An introduction to quantitative and qualitative approaches for researchers

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ABSTRACT

Research is important. It adds to our knowledge base, improves practice, shows which practices are effective and which are not, provides evidence to inform policy debates, and helps us as health professionals become better practitioners. Findings from research are shared at scientific meetings, conferences, and in medical journals such as this one.

To be useful, research must be carried out ethically, with full disclosure of how the data were collected. The researchers must have used appropriate statistical methods to analyse their data. This is vital if we are to draw valid conclusions and potentially change practice.

This paper will discuss quantitative and qualitative approaches used in research studies. By the end of this paper, you should understand the differences between the two approaches, and which is best suited for your planned research.

Introduction

The research process (see Figure 1) typically begins when a topic or issue is identified as of sufficient importance to be worthy of study. Often, the area of interest for research is very broad, and the researcher must focus on a specific topic to study. For example, a study of *'The health of teenagers in South Sudan*' will encompass an extensive range of physical and mental illnesses. It may be better to study a particular illness of concern, such as diabetes mellitus, and focus on a setting where data may be more accessible, for example, *'Characteristics of diabetes mellitus in under 18-year-olds in Juba'.*

Research builds on existing knowledge and not merely replicates previous research. It is essential to become familiar with the literature to understand what is already known about the issue, which is the objective of the planned study. This is the rationale for performing a literature review to locate relevant publications in journals and books. Where available, librarians may assist in this work.

After a review has been completed, the researcher should refine the research question to be answerable by the study. The study of diabetes in under-18-year-olds in Juba, for example, may now be reformulated into a much more focused research study: *Changes in the incidence of type 1 diabetes amongst under-18-year-olds in Juba from 2020 -2024.* A hypothesis can be constructed which can be statistically rejected if the findings are no more likely than a chance effect.

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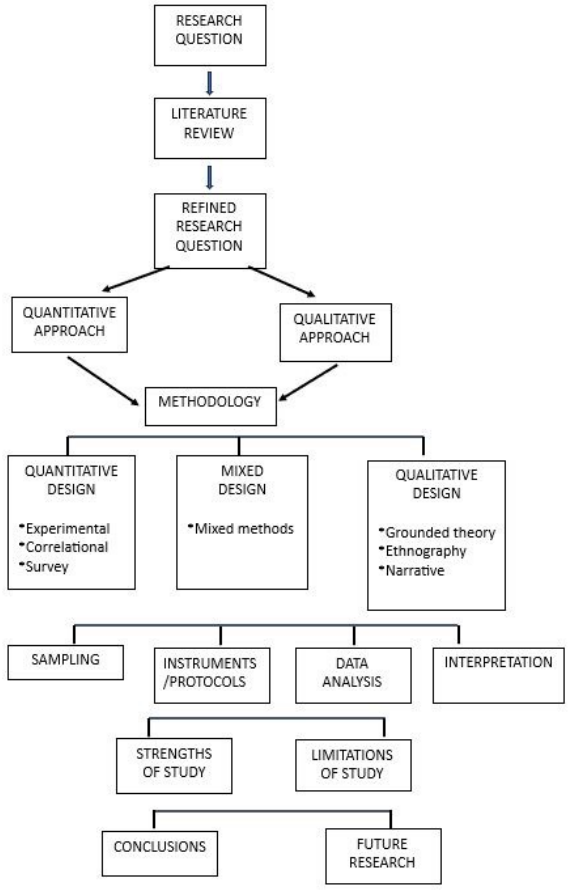

Figure 1. The Research Process

In another example, the researcher may be interested in glycaemic control among under-18-year-old patients with type 1 diabetes. In addition to quantitative measures of control, the investigators might want to explore patients' attitudes toward their condition and aspects of their behaviour.

The research question might be formulated: *Does contact with health professionals in the diabetes team based at Juba Teaching Hospital from 2022- 2023 lead to changes in behaviour and attitude to their condition in under-18-year-olds with type 1 diabetes?* The methodology, in this case, will need to assess behaviour and attitudes and compare them before and after contact with the health professionals. Again, a hypothesis can be generated, and the results analysed to determine the likelihood of any findings being due to chance.

The researcher will need to select either a quantitative or qualitative (or mixed) research approach to address the research question being studied. We will now discuss the characteristics of these approaches.

Quantitative research

Quantitative research is the process of collecting and analysing data. It is widely used to test hypotheses and causal relationships, make predictions, and find results that can be generalised to wider groups of subjects.

The quantitative research approach is used when:

- Describing the research issue that needs addressing in terms of trends or the relationship among variables,
- Creating research questions that are specific, narrow, measurable, and observable,
- Collecting numeric data from large numbers of people using well-validated instruments,
- Analysing trends, comparing groups, or relating variables using statistical analysis, and interpreting results by comparing them with prior predictions and past research,
- Writing the research report using standard evaluation criteria, taking an objective, unbiased approach.

The investigator in *quantitative* research is interested in trends or trying to understand how one variable affects another. The literature review will have identified key variables that are known to be relevant to the planned study and areas of uncertainty or where the evidence is contradictory. The tool used to measure the variable(s) of interest is important, as any limitations or inaccuracies in the measurement will affect the interpretation of the results. The number of participants in the study (the sample size) will determine the 'power' of the study and its generalisability to larger populations.

The appropriate statistical analytic tool must be selected for the study design. It is recommended to seek statistical advice *before* starting a research project to ensure the study can address the research question. The different analytic methods will be discussed more fully in the following paper in this series. In brief, raw data are first sorted and summarised using descriptive analysis. For example, mean, median, mode, range, standard deviation, quartiles, and percentiles.

Descriptive statistics simply describe the data without inferring a relation between one variable and another. Further analysis requires *inferential statistics* to make inferences from the data, such as the probability that an

observed difference between groups might have happened by chance. Statistical tools may be used to make inferences from the sample studied to a much larger population. The different statistical tools will be discussed in the following paper.

In *quantitative* research, it is essential to design studies to control variables that might introduce bias. For example, the selection of participants in a study might introduce bias. When subjects leave the study early, this can introduce bias, as those who remain may be different in important ways, which will have implications when interpreting the results. Bias also occurs when inappropriate statistical tests are used.

Study design measures to help prevent bias include using control groups, randomisation, double-blind design, and placebos. Sponsors of a research study may influence how the data is presented and, in the worst case, suppress critical evidence. Researchers must declare any conflicts of interest or financial relationships with the sponsor.

Types of quantitative research

Quantitative research produces objective data that can be analysed to identify trends and associations. In *intervention studies* (also known as experimental designs) such as clinical trials, one group receives an intervention, which is compared with a control group. Statistical analysis determines the likelihood of the results being more than just a chance effect. The results help to support or disprove the study's original hypothesis.

In a *correlational research study*, a single group of individuals may be studied to determine the relationship between variables of interest. Such studies can be prospective (longitudinal), where events are measured over time or cross-sectional at one specific point in time.

Cross-sectional studies are relatively quick to perform and are used to determine prevalence. By contrast, longitudinal studies are more likely to suggest a cause-and-effect relationship, although there is always the possibility that hidden variables account for the observed effects. For example, researchers might investigate the association between glucose levels and the development of diabetic foot ulcers in a cohort of patients with diabetes. The strength of the association can be statistically assessed, and the result is used to predict this complication more generally in larger populations of similar patients.

When no intervention is planned, no association is sought, and investigators are simply interested in trends, a *survey design* may be appropriate. A representative sample of the population of interest is surveyed to identify trends that can then be generalised to a larger group.

Quantitative research has the great advantage of objectivity. The results can be rapidly analysed and clearly communicated through statistics. However, it is unsuitable for some types of research.

However, participants cannot enlarge upon their responses or add context to explain their choices. The patient's perspective is not studied in this type of research. For example, researchers interested in finding out what it is like living with diabetes would need to adopt a *qualitative* approach to exploring their patients' experiences.

Qualitative research

Qualitative research is primarily concerned with meaning, subjectivity, and lived experience. It is exploratory and attempts to understand behaviour from the perspective of the study participant. Unlike in quantitative research, the qualitative researcher is integral to the research process, interacting with and interpreting what is being said.

Qualitative research is used when:

- Exploring a problem and developing a detailed understanding of a central phenomenon,
- Investigating research relevant to the participants' experiences,
- Collecting data based on words so that the participants' views are obtained,
- Analysing the data for description and themes using textual and thematic analysis,
- Interpreting the larger meaning of the findings takes into account the researchers' subjectivity.

Examples of qualitative research methodology include diary accounts, in-depth interviews, focus groups, and ethnography. For example, *diary* accounts give written accounts of personal experiences and reflections.

Table 1. Comparison of open-ended and closed questions

Open-ended questions	Closed-ended questions
Qualitative	Quantitative
Contextual	Data-driven
Personalised	Pre-determined and created
Exploratory	Focused

Interviews generate qualitative data using open questions (unstructured) or predetermined questions with the opportunity for the interviewer to explore responses further (semi-structured) (See Table 1). Ethnographic research is used in the social and behavioural sciences and consists of collecting data through careful observations, for example, shadowing individuals at work or living in a particular community.

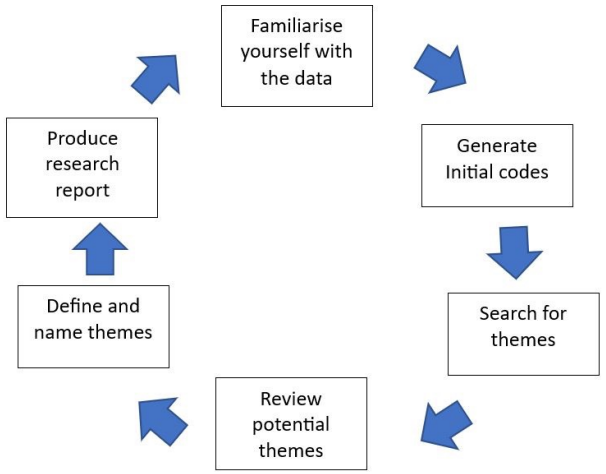

Figure 2. The continuous cycle of thematic analysis (Adapted from Clarke and Braun, 2017- see Further reading)

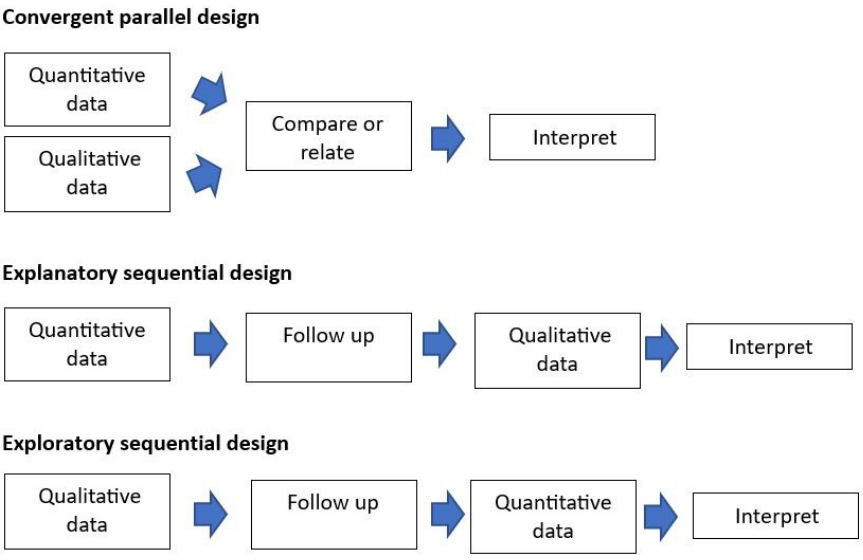

Figure 3. The mixed methods research designs

Various techniques are used to make sense of qualitative data. In thematic analysis, themes will emerge once the data has been coded. The procedure involved in *thematic analysis* is shown in Figure 2. The process starts with familiarising the data, which involves re-reading transcripts and notes and writing down initial ideas. The coding phase entails highlighting or labelling certain words or phrases in the data that will help the researcher make sense of the data. From these codes, themes are derived and reviewed to ensure they cover all the qualitative data.

Themes can be modified depending on how well they fit the data. Once defined, themes can be named, and the researcher can produce a summary report that attempts to interpret the data and draw inferences from it.

Grounded theory methodology collects empirical data, such as interviews or observations of participants. From the transcripts, the researcher looks for themes from which a theory can be derived that is 'grounded' in the results. This methodology is not used to test a hypothesis but rather to generate one.

Content analysis is another technique used in qualitative research to quantify and analyse the presence and relationships of words, themes, or concepts within textual data. The researcher can then make inferences about the messages within the text and what this means for the intended audience. This type of analysis can also be applied to transcripts from interviews.

Mixed methods research

In some study designs, the researcher will collect both qualitative and quantitative data at the same time. For example, a study investigating diabetes care in a particular setting, such as a nursing home, might collect quantitative data, namely glucose readings, HbA1c levels, and frequency of hypoglycaemic episodes, as well as data from qualitative interviews with the residents. This gives a more comprehensive understanding than either method alone. The two approaches need to be integrated to achieve more significant insights, and this process of integration can take place during

data collection, analysis, or the presentation of the results.

The different *mixed methods research designs* are shown in Figure 3. The researcher will need to consider whether to prioritise quantitative or qualitative data for their study (or whether they are both of equal weight) and plan the sequence of data collection:

- Where the study seeks to explain or elaborate on quantitative results (explanatory design), the explanatory sequential design is used.
- By contrast, a study that aims to develop an instrument or tool from qualitative data will use the sequential exploratory design.

Summary

While qualitative and quantitative research approaches are different, they should be considered complementary rather than competing against each other. Qualitative research can help generate theories or models of care that can be tested by quantitative methodology. They are certainly not mutually exclusive, and a mixed methods approach can help deepen understanding of quantitative results.

Both qualitative and quantitative research help healthcare professionals understand the impact and challenges of the care they provide. All health care team members should be encouraged to participate in research.

In the following paper, we will consider basic statistical methods used for data analysis (see page 207)

Further reading

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