

Review Article

Formulation of Research Question – Stepwise Approach

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ABSTRACT

Formulation of research question (RQ) is an essentiality before starting any research. It aims to explore an existing uncertainty in an area of concern and points to a need for deliberate investigation. It is, therefore, pertinent to formulate a good RQ. The present paper aims to discuss the process of formulation of RQ with stepwise approach. The characteristics of good RQ are expressed by acronym “FINERMAPS” expanded as feasible, interesting, novel, ethical, relevant, manageable, appropriate, potential value, publishability, and systematic. A RQ can address different formats depending on the aspect to be evaluated. Based on this, there can be different types of RQ such as based on the existence of the phenomenon, description and classification, composition, relationship, comparative, and causality. To develop a RQ, one needs to begin by identifying the subject of interest and then do preliminary research on that subject. The researcher then defines what still needs to be known in that particular subject and assesses the implied questions. After narrowing the focus and scope of the research subject, researcher frames a RQ and then evaluates it. Thus, conception to formulation of RQ is very systematic process and has to be performed meticulously as research guided by such question can have wider impact in the field of social and health research by leading to formulation of policies for the benefit of larger population.

KEYWORDS: Health, hypothesis, policy, research

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INTRODUCTION

A good research question (RQ) forms backbone of a good research, which in turn is vital in unraveling mysteries of nature and giving insight into a problem.^[1-4] RQ identifies the problem to be studied and guides to the methodology. It leads to building up of an appropriate hypothesis (Hs). Hence, RQ aims to explore an existing uncertainty in an area of concern and points to a need for deliberate investigation. A good RQ helps support a focused arguable thesis and construction of a logical argument. Hence, formulation of a good RQ is undoubtedly one of the first critical steps in the research process, especially in the field of social and health research, where the systematic generation of knowledge that can be used to promote, restore, maintain, and/or protect health of individuals and populations.^[1,3,4] Basically, the research can be classified as action, applied, basic, clinical, empirical, administrative, theoretical, or qualitative or quantitative research, depending on its purpose.^[2]

Research plays an important role in developing clinical practices and instituting new health policies. Hence, there is a need for a logical scientific approach as research has an important goal of generating new claims.^[1]

CHARACTERISTICS OF GOOD RESEARCH QUESTION

“The most successful research topics are narrowly focused and carefully defined but are important parts of a broad-ranging, complex problem.”

A good RQ is an asset as it:

- Details the problem statement
- Further describes and refines the issue under study

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- Adds focus to the problem statement
- Guides data collection and analysis
- Sets context of research.

Hence, while writing RQ, it is important to see if it is relevant to the existing time frame and conditions. For example, the impact of “odd-even” vehicle formula in decreasing the level of air particulate pollution in various districts of Delhi.

A good research is represented by acronym FINERMAPS⁵

- Feasible
- Interesting
- Novel
- Ethical
- Relevant
- Manageable

- Appropriate
- Potential value and publishability
- Systematic.

FINERMAPS

Feasible

Feasibility means that it is within the ability of the investigator to carry out. It should be backed by an appropriate number of subjects and methodology as well as time and funds to reach the conclusions. One needs to be realistic about the scope and scale of the project. One has to have access to the people, gadgets, documents, statistics, etc. One should be able to relate the concepts of the RQ to the observations, phenomena, indicators, or variables that one can access. One should be clear that the collection of data and the proceedings of project can be completed within the limited time and resources available to the investigator. Sometimes, a RQ appears feasible, but when fieldwork or study gets started, it proves otherwise. In this situation, it is important to write up the problems honestly and to reflect on what has been learned. One should try to discuss with more experienced colleagues or the supervisor so as to develop a contingency plan to anticipate possible problems while working on a RQ and find possible solutions in such situations.

Interesting

This is essential that one has a real grounded interest in one’s RQ and one can explore this and back it up

Table 1: Potential problems and solutions while making research question

Problem	Solution
Too broad	Specify lesser variables; narrow the question
Not enough subjects	Expand inclusion criteria; modify exclusion criteria; add other sources; lengthen study time
Methods beyond skill of investigator	Collaborate; learn skills
Too expensive	Fewer subjects/measurements; less expensive measurements; fewer follow-ups
Not interesting/relevant	Consult with mentor/peers; modify research Q

Table 2: Examples of few bad (left-hand side column) and few good (right-hand side) research questions

Bad examples of research question	Good examples of research question
Very narrow: What is the protein-energy malnutrition in schoolchildren in Delhi? This is too narrow because it can be answered with a simple statistic. Questions that can be answered with a “yes” or a “no” should also typically be avoided	Less narrow: How does the education level of the parents impact protein-energy malnutrition in schoolchildren of Delhi? This question is more specific will lead to more meaningful research and the results would provide the opportunity for an argument to be formed
Unfocussed: What are the effects of protein-energy malnutrition in schoolchildren in New Delhi? This question is so broad that research methodology would be very difficult and the question is too broad to be discussed in a typical research paper	More focused: How does protein-energy malnutrition among children affect academic performance in elementary schoolchildren in Delhi? This question has a very clear focus for which data can be collected, analyzed, and discussed
Very objective: How much time do young children in Delhi spend doing physical activity per day? This question may allow the researcher to collect data but does not lend itself to collecting data that can be used to create a valid argument because the data is just factual information	More subjective: What is the relationship between physical activity levels and childhood obesity? This is a more subjective question that may lead to the formation of an argument based on the results and analysis of the data. It is interesting and relevant too
Too simple: How are school systems in various schools of Delhi addressing childhood behavioral problems? This information can be obtained without the need to collect unique data. The question could be answered with a simple online search and does not provide an opportunity for analysis	More complex: What are the effects of intervention programs in the elementary schools on the rate of childhood psychological health among 6 th - 9 th -grade students? This question is more complex and requires both investigation and evaluation which will lead the research to form an argument that may be discussed. It is interesting and relevant

with academic and intellectual debate. This interest will motivate one to keep going with RQ.

Novel

The question should not simply copy questions investigated by other workers but should have scope to be investigated. It may aim at confirming or refuting the already established findings, establish new facts, or find new aspects of the established facts. It should show imagination of the researcher. Above all, the question has to be simple and clear. The complexity of a question can frequently hide unclear thoughts and lead to a confused research process. A very elaborate RQ, or a question which is not differentiated into different parts, may hide concepts that are contradictory or not relevant. This needs to be clear and thought-through. Having one key question with several subcomponents will guide your research.

Ethical

This is the foremost requirement of any RQ and is mandatory to get clearance from appropriate authorities before stating research on the question. Further, the RQ should be such that it minimizes the risk of harm to the participants in the research, protect the privacy and maintain their confidentiality, and provide the participants right to withdraw from research. It should also guide in avoiding deceptive practices in research.

Relevant

The question should of academic and intellectual interest to people in the field you have chosen to study. The question preferably should arise from issues raised in the current situation, literature, or in practice. It should establish a clear purpose for the research in relation to the chosen field. For example, filling a gap in knowledge, analyzing academic assumptions or professional practice, monitoring a development in practice, comparing different approaches, or testing theories within a specific population are some of the relevant RQs.

Manageable (M): It has the similar essence as of feasibility but mainly means that the following research can be managed by the researcher.

Appropriate (A): RQ should be appropriate logically and scientifically for the community and institution.

Potential value and publishability (P): The study can make significant health impact in clinical and community practices. Therefore, research should aim for significant economic impact to reduce unnecessary or excessive costs. Furthermore, the proposed study should exist within a clinical, consumer, or policy-making context that is amenable to evidence-based change.

Above all, a good RQ must address a topic that has clear implications for resolving important dilemmas in health and health-care decisions made by one or more stakeholder groups.

Systematic (S): Research is structured with specified steps to be taken in a specified sequence in accordance with the well-defined set of rules though it does not rule out creative thinking.

Example of RQ: Would the topical skin application of oil as a skin barrier reduces hypothermia in preterm infants? This question fulfills the criteria of a good RQ, that is, feasible, interesting, novel, ethical, and relevant.

Types of research question

A RQ can address different formats depending on the aspect to be evaluated.^[6] For example:

- Existence: This is designed to uphold the existence of a particular phenomenon or to rule out rival explanation, for example, can neonates perceive pain?
- Description and classification: This type of question encompasses statement of uniqueness, for example, what are characteristics and types of neuropathic bladders?
- Composition: It calls for breakdown of whole into components, for example, what are stages of reflux nephropathy?
- Relationship: Evaluate relation between variables, for example, association between tumor rupture and recurrence rates in Wilm's tumor
- Descriptive—comparative: Expected that researcher will ensure that all is same between groups except issue in question, for example, Are germ cell tumors occurring in gonads more aggressive than those occurring in extragonadal sites?
- Causality: Does deletion of p53 leads to worse outcome in patients with neuroblastoma?
- Causality—comparative: Such questions frequently aim to see effect of two rival treatments, for example, does adding surgical resection improves survival rate outcome in children with neuroblastoma than with chemotherapy alone?
- Causality—Comparative interactions: Does immunotherapy leads to better survival outcome in neuroblastoma Stage IV S than with chemotherapy in the setting of adverse genetic profile than without it? (Does X cause more changes in Y than those caused by Z under certain condition and not under other conditions).

How to develop a research question

- Begin by identifying a broader subject of interest that lends itself to investigate, for example, hormone levels among hypospadias
- Do preliminary research on the general topic to find out what research has already been done and what literature already exists.^[7] Therefore, one should begin with "information gaps" (What do you already know about the problem? For example, studies with results on testosterone levels among hypospadias)
- What do you still need to know? (e.g., levels of other reproductive hormones among hypospadias)
- What are the implied questions: The need to know about a problem will lead to few implied questions. Each general question should lead to more specific questions (e.g., how hormone levels differ among isolated hypospadias with respect to that in normal population)
- Narrow the scope and focus of research (e.g., assessment of reproductive hormone levels among isolated hypospadias and hypospadias those with associated anomalies)
- Once question has been framed, one should evaluate it. This is to realize if these would be effective RQs or if they need more revising
 - Is RQ clear? With so much research available on any given topic, RQs must be as clear as possible in order to be effective in helping the writer direct his or her research
 - Is the RQ focused? RQs must be specific enough to be well covered in the space available
 - Is the RQ complex? RQs should not be answerable with a simple "yes" or "no" or by easily found facts. They should, instead, require both research and analysis on the part of the writer
 - Is the RQ one that is of interest to the researcher and potentially useful to others? Is it a new issue or problem that needs to be solved or is it attempting to shed light on previously researched topic
 - Is the RQ researchable? Consider the available time frame and the required resources. Is the methodology to conduct the research feasible?
 - Is the RQ measurable and will the process produce data that can be supported or contradicted?
 - Is the RQ too broad or too narrow?
- Create Hs: After formulating RQ, think where research is likely to be progressing? What kind of argument is likely to be made/supported? What would it mean if the research disputed the planned argument? At this step, one can well be on the way to have a focus for the research and construction of a thesis. Hs consists of more specific predictions about the nature and direction of the relationship between two variables. It is a

predictive statement about the outcome of the research, dictate the method, and design of the research^[1]

- Understand implications of your research: This is important for application: whether one achieves to fill gap in knowledge and how the results of the research have practical implications, for example, to develop health policies or improve educational policies.^[1,8]

Brainstorm/Concept map for formulating research question

- First, identify what types of studies have been done in the past?
- Is there a unique area that is yet to be investigated or is there a particular question that may be worth replicating?
- Begin to narrow the topic by asking open-ended "how" and "why" questions
- Evaluate the question
- Develop a Hypothesis (Hs)
- Write down the RQ.

Writing down the research question

- State the question in your own words
- Write down the RQ as completely as possible.

For example, Evaluation of reproductive hormonal profile in children presenting with isolated hypospadias)

- Divide your question into concepts. Narrow to two or three concepts (reproductive hormonal profile, isolated hypospadias, compare with normal/not isolated hypospadias–implied)
- Specify the population to be studied (children with isolated hypospadias)
- Refer to the exposure or intervention to be investigated, if any
- Reflect the outcome of interest (hormonal profile).

Another example of a research question

Would the topical skin application of oil as a skin barrier reduces hypothermia in preterm infants? Apart from fulfilling the criteria of a good RQ, that is, feasible, interesting, novel, ethical, and relevant, it also details about the intervention done (topical skin application of oil), rationale of intervention (as a skin barrier), population to be studied (preterm infants), and outcome (reduces hypothermia).

Other important points to be heeded to while framing research question

1. Make reference to a population when a relationship is expected among a certain type of subjects
2. RQs and Hs should be made as specific as possible
3. Avoid words or terms that do not add to the meaning of RQs and Hs
4. Stick to what will be studied, not implications

5. Name the variables in the order in which they occur/will be measured
6. Avoid the words significant/“prove”
7. Avoid using two different terms to refer to the same variable.

Some of the other problems and their possible solutions have been discussed in Table 1.

GOING BEYOND FORMULATION OF RESEARCH QUESTION—THE PATH AHEAD

Once RQ is formulated, a Hs can be developed. Hs means transformation of a RQ into an operational analog.^[1] It means a statement as to what prediction one makes about the phenomenon to be examined.^[4] More often, for case-control trial, null Hs is generated which is later accepted or refuted.

A strong Hs should have following characteristics:

- Give insight into a RQ
- Are testable and measurable by the proposed experiments
- Have logical basis
- Follows the most likely outcome, not the exceptional outcome.

EXAMPLES OF RESEARCH QUESTION AND HYPOTHESIS

Research question-1

- Does reduced gap between the two segments of the esophagus in patients of esophageal atresia reduces the mortality and morbidity of such patients?

Hypothesis-1

- Reduce d gap between the two segments of the esophagus in patients of esophageal atresia reduces the mortality and morbidity of such patients
- In pediatric patients with esophageal atresia, gap of <2 cm between two segments of the esophagus and proper mobilization of proximal pouch reduces the morbidity and mortality among such patients.

Research question-2

- Does application of mitomycin C improves the outcome in patient of corrosive esophageal strictures?

Hypothesis-2

In patients aged 2–9 years with corrosive esophageal strictures, 34 applications of mitomycin C in dosage of 0.4 mg/ml for 5 min over a period of 6 months improve the outcome in terms of symptomatic and radiological relief. Some other examples of good and bad RQs have been shown in Table 2.

RESEARCH QUESTION AND STUDY DESIGN

RQ determines study design, for example, the question aimed to find the incidence of a disease in population will lead to conducting a survey; to find risk factors for a disease will need case-control study or a cohort study. RQ may also culminate into clinical trial.^[9,10] For example, effect of administration of folic acid tablet in the perinatal period in decreasing incidence of neural tube defect. Accordingly, Hs is framed.

Appropriate statistical calculations are instituted to generate sample size. The subject inclusion, exclusion criteria and time frame of research are carefully defined. The detailed subject information sheet and pro forma are carefully defined. Moreover, research is set off few examples of research methodology guided by RQ:

- Incidence of anorectal malformations among adolescent females (hospital-based survey)
- Risk factors for the development of spontaneous pneumoperitoneum in pediatric patients (case-control design and cohort study)
- Effect of technique of extramucosal ureteric reimplantation without the creation of submucosal tunnel for the preservation of upper tract in bladder exstrophy (clinical trial).

The results of the research are then be available for wider applications for health and social life

CONCLUSION

A good RQ needs thorough literature search and deep insight into the specific area/problem to be investigated. A RQ has to be focused yet simple. Research guided by such question can have wider impact in the field of social and health research by leading to formulation of policies for the benefit of larger population.

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Conflicts of interest

There are no conflicts of interest.

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