

Chapter-2

Designing, planning and conducting a scientific study

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Research is a systematic process of data collection and analysis in order to reach a conclusion. The steps in research extends from the process of transforming ideas and problems into researchable questions, choosing a research methodology that is appropriate to the purpose of the study and considering the challenges and constraints. The ultimate goal of research is to add to evidence base in order to develop new insights to various problems.¹ Dr Altman's statement in BMJ in 1994 still hold true that "we need less research, better research and research done for the right reasons." It is not uncommon to find seriously flawed research in medicine either by use of inappropriate design, poor literature review, small or unrepresented samples, wrong analysis or unjustified conclusions.² Researchers should strive for the highest achievable standards in the planning, conduct and reporting of their research. Conducting a study involves multiple steps, which are all interlinked.³ Any change in one step means reviewing all other steps to ensure the continuity of research process in a scientific manner.

Basic steps in planning and conducting a study include:
(Fig. 1)

1. Identify the problem area/ Idea for a study.
2. Critical review of existing literature.
3. Design the research project.
 - i. Formulate research question/Objective
 - ii. Formulate hypothesis

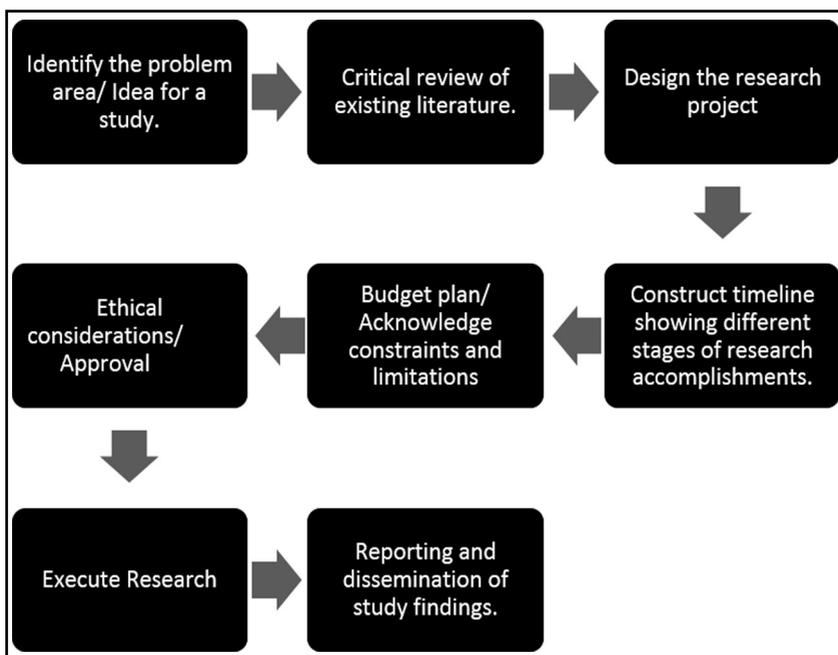


Fig.1: Essential steps in Planning and conduct of a study.

- iii. Define basic concepts and variables
 - iv. Choice of research design to meet objectives.
 - v. Methods of data collection & Analysis:
4. Construct timeline showing different stages of research accomplishments.
 5. Budget plan/ Acknowledge constraints and limitations
 6. Ethical considerations/Approval
 7. Execute Research
 8. Reporting and dissemination of study findings.

1. Identify the problem area/ Idea for a study:

The first step in conducting a research is to identify the problem or having an idea for a study.⁴ The idea for a study may come from an individual's own experience or from the realization to have a clear answer to a particular research

question. Study topic should be relevant, important, innovative and a cause of concern within the community. It also needs to be feasible in terms of availability of data, costs, tools requirement & time available to conduct the study. Study topic should also be acceptable to the community in which the study is to be conducted and ethical consideration need to be given due importance in topic selection. Study topic's attraction for funding may also be important in some context.

2. Critical review of existing literature:

Once a topic for study has been selected, researcher must do a comprehensive review of literature on the topic. Literature review provides foundation for the study and serves many purpose.^{5,6} It helps in finding out if the question might have been already answered by others. Information obtained during this step also help researchers, in understanding magnitude of the problem, current knowledge of the topic, methodology used in previous studies as well as any difficulties faced by researchers.⁷ Various databases like google scholar, PubMed, PubMed central, Psych info, Pakmedinet may be used to do literature search. All relevant references should be saved, & numbered. Citations of articles may be checked to identify more relevant materials. The results of literature search should then be synthesized into a literature review. Synthesis led to justification for the study question. Poor literature search has been identified as one of the factors leading to poor research standards and publications.⁸

3. Design the research project:

A research plan or approach is a framework or blueprint for conducting the research project. It includes various steps which are as follows.

i. Formulate research question/Objective:

Literature review help researchers in guiding towards focused and researchable research questions rather than them being vague or too broad. Carefully constructed research questions facilitate the search for a solution.¹

ii. Formulate hypothesis:

Hypothesis predicts the relationship between independent and dependent variable. Hypothesis of the study (where indicated) should be stated in clear and practical way. It should include clear description of exposure, outcome, and anticipated effect in population under study.

iii. Define basic concepts and variables:

Various terms and concepts used in study description may have different meanings. It is important that operational definitions for various term/ concepts for any study are specified clearly.

iv. Choice of research design to meet objectives:

Depending on the research question, one may choose among the many research designs (Quantitative, qualitative or mixed),^{1,9} however the choice of study design need to be justified.¹⁰

v. Methods of data collection & Analysis:

Data collection methods should be described in detail including the questionnaire/ tools to be used. Sample size needs to be calculated. Statistical methods and proposed analysis designs need to be finalized.

4. Construct timeline showing different stages of research accomplishments:

A realistic timetable for various steps of the research need to be considered at the planning stage. It helps in monitoring the progress of the study. A sample gnat chart is shown in Fig.2.

5. Budget plan/ Acknowledge constraints and limitations:

It is important for researcher to consider budget required for the study and whether one wish to apply for funding. Budget generally include Personnel costs, costs of equipment needed for study (e.g., computers, freezers, centrifuges) and running expenses (e.g., office expenses, computer and laboratory consumables, travel costs). Many guidelines about conduct of research exist, primarily for those involved in research

Activity	Month 1	Month 2	Month 3-4	Month 5	Month 6	Month 7-8	Month 9
Literature review							
Ethics Review Committee Approval							
Data Collection							
Data Entry							
Data analysis							
Paper write up							
Submission for publication							

Fig.2: Sample Gantt Chart.

supported by funding agencies.^{11,12} Constraints and limitations regarding budget should also have been considered in the initial stage, while assessing feasibility of the project.

6. Ethical considerations/Approval:

Major ethical issues involved in research include informed consent, Beneficence (do no harm) and confidentiality.¹³ Researchers must ensure the integrity and confidentiality of data collected in the course of clinical research. Necessary approvals (for example of Institutional Review Board) should be sought before the start of study. Adhering to ethical norms in research serves various purposes. It helps in promoting truth and the values that are essential to collaborative work, (such as trust, accountability, mutual respect, and fairness) alongside ensuring that researchers are held accountable to public. Given the importance of research, various professional organizations have developed guidelines outlining relevant policies and ethics requirements for specific areas, activities and research Settings.^{14,15}

7. Execute Research:

The actual study begins at this step by data collection. Once data is collected on various variables, it is organized, entered into a database and analyzed. Data analysis lead to conclusion and recommendations.

8. Reporting and dissemination of study findings:

Last step is to report the results of the study in a manner that is comprehensible. Various factors have been found to influence researchers' motivation to publish their work. Researchers are more likely to attempt to publish studies with positive outcomes.^{16,17} Presentations in conferences, various academic meetings are other ways to disseminate the study findings and increasing the research impact.

In conclusion, planning and conducting a study needs dedicated time and effort on part of the researcher. Basic steps in planning and conducting the research were highlighted in this chapter which hopefully will help researchers in selecting the right research approaches in order to answer questions about their area of interest.

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