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Preparation of a Good Research Question: A Starter Kit

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Authors' contributions

This whole work was carried out by the authors RS and VT.

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ABSTRACT

This article addresses key issues and aspects of writing a good research question. The article shows the way to young researchers on how to zero down on a topic and formulate a research question such that the research may be conducted in a fruitful and time bound manner. Often researchers begin haphazardly and struggle to complete their study because of flaws in research design. The article addresses these issues and proposes to guide the researchers in their attempts to frame and conduct a useful and innovative study through eight clearly identifiable steps. These include Identifying a Problem, Conceiving a Research question, Literature Review, Bringing Oneself Up-to-date, Framing the Research Question, Basic Available Study Designs, Designing the Study: The Checklist and Defining the Title.

Keywords: Medical research; study design; research question; case-control study; prospective study.

1. INTRODUCTION

Medical Research is a scientific and systematic way of obtaining data and information for solving health care problems. The scientific process consists of observations and hypotheses to generate research theories while the systematic process comprises planning,

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designing, sampling, sample size calculations, data collection and data analysis of the research to its completion. However, in order to achieve these goals a researcher requires a good research question before starting the research. A good starting point is attending conferences, research meetings, symposiums, teachings and discussions where recent work is presented that provides new ideas and updates on the subject. It is important to remember that research is teamwork and interacting with mentors/ supervisors/ colleagues and developing relationship with experts are very helpful tools to acquire facilities and expertise for developing a research question.

2. IDENTIFYING A PROBLEM

The young researcher can start with a review of literature of published and unpublished work in the interested field. Initial observational studies lay the step for generating hypothesis and force the researcher to keep imagination roaming on the topic. Identifying a gap in knowledge is the first step in the process. For example, surgery used to be recommended for asymptomatic gallstones patients because past studies advocated that up to 50% of such patients developed complications. However, a research group found that patients with symptomatic gallstones and other symptoms, which were not due to gallstones, were also taken into consideration in these studies. Later, a cohort of asymptomatic gallstones patients found that only 15% patients suffered any biliary pain in 15 years of follow up [1,2].

3. CONCEIVING A RESEARCH QUESTION

Development of a good research question paves the way for a good research foundation in the form of how knowledge should be acquired, how the truth of the knowledge should be evaluated and the form in which knowledge should be stated, which ultimately lays the path of improving diagnostic, therapeutic and prophylactic procedures as well as understanding the etiology and pathogenesis of diseases.

4. LITERATURE REVIEW

A thorough and systematic literature review shows the way forward since the research question is borne out of uncertainties in health care. It originates in observing day-to-day life circumstances, prior findings from own and others studies, experiences and reading on the topic. There is no paucity of research questions in this world. Once a research study is systematically and scientifically completed, it reveals another research question. Hence, the important thing is to find a good research question that can be transformed into good research. For example, a muscle relaxant that was gentle on the stomach drug was introduced in 1955 in the form of only Panadol [3], which has taken the forms of Panadol Extra, Panadol Rapid and Panadol Night for different purposes in due course.

5. BRINGING ONESELF UP-TO-DATE

It is also important that one brings oneself up-to-date with the expertise and applications in advance technologies that can provide useful insights into burning clinical problems. For example, less sensitivity and specificity of Mammogram, Blood Based Screening and breast Magnetic resonance imaging (MRI) have led to a new technology being developed, Molecular Breast Imaging (MBI). MBI identifies tumors in dense breast tissue that are often not visible with X-ray based analog or digital mammography and gives insights on breast tissues for early prognosis and treatment [4].

6. FRAMING THE RESEARCH QUESTION

Writing one paragraph on the decided topic is the beginning to the formulation of a research question. Conceiving a research question based on careful observations and speculations play a vital role. Thinking and rethinking on the written topic and making modifications make it perfect. Steven et al. [2] advocate just sitting and concentrating on the topic, even thinking while eating, bathing, in conversation with colleagues, imagining new answers to old questions as key ways to proceed. However, the researcher needs to be aware of certain other measures such as study designs in order to be able to frame the question. A focus on research design ensures that the study's aims and objectives are completed. Five basic research designs that can be used to adjust the identified research question are defined next. The researcher should identify and maintain all required parameters in the research design of the study as a general rule.

7. BASIC AVAILABLE STUDY DESIGNS

A descriptive design allows the researcher to describe a disease or characteristic of a group of subjects or a case or case series keeping in mind the population, place and time in the research question. For example: "Diabetes Mellitus (DM) among outpatients at a Primary Health Centre (PHC) in the year 2010." Here, DM is population, place is PHC and time period for collection of research data is year 2010. The researcher will collect data on all parameters (age, sex, family history, lifestyle etc.) of DM subjects that register at PHC in 2010 from medical records retrospectively and will describe these characteristics statistically. A researcher may be interested to know the burden of a disease or a characteristic in a population which is called a cross sectional or prevalence design. In this case, the researcher should keep the population, place, time and disease in the research question. For example: "Prevalence of DM at PHC from 2010 to 2011- a cross sectional design". Here, the population is all PHC subjects attending different Out-Patient Departments (OPDs), place is PHC, disease is DM and time is 2010 to 2011. The researcher will collect all the parameters from medical records on whether the subject was having diabetes or not during 2010 to 2011, according to prior clearly identified inclusion/exclusion criteria and will describe them statistically. This type of research can be retrospective or prospective where the researcher collects data only once at a particular point in time.

A researcher may be interested to compare proportions of exposure(s) and non-exposure(s) in diseased and non-diseased groups to know the risk factor(s) of the disease which is called a case-control design or case referent design. The researcher should mention exposure, outcome and population in the research question. For example: "Smoking and lung carcinoma- a case control study". The research design identifies the relation between smoking and lung carcinoma. Hence, some subjects are exposed to smoking and some are not. While the case population refers to those who have lung carcinoma, the control population refers to those who do not have lung carcinoma. The outcome of interest is lung carcinoma which has already happened i.e. case control research is mostly retrospective in nature.

A fourth form of research question comes under cohort design or follow-up design that seeks to know the prognosis or risk factors to follow up for a disease. The research question should mention exposure, outcome and population. This research is generally prospective in nature and the researcher follows up exposed and non-exposed subjects for a particular event to occur. There should be no disease at base line for which subjects are followed up.

Retrospective data can also be accommodated in the study, if all the details with no particular disease are available in records. A simple example for cohort research is: "A four-year cohort study of caries and its risk factors in adolescents with high and low risk at baseline" [5]. Here, adolescent population that do not have any dental caries at base line are divided into two exposure groups, one with high and the other with low risk of caries. All adolescents are going to be followed-up prospectively for four years to know the development of caries.

A fifth form of research question comes from clinical trials. The researcher tries to see safety, efficacy, effectiveness and efficiency of a new drug in phase-0, phase-I, phase-II, phase-III and phase-IV, respectively. Generally, the researcher develops research questions on phase-III clinical trials in academic and research health institutions. The researcher should keep the population, intervention, comparison and outcome parameters in the research question. A simple example of phase-III trial is: "Effect of health counseling on behavioral risk factors in a high risk cardiology population – a randomized control trial" [6]. The researcher wants to see the effect of health counseling on behavioral risk factors in this example, that is, there will be two groups in the research. One group will receive health counseling plus routine treatment and second group will receive only routine treatment. The researcher will measure the effect of health counseling over routine treatment among high risk cardiology patients. It is a randomized control trial which means that the patients will be allocated treatment branches in random but controlled manner.

8. DESIGNING THE STUDY: THE CHECKLIST

Remember, framing a research question is an iterative process that means that a change in the research question changes planning, designing, sampling methods, sample size, data collection and even data analysis for the research topic. Once the research question is ready, the researcher is advised to test it against the formula FINER (*F=Feasibility of the research, I=Interesting to the scientific community, N= Novel to the research, E= Ethically appropriate and R= Relevant for the research*) for its application [4].

Feasibility includes availability of adequate number of subjects, adequate technical expertise, available time, money and manageable capacity to conduct the research. If any one of these items is not adequate, the researcher needs to go back and improve upon the question. It may happen that the researcher does not have adequate number of subjects at the center where the study is being done; other centers may be contacted for recruiting and making up the adequate numbers. If the researcher does not have the technical expertise, then the researcher should contact an expert in that field and try to learn or get help from the expert in the form of consultancy or make the expert a team member to perform the research. Similarly, other problems can be resolved by hiring people or arranging resources for smooth conduct of the research. Sometimes the research question may be too broad and may not be manageable; the researcher should be more specific towards selection of variables and the research question may be narrowed to make it manageable. If the research is too expensive, the researcher may consider less costly research design, fewer subjects and measurements with few follow-ups to make the research within manageable capacity.

Research should be interesting to the scientific community, that is, it should be on a current topic of interest, beneficial to the policy planners and useful for the general public. If it is not interesting, the researcher should consult with the mentor, colleagues and explore literature on the topic for modifying the research question accordingly.

The third characteristic of a good research question is novelty, that is, research should extend previous knowledge, confirming or refuting previous findings or provide new findings.

The research should be ethical, that is, the researcher should take consent from the subjects/ community in just, beneficial and non-exploitative manner before enrolling into research. The subjects' right to privacy and confidentiality of information should be assured and ethically approved by the Institutional Review Board (IRB) in keeping with the guidelines of good clinical Practice.

Research should be relevant, that is, it should be relevant to scientific and clinical knowledge. It should be useful to health policy planners and should also give future directions.

9. DEFINING THE TITLE

In the mentioned example of phase-III clinical trial, the researcher may ask: Does the research title specify the study population? Does it specify the intervention parameters? Does it specify the comparison group and the outcome parameter? If the answers of all these queries are 'yes', the research title or research question is in accordance to research design.

10. CONCLUSION

The article addresses key aspects related to the formulation of a research question before planning a study. However, it is important for a researcher to have a full picture in view before embarking on research. Spending more time on conceptualization and working out the details of the study design leads to less stressful process of conducting the actual research. Some other aspects that the researcher should consider before taking on a research study are the sample size and plan of analysis. Involvement of a statistician at the conceptual level helps in conducting the study systematically. As Fisher (1938) rightly pointed out in his Presidential Address to the First Indian Statistical Congress in Calcutta, "To consult the statistician after an experiment is finished is often merely to ask him to conduct a *post mortem* examination. He can perhaps say what the experiment died of." [7] Thus, it is important that much thinking goes in before the study begins. Often the researcher is in a hurry to begin research and overlooks essential questions that hamper quick conduct of study. A well-conceptualized study saves time and uses resources effectively and efficiently.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Gracie WA, Ransohoff DF. The natural history of silent gallstones the innocent gallstone is not a myth. N Eng J Med. 1982;307:798-800.
2. Hulley SB, Cummings SR, Browner WS, Grady DG, Newman TB. Designing clinical research. 3rd ed. Philadelphia (PA). Lippincott Williams and Wilkins; 2007.

3. Chandra A. GlaxoSmithKline, Panadol 50 years. (Access on 23/03/ 2014). Available: <http://gsk.com.my/docs/Panadol%20Booklet.pdf>
4. Kaplan DA. Beyond the mammogram: Molecular Breast Imaging Emerges, Diagnostic imaging; 2011. (Access on 23/03/2014). Available: <http://www.physicianspractice.com>
5. Kallestal C, Fjelddahl A. A four –year cohort study of caries and its risk factors in adolescents with high and low risk at baseline. Swed Dent J. 2007;31(1):11-25.
6. Harting J, Van Assema P, Van Limpt P, Gorgels T, Van Ree J, Ruland E, Vermeer F, de Vries NK. Effect of health counseling on behavioral risk factors in a high risk cardiology population – a randomized control trial. Eur J Cardiovasc Prev Rehabil. 2006;13(2):214-21.
7. Fisher RA. Presidential address: The first session of the Indian statistical conference, Calcutta. Sankhya. 1938;4(1):14-17.

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