteristics of included core outcome set studies (N=31)

| | n (% of N studies) |
|---|---|
| **Continents involved in COS development - participants** | |
| Europe only | 8 (26%) |
| North America only | 2 (6%) |
| Asia only | 1 (3%) |
| Oceania only | 1 (3%) |
| Europe + North America | 1 (3%) |
| Europe + North America + Oceania | 2 (6%) |
| Europe + North America + Asia | 2 (6%) |
| Europe + North America + Asia + Africa | 2 (6%) |
| Europe + North America + Africa + Oceania | 1 (3%) |
| Europe + North America + Asia + South America | 1 (3%) |
| Europe + North America + Asia + South America + Oceania | 4 (13%) |
| Not Specified | 6 (19%) |
| **Disease categories*** | |
| Rheumatology | 6 (19%) |
| Neurology | 5 (16%) |
| Orthopaedics & trauma | 5 (16%) |
| Others** | 4 (13%) |
| Heart & circulation | 3 (10%) |
| Lungs & airways | 2 (6%) |
| Endocrine & metabolic | 2 (6%) |
| Health care of older people | 2 (6%) |
| Cancer | 1 (3%) |
| Anaesthesia & pain control | 1 (3%) |
| Infectious disease | 1 (3%) |
| **Interventions** | |
| Physical rehabilitation | 17 (55%) |
| Exercise/Physical activity | 8 (26%) |

| | |
|---|---|
| Physiotherapeutic interventions | 2 (6%) |
| Airway related | 2 (6%) |
| Others*** | 2 (6%) |
| **Population** | |
| Adults | 19 (61%) |
| Older adults | 4 (13%) |
| Children | 1 (3%) |
| Not specified | 7 (23%) |
| **Year of COS journal publication** | |
| 2000 or before | 0 |
| 2001 to 2010 | 2 (6%) |
| 2011 to 2020 | 19 (61%) |
| After 2020 | 10 (32%) |
| **Recommendations for outcome measurement instruments** | |
| Measurement instruments recommended | 15 (48%) |
| No recommendation for measurement instruments | 12 (39%) |
| Plans to address in the future | 4 (13%) |

COS – Core outcome sets

*Footnotes (Table 2):*

**One COS was categorised in more than one category, developed for cancer and older adults*

***The other disease categories included chronic conditions, public health, organ transplantation, and lower limb amputation*

****The other intervention included compression and yoga.*

Table 3 presents the minimum standards assessment of the included COS according to the COS-STAD criteria. [insert Table 3 here]

Table 3
Core Outcome Sets -STAndards for Development (COS-STAD) evaluation of the included studies (N = 31)

| Domain | Standard number | Standard | Standard met, n (%) | Standard unclear, n (%) | Standard not met, n (%) |
|---|---|---|---|---|---|
| Scope specification | 1 | The research or practice setting(s) in which the COS is to be applied | 31 (100%) | 0 | 0 |
| | 2 | The health condition(s) covered by the COS | 31 (100%) | 0 | 0 |
| | 3 | The population(s) covered by the COS | 31 (100%) | 0 | 0 |
| | 4 | The intervention(s) covered by the COS | 31 (100%) | 0 | 0 |
| Stakeholders participation | 5 | Those who will use the COS in research | 31 (100%) | 0 | 0 |
| | 6 | Health care professionals with experience of patients with the condition | 30 (97%) | 1 (3%) | 0 |
| | 7 | Patients with the condition or their representatives | 21 (68%) | 0 | 10 (32%) |
| Consensus process | 8 | Initial list of outcomes considered both healthcare professionals' and patients' views | 16 (52%) | 6 (19%) | 9 (29%) |
| | 9a | A scoring process was described a priori | 10 (32%) | 15 (48%) | 6 (19%) |
| | 9b | A consensus definition was described a priori | 8 (26%) | 17 (55%) | 6 (19%) |
| | 10 | Criteria for including/dropping/adding outcomes were described a priori | 8 (26%) | 17 (55%) | 6 (19%) |
| | 11 | Care was taken to avoid ambiguity of language used in the list of outcomes | 11 (35%) | 20 (65%) | 0 |

COS - Core outcome set

**Scope**

All 31 studies met the scope specification criteria, indicating that all included COS had specified clearly the applicable setting, health condition, population and the intervention. The majority of COS related to adults (19, 61%), with only one being developed for children. COS most frequently focused on physical rehabilitation interventions (17, 55%), approximately one-fifth of COS (6, 19%) were developed for rheumatological conditions. A detailed list of the included studies and study characteristics is provided in additional file (Appendix 3).

**Stakeholder participation**

All studies included researchers who would potentially utilise the COS. Thirty (97%) studies included healthcare professionals with experience of treating patients with the condition. Two thirds of the COS studies (68%) included patients with the condition or their representatives in the development process. Twenty-six studies (81%) reported the locations of participating stakeholders, with Europe and North America being the most frequently represented regions (68% (n = 21); 49% (n = 15), respectively). Individuals from five continents of the world participated in four (13%) COS. A fifth of studies (19%) did not specify where participants were from. (Table 2)

**Consensus process**

Just over half of the COS (16, 52%) considered the views of both healthcare professionals and patients when generating the initial list of outcomes. A priori description of the scoring process was mentioned in 10 studies (32%), and eight studies (26%) defined their consensus definition and criteria for modifying outcomes prior to the start of their study. More than one third of the studies (11, 35%) took care to avoid ambiguity of language in the outcome list. More than half of the studies were assessed as being unclear in providing a priori description of the consensus definition (17, 55%), identifying prespecified criteria for including/adding/dropping outcomes (17,55%), and taking care to avoid ambiguity of language (20, 65%).

**COS-STAD minimum standards**

Five studies (Haywood 2014(30), Goncalves 2019, (31) Harman 2019, (32) Connolly 2024, (15) and Hamzeh 2024(33) met all minimum standards for COS development.

**Outcome measurement instrument recommendations**

Among the 31 studies included in the current review, 15 (48%) recommended outcome measurement instruments for the core outcomes, 12 (39%) did not recommend any, and four (13%) noted plans to address this in the future (Table 2).

**Ongoing studies**

We also identified 21 ongoing COS studies for clinical trials and research from the COMET database. Of the 21, 4 (19%) related to musculoskeletal conditions and 4 (19%) related to neurology. The remaining 13

COS were for cancer (2), child health (3), critical care, cystic fibrosis, obesity, occupational health, persistent postural-perceptual dizziness (PPPD), prehabilitation, cardiovascular and respiratory conditions.

## Outcome domains in COS

The overall number of outcomes included in the COS ranged from 2 to 18 (median 7). The inclusion of patients had little input on the number of outcomes (Table 4).

Table 4
Core outcomes classified by domain using the Core Outcome Measures in Effectiveness Trials (COMET) taxonomy proposed by Dodd et al.(16)

| Area | Outcome domain | COS with input from patients, n (% of 23 COS) | COS without input from patients, n (% of 10 COS) | Total n (% of 33 COS) |
|---|---|---|---|---|
| **Adverse events** | Adverse events | 4 (19%) | 3 (30%) | 7 (22%) |
| **Death** | Mortality/survival | 7 (33%) | 1 (10%) | 8 (25%) |
| **Physiological/clinical** | | **19 (83%)** | **9 (90%)** | **28 (85%)** |
| | Cardiac | 6 (26%) | 1 (10%) | 7 (21%) |
| | Endocrine | 1 (4%) | | 1 (3%) |
| | Eye | 1 (4%) | | 1 (3%) |
| | General | 12 (52%) | 4 (40%) | 16 (49%) |
| | Immune | 2 (9%) | | 2 (6%) |
| | Injury | 2 (9%) | | 2 (6%) |
| | Musculoskeletal | 7 (30%) | 7 (70%) | 14 (42%) |
| | Neoplasm | | 1 (10%) | 1 (3%) |
| | Nervous system | 2 (9%) | | 2 (6%) |
| | Psychiatric | 1 (4%) | | 1 (3%) |
| | Renal_urinary | 1 (4%) | | 1 (3%) |
| | Respiratory | 5 (22%) | | 5 (15%) |
| | Skin | | 1 (10%) | 1 (3%) |
| | Vascular | 2 (9%) | 1 (10%) | 3 (9%) |
| **Life impact** | | **23 (100%)** | **10 (100%)** | **33 (100%)** |
| | Functioning | 23 (100%) | 10 (100%) | 33 (100%) |
| | Cognitive functioning | 6 (26%) | 1 (10%) | 7 (21%) |
| | Emotional functioning | 11 (48%) | 2 (20%) | 13 (39%) |
| | Physical functioning | 22 (96%) | 10 (100%) | 32 (97%) |

COS – Core outcome set, QOL – Quality of life

| Area | Outcome domain | COS with input from patients, n (% of 23 COS) | COS without input from patients, n (% of 10 COS) | Total n (% of 33 COS) |
|---|---|---|---|---|
| | Role functioning | 2 (9%) | 1 (10%) | 3 (9%) |
| | Social functioning | 3 (13%) | 2 (20%) | 5 (15%) |
| | Global QOL | 16 (70%) | 8 (80%) | 24 (73%) |
| | Personal circumstances | 2 (9%) | | 2 (6%) |
| | Delivery of care | 4 (17%) | 2 (20%) | 6 (18%) |
| **Resource use** | | **5 (22%)** | **3 (30%)** | **8 (24%)** |
| | Economic | 3 (13%) | 2 (20%) | 5 (15%) |
| | Hospital | 1 (4%) | 1(10%) | 2 (6%) |
| | Need for further intervention | 1 (4%) | | 1 (3%) |
| **Total range of outcome domains** | | **2 to 18 (Median – 7)** | **3 to 18 (Median – 6)** | **2 to 18 (Median – 7)** |
| COS – Core outcome set, QOL – Quality of life | | | | |

Table 4 shows the classification of overall outcome domains in the included COS, categorised according to the COMET taxonomy. [Insert Table 4 here]

The 'life impact' area was included in all COS irrespective of whether patients or their representatives participated. Mortality/survival was included slightly more frequently when patients were included (n = 7, 33%) than when not (n = 1, 10%).

In the musculoskeletal domain, physiological parameters that were very disease specific (e.g. muscle strength, joint range of motion based on region involved) were included more often when there was no patient participation. All COS included some aspect of functioning, irrespective of patient participation. However, patient participation increased the inclusion of emotional functioning outcomes to almost half of the studies (48%) compared to 20% when they were not included.

# Discussion

This study aimed to identify, appraise and classify the outcomes included in COS developed for research relevant to physiotherapy interventions. We identified a range of health areas for which COS exist in physiotherapy, with the rate of published physiotherapy studies increasing over time and a large number

of COS being in development. There is evidence of global participation in physiotherapy-related COS development, but this could be improved. When patients were included, they were more likely to include emotional functioning outcomes, whilst physiological musculoskeletal outcomes were more likely to be included by researchers or healthcare professionals, in COS without patient participation. This greater inclusion of emotional functioning outcomes suggests patients are prioritising the impact physiotherapy-related interventions are having on their lives, which goes beyond their physiological symptoms and physical function.

Most COS included participants from Europe and North America but less frequently from other areas of the world. Given that physiotherapy-related interventions are delivered across diverse healthcare systems and resource settings, multinational participation in COS development may be particularly important. A COS should specify the essential outcomes to be measured in every clinical trial in a particular area of health or healthcare. Thus, the inclusion of stakeholders from a wide range of settings can help ensure that the recommended outcomes reflect variations in different healthcare systems across the world. It is also recognised that some outcomes, and ways to measure them, may be culturally specific. Since a COS defines only the minimum agreed outcomes, it is to be expected that researchers will select additional outcomes based on the focus of their specific study. The use of COS should be facilitatory rather than inhibitory; researchers may choose to add culturally relevant outcomes that are specific to their population along with an existing COS.

COS-STAD evaluation in our study revealed that only five studies (16% of 31) [Additional file (Appendix 2)] fulfilled all the minimum standards in COS development. An earlier review (28) of 49 cancer COS revealed none of the studies met all criteria. More recent reviews in musculoskeletal conditions (34) and respiratory diseases (35) found 15% (6/40) and 14% (3/22) COS met all minimum standards respectively, similar to the findings in this review. This review included studies where COS were developed before COS-STAD was published in 2017. (10) Although it may be unfair to evaluate COS against standards published later, this assessment serves as a baseline for future comparison of COS and is not intended to be a criticism of included studies or study authors.

One area that requires improvement is patient participation. Patient participation is important to ensure outcomes important to them are included. Around two-thirds of the COS in this review included patient participants in their development. There has been a steady increase in patient participation in COS in general from 18% (COS published up to 2014) (17) to 85% (COS published in 2021) (24). This increase is mirrored in our review, with patient participation in 90% of studies published after 2020 [Additional file (Appendix 2)].

A priori decisions on the consensus process for COS development would help improve the minimum reporting standards, by enhancing transparency and accountability in the research process. There is an ongoing need for future COS developers to define in advance their scoring, consensus process, and criteria for including, dropping, or adding outcomes, ideally in a publicly available protocol. Again, improvement over time is noted, with 50% of teams developing COS published after 2020 considering

both patients and healthcare professionals' views during construction of the initial list of outcomes, and 40% having decided the criteria for scoring, including, adding and dropping outcomes a priori. These results demonstrate improvement in adherence to COS-STAD recommendations, mirroring the trend for COS more generally. (24)

A recent review of all COS for research (24) demonstrated that patient participation in development changes the likelihood of the inclusion of outcomes domains. For example, patient participation increased the likelihood that life impact outcomes were included (86% of COS with patient participation included at least one life impact outcome compared to 62% of COS without patient participation). Similarly in this review, patient participation impacted the inclusion of various domains, with emotional functioning more likely to be included when patients participated in the development process (48% vs 20%). An important difference in this review was that all COS reported at least one life impact domain irrespective of patient participation, in comparison to 76% of overall COS as reported in a recent review. (25) This potentially demonstrates that physiotherapists are not only seeking to determine the physiological effects of interventions but also the impact on the lives of the people being treated.

This review highlights the common outcome domains recommended by COS developers across a wide range of conditions where physiotherapy is offered as an intervention. This does not imply these outcome domains are to be measured across all trials where physiotherapy interventions are provided, rather they reflect the outcomes key stakeholders considered most important for physiotherapy interventions.

The existence of a COS for a particular clinical area or setting does not mean it will necessarily be used in research. COS development without subsequent uptake will lead to research waste, the very problem that COS aim to reduce. Thus, we intend to use the findings of this study to help improve awareness of COS among physiotherapy researchers. We also plan to identify the perceived barriers and facilitators to COS use amongst physiotherapy researchers and subsequently study how we could implement COS further in physiotherapy research. The findings of our study could help contribute to prioritising identification of relevant outcomes for physiotherapy interventions in future research studies.

The authors aim to develop a "Consortium for Core Outcome Sets in Physiotherapy" - a group that will aim to improve the quality of outcome selection and reporting in physiotherapy related trials. This group will subsequently aim to develop a research agenda for COS development and promote uptake of well-developed COS in physiotherapy related trials.

Strengths and Limitations

This study focusses on COS, which are widely recognised and advocated for use in research. (36) We evaluated each of the included COS according to the COS-STAD minimum standards. The COS-STAD evaluation and data extraction were verified by experienced researchers in the field of COS and outcome domain classification.

We should also acknowledge the possibility that there may exist additional COS that were not identified for inclusion in this review. However, the chances of missing any COS are low given that the COMET database is a living resource that is regularly updated via several sources, including an annual systematic review using a multi-faceted search strategy, citation alerts of key publications, and prospective registration of ongoing projects.

## Conclusion

This review highlights the need for greater global participation in physiotherapy COS, where relevant. The importance of including patients is paramount as it ensures that the COS captures outcomes critically meaningful to them. While developing COS, researchers are encouraged to use COS-STAD and publish their protocol a priori to help improve transparency in research.

## Declarations

**Ethics approval and consent to participate:**

Not applicable. This study did not require ethical approval as it did not involve any human participants.

**Consent for publication:**

Not applicable


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# Competing interests

SLG and PRW are members of the COMET Management Group. BC and PRW have published COS studies, included in the review. They were not involved in the eligibility assessment, data extraction, or COS-STAD assessment of the included studies. All other authors had no competing interests.

# Author Contribution

LVT: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing the first draft. SG: Formal analysis, Investigation, Data curation, Writing - review and editing, supervision SD: Formal analysis, Investigation, Data curation, Writing - review and editing, Supervision FD: Methodology, Validation, Writing - review and editing BC: Methodology, Validation, Writing - review and editing PRW: Conceptualization, Methodology, Validation, formal analysis, Writing - review and editing, Supervision, Project administration, Funding acquisition. All authors approved the final manuscript for submission.

# Data Availability

The dataset(s) supporting the conclusions of this article is(are) included within the article (and its additional file(s))

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# Figures

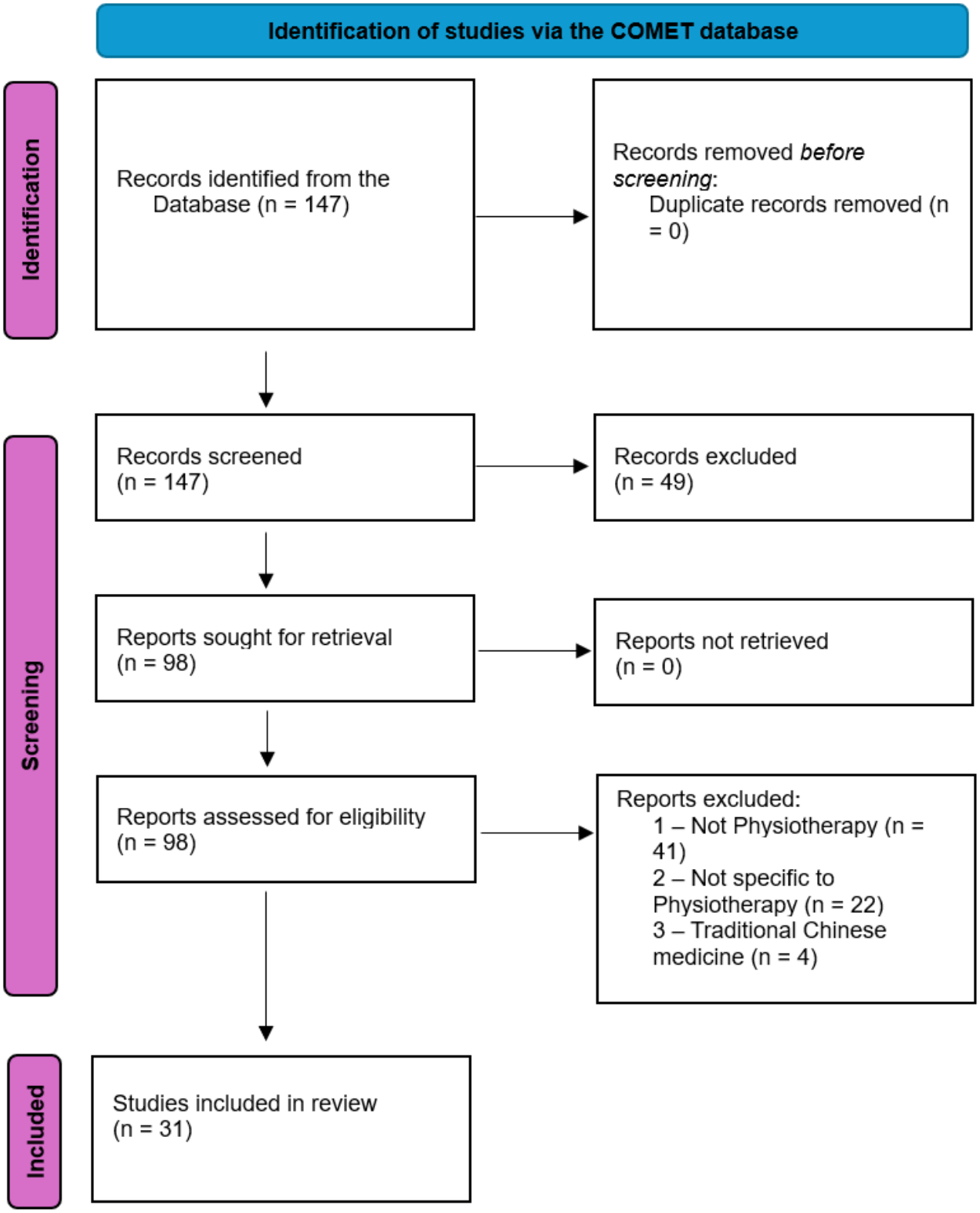



**Figure 1**

PRISMA flowchart

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