Practical Epidemiology and Biostatistics in Research

Pages with reference to book, From 221 To 221

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What is research? Testing hypotheses? Collecting data? Generating new knowledge? Does it mean elaborate and expensive facilities or a description of esoteric findings in impenetrable jargon?!
The Oxford Dictionary defines research as “careful search or enquiry after or for or into; endeavour to discover new or collate old facts, etc. by scientific study of a subject, course of critical investigation.” Others have defined research as systematic, controlled and critical investigation (or testing) of ideas generated by intuition; or the systematic search for new knowledge. This series of articles proposes to introduce the fundamental principles of research and create an appreciation of the underlying concepts. The aim is to help the reader become a more critical consumer of research/journal articles that may appear to be intimidating and to nurture a spirit of enquiry. It should be possible to learn what an article is about, to appreciate the nature of the findings, to assess whether the study was conducted appropriately and why it is considered important. Research is an integral part of professional development in medicine and can be a lot of fun. What is epidemiology? Originally defined as the study of epidemics, epidemiology now has a broader concept that includes the “3 D’s: the Distribution, Determinants and Dynamics of disease in human populations. The main aim is to identify causal association but also explains occurrence of and the natural history of diseases with the ultimate objective of providing guidance in the administration of health services.
What is biostatistics? “Bios” in Greek is “life” while “statos” is Latin for ‘facts of state or community”. Here numbers are used to tell a story so that numerical data are presented in a fashion by which their meaning can be better judged.
The Scientific Method consists of several steps:

Methodology
Steps in the development of a Research Proposal

Questions you must ask	Steps you will take	Important elements of each step
What is the problem or what is to be studied	statement of the problem	
What information is already available?	literature review	literature and other available information
Why do we want to carry out research? What do we hope to achieve?	formulation of objectives	research questions or hypotheses
What additional data do we need to answer our research questions? How are we going to collect this information?	research methodology	variables type of study data collection techniques sampling, plan for data collection ethical considerations pilot study or pre-test plan for data analysis and interpretation
How will the results be used?	plan for utilization and dissemination of results	
Who will do what and when?	workplan	manpower timetable administration, monitoring and evaluation
What resources do we need to carry out the study? What resources do we have?	resources required and budget	material support and equipment money

- Statement of the problem
- Formulation of hypothesis
- Testing
- Interpretation and presentation
- Utilization

Statement of the problem: What is bothering you, what is the question, what needs to be studied or verified? What is already known about the problem (literature review)?
Formulation of hypothesis: Rationale, aims, objectives -- i.e., what is the research question and why? What will the study contribute to our knowledge and understanding of the problem? Why do we want to carry out research? What do we hope to achieve?

Practical Epidemiology

1. Define epidemiology
2. Vocabulary for epidemiology
3. Rates and their adjustment
4. Types of studies
   - Observational
     - descriptive → Case report/Series
     - descriptive → Cross-sectional study
     - Analytical → Case-control/Retrospective
     - Analytical → Cohort/Prospective
   - Experimental
     - Historical/Natural
     - Clinical
5. Concept and measures of risk
   - Relative risk
   - Attributable risk
   - Odds ratio
6. Hypothesis testing (p values, confidence intervals, tests of significance)
7. Bias, Chance, Confounding
8. Validity and Reliability
9. Steps in study design
10. Critical reading of a journal

Testing: Research methodology/study design and analysis -- what data do we need to answer our questions? How are we going to collect this information? How will the data be processed and analysed?
Interpretation and presentation: Based on the research evidence is the hypothesis accepted, rejected, modified? Are the conclusions valid? How are the results to be presented (report, paper, verbal presentation, etc.)?
Utilization: Application of results -- feedback to the original problem, guidance for informed decision making.
What else is needed? A work plan, timetable (who will do what and when), resources and budget required.