1 Research for Health Care Practice

This chapter tells you what research is and explains why your research is important, introduces you to the basics of research introduces you to the rest of the book and the various ways of undertaking research.

The research approach described and discussed in this book can be used by anyone involved in health care practice within their own health care setting. The research can contribute to the development of health care practice for the particular time and place it was undertaken as well as adding to the wider body of knowledge about health and health care.

Anyone engaged with health care can use the research approach described in this book. This includes people living with long-term health conditions and community groups. People working as health professionals can incorporate this type of research into their day-to-day work, including those who directly care for patients and those managing or planning services.

Research undertaken as collaboration between people using health care services and local health care professionals is ideal as it brings into the research the perspective of those using health care services. However, health professionals have a key role to play in research for health care practice.

Health professionals are well positioned to take the initiative in research. They are often committed to health care for long periods, sometimes all their working life, so research can continue as part of their health care practice in the long term. They are well placed to notice change; for example, the impact of a new diagnostic or treatment technology, changes in the **population** they serve through migration or change in the local environment. Such changes may be the stimulus for research. Health professionals build up considerable knowledge of their own health care service and the community it serves, including its history, so they can take this into account in their research. They can also continue to observe the impact of change as well as the impact of their own service developments in the long-term.

Research is about the discovery of new knowledge. This includes any study of the natural, social or technical world that increases our understanding of it, and is undertaken in such a way that others can follow how it was done (transparency) and assess the robustness of the results. Research is a global

collaborative effort. Every research project, including those undertaken in a specific health care setting, can contribute to the development of new knowledge.

Health professionals contribute to the global research effort

Research can be thought of as many spirals of activity extending through time, with cycles of activity changing over time both locally and globally. Health professionals can contribute to research as part of the global research effort in the same way as academics and full-time researchers. The world is constantly changing, so we need to reinvestigate the world because it has changed. Our new knowledge about the world will itself change something about the world and so prompt further research. This could be in our own local context or more widely. New methods of investigating the world lead to further research as they give us the opportunity to find out more. Individual researchers only contribute to one part of the research spiral. For example, inspired by a need identified by a health professional in their research, an engineer may work on a new technology. This technology may be tested by another health professional for use in health care. A social scientist then studies the impact of this new technology on people's experience of illness. Understanding the experience of illness may prompt the engineer to modify the new technology or a health professional to review how the technology is incorporated into health care practice.

Most academic and research disciplines have knowledge and expertise relevant to health care. Being part of this multidisciplinary research effort is exciting and challenging but can also feel overwhelming. There is a danger that we ignore unfamiliar academic and research disciplines and assume that all relevant sources of knowledge and expertise for health care research are within the body of expertise we think of as health science or clinical science. We need to find a balance between drawing on the resources of the wider research community and getting on with investigating the health issues that concern us.

Understanding the range of types of research that relate to health and health care helps us to open our minds to knowledge, ideas and possibilities that we may rarely think about in our daily work in health care. The following examples illustrate the range of types of research relevant to health and how they feed into the research spiral. Each example is a patient we could meet in our clinical practice.

An 18-year-old man with insulin-dependent diabetes who has failed to attend follow-up at the diabetes clinic. His last blood test indicated poor control of his diabetes.

Table 1.1 Examples of the diverse research disciplines that contribute to the health care of people living with diabetes

Research disciplines	*Examples of research issues related to diabetes*
Genetics	Heredity of diabetes
Biochemistry	Refinements of insulin; new drugs
Engineering	Development of technology, e.g. artificial pancreas
Clinical research	Effect of treatment on short- and long-term health outcome
Psychology	Behavioural interventions to improve diabetes self-care
Epidemiology	Causation of diabetes; population health need assessment
Sociology	Understanding experience of diabetes including self-image; socio-economic influences on illness
Anthropology	How illness is expressed and controlled through social norms and culture
Organisational sciences	Health service organisation and its development
Information sciences	Access and content of health information
Economics	Health care funding, e.g. public/private
Political sciences	Prioritisation of health care; food and drug policy

Insulin is the key to this man's survival. To understand the research that led to the clinical use of insulin we have to look back into history. My aim is not to give you all the details of the history but alert you to the many different types of research that contributed over time to its discovery and use.

> Diabetes has been known since ancient time. Physicians observed each individual patient as a **case study**, describing their symptoms in detail. By comparing each **case** with other cases, they identified the symptoms they had in common as diabetes. In the 18th century, chemistry experiments showed the urine and blood of those with diabetes contained a lot of sugar. In the 19th century, the link was established between the symptoms of diabetes and changes found in the pancreas on dissection of those that had died. Detailed examination of the pancreas revealed the Islets of Langerhans and towards the end of the 19th century, research including animal experiments identified insulin as the key substance. In 1922 the joint work of physiologists and biochemists, with technical help from a pharmaceutical company, led to the isolation of insulin as an extract. This was then tested on a young boy dying of diabetes who survived on continuing insulin injections.

The research disciplines in the front line of this research included clinical research, chemistry, anatomy and pathology, physiology and biochemistry. These were supported by other disciplines including physics and engineering for the development of the microscope and organic chemistry for understanding substances such as proteins.

Once people with diabetes were able to survive on insulin, research continued to refine insulin treatments and to seek to understand the cause of diabetes. Epidemiology, the **social sciences** and **behavioural sciences** have also contributed to research on diabetes. Table 1.1 gives examples of research related to diabetes currently undertaken by different research disciplines.

Table 1.2 Examples of the types of research question different academic and research disciplines may ask in relation to depression

Type of research question	*Research discipline*
What are the cultural representations of depression? Why do people respond to depression in this way?	Anthropology
What symptoms indicate that an individual is suffering from clinical depression? How effective is a drug/psychological therapy for treating depression?	Clinical research
What is the loss of earning in the country related to depression? How cost-effective is the introduction of a new treatment?	Economics
How many people (who and where) suffer from depression? Why does the number of people with depression in a population change over time? How is the variation linked to the level of unemployment?	Epidemiology
How does the genetic make-up of a person influence their mental health? Where in the human genome are genes that influence mental health?	Genetics
How is mental health portrayed in the media and who/what influences this?	Media studies
How are services for the mentally ill best delivered in a rural setting and why? How does the culture of an organisation influence the health of the work force?	Organisational studies
How does a drug change the biochemistry at the neuron synapses? What dose of a drug is safe and effective?	Pharmacology
Why does the biochemistry of the neurone synapses differ in people with and without depression?	Physiology
What are the patterns of thought and behaviour in people with depression and why?	Psychology
What influences the prioritisation (or not) of mental health services for state funding? How does employment law influence the health of workers?	Social policy
Why is depression perceived as an illness? What do those with depression experience and what influences it? What is the influence of social networks on vulnerability to depression and how is this mediated?	Sociology

A man in his fifties who has low mood, insomnia, fits of tearfulness and irritability. He has successfully worked for a company at a local manufacturing plant for 10 years. With the shut-down of the local plant he was made redundant. He has a supportive family.

Research from many disciplines directly or indirectly informs the assessment and management of this patient. Different research disciplines tend to tackle different types of research question. Table 1.2 suggests examples of research questions inspired by encountering the man in the example above and the research discipline most likely to tackle each one. Notice the different focus of the different disciplines including: society, community, organisations, individuals, groups of individuals, physiology, biochemistry and genetics. Note also the different types of question words used: what, where, when, how, why, who. We consider the development of research focus and research questions in Chapter 2.

The research questions in Table 1.2 all feed into an overall research question of interest to health professionals:

[Why do people get depressed and why do they get better (or not)?]

It is unlikely that one piece of research could answer this overall question, but we build up understanding of depression through many different research projects undertaken in many different disciplines using various research approaches.

Whatever health problem we research, we need to remain open to the possibility that our research may suggest that health professionals don't have a lot to offer but that change is needed in the environment or society. For those of us working as health professionals, keeping an open mind about this can be difficult as it seems to undermine ourselves as health professionals and those who experience illness. However, keeping an open mind is vital for research and does not prevent us continuing to recognise the distress experienced by patients. If our research does suggest that what health professionals do makes little difference, this is an important contribution to the ongoing spiral of research activity. Other researchers will pick up the research issue and investigate it in a different way.

Finding out new knowledge while also improving health care

Research is sometimes considered as something very different from activities such as **evaluation** and **audit** that aim to improve health care. This can lead to health professionals feeling they can do audit and evaluation but cannot do research. However, there is no clear boundary between these activities and health professionals can contribute to both, often at the same time.

In research we aim to step back from studying particular people in a specific place and timeframe to ask what the study can tell us generally about how the world functions. **Audit** and **evaluation** are terms used to describe the process of studying a local health care service with the aim of improving that service. For example, an audit of diabetes care may involve the health professionals providing that care identifying people with diabetes who are not having regular check-ups, changing how they provide check-ups in order to improve the service, then observing whether those changes have made a difference. Evaluation also looks at the effect of changing how health care is delivered, though this may be undertaken by people not involved in providing the service. The methods of collecting **data** and analysing it may be similar for audit, evaluation and research. One of the key differences is the audience for the results. Generally, audit is for the practitioners in a local health care service, evaluation is for those making decisions about health care service provision, and research is for a wider audience to contribute to increasing knowledge of health and health care overall. However, studies aimed at a local audience can contribute to the development of new understanding more generally.

Box 1.1 Evaluation of waiting times in an emergency department

The manager of a busy hospital emergency department notices that many people attending seem to wait for hours before a decision is made about whether they stay in hospital or go home. This problem has been the focus of much media attention, so the manager knows it is not just a problem for this hospital. The manager cannot sort out the problem for the whole country, but can find out what is happening in his own department and why.

The manager asked those working in the department what they thought caused the long waits, but they all had different views on the issue. He therefore sought advice from colleagues experienced in the evaluation of organisations and decided to measure the length of time patients waited at different points in their progress through the emergency department. He set up a data collection system tracking where patients wait, how long they wait and what they wait for; for example, the length of wait to speak to the reception clerk, the wait to see a doctor, the wait to go to X-ray. Analysis of these patient flows showed that a major delay was the wait for a porter to take patients to X-ray.

With this evidence that the department needs an extra porter he presented the evaluation to the hospital executive board. They were convinced by the results, as they could follow how the data had been collected and that it revealed what really happens in the emergency department.

As the manager had worked out how to collect the data about patient waits without disrupting the everyday work of the department, he was able to collect data again, after the introduction of the extra porter. The evaluation therefore became an ongoing audit.

There are many different ways in which a local study can contribute to the development of new knowledge. Box 1.1 illustrates this using the example of an evaluation of the waiting times for patients in the emergency department of a hospital. The evaluation showed that the emergency department needed an extra porter. If the project were presented at a national conference about emergency care, people might return to their own departments suggesting an increase in the number of porters. Imagine what might happen: in some places an extra porter might reduce patient waiting times, in others it might make no difference because there were different causes of delay, and in some it might increase the patient waiting times as it led to a reduction in porters elsewhere in the hospital. Although the results of an evaluation may not seem to be of use to other people, there are ways in which its findings can provide useful new knowledge.

If the evaluation were presented in some detail, those hearing about it could assess whether their emergency department was similar to the original department, and from this make a judgment as to whether an extra porter would make a difference in their own department. For those of us working in the UK, where

national policy has a strong influence on how local services are delivered, it may be possible to find sufficient similarity to be fairly sure the solution will work so it can be directly transferred to a different department (**transferability**). Someone from a very different health care service would need to assess this very carefully as fundamental service issues, such as who is responsible for paying for what, can make a big difference to how a service functions. Of course, the only way of being sure is to try it out and assess what happens. If a number of emergency departments tried out introducing extra porters and observed and reported what happened, by comparing the experiences it might be possible to develop new knowledge about what is happening, and why, in a more general sense (generalise). For example, it might help increase understanding of how local social and organisational issues influence the implementation of national policy and guidance. These ideas could be compared with studies already published in research literature.

The lead nurse of an emergency department in a different hospital may decide to repeat the evaluation to see if they get the same results. If the health care service is similar, they may be able to collect and analyse the data in almost exactly the same way as the original study. They are using new knowledge from the original evaluation; that is, the way it was done, both the overall approach and how it was applied in the setting of emergency care.

Another department may want to try a modified approach, using only data collected routinely. To test this out the original department could be asked to re-analyse their data, including only data that would be routinely available (recorded as part of daily clinical activity), to see whether they would come to the same conclusion. If this is not possible, the other department could undertake the modified method themselves and compare their results with the original research. As the departments are not identical it is not possible to make a direct comparison, but the type and quality of data can be compared in order to judge how likely it is that the new data will give a robust result. If there are many gaps in the data, for example, some important delay points could be missed. This is important new knowledge for our understanding of how to evaluate health care organisations.

Ten years on from the original evaluation, the way in which emergency departments are run may have changed because of changes, internal or external to the health care system, that could be local or global. Examples include: change in the funding system; the availability of a different mix of health professional skills; new housing for families or older people nearby; a reduction in road traffic, and so fewer accidents; or changes in society's expectation of services. Although we may know a great deal about how organisations work and how to study organisations, because the time and context are different we may need to repeat the original evaluation to check whether our understanding still applies. This could then lead to new knowledge about health care organisation and how it is influenced by changes in a social context.

The evaluation may provide the opportunity to develop and test new ways of studying the world. For example, the availability of computers means it is now possible to carry out forms of data analysis that were previously very time-consuming or just not possible. Analysis of patient flow through an emergency department can now be studied using a technique called agent-based modelling, which requires a computer to do a huge number of calculations relatively quickly. Using this analysis method it is also possible to demonstrate what is likely to happen if changes are made in the emergency department such as increasing the number of porters. This type of analysis is continually being improved through testing on data from real-world situations, and so using it contributes new knowledge about the analysis method.

Studies undertaken in a particular health care setting, such as the emergency department described above, have the potential to contribute to the development of new knowledge about the world in many ways. The individual leading the local study may not have the time and resources to develop all the possible ways in which it can contribute to new knowledge, but others can through **collaboration**. The collaboration may be by working directly with other people, or indirectly through making the details of the local study available to others through formal publication or more informally, for example, by making the study report available to a network of interested people or on the Internet. However, the local study can only contribute to the development of new knowledge if it has been undertaken in a thoughtful and systematic way and the study reported in sufficient detail for the reader to really to understand what was studied, where and when, how it was studied, why it was studied, who was studied and by whom.

The basics of why we do research and how we do it

If we understand how the world works we are better able to predict what will happen in the world. For those of us working in health care, this may be the ability to predict the course of a disease, the effect of treatment or the impact of a change in the environment on health. If everything about the world we live in were obvious just from us observing it, then we would not need to do research. This is not how it is. There are important aspects of the world and how it functions, both natural and social, that cannot be immediately observed. Natural and social scientists have built up knowledge about how the world works and keep improving on this knowledge. The knowledge we have is only the best truth we have about the world at the moment. Researchers take what is currently known and change it to new knowledge. They do this using:

- their own knowledge about an issue and what other people know about it
- research methods and skills

- a way of reasoning
- special equipment such as microscopes or computers.

If it is obvious how a particular aspect of the world works, then we may not need to undertake research. There are examples from health where the effect of a treatment is so obvious that no further research is needed to demonstrate its effect. Perhaps the most famous example is the dramatic effect when penicillin was first introduced: patients who were expected to die from infections were given penicillin and got better.

What is currently known about an issue and how to study it, including the availability of current knowledge and of special equipment, influences what is researched and how research is undertaken. However, research is also influenced by what is happening in society, including cultural, political and economic factors. Even the research question itself is under these influences. The story of research on tuberculosis illustrates some of these issues (see Box 1.2).

Research on tuberculosis (Porter, 1997) | **Box 1.2**

Identifying the bacillus that caused tuberculosis

The microscope was a key invention that led to understanding many infectious diseases including tuberculosis. The German microbiologist Robert Koch led the team which confirmed in 1882 that mycobacterium tuberculosis was the bacillus that caused tuberculosis. Koch had a clear definition of what he meant by a micro-organism causing a disease. This included finding the micro-organism in every person suffering from the disease and being able to reproduce the disease in experiments with animals by inoculating it with the micro-organism. Thus, through the use of the microscope Koch and his team isolated one aspect of the world, the bacillus, and then in a controlled environment (his laboratory) experimented to see if the animals inoculated with the bacillus developed tuberculosis.

Social influences on tuberculosis

In Europe in the 18th and 19th centuries tuberculosis was a very common disease but not everyone who came into contact with the tuberculosis bacillus died of tuberculosis. Since the 17th century in the UK, births, marriages and deaths had been recorded. This meant that patterns of disease could be identified. Most of those dying of tuberculosis were the urban poor. This pattern of disease could be identified through the research methods used by epidemiologists who study health and disease of populations.

(Continued)

(Continued)

Historically, the discipline of **epidemiology** was developing as other social change took place, so by the time it was well established in the 20th century, the plight of the urban poor was changing. The social change was not driven only, or even mainly, by research findings but by other social issues, such as the need for healthy adults in the army and industry.

Demonstrating that streptomycin treats tuberculosis

By 1944 the microbiologist Selman Waksman had isolated the antibiotic streptomycin from fungus which killed the tubercle bacillus. This was tested in humans in the first **randomised controlled** clinical trial carried out with human subjects in 1946. Patients with the disease were identified and randomly allocated to a group receiving the new treatment or a group not receiving it. This random allocation is a way of controlling for other influences on the disease so that we can be sure any improvement in health is due to the new treatment and not to other factors. Waksman found more of the patients receiving streptomycin recovered from tuberculosis than patients who did not receive it. In order to design and analyse the trial, Waksman used **statistics**, developing a research discipline.

The different ways of reasoning in research and the development of theory

The way we reason in research is the process of thinking about what we observe in the world and what this tells us about how the world works. There are different ways of reasoning used in different types of research. This can cause confusion for us as health professionals because we draw on so many different types of research. Our understanding of how certain aspects of the world works is expressed as theory. This is a description of how the world works in a general sense (to the best of our understanding) rather than a description of what is happening in a particular time and place involving particular people. Sometimes the word **theory** is used to mean our suggestions about how the world works, before we have undertaken research to see if our suggestions are correct. These suggestions about how the world works are our **hypotheses**.

Undertaking research seeks knowledge that is not only about one particular time, place or person but may apply to many people in many places at different times. However, in our research we use data about particular people in particular places at a particular time. A key part of our reasoning in research is moving from the particular to the more general. In this process, known as **abstraction**, we leave out many details about particular people and their context, and use only the details we think are relevant to our research. If we get this wrong we can miss out the very details that are important.

Theories encapsulate our understanding of why things happen and help us predict what is likely to happen in other places, at other times, to other people. Theory is developed through research, refined through debate and comparison with existing research results and tested with further research. Theory is constantly being challenged and changed, as we understand more through research. Some theory may be very broad in its scope, claiming almost universal relevance, whereas other theory may only explain how the world works in certain types of situations. It is often the latter type of theory that we develop and test in our research as health professionals. However, by drawing together many research studies that suggest local theory, it is possible to develop more broad-ranging theory.

How theories are presented varies, and different research disciplines have different preferences. Many theories are explained through written text, sometimes accompanied by diagrams or models that represent the theory and are designed to aid understanding of the theory (examples of this type of diagram are Figure 5.1 and Figure 5.3). The use of text and diagrams is common in social, behavioural and health sciences. Other disciplines have very different ways of presenting theory, for example, computer models or mathematical formulae. Whatever form it takes, theory is a way of representing the particular aspect of the world we are studying and how it works. Sometimes theories are known as **models**. The usage of these terms varies and are sometimes interchangeable.

In health care our understanding of the world as expressed through theory draws on research undertaken in different ways using different ways of reasoning. The experimental method is used in a great deal of research related to health and has led to very successful theories about health and disease. To undertake experiments the aspect of the world to be studied is identified and defined, for example a disease or a drug. The experiment tests ideas (hypotheses) about cause, what causes what to happen. For example, in studies of tuberculosis (see Box 1.2), as the tubercle bacillus was found in everyone dying of tuberculosis, Koch reasoned that the bacillus caused tuberculosis in the sense that if the tubercle bacillus was not present a person would not get tuberculosis. In the randomised controlled trial of streptomycin as a treatment for tuberculosis, Waksman reasoned that as more of the people given streptomycin recovered than those who did not receive the drug, in a general sense streptomycin caused the recovery from the disease. This way of reasoning, known as **induction**, is now usually supported by statistical tests that tell us whether our observations could have happened by chance or not. Observing that the tubercle bacillus causes tuberculosis or that streptomycin cures tuberculosis does not tell us how this happens, that is the mechanism underlying the cause and how this might be different in different people, times and places. Induction as a way of reasoning is important within health-related research, but this type of research is not the focus of this book.

Epidemiologists and social scientists often use a similar way of reasoning to experimental research, although they often cannot manipulate the world to isolate a part of it to study. Instead, they identify the aspects of the world to study and

develop ideas (hypotheses) about what may be happening. For example, when studying tuberculosis they may suspect that poorer people living in towns are more likely to die of the disease than poor people living in rural areas (see Box 1.2). They then collect data and look to see if the pattern of data supports their hypothesis or not, and use statistical methods to check whether the pattern may be a chance finding or not. This book will introduce you to this type of research approach as it is often used to clarify further research questions. For example, finding that a poor person with the tuberculosis bacillus living in a town is more likely to die than a poor person with the tuberculosis bacillus living in the country does not tell us exactly what is happening to these people, why they die. What is it about living in a town that leads to more deaths, and does this apply to all towns wherever and whenever? To understand the mechanisms underlying their findings, researchers draw on other types of research evidence, such as laboratory research or research using 'thought experiments'.

The way of reasoning which can be thought of as 'thought experiments' involves observing a particular aspect of the world and collecting data and examining it for patterns that may indicate how the world is working at the time and place it is studied. The purpose is to understand the mechanisms by which the world works that we cannot easily see. However, there is no assumption that how the world works in one time and place will be the same at a different time and place. The world may work in a similar way in a similar time and place, but this would need checking. However, from the understanding of how the world works in many different times and places it is possible to develop ideas about how the world works in more general terms, which is known as theory. This process, known as **abduction**, differs from induction described above, as there is no assumption that the mechanisms by which the world works are exactly the same at different times and places, that is, that causes of a particular phenomenon are always the same. For example, understanding that social stigma is an important influence on how people respond to illness (Goffman, 1983) helps us understand this aspect of the world but does not specify that stigma develops in the same way for everyone nor remains the same at different times and places. Researchers often take existing theory and explore how it helps to understand what is happening for a certain group of people at a particular time and place. This research may then help to develop and refine the theory further. This research approach is the main focus of this book. It introduces you to how to undertake studies of people in a particular time and place that increase understanding of what is happening for these people, there and then, but which also contributes to the broader understanding of how the world functions using this way of reasoning.

Within disciplines such as mathematics a different way of reasoning is used which we mention here but is not the focus of this book. Having identified and defined the mathematical problem, the researcher develops what can be thought of as an internal logic to the problem (**deduction**). When the researcher applies mathematical knowledge to understanding the world, one of the ways of reasoning described above is used.

We undertake research in a particular time and place, collecting data from particular people. However, research also involves taking a step back from the detail to develop theory about how the world works, at least locally, using a way of reasoning that is clear to other people. Other researchers can test our theory elsewhere. The need to step back from the detail of individual people and their context when undertaking research underlies the difficulty of using research evidence in clinical practice. This is particularly so for evidence based on the inductive way of reasoning of experimental research.

Using research evidence in clinical practice

Research evidence is difficult to apply in health care practice because we need to focus on a particular individual within a social context at a particular time in history, whereas research seeks to understand how the world works in a more general sense, not tied to time, place and person. In health care, there will always be this tension between the particular and the general as health care research requires us to move in our thinking from the particular to the general and evidence-based health care requires us to move from the general to the particular (Rosenburg, 1998). Uncertainty of clinical practice is due to the nature of individuals and the nature of research evidence.

Research based in a laboratory considers a person in terms of their biochemistry in order to study one aspect of the person such as diabetes or depression. There is an underlying assumption that there is sufficient similarity between people at the level of biochemistry that such research findings may be applied to most people with diabetes or depression. However, in clinical practice we may find a particular patient with depression does not respond to, for example, a drug affecting the biochemistry of nerve synapses.

There are many factors that may inhibit the effect of the drug in a particular individual; a slight **difference** in their genes or biochemistry, a psychological influence, or factors in their social environment. Such uncertainty applies to any health care intervention.

The uncertainty of whether an intervention that is known to work for most of a group of people (as in a randomised controlled trial) will work for a particular patient is a different type of uncertainty. If results of a trial show that an intervention prevents early death in, for example, 50 out of every 100 patients (**probability** of benefit is one in two), then if the intervention is otherwise fairly safe it is worth trying for all patients. However, as health professionals we cannot guarantee to any one particular patient that they will be one of the 50 to benefit rather than one of the 50 that do not.

There is uncertainty in clinical practice because a health professional does not know enough or because the research has not been done. These are important, but in principal can be overcome. The uncertainty in clinical practice due to the very nature of research evidence is different, as it will always be there (Fox, 2002).

This uncertainty is difficult to deal with because it is a difficult concept, particularly for those of us living in a culture where science tends to be portrayed as providing certainty. Health professionals tend to avoid or skim over the issue in clinical practice (Griffiths et al., 2005).

Despite this uncertainty we should continue to use research evidence in our practice. History reminds us of the importance of seeking evidence for whether an intervention works. For example, blood letting was a popular practice from the 2nd century right through to the mid-19th century, although it is very unlikely to have benefited many patients.

Uncertainty due to the nature of research evidence may be less when research is undertaken in a similar setting to our own or with similar patients. For example, evidence about the best way of providing health care to a local population in the UK served by the National Health Service is more likely to be applicable to other populations in the UK than it is to a population in the USA where there is a very different health care system. Similarly, research evidence about the effect of a drug may be more applicable to people who are similar to the population participating in the research than to people who are very different.

Health care professionals who undertake research as part of their daily work can produce research evidence applicable to other similar situations or similar people, but we have to be cautious as we may not be aware of what it is about a particular situation or person that would make a difference to what happens when we attempt to apply the evidence. However, health professionals are well placed to observe what happens, as it happens, and can adapt way the evidence is applied to the benefit of their patients.

Using our skills of observation and noticing difference and change for research

Health professionals are trained to observe patients and can use this skill in research. Observing and describing what we observe is necessary for all research, although not all researchers undertake this research activity, relying on the observations of others. When we observe and then describe what we observe, we start the process of **abstraction**, picking out from all the many details of life the aspect we want to study. As our aim is to understand more about how the world works, we need to observe as much as possible about what affects the aspect of life we are interested in. We observe the world with prior knowledge about what we are likely to observe; however, we need be open to surprise and look for what we don't expect, otherwise we will only see what we expect to see and discover nothing new or, worse, reinforce current erroneous knowledge. This is no different to how we work with patients where we have to constantly check that we are not missing new or unexpected aspects of our patient's story.

When we observe we make comparisons, noting what is different or what has changed. We may hardly be aware we are doing this, as it is so much part of how we function as humans. Comparison can suggest why there is difference or change, that is, how it has come about. The skill of noticing difference and change is central to research and to health care practice. When assessing a patient we notice what is different about them compared to others or compared to how they were in the past. Noticing difference or change is often what sparks off a new piece of research. We notice something has changed and want to find out why. The process of doing research involves looking out for difference or change and assessing whether there really is a difference or change and how much. The difference or change may suggest the mechanism, or part of the mechanism, by which the change has occurred. We may not be able to establish exactly why something has changed because of the **complexity** of the world but by comparision we can develop theory. Observation of change and constant comparison is central to the research approach (**methodology**) described in this book.

Complexity and research for health care practice

When working in health care practice we became immersed in the health care setting, local the community it serves and the rich variety of patients. Through working in this setting we become accustomed to things not working out quite as we expected and adjust accordingly what we do for a particular patient or situation. We do this because we are working with the complexity of life and the world. Complexity can be a problem for research as it makes it difficult to know what we should focus on in our research. Research on tuberculosis illustrates some of these problems (see Box 1.2).

Although everyone dying of tuberculosis had the tubercle bacillus in their body, if a person was poor in the 19th century they were more likely to die of tuberculosis than if they were rich. There may be many different ways in which this came about, for example, the poor had inadequate nutrition, exposure to environmental pollution, concurrent diseases and needed to do hard physical work. This is an example of how causes of disease may be many and interacting and some may be difficult to identify.

During the 19th century, there were improvements in housing and nutrition for the urban poor at the same time as the methods of studying disease in populations were being developed. The world around the issue under study, in our example tuberculosis, changed while it was being studied. In experimental research where one aspect of the world is isolated, changes in the world during the research have little impact on the results. However, in research for health care practice we cannot isolate ourselves from this constant change.

Since the 19th century, tuberculosis and the tubercle bacillus itself have changed. For example, the presentation of tuberculosis has changed as it has become associated with AIDS and the bacillus has become resistant to antibiotics. This very specific aspect of the world under study has changed. As we undertake our research we have to consider whether what was being studied at a different time and place is the same as what we are studying here and now. We must also be aware that during our own research what we are studying may change. These issues can be very unsettling as they prompt questions such as:

Is my research about something that is real, that actually exists?

Is it possible to find out what is actually happening in the world?

There have been centuries of debate about the nature of the world (**ontology**) and how we investigate it and understand it (**epistemology**). For those of us working as health professionals we may not want to delve into these debates very much, but it is important that we are aware that there is debate. The way we decide to approach our research is influenced by the way we understand the nature of the world and how it can be investigated.

For those of us working as health professionals within Western scientific culture, our training and the evidence we use in practice is mostly based on the assumption that it is possible to understand the world through scientific endeavour and to identify what causes what, particularly through experiments and what is known as **reductionism**, where we look at the details underlying the focus of our research (for example, the structure of the tubercle bacillus). This approach has been very successful for many health issues, but the limitations of this approach continue to be tested and debated.

For many health issues social factors are important, for example poverty, personal relationships and community context. How these social factors cause ill health can be difficult to pin down and there is debate as to whether it is ever possible to identify precisely how social factors cause ill health.

In this book I have assumed that it is possible to identify aspects of the world that are really there, to understand the world, at least to some degree, through our research endeavour and that to some extent this understanding helps us to predict what is likely to happen in the future and how our interventions may change this. This view of what research can achieve has been termed **critical realism**: we assume there is a real world that exists even when we are not aware of it and that we can research it, yet we take care about the assumptions we make, in particular the assumption that we can prove what causes what. The words and phrases 'at least to some degree', 'to some extent', 'likely to' and 'may' are important as we need to be constantly aware of the limitations of what

we do in research. However, we only find out more about these limitations by continuing to investigate the world.

The way we develop our research questions and undertake our research is based on the assumptions we make about the world. Although it is unsettling, our research for health care practice is more likely to lead to new knowledge about the world if we continue to question the nature, even the reality, of what we are investigating and keep in mind that what we do discover is probably only a small part of what is actually happening and may also change.

Uncertainty underlies all research. We undertake research to be less uncertain, yet we have to continually be aware of uncertainty and question what may appear certain. This can make it very difficult to know how to go about doing research. Following the research process set out in the Introduction to this book provides a way of checking that, despite all the uncertainty, we are moving forward in our research. As we move through our research it is important to keep notes about our thoughts as well as what we do in a **research diary**, as by looking back over these notes we can see how our understanding of the world has changed. The next chapter guides you from your very first thought about undertaking research through to developing your research aims, questions and objectives. The remainder of the book follows the research process as mapped out in Table 0.3.

References

Fox, R.C. (2002) Medical Uncertainty Revisited, in *Gender, Health and Healing: The public/private divide*, G. Bendelow, M. Coopeuter, C. Vautier and S. Williams (Editors). London: Routledge. p. 236–53.

Goffman, E. (1983) *Stigma: notes on the management of spoiled identity*. New York: Prentice-Hall.

Griffiths, F., Green E. and Tsouroufli M. (2005) *The nature of medical evidence and its inherent uncertainty for the Clinical consultation: the example of midlife women.* BMJ, 330: 511–15.

Porter, R. (1997) *The Greatest Benefit to Mankind: A medical history of humanity from antiquity to the present*. London: Harper Collins.

Rosenburg, C. (1998) Holism in Twentieth-Century Medicine, in *Greater than the Parts Holism in Biomedicine 1920–1950*. New York: Oxford University Press. p. 335–55.

Further reading

The following reading provides greater depth on some of the issues covered in this chapter. You may also find the references above useful for reading about

the history of medical research (Porter, 1977) and the nature of evidence (Rosenburg, 1988; Fox, 2002; Griffiths et al., 2005).

Evaluation and research

Pawson, R. and Tilley, N. (1997) *Realistic Evaluation*. London: Sage.

One of the most important books on evaluation. This book clarifies what is meant by evaluation and how to do it to inform real-world issues. It is written in a style to contribute to the ongoing debate about what is research and what is evaluation, including the question of how do we know what we know about the world. However, it also assists you to undertake rigorous evaluation.

Robson, C. (2002) *Real World Research*. Oxford: Blackwell.

An excellent book on research methods for real-world issues written for a broad social science audience including those of us working in health care.

May, C. (2006) 'A rational model for assessing and evaluating complex interventions in health care'. *BMC Health Services Research*, 6 86.

This is an example of using the results of evaluations of several different, specific health service innovations to develop new understanding of health service organisation more generally. The paper included a description of how this was done, so provides a useful template for other researchers wanting to draw out more general lessons from many specific, local studies.

Complexity

Holt, T. (2004) *Complexity for Clinicians*. London: Radcliffe Medical Press.

This book provides an accessible introduction to complexity for clinicians and includes examples of clinical issues where complexity science may provide new perspectives.

Cilliers, P. (1998) *Complexity and Postmodernism*. New York: Routledge.

This book takes a more theoretical approach to complexity, placing complexity science within the social theory dominant at the time it was written. It remains one of the best expositions of complexity, though you may not want to read every chapter.

Critical realism

Danermark, B., Ekstrom, M., Jakobsen, L., Karlsson, J.C. (2002) *Explaining Society: Critical Realism in the social sciences*. London: Routledge.

This book provides a comprehensive introduction to the approach to research known as critical realism. The authors explain critical realism very thoroughly and explain how it contrasts to other approaches to research. The attention to detail by the authors makes it a book that takes time to read, but it is well worth reading from cover to cover to gain an understanding of ontology, epistemology, ways of reasoning and theory.