

EVIDENCE-BASED EVERYTHING

Making decisions is difficult. In health care, that is even more true, whether the decision affects policy or a patient, or whether it is a personal decision as to whether or not to have a treatment. No health care system can satisfy all the possible demands made upon it, so decisions about allocating resources are very important. Resources should be allocated to those things that are effective, and withdrawn from those that are ineffective. The only way of judging effectiveness is through evidence.

That begs the question of what constitutes evidence. The types and strengths of evidence that may be available to us are shown in the box. *Bandolier* aims to bring, in the main, evidence of types I and II.

This issue of *Bandolier* has an example of type I evidence a report of a meta-analysis on quinine in nocturnal leg cramps. This is a good report which establishes that quinine is effective in reducing the number of cramps in elderly patients, and in giving them more pain free nights. Any criticism may stem from the fact that in six eligible reports, a total of only 107 patients were studied.

Another issue is how to put over a simple message about effectiveness. *Bandolier* has begun to favour the NNT approach, and, as promised last month, we have a worked

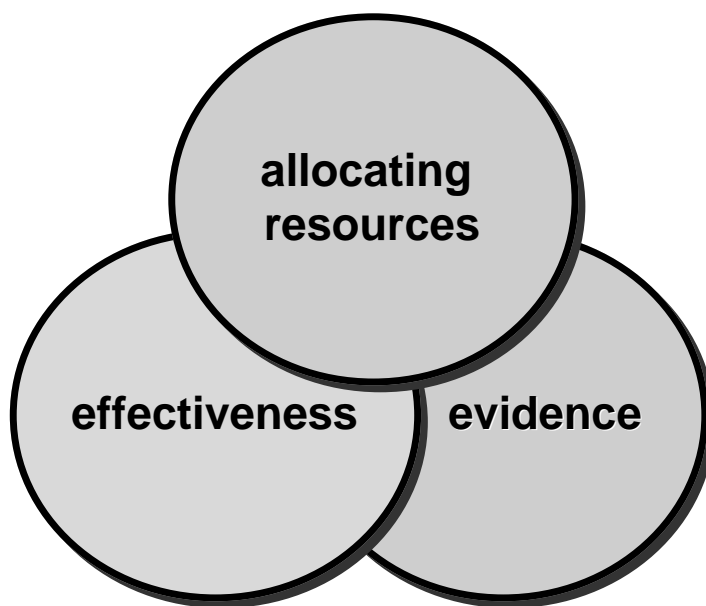
example from a meta-analysis of RCTs curing H pylori infection in peptic ulcer. Using NNTs, it has been possible to compress the message down to a single sentence - "Using antibiotics to cure H pylori infections in 100 patients with peptic ulcer, compared to using a short course of conventional acid suppressing medicines, results in 90 patients cured of the H pylori infection, 20 extra ulcers healed at six weeks and 56 more patients whose ulcers remain cured at one year."

Finding the evidence is not always straightforward, and this month we have begun a series on "How do I find.....?" Those already expert in evidence-gathering may know this already, but for those of us who are still getting to grips with the complexities of modern information systems, Judy Palmer's series will be invaluable.

The quality of guidelines can vary from superb to very poor. Colin Blake reviews the evidence around the use of the Royal College of Radiologists guidelines on use of X-ray diagnostics.

Finally, evidence is not just about science or medicine. It is, or should be, also about management.

Bandolier would love to carry examples of evidence-based management, or evidence about the effectiveness of different management methods.



Type & Strength of Evidence

- I Strong evidence from at least 1 systematic review of multiple well-designed randomised controlled trials**
- II Strong evidence from at least 1 properly designed randomised controlled trial of appropriate size**
- III Evidence from well designed trials without randomisation, single group pre-post, cohort, time series or matched case-controlled studies**
- IV Evidence from well-designed nonexperimental studies from more than 1 centre or research group**
- V Opinions of respected authorities, based on clinical evidence, descriptive studies or reports of expert committees**

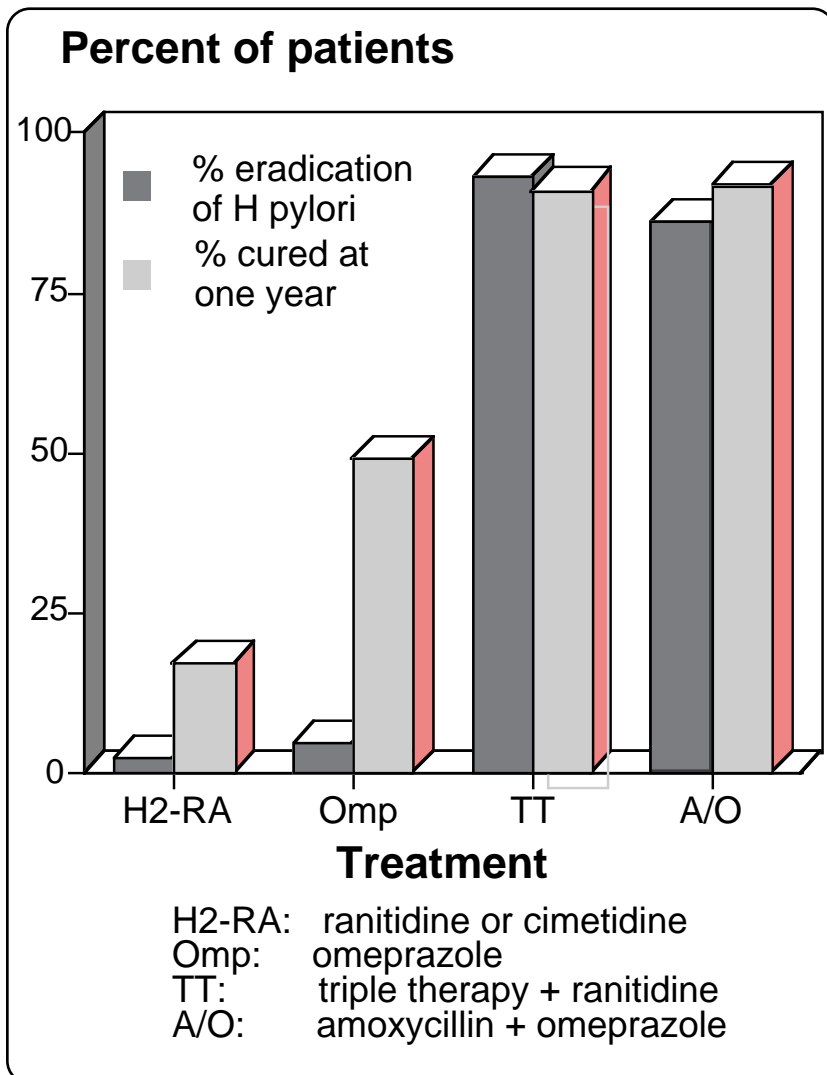
H PYLORI: NUMBERS-NEEDED-TO-TREAT

Bandolier 11 introduced the concept of numbers-needed-to-treat (NNT) as one way to define effectiveness. Concepts like this are always better understood with a worked example, and so in this edition we are bringing NNTs together with another *Bandolier* theme, that of *Helicobacter pylori* eradication as a cure for peptic ulceration.

Helicobacter pylori eradication and peptic ulcer

There is a growing body of evidence concerning the way in which antibiotics can be used to eradicate *H pylori* in the stomach and duodenum, and the way in which that eradication affects the course of peptic ulcer disease. The early literature in the 1980s contained few randomised controlled trials (RCTs), but the evidence is now much stronger.

A systematic overview of trials looking at *H pylori* eradication between 1983 and 1992 has recently been published [1]. This well conducted overview used solid methodology and identified eight trials involving duodenal ulcer, of which five were considered high quality. For the purposes of the present review, trials from 1992 were sought by use of a MEDLINE search, together with an approach to a number of pharmaceutical companies known or thought to be conducting clinical research in this area with a request for published studies which involved peptic ulcer and *H pylori* eradication.



There are three main issues to be addressed:

- whether antibiotic regimens are successful in eradicating *H pylori* infections
- whether antibiotic regimens affect immediate ulcer healing
- whether eradication has any effects on the subsequent course of the disease

Meta-analysis

Only randomised controlled trials published in peer-reviewed journals were accepted; abstracts and meeting proceedings, or preliminary findings were excluded. Most studies treated duodenal and gastric ulcers together, though some did not; no differentiation was made here. Treatments found involved triple therapy (combinations of metronidazole, tetracycline and bismuth, together with an H2-antagonist, usually ranitidine) and amoxycillin plus omeprazole; antibiotics were usually given for two weeks, and acid suppressing drugs for four weeks. Treatments were combined under these two headings. Active control treatments consisted of cimetidine, ranitidine or omeprazole given for 4-6 weeks to promote ulcer healing.

Single arm treatments were combined; for ulcer healing at about 6 weeks determined by endoscopy; for *H pylori* eradication determined from samples taken at endoscopy; and ulcers remaining cured at one year determined by endoscopy (Table 1: note that the references in this table can be obtained from the original report which is referenced at the end of the article, or from *Bandolier*).

Combined data from single arms for different treatments is shown in Table 2 and the Figure. Numbers-needed-to-treat [2] were calculated from combined single arms (Table 3).

Results

Use of histamine receptor antagonists (cimetidine, ranitidine) or the proton pump inhibitor omeprazole as a single therapy resulted in high levels of ulcer healing of about 78% at 10 weeks after therapy commenced, but eradication of *H pylori* was low, at 5% or less.

Studies of triple therapy (in combination with ranitidine or cimetidine) covering up to 768 patients demonstrated eradication rates of about 96%, with ulcer healing in 93% of patients at 10 weeks. A recent study [3] examined the need for an acid suppressing medicine (omeprazole) in combination with triple therapy, and found comparable eradication rates and ulcer healing; they concluded that addition of omeprazole was not needed, and that one week of treatment was sufficient. Most other studies continued acid

Table 1: Trials of H pylori eradication

Reference	Treatment	Ulcer healed (10 weeks)	H pylori eradicated	Relapse at 1 year
Marshall et al, 1988	Cimetidine	13/22	0/22	12/22
Graham et al, 1991	Ranitidine	44/52	0/52	not reported
Hentschel et al, 1993	Ranitidine	39/52	1/52	42/45
Graham et al, 1992	Ranitidine	ulcers healed	0/36	34/36
Coghlan et al, 1987	Cimetidine	ulcers healed	4/23	12/18
Marshall et al, 1988	Cimetidine + tinidazole	22/29	1/29	18/29
Rauws et al, 1990	Ranitidine + bismuth	21/26	3/55	34/50
Hosking et al, 1992	Omeprazole	56/72	3/72	not reported
Bayerdorffer et al, 1992	Omeprazole	25/26	0/26	12/25 (at 9 months)
Unge & Ekström, 1993	Omeprazole	49/76	3/76	49/76 (at 6 months)
Sung et al, 1994	Omeprazole	61/77	5/72	22/62
Hosking et al, 1994	TT alone	60/65	61/65	
Rauws et al, 1990	TT + ranitidine	17/19	15/19	1/17
Graham et al, 1991	TT + ranitidine	52/53	43/45	not reported
Graham et al, 1992	TT + ranitidine	ulcers healed	40/47	7/47
Labenz et al, 1993, 1994a	TT + ranitidine	15/19	16/19	3/19
Hosking et al, 1992	TT + omeprazole	70/74	70/74	not reported
Sung et al, 1994	TT + omeprazole	74/78	70/74	2/65
Hosking et al, 1994	TT + omeprazole	63/67	66/67	not reported
Borody et al, 1994	TT + omeprazole	not reported	398/423	not reported
Bayerdorffer et al, 1992	Amoxicillin + omeprazole	27/27	22/27	0/27 (at 9 months)
Unge & Ekström, 1993	Amoxicillin + omeprazole	129/157	84/157	47/157 (at 6 months)
Labenz et al, 1993, 1994a	Amoxicillin + omeprazole	19/19	15/19	3/19
Labenz et al, 1994b	Amoxicillin + omeprazole	62/67	59/67	not reported
Hentschel et al, 1993	Amoxicillin + metronidazole + omeprazole	48/52	46/52	4/46

Main details of randomised trials concerning H pylori eradication by antibiotics, ulcer healing and long-term outcome. TT is triple therapy of bismuth, tetracycline and metronidazole.

Table 2: Summary data of H pylori eradication

Treatment	Number of trials	Ulcers healed	H Pylori eradicated	Relapse rate at 1 year
Histamine receptor antagonists alone	5	96/126 (76%)	5/185 (2.5%)	100/121 (83%)
Histamine receptor antagonists plus one additional medicine	2	43/55 (78%)	3/55 (5%)	34/50 (72%)
Omeprazole alone	4	191/251 (76%)	11/246 (4.5%)	83/163 (51%)
Triple Therapy (with ranitidine or omeprazole)	7	299/310 (96%)	718/768 (93%)	13/148 (8.8%)
Amoxicillin and Omeprazole	4	156/165 (95%)	142/165 (86%)	7/92 (8%)

Table 3: Odds Ratios and NNT for H. pylori eradication treatments

Treatment	Active	Control	Odds Ratio (95% CI)	NNT
<i>Ulcer healing</i>				
Triple therapy	299/310	287/377	5.04 (3.30 - 7.71)	4.9
Amoxicillin/omeprazole	156/165	287/377	3.43 (2.13 - 5.50)	5.4
<i>H pylori eradication</i>				
Triple therapy	718/768	16/431	43.7 (34.3 - 55.7)	1.1
Amoxicillin/omeprazole	142/165	16/431	68.0 (45.3 - 102.1)	1.2
<i>Ulcers cured at 1 year</i>				
Triple therapy	135/148	101/284	9.4 (6.31 - 14.00)	1.8
Amoxicillin/omeprazole	85/92	101/284	9.7 (6.04 - 15.44)	1.8

These results were generated by combining single arms of RCTs and testing triple therapy (usually with ranitidine) and amoxicillin with omeprazole against the combined results of histamine receptor antagonists or omeprazole alone as controls.

How do I FIND?

suppressing medicine for some weeks longer than eradication therapy.

Use of amoxicillin with omeprazole, the other major treatment regimen, produced eradication rates of 70-86%, with ulcer healing of 89-95%. The numbers of patients in these studies is smaller than those with triple therapy. Omeprazole was usually used for some weeks longer than amoxicillin.

Numbers-needed-to-treat

The NNT analysis (Table 3) shows the following:-

- 1: For ulcer healing at about 6 weeks as judged by endoscopy, treating five patients with eradication therapy compared with acid-suppression alone resulted in one extra ulcer healed. The NNT for ulcer healing was about 5.
- 2: For H pylori eradication as judged by endoscopy and testing, treating one patient with eradication therapy compared with acid suppression alone resulted in one cure of H pylori infection. The NNT for H pylori eradication was 1.1.
- 3: For ulcers remaining cured at one year as judged by endoscopy, treating two patients with eradication therapy compared with acid suppression alone resulted in one extra ulcer remaining cured. The NNT for ulcers cured at one year was 1.8.

Although NNTs are a useful way of presenting the evidence, numbers with low values being good and high values worse they are not easily understood by all. Using the form of 100/NNT carries the same message in a slightly different and perhaps more intuitive way. Restating the results in this form gives the following message:-

"Using antibiotics to cure 100 patients with ulcers caused by H pylori infections, compared to using a short course of conventional acid suppressing medicines, results in 90 patients cured of the H pylori infection, 20 extra ulcers healed at six weeks and 56 more patients whose ulcers remain cured at one year."

References:

The analysis is taken from:

R A Moore. Helicobacter pylori and peptic ulcer: a systematic review of effectiveness and an overview of the economic benefits of implementing what is known to be effective. 1995 Copies are available from Cortecs Diagnostics, Tel 0181 568 6181

- 1 SJO Veldhuyzen van Zanten, PM Sherman. Canadian Medical Association Journal 1994 150: 189-98.
- 2 DL Sackett, RB Haynes, GH Guyatt, P Tugwell. Clinical Epidemiology: a basic science for clinical medicine. 2nd edition. Boston: Little, Brown; 1991.
- 3 SW Hosking, T Ling, SC Chung et al. Lancet 1994 343: 508-10

How do I find out if the intervention I want to use is effective?

Over the years most clinicians develop a portfolio of interventions for the conditions that present most commonly. Some of these may be ineffective or not cost-effective or both. Now every journal you pick up tells you that improved patient care depends on selecting only those interventions for which the evidence for clinical effectiveness is unequivocal.

I want it now!!

It is hard to find the time to check the literature. Often you want the answer immediately. It is tempting to rely on one or two sources, because any venture further afield into the literature shows that a lot of the evidence is contradictory. So what can you do?

Unfortunately, you are not going to find the evidence in one, easily obtainable package, nor will it be in one place. You will need time and information-searching skills. Libraries are an invaluable source of help. The Librarian will be able to search a wide range of databases which will provide pointers to the evidence in the published and semi-published, report-type literature.

Searching

Some of you will want to do the searching yourself. Index Medicus, the main paper-based source for bio-medical and clinical references, is now widely available in compact disk format - CD-ROM. Unfortunately the electronic versions only go back to 1966 so if you need older material the paper version is still important.

You may have bought MEDLINE on CD-ROM for the practice or department. Two companies are marketing CD-ROM versions currently - Silver Platter and CD-Plus. The main difference between the two is the type of search software that they provide; Silver Platter uses SPIRS and CD-Plus uses OVID. Whoever does the search, it is important to understand that there is a hierarchy in the published journal literature, from primary reports of research to reviews and overviews.

Systematic reviews and RCTs

What you want to look for are systematic reviews of randomised controlled trials (RCTs). These will aggregate the results of several or many RCTs. With aggregation many of contradictions are dissipated. To search MEDLINE for RCTs is more difficult than it sounds, mainly because of the way in which the National Library of Medicine indexes articles for inclusion in MEDLINE. The UK Cochrane Centre in Oxford has made a special study of this problem.

Efficient searching in MEDLINE can also be difficult if you do searches infrequently. Your local librarian will be able to help you work out the best search strategy to find randomised controlled trials and will also be able to give

you tips on how best to search MEDLINE in general. It is important to realise that for some questions, MEDLINE may not be the best source of evidence. Other databases exist which focus on different aspects of health care and which may be more appropriate.

You probably subscribe to the BMJ and Lancet. You are certainly deluged with 'freebies' and unsolicited magazines. You may have the time to be self-indulgent and browse. If not it is worth while adopting a simple elimination checklist for what you do and don't read. This will mean that you have to set aside some time to determine your criteria and to decide which titles are worth concentrating on and which should be immediately 'binned'.

David Sackett and his colleagues in *Clinical Epidemiology* (pp 362-378) give some useful guides on this process. The *ACP Journal Club* which comes out every 2 months provides succinct summaries of papers which present sound evidence (see Desert Island Texts, page 8).

New sources of information

In the last few years important new sources of information about clinical effectiveness have emerged in the UK. The NHS has encouraged and supported the development of three new centres for information - the UK Cochrane Centre in Oxford which produces the database of randomised controlled trials on pregnancy and childbirth, the Centre for Reviews and Dissemination in York which produces the *Effective Health Care Bulletin* and the Nuffield Institute for Health in Leeds which produces the *Outcomes Briefing*. It is worth making sure that you are on the mailing list for these publications by writing to one of the addresses below.

It is also worth getting a copy of Executive Letter EL(94)74 dated 28 September 1994 on Improving Effectiveness, either from your local District Health Authority or direct from the Department of Health. It contains lots of useful addresses for information.

We all rely heavily on people as a source of information. On the whole people are more user-friendly than databases. Sometimes the quickest way to find out whether an intervention is effective is to telephone an expert in the field (preferably one that understands the importance of evidence!) or if you don't know who is working in the field you can try using the PHISH (Public Health Information Sharing) database available from Steve Ashworth at Buckinghamshire Health Authority (01296 394022).

Internet

Finally, if you are a 'techy' you will know all about the Internet and will need no conversion. For the rest of you it may be worth considering a subscription to the Internet. But be warned! Useful sources of health information may be hard to find, you will run up huge telephone bills and you will need oceans or stratospheres of time to meander about the superhighways of cyberspace. Belonging to one of the international, subject-based mailing lists - newsnets - will give you access to clinicians all over the world with similar interests.

In a future issue of *Bandolier* we'll tell you how to get hold of a hard copy of the document you want to read. In the meantime if you need help on finding the evidence contact your local postgraduate medical centre librarian or if you are not sure who that is or where the library is, get in touch with Judy Palmer or David Stewart in the Health Care Libraries Unit in the John Radcliffe Hospital and we will point you in the right direction.

Judy Palmer, Director of Health Care Library Unit
John Radcliffe Hospital, Oxford
(Tel 01865 221951: Fax 01865 220040)

NOCTURNAL LEG CRAMPS

Leg cramps at night are common in elderly people, with perhaps 70% having leg cramps at some time. Quinine was first used over 50 years ago, and it has been suggested that it is the most beneficial form of treatment. The problem has been that trials of quinine in leg cramps have tended to use relatively small treatment groups and short treatment times, and there have been relatively few of them. The result has been uncertainty about whether prescribing quinine for patients with leg cramps was beneficial.

Meta-analysis

This uncertainty has been resolved by a recently published meta-analysis published in the British Medical Journal [1]. The authors searched for randomised controlled trials (RCTs) which had a double-blind, placebo-controlled, crossover design, and which were conducted in ambulatory elderly patients.

They found 11 such papers, but rejected five because they did not comply fully with their inclusion criteria. The six papers accepted had only 107 patients in all on whom individual data could be used in a meta-analysis to determine whether quinine was effective in reducing the number of cramps, their severity or duration, and the number of nights with cramps.

The doses of quinine used were 200 mg - 300 mg daily, usually taken in the evening or at bedtime.

Results

The meta-analysis showed :-

- A significant reduction in the number of cramps in people taking quinine. Over four weeks, they had almost 9 fewer cramps (95% confidence interval 4 - 13 cramps). This reduction in cramp numbers was even higher (nearly 13 cramps fewer) when a parallel group comparison of quinine and placebo was added to the analysis.
- A significant reduction in the number of nights free of cramps in people taking quinine. Over four weeks, there were almost 30% fewer nights with cramps.

- Studies with treatment times of four weeks had more positive results than those with two weeks. This suggests that dosing is cumulative, and a four-week trial may be necessary to show a beneficial effect, and indicates that quinine, to be effective, should be taken regularly.
- Quinine did not affect the severity of individual cramps or their duration when leg cramps occurred.
- Adverse events were uncommon, and only one patient had a severe reaction. Numbers of people studied were too few to characterise adequately the incidence of uncommon adverse effects.

This is an interesting meta-analysis, and the authors clearly show some of the difficulties encountered in amalgamating information. It's worth a read.

Reference:

M Man-Son-Hing, G Wells. Meta-analysis of efficacy of quinine for treatment of nocturnal leg cramps in elderly people. *British Medical Journal* 1995 310: 13-7.

DESERT ISLAND TEXTS

The ACP Journal Club

I cannot clearly remember the rules about the type of written material that the castaway is allowed to take to his desert island and do not therefore know if a subscription to a journal is allowed, but if I could take a journal subscription with me then I would undoubtedly choose the ACP Journal Club.

The ACP Journal Club's general purpose is "to select published articles according to explicit criteria and to abstract those studies and reviews that warrant immediate attention by physicians attempting to keep pace with important advances in the treatment, prevention, diagnosis, cause, prognosis or economics of disorders managed by internists". These articles are summarised in "value added abstracts" and commented on by clinical experts.

Each page of the journal contains an abstract and a commentary, often with additional references. The author of the original article is shown the commentary and asked if they want to respond.

The journals covered are the main general medicine journals and the ACP Journal Club is published every two months. There is often a very useful editorial on topics such as "how to harness MEDLINE for aetiology problems".

Not surprisingly much of the intellectual firepower for the journal derives from McMaster University in Ontario and the Editor is Brian Haines, with the Editorial Office being in the Health Information Research Unit in McMaster's Department of Clinical Epidemiology and Biostatistics.

One of the most useful features of the ACP Journal Club is the way in which the abstracts are titled. Although the ab-

stracts are short, succinct and readable, a survey of readers shows that some readers still only read the conclusions or the last sentence of the conclusions, so the last sentence has been turned into the title, providing very practical and easy to read titles; for example, an abstract of a trial of omeprazole states that "omeprazole was better than H2 antagonists in reflux oesophagitis".

The titles elegantly allow one to distinguish between a systematic review and a clinical trial. Clinical trial titles are summarised in the past tense, as epitomised in the omeprazole title. Abstracts of systematic reviews, which summarise the present state of knowledge on a particular topic, are given titles in the present tense, for example "anticoagulants and anti-aggregants prevent strokes in high risk patients".

The ACP Journal Club is wonderful and I would like to take it to my desert island. An agonising choice may, however, face me in 1995 because the *British Medical Journal* intends to launch a *European Journal of Evidence-Based Medicine*, about which *Bandolier* will write in the near future. Which one should I choose? Can I have both? Can I have either? Surely the desert island will be an evidence-based health care service, if only to ensure evidence-based self care.

J.A. Muir Gray

TOO MANY X-RAYS - KEEP TAKING THE GUIDELINES

There is ample evidence that too many patients are being referred for X-ray investigations which produce no clinical benefit. Through being given an unnecessary X-ray dose the patient may actually receive a clinical disbenefit. Purchasers are wasting some of their precious resources on an immediate test when recourse to available professional guidelines on the best use of radiology departments would both save them money and benefit their patients.

Royal College Guidelines

Concerned by the increasing number and cost of diagnostic facilities, the Royal College of Radiologists (RCR) has examined the extent to which the use of these facilities is effective. One early, striking result was in the use of skull radiography in the management of patients with head injury, when it was shown that only one patient in 4,800 might benefit. This led to the setting up in the period 1987-1990 of multi-centre studies of both GP and hospital practice designed to measure the effect of introducing guidelines of good practice for radiography. Each study showed a sharp reduction in X-ray referrals and investigations in the period following the issue of the guidelines: a decrease of 1,615 of the 12,782 referrals (12.6%) in the general practice study, and of 31,400 of the 403,000 inpatient and outpatient investigations (7.8%) in the hospital study.

Large reduction in skull X-rays

Within the overall figures, some particular trends are evident. For example the largest decrease in both GP referrals (30%) and hospital investigations (23%) was in skull X-rays, consistent with the earlier report of the RCR. Other large percentage reductions were noted in spinal and chest X-rays examinations which are the most common of all X-ray procedures. Abdominal referrals changed very little after the issue of the guidelines. This suggests that the guidelines were able to be used in a discriminatory manner to avoid unnecessary X-ray investigations but not at the expense of reducing those that may be beneficial.

20% of X-rays clinically unhelpful

Of particular interest are the values of the largest reductions by single centres that were observed in the study. These varied between about 15% to just under 50% for different types of examination. These levels of reduction are consistent with those observed in other independent studies and led the RCR Working Party to conclude that there is strong evidence that at least 20% of the radiological examinations carried out in NHS hospitals are clinically unhelpful. This translates over the whole country to an annual total of 7 million unnecessary X-ray examinations costing about £60 million, with the highest numbers of unnecessary X-ray examinations being those of chest, limbs and joints, and the greatest financial costs arising from examinations of the chest and from barium investigations.

Reducing X-ray doses to patients

In addition to these direct costs there are also indirect costs that derive from the effect of the X-ray doses to patients from the unnecessary X-ray examinations. The joint working party of the RCR and the National Radiological Protection Board on patient dose reduction estimates that the potential collective patient dose reduction from the limitation of clinically unhelpful X-ray examinations amounts to 3,200 man Sieverts across the whole country. This is roughly equivalent to the annual collective dose produced by all other artificial radiation sources.

Estimates of the monetary valuation of the harm associated with the exposure of 1 man Sievert are £5,000-£10,000, which translates to an annual national cost of £15-30 mil-

lion with the collective figure given above. Another way of looking at this is the number of additional fatal cancers that could result from the unnecessary X-ray doses. The risk to a patient from a single X-ray examination is of course very small, but available estimates of the lifetime risk of fatal cancers from common types of X-ray examination suggests that something of the order of 100 fatal cancers may arise each year from unnecessary X-ray examinations if the figures given earlier are correct.

There are clearly substantial patient benefits and cost reductions to be achieved from the elimination of unnecessary X-ray examinations, and these benefits lie in the hands of doctors who refer patients for X-ray examination. The guidelines issued initially by the Royal College of Radiologists and subsequently modified and incorporated into locally issued guidelines are the result of wide discussion between hospital clinicians and general practitioners.

The guidelines offer clear guidance in any given clinical situation whether and in what circumstances an X-ray investigation is indicated or not indicated. The earlier RCR studies have shown that guidelines of this kind can reduce substantially the number of unnecessary and unhelpful X-ray examinations with benefits both to patients and purchasers. However the Royal College Working Party was clear that the problems in how to assure compliance with agreed standards of practice have yet to be resolved. It is also likely to be true that without follow-up the initial beneficial effect of the guidelines will diminish. We must try to find ways of getting the message across and to make good practice become standard practice.

Dr CCF Blake, Regional Scientist, A&ORHA

References

- 1 Costs and benefits of skull radiography for head injury. *Lancet* 1981 ii:791-795.
- 2 R Chisholm. Guidelines for radiological investigation. *British Medical Journal* 1991 303:797-798.
- 3 A multicentre audit of hospital referral for radiological investigation. *British Medical Journal* 1991 303:809-812.
- 4 Influence of the Royal College of Radiologists guidelines on hospital practice. *British Medical Journal* 1992 304:740-743.
- 5 Influence of Royal College of Radiologists guidelines on referral from general practitioners. *British Medical Journal* 1993 306:110-111.

REDUCTION IN X-RAY REFERRALS FOLLOWING INTRODUCTION OF GUIDELINES

X-ray examination	Reduction in in-patient referrals	Reduction in out-patient referrals	Reduction in GP referrals
Chest	-6%	-13%	-9%
Skull	-29%	-21%	-30%
Spine	-10%	-13%	-17%
Barium	-7%	-7%	-7%
Excretion urography	-9%	-17%	-9%
Limbs and joints	-5%	-4%	-13%

Audit Commission National Report (1995) Improving Your Image (HMSO)