OP09

Systematic review and meta-analysis

Author & Presenter: Hakeem Yusuff

Department of Respiratory Sciences, University of Leicester, Glenfield Hospital, Leicester, UK

A systematic review is a high-level overview of a particular research question that systematically identifies, selects, evaluates, and synthesizes all high-quality research evidence relevant to that question in order to answer it. It involves the synthesis of the results of multiple primary studies related to each other by using strategies that reduce biases and random errors. A well conducted systematic review provides high quality evidence for a clinical practice and is regarded as the gold standard evidence to inform clinical practice.

The process of conduct of a systematic review requires the formulation of a precise research question that should clearly identify the participants of interest, the intervention, the comparator group, and the outcome. This is then followed by the identification of relevant studies. It is important to use all available MeSH terms related to the research question. Common databases to search for studies include MEDLINE, EMBASE, CENTRAL, LILAC, OVID. While selecting studies, it is important to have a flow diagram describing the screening and selection process. Sample flowcharts and guidance of the screening process are available on the preferred reporting items for systematic reviews and meta-analysis (PRISMA) website.

While extracting the data, to reduce the risk of bias, two investigators are preferred, working independently to reduce the risk of bias. The analysis could be quantitative or qualitative depending on the type of data obtained and homogeneity of the studies included in the systematic review. It is not uncommon for a systematic review to result in a narrative review of current literature due to paucity of data required to conduct a quantitative analysis.

Meta-analysis was first defined by Gene Glass in 1976 as a statistical analysis of a large collection of analysis results from individual studies, for the purpose of integrating the findings. Meta-analyses could be cumulative, retrospective, or prospective. Most meta-analysis in literature are cumulative but prospective meta-analyses are associated with the least bias.

The results of a meta-analysis are presented in forest plot graphically. A forest plot would display the effect size estimates and confidence intervals for every study included in the meta-analysis. The meta-analysis should also have an assessment for the heterogeneity of the included studies. Commonly heterogeneity is assessed using statistical tests. The x^2 and I^2 tests are commonly used. A x^2 test is a P-value of > 0.05 or I^2 of greater than 75% indicates significant heterogeneity.

A meta-analysis can be carried out using a fixed or random effect model. Where there is no heterogeneity, a fixed effect model is used otherwise a random effect model is employed. An assessment of publication bias is also required to check that the results are not influenced by positive, significant, or small studies. This is displayed graphically in a funnel

plot and is recommended where more than 10 studies have been included in the meta-analysis. The publication of the results of the meta-analysis should follow the PRISMA guidelines. The guidelines are available on the PRISMA website (http://prisma-statement.org).