

The notion of PICO for synthesis: planning the grouping of studies for meta-analyses and other syntheses

Cochrane Methods Symposium

6 February 2020

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Declaration of interest

I am employed by Cochrane Australia (CA), School of Public Health and Preventive Medicine, Monash University. CA is funded by the Australian Government through the National Health and Medical Research Council (NHMRC) to support the conduct and use of systematic reviews, research translation, and methodological development in evidence synthesis.

I am the director of the Melbourne GRADE Centre.

I have received funding from the NHMRC and other government funders to undertake commissioned systematic reviews and methodological review of systematic reviews and guidelines.

I am co-author on four chapters of the new Cochrane Handbook.

Defining the criteria for including studies and how they will be grouped for the synthesis

Joanne E McKenzie, Sue E Brennan, Rebecca E Ryan, Hilary J Thomson, Renea V Johnston, James Thomas

KEY POINTS

- The scope of a review is defined by the types of population (participants), types of interventions (and comparisons), and the types of outcomes that are of interest. The acronym PICO (population, interventions, comparators and outcomes) helps to serve as a reminder of these.
- The population, intervention and comparison components of the question, with the additional specification of types of study that will be included, form the basis of the pre-specified eligibility criteria for the review. It is rare to use outcomes as eligibility criteria: studies should be included irrespective of whether they *report* outcome data, but may legitimately be excluded if they do not *measure* outcomes of interest, or if they explicitly aim to prevent a particular outcome.
- Cochrane Reviews should include all outcomes that are likely to be meaningful and not include trivial outcomes. Critical and important outcomes should be limited in number and include adverse as well as beneficial outcomes.
- Review authors should plan at the protocol stage how the different populations, interventions, outcomes and study designs within the scope of the review will be grouped for analysis.

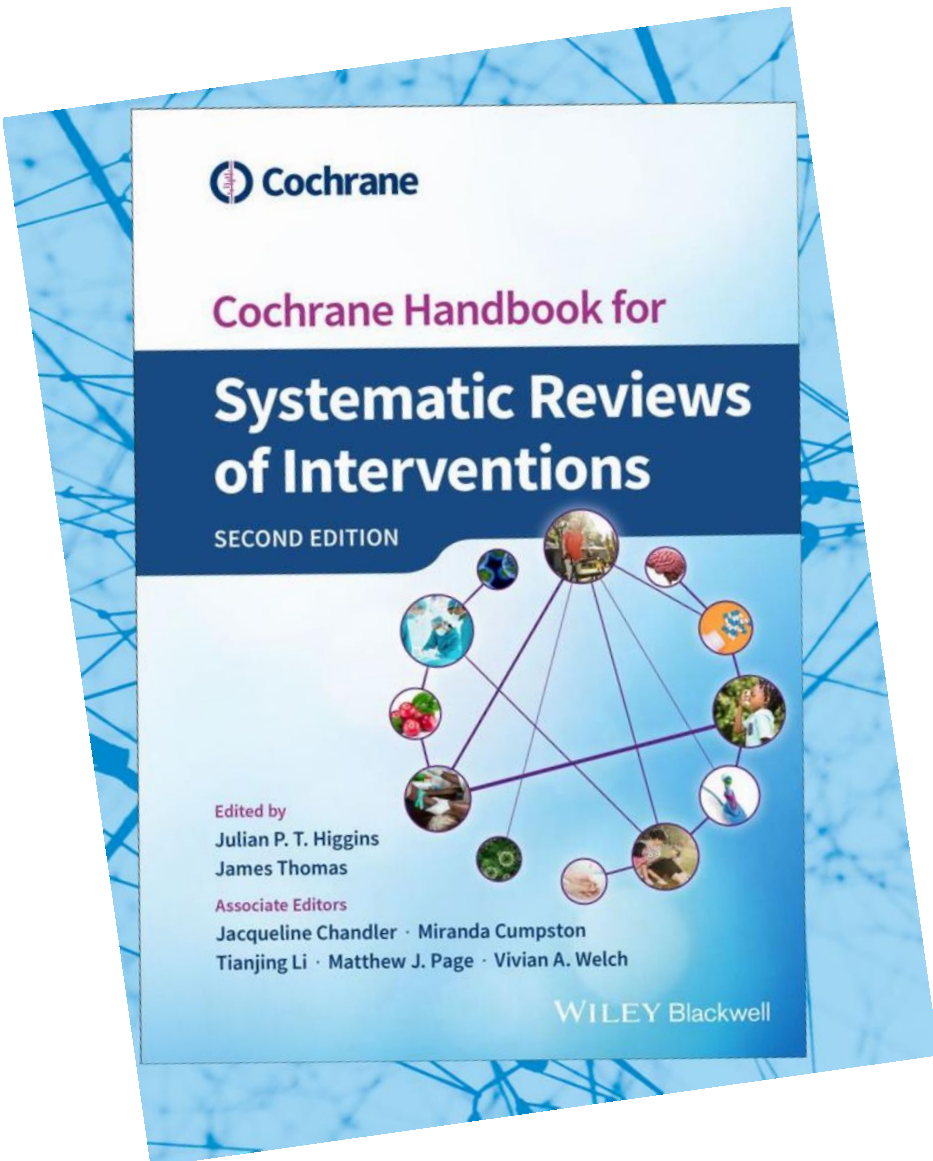
3.1 Introduction

One of the features that distinguishes a systematic review from a narrative review is that systematic review authors should pre-specify criteria for including and excluding studies in the review (eligibility criteria, see MECIR Box 3.2.a).

When developing the protocol, one of the first steps is to determine the elements of the review question (including the population, intervention(s), comparator(s) and

This chapter should be cited as: McKenzie JE, Brennan SE, Ryan RE, Thomson HJ, Johnston RV, Thomas J. Chapter 3: Defining the criteria for including studies and how they will be grouped for the synthesis. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). *Cochrane Handbook for Systematic Reviews of Interventions*. 2nd Edition. Chichester (UK): John Wiley & Sons, 2019: 33–66.

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Origins of PICO for synthesis

2011

Madrid methods symposium.
Jo McKenzie first aired the ideas on 'other synthesis methods' (Chapter 12).



2016

Julian and Tianjing added a subheading.
'Articulating the PICO for synthesis'



2018

Editors.
silence ...



2019

One chapter ends up as four. **PICO for synthesis was born.**



2015

One chapter becomes two

... and Jo, how is the **second chapter** progressing?



What **CHAPTER?**

2017

We were still at a loss as to what to write about PICO for synthesis (without copying the chapter on eligibility criteria), but managed **9207 words + 17 pages of tables**

2018

GoTo meeting.
We heard James say:
"Some useful stuff here. We like the work on PICO for synthesis. **WE'VE PUT THAT BIT IT IN CHAPTERS 2 & 3 ...**".

Three levels of PICO

1. **Review PICO** (planned at protocol stage) on which *eligibility of studies* is based [Chapters 2 and 3]
2. **PICO for each synthesis** (planned at protocol stage) which defines *the question that each synthesis aims to answer*. [Chapters 2 and 3]
3. **PICO of included studies** (determined at the review stage) which defines the questions investigated in the included studies [Chapter 9]

The questions we ask

Does **exercise** increase bone density in postmenopausal women?

PICO

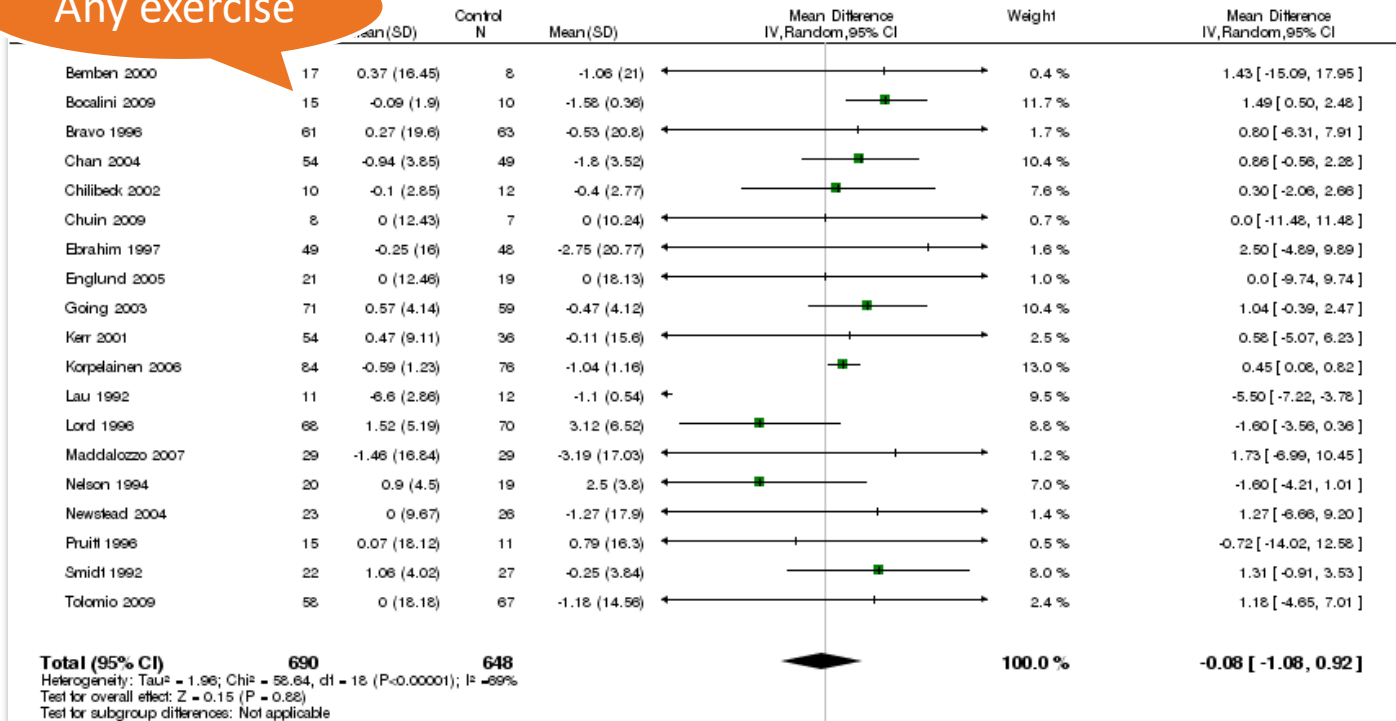
What is the comparative efficacy and acceptability of **different psychological therapies** for panic disorder?

What is the effect of **psychosocial interventions** for supporting women to stop smoking in pregnancy?

The questions we answer

Does **exercise** increase bone density in postmenopausal women?

Any exercise



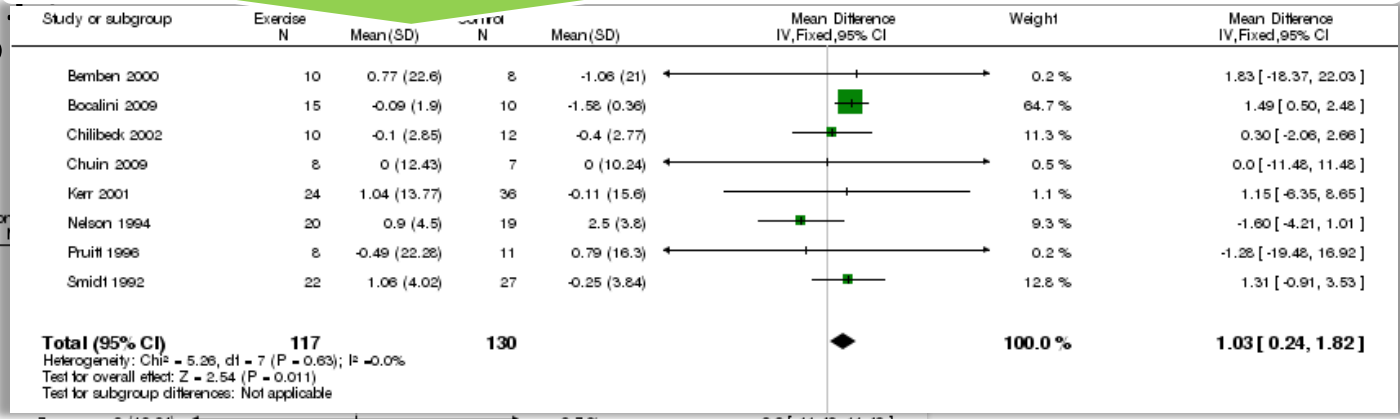
The ques

Does **exercise** increase bone density in postmenopausal women?

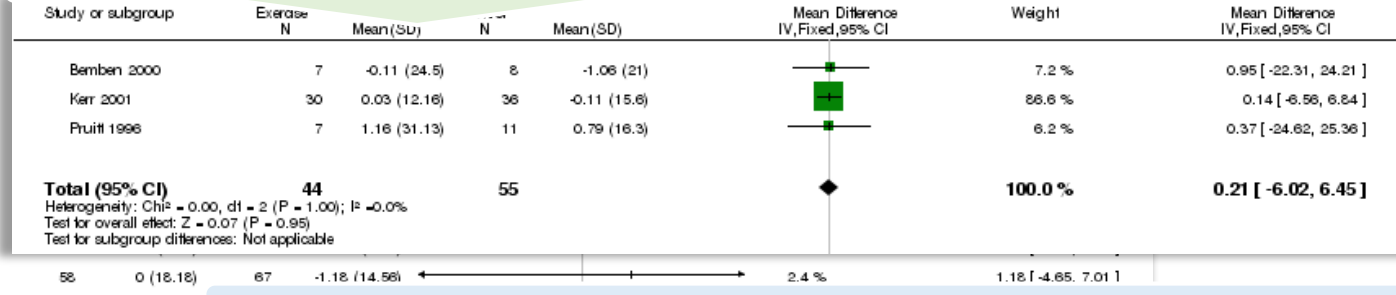
Any exercise

Does non-weight bearing, high force exercise increase bone density ...

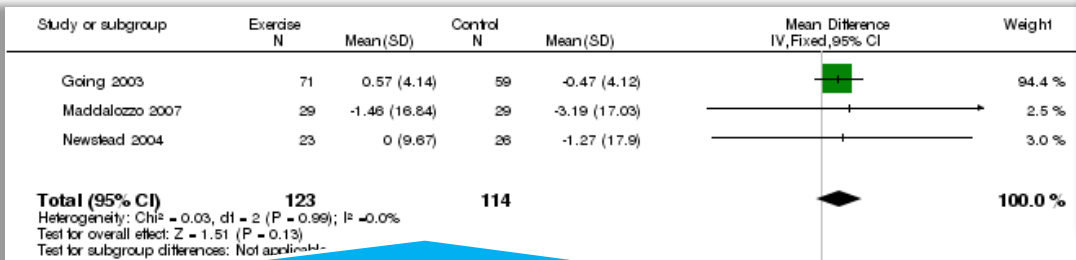
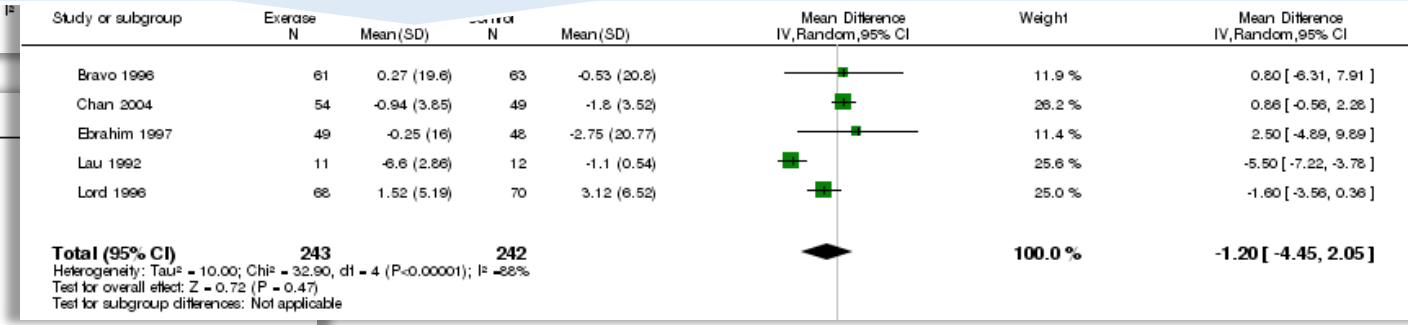
Study or subgroup	Exercise N	Mean(SD)	Control N	Mean(SD)
Bemben 2000	17	0.37 (16.45)		
Bocalini 2009	15	-0.09 (1.9)		
Bravo 1996	61	0.27 (19.6)		
Chan 2004	54	-0.94 (3.85)		
Chillbeck 2002	10	-0.1 (2.85)		
Chuin 2009	8	0 (12.43)		
Ebrahim 1997	49	-0.25 (16)		
Englund 2005				
Going 2003				
Kerr 2001				
Korpelainen 2006				
Lau 1992				
Lord 1996				
Maddalozzo 2007				
Nelson 1994				
Newstead 2004				
Pruitt 1996				
Smidt 1992				
Tolomio 2009				



Does non-weight bearing, low force exercise increase bone density ...



Does dynamic weight bearing, low force exercise increase bone density ...



Does dynamic weight bearing, high force exercise increase bone density ...

Exercise for preventing and treating osteoporosis in postmenopausal women

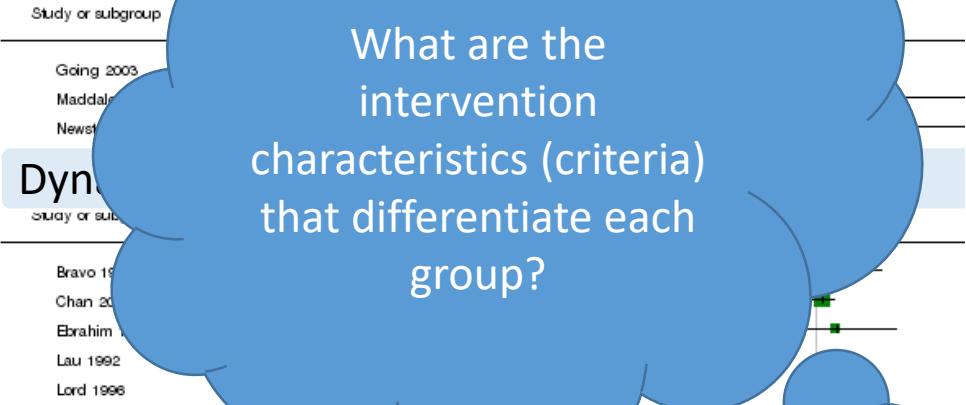
Cochrane Systematic Review - Intervention | Version published: 06 July 2011 [see what's new](#)
<https://doi.org/10.1002/14651858.CD000333.pub2>

New search Conclusions changed Used in 11 guidelines [View article information](#)

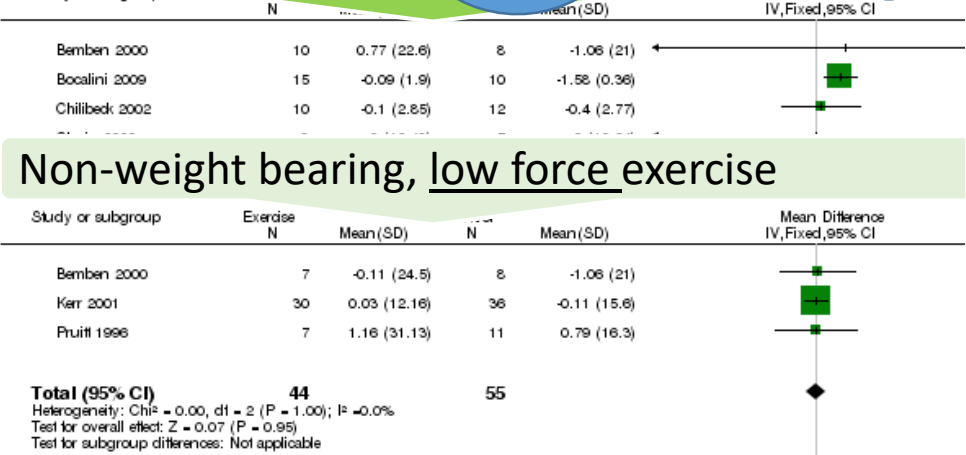
Tracey E Howe | Beverley Shea | Lesley J Dawson | Fiona Downie | Ann Murray | Craig Ross | Robin
 Lynn M Caldwell | Gisela Creed

PICO: Diverse and overlapping interventions

Dynamic



Non-weight bearing, low force exercise

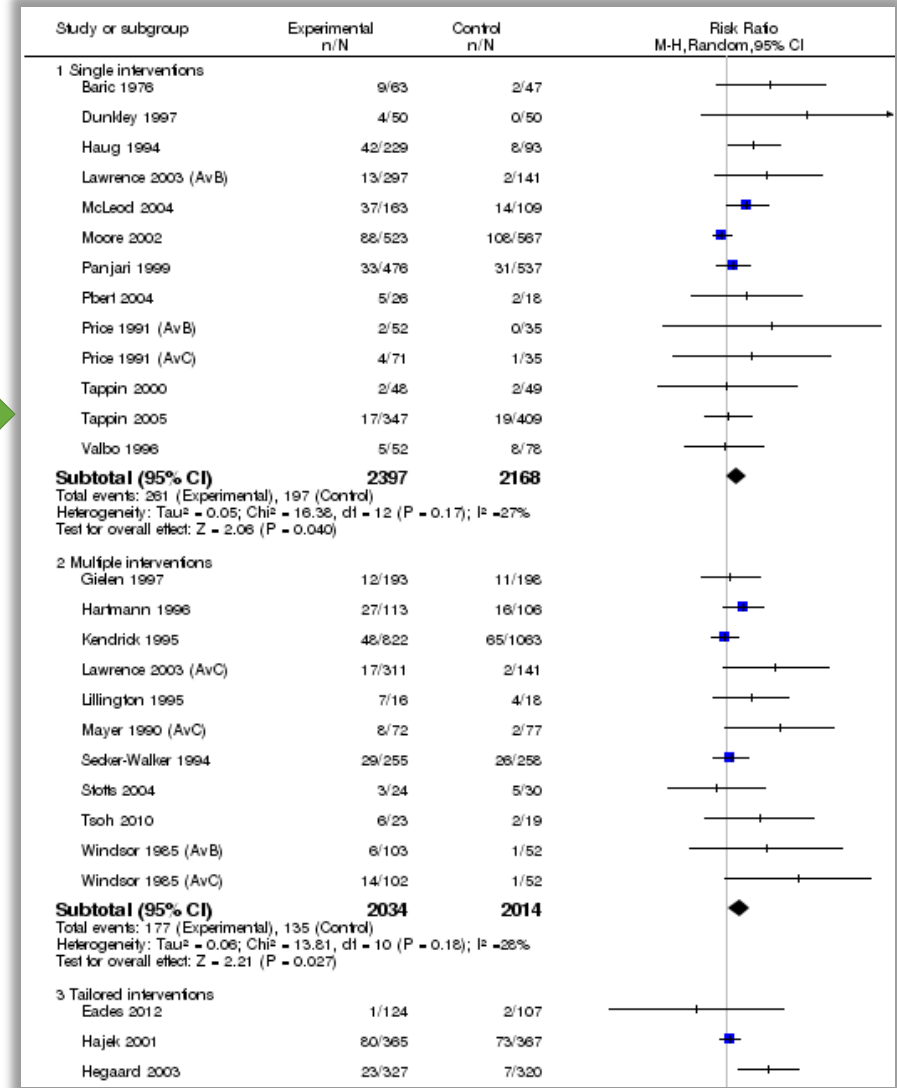


	Category	Description
9	DWB-HF	Supervised aerobic, weight-bearing (e.g. walking, jog, skipping, stair climb) and weight-lifting exercise (e.g. dumbbell presses)
16	DWB-HF	Progressive multidirectional jumping, increasing jump heights and repetitions
3	DWB-LF	Rapid walking, stepping up/down or aerobic dancing. Localised exercise (limbs, abdomen, back)
1	NWB-HF	Weight lifting (Quadriceps extension, hamstring flexion, leg press, shoulder press, biceps curl, triceps extension, seated row and latissimus pull) – high load, low repetitions
10	NWB-HF	Resistance weight training (wrist curl, reverse curl, biceps curl, triceps pushdown, hip flexion, hip extension, latissimus dorsi pull down, and calf raise; loading increase)
1	NWB-LF	Weight lifting (Quadriceps extension, hamstring flexion, leg press, shoulder press, biceps curl, triceps extension, seated row and latissimus pull) – low load, high repetitions
17	NWB-LF	Bench press, lateral pull down, military press, biceps curl, knee extension, knee flexion, hip abduction and adduction, leg press, back extension (more repetitions, lower force)

PICO characteristics of each included study

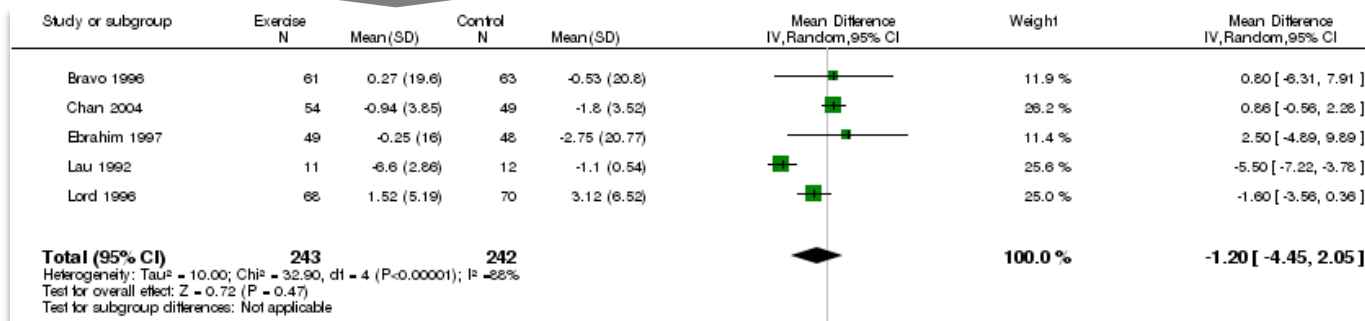
Which of these studies are 'eligible' for each synthesis?

PICO for each synthesis (i.e. the criteria for including studies)

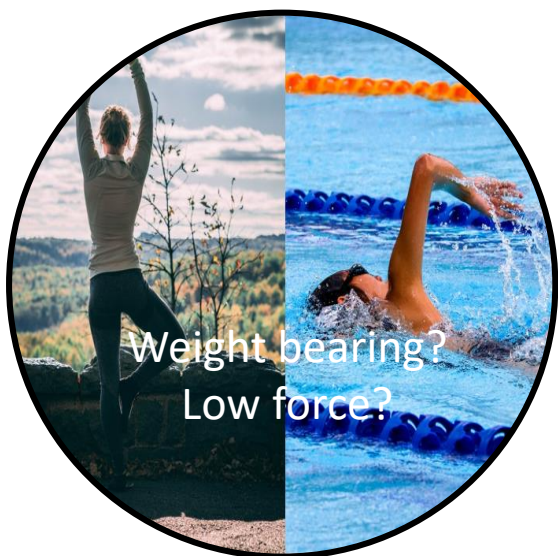


PICO for each synthesis

Does dynamic weight bearing, low force exercise increase bone density



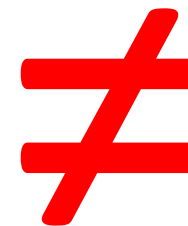
Study 1



Study 2



Study 3



Study 4



Should we pre-specify our PICO for each synthesis?



Ideally, yes!

(new guidance in 2019 Cochrane Handbook)
training.cochrane.org/handbook

... almost always some important variants
(dose, duration of treatment ...)

Why specify PICO for synthesis?*

Minimise bias & increase
reproducibility

Improve interpretation

Increase utility

Why specify PICO for synthesis?

Minimise bias & increase reproducibility

The way in which studies are grouped for synthesis influences findings . A decision to include a study (or not) in a given MA (or other synthesis) will change the result, and possibly the conclusion

Careful planning of groups may help

- avoid decisions influenced by the findings of individual studies
- increase the reproducibility of findings

Improve interpretation

Provides a 'standardised' terminology for interventions and outcomes that

- overcomes the varied descriptions used by study authors
- enables comparison and synthesis of PICO characteristics across studies
- provides a consistent language for reporting that aids interpretation

Increase utility

Helps ensure that we

- make best use of available data
- produce a review focused on questions relevant to decision makers (especially if involved in planning ..)

A process for planning PICO for each synthesis*

1. Identify intervention characteristics that may modify the effect of the intervention
2. Label and define intervention groups (+ define levels for group based on 'how much')
3. Check whether there is an existing system for grouping
4. Plan how the groups will be used in synthesis and reporting
5. Decide how to group interventions with multiple components or co-interventions
6. Build in contingencies by specifying both specific and broader intervention groups

Suggests steps and the decision points at each step

- Aim is to capture the 'behind the scenes' work
- Not intended to be prescriptive, may be iterative, and some steps may be concurrent
- Includes principles for developing a flexible plan, that maximises the potential to synthesise

A process for planning intervention groups for synthesis*

1. Identify intervention characteristics that may modify the effect of the intervention
2. Label and define intervention groups (+ define levels for group based on 'how much')
3. Check whether there is an existing system for grouping
4. Plan how the groups will be used in synthesis and reporting
5. Decide how to group interventions with multiple components or co-interventions
6. Build in contingencies by specifying both specific and broader intervention groups

Step	Considerations	Examples
1. Identify intervention characteristics that may modify the effect of the intervention.	<p>Consider whether differences in interventions characteristics might modify the size of the intervention effect importantly. Content-specific research literature and expertise should inform this step.</p> <p>The TIDieR checklist – a tool for describing interventions – outlines the characteristics across which an intervention might differ (Hoffmann et al 2014). These include 'what' materials and procedures are used, 'who' provides the intervention, 'when and how much' intervention is delivered. The iCAT-SR tool provides equivalent guidance for complex interventions (Lewin et al 2017).</p>	<p>Exercise interventions differ across multiple characteristics, which vary in importance depending on the review.</p> <p>In a review of exercise for osteoporosis, whether the exercise is weight-bearing or non-weight-bearing may be a key characteristic, since the mechanism by which exercise is thought to work is by placing stress or mechanical load on bones (Howe et al 2011).</p> <p>Different mechanisms apply in reviews of exercise for knee osteoarthritis (muscle strengthening), falls prevention (gait and balance), cognitive function (cardiovascular fitness).</p> <p>The differing mechanisms might suggest different ways of grouping interventions (e.g. by intensity, mode of delivery) according to potential modifiers of the intervention effects.</p>
2a. Label and define intervention groups to be considered in the synthesis.	<p>For each intervention group, provide a short label (e.g. supportive psychotherapy) and describe the core characteristics (criteria) that will be used to assign each intervention from an included study to a group.</p> <p>Groups are often defined by intervention content (especially the active components), such as materials, procedures or techniques (e.g. a specific drug, an information leaflet, a behaviour change technique). Other characteristics may also be used, although some are more commonly used to define subgroups (see Chapter 10, Section 10.11.5): the purpose or theoretical underpinning, mode of delivery, provider, dose or intensity, duration or timing of the intervention (Hoffmann et al 2014).</p> <p>In specifying groups:</p> <ul style="list-style-type: none"> • focus on 'clinically' meaningful groups that will inform selection and implementation of an intervention in practice; 	<p>In a review of psychological therapies for coronary heart disease, a single group was specified for meta-analysis that included all types of therapy. Subgroups were defined to examine whether intervention effects were modified by intervention components (e.g. cognitive techniques, stress management) or mode of delivery (e.g. individual, group) (Richards et al 2017).</p> <p>In a review of psychological therapies for panic disorder (Pompoli et al 2016), eight types of therapy were specified:</p> <ol style="list-style-type: none"> 1) psychoeducation; 2) supportive psychotherapy (with or without a psychoeducational component); 3) physiological therapies; 4) behaviour therapy; 5) cognitive therapy; 6) cognitive behaviour therapy (CBT); 7) 7. third-wave CBT; and

A process for planning outcome groups for synthesis*

1. Fully specify outcome domains
2. Determine whether there is an existing system for identifying and grouping important outcomes
3. Define the outcome time points
4. Specify the measurement tool or measurement method
5. Specify how multiplicity of outcomes will be handled
6. Plan how the specified outcome domains will be used in the synthesis
7. Build in contingencies by specifying both specific and broader outcome domains

Step	Considerations	Examples
1. Fully specify outcome domains.	<p>For each outcome domain, provide a short label (e.g. cognition, consumer evaluation of care) and describe the domain in sufficient detail to enable eligible outcomes from each included study to be categorized. The definition should be based on the concept (or construct) measured, that is 'what' is measured. 'When' and 'how' the outcome is measured will be considered in subsequent steps.</p> <p>Outcomes can be defined hierarchically, starting with very broad groups (e.g. physiological/clinical outcomes, life impact, adverse events), then outcome domains (e.g. functioning and perceived health status are domains within 'life impact'). Within these may be narrower domains (e.g. physical function, cognitive function), and then specific outcome measures (Dodd et al 2018). The level at which outcomes are grouped for synthesis alters the question addressed, and so decisions should be guided by the review objectives.</p> <p>In specifying outcome domains:</p> <ul style="list-style-type: none"> • definitions should reflect existing systems if available, or relevant literature and terminology understood by decision makers; • where outcomes are likely to be inconsistently labelled and described, listing examples may convey the scope of the domain; • consider the level at which domains will be defined (broad versus narrow) and the implications for reporting and synthesis: combining diverse outcomes may lead to unexplained heterogeneity whereas narrowly specified outcomes may prevent synthesis when few studies report specific measures; 	<p>In a review of computer-based interventions for sexual health promotion, three broad outcome domains were defined (cognitions, behaviours, biological) based on a conceptual model of how the intervention might work. Each domain comprised more specific domains and outcomes (e.g. condom use, seeking health services such as STI testing); listing these helped define the broad domains and guided categorization of the diverse outcomes reported in included studies (Bailey et al 2010).</p> <p>In a protocol for a review of social media interventions for improving health, the rationale for synthesizing broad groupings of outcomes (e.g. health behaviours, physical health) was based on prediction of a common underlying mechanism by which the intervention would work, and the review objective, which focused on overall health rather than specific outcomes (Welch et al 2018).</p>

Thank you!