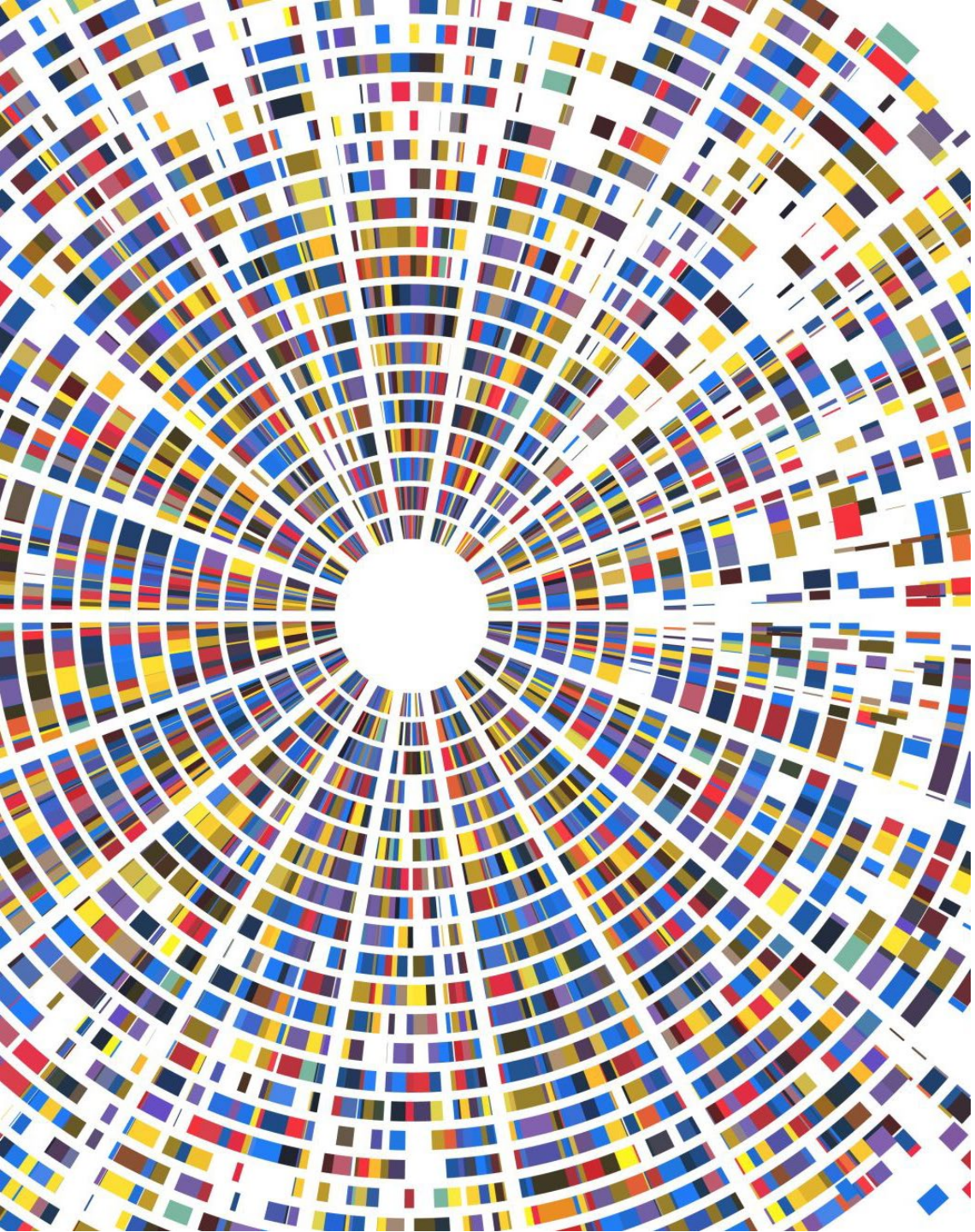

A Hands-On Introduction to Systematic Reviews and Meta-Analysis

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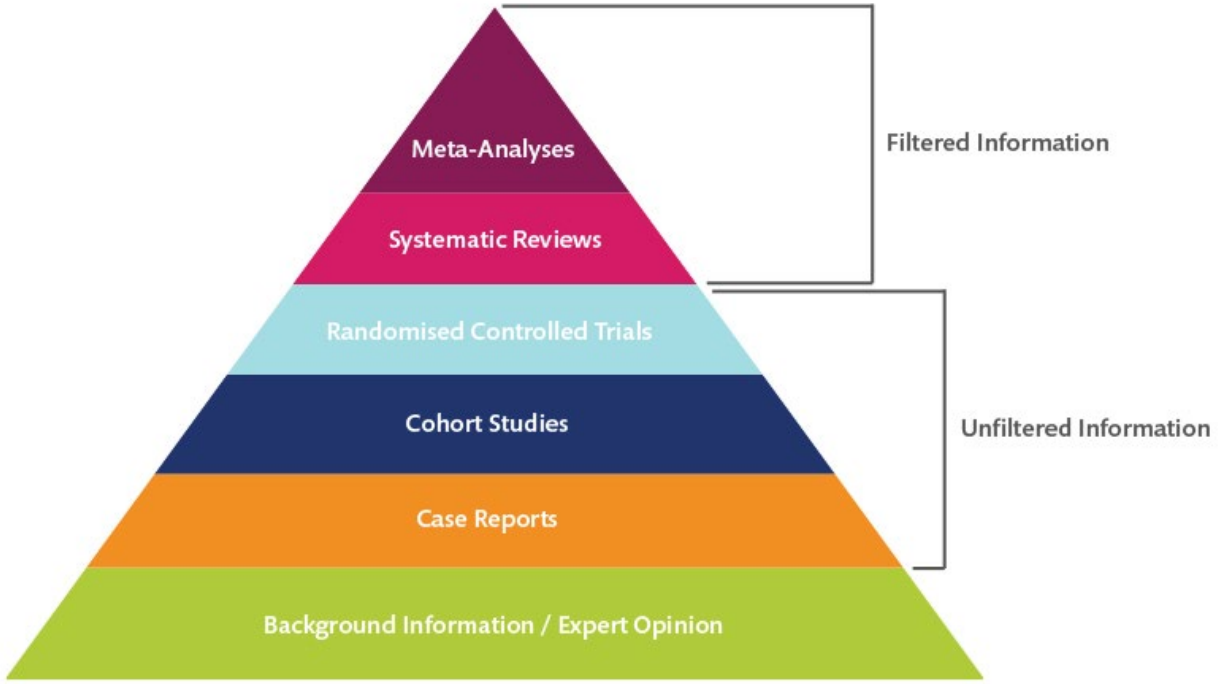
Systematic Reviews

What is a Systematic Review (SR)?

- "A systematic review collects **all possible studies** related to a **given topic and design**, and **reviews** and **analyzes** their results" – Anh & Kang (2018)
- "A SR is the synthesis of the **best available evidence** aimed at **answering specific questions** by means of explicit and rigorous use of the methods used to **identify, appraise and summarise** the most relevant studies." – Perestelo-Pérez (2013)
- "Systematic reviews, as the name implies, typically involve a **detailed and comprehensive plan and search strategy** derived a priori, with the goal of reducing bias by identifying, appraising, and **synthesizing all relevant studies on a particular topic**." – Uman (2011)

Systematic Reviews

- Answer a well-defined research question by collecting all relevant studies in an objective and reproducible manner and then summarizing their results in some way.



Source: Karolinska Institutet

Poll:

Is a Meta-Analysis a Systematic Review?

http://etc.ch/Y63n

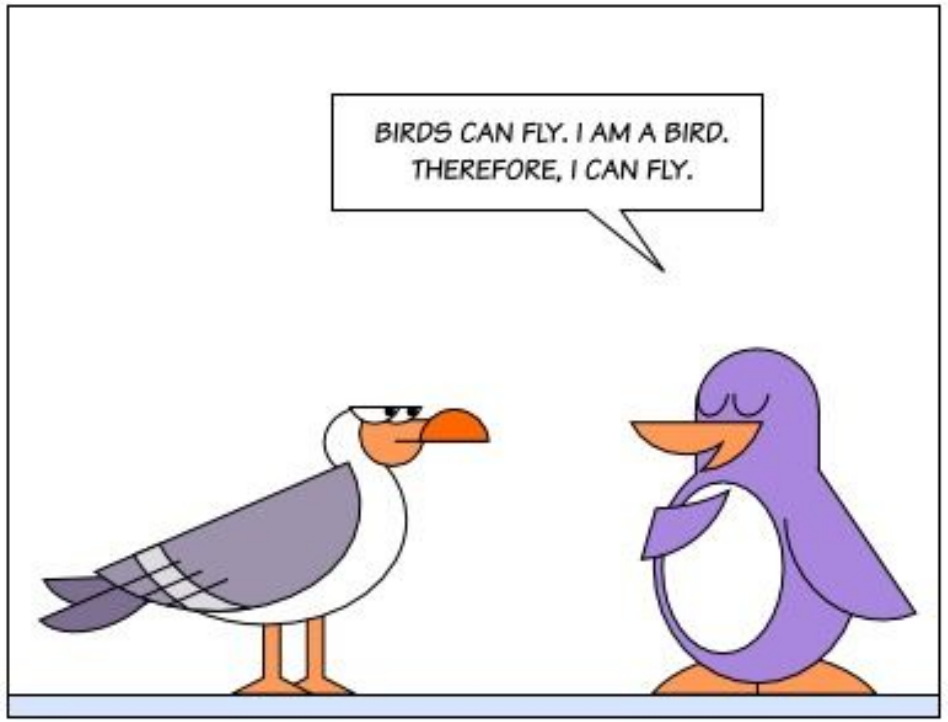
Is a meta-analysis a systematic review?

Yes	0
No	0

0 votes - 0 participants

Direct Poll

Source: https://directpoll.com/r?XDbzPBd3ixYqg8k0T6w8ljL7LxpC5dPyNi8h7kxdCWI



Yes!

+ Every meta-analysis is a systematic review but not every systematic review is a meta-analysis.

Why aren’t all systematic reviews meta-analyses?

+ A meta-analysis is not possible when you are unable to form a pooled estimate of the findings.

  Different/unrelated measures, theoretically different backgrounds, etc.

Why would someone want to conduct a systematic review?

+ Combine information from multiple studies.

  Discrepancies
+ Increase understanding about phenomenon.
+ Increase precision (applies to meta-analysis, but also to systematic reviews via frequencies, themes, etc.)

Steps for a Systematic Review

- Guidelines

  QUORUM → PRISMA checklist
  https://www.bmj.com/content/339/bmj.b2700

  Cochrane Review

  https://training.cochrane.org/handbook/current

Step 1: Research Question

1) Formulate research question

Not too broad.

Not too narrow.

Defined Population, Intervention, Comparison, Outcomes (PICO) – Anh & Kang (2018).

Stricter for meta-analysis.

Examples of Research Questions

- This study aimed to review how social desirability (SD) has been recently addressed in clinical psychology, establishing the following objectives: (a) to investigate the association of SD with other variables in the contexts of clinical psychology; (b) to ascertain whether SD was measured as a mono- or multidimensional variable; and (c) to find out whether personality traits were controlled for when testing the effect of SD on other variables. - Perinelli & Gremigni (2016)

Examples of Research Questions

- The primary focus is upon understanding the literature which relates to how victims respond to fraudulent communications as opposed to the offender. These diverse range of tactics used [can] be considered under three sub-headings, victim selection techniques, perpetration strategies and finally detection avoiding strategies':
- Victim selection techniques concern the strategies that fraudsters use to contact their victims, e.g. email or virus.
- Perpetration strategies: once the victim has been identified, these are the techniques used by fraudsters to secure money or identity, e.g. legitimate appearance of an email.
- …
- It is the first two of these that is the focus of this review and primarily the aim is to consolidate our understanding of the psychological mechanisms by which perpetrator (message) and victim (respondent) interact. – Norris et al. (2019)

Examples of Research Questions

We have two aims with our review: (a) to investigate usage patterns of Bayesian statistics within the field of psychology, and (b) to identify trends over time regarding the use of Bayesian statistics in psychology. To address this latter aim, we detail growth patterns within many different subcategories, including the use of Bayes with different statistical techniques and the use in different subfields of psychology. – van de Schoot et al. (2017)

Step 2: Exclusion/Inclusion Criteria

- PICO again (population, intervention, comparison, outcomes)
- Study type: randomized experiments, observational studies, quasi-experimental designs, qualitative research, interviews
- Unpublished literature
- Language
- Year

Anything else?

Step 3: Define the Search Criteria

- What database (Google Scholar, PsycInfo, ProQuest, PubMed, Web of Science, etc.)
- Boolean operators: AND, NOT, OR
- Search limiters (year, peer reviewed research)

Google Scholar tips

PsycInfo tips

PubMed tips

When you do search… save the date! (licensing articles, different number of results on different days)

Source: https://xkcd.com/1447/

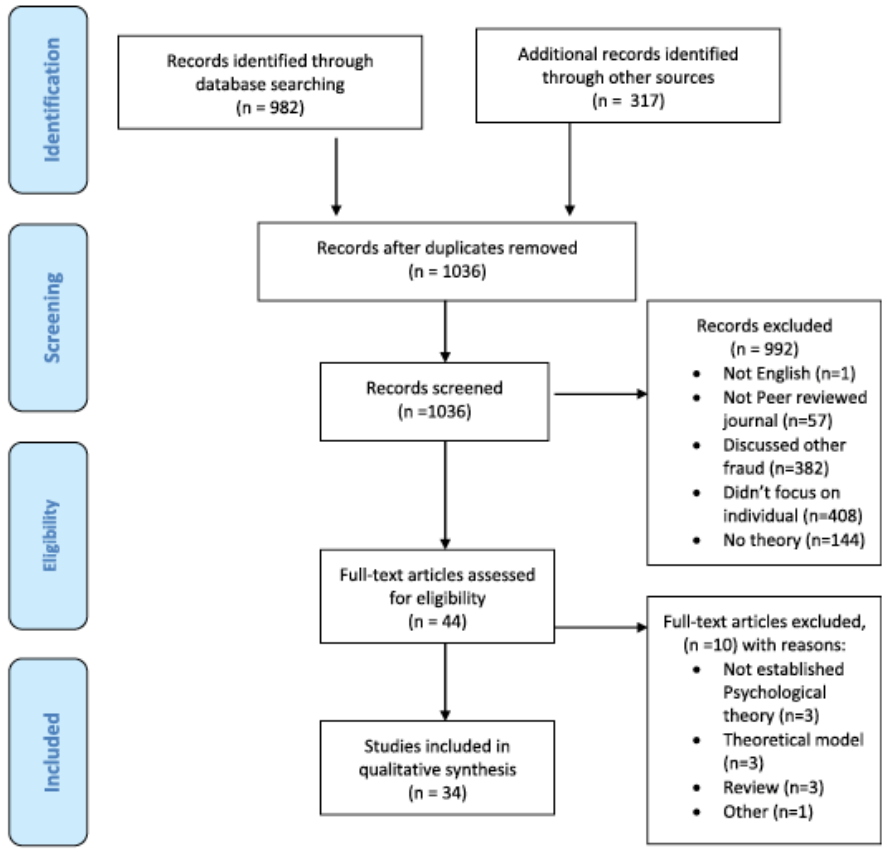
Pre-register!

- Open Science Framework, PROSPERO (health and social care), AsPredicted
- Moreau, D., & Gamble, B. (2020). Conducting a Meta-Analysis in the Age of Open Science: Tools, Tips, and Practical Recommendations. https://doi.org/10.31234/osf.io/t5dwg

Step 4: Select the Studies

- Retain studies that meet the inclusion criteria
  - Multiple reviewers, inter-rater reliability
  - Record excluded studies and reason for exclusion
- Consort diagram

Fig. 1 PRISMA flow diagram for identifying psychologically based studies into Internet-based fraud



Source Norris et al. (2019)

Step 5: Record and Analyse the Relevant Data

- Table
- Headings may include: study title, authors, doi, outcomes, etc.,

Table 1
Summary of the 35 Reviewed Studies' Characteristics

Study (country)	Participants	Main topic	SD measure[a]	Personality traits controlled for	Key results[b]
		Attitude, knowledge, and health behavior			
Ambwani & Chmielewski, 2013 (United States)	155 adults aged 18–23 years (69% female)	Body weight	PAI-PIM	None	SD significantly predicted weight-reporting discrepancies for women but not for men.
Boyer et al., 2012 (Canada)	41 women aged 18–27 years; 20 with provoked vestibulodynia (PVD) and 21 controls	Sexual arousal	BIDR-7	None	IM was not a moderator between genital and subjective arousal. In the PVD group, IM was significantly negatively correlated with subjective sexual arousal.
Crutzen et al., 2010 (The Netherlands)	7,077 adults (mean age = 43.3, *SD* = 13.1, 56.6% female)	Health risk behaviors (e.g., alcohol use, drug use, smoking)	MCSDS BIDR-6 SDS-17	None	Three longitudinal studies did not find any significant influence of SD on self-reported health risk behaviors in web-based research.

Source: Perinelli & Gremigni (2016)

Figure 4. Wordcloud showing terms used to describe the level of informativeness of the priors in the empirical regression-based articles.

Source: van de Schoot et al. (2017)

Meta-Analysis

What is Meta-Analysis?

- The statistical summarization of the effects from a set of studies investigating the *same research question*

  However, the term ‘meta-analysis’ often also applies to the entire process of generating a research question, finding studies that investigate the research question, extracting the necessary info from the studies, and combining the results from the related studies

    Relation to systematic review.

Why Perform a Meta-Analysis?

- A single study cannot be used to definitively quantify the magnitude of an effect

  Results (effects) vary from study to study due to sampling error, nature of the population, methodological procedures, etc.

- Unsystematic or narrative reviews of the literature are often extremely biased from both the perspective of the methods and the researcher

  E.g., the researcher usually has an a priori inclination regarding the nature of the effects under exploration

Meta-Analysis in Research

- Publications

  Journals, as well as other researchers, encourage meta-analyses

  Meta-analyses provide a great starting point for research, as they help *contextualize* a new study

- New Research

  Meta-analyses can be used as a tool to help researchers avoid *recreating the wheel*, or to find promising research areas by investigating past studies

- Grant Applications

  Meta-analyses are highly regarded in grant applications, as they frame the proposed research within existing research

  - Some funding agencies now require a meta-analysis of existing research as part of the grant application

Some History from Psychology

- 1952: Hans Eysenck concluded that there were *no favorable effects of psychotherapy*, starting a raging debate
  - 20 years of evaluation research and hundreds of studies failed to resolve the debate
- 1978: To prove Eysenck wrong, Gene Glass statistically aggregated the findings of 375 psychotherapy outcome studies
  - Glass concluded that psychotherapy did indeed work
- Glass called his method “meta-analysis”

The Emergence of Meta-Analysis

- Ideas behind meta-analysis predate Glass' work by several decades
  - Karl Pearson (1904)
    - Averaged correlations for studies of the effectiveness of inoculation for typhoid fever
  - R. A. Fisher (1944)
    - We can combine the results of several studies to get an appreciation for the probability associated with the aggregated data
    - Dealt primarily with combining *p*-values
- The start of the idea of *cumulating probability values,* although not specifically focused on effect sizes

The Emergence of Meta-Analysis

- W. G. Cochran (1953)
  - Discussed a method for averaging means across independent studies
  - Cochran was responsible for much of the statistical foundation that modern meta-analysis is built upon
- Cochrane Collaboration
  - A group of researchers from around the world that conduct systematic reviews of health care interventions and diagnostic tests and publish them in the Cochrane Library
    - E.g., https://canada.cochrane.org/

The Logic of Meta-Analysis

- Traditional methods of review usually focus on statistical significance testing
  - E.g., the effect was statistically significant in 4 out of 7 studies
  - However, we know that null hypothesis significance testing (NHST) is highly related to sample size, focuses on dichotomous decisions, etc.

- Meta-analysis focuses on the *direction* and *magnitude* of the effects across studies, not statistical significance
  - Direction and magnitude are represented by the effect size

When Can You Do a Meta-Analysis?

- Studies are empirical, not theoretical
- Results are quantitative, not qualitative
- Studies examine the same research question
- Results can be quantified in a comparable statistical form
  - i.e., effect size

Activity

Use of Social Desirability Scales in Clinical Psychology:

A Systematic Review

- The results section (folder with two studies, fill in chart on page 7)