Critiquing quantitative research

Julie Santy and Julia Kneale

Editor's comment
The ability to evaluate a piece of published research is becoming increasingly important for orthopaedic nurses. This article offers straightforward guidance and a framework to undertake this process. It is not intended to be a comprehensive or definitive piece but will get the novice started and reassure those who are already underway. It concentrates on quantitative research as it is hoped to produce a similar article on qualitative research at a later date. See Hayzen's article (p.85) in this issue that critiques a piece of published research.

PD

INTRODUCTION

There are an ever-growing number of research reports, papers and other publications available to the enquiring orthopaedic nurse. However, the publication of a paper does not mean that it is a perfect piece of research, nor are the findings and recommendations necessarily an appropriate basis for changing practice. It is becoming increasingly important for orthopaedic nurses to acquire the skills to review, interpret and evaluate the literature that is available in order that they can appropriately apply knowledge to practice. A critique of a published piece of research is a balanced judgement of its merits and value. It should be objective, constructive and unbiased.

The concept of clinical effectiveness has received considerable attention in health care. Effective clinical care has been given a boost by the white paper 'The New NHS; Modern and Dependable' (Department of Health 1998), placing importance on the concept of clinical governance which places a duty on all professionals to ensure that care is 'satisfactory, consistent and responsive' (Swage 1998). Clinical effectiveness was defined by the NHS Executive (1996) as being: 'the extent to which specific clinical interventions when deployed in the field for a particular patient or population do what they are intended to'.

Kneale & Knight (1997) indicate that this involves the application of research based knowledge to clinical practice. The aim of critical appraisal is to assess applicability to practice, which, clearly, varies according to the reader's practice area. Without the skills to appraise research and decide on its suitability this becomes impossible (Lipp 1997). The ability to assess whether the research is reliable and valid is also important, but it must be recognized that research that meets both these criteria must still be interpreted in the context of the clinical setting – in this case orthopaedic nursing. As a consequence, most nurse education programmes aim to incorporate critiquing research into their educational delivery and student assessment. This article will assist in the process of critically reading quantitative research papers. The paper assumes a basic level of understanding of the research process and the availability of supplementary literature.

QUANTITATIVE RESEARCH METHODS

The common paradigm in health care research is the quantitative approach which generally uses a structured procedure and methods to collect information under controlled conditions and emphasizes objectivity through statistical analysis (Polit & Hungler 1995). There are a variety of research methods that fall into this positivist paradigm which views research evidence as rooted in objective reality. The main categories of which are experimental, quasi-experimental and survey research.

Experimental research tends to be seen as the pivot of scientific research. It is viewed as the controlled comparison and manipulation of change. Experiments are concerned with variables; those things that are measurable when changed from one person or situation to another, for example, in a study that examines the effect of particular aspects of nursing care interventions on the pain experiences of clients. Both the nursing interventions and the pain experiences are variables, as these will vary from one individual nurse or client to another. Variables manipulated by the researcher are termed independent variables (e.g. the nursing interventions) and

Julie Santy, BSc (Hons), RGN, ENB 219, RNT, Lecturer, School of Health Studies, University of Bradford,
Julia Kneale, BA (Hons), RGN, ENB 219, RNT, Senior Lecturer, Faculty of Health, University of Central Lancashire, Preston, UK.

Correspondence to: **Julie Santy**, Lecturer, School of Health Studies University of Bradford, Unity Building, 25 Trinity Road, Bradford, BD5 OBB UK. Tel: ++44 1274 236425/01482 665801. E-mail: j.e.santy@bradford.ac.uk

the characteristics thought to vary as a result of the manipulation are dependent variables (e.g. the pain experiences of the patient).

Experiments are designed to test hypotheses, which are statements of expected causal relationships between dependent and independent variables (Avis 1994). Such hypotheses are usually presented as a statement which proposes a relationship between at least two variables, for example: 'Following a hot bath, shower, or immersion in a warm swimming pool, the rheumatoid arthritis sufferer's early morning pain and stiffness are reduced'. The aim of experimental research is to prove or disprove the hypotheses through systematic enquiry. In some circumstances researchers state the hypothesis as a null (or statistical) hypothesis; a statement saying that there is no actual relationship between two variables (Polit & Hungler 1995, p 405). The 'null' is stated as the basis for analysis rather than an attempt to convey negative expectations of the results.

The most common type of experimental approach in health care is the controlled clinical trial where strict controls are exerted over the independent and dependent variables and randomization of the sample subjects into control and experimental groups. Randomization allocates subjects randomly to different experimental conditions in order to provide clear evidence about causal relationships; this minimizes the effect of chance on the results of a study (Robson 1993). Examples of attempts to embrace this approach are Draper & Scott's (1997) work on Hamilton Russell traction and O'Brien et al's (1997) work on the value of wound drains in prosthetic hip surgery. However, because of issues around sampling and control these two pieces of work might be considered to be quasi-experimental. It must be recognized that complete randomization is very difficult to achieve in the clinical setting and it is unlikely that many nursing studies can achieve this.

In the orthopaedic clinical setting stringent controls are not always possible and the quasi-experimental approach is more valuable when researching in the practice setting. Sampling methods other than true randomization may be used and the controls on variables are less stringent, but these aspects may have a consequent effect on the validity and reliability of the study (Robson 1993). It is, therefore, the reviewer's responsibility to judge how far this affects the trustworthiness of the study for applicability to practice. A variety of models are available for quasi-experimental research, which attempt to reduce the level of bias (see Polit & Hungler 1995, p 168).

Surveys collect quantitative data with the aim of describing characteristics of a population through the collection of such data as demographic characteristics, health related variables, attitudes, opinions and beliefs related to health issues. This enables insight into the state of health, illness and treatment patterns of a given community (Polgar & Thomas 1995). Examples of the survey approach to research are Haugh et al's (1997) work on detecting infant hip abnormalities and Thorn's (1997) survey into the attitudes of nurses towards the assessment and control of postoperative pain. Such work attempts to describe a situation and is not concerned with relationships so hypothesis testing does not tend to be a feature.

THE PROCESS OF RESEARCH CRITIQUE

As a framework for the process of research critique it is helpful to use Polit & Hungler's (1995) five major steps in the research process. A summary of the issues to consider is provided in Box 1.

The conceptual phase

The conceptual phase of a study sets the scene. It allows the researcher to focus on all the underlying ideas and definitions which affect the study and its methods.

Theoretical framework

The section of the paper, which considers the research framework, must include the rationale for the study and its relevance to practice. This may have evolved from a larger interest area and then been refined to a focus of enquiry that can be related to an appropriate research process. In the report, the research problem and question should be explicitly stated and discussed in relation to the area of interest. Justification of the research focus should then be supported by relevant literature and published research within the arena. The hypothesis is the formalized prediction of the relationships between the variables in question; these variables will themselves need to be defined clearly and should be made clear in the early part of the report. Any theoretical concepts involved in the research process and design need to be clearly defined for the reader. All of these issues, which define concepts and formalize ideas, allow identification of the theoretical framework for the study. This means that the results will hold more significance and be applicable to a larger group of practitioners.

Literature review

The inclusion of a literature review enables the reader to see where the research fits with current knowledge and research in the area of interest. The researchers need to have critiqued the literature not merely reported or described it. Current, relevant research and relevant classical or doctrinal works must be included whilst the inclusion of out of date work detracts from the relevance of the review, as

Box 1 What to look for when undertaking a research critique

Journal	Is the journal credible and does it have double blind review? How long does it appear to have been from submission of the article to publication in the journal, if this is evident?
Title	Does the title allow you to understand what the research is about without reading anything else in the paper?
Author credibility	What qualifications and experience (academic and practice) do the researchers have to qualify them to undertake this work? Is their position and place of work appropriate for this research? How many authors are there and how well do they match each other? What other work have the researchers published?
Abstract	Does the abstract explain what the research is about and summarize the research approach and overall findings?
Literature review	Are the literature sources largely primary, recent (less than 10 years old unless the research is doctrinal/classic), relevant and made up largely of empirical work rather than opinion papers? Is there any major work that is missing? Is the literature listed and referenced correctly? Does the researcher critique or merely report other research? Is current knowledge summarized?
Theoretical framework	Does the paper clearly state the research problem, question, hypothesis, aims and objectives? Are these clearly related to the literature review? Are they discussed in sufficient detail for you to understand the background to the work? Are concepts sufficiently described? Do the hypotheses contain at least two variables? Are the study variables sufficiently described?
Methods	Is the research approach clear? Have the research approach and methods been justified with supporting literature? Do you know exactly how the research was carried out? Are any data collection tools e.g. questionnaires, scales etc. included in the text? Are instruments sufficiently described and the reliability and validity discussed? Does the researcher state how control is introduced to the study where this is necessary (experimental/quasi-experimental work)?
Sampling	Is the sampling plan clearly described? Are the characteristics of the sample sufficiently described? Is there evidence that the sample size is adequate?
Ethical issues	Are the rights of the study sample sufficiently considered? Is there evidence that human subjects/ethics committee approval has been gained? Have the ethical issues related to the study been sufficiently discussed in relation to the principles of autonomy, non-maleficence, beneficence and justice?
Pilot study	Is there evidence of a pilot study and subsequent changes?
Validity and reliability	Has the researcher considered all potential threats to internal validity? Is there consistency of the data collection method? Can the results be generalized to the whole population i.e. are they reliable?
Analysis	Are the statistical tests used appropriate for the aims of the study? Are they correctly executed and explained? Is the rationale for the choice of statistical tests given?
Results/findings/data display	Are the results presented in a clearly understood manner? Is the data displayed in sufficient detail and in a form that attracts rather than detracts from understanding? Are the results clearly related to the study framework and do they support the framework, hypothesis(es), research problem and question?
Discussion/conclusion/ limitations	Do the researchers make any unsubstantiated claims about the results of the study in terms of what they show? Does it relate back to the literature review or introduce new literature? Do the researchers clearly identify and discuss the strengths, weaknesses and limitations of their work?
Recommendations/ practice implications	Do the researchers make recommendations which are relevant to practice and which are based on the objective findings of the research? Do they make recommendations for further research? Are the findings generalized? Are any omissions in the study discussed or evident to the reader?
Overall presentation	Is the paper presented in an attractive and pleasing manner that makes it relatively easy for the reader to follow? Is it presented logically and clearly? Is the language used appropriate for the audience? Is terminology explained?

does any major work that has been missed. For this reason opinion articles can hold less academic weight, especially if used as the predominant form of literature. The literature sources used need to be primary (i.e. from the original source and not cited by another author) to ensure correct interpretation within the context of the research and literature review. The accuracy of the reference listing and the inclusion of all the in-text referencing allow the reader to easily obtain the source materials of interest.

Ethics

All research approaches require consideration of the ethical dimensions. Generally, the involvement of patients and vulnerable groups as subjects, e.g. children and the elderly, requires the approval of the local ethics committee. However, these rules vary and reference to the local ethical committee approval guidelines allows the researcher to judge whether ethical committee approval is required. The subsequent approval may be governed by conditions which need to be made evident and applied throughout the research process. Even studies which involve staff rather than patients although not necessarily requiring ethical committee approval must consider the relevant ethical issues since any work tends to involve human subjects who are vulnerable to harm in research situations.

The major ethical principles involved in research are as follows:

- Autonomy or respect for independent decision making e.g. the right to consent, refuse and withdraw from a study at any time. Attention to the issue of informed consent is vital to ensure that the subjects are aware of all issues in relation to the research and their role (Behi 1995)
- Beneficence, the duty to do good or benefit society
- Non-maleficence or the duty to do no harm
- Justice or fairness, that chance of benefit is equal for everyone (Eby 1995).

It is important that researchers make it explicit in the research report how each of these issues has been dealt with before the reviewer can conclude that the study has been carried out in an ethical manner.

Design and planning phase

Methods

The research method must be clearly indicated and relate to the theoretical framework discussed. The research approach should be justified with supporting literature and the reader should be able to replicate the study with the information provided in the paper. For example, if the researcher has chosen observation or questionnaires as the method of data collection the reason for this decision must be made clear in the report. Any data collection tools, e.g. scales and questionnaires, should be included in the text; however, validated research tools such as the Nottingham Health Profile (Hunt et al 1985) can be referred to and referenced rather than included in their entirety. Any research tools used must be described with reference to their reliability.

Population and sampling

The research sample is usually a selection of subjects from an overall population group that has been clearly defined. For example, a piece of work studying the attitudes of orthopaedic nurses towards their work could not possibly sample the whole population of orthopaedic nurses, so a sample group from perhaps one area of the country might be chosen. The aim of any sampling method is to draw a representative sample from the population in order to generalize the results back to the rest of the population. There are a variety of sampling frameworks, the most rigorous of which is random sampling, which ensures that every member of the population has an equal opportunity to be chosen for the study. If the sample is not truly randomly selected this may result in incorrect inferences and conclusions about the population (Polgar & Thomas 1995). In many quasi-experimental studies, non-random or convenience samples of available subjects are both appropriate and unavoidable, but inevitably lead to the potential for bias in the study (Avis 1994). The reviewer needs to consider to what extent the sampling plan affects the reliability of the results and whether this is sufficient to warrant concern over the trustworthiness of the work or whether the results can still be considered to be valuable. Where researchers have considered these issues and where possible attempted to resolve them, the reviewer has more of a chance of identifying any failings and deciding how severely they affect the findings. In experimental research it is important that the size of the sample is determined by objective estimation to ensure the significant difference in the outcomes for each of the study groups when compared to each other.

Pilot study

Where the researcher has used a previously untested research tool a pilot study is advisable. This is a dummy run, which helps to illuminate some of the problems of the research tool so that it can be altered or adapted prior to execution of the main study (Robson 1993). The results of the pilot study and subsequent actions should be included in the research report. Many nursing research studies, because of the small sample sizes used, may be considered to amount to pilot studies for future work and this should be stated in the paper.

Empirical phase

This phase of the work involves the methods used to gather data or evidence.

Data collection

The process of the data collection, procedures and implementation of the data collection method need to be considered. Procedures such as the training of research assistants and timing of the data collection method can adversely influence the results (Polit & Hungler 1995) if not executed in a well-considered manner. The ability to demonstrate these decision-making processes in the research report demonstrates the credibility and trustworthiness of the research.

Validity and reliability

The validity of research is dependent on whether the chosen research tools have measured what they were supposed to. Internal validity demonstrates if a study can claim that there is a relationship between cause and effect, e.g. treatment and outcomes (Robson 1993). There are a variety of threats to internal validity, which the reviewer needs to consider when critiquing research papers (see, for example, Robson 1993 p 71–72). These include issues that may occur which obscure relationships between variables, or issues that may inappropriately influence the outcomes or results. These may be a result of the behaviours of the researcher or subjects during the data collection process. An example is Draper & Scott's (1997) work, which evaluates the effect of Hamilton–Russell traction on the pre-operative management of patients with hip fractures. There was an observed difference in the mental test scores of the two experimental groups that, due to randomization, should have been equal. One possible explanation offered by the researchers was that the nursing staff decided not to apply traction to patients with low mental test scores after they had been allocated to the traction group. It was suggested that this was due to the nurses believing that these patients would be unlikely to cooperate with the application and maintenance of the traction system. This introduces potential bias to the study and potentially reduces the validity of the research. This is known as compensatory equalization of treatments (Robson 1993, p 72) and is one of many possible threats to internal validity.

External validity and research generalizability (the extent to which the research findings are generalizable beyond the immediate study sample and settings) are very similar as they relate to whether the study is readily related to the rest of the population.

Reliability applies to a number of areas such as the ability of different researchers to obtain the same results with the same research tool (inter-rater reliability). In other words, provided that external constraints do not vary we should expect a sample to give similar results on repeated measurement (Newell 1996) and this is one of the reasons why it is necessary to replicate studies in order to demonstrate external validity. Threats to external validity may lead to the findings being specific only to the group studied. This is dependent on the context in which the study took place and is specific to the historical influences on the group such as the point in time in which the study took place and specific to particular constructs and characteristics of the group under study (Robson 1993 p 73).

It is vital that nurses undertaking research critique understand the concepts of reliability and validity and are able to apply them to an evaluation of a research study by being aware of the issues which might affect both of these important concepts.

Analytical phase

Analysis

The statistical analysis of quantitative research studies, especially experimental research, appears to be a source of concern for many nurses attempting to make sense of research papers. An in-depth understanding of statistical tests is neither necessary nor feasible. However, it is important that the reviewer understands the analysis process and is able to ascertain whether the appropriate statistical tests have been executed and used correctly.

The researcher should first describe the demographic or descriptive characteristics of the sample and present this in an easily understood manner. Descriptive statistics look for patterns, to summarize and present a set of data and are concerned with describing the characteristics of the sample so that comparisons can be made. They are particularly useful when trying to determine whether two groups in an experimental study are equal enough for comparisons to be made and also for placing the sample group in context with the population in which the reader of the report may be interested.

Inferential statistics take analysis a step further and use data to make estimates, decisions, predictions and generalizations about sets of data in order to explore relationships (McClave & Dietrich 1994). It is these which the researcher uses to prove or disprove hypotheses in experimental and quasi-experimental research. In many studies inferential statistical tests are not required, for example in most survey research (Polgar & Thomas 1995, p 304). Inferential statistics test hypotheses by computing the probability of the obtained results occurring by chance alone. It is important for the reviewer to grasp in experimental and quasi-experimental research the importance of demonstrating these significant differences between outcomes and how tests can demonstrate this. Once this concept has been grasped many others will begin to fall into place.

It is not within the scope of this paper to address statistical tests in detail, but there are a variety of texts at all levels, which explain the principles and details of statistical tests in general use in research such as Rowntree (1991) and many specific nursing research texts.

Results, findings and data display

The display and layout of the data should attract rather than detract from the overall presentation and if done appropriately will be communicating the findings effectively. Methods chosen to present data are determined by the methods used to sort, handle and analyse data and by the theoretical framework of the research. Data can be reflected visually in graphics, which allow the reviewer to easily identify the main aspects of the data (Pearson 1997). Data should be presented in a form that uncovers the

deepest level of meaning in the simplest form possible. It should be possible to determine from the displayed results whether the framework and hypothesis have been supported.

Conclusion, discussion and limitations

This section of the report should restate the aims of the investigation and discuss the results with reference to the aims or experimental hypotheses stated in the early part of the work. The researcher should offer an analysis of whether what was found was what was expected and how the results relate to previous research (Polgar & Thomas 1995, p 336)

It is almost impossible to produce perfect research – especially in a world full of uncontrollable influences on nurses, patients and other persons found in the health care setting. Where there are design issues, which introduce bias, such as sampling that is not randomized, the researcher should clearly identify these and discuss to what extent this introduces bias to the study.

The researcher should attempt to place the findings on the same or related topics in context with the rest of the body of research. Research studies in isolation are of less value than those that make up part of a number of studies that have investigated the same or similar phenomena. Over time strong evidence can be gathered from small-scale studies which may not have been able to use stringent methods as in the quasi-experimental approach.

Dissemination phase

Recommendation and practice implications

The purpose of nursing research is to provide a scientific, rational basis for practice and all research has some implications for practice even if the results have proven to be inconclusive. The researcher should, at this point, discuss the findings of the research in terms of what implications they might have for practice. The reviewer needs to decide if, based on the evidence provided, the researcher's recommendations are worthy of consideration, particularly where there are recommendations for alteration in practice.

Title and abstract

The title of a research study is what is likely to attract the reader to seek out the full report in the first place, particularly if it has been discovered in the reference list of another work or in a computerized search facility. The title should indicate briefly and clearly what the study is about and how it was conducted. This will give the reader the opportunity to make informed decisions to whether the article, paper or original work is worth obtaining to review in more detail.

In many computerized search facilities abstracts are now provided to allow a more informed search of the literature. The abstract for a study should provide the reviewer with an overview of the study stating the research problem, aims and any hypotheses, a brief description of the methods and a short summary of the findings. This allows the reader to decide if the study is relevant and worthy of further investigation.

Credibility

Researcher and journal credibility are important factors in deciding whether the article is valuable to the reader. The journal credibility is based on the academic status and the professional reputation of the journal (Cormack 1996). The article should have been subjected to a double blind review process prior to publication. This process can be lengthy, as the process from initial submission or commissioning to publication of the final article can be up to or in excess of 12 months. This can then lead to criticisms of the research being out-of-date or superseded by other research published in the meantime.

The credibility of the author is also an issue to consider. Many research studies are undertaken and published by a team of researchers. In general, the author whose name appears first in the list has taken the leading role in the work. The authors' academic qualifications and employment position are important when deciding how credible the work may be. A higher degree, for example, is more likely to have provided some instruction in research methods and doctorate level study is undertaken entirely by involvement in a major research study. Computerized search facilities now allow the reviewer easy access to such information as a researcher's previous work. It is not only the amount of work which is relevant, but also the subjects, since immersion over a long period of time in a given topic is likely to add an expert dimension to the work.

It is also important to note that because a researcher does not have a higher academic qualification or hold an academic position this does not mean that their research is not credible. Indeed, much valuable research is small-scale research undertaken by practitioners or those studying at first degree level. In nursing research it is also equally important for the researcher or research team to be in touch with practice, so the clinical positions of the researcher are worthy of consideration. Where the researcher is inexperienced a reasonable level of supervision by a more experienced researcher is advisable and this relationship may or may not be evident in the report and sometimes is only apparent from the contributor list.

OVERALL PRESENTATION

Finally, the overall presentation of the article is of some importance since this affects whether

practitioners are attracted to it and are therefore likely to consider application of the findings to practice. Research should be well written, understandable on first or second reading, not over use jargon and be presented logically in keeping with the steps of the research process. The inexperienced reviewer, undertaking a research critique is in an ideal position to make judgements of this nature. Much research, because of the nature of the research process, its execution and the academic nature of scientific enquiry, is not always easily readable and the reviewer should try to work through those issues which are not easily understood. In the early stages of trying to understand the research process this is not always easy but becomes easier with practice and it is very rewarding when the light begins to dawn.

It is important that the reader does not give up seeking understanding at the first attempt as Burns & Grove (1995) suggest that comprehension is the first step in the research critique. This involves understanding the terms and concepts in the report as well as identifying the elements or steps of the research process such as the problem, purpose, framework and design. Comprehension is best achieved by first reading the abstract and grasping its contents. It is then advisable to read the entire study without trying too hard to understand difficult terminology and concepts, but merely trying to grasp the principles of the work and its major issues. On a second reading the reviewer should then write down the terms and contexts which are not understood and attempt to enquire, investigate and understand them before making a third reading and a more in-depth consideration of each phase of the report as outlined above.

CONCLUSION

It is vitally important that orthopaedic nurses acquire the skills with which to use the research findings of those whose time and effort has gone into scientific enquiry. As orthopaedic nursing progresses into the next millennium such skills will be increasingly required as the specialty becomes increasingly dynamic, forward thinking and clinically effective.

REFERENCES

Avis M 1994 Reading research critically. 1. An introduction to appraisal; designs and objectives. Journal of Clinical Nursing 3: 227–234

Burns N, Grove SK 1995 Understanding nursing research. Philadelphia, WB Saunders

Behi R 1995 The individual's right to informed consent. Nurse Researcher 3 (1): 14–23

Cormack D F S (ed) 1996 The research process in nursing, 3rd edn. Oxford, Blackwell Scientific

Department of Health 1998 The new NHS: modern and dependable: a national framework for assessing performance. London, DOH

Draper P, Scott F 1997 An evaluation of Hamilton Russell traction in the preoperative management of patients hip fracture. Clinical Effectiveness in Nursing 1: 179–188

Eby M A 1995 Ethical issues in nursing research: the wider picture. Nurse Researcher 3:1 5–23

Haugh P Trainor E, Kernohan G 1997 Nurses detecting infant hip abnormalities Journal of Orthopaedic Nursing 1:1 11–16

Hunt S M, McEwen J, McKenna S P 1985 Measuring health status; a new tool for clinicians and epidemiologists. Journal of the Royal College of Practitioners (April): 187

Kneale J, Knight C 1997 Do orthopaedic nurses have an effect on the quality of patient care? Journal of Orthopaedic Nursing 1:1 115–117

Lipp A 1997 Clinical effectiveness: raising awareness in clinicians. Clinical Effectiveness in Nursing 1: 220–222

McClave J T, Dietrich F H 1994 Statistics, 6th edn. New York, Dellem

Newell R 1996 The reliability and validity of samples. Nurse Researcher 3(4): 16–28

NHS Executive 1996 Promoting clinical effectiveness. London, NHS Executive

O'Brien S, Gallagher P, Engela D, et al 1997 The use of wound drains in total hip replacement surgery. Journal of Orthopaedic Nursing 1:2 77–83

Pearson L 1997 Quantitative analysis; the principles of data presentation. Nurse Researcher 4(4): 41–53

Polgar S, Thomas S A 1995 Introduction to research in the health sciences, 3rd edn. Melbourne, Churchill Livingstone

Polit D F, Hungler B P 1995 Nursing research principles and methods, 5th edn. Philadelphia, JB Lippincott

Robson C 1993 Real world research: a resource of social scientists and practitioner-researchers. Oxford, Blackwell

Rowntree D 1991 Statistics without tears: a primer for non-mathematicians. Harmondsworth, Penguin

Shepard K F, Jensen G M, Schmoll B J, Hack L M, Gwyer J 1993 Alternative approaches to research in physical therapy: positivism and phenomenology. Physical Therapy 73 (2): 34–47

Swage T 1998 Clinical care takes centre. Nursing Times 94 (14): 40–41

Thorn M 1997 A survey of nurses' attitudes towards the assessment and control of post-operative pain. Journal of Orthopaedic Nursing 1 (1): 30–38

BIBLOGRAPHY

Avis M 1994 Reading research critically. 1. An introduction to appraisal; designs and objectives. Journal of Clinical Nursing 3 227–234

Burns N, Grove SK 1995 Understanding nursing research. Critiquing nursing studies. Philadelphia, WB Saunders ch. 12

Polgar S, Thomas SA 1995 Introduction to research in the health sciences, 3rd edn. Melbourne, Churchill Livingstone chs 13–20

Polit D F, Hungler BP 1995 Nursing research principles and methods, 5th edn. Evaluating research reports. Philadelphia, JB Lippincott ch. 25

Rowntree D 1991 Statistics without tears: a primer for non-mathematicians. Harmondsworth, Penguin