Meta-Analysis

A study that combines the results of multiple studies to draw broader conclusions or identify patterns.

It is an extension of a systematic review that employs statistical techniques to pool the data from the literature in order to calculate a cumulative effect size. This is done to answer a clearly defined a priori question.

Meta-analysis is a statistical technique for quantitatively synthesizing similar studies from a systematic review. The conventional meta-analysis approach is useful, but is limited in that it can only compare two interventions at a time, and only those evaluated directly in head-to-head trials

Although all medicine based on science has some degree of empirical support, evidence based medicine (EBM) goes further, classifying evidence by its epistemologic strength and requiring that only the strongest types (coming from metaanalysis, systematic reviews, and randomized controlled trials) can yield strong recommendations; weaker types (such as from case control study) can yield only weak recommendations.

Network meta-analysis

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Guidelines

see PRISMA.Preferred Reporting Items for Systematic Reviews and MetaAnalyses.

see MOOSE Guidelines

Despite their increasing popularity in the neurosurgery literature, meta-analyses have not been scrutinized in terms of reporting and methodology.

Klimo et a., performed a literature search using PubMed/MEDLINE to locate all meta-analyses that have been published in the JNS Publishing Group or Neurosurgery.

Accepted checklists for reporting (PRISMA) and methodology (AMSTAR) were applied to each metaanalysis, and the number of items within each checklist that were satisfactorily fulfilled was recorded.

Klimo et al. sought to answer 4 specific questions: Are metaanalysis improving

1) with time;

2) when the study met their definition of a meta-analysis;

3) when clinicians collaborated with a potential expert in meta-analysis

4) when the meta-analysis was the only focus of the paper?

Results Seventy-two meta-analyses were published in the JNS Publishing Group journals and Neurosurgery between 1990 and 2012. The number of published meta-analyses has increased dramatically in the last several years. The most common topics were vascular, and most were based on observational studies. Only 11 papers were prepared using an established checklist. The average AMSTAR and PRISMA scores (proportion of items satisfactorily fulfilled divided by the total number of eligible items in the respective instrument) were 31% and 55%, respectively. Major deficiencies were identified, including the lack of a comprehensive search strategy, study selection and data extraction, assessment of heterogeneity, publication bias, and study quality. Almost one-third of the papers did not meet our basic definition of a meta-analysis. The quality of reporting and methodology was better 1) when the study met our definition of a meta-analysis; 2) when one or more of the authors had experience or expertise in conducting a meta-analysis; 3) when the meta-analysis was not conducted alongside an evaluation of the authors' own data; and 4) in more recent studies.

Reporting and methodology of meta-analyses in the neurosurgery literature is excessively variable and overall poor. As these papers are being published with increasing frequency, neurosurgical journals need to adopt a clear definition of a meta-analysis and insist that they be created using checklists for both reporting and methodology. Standardization will ensure high-quality publications [1)].

Pairwise meta-analysis

Pairwise meta-analysis is an established statistical tool for synthesizing evidence from multiple trials, but it is informative only about the relative efficacy of two specific interventions. The usefulness of pairwise meta-analysis is thus limited in real-life medical practice, where many competing interventions may be available for a certain condition and studies informing some of the pairwise comparisons may be lacking. This commonly encountered scenario has led to the development of network meta-analysis (NMA). In the last decade, several applications, methodological developments, and empirical studies in NMA have been published, and the area is thriving as its relevance to public health is increasingly recognized [2)].

References

1)
Klimo P Jr, Thompson CJ, Ragel BT, Boop FA. Methodology and reporting of meta-analyses in the neurosurgical literature. J Neurosurg. 2014 Apr;120(4):796-810. doi: 10.3171/2013.11.JNS13195. Epub 2014 Jan 24. PubMed PMID: 24460488.
2)
Efthimiou O, Debray TP, van Valkenhoef G, Trelle S, Panayidou K, Moons KG, Reitsma JB, Shang A, Salanti G; GetReal Methods Review Group. GetReal in network meta-analysis: a review of the methodology. Res Synth Methods. 2016 Sep;7(3):236-63. doi: 10.1002/jrsm.1195. Epub 2016 Jan 11. PMID: 26754852.