ESSENTIALS

RESEARCH AND EVIDENCE-BASED PRACTICE

For Nursing, Health and Social Care Students

VANESSA HEASLIP AND
BRUCE LINDSAY

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About the authors

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Bruce Lindsay worked in health care for over 30 years after qualifying in children's nursing and adult nursing in Sheffield. He was awarded a PhD for his research into the development of the care of children in acute hospitals. He was a Senior Lecturer and Deputy Director of the Nursing and Midwifery Research Unit at the School of Health Sciences, University of East Anglia, until 2012, and was a systematic reviewer for Cochrane for 15 years. He now works as an independent researcher in the field of social history and is also a freelance music journalist.

Introduction

In a country the size of the United Kingdom, around 3 million people are employed in health and social services. These services cost billions of pounds each year and are needed in every community. Most colleges and universities offer courses for students hoping to work in one of the many different health and social care professions, which – between them – employ vast numbers of practitioners.

Health and social care practice is influenced by many factors, including government legislation. It is also affected by local policies and procedures developed by individual companies, Social Services departments or National Health Service Trusts. Some practice is the result of custom, of having been done in a particular way for so long that no one can remember why. However, in contemporary health and social care it is crucial that all practice is 'evidence based' – in other words, it should be based on reliable information or data. As a health or social care practitioner, you are therefore expected to ensure that your practice is evidence based.

Much of the evidence for practice, though not all of it, comes from research. In other words, it comes from organised and deliberate investigations, which produce factual information that can be applied to the organisation and delivery of care. 'Research' and 'evidence-based practice' are therefore vital concepts to understand if you want to work in health and social care practice. Indeed, an understanding and appreciation of research is a professional expectation of health and social care practitioners endorsed by their respective professional bodies. For nurses, this means the Nursing and Midwifery Council (NMC); and for professions allied to medicine and social workers, the Health and Care Professions Council (HCPC). Health and social care practitioners are expected to follow professional guidelines set by their regulatory body to ensure safe practice.

The *Standards of Proficiency for Registered Nurses* (NMC, 2018, p. 8) stipulate that, at the point of registering as a qualified nurse, you must:

- Demonstrate an understanding of research methods, ethics and governance in order to critically analyse, safely use, share and apply research findings to promote and inform best nursing practice
- Safely demonstrate evidence-based practice in all skills and procedures.

For social workers, the *Standards of proficiency – Social workers in England* (HCPC, 2017, p. 13) asserts that you:

- Must be aware of a range of research methodologies
- Recognise the value of research and analysis and are able to evaluate such evidence to inform your own practice
- Should be able to use research, reasoning and problem-solving skills to determine appropriate actions.

This book aims to help you gain this understanding of research and evidence-based practice. We hope that this will enable you to better understand your own practice and to develop skills that will make you a valuable health or social care professional.

The scope of this book

This book will not turn you into a researcher, but we hope that it will help you to become an effective user of research findings and other evidence by helping you to understand what research is, how it's done, what it can and can't tell us and how it can provide evidence for practice.

Part One aims to make sense of the research process: the steps any researcher goes through to develop, carry out and report on a research project. Each chapter focuses on one or two steps in this process, from initial ideas about what to study to the ways in which researchers make their work available to others.

Part Two concentrates on how evidence is used to inform practice. It discusses ways of judging the usefulness of evidence for practice, how you can use it to inform your own practice and how it can be used to influence practice on a national or even global scale. *Chapter 10* looks at ways of ensuring practice quality through audit and evaluation and compares audit and evaluation with research.

Finally, *Chapter 11* discusses the future of research and evidence-based practice in health and social care. Much of this discussion focuses on possible developments in the short to medium term, when many readers of this book will be in their early professional careers. How will research and other evidence affect the ways in which your career develops and the environments in which you may practise?

How you should use this book

You should, of course, read it! It's relatively short, for a textbook, so you could read it from cover to cover without too much difficulty. However, you don't have to read it all from start to finish. Each chapter is self-contained and can be read usefully on its own. Indeed, in order to fit your study needs most effectively, you may want to read some chapters more than others, or perhaps read the chapters in a different order from that in which they are presented.

Each chapter has features which will, we hope, make the book more interesting and make your learning more effective. We've called them 'keys' because they are intended to unlock ideas, to enable you to enter new areas of knowledge, or to act as important clues to help you solve problems.

- ***Key questions*** appear at various points in each chapter, when there are important issues that you need to ask yourself about. Key questions do not necessarily have 'right' or 'wrong' answers. Indeed, in many cases you may not decide on an answer at all. They are brief exercises or prompts for reflection, which you should use to clarify your own ideas and your understanding of research or evidence-based practice.
- ***Key cases*** are short descriptions of real research studies, research activities, care activities or documents, which help to illustrate crucial topics within the text.
- ***Key points*** appear in the chapter summary at the end of each chapter and summarise the most important points. You should feel confident that you understand each key point before you move on.

In addition to these 'keys', each chapter closes with a list of further reading. These lists are not intended to be exhaustive, but to offer you some recommendations about where to go for more detailed information. In most cases the choices should be self-explanatory; where we have listed a publication that is not obviously related to the chapter, we include a brief explanation of our choice. General references within the text can all be found in the complete list of references at the end of the book.

Researchers and policy-makers seem to enjoy using jargon and it is impossible to write a book on research and evidence-based practice without repeating at least some of it. To help you understand this jargon, throughout the book you will find some words or phrases printed in bold **like this**. These terms are defined in the glossary near the end of the book.

An understanding of two terms, in particular, is crucial to your use of this book: 'research' and 'evidence-based practice'. We've used both terms a few times already, but what do we mean by them?

What is 'research'?

People use the word 'research' in two major ways. There is the idea of research as an activity: 'I'm doing research' or 'I'm researching'. There is also the idea of research as a product: 'we're using research' or 'the research tells us to work like this'. In the latter case, we think it is more correct to talk about 'research findings' or 'results', not just 'research'. For this reason, when we refer to the products or outputs of research projects we will usually use the term 'research findings'. Research as a process or activity needs more careful consideration.

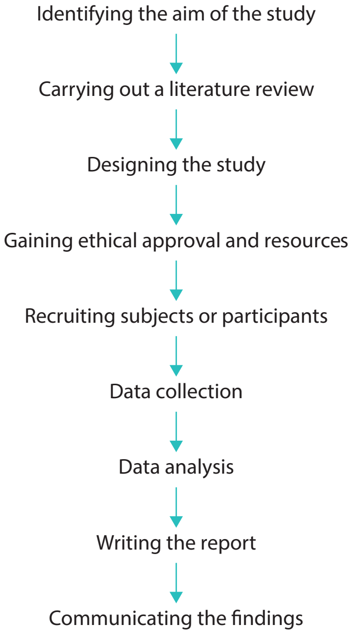
For instance, there is a considerable media focus on obesity in Britain, and how we as a nation are becoming more obese. Let's say we want to explore this further and want to know the weight of the average British resident. We ask all our friends (62 people) their weight in kilograms; we then add up all these weights and divide by 62. We decide that the answer tells us the weight of the average resident of Britain.

- Have we just done some research?
- Are we right to think that our result answers our question?
- If not, what should we have done?

As this example shows, research doesn't have a single definition that everyone agrees on. Some authors use the word 'research' to refer to any systematic inquiry or structured investigation. Others emphasise the need for a question to be answered or a phenomenon or event to be explored or investigated. Some definitions are very short. In preparation for the 2014 Research Excellence Framework (REF), which is used to assess the quality of research carried out in higher education institutions in the UK, research was defined as '…a process of investigation leading to new insights, effectively shared' (Research Excellence Framework, 2012). Meanwhile, Polit and Beck (2012, p. 4) define research as 'systematic inquiry that uses disciplined methods to answer questions and solve problems'. Both these definitions suggest that the ultimate goal of research is to develop, refine and expand a body of knowledge, while also recognising that research is a planned process of inquiry.

The research process

Progressing through the individual stages of a research project, from thinking of the initial idea to communicating the findings to the wider world, is referred to as the 'research process'. The flowchart below is our interpretation of this process: other authors will present you with their own variations. We have used this process as the basic structure for *Part One* of this book, where these different stages are discussed.



The research process – an interpretation.

Evidence-based practice

The term 'evidence-based practice' also needs defining. Many health and social care professionals use it to mean 'practice which is supported by research findings', but this seems to us to be rather too narrow a view. ‘Evidence’ includes more than just the findings of formal research projects. Likewise, simply accepting the results of a particular research study and applying them to every care situation is not an appropriate use of evidence.

There are many definitions of evidence-based practice, or evidence-based medicine, or evidence-based care, or whichever term you care to use. One of the best known is the one proposed by Sackett *et al*. (1997, p. 2), who state that evidence-based practice is ‘the conscientious, explicit and judicious use of current best evidence about the care of individual patients’.

To paraphrase, it involves using the best evidence you have about the most effective care of individuals, using it with the person’s best interests in mind, to the best of your ability and in such a way that it is clear to others that you are doing it. Sackett *et al*. (1997) were specifically discussing medicine, but their definition seems to apply equally well to nursing, social work, midwifery or any other related activity.

It is important to note that Sackett *et al*. (1997) refer to ‘current evidence’, and this is really important, as evidence-based practice is not static; it changes and develops as our understanding of the evidence evolves. For example, years ago, many nurses may have whipped up egg whites and applied them to patients’ pressure areas because, at the time, this was recognised as a good way to aid wound healing. However, this practice is no longer undertaken, as current evidence does not uphold its efficacy. Through your careers as health or social care professionals, your practice will no doubt continue to change and evolve (as ours has) and this is why it is important to keep informed of current evidence.

We also wish to note that Sackett *et al.* (1997) refer to ‘current best evidence’ rather than ‘research evidence’. When we deliver health or social care, we do not always have relevant or applicable research findings available to us. In many situations, we do not have sufficient time to look for research findings; and in other situations, the relevant research has yet to be carried out. In yet other situations, research findings are available, but they are not the ‘best evidence’ for us. To give an example, let’s say research findings suggest that antibiotic X is the best treatment for Mr Bryant’s ear infection. But you know from his medical notes that Mr Bryant is allergic to antibiotic X. Which evidence would you place most importance on when planning Mr Bryant’s care?

So if evidence can come from more than research findings, what other sources should we consider? The World Health Organization (2017) suggests that in making decisions about evidence-based practice in health and social care we need to consider: the best available evidence, the environment in which the care is provided, the individual person’s values and preferences, and the professional judgement of the individual providing the care. These sources are considered in *Part Two* of this book.

We hope you will find this book interesting, enjoyable and useful. This is a tall order for any textbook, we know, and research is not always seen as the most important subject by students or practitioners in health and social care. We become health or social care practitioners in order to work with and for people, in very practical ways, and learning about the process of evidence creation seems less important than learning about practical activities. But health and social care practice must be driven by reliable evidence in order to ensure that the care we are providing is the best possible care; this is why the conscientious practitioner needs to understand how this evidence is developed.

FURTHER READING

Health and Care Professions Council (2017) *Standards of proficiency – Social workers in England*. London: Health and Care Professions Council.

Nursing and Midwifery Council (2018) *Future nurse: Standards of proficiency for registered nurses*. London: Nursing and Midwifery Council.

Chapter 6

Data analysis

LEARNING OUTCOMES

When you have completed this chapter you should be able to:

6.1 Understand major ways of analysing data – their benefits and drawbacks

6.2 Understand quantitative and qualitative data

6.3 Understand levels of quantitative data analysis

6.4 Understand major statistical tests

6.5 Differentiate between types of qualitative analysis

6.6 Understand major methods of qualitative analysis.

6.1 Introduction

Data that has not been analysed can give us some information, but it's only after analysis that researchers feel confident about using it to reach conclusions and make recommendations that might be useful for health and social care practice. Analysis is the stage where we make sense of the data, turning what can appear to be a meaningless collection of numbers or words into a body of evidence on which practitioners or policy-makers may base major decisions.

Data analysis is not, of course, a straightforward process. Again, we will be discussing a wide range of classifications, debates, arguments and methods, even though the basic division is a simple one. Analysis can be **qualitative** or **quantitative**, but each of these approaches includes a wide choice of more specific methods and this choice seems to be increasing every year.

6.2 Quantitative analysis and qualitative analysis: the same but different?

Before we look at quantitative and qualitative analysis separately we want to look at them together, to consider their similarities before we look at their differences. All data analysis attempts to do the same thing: to make sense of data that has been collected, in order to provide us with information. Analysis is 'the process of organizing and synthesizing data so as to answer research questions and test hypotheses' (Polit & Beck, 2012, p. 719). The information gained from this process may be used to explain past events, establish relationships or develop understanding of experiences. Some analysis will be incredibly successful; some will fail miserably. Some will enable practitioners to make major improvements in treatment or care; some will mislead us. It doesn't matter if the analysis is quantitative or qualitative.

Analysis attempts to answer a research question by constructing explanations and speculating about the reasons why particular outcomes arise. It involves extracting meaning from data, by summarising it, making it less complicated and more understandable. In health and social care, it is an attempt to understand human behaviour. Once again, it doesn't matter if it's quantitative or qualitative. Of course, not everyone agrees with this perspective. Lincoln and Guba (1985, p. 333), two leading supporters of naturalistic research, emphasise that qualitative analysis is about reconstructing raw data into 'meaningful wholes' – so it is not about reduction but induction.

So why do so many research textbooks, including this one, separate qualitative and quantitative analysis? We think there are two main reasons. Firstly, although quantitative and qualitative analysis share the same aims and intentions, they use different methods and deal with raw material (data) presented in different forms (numerical in quantitative research, and words and text in qualitative research). When you are trying to help students make sense of analysis, or when you are a student trying to develop your own understanding of the process, it makes sense to separate the methods in this way. All the methods that use numbers, statistics and mathematics fit neatly into one broad category; while all the methods that work with text or words fit neatly into another category. After all, a modern secondary school education prepares your mind in this way by teaching maths and English separately.

The second reason is specific to the development of health and social care research. It's what writers have previously referred to as 'the Paradigm Wars'. In our opinion, this description over-dramatises the disagreements between the more extreme supporters of the two opposing **paradigms** of **positivism** and **interpretivism**. It implies clear distinctions not only between the paradigms but also at the levels of **methodology** and methods.

Onwuegbuzie and Leech (2005, p. 217) refer to two research 'subcultures': the 'positivistic quantitative' subculture and the 'interpretivist qualitative' subculture. This notion of subcultures suggests two distinct, opposing camps of researchers: a positivist camp where only experimental methodologies and quantitative methods are allowed; and an interpretivist camp which uses only naturalistic methodologies and qualitative methods. It's true that some researchers will stick doggedly to a very narrow idea of what constitutes 'research', but increasing numbers are taking a more flexible position. Glogowskagy (2011) refers to this as 'paradigm peace', reflecting a more pragmatic approach which chooses the methodology best suited to answering a particular research question.

As we hope we have made clear in earlier chapters, health and social care research really needs to adopt a pragmatic approach, whereby the most appropriate methodology is chosen for each project. However, we still think of methods of data analysis as either quantitative or qualitative because it's easy to make a distinction between the analysis of numbers and the analysis of words. Data collection methods such as surveys, interviews or observation can be used to collect quantitative and/or qualitative data. Data analysis methods are designed either for text or numbers. We will now go on to discuss quantitative and qualitative methods of data analysis separately. But remember, data analysis in health and social care research is characterised more by similarities than by differences.

6.3 Quantitative analysis

In this chapter, we aim to provide you with a basic understanding of quantitative data analysis so when you are reading quantitative data reports or quantitative research papers you have an understanding of how the research was analysed. It is beyond our remit to provide sufficient detail to enable you to become proficient in analysing quantitative data yourself. However, if you would like to explore this further, there are numerous books available that can assist you. Two that we recommend are *Discovering Statistics Using IBM SPSS Statistics* (Field, 2017) and *Medical Statistics Made Easy* (Harris & Taylor, 2014).

Essentially, quantitative analysis attempts to make sense of numbers. But, as Parahoo (2006, p. 376) notes, 'numbers in themselves have no intrinsic worth: they have to be given meaning by those who use them'. Much of this giving of meaning has to come before the data collection stage of a study. For example, if our project collects data about urine output, we need to decide what units of measurement we will use: a measurement of 100 millilitres is very different from a measurement of 100 fluid ounces. Likewise, in a study of people's ideas about the quality of care in a care home, if we ask each person to score the care on a scale of 1 to 10 then we need to make it clear that 1 represents 'the best care' and 10 'the worst', to avoid confusing the participants.

If we don't clearly define what numbers mean before we start collecting data, our data will be meaningless and our analysis will therefore be unreliable. Conversely, as long as we collect reliable data, our analysis has the potential to provide meaningful information. In quantitative analysis there are two basic forms in which this information can be provided: levels of measurement and statistical analysis.

6.4 Measurement scales

We often use quantitative data to measure things, so that we can understand those things more clearly. Some of our measurements in day-to-day life are quite subjective and it is impossible to interpret them reliably and consistently. Applying numerical values to these measures helps us achieve **reliability** and consistency.

If we say that someone is 'tall', or that the weather is 'cold', or that a new pair of shoes is 'expensive', we are making judgements about height, temperature or cost. But our judgements might not be shared, or understood in the same way, by others. If we say instead that someone is 180cm in height, or that the temperature is 6°C, or that the shoes cost £200, we are applying more accurate and objective measurements. Assuming that our information is correct, no one will argue with our measurements. A 198cm-tall millionaire from Alaska might, of course, argue that 180cm is not tall, 6°C is not cold and £200 is not expensive, but this is a disagreement about *interpretation* of measurement, not about the measurement itself.

Presenting our data in numerical form enables us to compare it. The levels of comparison that can be made vary according to the types of measurement that we can achieve. Statisticians generally refer to four measurement scales (or types of data):

- nominal
- ordinal
- interval
- ratio.

Nominal scales allow us to allocate individual subjects or outcomes to different categories. Stating that subject A is female and subject B is male allows us to allocate each person to a distinct group, female or male. But we can't go on to make any quantitative judgements: we can't say that subject A has more 'femaleness' than subject B has 'maleness'. However, this is useful data to identify aspects of your sample. For example, in a study of 100 patients, with a sample of 60 men and 40 women, we can say that 60% of the sample were male and 40% were female.

Ordinal scales take us one stage further, enabling us to place subjects in some sort of ranking order. An example of an ordinal scale might be judgements about the depth of colour of subjects' hair. We can say that subjects A, B and C all have brown hair, but that C's is darker than B's and A's is darker than C's. An ordinal scale does not, however, enable us to quantify the degree of difference. We can't say that C's hair is 11% darker than B's and A's is 16% darker than C's. Another ordinal scale is the type used to measure a person's satisfaction with something – such as a patient's satisfaction with a new therapy service. A satisfaction survey might ask patients to rank their care as 'excellent', 'good', 'average', 'poor' or 'very poor'. It's easy to see that 'good' is better than 'average' but we can't tell by how much it's better. Nor can we tell if a rating of good was almost an excellent rating or only slightly better than an average rating.

Interval scales enable us to identify differences with greater accuracy than ordinal scales. They offer us equal distances between values and allow us to place those values on a continuum. One of the best examples of an interval scale is the Celsius scale for temperature measurement. This scale enables us to use specific values with constant, regular differences between these values. So we know that the difference between 10°C and 11°C is the same as the difference between 31°C and 32°C. However, interval scales don't have absolute zero points so we can't say that 20°C is twice as warm as 10°C, because temperatures can fall below 0°C.

Scales with an absolute zero point, as well as equal intervals between values and a clear continuum of values, are known as ratio scales. Height measurement is a practical example of a ratio scale. The difference between 5cm and 10cm is the same as that between 95cm and 100cm. A height of 165cm is taller than one of 162cm. More importantly, there is a real zero point: 0cm equals no height. This means that we can state relationships between two measurements more precisely. A person who is 200cm tall *is* twice the height of one who is 100cm tall.

Each of these scales allows us to present data in numerical form. A nominal scale, where people are categorised as ‘male’ or ‘female’, allows the researcher to allocate a number to each category: 0 for male and 1 for female, for example. The researcher can allocate a number to each category in an ordinal scale just as easily, so that ‘excellent’ equals 5 and ‘very poor’ equals 1. Interval and ratio scales tend to have numerical values already. This level of quantitative information is useful in itself, but rather limited. It tells us something about each individual subject or participant in a study, but not about the participants as a group, nor about an individual participant’s place within the group. To be able to reach conclusions about relationships, the researcher needs to carry out some more complex statistical analysis.

6.5 Types of statistical analysis

In this discussion we will divide statistical analysis into two types: **descriptive** and **inferential statistics**. This is the most basic division you can find in the research literature and it is used by authors such as Parahoo (2006) and Polit and Beck (2012). Other authors use different classifications, based on alternative ways of defining categories. Field (2017) refers to **parametric** and **non-parametric** statistics, based on the types of data they are applied to. Clifford (1997) subdivides inferential statistics into two categories: inferential and correlational.

6.5.1 Descriptive statistics

Descriptive statistics provide us with information about the whole body of data. They summarise the data and enable the reader to gain a clear idea about all the results in terms of their similarities and differences. Descriptive statistics normally provide information about three areas: frequency distribution, central tendency and variation (Polit & Beck, 2012).

Frequency distributions

Frequency distributions are a mechanism for organising numerical data from lowest to highest (distribution) together with the number of times (frequency) each value was provided. Frequency distributions consist of two aspects; observed values (Xs) and frequency of cases of each value (fs); which must not exceed the total sample size (Polit & Beck, 2012). This data is typically presented as a histogram (see *Figure 6.1*) or frequency polygon (see *Figure 6.2*).

Figure 6.1 *Histogram.*

Figure 6.2 *Frequency polygon.*

Central tendency

Measures of central tendency tell us about common features of a set of data, particularly about the midpoints of the range of responses. The most common measure of central tendency is the mean. The median and the mode can also be calculated relatively easily but they are not usually as useful.

A set of ten responses will help to illustrate the three measures of central tendency. Let’s assume that they are scores out of ten, given by respondents when asked to rate the quality of service provided by a housing association:
4, 4, 5, 6, 6, 6, 7, 7, 8, 8.

The mean, or arithmetic average, is calculated by adding up the scores and dividing the result by the number of individual scores. In this case we get 61 divided by 10, so the mean is 6.1.

The median is the point which 'divides the distribution of scores into two equal halves' (Cornish, 1998, p. 8). With an odd number of responses, the median is the middle score. With an even number, you take the two scores on either side of the midpoint, add them together and divide by 2. In our example the median is (6 + 6) ÷ 2, which equals 6.

The mode is the most frequently occurring response. In this example it is also 6.

All three measures in this example are close together: 6.1, 6 and 6. This is not always the case.

Let's assume that the ten responses gave the following scores:
1, 2, 3, 4, 7, 8, 9, 9, 9, 9.

With these scores, the mean is still 6.1 (61 ÷ 10). The median is now 7.5 ((7 + 8) ÷ 2). The mode becomes 9, as 9 occurs four times.

We hope you can see from these two examples that measures of central tendency don't in themselves offer us a clear description of a set of data. We need to know about the variation in data as well as similarities.

KEY QUESTION 6.1 – MEAN, MEDIAN OR MODE?

In an out-of-hours care centre the following numbers of people were seen each hour, from 0800 to 2200, on a Sunday:
6, 6, 10, 8, 13, 10, 6, 7, 20, 14, 11, 6, 12, 4, 2.

- What was the mean attendance per hour?
- What figure represents the median attendance?
- What number is the mode attendance?
- What does the data tell you about the centre's activity?
- What conclusions, if any, can you draw from these figures?

Measures of variation

Measures of dispersion or variation (Polit & Beck, 2012) help us to understand the ways in which data is spread or dispersed. Three commonly used measures of dispersion are the range, distribution and standard deviation. The range is a reasonably simple measure. It refers to the difference between the highest and lowest values in a sequence. In our first example about the housing association (see above) the range is the difference between 4 and 8, which is 4; in our second example it's the difference between 1 and 9, which is 8.

Distribution refers to the way in which data is spread, or distributed, around the mean value. A normal distribution occurs when values are spread reasonably equally above and below the mean, giving a curve that resembles a bell when values are plotted on a graph (see *Figure 6.3*). Distributions can also be abnormal, skewed to the left or to the right of the graph.

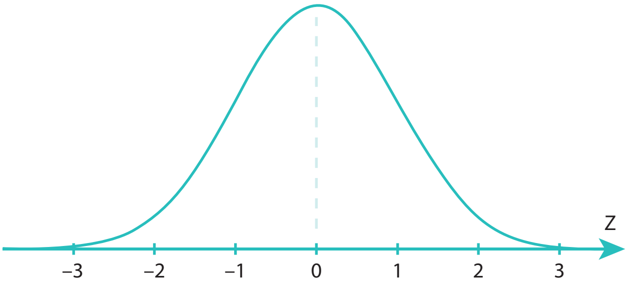


Figure 6.3 *Normal distribution curve.*

When the distribution of the data is not symmetrical, there is no even spread of data on each side of the midpoint. This means that the peak of data is off-centre and one side has a longer curve than the other; we refer to this as a skewed distribution (see *Figure 6.4*). When the longer tail points to the right, the distribution is referred to as a positive skew. Conversely, when the tail extends to the left, the data is negatively skewed (see *Figure 6.4*). An example of a positively skewed distribution would be the age at which women have their first child, as more women will have their first child towards the lower end of their lifespan. An example of negative skew would be the age of women when they die, as more women die in older age than at the start of their life.

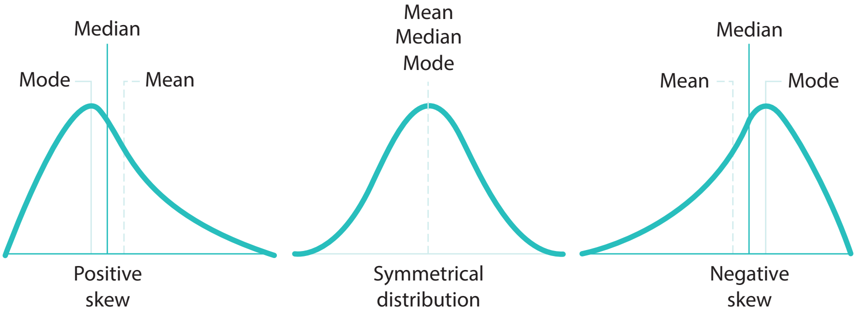


Figure 6.4 *Normal and skewed distribution.*

Standard deviation (SD) gives us further information about the distribution of data. Specifically, this measurement tells us about the extent to which scores are spread around the mean. A small SD suggests that the values are clustered around the mean; a large SD suggests that they are spread more widely (Parahoo, 2006). A single SD either side of the mean will include about 68% of the data; two SDs either side of the mean will include 95% of the data; three SDs either side will include almost all the data.

Our two sets of test results can help us to illustrate this.

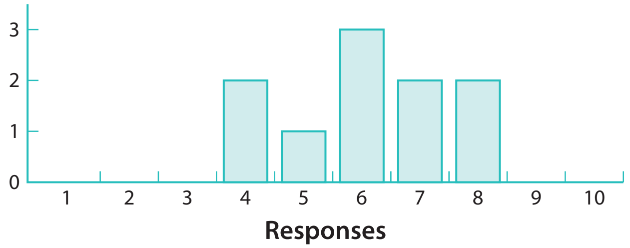


Figure 6.5 *A mean of 6.1 and a median of 6.*

In *Figure 6.5* the data has a mean of 6.1 and a median of 6. You can see that the distribution is roughly symmetrical: that is, equal numbers of responses fall on either side of the mean and median. The graph shows a 'bell-shaped' appearance, indicating a normal distribution. In *Figure 6.6* the mean is still 6.1 but the median is 7.5. There were no scores of 5 or 6 in the data. The distribution is skewed and abnormal.

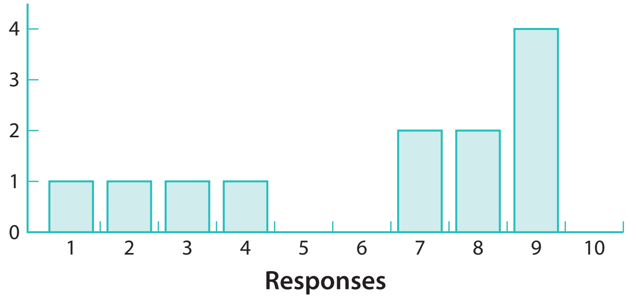


Figure 6.6 *A mean of 6.1 and a median of 7.5.*

We can undertake multiple tests in descriptive statistics but we just want to mention two in particular. The first is cross tabulation, which enables us to compare different variables. For example, we could compare drinking habits between men and women, or smoking rates across different age groups; this analysis can tell us if one group tends to undertake a specific behaviour more than another group. The second is correlation, where we can explore a potential correlation between different variables – for example, smoking habit and blood pressure reading. As you can see, descriptive statistics are very useful in health and social care.

6.5.2 Inferential statistics

Few research projects have the capacity to study an entire population of interest; researchers must therefore study samples of varying size. If they then wish to show that findings within the sample are generalisable to the population as a whole they need to provide evidence in support of their claim. Inferential statistics based upon the laws of probability provide a means of drawing conclusions about a population (Polit & Beck, 2012); they allow us to *infer* that findings will apply to the whole population, not just to the sample. However, it must be remembered that using inferential statistics is not foolproof; the quality of the results produced depends on the quality of the data and use of the most appropriate tests.

A quick check of textbooks and websites will easily reveal at least ten or twelve inferential statistical tests that are routinely used in health and social care research. These tests are usually classified as either parametric or non-parametric, according to the level of measurement that needs to be possible in order to use a test. For instance, parametric tests can be used only when interval or ratio level measures exist and when data are normally distributed. Non-parametric tests can be applied to nominal or ordinal level data and do not need a normal distribution. Parametric tests are usually seen as more powerful than non-parametric ones.

Researchers cannot therefore simply choose any inferential statistical test; they must use one that matches the criteria for distribution and levels of measurement (see *Table 6.1*).

Table 6.1 *Quick guide to statistical tests (Polit & Beck, 2012, p. 412)*

Level of measurement of dependent variable	**Group comparisons: number of groups (the independent variable)**				**Correlational analyses (to examine the relationship strength)**
	2 groups		**3 groups**		
	Independent group tests	**Dependent group tests**	**Independent group tests**	**Dependent group tests**	
Nominal (categorical)	χ^2 (or Fisher's exact test)	McNemar's test	χ^2	Cochran's Q	Phi coefficient (dichotomous) or Cramér's *V* (not restricted to dichoto-mous)
Ordinal (rank)	Mann–Whitney test	Wilcoxon signed rank test	Kruskal–Wallis *H* test	Friedman's test	Spearman's rho (or Kendall's tau)
Interval or ratio (continuous)*	Independent group *t*-test	Paired *t*-test	ANOVA	RM-ANOVA	Pearson's *r*
	Multifactor ANOVA for 2+independent variables				
	RM-ANOVA for 2+groups x 2 + measurements over time				

*For distributions that are markedly non-normal or samples that are small, the non-parametric tests in the row above may be needed.

A deep understanding of each of these different types of tests is beyond the scope of this book, but you do need to be able to assess whether the appropriate test was used in a particular research project. For example, if the research paper presents a correlational analysis (across three groups), using rank data, you would expect the researchers to have used the Friedman's test. Likewise, if it was a group comparison of two groups using interval data then the Paired *t*-test is the appropriate test to use. If incorrect tests are used to analyse the data, the results have to be viewed with caution.

6.5.3 Calculating uncertainty

Although many publications use phrases such as 'research has shown', few health and social care researchers would claim that their results can be applied to the real world with 100% certainty. Instead they will carry out further calculations to estimate the degree of certainty that they can apply to the results of their studies. Two estimates of accuracy are commonly used in health and social care research: probability and **confidence intervals**.

Probability is usually shown by the *p*-value. In research this is used to indicate the likelihood that a result has occurred by chance, rather than because there is a genuine relationship between variables. If a result achieves a predetermined *p*-value, or less, it is said to be statistically significant. *P*-values are expressed as decimal numbers, so you will commonly see *p*-values of, for example, 0.05, or 0.01, or 0.001. Most researchers take a *p*-value of 0.05 or less as being statistically significant, although this is a fairly arbitrary figure (Parahoo, 2006). A *p*-value of 0.05 is stating that the likelihood of a result occurring by chance is 5/100 or 1 in 20; a *p*-value of 0.01 means that the likelihood is 1 in 100. The smaller the *p*-value, the more statistically significant a result is said to be.

The confidence interval (CI) seems to have become a standard measure of certainty in health and social care research in recent years. A confidence interval is 'a range within which, assuming there are no biases in the study method, the true value for the population parameter might be expected to lie' (Coggon *et al.,* 1993, p. 62). Usually it is expressed as a 95% confidence interval (95% CI), as an additional note of caution. In other words, the research team is stating that they are confident that in 95% of cases (that is, 19 out of 20), the true result in the population as a whole will be somewhere within the range of values stated.

Let's take another example. A study of social care finds that in its sample of 100 people the average waiting time for referral to a specialist service was 16 days. The researchers will not simply state that 16 days would be the average waiting time in the population as a whole. Instead, they will calculate the range of values within which they predict the actual average is likely to fall, with 95% confidence. In the report they will state the study result and the likely true figure for the population as a whole in this way: 16 days, 95% CI: 13–19 days. In other words, they are stating that in 19 out of 20 cases the average waiting time in the actual population will be somewhere between 13 and 19 days.

As a rule, small sample sizes will produce wider confidence intervals than large samples. To put it another way, the bigger your sample, the more certain you can be that your result is accurate.

6.6 Major methods of qualitative analysis

Quantitative analysis may incorporate a wide range of analytical tests, but they are all essentially variations on a single theme: the creation of numerical data for analysis by statistical or mathematical means. Qualitative analysis, in contrast, draws on a more diverse range of strategies and can make use of raw data in a greater variety of forms. In this chapter we aim to provide you with a basic understanding of qualitative data analysis. A full and detailed exploration of qualitative analysis is beyond the scope of this book. If you would like to further your understanding of this topic, there are numerous books available that can assist you in this. Two we recommend are *Qualitative Data Analysis* (Miles, Huberman & Saldana, 2013) and *Qualitative Research in Nursing* (Holloway & Galvin, 2016).

Most qualitative research produces text. This can be created directly, through written responses to open survey questions, or in diaries written by research participants. It can also be produced indirectly, by transcribing interview recordings. But qualitative analysis is not limited to the use of data in text form. It has also developed strategies to analyse other forms of data, such as artwork, architectural plans and objects (such as surgical instruments).

We noted earlier that qualitative methods are characterised by a great deal of debate about which method is best, so you will not be surprised to hear that qualitative analysis cannot be neatly classified. Well over 30 different forms of qualitative data analysis are identified in the literature. Petty *et al.* (2012) identify the following:

- thematic analysis
- content analysis
- constant comparison
- discourse analysis
- critical discourse analysis
- conversation analysis
- narrative analysis.

It's difficult to tell if these types of analysis are all truly distinct from each other, or whether some of them represent small variations in approach or the same methods applied to different data sources. But it's clear that there are many ways of analysing data qualitatively. Thankfully, a small number of methods predominate in health and social care research and we want to discuss only two of them in this chapter:

- thematic analysis
- constant comparison.

6.6.1 Thematic analysis

Thematic analysis is one of the 'most useful and most widely used' methods of qualitative data analysis (Grbich, 2007, p. 36). In a thematic approach, analysis takes place once all the data has been collected. It is, according to Grbich (2007, p. 16), 'a process of segmentation, categorisation and relinking of aspects of the database prior to the final interpretation'. It is advocated by Holliday (2016, p. 94), who describes it as an approach in which 'all the data is taken holistically and rearranged under themes which emerge as running through its totality'. It is also the qualitative analysis method we use in our own work. Braun and Clarke (2006) have identified six steps in undertaking a thematic analysis (see *Table 6.2*).

Table 6.2 *Process of thematic analysis (Braun & Clarke, 2006)*

Stage 1	Familiarising yourself with your data – here you transcribe your data and then read and re-read your data set, noting initial ideas
Stage 2	Generating initial codes – here you systematically work across your data, identifying codes of interest
Stage 3	Searching for themes – here codes are grouped into potential themes
Stage 4	Reviewing themes – at this stage you check if your identified themes include your initial notes (stage 1) and the codes identified (stage 2). At this stage you also produce a thematic 'map' of the analysis
Stage 5	Defining and naming themes – here you continue to refine your analysis, especially the identified themes and the overall story told by the data
Stage 6	Producing the report – here you present the data, and identify and include excerpts from the transcripts to support the themes presented. At this stage you also return to the research question to ensure that the findings reflect the aims of the research

KEY CASE 6.1 – A STUDY OF E-LEARNING IN THE EDUCATION OF STUDENT NURSES

In a study of an international e-learning project called a 'Community of Practice' (Lindsay, 2007), participants were invited to evaluate the project design and implementation. Eleven participants out of a total of fifteen took part in the evaluation: a response rate of 73%. In response to three open questions about the project, the respondents made 31 separate comments. Through thematic analysis and coding, three themes were identified: concept, content and implementation (see *Figure 6.7*). Two of these themes, content and implementation, each included three smaller subthemes.

These themes and subthemes developed from the data: in other words, they are the result of the (hopefully unbiased) interpretation of participants' responses.

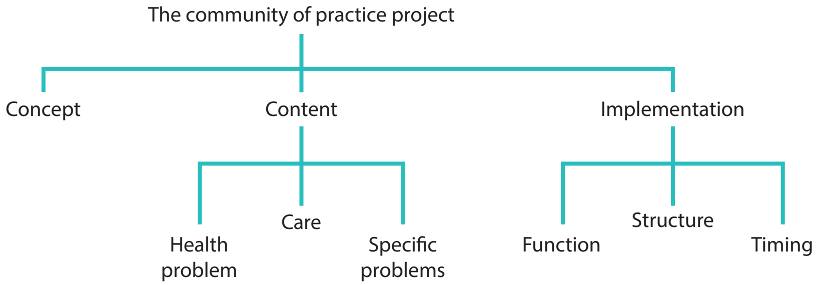


Figure 6.7 *Thematic analysis of community of practice project.*

6.6.2 Constant comparison

This method of data analysis was developed by Glaser and Strauss in the 1960s as part of their development of **grounded theory**, which we discussed in *Chapter 3*. Lincoln and Guba (1985) note that Glaser and Strauss intended constant comparison to be used as a way of deriving or grounding their theory development, not just as a way of analysing data, but in health and social care research it is more commonly used as a means to analyse data. Interestingly, Lincoln and Guba also note that Glaser and Strauss saw their approach as part of a positivist paradigm, even though constant comparison is now firmly rooted in naturalistic methodologies.

Constant comparison is similar to thematic analysis, in that the researcher reviews and interrogates the data in order to produce a meaningful, organised classification. However, a key difference is in the way that the process is undertaken, or more specifically in the relationship between data collection and analysis. In constant comparison the researcher begins to analyse the data as soon as it starts to emerge, rather than at the end of the data collection process. Early data analysis informs data collection and can lead to developments in the collection process. For example, early analysis might lead to a revision of the interview schedule, or a deliberate move towards selecting those participants who can best assist in testing out early ideas.

KEY QUESTION 6.2 – CAN YOU RECOGNISE DIFFERENT TYPES OF QUALITATIVE DATA ANALYSIS?

Select a database of your choice (such as Medline or Google Scholar) and search for research publications which use three different types of qualitative data analysis, one from each of the lists at the start of *Section 6.6*. For example, search for ‘thematic analysis’, ‘discourse analysis’ and ‘case analysis’. Identify papers that use these types of analysis and then read them.

- How do they present their analysis and findings?
- How does this vary between the types of analysis?
- How does this compare to the ways in which other papers analyse and present quantitative data?

6.6.3 Ensuring quality

During the analysis phase of the research the researcher needs to ensure that the findings accurately reflect participants’ views and this involves ensuring the rigour of the research. However, the terms used to reflect quality and rigour are different depending on the methodological stance and type of data used. Petty *et al.* (2012) explore quality in research, highlighting the differences and similarities between quantitative and qualitative data (see *Table 6.3*).

Table 6.3 *Comparing quantitative and qualitative data*

Quantitative	Qualitative	What it is and how it is achieved
Objectivity	Confirmability	Extent to which the research findings have emerged from the research and not from the bias of the researcher. This is achieved through a clear articulation of the research analysis process.
Reliability	Dependability	The extent to which the study can be respected. Achieved through a clear articulation of how the research was conducted (research process).
Internal validity	Credibility	Degree to which the findings can be believed by the participants of the study. Can be achieved through sharing the analysis with other researchers or the participants themselves (member checking), as well as the researcher reflecting upon their stance in the research.
External validity	Transferability	Extent to which findings from the research can be applied to other contexts or participants. In qualitative research this is often judged by the readers themselves.

Adapted from Petty *et al.*, 2012.

6.7 Conclusion

As a reader and potential user of research and research findings, you do not have to analyse data yourself. However, having at least some understanding of the process means that you can make judgements about the quality of data analysis and do not simply have to take it on trust that a particular piece of research is valid and reliable. This understanding is invaluable because, as we have already said, just because a research report has been published doesn't mean that it is necessarily of good quality.

CHAPTER SUMMARY

Five key points to take away from Chapter 6:

- ☑ Data can be analysed quantitatively or qualitatively.
- ☑ These two approaches to analysis have many similarities as well as differences.
- ☑ There is no single universally applicable approach to quantitative or qualitative data analysis: researchers should select the best approach for their data.
- ☑ Different ways of analysing data produce different results: always consider what the analysis of data might fail to tell you, as well as what it does tell you.
- ☑ It is important to explore the rigour of the research.

FURTHER READING

These texts all focus on either quantitative or qualitative analysis, offering a much more in-depth discussion of analysis than this book can provide.

Coggon, D., Rose, G. & Barker, D.J.P. (1993) *Epidemiology for the Uninitiated*, 3rd edition. London: BMJ Publishing Group. This is a brief book, focusing on the use of statistical analysis in the study of patterns of disease but offering plenty of information about use by health or social care practitioners.

Field, A. (2017) *Discovering Statistics Using IBM SPSS Statistics*, 5th edition. London: Sage.

Harris, M. & Taylor, G. (2014) *Medical Statistics Made Easy*, 3rd edition. Banbury: Scion Publishing.

Holliday, A. (2016) *Doing and Writing Qualitative Research*, 3rd edition. London: Sage.

Holloway, I. & Galvin, K. (2016) *Qualitative Research in Nursing*, 4th edition. Sussex: Wiley.

Maltby, J., Day, L. & Williams, G. (2007) *Introduction to Statistics for Nurses*. Harlow: Pearson Education. This text provides a far more in-depth discussion of statistics than most nurses or health professionals will ever need. Its discussion of the use of software in data analysis is particularly useful.

Miles, M., Huberman, M. & Saldana, J. (2013) *Qualitative Data Analysis*, 3rd edition. London: Sage.

Polit, D.F. & Beck, C.T. (2012) *Nursing Research: generating and assessing evidence for nursing practice*, 9th edition. London: Lippincott Williams & Wilkins.

Silverman, D. (2011) *Interpreting Qualitative Data*, 4th edition. London: Sage.