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# **Systematic reviews: key principles of their development and reporting**

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**The EQUATOR Network workshop  
31 October 2013, WHO, Geneva**

# Systematic review

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- **A systematic review is a scientific investigation that focuses on a specific question and uses **explicit, prespecified scientific methods** to identify, select, assess, and summarise the findings of similar but separate studies.**
  - A study of studies
- **Objective is to summarize evidence from multiple studies using explicit methods**
- **It may include a quantitative synthesis (meta-analysis), depending on the available data**



# Key characteristics of SR

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- **Focused well defined research question**
- **Clearly stated title and objectives**
- **Comprehensive strategy for identification of all relevant studies (published & unpublished)**
- **Explicit (and justified) predefined inclusion & exclusion criteria**
- **Critical appraisal of studies**
- **Synthesis of the results of eligible studies**
  - Quantitative (meta-analysis)
  - Qualitative
- **Structured report**



# Systematic review

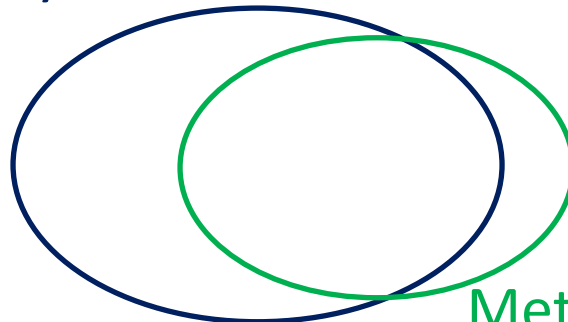
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- **A systematic identification and evaluation of all the available relevant evidence**
  - always a good approach to address evidence regarding a health care issue

## Meta-analysis

- **Statistical combination of the numerical results of several studies**
  - may be appropriate as part of a systematic review

Systematic reviews



Meta-analyses



# Principles

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- **Systematic reviews are governed by principles of**
  - methodological rigour
  - transparency
  - Reproducibility
- **The same principles apply to all study types; we focus on randomised trials (RCTs)**



# Rationale for systematic reviews

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- **To minimize bias**
  - of the reviewer, and in the research studies themselves
- **To enhance precision**
  - by including all the relevant evidence
- **To put results into context**
  - examine conflicts and understand differences
- **To help prioritize research**
  - by knowing exactly what has been done, how well, and with what findings



# The systematic review process

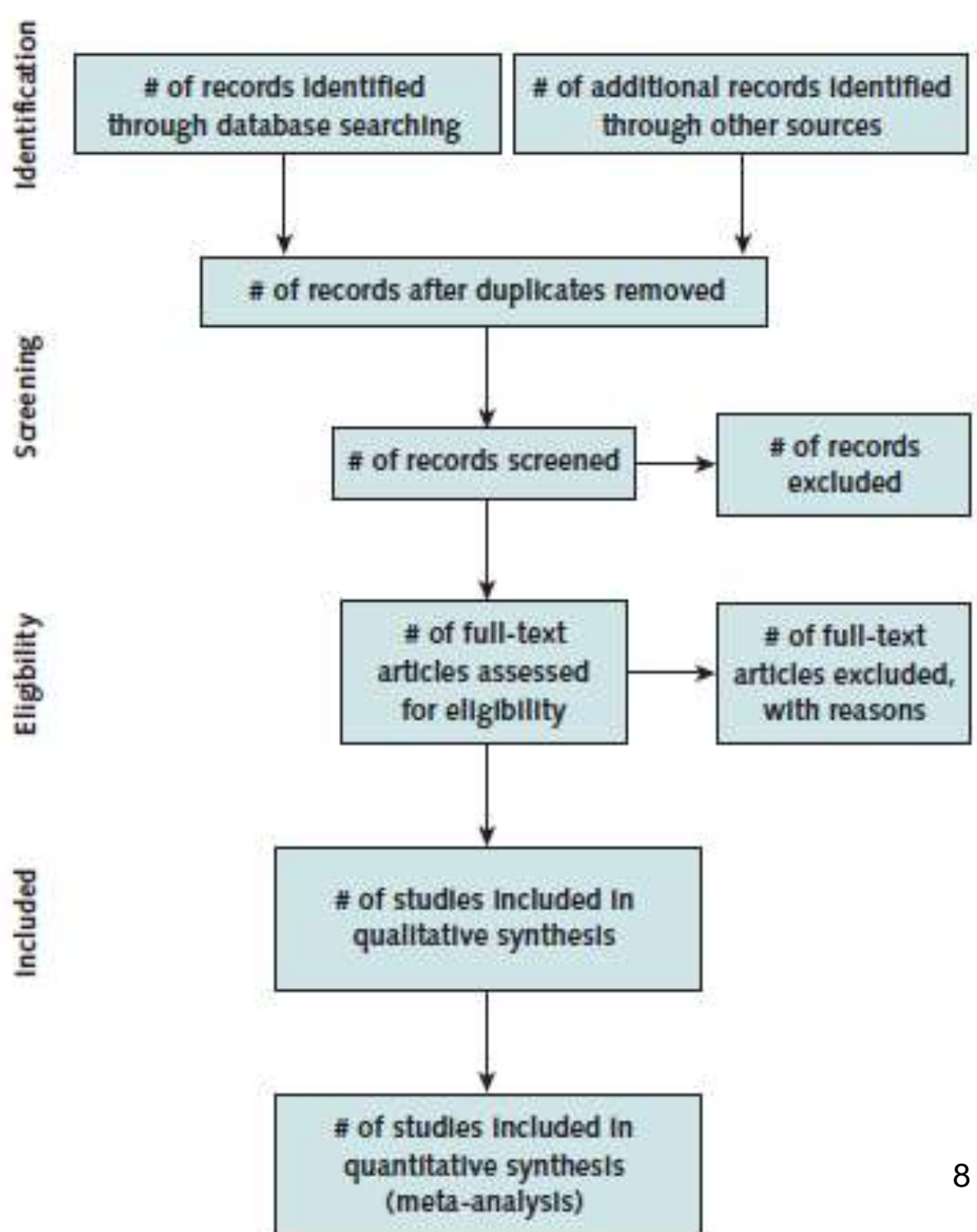
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- 1. Formulation of a clear question**
- 2. Eligibility criteria for studies**
- 3. Search for potentially relevant studies**
- 4. Selection of studies into the review**
- 5. Extraction of data**
- 6. Assessment of methodological quality of included studies**
- 7. Synthesis of findings (possibly using meta-analysis)**
- 8. Presentation of data and results**
- 9. Interpretation and drawing conclusions**

**NB: Should have a protocol**



# PRISMA Flow diagram





# Data to be extracted

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- **Study design**
- **Details of interventions**
- **Patient characteristics**
- **Study methods**
  - Method of randomization
  - Blinding (participants, caregivers, assessors)
  - Method of analysis
- **Results (per group)**
  - Sample size
  - Number with each binary outcome
  - Mean and SD for each continuous outcome
  - Loss to follow up



# Data extraction problems

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- **Poor presentation of methodology and results in papers causes many problems**
  - The allocation procedure is often not stated clearly
  - Results may be given incompletely
    - Only as P value
    - For continuous outcomes SD often missing
  - It may be unclear if all randomised patients were included in the analysis
- **Often not clear how to proceed when necessary information is not given**
  - Contact with the authors is desirable



# Outcome measures

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## ▪ BINARY OUTCOMES

- death
- relapse
- cure
- etc
  
- may be good or bad
- may be continuous originally (e.g. pain relief)
- any time element is ignored

## ▪ CONTINUOUS OUTCOMES

- physical measurement (e.g. lung function)
- duration (e.g. time to walk 50m, stay in hospital)
- volume (e.g. blood loss)
- area (e.g. pressure sore)
- biochemical measurement
- quality of life
- etc

## ▪ TIME TO EVENT OUTCOMES

- time to death
- time to healing



# Systematic review conduct: some key points 1

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- **Protocol**
- **Objectives**
  - Focused well defined research question
  - Primary outcome (one)
  - Minimum number of secondary outcomes
  - Include adverse events (harms) if relevant
- **Eligibility criteria**
- **Literature search**
  - Comprehensive (electronic databases, grey literature, reference lists, personal communication, ...)



# Systematic review conduct: some key points 2

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- **Identifying eligible studies**
  - Selection of studies using predefined criteria
  - Independently done by more than one reviewer
  
- **Data extraction**
  - Data extraction sheet
    - Methods
    - Results
  - Independently done by more than one reviewer



# Systematic review conduct: some key points 3

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## ▪ Assessment of risk of bias

- Problems with the design and execution of individual studies of healthcare interventions raise questions about the validity of their findings
- In clinical trials, biases can be broadly categorized as **selection** bias, **performance** bias, **detection** bias, **attrition** bias, **reporting** bias and **other** biases that do not fit into these categories
- Cochrane Collaboration developed the '**Risk of bias tool**'
  - sequence generation (selection bias)
  - allocation concealment (selection bias)
  - blinding of participants and personnel (performance bias)
  - blinding of outcome assessment (detection bias)
  - incomplete outcome data (attrition bias)
  - selective outcome reporting (reporting bias)
  - other potential sources of bias



# Systematic review conduct: some key points 4

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- **Data synthesis**
  - **Qualitative:** descriptive summary
  - **Quantitative - meta-analysis:** statistical combination of data from a number of studies when there are
    - Minimal differences between studies
    - Outcome measured in the same way
    - Data are available
- **Investigation of possible reporting bias**
  - Unpublished results
- **Interpretation**
- **Summary of findings (GRADE)**
  - Key information in a quick and accessible format
  - Relating the quality of evidence to the outcomes



# Poor reporting of systematic reviews

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- **Good reporting of primary studies is crucial for SR development**

**BUT**

- **Reviews themselves are afflicted by the problems of poor reporting**
  - Moher et al. assessed epidemiological and reporting characteristics and bias-related aspects of 300 systematic reviews (of which 125 were Cochrane reviews).
  - The overall quality of reporting of key aspects of methodology was very inconsistent with particularly discouraging findings for non-Cochrane reviews.

[Moher; *PLoS Medicine* 2007]





# Reporting guidelines for systematic reviews

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- **Should take account of the key methodological components of a review**
  - An aid for authors and reviewers
- **What information should be given about the review itself?**
- **What information should be given about the primary studies?**

