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Review Article

How to Design a Relevant Research Question: A Guideline Proposal for Researchers

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Abstract

Objective: Solving problems and addressing unanswered questions in the scientific community are the main motivators for the continuous development of research in the health sciences. Designing scientific research involves several phases in the development of the initial research proposal. Before a proposal begins, the researcher must determine the research question they aim to answer, addressing gaps in the literature, filling possibles bias in previous studies or confirming pre-existing results. Determining a relevant and scientifically impactful research question is the foundation for outlining a significant research proposal that can generate meaningful results for the scientific community. Despite the methodological advancements currently available and the importance of determining a research question, which is the foundation for any scientific study, the literature is scarce in studies that guide researchers to design a relevant research question that provides the fundamental information needed to initiate a research proposal with potential for publication and citation. This short communication aims to develop a guideline to assist in formulating a relevant, powerful, and systematic research question, and enable the scientific community to continue its development by focusing on more relevant research and unanswered questions, thus increasing the publication and citation potential of their studies.

Conclusion: Designing a relevant and objective question will help researchers optimize the start of their study. Formulating a well-structured question is the first step in building research aimed at answering important questions for the development of well-designed studies, which will consequently facilitate approval by ethics committees and, later, acceptance in high-impact scientific journals.

Keywords: Guideline; Health Science; Research design; Research and Development Projects

Abbreviations

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analysis; SR: Systematic Reviews; MA: Meta-Analysis; PRISMA-SCR: Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Review; STROBE: Strengthening the Reporting of Observational Studies in Epidemiology; CONSORT: Consolidated Standards of Reporting Trials; CRIS: Checklist for Reporting In-vitro Studies

Introduction

Solving problems and addressing unanswered questions in the scientific community are the main motivators of research's continuous development of research in health sciences [1]. Designing scientific research involves several phases in developing the initial research proposal. The research proposal should be clear, specific, and systematic objective related to the study's field [1]. Before a

proposal begins, the researcher must determine the research question they wish to answer, addressing gaps in literature, filling possibles bias in previous studies or confirming previous results.

Determining a relevant and scientifically impactful research question is the foundation for outlining a significant research proposal that can achieve meaningful results within the scientific community [1]. The research question has 7 main goals: 1- guide the initial literature search ; 2- identify gaps in the area of interest; 3- identify biases in previous studies and propose a methodology improving internal and external validity; 4- confirm or counter previous results in the same interest field; 5- demonstrate to ethics committees that the study is relevant and will lead scientific gains; 6- show the scientific community the study's importance in advancing its field of interest; 7- create reader's interest to access the study and motivate future studies to use it as a reference [1,2].

The literature is vast with different types of studies, diverse methodologies and outcomes that can be achieved within a study proposal, and scientifically recognized guidelines for conducting each type of study. Guidelines such as PRISMA, used systematic reviews (SR), and meta-analyses (MA) [3,4], PRISMA-SCR, applied in scoping reviews [5], STROBE [6] for the design, conduct, and writing of retrospective studies, and CONSORT [7], for clinical trials, as well as CRIS Guidelines for in vitro studies [8]. These guidelines have been crucial for increasing the level of scientific evidence in several types of studies, guiding researchers in the systematic conduct of research, facilitating the identification of biases by reviewers, and providing the scientific community with an universal standard communication on the best practices for scientific research.

However, despite the methodological advancements currently available and the importance of determining a research question, which is the foundation for any scientific study, the literature is scarce in studies that guide researchers to design a relevant and powerful research question that provides the basic information needed to initiate a relevant research proposal.

Objective

This short communication aims to develop a guideline with the steps to be followed to assist in designing a relevant, powerful, and systematic research question, and enable the scientific community to continue its development by focusing on more relevant research to unanswered questions, thus increasing their studies' publication and citation potential.

Designing a research question

Determine population and type of study

The research question should be coherent, direct, free of interpretation, and should reflect the main objective of the study [1]. The researcher must consider that their question should calls up the attention of reviewers and readers regarding the relevance of the study. However, it should not anticipate the methodologies applied, expected results, or future directions. These aspects of the research should be addressed after the study is completed in the text to be published.

The primary principle on determining a research question is defining the field of interest for the study. Once the field of interest is defined the first step to consider, when determining the research question, is the population and type of study to be conducted [9]. Research in health science can be conducted in humans, animals, and laboratory settings.

Human study

Conducting a human study, it is necessary to determine the characteristics of the research participants and the factors that will guide the course of the study. Age range should be considered and explicitly stated in the research question. Thus, terms of age classification, such as newborns, infants or pediatric, adolescents, adults, young adults, and elderly, should follow the age range criteria for each group [10,11].

Human study should always define the participants' gender to be included, based on the expected outcome. Some studies may focus only male patients [11], only female patients [10], or both genders [12]. This information may seem insignificant, but allows an easier development, not only in formulating the question but also in the study design, reducing selection bias.

Finally, if the study to be conducted involves interference or aims to assess a specific local or systemic condition, this informa-

tion should be clear in the final question and later described in the research proposal and manuscript [10]. If the study's goals are not to assess a specific disease, but comorbidities and pathologies may interfere with the outcome to be evaluated, there is no need to include it in the question. However, these should be properly described as inclusion and exclusion criteria.

Animal studies

The availability of conducting research in animals varies depending on animal species and size to be studied. Determining it, in the research question, will facilitate the design, execution, and both external and internal validity of the study. Once this variable is determined, the sex of the animals must also be specified and described in the question, depending on the research goal, the sex of the animal may interfere with the results, leading to study's selection bias [13].

Laboratorial studies

In laboratory setting studies, the researcher must first determine the type of analysis to be conducted, such as material resistance, biofilm development on a specific surface, analysis of microorganism growth or inhibition on a specific material, among others. Once the experimental model is defined, the researcher must decide which laboratory method will be used to guide the structure of the research question [15].

Literature screening in the last 10 years.

Once the population of interest and the type of study to be conducted are defined, an initial literature search, in indexed databases, should be conducted, covering the last 10 years to identify studies that may have addressed the same question. In this context, two situations may be found:

If the initial literature search does not identify any studies or only a few studies with the same research focus, the proposed question is feasible and relevant. However, the researcher may identify multiple similar studies to the initial proposal. In this scenario, the following alternatives will assist in formulating the research question.

Conduct a search for SR and MA on the interest field.

If SR and MA related to the interest area are not identified, it is suggested to conduce a SR and MA, as this study design not only provides high scientific evidence and strong publication potential but also offers data for the researcher to identify gaps in the literature and possible biases in previous studies. Identifying the gaps and biases in the studies found during this systematic search will guide the next steps in the research question and direction.

If the researcher identifies one or more reviews on the topic of interest, the authors should access the studies included in reviews, which will guide the research question, and it may follow the following steps.

The researcher can keep the interest field and propose a new research method focusing on obtaining different results from those previously published.

Reproduce the previously conducted methodology to analyze the reproducibility of earlier methodologies, confirming or counter the expected results with those previously available in the literature.

Perform an innovative operative technique compared to previously published studies, and compare the results obtained in your study with earlier studies.

Bias Identification in previous studies and suggest an innovative topic.

If biases in previous studies are not identified, the researcher can follow the methodologies previously described to confirm or counter the results already published.

However, if potential biases are identified, the researcher should

- Keep the interest field and methodology previously described and fill the identified biases.
- Keep the interest field and propose a research question focusing on suggesting an innovative method.

Comparisons

The main goal of research is to achieve an outcome, it is essential to researchers define which comparison will be conduce [15]. Although, control group definition is more related to methodology designing, it is suggested that when determining the research question, the researcher should define whether a control group will exist and how it will be conducted [15].

Outcome

At the end of the entire research question designing process, the researcher should consider the primary study's outcome [4]. Understanding the state of the art of the topic to be analyzed will allow the researcher to propose the possible outcome on their research and assess whether the proposed outcome is relevant in the literature. A low relevant outcome will result in greater difficulty obtaining approval from ethics committees and ultimately limit publication acceptance. Finally, proposing a high-impact outcome when designing the research question will save the research team time and financial resources avoiding proposals that are not viable or low scientific interest. Table 1 outlines the guideline to be followed during the formulation of a research question and Figure 1 shows the flowchart to be followed by researchers in determining their question.

	Item #	Recommendation
Population and study model to be conduce	1	(a) Humans:
		(a1) Age range;
		(a2) Gender;
		(a3) Identify local and systemic alterations that may interfere with your research;
		(b) Animals;
		(c) Laboratorial;
Review of previous publications related to the area of interest (last 10 years)	2	(a) Absence or few studies; Feasible proposal;
		(b) Many associated studies: Search for SR and MA on the topic:
		(b1) If there are no SR and MA, consider conducting an SR and MA to identify the gaps and biases in the existing studies;
		(b2) RS e MA published, review the methodology and outcomes of the included studies to guide your proposal; (b2.1) Propose new methodology; (b2.2) Confirm methodology reproductibility; (b2.3) Suggest a new operative technique;
Identify biases in similar proposals and present an innovative proposal	3	(a) Not identified: Replicate the methodology to confront or confirm the results
		(b) Bias identified: (b.1) Keep the interest field filling the gaps; (b.2) Keep the interest field with an innovative methodology;
Comparisons	4	Chose a control group;
Outcomes	5	Determine a scientific relevant outcome;

Table 1: Guideline to be followed in research question design.

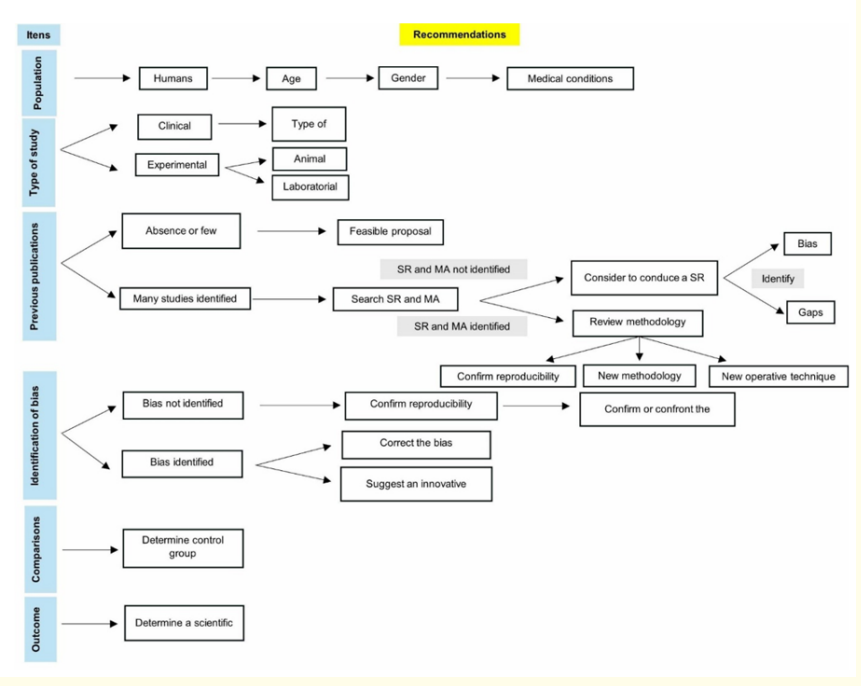

Figure 1: Flowchart to be followed by researchers in determining their questions.

Conclusion

Designing a relevant and objective question will help researchers optimize the start of their study. Formulating a well-structured question is the first step in building research aimed at answering important questions for the development of well-designed studies, which will facilitate approval by ethics committees and, later, acceptance in high-impact scientific journals.

Author Contributions

- **Gustavo Faria Cerqueira:** Conceptualization, literature screening, literature data analysis, writing-review and editing.
- **Kelly Regina Micheletti Cerqueira:** Conceptualization, writing-review and editing.
- **Sandrine Bittencourt Berger:** Conceptualization, table and image design, final review.

Conflicts of Interest Statement

The authors declare no conflict of interest.

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