

**FORMULATION OF RESEARCH QUESTIONS FOR DIFFERENT STUDY DESIGNS****¹Godfrey M. Limungi and ^{2,*}Festus M. Muriuki**¹Lecturer Nursing Department, Kenya Medical Training College Lodwar Kenya²Lecturer School of Nursing Sciences, Meru University of Science and Technology Meru Kenya**Received 14th April 2023; Accepted 17th May 2023; Published online 26th June 2023**

Abstract

Background: Research questions may be said to be related to the study designs. By reading research question, the reader may be able to ‘tell’ what kind of study design the researcher may adopt for the study. In this article, research questions for different study designs and how to formulate them, is discussed. The necessity for this article has been informed by concerns raised by many research students on lack of proper understanding of the concept as discussed by different authors. **Methods:** Discussion is done in a simple, brief and clear manner based on literature review and authors’ experiences as researchers and nurse educators. **Result:** This is a discussion paper. **Conclusion:** In this article, it is noted that research questions are formulated by the researcher based on the problem under the study and study design. Formulation of appropriate research questions for different study designs may be facilitated by the use of PICOT tool.

Keywords: Population, Intervention, Outcome, Control, Time.

INTRODUCTION

Experienced researchers have always argued that a good research is a product of good research questions.¹ A good research question is related to the study design. Thus, appropriate study design will result into good research question(s). However, formulating research question among research students has remained ‘a nightmare’. Many have raised issues with research questions indicating that they don’t understand what research questions are, and how to formulate them. Research questions may be said to be questions asked in the ‘mind’ of the researcher regarding the problem under the study. They are the questions that are formulated by the investigator in relation to the planned study.² These questions are not the ‘ordinary’ questions but are rather specific to the problem under study. They are the foundation step in developing objectives of the study. Research questions are based on the study design and therefore different study designs will have different research questions. By reading the study questions, the reader should be able to get a cue of which study design may be employed by the researcher for the study. Therefore, research questions are not listed somewhere for the researcher to select. They are formulated by the researcher based on the problem under the study, hence the necessity of selecting appropriate study design capable of answering the question(s). They may be said to be the ‘creativity’ of the researcher, because they are his/her imagination.¹ It is the researcher who ‘creates’ them by asking himself/herself on what may be the problem that may need to be answered by the study. Research may have one main question focusing on the main objective of the study, or may have sub questions focusing on specific objectives of the study. For example: In a study on utilization of pain rating scales in paediatric care in a tertiary children’s hospital in Kenya, we may have one main research question or sub questions. The main research question may be the one to be used in coming up with the main objective of the study.

Thus, we may have our main research question being: What is the effectiveness of pain rating scales in pain management among paediatric patients in a tertiary children’s hospital in Kenya? We may also have sub questions which may be used to form specific objectives of the study. Such questions may include: What is the level of knowledge on pain rating scales in paediatric care among the health professionals in a tertiary children’s hospital in Kenya? What is the level of utilization of pain rating scales in paediatric care among the health professionals in a tertiary children’s hospital in Kenya? Therefore as demonstrated in the above study, research question may not necessarily be one. For academic purposes, in African context, research questions are asked focusing on specific objectives of the study and therefore the number of research question should equal the number of specific study objectives. Of importance to note is that whether the researcher has one or many(sub divided)research questions, the element of being specific, clear and focused to the problem under investigation should not miss.¹ Research questions that are properly formulated should not provide “no” or “yes” answers. To avoid such answers, questions starting with: what, how or why may be necessary.³ However, the kind of research question to be formulated will depend on the study design. Thus it may be said that research design is the plan that the author/researcher wishes to use in his/her study. Before the author undertakes any research, he/she should have a well selected study design. This is important because it will direct the investigator on what kind of research questions to be formulated and how the study may be conducted.³ The selected study design must be able to answer the research question for it to be appropriate for the study. Therefore, research designs are selected based on their suitability to answer the research question.² A researcher may select any of the known study design from the epidemiological study designs, based on the suitability and applicability of it in his /her study.⁴ According to Epidemiology, study designs are broadly classified into two main classes which include experimental study design (interventional) and observational study designs. In experimental study designs, the investigator may be said to have control of the study. This is because the exposure group is

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assigned by performing of an intervention either to some of the participants or all of them. Mostly, experimental studies are used when the researcher may be having a goal of testing the efficacy of the subject under the study. It may be the efficacy of a preventive or treatment measure. For example, in a study to determine the effectiveness of steroids in prevention of respiratory distress syndrome in neonates, the investigator may assign pregnant women who are the study participants to receive either dexamethasone (intervention) or standard care of treatment. Assigning is done randomly. Experimental study designs are again classified into two categories, namely: True experimental study design (Randomized clinical trials) and quasi experimental study design (non-randomized clinical trials). The former is more 'powerful' in determining if there is a cause-effect relationship existing between an intervention and outcome than the later. The strength is in randomization process. Observational study designs are also broadly divided into two 'arms' namely: descriptive study designs and analytical study designs. Descriptive study designs are said to lack hypothesis compared to analytical study design which has the hypothesis of the study. Therefore descriptive studies utilize descriptive statistics because they do not seek to prove or disapprove relationship between variables. Example of descriptive study designs may include descriptive cross sectional study designs, case report and case series. Analytical study design has hypothesis. These studies seek to prove or disapprove the relationship between variables and therefore they use inferential statistics to achieve this role. Example of analytical study designs may include cohort study designs, case control studies, correlational studies and analytical cross sectional studies.

Study designs may also be named based on the purpose of the research, the method of data collection, time of data collection, the method of data analysis and type of data involved.² An example of research design based on purpose of the research is descriptive study designs. Using this example, the purpose of the study is to 'describe' hence becoming descriptive study design. Based on time of data collection, data can be collected at a fixed period of time (cross sectional study designs). It can also be taken at different times in a period (longitudinal study designs). In view of longitudinal studies, we may again classify them based on directionality (retrospective longitudinal study designs and prospective longitudinal study designs). In retrospective longitudinal study design, data are collected in 'backward' direction while in prospective longitudinal studies data are collected in 'forward' direction.⁵ All these study designs will have their research questions formulated differently, hence the need of discussing them. Therefore basically, research question should give a hint of what may be the appropriate study design for the study. So how do we formulate research questions?

DISCUSSION

Formulating research question(s)

Most of the research students have had difficulties in formulating research question. However, as we have discussed above, a researcher may need to properly understand his/her study design which is the basis for good research questions. Additionally, researchers have developed a tool that is very useful in formulating research question.⁶ PICOT is a useful tool that can be utilized by researchers in formulating research questions. The tool may be useful in formulating research

questions in almost all of the study designs. PICOT is mnemonic standing for: P=Population (population of interest under study), I=Intervention (an action to which the population of interest is exposed), C=Control (action to which control group is exposed), O= Outcome (variable that is being measured in the study) and T=Time (period over which outcome is being measured). A good research question should be formulated in such a manner that it captures components of PICOT even though some may lack few of the components. Depending on study design, some research questions will have all the component of PICOT. Study designs like RCTs will have all the components while descriptive study designs may lack some of these components. An example of formulating research question using PICOT may be demonstrated in a study on effectiveness of family planning education in Kenya medical training college. In this example, we may have students of Kenya medical training college as the population (P), Family planning education module may be intervention (I), a standard module of training without family planning education may be the control (C), irresponsible pregnancy may be the outcome (O) and the year of study 2022 may be the time (T). Thus, the research question that may be formulated may include: What is the rate of pregnancy (O) between the Kenya medical training college students (P) who received family planning education (I) versus those who did not have family planning education module (C) between January and February 2022 (T)?

The above question is comparing outcome from two different groups and therefore is an example of an interventional study design. The outcome is about rate of pregnancy among two groups of students. Therefore the reader may guess that the study design based on this research question may be cohort study design. The same question can be asked differently in a different study design: What is the effectiveness of family planning education on prevention of pregnancy among the students of Kenya medical training college? The question may be pointing at an experimental study design like true experimental study design or quasi experimental study design. If the same question is asked: What is the prevalence of irresponsible pregnancy among the Kenya medical training college students who have received family planning education? Then the question may be pointing at a descriptive cross sectional study design. If the above three questions are analysed using PICOT, then it may be noted that all the components of PICOT are not fitting in some of the questions. Some questions are lacking the control component while others are having the components which are not following any specific order.

Conclusion

In this article, it is noted that research questions are formulated by the researcher based on the problem under the study and study design. Formulation of appropriate research questions for different study designs may be facilitated by the use of PICOT tool. However, it is not obvious that all components of PICOT will feature in all research questions. Depending on the study design, some questions will have all the components while others will have some. The components may not necessarily follow each other in any order in the question.

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