4 Reading and evaluating the scientific literature

4.1. Literature study

A literature study is a fundamental part of the planning and implementing of any research project. A researcher may only be able to plan a meaningful project if he has made a careful study of the literature in connection with his field of research beforehand.

The most important reason for a literature study is to become acquainted with theories, definitions, previous relevant research, etc. in connection with a specific subject or problem area. On the basis of the accumulated information, a researcher gets a clearer view of the nature of the issue and is able to outline or demarcate the problem positively and to set hypotheses.

From the literature, the researcher usually gets an indication of the most effective procedures, measuring instruments and methods of analysis that can be used. This knowledge enables the researcher to plan the project accurately. A thorough study of the literature also helps the researcher to understand the actuality of the intended research. If it turns out that the research envisaged has already been done and that the "problem" has been solved satisfactorily, no purpose will be served by repeating the work.

Review articles are a rich source of information. These articles are usually written by an expert or a pioneer in the subject area. For newcomers to a field, it is recommended that they first read some review articles in order to understand the big picture. Thereafter, scrutinize the most recent literature. In particular, try to highlight the divergent points of view chronologically to enable the reader to sense immediately in which direction the proposed research is headed.

4.2. Questions that need to be answered when reading a publication

There are six questions that one should be able to answer when reading a research article – these six questions also deal with different parts of the paper.

Why? The study question – considers the aims of the study. One should always consider the reasons for the study and must determine whether sufficient evidence is presented to justify the study.

How? Study methodology – considers the methods used in the study. One needs to critically review the methodology used and decide whether it is valid for obtaining a correct result.

Who? The study population – considers the analyses of the results. One must decide whether the sample used is representative enough of the population to extrapolate the results back to the larger population.

What? Treatments and outcomes – considers the analyses of the results. One must ascertain whether the treatments applied are clearly defined and whether the response variables are appropriate.

How many? Outcomes – considers the analysis of the results and the conclusions. One must consider whether the sample size is sufficient and whether the significance ascribed to the results is correct.

So what? Overall significance – considers the conclusions. One must decide: what is the overall significance of the reported findings.

4.3. Critical appraisal of an article

As a scientist one must learn to critically appraise published articles. Critical appraisal is a systematic process used to identify the strengths and weaknesses of a research article in order to assess the usefulness and validity of research findings. This is important as it will determine whether you will use the article in your thesis/protocol/publication.

The concept of critical appraisal has largely grown out of the evidence-based health care movement. It fits into the cycle of getting evidence into practice. This means improving the quality and cost effectiveness of health care by finding the best available research evidence on the outcomes of health care interventions, and basing decisions on health care upon it.

In practice this translates as:

- Finding the evidence (searching the most appropriate databases)
- Carefully checking the validity of the research (critical appraisal)

• Applying the lessons learnt from the evidence to patient care (getting research into practice)

Critical appraisal means being able to look at a piece of research in an objective and structured way to decide how valid it is compared to other research.

The **Abstract** should contain everything that is important in the study which includes the reason for the study, methods used, results and significance of the findings. The abstract is usually read first and will make you decide whether it is worth reading the entire article.

The aim of the study should clearly be stated in the **Introduction**. Is the study's research question relevant? In a causal study the relationship between exposure and outcome is attempted to be clarified. In a descriptive study, one delineates the facts or contents which are going to be measured and attempts to infer the findings to a target population. In addition to the aim/objectives the author should provide some background and current understanding of the problem in the Introduction.

In the section of **Materials and Methods**, the contents of measurement should be provided. One should be able to judge the validity of these measurements and therefore the investigator should explicitly state the determinants of each measurement. This should include the name and model number of the measuring instrument as well as QA/QC procedures used with the measurement. Determine whether appropriate controls were used or not. In clinical studies assess whether the inclusion and exclusion criteria are relevant. In human and animal studies it should be stated that ethical approval was obtained.

In the **Results** section it should be determined whether the statistical analysis was performed properly. Are the results presented correctly?

For the **Discussion** determine whether appropriate explanations are provided. This should be done using knowledge of the subject area. The question to be answered is whether the objective set in the Introduction was accomplished. Most importantly what do they conclude from this finding. Does the study add anything new? Do the data justify the conclusions?

Critically appraising an article will therefore assist in determining what the relevance of the research is to one's own research.

4.4. References

Du Prel J-P, Röhrig B, Blettner M. Critical appraisal of scientific articles. Dtsch Arztebl Int 2009; 106:100-105.

Young JM, Solomon MJ. How to critically appraise an article. Nat Clin Pract Gastoenterol Hepatol 2009; 6:82-91.