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Meta-analysis in Clinical Research: Target and Techniques [Review]

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Abstract: Meta-analysis is a process of combining results that can be used to draw conclusions about therapeutic effectiveness or to plan a new study. It is a process that can provide a logical structure for the introduction of quantitative methods for the review, evaluation and synthesis of information from different studies. The need for meta-analysis arises when results from clinical trials of small sample size are controversial and large single study is not feasible. Certain guidelines should be followed in designing a sound meta-analysis. The design includes protocol development, objectives, literature search, publication bais, measures of study outcome and quality of data. The statistical procedures include consistency [homogeneity] and nature of the study outcome and techniques of pooling results from several studies. For single study, the outcome measurement may be in the form of difference between means or proportions which can be derived from binary data. As an explicit strategy for summarizing results, meta-analysis may help clinicians and researchers in better understanding of the findings of clinical studies.

INTRODUCTION

In clinical research there is a long tradition of literature review to assess the current state of knowledge with respect to the treatment of a given disease entity. The tradition of literature review is by its nature retrospective. When the results of published studies are inconsistent or inconclusive, it is difficult to reach a conclusion and recommendation for treatment. The inconsistencies of published reports may be due to small sample sizes, different study designs, different populations, varying diagnostic techniques and outcome measures over time. Meta-analysis methods attempt to provide some structure to the struggles of the researcher who reviews the literature. Meta-analysis is not a statistical method, per se, but it is a procedure of research synthesis that utilizes many techniques of measurement and data analysis.[1]

In this article we aimed at introducing the technique of meta-analysis, in a simple way, to our colleagues working in public health. We hope to attain this aim through describing the meaning of the term, the terminology associated with it, its importance, limitations and the current statistical models used with meta-analysis.

Definition

Meta-analysis is a quantitative approach for systematically combining the results of previous research in order to arrive at conclusions about the body of research. It is a key component of evidence-based health care.[2] Such analysis pools individual randomized controlled trials together to arrive at an overall estimate of the effect of the intervention under consideration. Meta-analysis is considered as an observational retrospective approach, the unit of analysis is a "study" or a "trial".[3] Instead of meta-analysis some authors adopted the spelling met-analysis, others seem to prefer the terms "systematic overview",[4] "pooling data" and "quantitative literature review".[5] In social sciences the term "research synthesis" is sometimes used.[6]

History

The term "meta-analysis" was coined by Glass in 1976 from the Greek prefix "meta" which means "transcending," and the root, analysis.[7] However, the statistical combination of data from multiple studies of the same topic began long before a word for it was coined. One of the earliest meta-analyses, perhaps the first, was conducted by Karl Pearson in 1904 who