

Developing great research questions

EARLENE E. LIPOWSKI

Textbooks and successful researchers will tell you that the selection and formulation of a good research question are important, if not the most important, parts of research. Unfortunately, relatively little guidance is available about the genesis of good questions, either from books or mentors.^{1,2} Brilliant research questions do not appear spontaneously, and the ability to pose good questions is not an innate skill; however, the skill can be cultivated and used successfully in conjunction with guidance from colleagues and mentors.

This article addresses three steps for developing great research questions: (1) ask interesting questions, (2) select the best question for research, and (3) turn the research question into a testable hypothesis.

Ask interesting questions

Practitioner–researchers should begin to form research questions by contemplating personal experiences in practice instead of contemplating data.² Data are just one component of answering important questions. Very specific questions are needed to transform data into information that is useful for making decisions and solving problems.

Experienced practitioners may contemplate aspects of their practice

Purpose. The process for developing a good research question is described.

Summary. Three steps comprise the formulation of a great research question: (1) ask interesting questions, (2) select the best question for research, and (3) transform the research question into a testable hypothesis. Research is designed to generate information that cannot be gained from any other source. A research question is a narrow, challenging question addressing an issue, problem, or controversy that is answered with a conclusion based on the analysis and interpretation of evidence. A variety of strategies can be applied to stimulate creative thinking and generate new insights into old problems. A good research question challenges researchers to see matters from a new perspective and to learn something new. Practice research questions are evaluated by the probability of achieving their goal, along

with the potential impact and feasibility of the project. The proposed research must meet important professional and societal goals, fit with the mission of the organization, garner administrative support, and be accomplished with available resources in a reasonable time frame. The research question should be refined to generate one or more hypotheses that specify the nature of the relationships to be observed and measured. Properly formulated questions yield findings to inform decisions that enhance practice, transfer to other settings, and make efficient use of resources.

Conclusion. Developing a good research question is the most important part of the research process. The question should be narrow and address an important issue that fits within the mission of the organization.

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that are unwieldy and problematic, resources that are in short supply or in excess, or outcomes that are disconcerting. Inquisitiveness and creativity are based in both emotion and reason, so good questions arise from both intellectual and visceral responses to the practice environment. Questions to consider may include the following: Have others faced a similar practice problem? Is this a routinely observed occurrence? What circumstances would make the

situation controllable? Good questions challenge us to see matters from a different perspective and learn something new.

New practitioners may capitalize on inexperience by inquiring about policies and procedures. “Work arounds” and quick fixes to complex problems nearly always benefit from investigation. Pet theories and practice traditions with little or no evidence to support them are worth scrutiny. “Why do we do it that way”

The Research Fundamentals section comprises a series of articles on important topics in pharmacy research. These include valid research design, appropriate data collection and analysis, application of research findings in practice, and publication of research results. Articles in this series have been solicited and reviewed by guest editors Lee Vermeulen, M.S., and Almut Winterstein, Ph.D.

may be the most neglected question in practice and one that a novice can legitimately pose to senior colleagues.³ Even well-accepted practices should not be unassailable. For example, practitioners may legitimately ask “What is accomplished by maintaining a formulary?”

Continuous assessment of policies, procedures, and programs is necessary because science and technology can render them obsolete. All programs must demonstrate that they operate satisfactorily and consistently with adequate attention to their long-term maintenance. Periodic audits should question a program’s reach, breadth of adoption, effectiveness, unintended consequences, and effects on patients, practitioners, and other stakeholders.⁴

Case studies and paradoxical incidents are reliable sources of interesting research questions in practice. Attempts to clarify complex relationships, reconcile conflicting results, and account for exceptions to the rule inspire investigations. Relevant questions include “What makes this an interesting case?” “What features are emphasized or omitted when colleagues discuss the case?” “What would it take to generate an alternative outcome?” Making this line of questioning a routine part of practice not only leads to good research questions but enhances the problem-solving skills of the health care team.

Two strategies commonly used in diagnostic investigations lend themselves to identifying potential research questions. First, clinicians commonly consider symptoms in

terms of their frequency, intensity, and duration. Typical questions include the following: How frequently has the symptom or event fallen outside the norm and why? How intense was the symptom or how extreme were the deviations from normal? What was the duration of the symptom? How did symptoms that were long but infrequent differ from symptoms that were of short duration but occurred at frequent intervals?

Secondly, just as patterns, trends, and extreme values in symptoms like heart rate and body temperature provide diagnostic clues, patterns, trends, and outliers in practice spark new insights for investigation. Regularly recorded outcomes should be monitored and examined for trends over time. Patterns that are erratic or predictable not only invite investigation but guide it.

Quality-improvement programs are another source of ideas for research and often make use of creative-thinking strategies for new insights to old problems. Creativity is the process of generating many ideas.⁶

Certain circumstances and habits squelch inquiry or stifle investigations and should be avoided. Overpreparation can diminish creativity.⁵ For example, literature reviews are necessary, but obsessive searching can suppress creative and fresh approaches and consume an inordinate amount of time.

There are circumstances and habits that stimulate thinking and foster innovation that should be sought and encouraged. Sabbaticals, quiet times, Internet surfing, and other seemingly aimless pursuits, whether long or short, contribute to the creative process.⁷ Researchers should nurture new insights by having a wide variety of interests and pursuing related and unrelated hobbies and pastimes. Similarly, introspection should be used to recognize and overcome personal mental barriers.⁷

A final bit of advice is to keep an open mind and be prepared for the unexpected. A reporter writing about successful researchers summed it up well: “Discoveries rely very little on blind luck or grand strokes of genius and much more on solid logic, a talent for comparison and a mind so steeped in a discipline that it can recognize an unexpected clue for what it’s worth.”⁸

Identify a good research question

Not all interesting questions make good research questions. Research generates conclusions based on an analysis of evidence. For example, “Are the prices charged by the XYZ pharmaceutical company fair?” is not a research question, because the answer rests on individual attitudes and beliefs. A question that can be answered by gathering evidence might be “What are the best measures for reducing the prices of drugs that our organization purchases from company X?”⁹

Questions about study design rather than the underlying issue or problem are not research questions. A research question is a logical statement that progresses from what is known or believed to be true to that which is unknown and requires validation.

Some questions are too broad and must be broken down into a logical series of steps. Rather than asking what can be done to reduce the amount of medications that are wasted each year in the United States, a more precise and manageable question is, “What can be done in our institution to reduce the number of intravenous preparations that are not used before their expiration date?” The latter question clearly expresses a precise locale and scope for study.¹⁰

Research has a purpose and objectives. The research question is the purpose stated in the form of a question.⁹ Research objectives specify exactly what is to be done to achieve the purpose. Both the purpose and

objectives are clear and unambiguous: What do we need to know and why?

Meaningful inquiry ignores details and gets to the heart of the issue. One technique is to ask “why” five times in succession. Why did the patient have a poor outcome? If the answer is because she received the wrong treatment, the second question is “Why did she receive the wrong treatment?” If the answer is that the clinician was not aware of new information, then the third question becomes “Why was the clinician not aware of the new information?” The process continues through at least five iterations until questions about root causes are revealed.

Priorities are a consideration in all types of research but practice research warrants specific consideration. “[Practice] researchers must be sufficiently involved in the life of the target community to have some idea of which topics are of interest and which individuals might be called together to discuss them.”¹¹

Practice-based research has characteristics that fit and use the unique strengths of a practice setting. Primary care settings, for example, are well suited for longitudinal studies that depend on the therapeutic relationship between patient and professional and incorporate knowledge of the patient’s social environment.⁴

The goal of most practice research is to foster change. Organizational “buy in” is needed to accomplish this goal. It requires a commitment from administrators and colleagues to support the research plan and act on any findings.

A formal meeting with administrators and any decision-makers should be held to discuss the need for the project, identifying at least one priority population that will benefit from the project. The group must agree on project logistics and the amount of time and money available for the research. A supportive administrator will propose viable responses

to the project’s results. Researchers must understand the information that the administrator needs and acquire data to meet those needs.

One way to ensure that a question is important is to examine the four s’s: size, scope, scalability, and sustainability.¹² Size—more precisely, effect size—refers to the magnitude of the effect that can be produced by an intervention. Scope is concerned with the extent to which existing program activities could be affected. Scalability suggests that the results have the potential for expansion to a substantial outcome through a series of graded steps. Sustainability takes the potential for long-term support of a program into account. Different stakeholders or decision-makers may have different sets of priorities. For example, cost-effectiveness is a common requirement of both managers and administrators.

Although it is difficult to identify sound research questions, an inquiring mind and inquisitive attitude frequently produce more questions than can be researched with available time and resources. The proposed project must meet important goals, fit with the mission of the organization, garner administrative support and resources, and be completed within a reasonable time frame.

However, it must be understood that there are times when research should *not* be conducted.¹³⁻¹⁵ If money, personnel, and time are not adequate, it is prudent not to start the project. Sometimes it is possible to scale down a project but only if all parties acknowledge the implications of that decision.^{14,15} If the study has little credibility or is irrelevant to decision-makers or if administrators believe that the answer is already known, there is little justification for pursuing the matter.

Transform research questions to testable hypotheses

A hypothesis is a declarative sentence that predicts the results of a

research study based on existing scientific knowledge and stated assumptions. It is a prediction that answers the research question. Hypotheses are statements that, if true, would explain the researchers’ observations.

A hypothesis specifies a relationship between two or more variables. In practice-based research, a hypothesis typically involves a prediction that a program or a treatment will cause or otherwise be related to a specified outcome. For example, “Patients who receive medication counseling will have greater adherence to the medication regimen” is a hypothesis. It identifies medication counseling and adherence as two variables whose relationship can be observed and measured.^{2,16}

Acknowledging the assumptions associated with the hypotheses is a prerequisite for all studies. Assumptions that are not recognized or acknowledged can lead to research plans and designs that are overly simplified or overly complex and possibly even unnecessary.¹⁷ Interesting research questions always challenge assumptions, and the presence of assumptions confirms that a study poses a sound research question.

It is helpful to think about an investigation in terms of a working model. The dependent variable is the focus of the activity or project. It is the circumstance or problem that is to be affected or changed—in this case, medication adherence. Independent variables, such as medication counseling, are causal factors that appear to influence the issue or problem. They are precursors of the dependent variable. Correlates are variables that can influence the dependent variable and the independent variable and should be noted. Research is structured to examine variables that are critical to the model and feasible to investigate given the time, resources, and characteristics of the participants.

It is the researcher’s responsibility to describe precisely how the vari-

ables of interest will be measured. For example, counseling might be measured as being present or absent, the amount of time spent, or the number of points discussed. The outcome—adherence—might be measured by the number of doses missed as reported by the patient, refills that were obtained according to the dispensing record, the proportion of timely doses as measured by an automated pill dispenser, or one of many other options.

The research hypothesis is restated in the form of a null hypothesis to use inferential statistics to evaluate the hypothesis. In this example, the null hypothesis is that there is no relationship between medication counseling and adherence. A statistical test estimates the probability that the null hypothesis is true given the empirical evidence. The null hypothesis is rejected if there is sufficient statistical evidence to do so. Hypotheses make interpretation impartial.

The number of variables in the hypothesis and the nature of their relationship determine the appropriate statistical techniques to test the hypothesis. Statistical tests will be addressed in more detail by future installments in this series.

At this point, it is sufficient to note that the veracity of a hypothesized relationship can never be proven conclusively. The relationship between counseling and adherence, for example, cannot be established with certainty based solely on empirical observation. This is because it is impossible to observe every patient, every prescription medication, and every counseling session to rule out the possibility that the relationship did not hold in one or more instances.

Generally, a project should have no more than three hypotheses. The hypotheses should be stated along with an explanation of the logic with which they were derived. Alternative hypotheses and reasons why they were not selected should be acknowledged.

Inquiries for the purpose of determining facts and describing circumstances may be the reason for some projects. These studies may not require a hypothesis.¹⁸ However, true research involves more than description. Facts are only useful if applied for drawing conclusions and solving problems. Corrective action taken as a result of fact-finding can be research.

Researchers must be prepared for unexpected results. Unexpected results represent the possibility of learning something new about the phenomenon under study. Being wrong occasionally is a good thing, too. It means that our judgments as researchers are fallible and that there is a good reason for conducting research.

Finally, research should not be embarked upon with the idea that the empirical evidence will prove “truth.” Research can only demonstrate the utility of an idea within a specific context.²

Conclusion

Developing a good research question is the most important part of the research process. The question should be narrow and address an important issue that fits within the mission of the organization.

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