So you want to do research? 1: an overview of the research process

Keith A Meadows

Relative to some other health-care professions, nursing has an immature research tradition and a limited body of research-based knowledge to draw on. Despite progress in recent years, the contribution of nursing to health-care research and development has not been maximized. While this may be due to self-imposed constraints, such as nurses perceiving research as something separate to their practice (Edwards et al, 2002) or insufficient professional confidence, institutional barriers have constrained both capacity and development (Thompson et al, 2001).

However, things are changing. *Making a Difference* (Department of Health (DH), 1999) – the national strategy for nursing, midwifery and health visiting – indicated a commitment to develop a strategy to influence the research and development (R and D) agenda, and to strengthen capacity to enable nursing, midwifery and health-visiting research. The Research Society of the Royal College of Nursing is proactively influencing the UK research policy agenda and is supporting the development of R and D, quality improvement and the development of an information agenda across every field of practice.

Research is important to the nursing profession because, over the past 15 years, policy and professional developments have increasingly placed pressure on nurses to be more accountable for their actions. The introduction of national service frameworks, the National Institute for Clinical Evidence (NICE) and the Commission for Health Improvement (CHI) means that evidence-based nursing practice is firmly established in professional and policy agendas. The question remains, however, whether nursing has the R and D capacity to enable thoughtful evidence-based practice. In a study on the use of research information in clinical decision-making, Thompson et al (2001) identified several barriers to nurses using research-based information in practice, one of which was a lack of research appreciation skills and confidence.

Other reasons why R and D is important to nursing are to answer specific clinical questions, to provide answers to wider clinical questions, to develop practitioners and managers with research awareness skills and to develop R and D leaders.

The aim of this article (the first of a series on designing and conducting a research project) is to provide students and practitioners with a brief introduction to the key phases of the research process. Each of these phases will be discussed in detail later in the series. This article focuses on:

- The difference between research and development
- Developing the research question
- Approaches to reviewing the literature
- An introduction to qualitative and quantitative research methodologies, including sampling, data collection methods and analysis
- Dissemination of research findings to different audiences.

What is 'research and development'?

The Oxford English Dictionary defines research as '…systematic investigation to establish information',

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ABSTRACT

Relative to some other health care professionals, nursing has an immature research tradition as well as a limited body of research-based knowledge to draw on. Nevertheless, research is important to the nursing profession which over the past 15 years has increasingly had pressure placed on it to be more accountable for its actions. Research is also important so as to answer specific and broader clinical questions. This article, the first in series of seven, is aimed to provide novice researchers with an overview of the research process, with a specific focus on developing the research question, undertaking a review of the literature, describing the different research methodologies, sample size, data collection methods and analysis. Different approaches for ensuring more effective dissemination of research findings to different audiences are also briefly discussed.

'The research question needs to be operationalized, i.e. framed so as to define exactly why, how, what and who is being studied. Without a tightly focused research question, it is difficult to interpret the results.'

while the Department of Health (DH) defines R and D as work:

- Which is designed to provide new knowledge
- Whose findings are potentially of value to those facing similar problems elsewhere
- Whose findings are planned to be open to critical examination and accessible to all that could benefit from them (DH, 2003).

Research is the process of identifying a question or questions, choosing and applying the most suitable method for collecting and analysing the information to answer the question and finally disseminating the findings for the benefit of others.

Development has been defined as '… the systematic evaluation of the application of the results of research in practice' (Aynsley-Green, 1998).

As an example, a nurse may have read a research paper on ways of reducing non-attendance at a diabetes outpatient clinic. The published results were encouraging and the methods were well described and straightforward to apply in his/her own clinic, so he/she decides to try this out. The first thing to do would be to get an accurate picture of the situation in the clinic – a baseline assessment. He/she would then apply the methods and then evaluate their impact on the non-attendance rate over a given time period. The nurse would then ask questions such as: is there a difference in the non-attendance rate from baseline? What are the benefits in terms of costs? What are the demands on resources? Do the benefits outweigh the costs?

The evaluation must be carried out using the right methods for collecting this kind of information. It requires careful planning to ensure all appropriate data are recorded at specific and relevant times in a manner to enable a full analysis to be carried out.

It is worth pointing out that this process of evaluation is not the same as audit, where findings are not representative of any other population other than that under study and which does not generate new knowledge.

An overview of the research process

The main phases of research are shown in *Figure 1*.

1. Identify the research question

Often, research questions develop over time and can originate from a number of different sources, including previous research, the literature and observation. For example, a nurse may have read in the research literature that a change in practice may lead to greater service uptake with a particular ethnic group. He/she wants to see if a similar practice change will result in a similar change among a different ethnic group.

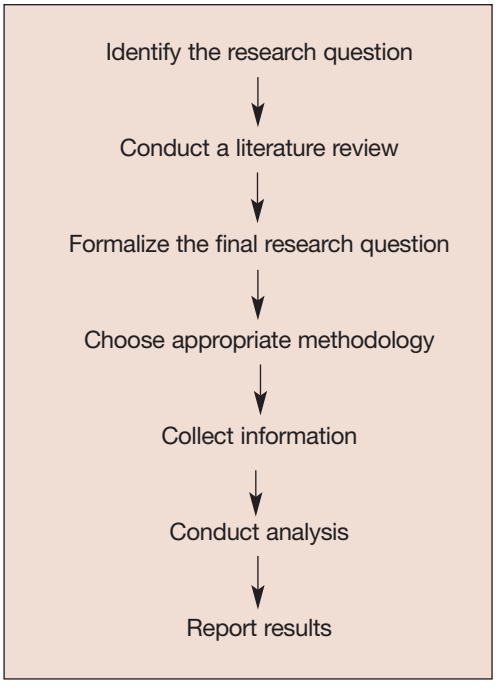

Figure 1. Key stages of a research project

Another situation may be that a nurse has observed, over time, that pregnancy termination rates are higher in a certain group of women compared to others and wants to know what the factors could be that lead to this observation.

These questions are the starting point, but they are not sufficiently specific to go out and collect information to answer them. The research question needs to be operationalized, i.e. framed so as to define exactly why, how, what and who is being studied. Without a tightly focused research question, it is difficult to interpret the results.

An investigation into the level of depression in a group of older patients, for example, would require careful definition of the type of illness, how it will be measured and what the rationale is for asking the research question, i.e. is it clinical or reactive depression and why? The manner of the illness may well dictate the measure used as this determines different aspects of the illness.

In relation to the pregnancy termination example above, there needs to be a specific definition of which women will be studied, e.g. women aged 20–30 years. Yet ethnicity or marital status may also be relevant to the outcomes of the study. The research question should be grounded wherever possible in the literature, be specific and explicit in what or who is being studied and why, so that the results have meaning (Robson, 2002).

An alternative to the research question is the research hypothesis. This differs from the research question in that it makes a prediction, starting with

the word 'that', e.g. 'that pregnancy termination rates in women aged 20–30 years is directly related to marital status'. As with a research question, a hypothesis has to be carefully framed and operationalized in order to test it. However, hypotheses tend to be embedded in a theory and, if the hypothesis is supported by the research, it goes some way in adding support to the theory (Gross, 1992).

2. Conduct a literature review

Reviewing the literature is an essential part of defining the research question or hypothesis. It can give background to the research by identifying what, if any, research has gone on before, what factors have been considered and the variables measured.

Existing literature forms the basis for research and can provide a context for interpreting findings as well as preventing unnecessary repetition of research. All formal grant applications require some form of literature review to provide the background to the proposed research.

Until quite recently, literature review involved laboriously tracking down book and journal references by hand. Now, however, there is a wide variety of electronic or internet-based resources that simplify the process of finding articles and other published material (*Table 1*). These may be accessible from home or through a library, free or on payment of a charge. They allow searches for relevant literature using specified years, keywords, authors or journals. Examining the reference lists of the literature identified is also strongly recommended to direct the researcher to further material and key authors in the area (NHS Centre for Reviews and Dissemination, 1996).

When the review stops providing any new material to that already identified, this usually suggests that the review has been comprehensive. However, the review should not be limited to published research material. The 'grey' literature, such as unpublished reports or work-in-progress, can also be important as can non-research-based literature and the popular media, which can highlight areas of concern, opinion and attitudes.

3. Formalize the final research question

Finally, the research question must be formalized so that what is to measured and how, is made explicit. Using a hypothetical example, we could ask: 'Why is the pregnancy termination rate in single women aged between 25 and 35 attending the outpatients clinic, with moderate reactive depression as measured by the Beck Depression Inventory, significantly higher than married women aged 25 to 35 years with moderate reactive depression?'

Table 1. Online sources of bibliographic information

Medline	www.ncbi.nlm.nih.gov/PubMed/
CINAHL	www.cinahl.com
ENB	enb-search.ulcc.ac.uk/cgi-bin/hcdsearch
Psycline	www.psycline.org
ERIC	www.eric.ed.gov
Metcrawler	www.metacrawler.com/info.metac/dog/index.htm
JISC	www.jisc.ac.uk
Cochrane Database	www.update-software.com/Cochrane/default.htm
British Medical Journal	www.bmj.com
BIDS	www.bids.ac.uk/
OMNI	omni.ac.uk
EMBase	www.embase.com
Athens	www.athens.ac.uk

4. Choose appropriate methodology

Research methodologies can be generally classified as either qualitative or quantitative. Broadly speaking, quantitative methods seek to measure broad patterns of health and illness and identify specific problems or groups of particular ill health or behaviour, while qualitative methods help to develop an understanding of the experiences and behaviour underlying the quantitative findings (Nazroo and O'Connor, 2002). The choice as to which to use is heavily dependent on the nature of the research question/hypothesis and the kind of information required to answer it.

Qualitative method

Qualitative research seeks to provide explanations of behaviour and attitudes (Hoinville and Jowell, 1978). Furthermore, it enables the exploration of subtle variations, the particular language used to describe emotions and experience and the context of the situation. For example, qualitative research can address the limitations of population-based surveys of mental health, which use standardized research tools developed around western concepts of illness, by unmasking the cultural differences in the way experiences and behaviour are expressed (Kleinman, 1987).

Qualitative research is also implicated where there is a lack of prior research or theory or where a description and analysis of culture and behaviour from the perspective of those being studied, is needed (Bryman, 1988). For example, while there are numerous descriptive studies on homeless people (Partis, 2003), in terms of demography, little is known about what sustains and fosters a homeless person's hope. Partis (2003) carried out a qualitative study to explore

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this. Partis produced an emerging theory which provided a clearer understanding of the meaning of hope from the perspective of the homeless person.

Finally, qualitative research can also be a precursor to a quantitative study and is helpful for generating research questions.

These characteristics of qualitative research, and the need to draw wider inferences and generate conceptual frameworks which can be applied to the broader population, mean it is essential that samples of respondents for such research are selected to reflect a range of diversity, rather than represent the number of people with these characteristics (Nazroo and O'Connor, 2002). For example, in the exploration of the psychosocial impact of diabetes on daily living, people would be selected who show a range of characteristics which, from experience or research, have been shown to impinge on how they live with the illness. This would include respondents with a range and severity of problems, of different ages and duration of illness and living alone or in a relationship.

The common theoretical framework for qualitative research is the central concepts of Heideggerian phenomenology (Heidegger, 1962). This considers that an understanding of the individual cannot occur in isolation from the person's world and that each person's unique view of the world and their social reality is as valid and true as any other.

Quantitative method

Quantitative research, by contrast, uses standardized methods for collecting data, which is often in the form of a questionnaire. The information collected is then transformed into numbers to enable some form of statistical analysis to be carried out.

Quantitative research can be descriptive, analytical or experimental. Descriptive studies are carried out to determine, for example, the frequency of a disease, the kind of people suffering from it and to describe patterns such as the distribution of attributes and variables like sex, age, occupation and ethnicity. Descriptive studies seek to characterize people affected. They may involve observations made at one point in time – so-called cross-sectional studies – and longititudinal studies, in which observations are repeated in the same study group over a period of time (Menard, 1991).

Analytical studies go beyond the descriptive to provide explanations of the phenomena studied, e.g. to test specific hypotheses or determine why one particular group or person is affected while another is not (Robson, 2002).

Experimental studies explore the outcomes resulting from the manipulation or introduction of a variable such as treatment (Robson, 2002), e.g. an investigation into the impact of psychosocial counselling over a given time period compared to no counselling, in the rehabilitation of patients after their first myocardial infarction. One approach might be to randomly allocate the patients to either the treatment group or the no-treatment group (control group) and measure whether there were any statistically significant differences in the psychosocial outcomes between the groups. It is however, worth pointing out that care should be taken under such experimental conditions as these, to ensure that a control group with a normal standard of care is provided because no counselling might not be an option in such circumstances.

5. Collect the information

Obviously, before analysing the data, it must be decided how it will be collected and who it will be collected from. Part of the process will include gaining ethical approval from the relevant research ethics committee.It also worth mentioning that a requirement of all research ethic committees is that consent must be obtained from the individuals taking part in the research.

Qualitative approaches

The two commonest approaches to exploring the person's view of the world are through in-depth interviews and group discussions. In-depth interviews are conducted on a one-to-one basis by the researcher, generally with the aid of a topic guide, which is a list of areas or themes to be discussed in the interview. However, because the questioning is responsive to what the interviewee is saying, e.g. through the use of probing questions (e.g. 'could you tell me more about that?' or 'why do you feel that way?'), both the time spent on the different themes and the order in which they are addressed can vary between interviews.

To enable the interviewer to pay full attention to what is being said in the interview by the respondent, as well as noting non-verbal behaviour, interviews are often tape-recorded. This will provide a detailed account of the respondent's response and a verbatim transcript for future analysis.

Samples for qualitative research should be purposively selected to ensure coverage of the defining characteristics of the population under study, relevant to the research question, and to cover the full range of subgroups so as to identify, explore and explain variations in the nature of views and experiences between them. To ensure sufficient diversity of behaviour, attitudes and experiences, sample sizes should not generally be less than 20 participants.

The minimum size of the sample needed for a study can be dictated by the point of saturation – the point at which no new information about or insight into the phenomenon under study is obtained. It is impossible to predict in advance what the minimum sample size will be. However, the prolific nature of qualitative data, which can be related to the research question, the diversity of participants, and the range of themes explored, tends to produce a physical limitation on the maximum size of the sample.

Group discussions, also be called focus groups, generally comprise six to eight respondents (participants) and one or two moderators (facilitators). Respondents will be selected (non-randomly) to ensure that they are sufficiently similar to enable them to be open about their views and experiences, but also sufficiently different to assist discussion and ensure diversity in views. The task of the moderator(s) is to ask open questions of the group and to encourage respondents to discuss their attitudes and experiences. This discussion of attitudes and experiences can highlight both common experiences and differences in the group, as well as acting to stimulate further thought and interaction. Group discussions also enable the moderator to observe social interactions. A limitation of group discussions, however, is that they are less useful in obtaining personal accounts (Krueger and Casey, 2000). As with in-depth interviews, a topic guide listing the key areas and themes to be explored will be used and discussions may be audio recorded to provide verbatim transcripts for analysis.

Skill is required in moderating group discussions, e.g. in dealing with over-talkative and reticent members of the group. For a more detailed discussion on focus groups, see Morgan (1997) and Krueger and Casey (2000).

Quantitative approaches

Methods

Although clinical studies may use a variety of measurements of physical attributes or physiological processes, much nursing research collects quantitative information, often using a questionnaire. There are three main ways in which information can be obtained using questionnaires: self-completion, in which respondents fill in the answers by themselves; face-to-face interviews, where an interviewer asks the question in the presence of the interviewee and also records the respondent's answers; telephone interviews, in which the respondent is contacted by telephone and the interviewer asks questions and records answers.

Each of these methods has its strengths and weaknesses. Self-completion questionnaires can be sent by post, enabling large samples to be reached, but response rates can be low. They are inappropriate for populations with high levels of illiteracy, and if sent by post need to be short and the questions asked need to be in simple language – the experience of many researchers suggests that long, complex questionnaires are often either not completed or incorrectly completed. Nevertheless, carefully designed self-completion questionnaires can provide useful and representative information. In addition, by offering respondents the opportunity to complete them in the privacy of their own home, they can overcome some of the barriers of embarrassment or shame in the collection of sensitive data.

Face-to-face interviews address a number of the limitations of the self-completion questionnaire; they can be used in populations with high levels of illiteracy and interviewers can provide clarification and deal with misunderstandings as well as ensure that information is collected. However, they often require training, cost more, there are risks of interviewer bias and the collection of sensitive data can be problematic. Compared to postal questionnaires, the size of the sample reached can be limited unless there is more than one interviewer.

Telephone surveys combine both the advantages and disadvantages of the self-completion questionnaire and face-to-face interview. They enable large samples to be reached, interviewers can provide clarification and address misunderstandings, and levels of literacy are not such a significant problem. Limitations include confidentiality, bias and the asking of sensitive questions. Telephone surveys may also have to be conducted in the evenings, when respondents can be reluctant to answer certain questions when other persons are present, and results can be biased because only respondents with a telephone are included in the sample.

Sample

The second main consideration is who the information will be collected from. In contrast to qualitative research, quantitative research results are drawn from a sample, which is representative of the total population of interest so that findings can be generalized, e.g. the smoking behaviour of all men aged 35–60 years in a given geographical area. An exhaustive survey would entail the completion of perhaps many thousands of questionnaires. To overcome this, sampling can be used to give the same information but from a smaller number of respondents.

There are a number of different sampling techniques available. The most commonly used is some form of random, or probability, sampling. A random sample is intended to be representative of the

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population about which you wish to make predictions or generalizations, to ensure the validity of any inferences that are drawn from the statistics. Using the example of smoking behaviour among men aged 35–60, there are a number of different sampling strategies to achieve this, e.g:

- Simple random sampling, where selection is made by chance alone such as drawing numbers from a hat. This means every man aged 35–60 years in the defined geographical area has an equal chance of being selected
- Systematic sampling, where selection is made according to some fixed interval, e.g. every fourth house
- Cluster sampling, an example of what is called multi-stage sampling and which is appropriate when undertaking interviews in the field to minimize travel. To avoid travelling over a wide area, smaller areas can be sampled, then from these, sample the practices. The number of sampling stages is dependent on the study, but a limitation of this approach is that the precision of the sample is reduced.

Each of the sampling procedures have both strengths and limitations and before designing any study it is strongly recommended that a statistician be consulted. For more information on how to sample in surveys, please refer to Fink (1995a).

6. Conduct the analysis

Qualitative analysis

There are a number of approaches to the analysis of qualitative research data. Generally speaking, analysis comprises a number of stages involving content analysis of the transcripts leading to the summarizing and classifying of data in a thematic framework, which is grounded in the respondents' own accounts. Each transcript is analysed in a systematic way using a common methodological framework, so enhancing the reliability and validity of the interpreted findings. Validity is about how sure we are in measuring what we think we are measuring, while reliability is how reliable are our findings. Just because something is reliable does not mean it is valid however. We cannot have validity without reliability. For example a clock can always be reliably 10 minutes fast but it is invalid for telling the correct time.

Other approaches to the analysis of qualitative data are discussed in more detail in Bryman and Burgess (1994) and Miles and Huberman (1994).

The data obtained from qualitative research should never be subjected to statistical analysis or quantified; reporting of the findings from qualitative research should be based on the analysis of the narrative of individual experiences. Samples for qualitative research have not been selected to be statistically representative of the population under study, but to identify, explore and explain variations in the nature of views and experiences (Nazroo and O'Connor, 2002). It is therefore methodologically unsound, for example, to state that 'x% of respondents experienced strain and worry resulting from caring for family members'. Instead, state that 'caring for family members was seen by some respondents to be a considerable strain and worry' (Fenton and Karlson, 2002). Such findings could then be supplemented with relevant quotes from the respondents.

Quantitative analysis

Analysis of data collected by quantitative research will usually involve some form of statistical analysis. Statistics is '…the mathematics of organizing and interpreting numerical information. The results of statistical analyses are descriptions, relationships, comparisons, and predictions' (Fink, 1995b).

Descriptive statistics provide information on the composition of the sample, e.g. how many were under the age of 35 years, or the percentage of men or women having a given treatment. Descriptive statistics also include describing the study sample in terms of the mean, mode and median values of, for example, age, duration of illness, income, attitudes and health status. (The mean is the average value, the mode is the most occurring value and the median is the value which divides the data in half – half the cases have a value less than the median and half the cases have a value greater than the median.) Descriptive statistics may also include measures of spread of data such as the standard deviation, which is the measure of spread around the mean, and range, which is the difference between the smallest and largest value of an observation.

Using statistics to examine relationships is to look for associations between and among variables. For example we might be looking at the strength of association between lung function and physical exercise or smoking behaviour. This relationship may be expressed as a correlation coefficient, which is expressed numerically as ranging between –1 to +1. For example, a correlation coefficient of 0.90 between psychosocial support and perceived wellbeing would be indication of a strong relationship between the two. A correlation of -0.90 would indicate an inverse relationship between the two variables, i.e. the lower the level of psychosocial support the higher the perceived wellbeing (Fink, 1995b).

Statistics can also be used to compare two groups on one or more factors or variables, e.g. to compare differences in wellbeing between men and women or dif-

ferent treatment regimens. Key to interpreting these comparisons is statistical significance – any differences found that are statistically meaningful and not due to chance alone (Fink, 1995b; Argyrous, 2000).

Finally, statistics can be used to predict outcome, e.g. which of the characteristics such as age, duration of illness, attitudes and treatment is linked with well-being (Meadows, 1996).

Choice of the methods of analysis to use will be dependent on the purpose of the analysis, the number and type of variable and type of data. For a more detailed explanation on how to analyse quantitative data, please refer to Fink (1995b).

7. Report results

Dissemination of research is essential if the findings are to be of benefit to others. Nurses must be open to critical examination by their peers and must promote service development based on sound evidence. Dissemination can also reduce the chances of unnecessary, and possibly costly, replication by others.

Leese et al (1996) identified four distinct audiences to whom the results of research in primary care are disseminated: policy makers; managers and health professionals; the academic and scientific community; users and representatives of primary care.

At the very least, every study should end with a report, comprising the background to the study, methods, results and discussion including the limitations of the study and conclusion, which should be lodged in a place to enable examination by others. A final report is, more often than not, a mandatory requirement of funding bodies. Dissemination should not, however, stop at a report where it can remain as unread as part of the 'grey' literature.

Consideration should be given to other types of output reflecting the needs of the target audience. Detailed articles in peer-reviewed journals, books and presentations at academic and scientific meetings are ways to reach the academic and scientific community, whereas executive summaries and general articles will often be sufficient for managers and health professionals. Local presentations to inform peers are also essential.

Conclusion

This first paper in a series of six has provided an overview of the key phases, as a backdrop to a more detailed account of each of the seven stages described here.

The second paper of the series will focus on the development of the research question. This will be followed in the series by an introduction to qualitative and quantitative research methods, questionnaire design and getting your research published. ■

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KEY POINTS

- Research is designed to provide new knowledge.
- It involves asking a question, choosing and applying appropriate methodology.
- Its findings should be widely disseminated.
- It should be of potential value in the provision of effective health care.

So you want to do research? 2: developing the research question

Keith A Meadows

In the first paper of this series (Meadows, 2003), the main phases of the research project were mapped out. Heading this process was identifying the research question. Identifying and formalizing the research question are where many problems with research occur. Without a well-defined and specific research question or hypothesis, even if the research is carried out to the end, it is unlikely to provide much information. A tightly-focused research question or hypothesis dictates what data are collected, how they are collected and analysed and provides a context for the results.

The aim of this paper is to discuss the process of developing a research question from the initial idea through to the final research question, which is defined in operational terms, is unambiguous, measurable and worthy of the research effort.

Developing the research question

Most research originates from a problem or question identified from the literature or arising out of the experiences of the researcher relating to some general problem. For example, it might have been observed that non-attendance rates at an outpatient clinic appear to be very high for a particular group of patients and the purpose of the research would be to explore the reasons why. Alternatively, the researcher may want to consider whether the implementation of a programme, e.g. to facilitate a patient-centred approach to the management of a specific chronic illness, has beneficial outcomes in terms of patient's wellbeing compared to no programme, or which rehabilitation programme has better outcomes for patients than another following a myocardial infarction (MI).

Reviewing the literature

The first essential stage in developing the research question should be reviewing the literature. By reviewing the literature at an early stage, existing research associated with the problem can be identified and will assist in drafting the raw research question. Having decided on the raw, or rough, question to be addressed by the research, two questions will need to be answered to refine the research question(s). First, what kind of information needs to be collected to answer the question? Second, how is this information collected? In other words, the design of the study or research needs to be decided and the right methodology to fit the type of question needs to be selected. A comprehensive review of the literature helps to answer these questions by identifying earlier research and the methodologies used.

An effective way of identifying relevant literature is through the use of electronic sources (*Table 1*). Relevant literature can be searched over specified years, using keywords, by study area, and by author. Medline and EMBASE provide coverage of the literature in many health-care areas but do not record all publications from all medical journals. While Medline has a wide coverage of English language journals, EMBASE provides an increased coverage of articles in other European languages.

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ABSTRACT

The development of the research question for a study can be where a lot of research fails. Without a well-defined and specific research question or hypothesis, findings from the research are unlikely to tell us very much. Developing a tightly-focused research question or hypothesis defines how and what data is collected and analysed and provides a context for the results. This article, the second in a series of six, focuses on the process of developing a research question or hypothesis from the initial idea through to the final research question, using examples to illustrate the key principles. Approaches to reviewing the literature, including hand searching and the use of electronic sources, are described together with their different strengths and weaknesses. An overview of the deductive and inductive approaches to research are described, as well as the underlying rationale of the null hypothesis and one and two-tailed tests. Finally, issues around the feasibility of the study, including, cost, time and relevance, are discussed in relationship to developing the research question or hypothesis.

The comprehensiveness, or recall, of a database search depends on the search strategy applied. Searches with high recall may have low precision, i.e. while they retrieve a large number of articles, many of these might be inappropriate (NHS Centre for Reviews and Dissemination, 1996). These problems can be minimized, to a degree, through the use of search strategies and knowledge of the relevant terms used for indexing. However, such skills are not easy to acquire and it is therefore highly recommended that an information scientist is consulted at an early stage of the review process.

Scanning the reference lists of retrieved articles, and the bibliographies of systematic and non-systematic review articles, can identify additional literature not recovered by the search. Whenever possible, key journals in the field should be searched by hand to identify articles which may have been missed or overlooked in the various database searches. Hand searching is also useful in identifying recent articles which have not yet been cited or indexed electronically (NHS Centre for Reviews and Dissemination, 1996).

Published literature can provide a rich source of research ideas through either extending or refining previous research. Other sources of ideas include:

- The Research Findings Register (http://tap.ukwebhost.eds.com/doh/refr_web.nsf/Home?OpenForm) provides a summary of research projects funded by the NHS, including information such as the research question, methods and findings. The research projects listed are fairly current, which is sometimes not the case with journal articles.
- The National Research Register is a database of about 80 000 ongoing and recently completed research projects funded by, or of interest to, the UK's health service (www.update-software.com/national/)
- The NHS Centre For Reviews and Dissemination (www.york.ac.uk/inst/crd/) holds abstracts of quality-assessed systematic reviews, economic evaluations of health-care interventions and publications and projects by a variety of health-care technology assessment agencies
- The Cochrane Library holds freely-accessible abstracts of Cochrane Reviews (www.update-software.com/cochrane/).

Conference proceedings can be a useful source of information of research in progress and completed. They are generally an unreliable source of data, so where possible, reports from the author(s) should be obtained before any reference is made to the study (NHS Centre for Reviews and Dissemination, 1996).

Results of studies which have been published in reports, conference proceedings, and discussion papers or other formats, and which have not been indexed on the main databases, is known as 'grey literature'. The identification of grey literature is difficult, although the libraries of specialist research centres, research funding organizations and societies may provide a useful source.

It is important to stay focused on the relevant issues and concepts when undertaking a literature review. Whenever possible, the researcher should concentrate on that literature which is credible and has undergone peer review, although identifying other types of literature can be helpful.

Table 1. Online sources of bibliographic information

Medline	www.ncbi.nlm.nih.gov/PubMed/
CINAHL	www.cinahl.com
ENB	enb-search.ulcc.ac.uk/cgi-bin/hcdsearch
Psycline	www.psycline.org
ERIC	www.eric.ed.gov
Metcrawler	www.metacrawler.com/info.metac/dog/index.htm
JISC	www.jisc.ac.uk
Cochrane Database	www.update-software.com/Cochrane/default.htm
British Medical Journal	www.bmj.com
BIDS	www.bids.ac.uk/
OMNI	omni.ac.uk
EMBase	www.embase.com
Athens	www.athens.ac.uk

Research design

Research methodology can be broadly categorized as either qualitative or quantitative. The aim of qualitative research is to help understand social phenomena in a natural, rather than an experimental, setting with emphasis on the meanings, experiences and views of the participants (Pope and Mays, 1995); i.e. to determine 'why', rather than 'how many'. Anastas and MacDonald (1994) refer to qualitative research as 'flexible designs', which are interpretative, using ethnographic or qualitative approaches and with less pre-specification as to what information is required. Often in flexible designs, the design evolves and develops as the research continues.

Quantitative research, which includes experimental research such as randomized control trials (RCTs) and surveys, are examples of what Anastas and MacDonald (1994) refer to as 'fixed research designs'. Quantitative research is generally under-

'The aim of qualitative research is to help understand social phenomena in a natural, rather than an experimental, setting with emphasis on the meanings, experiences and views of the participants, rather than providing quantified answers to a research question.'

taken using a model that requires the need to know exactly what to do before collecting and analysing the data. Quantitative research has a reliance on statistical analysis and generalizations and is often theory driven (Robson, 2002). Therefore, before starting, some idea is needed of what area is to be dealt with, what information is to be gathered, and how.

Types of research question

Why the question is being asked, and the type of information to be collected to answer it, determines the type of research design to be used. For example, differences in the experience of mental illness across different cultures or ethnic groups could be investigated using standardized survey techniques and quantitative analysis (i.e. fixed design) to describe differences in rates of illness such as incidence and prevalence. On the other hand, by taking a qualitative approach (flexible design) the researcher would gain insights into, and an understanding of, the factors and experiences from the analysis of the narrative, obtained from in-depth interviews, which underlie the identified differences (Nazroo and O'Connor, 2002). There are three broad types of questions which research can address:

1. Descriptive

The purpose of the study is to describe what is going on or what exists. For example, differences in rates of illness or the proportion of outpatients sampled with various opinions about the level of service provided. Both quantitative and qualitative research methods can be applied to answer descriptive questions.

2. Relational

This is when a study looks at the relationship between two or more variables, e.g. the proportion of men and women with negative attitudes on the level of service provision, or the proportion of women with eating disorders compared to men. In these examples, the relationship between gender and negative attitudes and eating disorders are respectively being examined. Only quantitative or fixed research design can answer these types of questions.

3. Causal

This is when a study is designed to examine whether one or more variables significantly causes or affects one or more outcome variables. For example, does an intervention programme improve patient self-reported wellbeing? Only a quantitative or fixed research design can answer these types of questions. For more information of the different types of research questions see Fink (1995), Robson (2002).

The research hypothesis

An alternative to the research question is the research hypothesis. In contrast to a research question, an hypothesis is a prediction, which is phrased in operational terms as to exactly what the researcher thinks will happen in the study and is generally linked to some underlying theory (Gilbert, 2001; Robson, 2002). The broad subject matter could, for example, be to test the hypothesized effects of some treatment on some measurable outcome.

Generally, a hypothesis is set in the context of some theory. The theory need not be some 'blue-sky' scientific theory and not all studies will necessarily have, or require, a hypothesis; the study might be designed to be exploratory, or to explore some area more thoroughly in order to develop some specific hypothesis or predictions that can be tested in future research. On the other hand, a research question may be asked which is unrelated to any particular theory, but addresses a particular problem.

There are two approaches to establishing facts: the inductive and deductive methods. With inductive reasoning, the focus is shifted from specific observations to making broader generalizations and theories. This could be done by making a number of specific observations, e.g. observing that quality of life improves in patients receiving psychotherapy, and from these make generalizations about the benefits of psychotherapy on quality of life. It is possible to test a number of hypotheses to test these generalizations and develop a theory. However, a major limitation of the inductive approach is that it is not possible to prove such generalizations beyond the specific situation under study. On the other hand, deductive reasoning involves working from the general to the specific. For example, a researcher may be developing a theory around the effectiveness of psychotherapy on the quality of life of patients. He/she would develop a number of specific hypotheses to test. As each of these hypotheses are tested and confirmed, this provides growing support for the theory. For a more detailed discussion on hypothesis testing, see Argyrous (2000).

Research question or hypothesis?

Choosing whether the study will ask a research question or test a hypothesis is, of course, dependent on the purpose of the study. If a prediction is to be tested, which is related to some underlying theory, a hypothesis for the study needs to be developed. However, if a description of what exists in the study population is needed, or an examination of relationships between variables and/or factors, or examination of the causes and effects of a new treatment, the relevant research question needs to be asked. How

this question is asked is dependent on whether the researcher is undertaking a quantitative or qualitative research study.

Operationalizing the research question

We know that the type of information obtained from a study is dependent on the question or questions asked, and the type of questions asked has an important bearing on whether the research methodology chosen is qualitative or quantitative.

Because of the nature of qualitative research, with its tendency to focus on the narrative so as to have a better understanding of social phenomena in natural rather than experimental conditions, the questions that are asked in qualitative research are different from those in quantitative research.

Often in qualitative research, the research questions evolve from a conceptual framework which is built by the researcher, either graphically or in narrative form, showing the key factors, variables and concepts to be studied and their presumed interrelationships. The framework can be theory-driven, simple, descriptive, and causal or common-sensical (Miles and Huberman, 1994). For a more detailed discussion on conceptual frameworks and research questions in qualitative research, see Miles and Huberman (1994).

In the early phases of setting up a quantitative, or fixed-design study, the research question will be a preliminary one, which will be too vague or broadly phrased to enable specific data to be collected and analysed to answer it. A comprehensive review of the literature will be essential to identify what previous research has been undertaken and which methods have been used to answer the question. This information will provide the basis for developing the research question so that what is being asked, and how it is being asked, is made explicit. This is known as 'operationalizing' the research question.

Operationalizing the research question involves first, identifying the concepts referred to in the research question and second, converting these concepts into operational definitions and expressing them as measurable indicators. In other words, having identified the 'concepts' in the research question, the researcher must determine how these concepts will be measured. Determining what data need to be collected and the best approach to collecting the information, will then follow on. A concept has been described as:

> **'a label we put on a phenomenon that enables us to link separate observations and to make generalizations (e.g. depression, quality of life, disability). A convenience, a name we give to observations and events.' (*Trochim, 1999*)**

A concept can range from the concrete to the abstract and the degree of that abstraction will have a significant impact on the ease and availability in the selection of the indicator(s) to measure the concept(s). The more abstract the concept, the greater the difficulty. For instance, the concept 'physical functioning' could be considered to be more concrete and understandable and, consequently, more easily defined than 'self-esteem'. Physical functioning could be operationally defined in terms of ability to climb one flight of stairs, walk more than a kilometre or 100 metres. Yet for self-esteem there is less clarity and perhaps agreement as to what it is and its constituent components. These stages can be summarized as a simple strategy for operationalizing a research question:

- Formulate the research question
- Identify each of the concepts or main ideas in the research question and list these as Concept 1, Concept 2, and so on
- Review the literature, search for and list identified operational terms for each of the concepts
- Identify and list measurable indicators for each concept
- Rewrite the research question in an operational form.

Example 1

The first raw question could be:

'*Which treatment is better for treating psychiatric disorders?*'

In its present format there is no way to test the question – which treatments and psychiatric disorders are of interest? However, following a review of the literature it may be possible to move on to a more structured question such as:

'Is psychotherapy more beneficial than psychiatric medication for people with a psychiatric disorder?'

This question is testable, but in its present form is too general. There are three key concepts: psychotherapy, psychiatric disorder and psychiatric medication (*Table 2*). To operationally define these, it needs to be clear as to what is meant by psychiatric disorder (i.e. acute or chronic; mild or severe), what type of psychotherapy, what type and dosage of medication will be given, over what period of time, and how would the outcome be measured?

Working from *Table 2,* a more specific question could be:

'Will there be a statistically significant improvement in mildly depressed women as assessed on the

'Often in qualitative research, the research questions evolve from a conceptual framework which is built by the researcher, either graphically or in narrative form, showing the key factors, variables and concepts to be studied and their presumed interrelationships'

Beck Depression Inventory (BDI) after 6 months of cognitive therapy compared to fluoxetine (Prozac)?'

This question operationally defines both the type and degree of illness, against an objective measure or measurable indicator – the BDI (Beck et al, 1961), as well as the time period and treatment. In addition, by stating a statistically significant improvement, it can be determined whether any difference found will not be by chance, rather than just random improvement.

Example 2

'Does rehabilitation improve quality of life of patients post-MI ?'

Again, the question is testable but needs to be more precise. First, a definition is needed of what kind of rehabilitation is provided. Also, there is no mention of a control group. There may be an improvement, but it may also be found that quality of life improves in patients not attending a rehabilitation programme, so a control group is needed to compare and measure the effectiveness of any changes. What does the rehabilitation programme comprise? How long after the completion of the rehabilitation programme is it of interest to find improvements in quality of life? What does quality of life mean?

Quality of life is an ill-defined concept and can cover a number of non-health as well as health-related dimensions including psychological wellbeing, pain, social activity, role and physical functioning. Many so-called quality of life measures are, in fact, measures of health status. As a consequence, the researcher needs to be specific in predicting which areas to expect changes to occur, e.g. social and role activity, and psychological wellbeing.

The population of interest also needs to be clarified – are we thinking about all patients who have suffered MI? Anxiety levels arising from participating in a rehabilitation programme might, for example, be higher for patients with a second MI compared to first MI, therefore possibly reducing any beneficial effect on psychological wellbeing. What if patients with diabetes were to be included? Will they be more concerned over increased risks of acute complications such as increased hypoglycaemic episodes? Age may also be a key factor of outcome. The length of the programme needs to be defined. Too short, and any potential improvement may be missed. But, what is meant by improvement? What levels of improvement are being looked for and compared, to justify the programme's effectiveness?

Research questions must be written to avoid ambiguity; they must be specific as to what is an answer, they must be answerable with the data available and the method used to collect the data and, finally, must be worthy of the research being undertaken. For a more detailed discussion on developing research ideas and research questions, see Robson (2002).

Table 2. Operationalizing the concept (after Trochim, 1999)

Concepts	Concept 1	Concept 2	Concept 3
	Psychotherapy	Psychiatric disorder	Psychiatric medication
Operational terms	Cognitive therapy	Mildly depressed	Fluoxetine
Measurable indicators	6 months	Beck depression inventory	

Operationalizing the research hypothesis

Types of hypothesis

As with the research question, the hypothesis must be operationalized so that what is being predicted, and how, is made explicit. In the earlier example of the effectiveness of cognitive therapy on mildly depressed patients, assume a theory is being developed around the effectiveness of cognitive therapy. The hypothesis could be, for example:

'That there will be a statistically significant improvement in mildly depressed women compared to men as assessed on the BDI after 6 months of cognitive therapy compared to fluoxetine.'

This is almost identical to the research question with the exception that the hypothesis is written as a prediction by the use of the word 'that'. In all other respects, the level of specificity is the same.

The formal way of setting up the hypothesis test is to formulate two hypothesis statements. The first describes the prediction, e.g. that there will be a statistically significant improvement in mildly depressed women compared to men as assessed on the BDI after 6 months of cognitive therapy compared to fluoxetine. The hypothesis making the prediction is known as the alternative hypothesis (sometimes notated as HA or H1). The only other possible outcome to the prediction is that the variables will not be related, i.e. that there will not be a significant improvement in mildly depressed women compared to men as assessed on the BDI after 6 months of cognitive therapy compared to Prozac. This second type of hypothesis is called a null hypothesis and represents the alternative hypothesis (sometimes notated as HO or H0) (Siegal and Costellan, 2001).

Alternative and null hypotheses are needed because it is much easier to test the null hypothesis than the alternative. For example, it only needs to be established that there is a significant difference between the rate of detecting tuberculosis in a screened group, compared to non-screened group, to reject the null hypothesis and accept the alternative hypothesis, i.e. the prediction is supported. It does not need to be specified by how much the detection rate differs, just that there is a statistically significant difference.

Usually in research, the researcher is trying to find support for the alternative hypothesis but in some studies, the prediction might be that there will be no difference or change. In such cases, the researcher is trying to provide support for the null hypothesis, rather than the alternative.

One-tailed and two-tailed hypotheses

The alternative hypothesis example above, where the direction of the outcome was specified as a statistically significant improvement in mildly depressed women compared to men, is called a one-tailed hypothesis (Argyrous, 2000). When a hypothesis has been written without specifying a direction of the outcome, this is called a two-tailed hypothesis. A two-tailed hypothesis can be used when the researcher is unsure, or not sufficiently confident, to make a prediction about the direction of the outcome. In this case, the hypothesis would be written to reflect this uncertainty. For example:

'That there will be a statistically significant improvement between mildly depressed men and women as assessed on the BDI after 6 months of cognitive therapy compared to fluoxetine'

Here the hypothesis has been written as predicting a significant difference in outcome between men and women without specifying which group will improve most. In other words, the direction of the outcome has not been hypothesized. The importance of whether a one-tailed or two-tailed hypothesis is tested, is the statistics used to test the hypothesis. This will be discussed in the fourth article of this series, but for a more detailed discussion of hypothesis testing, see Argyrous (2000).

Using the question or hypothesis

Finally, when developing the research question or hypothesis, the researcher will need to consider whether the study is feasible or not, e.g. he/she may have to make a trade-off between rigour and practicality. Will the researcher have the resources to complete the research? Can the required cooperation be obtained from other staff and patients to carry out the project in the specified time? Is the length of the project reasonable? Can the project be completed in the time available? What is the possible impact on day-to-day work and colleagues? Is the research relevant?

With ever-increasing demands on research funds, research must be timely, relevant and cost-effective. The chosen research topic might be of great importance to the researcher, but where does it fit into factors such as current practice, priorities and needs? All research will require ethical approval before starting and issues concerning patient consent will also need to be addressed. ■

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KEY POINTS

- All research should have a specific and well-defined research question or hypothesis.
- Reviewing the literature is an essential phase in the development of the research question or hypothesis.
- The research question and the information needed to answer it determines the research design.
- Research should be timely, relevant and cost-effective.

So you want to do research? 3. An introduction to qualitative methods

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ABSTRACT

This article describes some of the key issues in the use of qualitative research methods. Starting with a description of what qualitative research is and outlining some of the distinguishing features between quantitative and qualitative research, examples of the type of setting where qualitative research can be applied are provided. Methods of collecting information through in-depth interviews and group discussions are discussed in some detail, including issues around sampling and recruitment, the use of topic guides and techniques to encourage participants to talk openly. An overview on the analysis of qualitative data discusses aspects on data reduction, display and drawing conclusions from the data. Approaches to ensuring rigour in the collection, analysis and reporting of qualitative research are discussed and the concepts of credibility, transferability, dependability and confirmability are described. Finally, guidelines for the reporting of qualitative research are outlined and the need to write for a particular audience is discussed.

The past decade or so has seen an increase in the use of qualitative research in the social sciences in general. However, in the health field – with its traditional emphasis on quantitative research methods including randomized controlled trials and experimental methods – the application of qualitative research methodology has been less progressive. One possible reason for this is that qualitative research is often viewed as being unscientific and lacking rigour and that its findings are not generalizable (Mays and Pope, 1995). However, in a climate of ever-increasing complexity in the provision of health care, health professionals' work and of related organizational and cultural changes, traditional quantitative methods are not always the most appropriate for dealing with questions that investigators are now asking.

The aim of this article is to introduce some of the key issues in qualitative research, starting with a description of qualitative research and the two main methods for collecting qualitative data, through to an overview on the analysis of qualitative data, ensuring rigour and the appropriate reporting of the research findings.

Choosing the appropriate methodology

Research methodologies can be broadly categorized into either qualitative or quantitative. Quantitative research focuses on the use of standardized methods (e.g. questionnaires) to collect information, which is then transformed, into numbers to enable some statistical analysis.

The aim of qualitative research is to help in the understanding of social phenomena in a natural rather than an experimental setting with an emphasis on the meanings, experiences, attitudes and views of the participants rather than providing quantified answers to a research question (Hoinville and Jowell, 1978; Pope and Mays, 1995). Data obtained from qualitative research are usually in the form of words rather than numbers and these words are based on observation, interviews or documents (Miles and Huberman, 1994). Qualitative data can also include still or moving images.

The focus of qualitative research is to determine 'why?' rather than 'how many?'. Glaser and Strauss (1967) argued that 'qualitative research can make a valuable and unique contribution by generating a conceptual framework for research that is grounded on information about how people actually feel and think'.

Miles and Huberman (1994) have identified a number of recurring features of qualitative research. These include:

- The researcher's role to gain a holistic overview of the context under study
- To capture data on the perceptions of local 'actors' (individuals) from the inside
- That most analysis is done with words
- That relatively little standardized instrumentation is used.

Qualitative research is also often described as essentially inductive in its approach, i.e. it is data-driven, with findings and conclusions being drawn directly from the data. This is in contrast to the deductive approach commonly used in quantitative research, whereby ideas and hypotheses are formulated and tested out in the data specifically collected for the purpose.

While there are some clear and distinguishing differences between quantitative and qualitative research methodologies, Pope and Mays (1995) have stressed the importance of avoiding a rigid demarcation between the two research traditions. Rather they view both research traditions as complementary. For example, qualitative work can be the preliminary phase to a quantitative study where there is a lack of prior research or theory. At its simplest this can be to identify the terms or words for use in the subsequent survey questionnaire, or to provide a description and understanding of a behaviour or situation. Alternatively the use of qualitative techniques can supplement the findings of a quantitative study, e.g. by exploring ethnic differences in the experience of psychiatric illness which underlie the findings of a survey (O'Connor and Nazroo, 2002). Similarly, qualitative methods can be used as part of a process of triangulation (Denzin, 1970), in which several different methods of data gathering are used to examine a single phenomenon. The third way in which qualitative research can be used is the study of complex behaviours and attitudes from the perspective of the patient and or professional which is not open to quantitative research methodology. Pope and Mays (1995) referred to this type of research as 'stand alone qualitative research', which is increasingly evident in studies of health service organization and policy.

Benoliel (1984) has described the important purposes of qualitative research as:

- Description – where little is known about a group of people or social phenomena
- Hypothesis generation – where no explicit hypothesis exists and where the collection of in-depth information enables the formulation of hypotheses, which could be tested more formally in subsequent research
- Theory development – where qualitative data are analysed with the view of developing an integrated scheme to explain the observed phenomena.

Collecting the information

As already pointed out, qualitative research meets different objectives from those of quantitative research and as a consequence provides a very different type of information. This information is often unstructured, unwieldy and, more often than not, consists of verbatim transcripts from discussions with the respondents, field notes and other written documents (Ritchie and Spencer, 1994).

The principal methods of obtaining qualitative data are the research interview and/or group discussion (also known as focus groups). There are three main types of interview: structured, semi-structured and in-depth. Structured interviews ask standardized questions with predetermined responses, e.g.:

'How would you rate your overall health over the past 7 days?

Excellent Good Fair Poor'

Semi-structured interviews are conducted using a loose structure of open-ended questions which define the area to explored and which the respondent can answer in his or her own words: e.g. What would you describe as good health?

In-depth interviews, also known as unstructured interviews, are the least structured and are the main method used in qualitative research for obtaining information.

In-depth interviews

In-depth interviews should be flexible, interactive and responsive. The questions should also be worded to encourage respondents to provide a detailed response in their own words. Good questions in qualitative research should be open-ended, neutral, sensitive and clear to the interviewee and can be based on behaviour or experience, opinion or value, feeling, knowledge and sensory experience (Patton, 1987).

The process of undertaking an in-depth interview can and preferably should be facilitated through the use of a topic guide. This is simply a list of topics or themes and sub-themes to be explored during the interview. How these topics and themes are phrased as questions is normally at the discretion of the interviewer. However, care should be taken when framing the questions to ensure they are comprehensible to the respondent. The topic guide is just that, and should not be used in a way that restricts the flexibility and interactive nature of the interview or responsiveness of the respondents' answers. The interview should be conducted in such a way to enable spontaneous emergence of topics that might not have been previously considered relevant by the researcher.

Encouraging people to speak freely and at length about themselves or their situation is an essential requirement of qualitative research,

'Good questions in qualitative research should be open-ended, neutral, sensitive and clear to the interviewee and can be based on behaviour or experience, opinion or value, feeling, knowledge and sensory experience'

'A considerable amount of detailed information can be obtained from group discussions … but it is likely that the detail will not match that obtained from separate in-depth interviews.'

which can be achieved through the personalization of the discussion. For example rather than asking about waiting times in general, or problems in getting access to GPs, respondents should be asked about their own experiences of waiting times or registering with their local GP.

Both verbal and non-verbal cues can also help in encouraging the respondent to talk openly. The use of a simple 'mmm' or 'uh-huh' or 'I see' shows understanding and interest, which can stimulate discussion. Respondents can also be asked probing questions ('probes') to encourage them to provide more depth or detail, for example 'How did you feel when you were told that you would have to wait 6 moths for an appointment?'. Another approach is to repeat the expression made by the respondent. For example: 'You said you felt very angry when told…?', which can be followed by an expectant pause to encourage a response.

It is important to make clear the distinction between probing and prompting. For example: 'Did you feel very angry when you were told you had to wait 6 months before you could have the operation?' is prompting the respondent to say something not in his or her own words. This is very different from reflecting the respondent's comment back at them: e.g. 'You said that you felt very angry. Can you tell me why?'.

Non-verbal cues to encourage openness in the respondent include taking an open and relaxed posture, making good eye contact and nodding of the head to indicate interest or understanding.

The optimal length of an in-depth interview is dependent on a number of factors, which include the resources and time available to carry out the interviews, the depth of enquiry and age of the target group. Interviews over 1½–2 hours are likely to be getting close to the limit when fatigue sets in for both the interviewer and interviewee.

Carrying out qualitative interviews requires a considerable amount of skill and it cannot be assumed that clinical skills are transferable to achieve this. Maintaining control of the interview is essential, for example in dealing with verbose interviewees, but it is also important to choose the appropriate degree of directiveness to maintain that control. Some of the common pitfalls in interviewing include: jumping from one subject to another, giving interviewees medical advice, offering one's own perspective – so possibly biasing the interview, and asking embarrassing or awkward questions (Field and Morse, 1989).

For a more detailed discussion on conducting in-depth interviews, see Burgess (1984), Bryson and Burgess (1990), Gilbert (2001), Robson (2002).

Group discussions (focus groups)

Group discussions can be cheaper and quicker to organize than individual interviews with the same number of respondents. Group discussions are usually led by one or two moderators, whose task is to ask open questions to the group as a whole, to encourage group members to discuss the issues of interest to the researchers, and manage the whole process. The moderators should ensure that every member of the group speaks as well as preventing over-talkative participants from dominating the discussion and that participants keep to the topic. The moderator should, wherever possible, interfere as little as possible in the discussion, other than summing up occasionally the views expressed and feeding this back to the group. The moderator should also stimulate further discussion by highlighting inconsistencies in the views put forward by the group.

For a more detailed discussion on setting up and running a group discussion see Morgan (1997), Krueger and Casey (2000), Gilbert (2001), Robson (2002).

As with in-depth interviews, a topic guide should be used but might be much shorter to enable the moderator to rapidly review the range of topics during the discussion. Group discussions should probably not exceed 2 hours in length for the same reasons as interviews. If possible group interviews should be audio-recorded to facilitate transcribing of the discussion.

While a considerable amount of detailed information can be obtained from group discussions comprising, for example, eight participants, it is likely that the detail will not match that obtained from eight separate in-depth interviews. As a consequence they are less suitable than in-depth interviews when the objective is to develop hypotheses and identify personal motivations (Hoinville and Jowell, 1974).

Sampling and recruitment

As the aim of qualitative research is to identify the different behaviours and attitudes of participants in relation to a particular subject, it is important that the participants for in-depth interviews and discussion groups are selected purposively so as to represent a wide spectrum of these views and experiences and to cover the full range of subgroups so as to identify, explore and explain variations in the nature of views and experiences between them (Hoinville and Jowell, 1978).

While there appear to be no formal rules regarding the recruitment of participants for group discussion work, groups usually comprise around six

to eight respondents who are selected purposively to ensure coverage of the range of behaviours, experiences, values and attitudes relevant to the topic under study. More than ten participants can make managing the group difficult (Krueger and Casey, 2000).

When selecting group participants there should be sufficient similarity between participants to ensure that they feel confident in being open about their views and experiences, but there should also be some diversity to stimulate debate (Hoinville and Jowell, 1974).

'For further reading on sampling for qualitative research and non-probability sampling see: Fink (1995), Krueger and Casey (2000), Robson (2002).

Ethics and consent to participate

Any research involving the use of human subjects either directly or indirectly, must receive ethics approval. This will generally mean submitting to the ethics committee, details of the research, including who will take part in the research, what the research will comprise, issues of data protection and confidentiality, such as how data collected will be stored and who will have access to it. Copies of any questionnaires scales, tests and interviews schedules and topic guides that will be used in the study will also have to be reviewed by the ethics committee. It is also worth bearing in mind that it is now common practice that journals, before publishing research studies, need to be assured that ethics approval has been granted for the research. Ethics committees will also need to see evidence on how informed consent from the study participants will be obtained and issues such as the ability of participants' to give consent, including mental ability, age, level of literacy and language etc will be addressed.

Conducting the analysis

A detailed discussion on how to conduct the analysis of qualitative data is beyond the scope of this article, but a number of very good books are available which provide in-depth discussions of the topic (e.g. Miles and Huberman, 1994; Bryman and Burgess, 1993; Gilbert, 2001; Robson, 2002).

Essentially, qualitative data analysis is about detection – defining concepts and understanding internal structures; categorising, e.g. the different type of behaviours or attitudes; theorising – seeking explicit or implicit explanations; and exploration – e.g. finding associations between behaviours and attitudes and mapping the range and nature of the phenomena under study (Ritchie and Spencer, 1994). Miles and Huberman (1994) defined analysis of qualitative data as three flows of activity, which are data reduction, data display and drawing conclusions/verification.

Reducing the data

This is the process whereby the information in the form of field notes and transcripts from the interviews and or group discussions is simplified and transformed. This can often be through coding of the data, e.g. identifying specific groups or types of behaviour or attitudes, but also includes the writing of summaries and identifying themes within the data. The data reduction or transforming process should continue throughout the study until the final report has been written and should not be seen as a separate function from analysis but as a part of it.

Essential to the process of data reduction is the need for the researcher to become very familiar with the type, range and diversity of the data. This will involve the full 'immersion' of the researcher in the data – listening to tapes, reading transcripts and studying field notes – which will allow the researcher to conceptualize and put into some context any hunches or emergent themes which were formed during data collection.

Data display

As a word-based methodology, the commonest approach to displaying qualitative data has been as text. However, data displays can also include charts, graphs, matrices and networks. Through the use of these forms the range and nature of the phenomena can be mapped, typologies created and associations plotted in a systematic way (Miles and Huberman, 1994). The aim of displaying the data is to build a picture of the data as a whole to aid systematic and self-conscious analysis. It should be seen as part of the analysis, with data reduction and display interlinked and building on one another.

Drawing conclusions/verification

It is likely that throughout the whole process of analysis the researcher is drawing conclusions about what things mean, the different patterns, regularities and explanations. The final conclusions should however, only be drawn once data collection is over. Drawing conclusions is only half the story as conclusions need to be verified (Miles and Huberman, 1994). Ensuring rigour in qualitative research and the integrity is part of that verification process.

'Qualitative data analysis is about detection… categorising… theorising… and exploration.'

'On no account should qualitative data undergo statistical analysis or be quantified in any way, no matter how tempting this may be.'

Ensuring rigour in qualitative research

A common criticism of qualitative research is that it lacks scientific rigour and in contrast to the traditional biomedical approach of using quantitative research, lacks reproducibility and generalizability and is considered little more than a collection of anecdotes and personal impressions (Mays and Pope 1995). Much of this criticism results from the different approaches of qualitative and quantitative research and their ability to ensure the reliability and validity of their findings. All research methods, however, have their strengths and weaknesses. For example, there is a considerable amount of research that shows that the intended meaning of a survey question is not always universally shared among all respondents (Meadows et al, 2000). Equally, how can a researcher ensure that his or her presence in some way has not biased or influenced the observed behaviour?

Quantitative research, unlike qualitative research, is able to produce statistical models and report statistically significant findings. These may or may not be fully justified, but do seem to provide some truth-value to the findings in terms of their reliability and validity. However, as with qualitative research, this will depend on the skills of the researcher, the appropriateness of the question asked and the methods used to answer it. It is not at all clear that the same concepts of reliability and validity can or should be applied to qualitative research, which uses different methods and collects different data. Nevertheless, there should be some practical standards that can be used to judge the quality of the conclusions from qualitative research.

Lincoln and Guba (1985) made a strong case that the conventional criteria applied to quantitative data were inappropriate in assessing qualitative research. They proposed that the concepts of internal and external validity (generalizability), reliability and objectivity be replaced by alternatives that reflect more faithfully the underlying assumptions of qualitative research, notably credibility, transferability, dependability and confirmability.

Miles and Huberman (1994) provide a detailed description of each of these concepts together with examples of relevant queries, which are summarized here:

- Credibility: Do the findings of the study make sense? Are they credible to the people we study and our peers? Relevant queries: How context-rich are the descriptions? I.e. How much are the descriptions embedded into the specific context of the study? Are the findings generally consistent with one another, are they internally coherent?
- Transferability: Do the conclusions of the study have a greater import? How far can they be generalized? Are they transferable to other contexts? Relevant queries: Are the characteristics of the sample, setting and processes fully described? Is the sample sufficiently diverse enough to encourage broader applicability?
- Dependability: Is the process of the study consistent, stable over time and across researchers? Relevant queries: Are the research questions clear and is the study design appropriate for them? Were data collected across the full range of settings, times and respondents as suggested by the research question?
- Confirmability: Is the research reasonably free from unacknowledged researcher bias? Relevant queries: Are the study's general methods and procedures explicitly described and detailed? Can we follow the actual sequence of how the data was collected, processed, transformed and displayed?

As with quantitative research, the strategy is to ensure that the rigour in qualitative research is systematic and self-conscious. In doing so the researcher should seek to provide an account of the methods and data which can stand independently and which is a plausible and coherent explanation of the topic under study along the lines described here. As a process qualitative research needs to be well documented.

For further reading on issues of rigour in research see Sandelowski (1986) and Koch and Harrington (1998).

Reporting findings

Strategies for reporting and publishing research findings must be considered from the earliest stages of a research project. Dissemination of research is essential if the findings are to be of benefit to others, be open to critical examination by professional peers and promote service development based on sound evidence. Approaches to reporting qualitative data will be examined alongside approaches for quantitative data in a later paper in this series.

One important aspect of reporting the findings from qualitative research is that on no account should the data undergo statistical analysis or be quantified in any way, no matter how tempting this may be. Of course it is perfectly acceptable to report how many women and men or GPs for example, took part in the study, but it is important to remember that the findings from qualitative

research are based on the analysis of the narrative of individual experiences and that study participants for qualitative research have not been selected to be statistically representative of the population under study, but to provide variations in the nature of their views and experiences. So statements such as 'x% of respondents experienced strain and worry resulting from caring for family members'. should be avoided and more appropriately described, for example, as: 'Caring for family members was seen by some respondents to be a considerable strain and worry' (Fenton and Karlson, 2002).

Conclusion

This necessarily brief overview has attempted to describe the ethos and practice of qualitative research. Contrary to popular belief, qualitative research is not 'easier' or 'softer' than quantitative research. It requires planning and care in its execution, and calls on a wide range of skills. Novice researchers are strongly encouraged to discuss planned research with an experienced researcher, in order that they get the most out of the process and the data collected. ■

KEY POINTS

- The aim of qualitative research is to help us understand social phenomena in a natural setting through the analysis of the meanings, experiences, attitudes and views of the participants.
- As with quantitative research the strategy is to ensure that the rigour in qualitative research is systematic and self-conscious.
- More often than not the method through which qualitative data is obtained is the research interview and or group discussion.
- Concepts of internal and external validity (generalizability), reliability and objectivity should be replaced by alternatives, which reflect more faithfully the underlying assumptions of qualitative research, notably: credibility, transferability, dependability and confirmability.
- As with quantitative research it is essential to ensure that the rigour in qualitative research is systematic and self-conscious.

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So you want to do research? 4: An introduction to quantitative methods

Keith A Meadows

Common in clinical and biomedical research, quantitative research is an essential part of health services research. Perhaps the most obvious example of this is the randomized controlled trial, with its emphasis on experimentation and large sample sizes. However, quantitative research encompasses a much broader spectrum of activity, which can include small-scale descriptive studies through to more complex studies where relationships between variables are explored.

In contrast to qualitative research which is often viewed as being unscientific and lacking rigour (Mays and Pope, 1995), quantitative research – with its focus on hypothesis testing, reliability and validity, enumeration and statistical inference – has been considered as the epitome of the scientific approach. Despite the antithetical portrayal of the qualitative and quantitative approaches, but acknowledging that there are some clear and distinguishing features between them, they should be seen as complimentary to each other. For example, qualitative research can provide a good foundation for quantitative research, particularly in areas where little is known about the subject. Equally quantitative research can provide insight into areas in need of further and in-depth investigation.

This article introduces some of the key issues in quantitative research, starting with a description of quantitative research and the types of research designs, the strengths and weaknesses of the different methods of data collection, an overview of the different sampling methods for collecting data, through to an overview on the analysis of quantitative data. The article also discusses considerations for ensuring rigour and the reporting of the research findings.

Choosing the correct methodology

What is quantitative research?

Turning your research question into a research project and selecting the most appropriate research design are the crucial parts of any enquiry. When choosing the research design a number of issues need to be borne in mind:

- Purpose(s) – What is the study trying to achieve and why is it being done?
- Theory – What (if any) theory will guide or inform the study? How will the study's findings be understood?
- Research question(s) – What is the research question asking?
- Methods – What methods (e.g. questionnaire, interviews, observation) will be used to collect the information?
- Sampling – From whom, where and when will the data be collected? (Robson, 2002).

In earlier articles of this series (Meadows, 2003a,b) different research strategies have been generally classified as either qualitative or quantitative. The aim of qualitative research is to help us to understand social phenomena in a natural rather than an experimental setting with emphasis on the meanings, experiences, attitudes and views of the participants and the focus on to determine 'why?' rather than 'how many?' (Hoinville and Jowell, 1978; Pope and Mays, 1995). Data obtained from qualitative research is usually in the form of words rather than numbers and these

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ABSTRACT

This fourth article of a series of six focuses on some of the key aspects of quantitative research methods. Starting with an overview of what quantitative research is, the distinguishing characteristics of experimental and non-experimental research strategies, the different approaches for collecting data including, self-completion questionnaires, interviews and scales, together with their respective strengths and weaknesses are discussed. The differences between probability and non-probability sampling and the different methods for selecting a sample are described. Aspects of quantitative data analysis are briefly reviewed and the concepts of reliability and validity are described in the context of ensuring rigour in the research design. Finally, some guidance on the reporting the findings from quantitative research is provided.

words are based on observation, interviews or documents (Miles and Huberman, 1994).

Quantitative (or 'fixed-design') research involves experiments (such as randomized control trials (RCTs)) and surveys, where data are collected using standardized methods such as questionnaires and structured interviews. The data are in the form of numbers from which statistical generalizations can be made. Key characteristics of quantitative research are that much of it is pre-specified in terms of what and how is going to be done (Robson, 2002) and that the approach is deductive (where data are specifically collected for the purpose of testing ideas and hypotheses) rather than inductive (where ideas and generalizations emerge from the data). In other words, quantitative research should be theory-driven, and the variables to be measured (i.e. properties which can vary and be measured, such as disease duration, age, gender, depression score) and the procedures to be followed in the collection and analysis of the data, should all be pre-specified. In contrast to qualitative research where findings are reported from the perspective of the individual, findings from quantitative research are reported in terms of aggregates and group properties and averages.

Types of fixed quantitative research designs

Quantitative research strategies can be broadly classified as experimental or non-experimental (descriptive). Experimental designs are characterized by the manipulation or introduction of some variable – such as treatment – and comparing the outcome with a control group, which has not received the treatment. The most common example of an experimental design is the RCT, in which study participants are randomly allocated to either the experimental or control group. In contrast, in non-experimental designs the data are obtained from existing groups, for example, to look at the relationship between a number of variables such as the scores on a depression scale and sex or age (relational design); to identify the type and frequency of diseases in a specific group of people (descriptive); to determine why a particular group is affected while another is not (analytical). *Box 1* lists examples of quantitative studies.

Box 1. Examples of a range of quantitative studies

A comparative study of self-perceived health of parents of children with Down's syndrome and a randomized control group of parents from the Swedish SF-36 norm population.
Hedov G, Anneren G, Wikblad K (2000) Self-perceived health in Swedish parents of children with Down's syndrome. *Qual Life Res* **9**(4): 415–22

An assessment of the impact of cancer on the psychological well being of newly diagnosed cancer patients before and during a course of radiotherapy.
Chandra PS, Chaturvedi SK, Channabasavanna SM et al (1998) Psychological well-being among cancer patients receiving radiotherapy–a prospective study. *Qual Life Res* **7**(6): 495–500

A prospective cohort study of 7726 adults to determine whether poverty and unemployment increase the likelihood of delaying the recovery from common mental disorders.
Weich S, Lewis G (1998) Poverty, unemployment, and common mental disorders: population based cohort study. *BMJ* **317**(7151): 115–9

A cross-section study to examine the role of health status, personality and coping style on the reporting of health-related quality of life of HIV seropositive gay and bisexual men
Burgess AP, Carretero M, Elkington A, Pasqual-Marsettin E, Lobaccaro C, Catalan J (2000) The role of personality, coping style and social support in health-related quality of life in HIV infection. *Qual Life Res* **9**(4): 423–37

Methods of data collection

Surveys and questionnaires

One of the most common ways of collecting information in quantitative studies is the survey, which almost always uses self-completion questionnaires, face-to-face or telephone interviews or tests and scales.

Surveys

Most people have participated in a survey. A survey is a system for collecting information on a range of topics including health, education, psychology, law etc. (Fink, 1995a) of which the main characteristics are that data are collected from a number of individuals using a systematic and standardized approach (e.g. questionnaire/structured interview schedule/scales or tests) and that these individuals are a representative sample of the population under study.

The requirements of a good survey, whether small or large, are that:

- Its objectives must be specific and measurable
- The design must be sound
- The sample(s) or population studied must be appropriate for the study
- The questionnaires, scales and tests used must be reliable and valid
- The most appropriate analysis must be applied to meet the objectives
- Findings must be reported accurately (Fink, 1995a).

There are a number of ways in which questionnaires can be administered in a survey:

- Self-completion, where respondents fill in the answers themselves and the questionnaire is either sent out by post or handed to the respondent to complete.
- A face-to-face interview, where an interviewer asks the respondent the question and also completes the questionnaire. In quantitative studies the interviewer is more likely to use a fully structured interview schedule which has pre-set questions in a set order with fixed wording and responses for the respondent to choose from.

- Telephone interviews, where respondents are contacted by telephone and are asked the questions and the interviewer records the answer as in a face-to-face structured interview.

Tests and scales

While tests and scales are included under the category of questionnaires, they differ somewhat from what we traditionally understand a questionnaire to be. Questionnaires might ask, for example, 'How long did you have to wait before being seen by a doctor?' or 'How satisfied were you with the treatment you received?'. Tests and scales by contrast have been developed to assess people's abilities, attitudes, opinions, physical and psychological functioning etc. A typical example of a test might be the person's IQ or intelligence. Scales are intended to gain an insight into the individual's physical and psychological functioning, e.g. the Hospital Anxiety and Depression (HAD) scale (Zigmond and Snaith, 1983). Whether the objective is to assess the ability of the individual or gain some insight into the individual's opinions, attitudes or physical functioning, the purpose is to quantitatively scale the person on the measured attribute.

Uses of surveys and questionnaires

Surveys using questionnaires and standardized interviews can be used in both non-experimental and experimental designs as a method for collecting data (Fink, 1995a). Common uses for a survey in an experimental design include the measurement of change during, and outcome at the end of the experiment. For example, we might want to compare at two weeks, one and two months after attending a one-day education programme, the changes in the social, psychological and physical functioning of patients who had experienced hypoglycaemic episodes compared to a control that had not. Or we might want to interview patients who took part in a counselling programme two months after finishing the course and compare the outcomes with a control group. Surveys can also be used in experimental studies for other purposes, such as selecting study participants and checking on the comparability of the experimental and control groups, e.g. by age, sex, level of education etc.

Exmples of non-experimental studies that involve the use of a questionnaire, interview, scale or test, might include a cross-sectional design using a postal survey to find out the perceptions of the quality of the services provided to outpatients of a diabetes clinic, or a telephone interview with postoperative patients to find out what has happened since surgery. For a cohort study we might be interested in monitoring over time the reported health-related quality of life of a group of patients with severe hypoglycaemia. With a case-control study, we might want to examine the attitudinal, social and demographic variables of people to help understand why some people did not continue to use a particular insulin injection device compared to matched controls who did.

Strengths and weaknesses of questionnaires, interviews and tests

Every method of data collection has its strengths and weaknesses. Self-completion questionnaires are often sent by post enabling large samples to be reached, but response rates can be low, they are inappropriate for populations with high levels of illiteracy, they need to be short and the questions asked need to be in simple language. However, with careful design of the study and the questionnaire, self-completion questionnaires can provide very useful and representative information as well as overcome some of the barriers in the collection of sensitive data (see Oppenhiem, 1992).

Face-to-face interviews address a number of the limitations of the self-completion questionnaire: they can be used in populations with high levels of illiteracy, and interviewers can provide clarification and deal with misunderstandings as well as ensure that information is collected. However, face-to-face interviewing often requires training and cost more in time and resources, there are risks of interviewer bias and the collection of sensitive data can be problematic. Compared to postal questionnaires the size of the sample reached can be limited unless there is more than one interviewer.

Telephone surveys combine the advantages and disadvantages of the self-completion questionnaire and face-to-face interview. Telephone interviews enable large samples to be reached, interviewers can provide clarification and address misunderstandings, and levels of literacy are not such a significant problem. Limitations include confidentiality, bias and the asking of sensitive questions. Telephone surveys may also have to be conducted in the evenings when respondents can be reluctant to answer certain questions if other people are present. Results can also be biased because only respondents with a telephone have been included in the sample.

The importance of careful thought in the design of a questionnaire, interview schedule, scale or test cannot be stressed enough and will be discussed in detail in the next article of this series.

Sampling in surveys

Using an example from the first article of this series (Meadows, 2003a), we might want to carry out a survey of the smoking behaviour of all men aged between 35 and 60 years in a particular geographical area. Depending on the size of the area, and for our

'The importance of careful thought in the design of a questionnaire, interview schedule, scale or test cannot be stressed enough.'

'Non-probability sampling involves choosing samples not so much to be representative of the target population, but on the characteristics of the target population. '

findings to have some meaning, this would most likely entail the completion of perhaps many hundreds or thousands of questionnaires. To overcome this difficulty we would use sampling techniques that would give us a degree of confidence and the same information, but from a smaller group of men.

A sample is a portion or subset of the population we wish to study. There are two types of sampling methods we can use to select our sample.

Probability sampling

The first of these is probability sampling where every sampling unit (i.e. each man aged between 35-60 years) has an equal chance of being selected from the target population (i.e. all men aged 35 –60 years in the geographical area). The underlying rationale of probability sampling is random selection, which removes subjectivity in choosing the sample (Fisk, 1995b). If done correctly, it provides us with some confidence that our sample is representative of the target population and that our survey findings can be extrapolated to the target population within certain limits of confidence. There are several ways in which a probability sample can be selected:

- Simple random sampling – Selection is made by chance alone such as drawing numbers from a hat, or, for example, from a list of men 35 to 60 years of age with type 2 diabetes attending a diabetes centre. Each number or man has an equal chance of being selected. While this is simple to do, lists are not always available, and this method can be costly in practice if sampled units are geographically widely dispersed.
- Stratified random sampling – The target population is divided into different subgroups – e.g. by sex, treatment type, age – from which a random sample is selected. This is more likely to reflect the target population and reduce sampling variations, but can be time consuming and costly.
- Systematic sampling – You want to select 200 patients from a list of 1000 names to take part in a survey on attitudes to the service provided by a health centre, or interview the head of the household from 1000 addresses. Dividing 1000 by 200 gives 5, meaning that 1 in every 5 patients or addresses is selected. Although convenient, this method is not suitable where there is possible repetition in the list, e.g. names starting with a certain letter or dates of birth.
- Cluster sampling – Naturally occurring units such as GP practices, health centres, hospitals, schools, are randomly selected and the unit of interest is included in the sample. For example to explore the attitudes of GPs across London to the new contract, you could first randomly select geographical areas across London and from these randomly select GP practices and then interview all the GPs in those practices. This is a convenient method because it uses existing groups, and particularly with larger sampling units such as hospitals, schools, lists to be more likely to be available.

Non-probability sampling

Non-probability sampling involves choosing samples not so much to be representative of the target population, but on the characteristics of the target population. As a consequence we are unable to say whether the findings from the study are or are not applicable to the target population.

The most common application of non-probability sampling is in flexible or qualitative research designs, where the emphasis is to select purposively the sample so that it represents a wide spectrum of views and experiences as well as covering the full range of individuals to identify, explore and explain variations in the nature of views and experiences between them. Non-probability sampling can also be applied to quantitative designs, for example when we need to survey hard-to-identify groups. The methods used in non-probability sampling are:

- Convenience sample – Using a group of individuals that are readily available and are willing to be surveyed. For example, we are interested in finding out what health services older people use. To answer this question we could post interviewers or give out questionnaires at positions where we are likely to recruit older people, such as at specific outpatient clinics or health centres.
- Snowball sampling – Members of the group are requested to identify other member of the target population. This is most commonly used when dealing with a hard-to-identify group, or when no listing is available, e.g. illicit drug users.
- Quota sampling – Divides the target population into subgroups, e.g. by sex or age, based on known estimates and then selects the proportion of people in each of the subgroups from the target population. If we are interested in looking for any differences in dental health care between boys and girls aged 10–15 years at a particular school. Estimates from the school tell us that 24% of boys and 19% of girls are 10 years old, 21% boys and 20% girls are 11 years old, and so on. From these figures we would then select boys and girls in these proportions to be surveyed.

For a detailed discussion on sampling procedures, see Fink (1995b); Argyrous (2000); Barnett (2002).

Deciding on the sample size

When considering the sample size it is important that

you are clear what the objectives of the study are and what is the research question or hypothesis (Fink, 1995b). As the size of the sample increases the sampling variability or error decreases. However, the larger the sample the more costly the data collection and analysis will be, so making sure you have the optimal sample size is important. The sample needs be selected so it is as representative of the target population as possible, is of a sufficient size to detect effects or changes in the variable studied and it is as free as possible from sampling errors. Determining the appropriate sample size requires the use of statistical calculations, which will involve answering a number of statistical questions, e.g. what chances should there be of finding a significant difference between the groups investigated? (i.e. the 'power' of the test) (see Siegal and Castellan, 1988); what differences between our groups would be considered to be important (e.g. the mean difference in age between those patients reporting improvement in quality of life following psychotherapy treatment and those not)?

A health warning

Survey sampling is a complex and important part of the research process and while a number of issues have been briefly discussed in this article, it is beyond the scope of the series to discuss in detail the strengths and weaknesses of the different methodologies. It is always strongly advised that a statistician is consulted at the earliest stage of the project design. For a well written, comprehensive and simple guide on sampling in surveys see Fink (1995b). Barnett (2002) contains a more detailed and mathematical approach to sampling.

Analysis and interpretation of quantitative data

Statistical significance

The analysis and interpretation of quantitative data is very different from that of qualitative data. With quantitative research we are dealing with numbers rather than narrative and quantitative analysis is practically synonymous with significance testing (e.g. is the difference in mean ages statistically significantly different, or in other words is it likely that this finding was not due to chance?).

Looking for statistical significance in findings is controversial. One problem is that statistical significance is not related to the size or the importance of the effect or relationship at which we are looking (Robson, 2002). For example we might find that the mean difference in patients' quality of life scores is significantly higher in the group of patients who underwent some psychosocial intervention compared to those who did not. Although significant (i.e. the finding was not due apparently to chance), what does this finding really mean? Firstly, the chance of finding a statistically significant result increases as the size of the sample increases. Secondly, although statistically significant, the differences between the means might be marginal. Thirdly, the observed difference might have very little clinical significance despite being statistically significant. For a detailed discussion on the significance test controversy see Robson (2002), pages 400–2.

Analysis

All analysis of quantitative data will involve some statistical manipulation, which can range from organizing the data, to provide a descriptive account of the findings, such as the mean age and range of the sample, or the percentage of men and women etc, through to the very complex statistical analyses involving multivariate analysis.

While a detailed discussion on how to conduct this analysis is beyond the scope of this article, a brief overview of the main approaches is given below. For a more detailed discussion of the analysis of quantitative data see Siegal and Castellan (1988); Fink (1995c); Argyrous (2000); Robson (2002).

A simple approach to quantitative data analysis is to first report on each of the important or individual variables. For example we could, using frequency distributions and graphical displays (bar chart, histograms and pie charts), report on the composition of our sample, highlighting characteristics such as age, sex, duration of disease, types of treatment, the percentage of patients reporting they felt very satisfied with the service provided by the clinic etc. We could also provide summary statistics which include measures of central tendency such as the mean, mode and median, measures of variability including the range (the difference between the lowest and highest value or score), variance and standard deviation (measures of the spread of the scores around the mean) and confidence intervals (CI) which provide us within a given statistical probability, the limits within which our mean score can lie.

At a more complex level we can analyse the relationships between two or more variables. When looking at the relationship between two continuous variables, e.g. age and the level of physical functioning, the strength and the direction of the relationship are given by the correlation coefficient. Other measures of relationship include the Chi-square (χ^2) test, which shows the degree of association between two or more non-continuous variables (such as sex) or continuous variables which have been categorized (e.g. age in years to age groups). More complex statistical procedures when looking for relationships

'All analysis of quantitative data will involve some statistical manipulation, from organizing the data, to providing a descriptive account of the findings… through to the very complex statistical analyses involving multivariate analysis.'

'Validity is about the confidence we have that we are measuring what we think we are; the accuracy of our results. Do our results actually reflect what is happening or are they due to something else?'

between three or more variables include multiple regression and multivariate analysis, factor analysis and structural equation modelling.

A traditional task of analysing quantitative data is exploring whether differences exist between variables under different conditions or in different groups. For example, is there a difference in the measured outcome of psychological distress between groups of patients undergoing different forms of psychosocial intervention? Or do women score higher on quality-of-life scale compared to men? There are a number of statistical tests available to test whether such differences exist and to make inferences that the findings are statistically significant. The choice of test depends on whether we are looking for differences between one, two, three or more groups and the nature of the data (Argyrous, 2000). But bearing in mind the controversy regarding the value of a statistical test that simply tells us whether the finding is by chance or not, there should be greater emphasis on looking at the effect size which is independent of the size of the sample.

Choosing the most appropriate method of analysing data is an essential part of the research process. Assuming that the chosen method is the right approach the interpretation of the findings becomes one of deciding whether our findings provides the evidence we are looking for, be it a relationship between two variables or the difference between two patient groups.

Ensuring rigour in quantitative research

When undertaking research of any kind the strategy must be to ensure that the rigour in the research is systematic and self-conscious. In doing so the researcher should seek to provide an account of the methods and data, which are plausible and can stand independently, and coherent explanations of the topic under study (Miles and Huberman, 1994).

The two key concepts when establishing the rigour of quantitative research are reliability and validity (see Robson, 2002).

Reliability is about how well the data we collect can be reporoduced using the same measure. Unreliability can stem from a number of different sources. For example, we might be measuring the level of diabetes-related knowledge in people with diabetes using a specifically-designed questionnaire. If the scale were reliable then we would expect the knowledge score obtained from each person to be very much the same whether we gave them the test on a Monday or a Friday. Of course there are likely to be some random fluctuations in the scores between the two occasions perhaps due to tiredness or other short-term effects. Of more importance however, are the more systematic causes leading to unreliability for example, if a question has been written in such a way that it can be misinterpreted. Other causes of unreliability include observer bias, where the observer consciously or unconsciously biases their reporting.

While reliability is an essential requirement of whatever it is we are measuring, it is insufficient to ensure the validity of what we are measuring. Something can be reliable without being valid. Our diabetes knowledge questionnaire for example, may provide consistent scores between different administrations but fail to discriminate between those with better diabetes-related knowledge.

Validity is about the confidence we have that we are measuring what we think we are; the accuracy of our results. Do our results actually reflect what is happening or are they due to something else?

Taking the diabetes-related knowledge example further, we might want to implement an education programme and test whether this does in fact improve the level of diabetes-related knowledge. To test the effectiveness of the programme we could use a diabetes knowledge questionnaire to see whether there were overall improvements in knowledge following the programme's implementation. So the first thing we would be interested in is the validity of the questionnaire itself. There are different types of validity we need to consider, which are briefly discussed here.

Construct validity is most important form of validity and often the most difficult to determine. Construct validity is a measure of how well you are measuring what you think you are measuring. In the case of a scale or test it is how meaningful the scale or test is. Construct validity can generally only be determined after much practical use where evidence supporting the usefulness of the scale or test is accrued over time. Evidence in support of construct validity could be the scale's ability to discriminate between different levels of the measured attribute, e.g. knowledge, and that the scale's score's would show the predicted relationship with other concepts, for example age or disease duration.

Criterion validity is a measure of how well the scale or test predicts future outcomes or how well the scale's score correlate with some 'gold standard' of the same variable. For example, the ability of a test of school educational achievement to predict entry to university, or scores of a diabetes knowledge questionnaire to show a strong relationship with another measure of diabetes knowledge which is considered as the 'gold standard'.

Content validity is the extent to which the items in the scale or test reflect the measured concept. For example, if we were developing a scale to measure

diabetes-related knowledge in general, the content should represent the different areas such as blood monitoring, diet, complications, foot care etc.

Face validity is the least important form of validity and is a casual review of how good the items of the test appear. At its simplest, if we were asking patients about their level of anxiety, then we would expect the questionnaire to comprise relevant items relating to anxiety. If is does not then the measure does not have face validity. Face validity is often confused with content validity and it is essential that the distinction between the two is made.

Internal validity

Having established that our scale of diabetes-related knowledge has demonstrable reliability and validity, the next aspect of validity we need to establish is whether the outcome is related to the intervention. If we are able to demonstrate the causal relationship between improvement in diabetes-related knowledge (the outcome) and the implementation of the education programme (the treatment), the study is said to have internal validity (Campell and Stacey, 1963).

Just because we have a finding that the level of diabetes-related knowledge improves following the implementation of the education programme, there are a number of possible reasons why it might be still be unwise to conclude this the case. Changes in outcomes following some intervention can also be due to other factors outside the study itself. Campbell and Stanley (1963) have referred to these factors as 'threats' and have suggested eight possible threats to achieving internal validity (*Box 2*). (Robson, 2002 has a more detailed discussion on internal validity).

Generalizability

In addition to validity of a study, we need to identify how applicable our findings are to other situations, settings and people, in other words the 'generalizability' of the study. Campbell and Stanley (1963) refer to this as external validity. For example, our study on the effectiveness of an education programme on people with diabetes might have been carried out on people ages between 18 and 35 years of age with type 1 diabetes. If we want to know how effective the education programme would be with an older group of people with type 1 diabetes, we should then be concerned with the generalizability of the study. The factors which limit the ability to generalize from a particular study include: the specific group studied; the setting or context in which the study took place; the uniqueness of the specific experience or history of the group studied; and the construct or concepts studied which may be specific to the group studied (LeCompte and Goetz, 1982). So in our example study it would be less likely that we could generalize the outcomes of the study to people with tablet-treated type 2 diabetes aged over 55 years, because of differences in the specific and unique experiences resulting from the different treatments as well as the different knowledge requirements between type 1 and type 2 diabetes.

Box 2. Threats to internal validity

1. History – Things changing in the environment of the participants not related to the study
2. Testing – Changes occurring as a result of experience and practice gained from pre-tests
3. Instrumentation – Changes in the way participants were assessed pre and post testing
4. Regression – Study participants chosen for being atypical (e.g. high scores) are less likely to be less atypical at later testing
5. Mortality – Participants dropping out of the study, loss to follow-up
6. Maturation – Growth, change or development in participants unrelated to the study
7. Selection – Initial differences between groups before involvement in the study
8. Selection by maturation interaction – Groups naturally growing apart or together

Source: Campbell and Stanley (1963)

Reporting the results

As discussed in an earlier article of this series (Meadows, 2003c) the aim of writing is both communication and persuasion (Gilbert, 2001). Reporting the findings from research is an essential stage of the research process. Dissemination of research is essential if the findings are to be of benefit to others, be open to critical examination by peers and promote service development based on sound evidence.

While there is little consensus on how qualitative research should be reported (Robson, 2002), there is a conventional model for quantitative research reports (*Box 3*). While the format might vary slightly according to the type of journal the research report is being submitted to, the format in which the research is written up will by and large be the conventional approach. However, the mode in which the results are being presented (e.g. oral or poster etc) and the audience, may call for alternative forms to aid the communication, but can also be along the lines required by scientific journals. When reporting quantitative research in a scientific journal, it should be in a manner and of sufficient detail to enable someone else to replicate it.

Ethics and consent to participate

Last but not least are the issues of ethics and consent. All research involving the use of human subjects either directly or indirectly, must receive ethical approval before commencing. This will generally mean submitting to the ethics committee, details

Box 3. The key areas of a research report for a scientific journal

Title: Describes in summary the main purpose of the study.

Abstract: A concise summary of the research approx 150 –500 words.

Introduction: Providing a background to the study, previous research in the area, purpose of the research, research question or hypothesis to be tested.

Methods: A detailed description of the procedures including: the number of study participants and their characteristics and how selected; equipment and materials used including a description of the questionnaires/interview schedule and tests used; how these were scored; the reliability and validity of scales and tests used; description of the setting where the study took place; statistical methods used to analysis data; duration of the study.

Results: Number of participants and their descriptive statistics (e.g. age, sex etc); description of the quantitative data analysis findings using where possible tables, graphs and figures.

Discussion: Was the research question answered or hypothesis supported? What was the relationship between the study's findings and previous research? What are the implications of the research findings? What questions has the research raised and what are the suggestions for further research? What are the limitations of the research and how could the research have been improved?

Conclusion: A summary of the purpose of the research and its key findings and implications.

References: All references cited in the report in standard format or as requested by the scientific journal.

For a simple guide on reporting of survey results see Fink (1995d)

of the research, including who will take part in the research, what the research will comprise, what measures will the research use, storage of data etc., as well as copies of any questionnaires scales, tests and interviews schedules that will be used. It is also now common practice for journals before publishing research studies to be assured that ethics approval has been granted for the research. Gaining informed consent from the study participants is essential, and in doing so the researcher must consider such issues as the ability of the participant to give consent, including mental ability, age, level of literacy and language.

KEY POINTS

- Quantitative research strategies can be broadly classified into experimental and non-experimental (descriptive) designs.
- Experimental designs are characterized by the manipulation or introduction of some variable such as treatment and comparing the outcome with a control group.
- One of the most common ways of collecting information in quantitative studies is the survey, which almost always uses self-completion questionnaires, face-to-face or telephone interviews, or tests and scales.
- Every approach to the analysis of quantitative data will involve some statistical manipulation, which can range from organizing the data, to providing a simple descriptive account of the findings, to very complex analysis.
- The key concepts for establishing the trustworthiness of quantitative research are reliability and validity.

Conclusion

In describing some of the key considerations and methods for undertaking quantitative research, this article has sought to convey a single important message: that, as with qualitative research, careful planning and a well formulated research strategy are essential before a study can commence. The next article in this series will examine the process of formulating a questionnaire. ■

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So you want to do research? 5: Questionnaire design

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ABSTRACT

This article describes the key aspects in the design, construction and adaptation of survey questionnaires. There are different types of questionnaire, each of which has its advantages and disadvantages. Aspects of constructing the questionnaire are discussed in detail; choosing the mode of administration; the objectives of the survey; availability of resources; characteristics of the target population; and quality of data. Issues concerning the identification of the questionnaire's content, wording and sequencing of the questions, through to the overall appearance and layout of the questionnaire are also considered. Differences in the role of open-ended and closed questions, together with their strengths and weakness, are outlined, and the need to undertake pre-testing and piloting as an integral part of questionnaire development is highlighted. Finally, issues around the adaptation of existing questionnaires are discussed with particular emphasis on their use in different language and cultural groups, and the need to achieve conceptual, content, semantic, operational and functional equivalence is described. An overview of the translation process is provided.

Collecting information using a questionnaire as part of a research study, service evaluation or audit, is now common practice. There is a variety of questionnaire types that can be used. Whichever way questionnaires are used and for whatever purpose, the same design rules should apply in their construction to ensure that they are appropriate for their intended use. Each questionnaire should be designed to minimize respondent and interviewer errors in the understanding of the questions and recording of the answers, as well as maintain the interest and cooperation of the respondent. Questionnaires are often used with little thought given to these issues, which can lead to the collection of unreliable information.

This paper, the fifth in the series, describes the different types of questionnaire together with their advantages and disadvantages, and the key issues of questionnaire design including content, question construction, questionnaire format and adapting existing questionnaires.

Types of questionnaires: advantages and disadvantages

The first choice that needs to be made when designing a study or survey, is the mode in which the questionnaire will be administered.

Self-completion questionnaire

Self-completion questionnaires are completed in writing by the repondent. The most common use of self-completion questionnaires is delivery and return through the post. However, they can also be completed in the presence of the researcher (supervised self-completion), who can provide assistance and check the questionnaire for completeness.

Self-completion questionnaires offer low cost relative to other methods, potential coverage of a widely dispersed population and a wider coverage in the study population. They avoid the possibility of interviewer bias, although weaknesses in design and wording can still lead to biased reporting.

However, self-completion questionnaires have the potential for low response rates, require a level of literacy to complete the questionnaire as well as the availability of an accurate list or sampling frame from which to select the sample of respondents. Self-completion questionnaires are appropriate for less complex topics and need to be easy to complete without assistance. It is generally suggested that self-completion questionnaires be shorter than those administered during interview and contain mostly closed ended questions (Bouraque and Fielder, 1995). They are less suitable for recording open-ended data, complex questioning and question skip patterns (in which the answer to one question dictates which subsequent questions are answered). Bourque and Fielder (1995) provide a more detailed discussion on the advantages and disadvantages of self-completion questionnaires.

Interviewer-administered questionnaire

With interviewer-administered questionnaires, each respondent is asked the same questions by the interviewer, in the same way, in order to eliminate as far as possible any bias. Advantages of this mode of administration include the collection of more

detailed and complex data, the possibility to clarify misunderstandings and the opportunity for the interviewer to probe for additional information. Open-ended questions can be used, in addition to filter questions (see above and *Box 4*) and complex question skip patterns. Recording of the information is undertaken by the interviewer, so is not dependent on the respondent's level of literacy.

Interviewer-administered questionnaires are generally more costly and resource-needy than self-completion questionnaires, because interviewers often need to be trained and their administration may involve travel. They can also be more time consuming. The personal characteristics of the interviewer – e.g. age, class, sex, race, level of experience – can have an effect on the response rates and the nature of the responses. Interviewers can also introduce both random and systematic error, e.g. in the recording of answers, by changing the wording of the questions or by selective recording of answers and differential probing between interviewers (Oppenheim, 1992).

Telephone interview

In some ways, telephone interviews maximize the advantages of self-completion questionnaires and face-to-face interviews, while minimizing their disadvantages. Because the need to travel is removed, thay can cover a widely dispersed population and achieve a wide coverage in the study population relatively quickly and at a low cost. Response rates, although generally not as high as face-to-face questionnaires, can be between 90% and 95% (although they are dependent on the topic of the survey, with higher rates when the topic is of direct interest to the respondent) (Morton-Williams, 1993). Interviewer characteristics such as age and race will have a less direct effect on the answers given than other variables, e.g. accent. Telephone interviews are considered suitable for most complex subjects, are less likely than face-to-face interviews to obtain just socially acceptable answers, and can deal with more sensitive subjects.

An obvious disadvantage of telephone interviews is the problem of sampling bias and generalizability of the findings, as people of lower income, young people, and ethnic minorities are less likely to have a telephone. They are also unsuitable for samples which comprise people who are hard of hearing, older people and some ethnic minorities, unless the interviewer is speaking the same language. Visual aids such as prompt cards cannot be used and the use of complex response formats and questions with long lists of multiple choice answers should be avoided because of memory effects. Detailed discussion on interviewing and telephone surveys can be found in Frey and Oishi (1995) and Oppenheim (1992).

Constructing a questionnaire

Constructing a questionnaire and wording the questions are not simple tasks. They require skill and an understanding of the key issues, as well as time to develop a questionnaire that is appropriate to meeting the objectives of the study.

One of the major pitfalls that the novice, and sometimes expert, falls into when designing a questionnaire is formulating questions that are difficult to ask or answer. These may include those that use unfamiliar words or phrases, or are too vague and unspecific, e.g. 'How have you been feeling today?'. Double-barrelled and catch-all questions are also unsatisfactory, e.g. 'How satisfied are you with the medication you are taking and the staff who look after you?'. Overly long questions are difficult to answer, e.g. 'Over the past year have you attended any hospital including your local hospital, but not including accident and emergency departments or to visit friends or family?'. Questions that invite distortion or are leading should also not be used, e.g. 'Do you think patients should be examined by a doctor of the same sex?'.

Reliability and validity

The practical value of a questionnaire depends on the reliability and validity of the information it collects.

Reliability refers to how well data collected by using a questionnaire can be reproduced. The most common indicator of reliability is test-retest reliability. This is a measure of how stable the respondents' responses are between time 1 and time 2, when we can assume that there should be no natural change in the responses, e.g. because of treatment, maturation etc. A poorly-designed questionnaire might result in variation in the responses of the respondents between times 1 and 2, leading to measurement error. The common method of measuring test-retest reliability is a statistical test – the correlation coefficient between the two sets of responses, which should not be less than 0.70 (Litwin, 1998). Other tests of reliability include measuring the interviewer's consistency and the consistency between interviewers.

Internal consistency is another measure of reliability but is different from those mentioned above; it is a measure of how well a group of questions 'tap' a particular concept. For example, we would expect a scale designed to measure physical ability to comprise items that tap the various aspects of the concept, e.g. the ability to climb stairs, walk a block, run 100 metres etc. If this were the case, the scale would then have a high internal consistency.

Validity is how well the questionnaire measures what it is intended to measure. For a measure to be valid it must be reliable, but something can be reliable without being valid – a clock that is always

'The practical value of a questionnaire depends on the reliability and validity of the information it collects.'

'Findings from high-grade studies indicate that no particular mode of administration is superior in all respects or in all settings, and that the choice of mode should be decided on a survey-by-survey basis.'

10 minutes fast is reliable, but is not a valid indicator of time. Validity of a questionnaire can be measured in a number of ways, including face, content, criterion and construct validity.

Face validity is the least scientific and is based on a basic review of whether the items look appropriate. If we were asking about attitudes to smoking then the measure would have face validity if the questions appeared to be about attitudes to smoking.

Content validity, which is often and incorrectly confused with face validity, is assessed on the extent to which the questionnaire's content includes everything it should, and does not include anything it should not. Evaluating content validity of a questionnaire should be based on expert review, e.g. expert panels including patients.

Criterion validity is how well the questionnaire is able to predict some future event, behaviour or outcome, or how it compares with a similar measure of the same thing.

Construct validity is the most difficult form to assess. It is often based on the extensive use of the questionnaire and is the amalgamation of all the evidence of its performance, including content and criterion validity.

Wherever possible it is recommended that existing questionnaires that have been widely used and been shown to be reliable and valid, should be used. This is often possible when we wish to use standardized questionnaires that have undergone considerable development and about which there is published evidence of their reliability and validity. However, this is not always possible, particularly when the information requirements of the questionnaire are specific to a one-off study. Under such circumstances the only option is to either adapt an existing questionnaire or construct a questionnaire from scratch, which can include questions adopted from existing questionnaires wherever possible.

A detailed discussion on all the key aspects of questionnaire design and construction is beyond the scope of this article, but a number of excellent books and other publications are available which provide an in-depth discussion of the topic. These include, Dillman (1978); Sudman and Bradburn (1982); Oppenheim (1992); Fowler (1995); Litwin (1995); and Jenkings and Dillman (1997).

Choosing the mode of administration

Deciding on the mode of administration is the first stage in choosing or developing a questionnaire. The advantages and disadvantages of the different modes of administration need to be taken into account. Findings from high-grade studies indicate that no particular mode of administration is superior in all respects or in all settings, and that the choice of mode should be decided on a survey-by-survey basis (McColl et al, 2001). The factors which should be taken into account include the following:

- If the ***objectives*** of the survey are, for example, to gain an insight into the attitudes of homeless people, then a self-completion or telephone-administered questionnaire is not feasible. If, however, we wanted to find out the level of satisfaction of a sample of patients registered with a general practice using a five-item questionnaire, this could be carried out using either a self-completion or a telephone interview.
- Availability of ***resources*** include costs, personnel to conduct interviews or handle administrative tasks, skill and time to develop and administer the questionnaire, data coding and entry, data analysis.
- Characteristics of the ***target population*** include their overall educational level and the accessibility to the respondents. If the potential respondents are geographically widely dispersed then face-to-face interviewing will be impractical. If the target population is difficult to access, e.g. homeless people, or is considered not to have an overall educational level sufficient to understand and answer questions spoken over the telephone, then self-administration or telephone interviewing is likely to be inappropriate and logistically difficult.
- The ***mode of administration*** can have an impact on the quality of the data generated. This includes sampling method and the ability to reach all eligible respondents, response rates, confidentiality, interviewer effects, the volume and complexity of the data collected.

Questionnaire content

Tailoring the content to meet the objectives of the survey ideally includes both a comprehensive review of the literature and the undertaking of a small-scale qualitative study to identify the range of behaviours, attitudes and issues relevant to the objectives of the survey. A literature review will provide information on any other studies which have been done on the topic, the current state of knowledge in the area, help build on or extend current work, identify methods of data collection, and highlight the content of existing questionnaires and any problems experienced (Bourque and Fielder, 1995). Qualitative research enables the exploration of views and behaviour patterns, using the two main methods of in-depth interviews and focus groups. It can provide the basis for deriving relevant questionnaire content (Meadows, 2003).

The topic areas and variables, and their relationships with other variables identified from the litera-

ture review and qualitative research, need to be included in the questionnaire. They should be listed and decisions should be made on how they can be measured. From this, the detailed design work can start, such as formulating the specific questions, deciding on the sequence of questioning and listing answer categories, adding instructions, and signposts and question skip instructions if its an interview administered questionnaire (Hoinville and Jowell, 1978). One approach to achieve this is to develop a flow chart of the different questions and sections of the questionnaire (*Figure 1*).

Open/closed questions

Open-ended and closed questions both have their place in survey design. A closed question (*Box 1*) provides a choice of alternative answers from which the respondent is asked to select, by ticking or underline, or choosing from a read-out list or prompt card. Closed questions can be attitudinal or factual and the choice of answers or response options form very much part of the question (Oppenheim, 1992).

Closed questions enable comparison across individuals or groups of respondents, require less time to complete than open-ended questions and are easy to code and process. However, they cannot capture in-depth or spontaneous responses and can sometimes unknowingly bias answers by forcing the respondent to choose between alternative responses or consider options that they had not previously considered (Oppenheim, 1992).

In contrast, open-ended questions do not provide any predetermined answers, which enables the respondent to answer the question using his or her own words. This can be very useful when trying to identify in more depth the respondent's thoughts, feelings and experiences. Open-ended questions provide opportunities to probe and can also help to identify the range of answers or response categories for use with a closed question. As a consequence open-ended questions are important in the development stage of a questionnaire. One disadvantage is that they require more effort from the respondent and therefore should be used sparingly in self-administration questionnaires. Furthermore they are subject to interviewer variability, are more time consuming to answer, and consequently limit the number of questions that can be asked in a given time. Answers to open-ended questions are more difficult to analyse than those to closed questions and make comparisons between groups difficult.

Which is more valid? An open-ended question can produce more non-common category responses than a closed question, but these tend to be small and miscellaneous and providing the response categories in the closed question cover the main issues identified in previous developmental work, the use of either question will result in similar conclusions (Schuman et al, 1986; McColl et al, 2001).

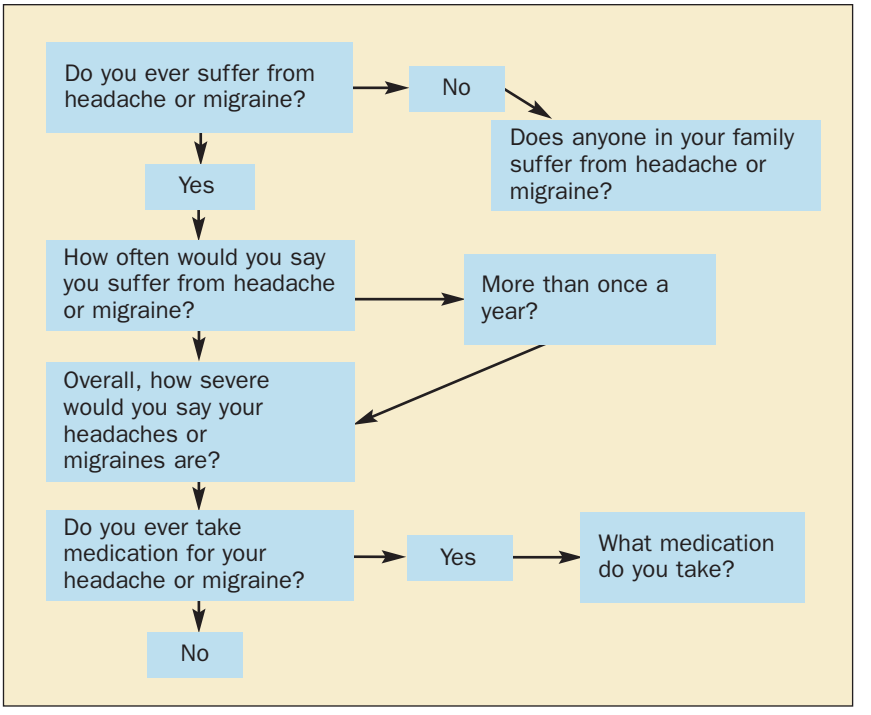

Figure 1. Flow chart for questioning sequence.

Question wording and sequencing

Miller (1984) has described the wording and ordering of questions as the 'rich folklore of survey research'. Constructing a questionnaire must be seen as an important and integral part of the whole research process.

The principle aim in writing a question is to ensure that each question means the same to the surveyor and respondent, who should be able to respond with as accurate a response as possible (Frey, 1989). Sudman and Bradburn (1982) have identified a number of factors that need to be addressed when designing survey questions. These include:

- ***Memory***. Avoid over-taxing the respondent's memory
- ***Motivation***. Ask questions that are relevant to the respondent
- ***Communication***. Ensuring what we are asking

Box 1. Example of a closed question

Which of the following would you find most difficult doing? (Please circle the appropriate number)

Walk across the room	1
Climb one flight of stairs	2
Walk one kilometre	3
Run half a kilometre without stopping	4

'Common sense should tell us that paying attention to the design and layout of a questionnaire is an important stage in its development.'

the respondent is clearly communicated
- ***Knowledge***. Only ask for information the respondent is likely to have.

Despite the wide range of research and the evidence base for 'best practice' in questionnaire design, relatively little of this can be generalized to health-related research and so caution should always be exercised when extrapolating findings to health surveys (McColl et al, 2001). Nevertheless, there are recognized guidelines and principles of question wording which should be followed whatever the chosen mode of administration (*Box 2*).

Response categories

The choice, wording and ordering of response categories is as critical as the wording of the question itself and can have a significant impact on how respondents interpret and answer the question. As with evidence on best practice for question wording, findings are inconsistent. However, there are a number of common-sense recommendations, as well as recommendations for practice based on one or more high grade comparative studies (McColl et al, 2001):

- Ensure response categories for closed questions are mutually exclusive, i.e. do not overlap (e.g. What is your age next birthday? 15–25, 26–35, 36–45 years, as opposed to 15–25, 25–35, 35–45)
- All potential options/categories are exhaustive and if necessary include the option 'other, please specify'
- Be aware that response options can send a message about the type and range of ideas, in addition to concepts the respondent should be thinking about
- An open space should be provided in self-completion questionnaires for free comment, which can improve response rates
- For factual questions the 'don't know' option can be omitted.

Box 2. Aspects of good question wording

- Use simple language, avoid the use of technical terms, professional jargon and abbreviations
- Avoid words that may have more than one meaning (e.g. dinner)
- Avoid questions that are not sufficiently specific (e.g. How well do you manage your diabetes?)
- Avoid ambiguity (e.g. What kind of day has it been for you?)
- Keep the maximum number of words in a question to approximately 20
- Avoid double-barrelled questions (e.g. How do you feel about the treatment you have been receiving for your present illness, and the doctors who are treating you?)
- Avoid double negatives – a negative statement followed by a disagree response (e.g. I feel there is no one I'm close to – disagree)
- Avoid leading questions (e.g. Many patients now days think that waiting times in the NHS are too long. Do you?)
- Avoid the use of loaded words and concepts (e.g. those which are emotionally coloured and suggest a feeling of approval or disapproval)
- Avoid the use of presuming questions (e.g. How long did you have to wait the last time you visited your local accident and emergency department?)

After Moser and Karlton (1971), Oppenheim (1992), (McColl et al (2001)

Question sequencing

The position of a question may affect the way the respondent answers it (Schuman et al, 1983; Serdula et al, 1995). Researchers need to be aware of the potential effects of the order of questions in self-completion and interviewer-administered questionnaires. Researchers should follow recommendations on questionnaire design, including:

- Specific questions should follow on from general questions
- Demographic questions (e.g. age, sex, education and race) should be placed at the end of the questionnaire
- The apparent relevance and salience of opening questions can influence respondents' motivation to complete the questionnaire. Therefore, relevant and salient questions should be placed close to the front of the questionnaire although highly sensitive questions should not be among the first few
- Whenever possible questions should be ordered from easy to difficult in the questionnaire
- Questions should be blocked by topic (McColl et al, 2001).

Formatting the questionnaire

Common sense should tell us that paying attention to the design and layout of a questionnaire is an important stage in its development. A well-designed questionnaire can simplify the tasks of the respondent, interviewer and data processor (Sudman and Bradburn, 1982), reduce errors in the asking of the questions and minimize variability between interviewers and data processors (McColl et al, 2001). Appearance and layout of a questionnaire can influence a respondent's decision on whether to respond.

The main issues around the appearance and layout of questionnaires include length of questionnaire, question and response category format, print details such as font and typeface, pagination and instructions. However, unlike issues of question wording and sequencing, less attention has been paid to principles for the formatting of questions, or comparative studies on influence of questionnaire appearance and layout on response rates and bias. Nevertheless, expert opinion recognizes the importance of enhancing the appearance and layout of questionnaires, and is supported by psychological theories in a number of cases (McColl et al, 2001).

Length

Findings in relation to the effect of questionnaire length on response rates are equivocal, but a longer questionnaire may potentially lead to fatigue or carelessness, or put off potential respondents. However, reviews have shown that questionnaires on topics which are relevant or interesting can probably be longer than questionnaires on more general topics or those for the general population (Oppenheim, 1992; McColl et al 2001).

Question and response category format

Questions and response categories can be formatted horizontally or vertically (*Box 3*). Bourque and Fielder (1995) prefer the vertical format because the question is clearly differentiated from the responses, and also because it can make data entry simpler and less prone to error. Dillman (1978) and Sudman and Bradburn (1982) recommend the vertical format because it gives a less cluttered appearance and adds to the respondent's feeling of accomplishment. However, on the grounds of conserving space, an exception to the rule would be where a set of questions uses the same set of responses. Whether the respondent is asked to tick a box or circle a number appears to not be significant (McColl et al, 2001), but a mixture of circling and ticking should be avoided.

A consistent format should be kept throughout the questionnaire and the natural reading style of left to right should be considered when placing headings, codes or instructions. Whenever possible graphics should be used to steer the respondent or interviewer through the questionnaire or indicate skip patterns (*Box 4*).

Print details

Font sizes less than 10 points should be avoided. If it is anticipated that respondents might have visual problems, e.g. older people or particular illness groups, then 14 to 16 points should be considered, depending on the typeface. Over-use of upper case letters and italics should be avoided.

Pagination

There is little evidence as to whether questionnaires in the form of booklet or individual pages has any effects on response rates, or what the relative benefits are of double *vs* single-sided printing. However, McColl et al (2001) recommend using a booklet format with double-sided printing using a standard A4-folded-A5 format.

Instructions

Both self-administration and interviewer-administered questionnaires will almost certainly require instructions. The purpose of instructions is to facilitate the process of collecting information by helping the respondent and interviewer move through the questionnaire. Self-administration questionnaires will generally include brief introductory comments on the purpose of the survey, the type of questions to be asked and why the information is required, in addition to instructions on what to do with the questionnaire when completed. These instructions should always be placed at the beginning of the questionnaire. However, more specific instructions relating to particular questions should be placed as close to the question as possible. Instructions for the interviewer are likely to include which questions should be asked of which respondents, the script asking the question and what probes should be used to get additional information from the respondent.

Box 3. Examples of a survey question formatted horizontally and vertically

Horizontal

How would you rate your health over the past 7 days?

Excellent	V. good	Good	Fair	Poor
1	2	3	4	5

Vertical

How would you rate your health over the past 7 days?

Excellent	1
V. good	2
Good	3
Fair	4
Poor	5

Other aspects of questionnaire appearance

- Avoid splitting a question or its response options across two pages.
- Do not use lines for responses to open-ended questions; leave sufficient white space between questions
- Consider the use of coloured paper to distinguish between different questionnaires
- Ensure the front cover contains the title of the survey and the name and address of the organization carrying it out
- Provide a back cover with blank space for respondents to make open comments
- Print a 'thank you' after the last question and provide details of where to return the questionnaire.

Box 4. Example of questions to guide the participants

ASK ALL: Q4. What is your current marital status?

Married	1	
Widowed	2	→ SKIP TO Q7
Single	3	
Separated or divorced	4	

'In the same way that health and illness may be conceptualized in different ways across cultures, the validity or relevance of the questionnaire items representing a given domain or concept may also vary.'

Pre-testing/piloting

Given the complexity of the questionnaire design process, it is highly unlikely that the first draft of a questionnaire will be perfect. Pre-testing the questionnaire can highlight any problems with it, including excessive length, incomprehensibility, missing questions etc. Pre-tests can be carried out using focus groups (Bourque and Fielder, 1995) and, more recently, cognitive aspects of survey methodology (CASM), which draws on the theories of cognitive psychology and the use of cognitive laboratory techniques to improve questionnaire design (Sirkin et al, 1999; McColl et al, 2003).

Pilot studies focus on testing the whole administrative procedure of using the questionnaire in a smaller but representative sample of the participants before the main study. Here the aim is to test the whole questionnaire, letter of introduction, instructions to participants, reminder letters etc. It is a small-scale test of the main study to check that all the procedures are working properly and, if not, to rectify them before the main study.

Adapting existing questionnaires

Rather than develop a new questionnaire, it is sometimes possible to use or adapt an existing one, or use some of its questions. While this may enable comparison with other studies, there are a number of considerations when adapting another questionnaire because the original is too long, or it is going to be used on a different population. First, adapting an existing questionnaire for a different purpose or group than that for which it has been developed can have serious implications for its reliability and validity. Because a questionnaire is reliable and valid in one setting, it cannot be assumed this is the case in all settings. Even a slight alteration to the wording of a question or the order of questions can impact on how people answer, so laying claim to the original questionnaire's reliability and validity should be avoided after adaptation. Before any adapted questionnaire is put into the field, it should undergo some pre-testing to evaluate its reliability and validity, and it is these findings which must be reported.

Some questionnaires are under copyright and the first step before either using or adapting the questionnaire is to contact the author to obtain permission to do so. Even if not under copyright, the user is obliged to notify, and respect the recommendations of, the author, and to cite the original source.

One reason why a questionnaire might require adaptation is where it needs to be used with people of different cultures and languages than for whom it was originally developed. When this is the case, there are very strong arguments against the assumption that translating the content of the questionnaire into the required language will be sufficient (Herdman et al, 1998; Meadows and Wisher, 2000). Emphasis should be placed on achieving equivalence across the different cultural groups in the concepts measured and the items tapping these concepts. The different types of equivalence are outlined in *Figure 2*.

Conceptual equivalence

Investigating conceptual equivalence involves exploring the ways in which health and illness are conceptualized, as well as the values that are placed on them, and understanding that such meanings and values are part of the culture's social reality. An illustration of this is the work of Howlett et al (1992) on the analysis of the responses to the UK national health and lifestyle survey in an attempt to determine ethnic patterns in the concepts of health and illness. Comparing the beliefs of groups of Asians and Afro-Caribbeans with a matched sample of whites, they found that the Afro-Caribbeans were more likely to describe health in terms of strength and fitness, whereas Asians saw it in relation to one's ability to perform everyday activities.

How individuals experience an illness is a cultural phenomenon reflecting beliefs about aetiology, illness behaviour and the assigned roles of the respective parties (Hunt, 1986). Reluctance to express forms of emotional distress can be observed in a number of cultures for a variety of reasons.

Item/content equivalence

In the same way that health and illness may be conceptualized in different ways across cultures, the validity or relevance of the questionnaire items representing a given domain or concept may also vary. Item or content equivalence is established when the items estimate the same parameters or describe a phenomenon in each culture.

Item relevance will vary across cultures with respect to specific social and leisure activities or illness behaviour. For example, questions about difficulty in climbing stairs or ability to tend the garden will have little relevance in a culture where a large proportion of the population live in housing without stairs or a garden. Care should also be taken with items that could be considered as universal, such as the activity of dressing, but where inability to do so might be perceived as less or more serious (and indicative of differing levels of incapacity) in different cultures (Katz et al, 1963; Herdman et al, 1998). Questions will also vary in terms of acceptability, e.g. questions relating to suicidal ideas may be offensive to some cultures.

Semantic equivalence

Semantic equivalence is about retaining the meaning of each item after its translation into the target language(s), and is a key issue in achieving culturally equivalent questionnaires. Differences between languages and cultures in the salience of concepts, idioms and colloquialisms mean a literal translation from one language to another can be inappropriate. Literal translation, while allowing for changes in the word order and syntax, maintains a one-to-one correspondence between the words, possibly resulting in an incongruence in the meaning of concepts between the different languages (Bullinger et al, 1993).

There needs to be careful consideration of appropriate words and phrases in the translation process. Before translation of a questionnaire it is important that the meaning of key words and expressions are clearly understood, e.g. by providing descriptions of the ideas behind the key words and expressions, as well as the nature of the information expected to be obtained from the question(s). Such information can be of significant value to the translators.

Operational equivalence

The methods of collecting data, i.e. mode of administration, questionnaire format, instructions and measurement methods, will affect the results differently in the different cultures or language groups. Operational equivalence will be achieved when these different elements are shown not to affect the results.

Functional equivalence

Functional equivalence is the extent to which the questionnaire does what it is supposed to do, equally well across the different cultural/language groups. Assessing the extent to which functional equivalence has been achieved involves assessing the degree to which the other types of equivalence (described here) have been carried out. Only if 'reasonable equivalence' has been achieved in all of the areas described can it be argued that the results obtained are likely to be comparable.

The translation process

The forward-backward translation procedure (Brislin, 1970) is the one most commonly quoted in the adaptation and translation process. First, a forward translation is carried out using a bilingual person or persons who translate the questionnaire from language A to language B. The forward translation is then back-translated from language B to language A by a bilingual person or persons. Ideallt, a panel of bilingual experts them compares the equivalence between the forward and backward translation. This procedure should continue until 'satisfactory equivalence' is achieved between the original and translated versions.

When a questionnaire is to be translated, the following recommendations should be followed:

- Use linguistically competent translators who are conversant in the target languages
- Translators should be fully aware of the objectives of their role in the process and ideally have prior experience in adapting health-related questionnaires for cross-cultural use
- Some form of structured evaluation by the translators should be available, e.g. regarding difficulties experienced, which could enhance the ability to identify problems at an early stage of the process
- Forward translations should be produced by at least two independent translators to enable the identification of errors and misunderstandings resulting from the source version. The quality of the forward translation will be higher when teams rather than individuals carry out each translation
- As many back translations as forward translations should be produced
- A group of bilingual speakers should review and verify the equivalence between the source and final versions
- Pre-testing the translated questionnaire should be carried out on a representative sample of the population under study (Leplege and Verdier, 1995; Guillemin et al, 1993).

Despite all of these quality controls within the translation process, language remains a subjectively perceived form of communication. The objective of translation is to retain the intended meaning of the message, so there will always be an aspect of art involved in the process and in which the balance is achieved between rigidity, accuracy and the naturalness. For further reading on the cross-cultural adaptation of health-related questionnaires see

Figure 2. Types of cross-cultural equivalence of a questionnaire.

Conceptual equivalence	The existence and relevance of the concept (ideas and experiences etc) in both cultures
↓	
Item/content equivalence	Each item describes a phenomenon relevant to both cultures or the situation described or experiences evoked in the original version are applicable to the target population.
↓	
Semantic equivalence	The meaning of each item, word or expression is retained after translation into the language of the target culture.
↓	
Operational equivalence	The way in which data collection is carried out (self-completed *vs* structured interviews) may have differential effects on data collected.
↓	
Measurement equivalence	That the psychometric and/or measurement properties of the adapted questionnaire is similar to that of the original instrument
↓	
Functional equivalence	The degree to which equivalence in the preceding stages has been achieved.

Bullinger et al, (1993); Meadows et al (1996); Bentzen et al, (1998); Meadows and Wisher (2000).

Conclusion

This article has attempted to describe the important aspects in the design of self-completion and interviewer administered questionnaires, as well as issues which need to be considered when adapting existing questionnaires, particularly for use in different cultural and language groups.

Constructing a questionnaire is not a simple process and requires skill, planning and care to ensure that all the relevant information is collected and that the information is both reliable and valid. Before undertaking the design of a questionnaire and using it, the novice researcher is strongly advised to discuss their research plans with an researcher experienced in questionnaire design so as to maximize the benefits of the process both in terms of the quality of the data collected and findings. ■

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KEY POINTS

- Using a questionnaire to collect information for studies or surveys is now common practice.
- The mode of questionnaire administration is the first choice to be made.
- The wording and ordering of questions is central to their reliability and validity.
- A well-designed questionnaire can simplify the tasks of the respondent, interviewer and data processor as well as producing reliable data.
- Pre-testing and piloting the questionnaire is an integral part of its development.
- Adapting an existing questionnaire for a different purpose or group of people can have serious implications on its existing reliability and validity. Emphasis must be placed on achieving equivalence across the different cultural or language groups in the concepts measured and the items tapping these concepts.

So you want to do research? 6: Reporting research

Keith A Meadows

The objective of writing is both communication and persuasion (Gilbert, 2001), so reporting your research is an essential stage of the research process and 'is not just an exercise for our private enjoyment' (Miles and Huberman, 1994). Dissemination of research is essential if your findings are to be of benefit to others, to be open to critical examination by your peers, and to promote service development based on sound evidence.

A research report or paper should highlight what the research adds to the body of knowledge, how the research process has been conducted and the limitations of the research and findings.

One of the traditional ways of disseminating findings from research is through the publication of the research paper. However, publishing your research in a journal is not the only way to disseminate research findings. For example, if the study has been funded by a grant from a charity or other grant awarding body, it is likely that an end-of-project report is required to be submitted to the awarding body.

This last article in the series reviews some of the key issues that need to be considered when preparing your research findings for dissemination, whether as a publication or report.

Getting started

Writing up of research should be planned carefully because it is an important part of the research process.

As the research develops so should the shape of your report or paper. Some parts can be written before the data collection stage has been completed, e.g. the background to the research (including accounts of previous research), its theoretical grounding, aims and objectives of the research and methodology to be used.

If the research is collaborative, it is important to decide at the outset who will be the contributing authors and what their respective responsibilities will be in the whole process. It may sometimes be helpful to ensure that these agreements are made in writing. While this might appear to suggest lack of trust in one's colleagues, it is not unknown for research teams to come to grief because such arrangements are not in place. Written agreements outlining the responsibilities of the respective authors can be helpful to make sure everyone is aware of their specific role in the process. It is also helpful to map out other possible publications which might or will arise from the research, together with decisions on who shall lead and who are the contributing authors.

Decisions on who should be contributing authors should be based on their level of contribution to the research, in addition to their input at the writing stage. The authors should have made a significant contribution to the research, e.g. at the conceptual, design or analytical level, or contributed to the writing and editorial stage.

Writing for an audience

Whether writing a report for a small audience or paper for a journal, it is important to be aware that when we write we are doing so for a specific audience and effect. Knowledge of the type of audience our writing is aimed at will help the writing process.

Leese et al (1996) identified four distinct audiences to which the results of research and development in primary care are disseminated. These are:

- Policy makers
- Managers and health professionals

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ABSTRACT

This last article of the series reviews some of the key issues that need to be considered when preparing your research findings for dissemination. Dissemination is an integral part of the research process and this article outlines some of the initial steps that need to be taken, including the establishment of agreements between authors. The importance of writing for a specific audience and how this determines the content of the report is then discussed. An overview together with guidelines on how to report qualitative and quantitative research is presented. General guidance on the choice of title, writing an abstract, listing references and acknowledgments are discussed. The article concludes with an outline of some of the key criteria editors use when reviewing a paper for publication.

- The academic and scientific community
- Users and representatives of primary care.

Consequently, consideration should be given to the stance your writing takes, i.e. that your writing reflects both the needs of the target audience and the type of effect you are hoping to achieve. For example, if the intended audience is policymakers, theoretical or methodological advancement resulting from your research should be secondary to its findings and implications for health-service organization. If the audience is researchers, the aim of the report might be to provide a deeper understanding of the topic, add to existing information or advance methodological procedures in that area.

In addition to the type of audience, one should also take into consideration the variety of article types, e.g. editorials, debates, reviews, letters etc, each of which has a different but specific function to inform. For example if your research included an extensive and methodologically sound review of the literature which could only be summarized in your research paper because of limited space, then submission to an appropriate journal as a review article could be considered.

Read the journal in which you wish to publish. This will give you a feel for the types and style of papers considered by the publication. However, the golden rule is always read the journal's 'instructions to authors'. It is essential to consider the publication's target audience and the message of the article to be submitted. Failure to do so is likely to result in rejection by the editor.

What you write is also determined by the nature of the research you are reporting on. As discussed earlier in the series (Meadows, 2003a,b), research methodology can be broadly categorized as either qualitative or quantitative. Quantitative research focuses on the use of standardized methods (e.g. questionnaires) to collect information which is then transferred into numbers for statistical analysis. The aim of qualitative research is to help in the understanding of social phenomena in a natural rather than an experimental setting, with emphasis on the meanings, experiences, attitudes and views of the participants through the analysis of narrative, rather than providing quantified answers to a research question (Hoinville et al, 1978; Pope and Mays, 1995). Because of these dissimilar methodologies, the manner in which the research findings are reported differ considerably.

Box 1. Guidelines for qualitative reports

- A qualitative report should inform us about the rationale for the study and what it was about.
- It should tell us clearly and in some depth what was done, by whom and how. It should demonstrate how the key concepts emerged and which variables appeared and disappeared and what were the important components of the data which led to important insights.
- It should provide basic data in the form of vignettes, organized narrative, photographs or other displays of data so that the reader can also draw conclusions.
- Conclusions should be articulated and described in broader meanings and in the context of ideas and action they can affect.

(After Miles and Huberman 1994; Robson, 2002)

Qualitative research

There is little consensus on how qualitative research should be reported (Robson, 2002). Miles and Huberman (1994) considered that the conventional format found in the reports of quantitative research is 'too schematic and constraining' and that the reporting of qualitative research should respect its strengths, such as its emphasis on meaning, holism and the data being grounded in the experiences of the research participants. When preparing a paper for an academic journal it is advisable to look at the format of previous papers and follow any guidelines included in the journal. Some journals even have specific policy for the reporting of qualitative research.

Despite a lack of consensus on the reporting format, Miles and Huberman (1994) and Robson (2002) have produced guidelines on reporting qualitative research, which have been summarized in *Box 1*.

Robson (2002) provides a checklist of sections in a report of a qualitative study which would cover most aspects found in a qualitative research report and are as follows:

- The first pages should include the title, abstract, contents list and introduction explaining the purpose of the report, the research question, and outline of the research and structure of the report.
- The literature review should highlight the existing state of knowledge about the subject, an evaluation of this work and the relationship of this previous work to the present study.
- The methodology includes how and why the data were obtained, methods used to collect the data, approaches taken to data analysis and discussion of the integrity of the data and ethical issues.
- Data are at the heart of the report. It is important to remember that often in qualitative research data collection goes hand-in-hand with analysis and as a consequence it is often inadvisable to have separate sections or chapters on data and analysis.
- The final chapter should address the research question asked and what the answer(s) are, how

and what are the links of the research to those discussed in the literature review, what lessons have been learned from the study, implications of the findings and specific suggestions for further research.

One important aspect about reporting the findings from qualitative research is that the data should never undergo statistical analysis or be quantified in any way, no matter how tempting this may be. It is perfectly acceptable to report, for example, how many women and men or GPs took part in the study, but it is important to remember that the findings from qualitative research are based on the analysis of the narrative of individual experiences. Furthermore, it should be remembered that the study participants for qualitative research have not been selected to be statistically representative of the population being studied, but to provide variations in the nature of their views and experiences. Statements such as 'x% of respondents experienced strain and worry resulting from caring for family members' should be avoided. A more appropriate example may be, 'Caring for family members was seen by some respondents to be a considerable strain and worry' (Fenton and Karlson, 2002).

Examples of the narrative are often taken from the transcripts of the interviews or group discussions, and are reproduced in the report to illustrate a point or describe the participants understanding of a concept. This is illustrated by two examples taken from a report on a series of interviews with a number of ethnic groups in their experiences of psychiatric illness (*Boxes 2 and 3*) (O'Connor and Nazroo, 2002).

Qualitative data can also be displayed in a number of ways, including charts, graphs, matrices and networks, and the researcher must be open to all means of ensuring that the data and findings are displayed in a systematic and powerful way. Often charts, diagrams, graphs etc, can communicate complicated concepts and arguments more effectively than the written word.

Quantitative research

While there is little consensus on how qualitative research should be reported (Robson, 2002), there is a conventional model of how quantitative designs should be presented (*Box 4*). This format might vary slightly according to the type of audience being targeted and the journal the research paper or report is being submitted to. However, generally the format in which the research is presented will follow the conventional approach. When reporting fixed-quantitative research in a scientific journal, it should be in a manner and of sufficient detail to enable someone else to replicate it.

Other elements in the reporting process

In addition to the introduction, methods, results, discussion and conclusion, a research paper or report will also require:

- A title
- An abstract
- References
- Acknowledgments.

The title should be concise but informative. It should not give the results of the study, but it should mention the subject, the focus of the research and the type of design. For example, *'An assessment of the impact of cancer on the psychological well being of newly diagnosed cancer patients before and during a course of radiotherapy*' (Chandra et al, 1998).

The abstract should be able to tell the reader why the study was done and what was done, what was found and what the conclusions were. The abstract should stand alone in being able to describe the research. Journals often require abstracts to be structured in the same way as the paper, e.g. background, methods, results, discussion and conclusion.

References should always be read first and cited accurately. Avoid citing too many papers and limit the list to those that are directly relevant to the research being reported. Always follow the house style of the journal to which you are submitting (e.g. Harvard or Vancouver). If your research is in the form of a report that is not for publication and no particular format has been requested, choose a style

Box 2. Example 1

Linked with the idea of stoicism was the concept of hope and 'looking at the brighter side'. For example, a Pakistani man, whose business had gone bankrupt, described how:

'There's always a light at the tunnel, day follows night, it goes round in circles sometimes. You get your hard times but always followed by good times.'

Box 3. Example 2

Finally, relaxation was a strategy that was seen by some to have more support in some cultures rather than others.

'I'm not going to sit down and start to worry about it…worry about it you're going to start greying quick and get old before your time.'

'While there is little consensus on how qualitative research should be reported … there is a conventional model of how quantitative designs should be presented.'

you feel comfortable with and retain it throughout the report. References should always be at the end of the paper or report, and not as a foot note on each page.

A good writing style is important when reporting your research findings, so spend time trying to improve your style to be readable. Ask your colleagues to read the report. Never doubt that your style can be improved – you may be surprised how much improvement can be made by the editor to your 'perfect' paper. Always use simple words, avoid using colloquial language and jargon and use an active rather than passive tense wherever possible.

Often the paper will go through a number of drafts, sometimes resulting in significant changes before you and your co-authors are satisfied. This can take many weeks, perhaps months, but it is time well spent if a clear improvement is seen in the paper. However, constant tweaking to make minor improvements must be avoided as this kind of behaviour leads to delay in publication.

Box 4. The key areas of a quantitative research report for a scientific journal

- **Title** – Describes in summary the main purpose of the study.
- **Abstract** – A concise summary of the research approx 150–500 words.
- **Introduction** – Provides a background to the study, previous research in the area, purpose of the research, research question or hypothesis to be tested.
- **Methods** – A detailed description of the procedures including: the number of study participants and their characteristics and how selected together with sample size calculations; equipment and materials used including a description of the questionnaires/interview schedule and tests used; how these were scored; the reliability and validity of scales and tests used; description of the setting where the study took place; statistical methods used to analysis data; duration of the study.
- **Results** – Number of participants and their descriptive statistics (e.g. age, sex etc.); description of the quantitative data analysis findings using where possible tables, graphs and figures.
- **Discussion** – Was the research question answered or hypothesis supported? What are the main findings from the study? What was the relationship between the study's findings and previous research? What are the implications of the research findings? What questions has the research raised and what are the suggestions for further research? What are the limitations of the research and how could the research have been improved?
- **Conclusion** – A summary of the purpose of the research and its key findings and implications.
- **References** – All references cited in the report in standard format or requested by the scientific journal.

Submitting your paper to a journal

It is more than likely that if you are submitting the results of your research to a journal with a view to publication, it will be reviewed before being accepted. The review process can differ between journals, but in most cases it might be first read by the editor and then by two or more reviewers with knowledge in the area, who will critically review the paper and advise the editor. The author(s) will then be advised about the outcome, which might be 'accept without revision' (although this is unlikely), 'revise and review', 'reject and resubmit' or 'reject'. The outcome is dependent on a number of factors, including the particular journal you submit to, and the journal's ranking in the list of leading journals. So how can the chance of your paper being accepted be raised and what is it that editors and reviewers look for in a paper?

Broadly, papers need to describe research that is original and important, where the methodology used is correct and that journal readers will find it interesting. Your paper will gain favour with the editor and reviewers if the research question(s) has been clearly stated, the message is clear and important and your methods and results are clearly presented. Your paper will need to demonstrate brevity and clarity in style, with good grammar and spelling. It is important to remember to include an abstract.

Editors and reviewers do not like papers which describe unimportant or unoriginal research and very long papers. Papers are usually rejected because they have either incorrect or flawed research methods, e.g. statistical analysis, unrepresentative samples in quantitative research, provide no statistical justification to the size of the selected sample, have problems in the recruitment of patients to the study, or the discussion or conclusion is unrelated to the results. Other reasons include no evidence of ethical approval, very badly written and presented papers, paper sent to more than one journal at the same time and conflicts of interest, e.g. if the post of the author reporting the findings from a drug trial is also funded by the pharmaceutical company producing the drug. If you are in any doubt, contact the journal's editor – most are very happy to talk to you.

Before submitting your paper to editorial review it might be helpful to evaluate your own research using the checklists of the Critical Appraisal Skills Programme (CASP) at www.phru.nhs.uk/~casp/casp.htm. Follow the links to learning resources and critical appraisal tools.

Conclusion

The focus of this paper has been on the final but equally important phase of a research project, the dissemination of the outcomes of the research. Dissemination, whether through submission of a report to a funding body or publication in a journal, should be seen as an integral part of the research process and as such should be addressed early on in the project, and not seen as simply something to be done at the end of the research.

Careful consideration should be given to the messages from the research and audience at whom the reports are aimed. Particular care should be given to the originality and importance of the research, the choice of methodology, the conclusion drawn and the style in which the research is presented. Dissemination of research is essential if our findings are to be of benefit to others, as a consequence dissemination should receive the attention it deserves. ■

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KEY POINTS

- Dissemination of research is essential if our findings are to be of benefit to others, and to be open to critical examination by our peers as well as promote service development, based on sound evidence.
- One of the traditional ways of disseminating the findings from research is through the publication of the research paper, which describes the research and its findings.
- Knowledge of the type of audience our writing is aimed at will help the process.
- One important aspect on the reporting the findings from qualitative research is that on no account should the data undergo statistical analysis.
- Papers need to describe research which is original and important, where the methodology used is correct and that journal readers will find it interesting.