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Education and debate

How to read a paper: Papers that go beyond numbers (qualitative research)

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What is qualitative research?

Epidemiologist Nick Black has argued that a finding or a result is more likely to be accepted as a fact if it is quantified (expressed in numbers) than if it is not.[1] There is little or no scientific evidence, for example, to support the well known "facts" that one couple in 10 is infertile, or that one man in 10 is homosexual. Yet, observes Black, most of us are happy to accept uncritically such simplified, reductionist, and blatantly incorrect statements so long as they contain at least one number.

Researchers who use qualitative methods seek a deeper truth. They aim to "study things in their natural setting, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them,"[2] and they use "a holistic perspective which preserves the complexities of human behaviour."[1]

Summary points

Qualitative methods aim to make sense of, or interpret, phenomena in terms of the meanings people bring to them

Qualitative research may define preliminary questions which can then be addressed

in quantitative studies

A good qualitative study will address a clinical problem through a clearly formulated question and using more than one research method (triangulation)

Analysis of qualitative data can and should be done using explicit, systematic, and reproducible methods

Questions such as "How many parents would consult their general practitioner when their child has a mild temperature?" or "What proportion of smokers have tried to give up?" clearly need answering through quantitative methods. But questions like "Why do parents worry so much about their children's temperature?" and "What stops people giving up smoking?" cannot and should not be answered by leaping in and measuring the first aspect of the problem that we (the outsiders) think might be important. Rather, we need to listen to what people have to say, and we should explore the ideas and concerns which the subjects themselves come up with. After a while, we may notice a pattern emerging, which may prompt us to make our observations in a different way. We may start with one of the methods shown in box box, and go on to use a selection of others.

Box 1: Examples of qualitative research methods

Documents—Study of documentary accounts of events, such as meetings

Passive observation—Systematic watching of behaviour and talk in natural occurring settings

Participant observation—Observation in which the researcher also occupies a role or part in the setting, in addition to observing

In depth interviews—Face to face conversation with the purpose of exploring issues or topics in detail. Does not use preset questions, but is shaped by a defined set of topics

Focus groups—Method of group interview which explicitly includes and uses the group interaction to generate data

Box box summarises (indeed, overstates) the differences between the qualitative and quantitative approaches to research. In reality, there is a great deal of overlap between them, the importance of which is increasingly being recognised.[4]

Box 2 Qualitative versus quantitative research—the overstated dichotomy

	Qualitative	Quantitative
Social theory	Action	Structure
Methods	Observation, interview	Experiment, survey
Question	What is X?	How many Xs?
	(classification)	(enumeration)
Reasoning	Inductive	Deductive
Sampling method	Theoretical	Statistical
Strength	Validity	Reliability

Reproduced with permission from Mays and Pope, *Qualitative Research in Health Care*[3]

Quantitative research should begin with an idea (usually articulated as a hypothesis), which then, through measurement, generates data and, by deduction, allows a conclusion to be drawn. Qualitative research, in contrast, begins with an intention to explore a particular area, collects "data" (observations and interviews), and generates ideas and hypotheses from these data largely through what is known as inductive reasoning.[3] The strength of the quantitative approach lies in its reliability (repeatability)—that is, the same measurements should yield the same results time after time. The strength of qualitative research lies in validity (closeness to the truth)—that is, good qualitative research, using a selection of data collection methods, really should touch the core of what is going on rather than just skimming the surface. The validity of qualitative methods is greatly improved by using a combination of research methods, a process known as triangulation, and by independent analysis of the data by more than one researcher.

The so called iterative approach (altering the research methods and the hypothesis as the study progresses, in the light of information gleaned along the way) used by qualitative researchers shows a commendable sensitivity to the richness and variability of the subject matter. Failure to recognise the legitimacy of this approach has, in the past, led critics to accuse qualitative researchers of continually moving their own goalposts. Though these criticisms are often misguided, there is, as Nicky Britten and colleagues have observed, a real danger "that the flexibility [of the iterative approach] will slide into sloppiness as the researcher ceases to be clear about what it is (s)he is investigating."[5] These authors warn that qualitative researchers must, therefore, allow periods away from their fieldwork for reflection, planning, and consultation with colleagues.

Evaluating papers that describe qualitative

research

By its very nature, qualitative research is non-standard, unconfined, and dependent on the subjective experience of both the researcher and the researched. It explores what needs to be explored and cuts its cloth accordingly. It is debatable, therefore, whether an all-encompassing critical appraisal checklist along the lines of the Users' Guides to the Medical Literature[6 7 8 9 10 11 12 13 14 15 16 17 18 19] could ever be developed. Our own view, and that of a number of individuals who have attempted, or are currently working on, this very task,[3 5] is that such a checklist may not be as exhaustive or as universally applicable as the various guides for appraising quantitative research, but that it is certainly possible to set some ground rules. The list which follows has been distilled from the published work cited earlier,[2 3 5] and also from our own research and teaching experiences. You should note, however, that there is a great deal of disagreement and debate about the appropriate criteria for critical appraisal of qualitative research, and the ones given here are likely to be modified in the future.

Question 1: Did the paper describe an important clinical problem addressed via a clearly formulated question?

A previous article in this series explained that one of the first things you should look for in any research paper is a statement of why the research was done and what specific question it addressed.[20] Qualitative papers are no exception to this rule: there is absolutely no scientific value in interviewing or observing people just for the sake of it. Papers that cannot define their topic of research more closely than "We decided to interview 20 patients with epilepsy" inspire little confidence that the researchers really knew what they were studying or why.

You might be more inclined to read on if the paper stated in its introduction something like, "Epilepsy is a common and potentially disabling condition, and up to 20% of patients do not remain free of fits while taking medication. Antiepileptic medication is known to have unpleasant side effects, and several studies have shown that a high proportion of patients do not take their tablets regularly. We therefore decided to explore patients' beliefs about epilepsy and their perceived reasons for not taking their medication."

Question 2: Was a qualitative approach appropriate?

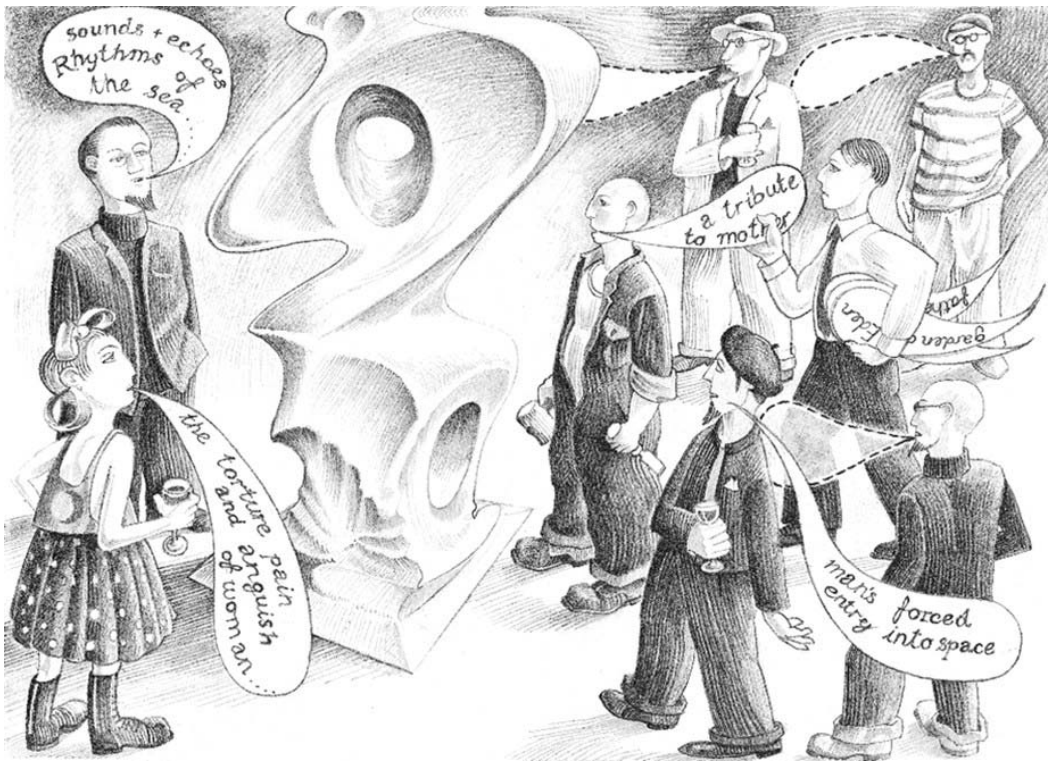
If the objective of the research was to explore, interpret, or obtain a deeper understanding of a particular clinical issue, qualitative methods were almost certainly the most appropriate ones to use. If, however, the research aimed to achieve some other goal (such as determining the incidence of a disease or the frequency of an adverse drug reaction, testing a cause and effect hypothesis, or showing that one drug has a better risk-benefit ratio than another), a case-control study, cohort study, or randomised trial may have been better suited to the research question.[19]

Question 3: How were the setting and the subjects selected?

The second box contrasts the statistical sampling methods of quantitative research with theoretical methods of qualitative research. In quantitative research, it is vital to ensure that a truly random sample of subjects is recruited so that the results reflect, on average, the condition of the population from which that sample was drawn.

In qualitative research, however, we are not interested in an "on average" view of a patient population. We want to gain an in depth understanding of the experience of particular individuals or groups; we should therefore deliberately seek out individuals or groups who fit the bill. If, for example, we wished to study the experience of non-English speaking British Punjabi women when they gave birth in hospital (with a view to tailoring the interpreting or advocacy service more closely to the needs of this patient group), we would be perfectly justified in going out of our way to find women who had had a range of different birth experiences—an induced delivery, an emergency caesarean section, a delivery by a medical student, a late miscarriage, and so on—rather than a "random" sample of British Punjabi mothers.

Question 4: What was the researcher's perspective, and has this been taken into account?



It is important to recognise that there is no way of abolishing, or fully controlling for, observer bias in qualitative research. This is most obviously the case when participant observation is used, but it is also true for other forms of data collection and of data analysis. If, for example, the research concerns the experience of asthmatic adults living in damp and overcrowded housing and the perceived effect of these surroundings on their health, the data generated by techniques such as focus groups or semistructured interviews are likely to be heavily influenced by what the interviewer believes about this

subject and by whether he or she is employed by the hospital chest clinic, the social work department of the local authority, or an environmental pressure group. But since it is inconceivable that the interviews could have been conducted by someone with no views at all and no ideological or cultural perspective, the most that can be required of the researchers is that they describe in detail where they are coming from so that the results can be interpreted accordingly.

Question 5: What methods did the researcher use for collecting data—and are these described in enough detail?

I once spent two years doing highly quantitative, laboratory based experimental research in which around 15 hours of every week were spent filling or emptying test tubes. There was a standard way to fill the test tubes, a standard way to spin them in the centrifuge, and even a standard way to wash them up. When I finally published my research, some 900 hours of drudgery was summed up in a single sentence: "Patients' serum rhubarb levels were measured according to the method described by Bloggs et al [reference to Bloggs et al's published paper]."

The methods section of a qualitative paper often cannot be written in shorthand or dismissed by reference to someone else's research techniques. It may have to be lengthy and discursive since it is telling a unique story without which the results cannot be interpreted. As with the sampling strategy, there are no hard and fast rules about exactly what details should be included in this section of the paper. You should simply ask, "have I been given enough information about the methods used?", and, if you have, use your common sense to assess, "are these methods a sensible and adequate way of addressing the research question?"

Question 6: What methods did the researcher use to analyse the data—and what quality control measures were implemented?

The data analysis section of a qualitative research paper is where sense can most readily be distinguished from nonsense. Having amassed a thick pile of completed interview transcripts or field notes, the genuine qualitative researcher has hardly begun. It is simply not good enough to flick through the text looking for "interesting quotes" which support a particular theory. The researcher must find a systematic way of analysing his or her data, and, in particular, must seek examples of cases which appear to contradict or challenge the theories derived from the majority.

One way of doing this is by content analysis: drawing up a list of coded categories and "cutting and pasting" each segment of transcribed data into one of these categories. This can be done either manually or, if large amounts of data are to be analysed, via a tailor-made computer database. The statements made by all the subjects on a particular topic can then be compared with one another, and more sophisticated comparisons can be made such as "did people who made statement A also tend to make statement B?"

In theory, the paper will show evidence of "quality control"—that is, the data (or at least, a sample of them) will have been analysed by more than one researcher to confirm that they are both assigning the same meaning to them, although in practice this is often difficult to achieve. Indeed, when researching this article, we could find no data on the interobserver reliability of any qualitative study to illustrate this point.

Question 7: Are the results credible, and if so, are they clinically important?
We obviously cannot assess the credibility of qualitative results through the precision and accuracy of measuring devices, nor their significance via confidence intervals and numbers needed to treat. It usually takes little more than plain common sense to determine whether the results are sensible and believable, and whether they matter in practice.

One important aspect of the results section to check is whether the authors cite actual data. Claims such as "general practitioners did not usually recognise the value of audit" would be infinitely more credible if one or two verbatim quotes from the interviewees were reproduced to illustrate them. The results should be independently and objectively verifiable—after all, a subject either made a particular statement or (s)he did not—and all quotes and examples should be indexed so that they can be traced back to an identifiable subject and setting.

Question 8: What conclusions were drawn, and are they justified by the results?
A quantitative research paper should clearly distinguish the study's results (usually a set of numbers) from the interpretation of those results (the discussion). The reader should have no difficulty separating what the researchers *found* from what they think it *means*. In qualitative research, however, such a distinction is rarely possible, since the results are by definition an interpretation of the data.

It is therefore necessary, when assessing the validity of qualitative research, to ask whether the interpretation placed on the data accords with common sense and is relatively untainted with personal or cultural perspective. This can be a difficult exercise, because the language we use to describe things tends to impugn meanings and motives which the subjects themselves may not share. Compare, for example, the two statements, "three women went to the well to get water" and "three women met at the well and each was carrying a pitcher."

It is becoming a cliché that the conclusions of qualitative studies, like those of all research, should be "grounded in evidence"—that is, that they should flow from what the researchers found in the field. Mays and Pope suggest three useful questions for determining whether the conclusions of a qualitative study are valid:

- how well does this analysis explain why people behave in the way they do?
- how comprehensible would this explanation be to a thoughtful participant in the setting?; and
- how well does the explanation cohere with what we already know?[3]

Question 9: Are the findings of the study transferable to other clinical settings?
One of the commonest criticisms of qualitative research is that the findings of any qualitative study pertain only to the limited setting in which they were obtained. In fact, this is not necessarily any truer of qualitative research than of quantitative research. Look back at the example of British Punjabi women described above. You should be able to see that the use of a true *theoretical* sampling frame greatly increases the transferability of the results over a "convenience" sample.

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Conclusion

Doctors have traditionally placed high value on numerical data, which may in reality be misleading, reductionist, and irrelevant to the real issues. The increasing popularity of qualitative research in the biomedical sciences has arisen largely because quantitative methods provided either no answers or the wrong answers to important questions in both clinical care and service delivery.[1] If you still feel that qualitative research is necessarily second rate by virtue of being a "soft" science, you should be aware that you are out of step with the evidence.

In 1993, Pope and Britten presented a paper to the BSA Medical Sociology Group conference entitled "Barriers to qualitative methods in the medical mindset," in which they showed their collection of rejection letters from biomedical journals. The letters revealed a striking ignorance of qualitative methodology on the part of reviewers. In other words, the people who had rejected the papers often seemed to be incapable of distinguishing good qualitative research from bad. Somewhat ironically, qualitative papers of poor quality now appear regularly in some medical journals, whose editors have climbed on the qualitative bandwagon without gaining an ability to appraise such papers. Note, however, that the critical appraisal of qualitative research is a relatively underdeveloped science, and the questions posed in this chapter are still being refined.

The articles in this series are excerpts from *How to read a paper: the basics of evidence based medicine*. The book includes chapters on searching the literature and implementing evidence based findings. It can be ordered from the BMJ Publishing Group: tel 0171 383 6185/6245; fax 0171 383 6662. Price £13.95 UK members, £14.95 non-members.

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Education and debate

How to read a paper : getting your bearings (deciding what the paper is about)

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The science of "trashing" papers

It usually comes as a surprise to students to learn that some (perhaps most) published articles belong in the bin, and should certainly not be used to inform practice.[1] The first box shows some common reasons why papers are rejected by peer reviewed journals.

Why were papers rejected for publication?

- The study did not address an important scientific issue
- The study was not original (someone else had already done the same or a similar study)
- The study did not actually test the authors' hypothesis
- A different type of study should have been done
- Practical difficulties (in recruiting subjects, for example) led the authors to compromise on the original study protocol
- The sample size was too small
- The study was uncontrolled or inadequately controlled
- The statistical analysis was incorrect or inappropriate
- The authors drew unjustified conclusions from their data
- There is a significant conflict of interest (one of the authors, or a sponsor,

might benefit financially from the publication of the paper and insufficient safeguards were seen to be in place to guard against bias)
- The paper is so badly written that it is incomprehensible

Most papers now appearing in medical journals are presented more or less in standard IMRAD format: Introduction (why the authors decided to do this research), Methods (how they did it, and how they analysed their results), Results (what they found), and Discussion (what the results mean). If you are deciding whether a paper is worth reading, you should do so on the design of the methods section and not on the interest of the hypothesis, the nature or potential impact of the results, or the speculation in the discussion.

Critical appraisal

The assessment of methodological quality (critical appraisal) has been covered in detail in many textbooks on evidence based medicine,[2 3 4 5 6] and in Sackett and colleagues' Users' Guides to the Medical Literature in *JAMA*.[7 8 9 10 11 12 13 14 15 16 17 18 19 20 21] If you are an experienced journal reader, the structured checklists produced by these authors will be largely self explanatory. If you are not, try these preliminary questions.

Question 1: Why was the study done, and what clinical question were the authors addressing?

The introductory sentence of a research paper should state, in a nutshell, what the background to the research is. For example, "Grommet insertion is a common procedure in children, and it has been suggested that not all operations are clinically necessary." This statement should be followed by a brief review of the published literature.

Unless it has already been covered in the introduction, the hypothesis which the authors have decided to test should be clearly stated in the methods section of the paper. If the hypothesis is presented in the negative, such as "the addition of metformin to maximal dose sulphonylurea therapy will not improve the control of type 2 diabetes," it is known as a null hypothesis.

Summary points

Many papers published in medical journals have potentially serious methodological flaws

When deciding whether a paper is valid and relevant to your practice, first establish what specific clinical question it addressed

Questions to do with drug treatment or other medical interventions should be addressed by double blind, randomised controlled trials

Questions about prognosis require longitudinal cohort studies, and those about causation require either cohort or case-control studies

Case reports, though methodologically weak, can be produced rapidly and have a place in alerting practitioners to adverse drug reactions

The authors of a study rarely actually believe their null hypothesis when they embark on their research. Being human, they have usually set out to show a difference between the two arms of their study. But the way scientists do this is to say, "Let's assume there's no difference; now let's try to disprove that theory." If you adhere to the teachings of Karl Popper, this hypotheticodeductive approach (setting up falsifiable hypotheses which you then proceed to test) is the very essence of the scientific method.[22]

Question 2: What type of study was done?
First, decide whether the paper describes a primary study, which reports research first hand, or a secondary (or integrative) one, which attempts to summarise and draw conclusions from primary studies. Primary studies, the stuff of most published research in medical journals, usually fall into one of three categories:

- Experiments, in which a manoeuvre is performed on an animal or a volunteer in artificial and controlled surroundings;
- Clinical trials, in which an intervention, such as a drug treatment, is offered to a group of patients who are then followed up to see what happens to them; or
- Surveys, in which something is measured in a group of patients, health professionals, or some other sample of individuals.

The second box shows some common jargon terms used in describing study design.

Terms used to describe design features of clinical research studies

*Parallel group comparison*Each group receives a different treatment, with both groups being entered at the same time; results are analysed by comparing groups

*Paired (or matched) comparison*Subjects receiving different treatments are matched to balance potential confounding variables such as age and sex; results are

analysed in terms of differences between subject pairs

*Within subject comparison*Subjects are assessed before and after an intervention and results analysed in terms of changes within the subjects

*Single blind*Subjects did not know which treatment they were receiving

*Double blind*Neither did the investigators

*Crossover*Each subject received both the intervention and control treatments (in random order), often separated by a washout period with no treatment

*Placebo controlled*Control subjects receive a placebo (inactive pill) which should look and taste the same as the active pill. Placebo (sham) operations may also be used in trials of surgery

*Factorial design*A study which permits investigation of the effects (both separately and combined) of more than one independent variable on a given outcome (for example, a 2x2 factorial design tested the effects of placebo, aspirin alone, streptokinase alone, or aspirin plus streptokinase in acute heart attack[23])

Secondary research is made up of:

- Overviews, which may be divided into:

[Non-systematic] reviews, which summarise primary studies;

Systematic reviews, which do this according to a rigorous and predefined methodology; and

Meta-analyses, which integrate the numerical data from more than one study.

- Guidelines, which draw conclusions from primary studies about how clinicians should be behaving.
- Decision analyses, which use the results of primary studies to generate probability trees to be used by health professionals and patients in making choices about clinical management.[24] [25] [26]
- Economic analyses, which use the results of primary studies to say whether a particular course of action is a good use of resources.

Question 3: Was this design appropriate to the research?
This question is best addressed by considering what broad field of research is covered by the study. Most research studies are concerned with one or more of the broad fields shown in the box below.

Broad fields of research

- *Therapy:* testing the efficacy of drug treatments, surgical procedures, alternative methods of service delivery, or other interventions. Preferred study design is randomised controlled trial
- *Diagnosis:* demonstrating whether a new diagnostic test is valid (can we trust it?) and reliable (would we get the same results every time?). Preferred study design is cross sectional survey in which both the new test and the gold standard are performed
- *Screening:* demonstrating the value of tests which can be applied to large populations and which pick up disease at a presymptomatic stage. Preferred study design is cross sectional survey
- *Prognosis:* determining what is likely to happen to someone whose disease is picked up at an early stage. Preferred study design is longitudinal cohort study
- *Causation:* determining whether a putative harmful agent, such as environmental pollution, is related to the development of illness. Preferred study design is cohort or case-control study, depending on how rare the disease is, but case reports may also provide crucial information

Randomised controlled trials

In a randomised controlled trial, participants are randomly allocated by a process equivalent to the flip of a coin to either one intervention (such as a drug) or another (such as placebo treatment or a different drug). Both groups are followed up for a specified period and analysed in terms of outcomes defined at the outset (death, heart attack, serum cholesterol level, etc). Because, on average, the groups are identical apart from the intervention, any differences in outcome are, in theory, attributable to the intervention.

Some trials comparing an intervention group with a control group are not randomised trials. Random allocation may be impossible, impractical, or unethical—for example, in a trial to compare the outcomes of childbirth at home and in hospital. More commonly, inexperienced investigators compare one group (such as patients on ward A) with another (such as patients on ward B). With such designs, it is far less likely that the two groups can reasonably be compared with one another on a statistical level.

A randomised controlled trial should answer questions such as the following:

- Is this drug better than placebo or a different drug for a particular disease?
- Is a leaflet better than verbal advice in helping patients make informed choices about the treatment options for a particular condition?

It should be remembered, however, that randomised trials have several disadvantages (see box).[27] Remember, too, that the results of a trial may have limited applicability as a result of exclusion criteria (rules about who may not be entered into the study), inclusion bias (selection of subjects from a group unrepresentative of everyone with the condition), refusal of certain patient groups to give consent to be included in the trial,[28] analysis of only predefined "objective" endpoints which may exclude important qualitative aspects of the intervention, and publication bias (the selective publication of positive results).[29]

Randomised controlled trial design

Advantages

- Allows rigorous evaluation of a single variable (effect of drug treatment versus placebo, for example) in a precisely defined patient group (postmenopausal women aged 50-60 years)
- Prospective design (data are collected on events that happen after you decide to do the study)
- Uses hypotheticodeductive reasoning (seeks to falsify, rather than confirm, its own hypothesis)
- Potentially eradicates bias by comparing two otherwise identical groups (but see below)
- Allows for meta-analysis (combining the numerical results of several similar trials at a later date)

Disadvantages

- Expensive and time consuming; hence, in practice:
- Many randomised controlled trials are either never done, are performed on too few patients, or are undertaken for too short a period
- Most are funded by large research bodies (university or government sponsored) or drug companies, who ultimately dictate the research agenda
- Surrogate endpoints are often used in preference to clinical outcome measures may introduce "hidden bias," especially through:
- Imperfect randomisation (see above)
- Failure to randomise all eligible patients (clinician only offers participation in the trial to patients he or she considers will respond well to the intervention)
- Failure to blind assessors to randomisation status of patients

There is now a recommended format for reporting randomised controlled trials in medical journals.[30] You should try to follow it if you are writing one up yourself.

Cohort studies

In a cohort study, two (or more) groups of people are selected on the basis of differences in their exposure to a particular agent (such as a vaccine, a drug, or an environmental toxin), and followed up to see how many in each group develop a particular disease or other outcome. The follow up period in cohort studies is generally measured in years (and sometimes in decades), since that is how long many diseases, especially cancer, take to develop. Note that randomised controlled trials are usually begun on patients (people who already have a disease), whereas most cohort studies are begun on subjects who may or may not develop disease.

PETER BROWN

View larger version (145K):
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[in a new window]

A special type of cohort study may also be used to determine the prognosis of a disease (what is likely to happen to someone who has it). A group of patients who have all been diagnosed as having an early stage of the disease or a positive result on a screening test is assembled (the inception cohort) and followed up on repeated occasions to see the incidence (new cases per year) and time course of different outcomes.

The world's most famous cohort study, which won its two original authors a knighthood, was undertaken by Sir Austin Bradford Hill, Sir Richard Doll, and, latterly, Richard Peto. They followed up 40 000 British doctors divided into four cohorts (non-smokers, and light, moderate, and heavy smokers) using both all cause mortality (any death) and cause specific mortality (death from a particular disease) as outcome measures. Publication of their 10 year interim results in 1964, which showed a substantial excess in both lung cancer mortality and all cause mortality in smokers, with a "dose-response" relation (the more you smoke, the worse your chances of getting lung cancer), went a long way to showing that the link between smoking and ill health was causal rather than coincidental.[31] The 20 year and 40 year results of this momentous study (which achieved an impressive 94% follow up of those recruited in 1951 and not known to have died) illustrate both the perils of smoking and the strength of evidence that can be obtained from a properly conducted cohort study.[32] [33]

A cohort study should be used to address clinical questions such as:

- Does high blood pressure get better over time?
- What happens to infants who have been born very prematurely, in terms of subsequent physical development and educational achievement?

Case-control studies

In a case-control study, patients with a particular disease or condition are identified and "matched" with controls (patients with some other disease, the general population, neighbours, or relatives). Data are then collected (for example, by searching back through these people's medical records or by asking them to recall their own history) on past exposure to a possible causal agent for the disease. Like cohort studies, case-control studies are generally concerned with the aetiology of a disease (what causes it) rather than its treatment. They lie lower down the hierarchy of evidence (see below), but this design is usually the only option for studying rare conditions. An important source of difficulty (and potential bias) in a case-control study is the precise definition of who counts as a "case," since one misallocated subject may substantially influence the results. In addition, such a design cannot show causality—the association of A with B in a case-control study does not prove that A has caused B.

A case-control study should be used to address clinical questions such as:

- Does the prone sleeping position increase the risk of cot death (the sudden infant death syndrome)?
- Does whooping cough vaccine cause brain damage?
- Do overhead power cables cause leukaemia?

Cross sectional surveys

We have probably all been asked to take part in a survey, even if only one asking us which brand of toothpaste we prefer. Surveys conducted by epidemiologists are run along the same lines: a representative sample of subjects (or patients) is interviewed, examined, or otherwise studied to gain answers to a specific clinical question. In cross sectional surveys, data are collected at a single time but may refer retrospectively to experiences in the past—such as the study of casenotes to see how often patients' blood pressure has been recorded in the past five years.

A cross sectional survey should be used to address clinical questions such as:

- What is the "normal" height of a 3 year old child?

- What do psychiatric nurses believe about the value of electroconvulsive therapy in severe depression?
- Is it true that half of all cases of diabetes are undiagnosed?

A memorable example of a case report

A doctor notices that two newborn babies in his hospital have absent limbs (phocomelia). Both mothers had taken a new drug (thalidomide) in early pregnancy. The doctor wishes to alert his colleagues worldwide to the possibility of drug related damage as quickly as possible.[35]

Case reports

A case report describes the medical history of a single patient in the form of a story: "Mrs B is a 54 year old secretary who developed chest pain in June 1995...." Case reports are often run together to form a case series, in which the medical histories of more than one patient with a particular condition are described to illustrate an aspect of the condition, the treatment, or, most commonly these days, adverse reaction to treatment. Although this type of research is traditionally considered to be "quick and dirty" evidence, a great deal of information can be conveyed in a case report that would be lost in a clinical trial or survey .[34]

The hierarchy of evidence

Standard notation for the relative weight carried by the different types of primary study when making decisions about clinical interventions (the "hierarchy of evidence") puts them in the following order[36]:

1. Systematic reviews and meta-analyses
2. Randomised controlled trials with definitive results (confidence intervals that do not overlap the threshold clinically significant effect)
3. Randomised controlled trials with non-definitive results (a point estimate that suggests a clinically significant effect but with confidence intervals overlapping the threshold for this effect)
4. Cohort studies
5. Case-control studies
6. Cross sectional surveys
7. Case reports.

The articles in this series are excerpts from *How to read a paper: the basics of evidence based medicine*. The book includes chapters on searching the literature and implementing evidence based findings. It can be ordered from the BMJ Bookshop: tel 0171 383 6185/6245; fax 0171 383 6662. Price £13.95 UK members, £14.95 non-members.

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