IN-DEPTH REVIEW

The application of the methods of evidence-based practice to occupational health

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Evidence-based methods of practice are becoming widely used in many areas of healthcare. The techniques of data appraisal, systematic review and meta-analysis and their application to clinical and preventative medicine through clinical guidelines and economic analyses are well established. These methods have only been applied to occupational health risks and interventions in a very limited way and there is considerable scope for wider use, especially in the clinical aspects of practice. This should improve the quality of prevention and would also enable practitioners to give more soundly based advice and to secure their professional positions as providers of quality assured information. Human and financial resources and commitment to the development of evidence-based approaches by the professions and those they work for are pre-requisites for success.

Key words: Evidence-based practice; guidelines; intervention; occupational health; professional development; reviews; risk assessment.

EVIDENCE-BASED PRACTICE IN HEALTH CARE

In many areas of health care and prevention a quiet revolution has been taking place. Traditionally a practitioner learned ‘facts’ as a student and then applied this knowledge throughout his or her professional life, modifying it in the light of experience and the occasional major breakthrough. First obstetricians and then other practitioners recognized that their knowledge about the nature and scale of risks and on the effectiveness of interventions must constantly be updated and that the only good practice is that which is founded on the best currently available knowledge applied, in the case of curative medicine, in the light of the patient’s needs. This approach is dynamic and thrives best where good studies on the causes and treatment of disease are available—as was shown some years ago by the contribution of the results of a number of large trials on the treatment of childhood cancers to improved prognosis. Examination of evidence may also show that treatments generally recognized as useful are not or may even be dangerous and so should no longer be used. For instance the use of plasma to maintain circulatory volume.

This change in emphasis has depended on ready access to sources of information on completed studies—largely made possible by computer accessible databases such as MEDLINE—supplemented by accepted methods of analysing and summating the results of searches.

SOURCES OF EVIDENCE

Electronic databases provide the technology which makes evidence-based practice feasible. The most well-known are as follows.

1. MEDLINE—a database maintained by the National Library of Medicine in the USA and which covers the major medical journals. Searches by ‘mesh’ headings, a standard index system, or by key words. Free access from several providers, such as the BMA, Grateful Med., or from most medical or university libraries.

2. EMBASE—a database covering a broadly similar set of topics to MEDLINE but with more emphasis on European non-English language journals and on pharmacology. Free access via BMA and at most medical or university libraries.
3. Cochrane reviews—a series of databases which index reviews and comment on their soundness. Some are prepared by members of the Cochrane collaboration; a worldwide network of medical researchers committed to the best use of evidence in practice. There are few entries specifically on occupational health topics. Subscription CD service but widely available in medical libraries.

4. OSHROM—a compilation of databases concerned with occupational health and safety, including those of HSE in UK and NIOSH in USA. Also covers regulatory matters and some magazine type articles. Subscription CD service available in some university and commercial libraries.

5. World wide web—a large amount of information but the quality varies according to who posts it and their motives for doing so. A search using one or more of the available search engines can sometimes provide useful leads or a flavour of popular concerns and commercial opportunities.

6. Other sources—in addition to information in peer reviewed journals, accessible through sources 1–4, relevant material may be in the less accessible 'grey literature', such as conference proceedings, theses and official reports. Citations in articles found on databases and informal discussion may lead to these.

7. Textbooks—these can reflect current practice but only a few so far adopt a rigorous evidence-based approach. They remain an important way into a topic but can reflect the authors' quirks and are inevitably out of date by the time they are published in developing areas of practice.

8. Library access—sources 1–5 can be interrogated rapidly but the search will only find titles or abstracts of papers. These then need to be followed up if they indicate that the full paper will inform the question being addressed or the methods used need to be scrutinized. A good university medical library can often give same day access to roughly half of the papers identified in a search but at some personal cost in time and copying. Other libraries will be more limited. Papers can be ordered for a fee from some libraries, e.g. the BMA, RSM, or from the British Library, which operates a mail order service through other libraries for virtually every journal.

A structured approach is essential to avoid the sort of biases which we all have when informally reading and then summarizing information. This approach may, as early advocates of evidence-based practice proposed, be applied to individual clinical problems but most of the methods of analysis and summarization used require considerable time and effort and will almost always be applied to resolve generic issues. Quality assured reviews are key aids to evidence-based practice and an increasing number have now been prepared and are indexed, for instance on the Cochrane database. Data can also be used to prepare clinical guidelines which derive recommendations for good practice in a quality assured way or to assess the economic implications of intervention.

**EVIDENCE-BASED PRODUCTS**

The results of a search are presented in the form of a structured summary, as follows.

1. Critical appraisal—assessment of a paper or report in a structured way which concentrates on the quality of the methodology and the applicability of the results to the problem in hand. A critical appraisal may be done to inform a particular clinical decision or as a more general guide to good practice.

2. Systematic review—a structured review of a number of reports, where criteria for inclusion and methods of data extraction and analysis are defined in advance and quality assured throughout to avoid the introduction of reviewer biases or over interpretation of the data into the review's findings.

3. Meta-analysis—an extension of the approach used in a systematic review to quantitative data which is sufficiently homogeneous to be summarized by adding data sets together and weighting them according to their size, thus producing a single estimate at the end with an indication of its limits of confidence.

4. Clinical guideline—evidence-based guidelines use the results of systematic reviews and meta-analyses to make recommendations on good practice. The confidence which can be placed in each recommendation is normally indicated.

5. Economic analysis—estimates from systematic reviews and meta-analyses are used as the basis for evaluating the relative utility of health care options in terms of their costs and outcomes.

The methods of evidence-based practice include qualitative appraisals and quantitative summary statistics which enable options for action to be compared more readily and explained to others. These include the use of relative and absolute risk in studies of causation and adverse effects, calculation of the incremental benefit of additional diagnostic tests and estimation of the number needed to be treated to secure one more favourable outcome in reviews of therapy.

**PRESENTATION OF EVIDENCE-BASED RESULTS**

One of the keys to the effective use of evidence-based methods is the ability to present summary data in a way which is helpful to users.

**Causation**

Studies on causation, adverse effects and prognosis have broadly similar structures in that they look at the probabilities of events taking place and compare this in different groups. Studies are commonly either:
• cross-sectional studies measuring prevalence,
• cohort studies measuring incidence,
• case–control studies comparing risk factors.

Results can usually be presented in terms of a comparison of relative risk between two groups or as an absolute risk for each group studied.

Diagnosis
Investigation of the value of a diagnostic technique will aim to show how well it predicts the presence of the condition being sought—its validity. This may be expressed in terms of its sensitivity—ability to label true cases correctly, and its specificity—ability to label non-cases correctly. Because these measures will depend on the frequency of cases in the population the comparison of the pre- and post-test probabilities of reaching a correct diagnosis is usually a better measure of the usefulness of the technique.

Intervention
The gold standard for assessing the effectiveness of a treatment is the randomized controlled trial. From this and from other less rigorous comparisons on treatment (or any other intervention) benefits can be summarized in terms of the number of people who need to be treated by the preferred treatment to secure one additional cure.

In recent years evidence-based methods have achieved a high profile in preventative and curative health care planning. Systematic reviews have been required to justify health spending and clinical practice has been found wanting where evidence-based guidelines have not been followed. This has led to strongly held professional positions on the relative importance of evidence, experience and patient expectations.

By providing benchmarks against which clinical performance can be assessed evidence-based practice also underpins the concept of clinical governance which is now being introduced in the National Health Service. This has been concisely defined as 'Corporate responsibility for clinical performance', i.e. individual clinical performance is now a public and not a private matter! This has major implications for professional bodies, such as the Faculty of Occupational Medicine, which are concerned with the training and continuing performance of their members, for the General Medical Council and for those who employ health professionals.

One important consequence of the use of evidence-based methods is the acknowledgement of uncertainty. The methods are only as good as the information which underpins the concept of clinical governance which is now being introduced in the National Health Service. This has been concisely defined as 'Corporate responsibility for clinical performance', i.e. individual clinical performance is now a public and not a private matter! This has major implications for professional bodies, such as the Faculty of Occupational Medicine, which are concerned with the training and continuing performance of their members, for the General Medical Council and for those who employ health professionals.

One important consequence of the use of evidence-based methods is the acknowledgement of uncertainty. The methods are only as good as the information which is available. Rigorous quantitative answers can be provided for some questions. Ignorance is clearly displayed on others. The rational response to this is to carry out investigations which will resolve the uncertainty but this cannot often be done within the time-scale for solving the problem in hand. The NHS is moving towards arrangements for identifying, prioritizing and carrying out such work. In the absence of such an initiative, deciding who should pay for and undertake further work can cause long delays. Practitioners will often need to take action based on less than perfect information and frequently will not be well placed to remedy knowledge gaps and this can cause insecurity about current practice and cynicism about evidence-based approaches.

THE SCOPE FOR EVIDENCE-BASED METHODS IN OCCUPATIONAL HEALTH

Occupational health has much in common with other areas of health care in terms of the need to define good practice and check its effectiveness. It differs in that it is practised within a framework of employment law, practices and regulations and supports those who have legal duties and collective aspirations concerned with conditions at work. It is also distinguished from other aspects of health care by a different and less settled pattern of competencies and by diffusion of responsibilities because of the many separate organizations involved and because maintenance of health is usually seen as an incidental part of business activities and not the central purpose of the enterprise, as is the case with the NHS. Thus, while the principles of evidence-based practice will be similar there are likely to be different reasons for applying them and different responses to the use of evidence-based information.

Use of evidence-based methods
The techniques of evidence-based practice have already been applied to a limited number of occupational health problems, as given in the following examples.

• Systematic reviews on the prevention of low back pain in industry and stress management programmes.
• Meta-analyses on the relationship between cumulative exposure to asbestos and the relative risk of lung cancer and the relationship of solvent exposure to cancer and the use of the method for occupational cohort studies has been discussed.
• Economic appraisals of the benefits of workplace lifestyle programmes.

This approach is not new: Thomas Legge undertook a very detailed review and what we would now call a meta-analysis on the causes, incidence and treatment of industrial anthrax in 1906.

In addition there are many evidence-based sources in other areas of health care which can be utilized in occupational health, such as prognostic information on those with ischaemic heart disease which can be used to develop evidence-based medical standards for transport safety.

Evidence-based approaches need evidence! Appraisal of data on occupational risks and interventions frequently reveals the weakness of the evidence supporting current assumptions of risk or diagnostic and preventative methods. An overview of evidence for current occupational health practice could be presented as follows. It is a subjective appraisal, but can readers fault it?
Nature and scale of risks. Many major risks have sound cohort studies indicating their nature but often with limited exposure data (e.g. noise, asbestos, cadmium, hyperbaric work). For some risks the information is so old that it cannot be judged by current standards (phosphorus, lead). For less specific risks, such as musculoskeletal disease, the evidence is often limited to cross-sectional studies of current workers. Where controls are based on a precautionary approach derived from animal studies the level of risk may not be determinable. This is also so where extrapolations are made from high to low dose groups and where individual variations in response are wide, as with allergens.

Diagnostic techniques. Limited information specific to occupation, for instance on lung function testing. Extrapolation can often be made from other circumstances but population normal values may not be transferable.

Intervention. A range of studies and statistics relating improvements in the working environment to reductions in disease frequency. Hardly any investigations of clinical interventions such as health surveillance or selection for employment.

Fitness for work. Large experiential base but very little evidence of reasonable quality. Audit shows considerable variations in professional judgements.

Health promotion at work. Very little evidence. Some extrapolation possible.

The author’s experience

Three critical appraisals were carried out as feasibility studies on the evidence base for occupational asthma. These were revealing both as regards the available data and the practicability of improving it.

The contribution of peaks of exposure to asthma induction - critical in designing effective control regimes. Good evidence for irritants. Limited evidence of a contribution to sensitization for di-isocyanates and platinum salts but not for other agents. Little scope for designing studies to clarify the contribution of peaks to sensitization, hence for improving evidence base and control regime.

The incremental benefits of different diagnostic tests for occupational asthma: information needed for optimizing screening and case investigation. Good evidence from non-occupational studies. Limited evidence from one study of a population with known occupational risks. No evidence from screening in occupational groups. A fair evidence base but only useable by extrapolation.

The contribution of health surveillance to prevention of occupational asthma: essential to justify any recommendation for surveillance. Good evidence that late effects are less severe when diagnosis is made soon after symptoms start but only very limited evidence for one agent that health surveillance, per se, reduces the frequency of late effects. While this data does not provide justification for any particular method of surveillance it would be feasible to mount a study to investigate benefits.

Feasibility of practitioners undertaking such assessments

These appraisals also provided information on the feasibility of practitioners undertaking such assessments to assist with their work. Each appraisal took about 25 hours of working time and required a month to complete, because of the need to obtain some references by inter-library loan. Thus significant resources are required and there could be considerable economies in collaborative appraisal, review and guideline preparation activities.

Another recent investigation assessing the evidence base on occupational health was a scoping study to determine which musculoskeletal conditions had a sufficiently strong evidence base for the preparation of clinical guidelines on their occupational aspects. There was sufficient information on intervention for low back pain but not on neck or upper limb disorders, although even here relatively few studies looked at return to work as an end-point.

It is also possible to use an evidence-based approach to refine the questions to be posed in a review, thus an attempt to collect data on the prevalence of mental illness in the UK working population showed clearly that a simple estimate of prevalence was inappropriate as differential selection and survival in employment had to be considered as one of the prime determinants of measured prevalence and this led to re-direction of the project.

Attitudes to evidence-based methods

There is assent to the principle of improving occupational health practice and hence enhancing prevention but reservations have been expressed about the application of evidence-based methods. Because much practice derives from legal requirements a compliance mentality is frequent, where action is often taken reluctantly without an urge to explore its basis, except in order to try and fault any demanding changes which are proposed for new regulations or official statements of good practice. In other circumstances practice, for instance on health promotion carried out by contract providers, may be profit driven with providers unwilling to limit procedures to those which are demonstrably effective. In addition users of occupational health advice frequently value stability and certainty in action more than change and improvement, especially as it is often seen as peripheral to their main line of business.

Practitioners may themselves be enmeshed in some of these attitudes, especially when they have championed current practices and see themselves as too busy or too problem orientated to re-consider approaches or to justify the need to put resources into the assessment of evidence and then to live with both its results and any uncertainties identified.
DEVELOPING EVIDENCE-BASED OCCUPATIONAL HEALTH

Three points need to be emphasized in relation to developing evidence-based occupational health.

- There is acceptance of evidence-based approaches in most other areas of health care and they are being adopted as benchmarks for good practice.
- Management in industry is increasingly driven by quality assurance requirements and the adoption of standards of accreditation.
- The public critically questions the basis for official and professional decisions which appear to be arbitrary. They are now backed by new anti-discrimination and pro-disclosure law.

In this climate it is difficult to see any survivable future for occupational health practice which is not explicitly evidence-based, nor for any sustainable basis apart from an interdisciplinary one for developing evidence-based guidelines.

Regulatory bodies such as HSE and the Industrial Injuries Advisory Council have long used an evidence-based approach in establishing causation for preventative and compensation purposes. Given the basic assumption—unfaulted but only evidence-based in some circumstances—that reducing exposure is a rational way of reducing risk, assessing the effectiveness of HSE has also applied this approach to prevention. The biggest gaps in evidence-based approaches lie in those areas that are the field of the clinical occupational health professions, that is clinical aspects of health risk management such as health surveillance, fitness for work and the use of the workplace as a setting for health promotion. These are areas where regulation has not been the dominant factor in shaping UK practice and hence any lead will need to come from the clinical occupational health professions and from those who benefit from their advice on these matters. This will require financial resources and professional skills, supplemented by expertise in data appraisal and reviewing.

The current project aimed at preparing clinical guidelines on the management of occupational aspects of low back pain is a potential model for a viable approach. The work has been funded by Blue Circle International as a corporate community project for 1999. The clinical guidelines are being prepared by a working group under the auspices of the Faculty of Occupational Medicine, which includes members of several professions; British Occupational Health Research Foundation are assisting and two reviewers who previously worked on the Royal College of General Practitioners guidelines on back pain management have been contracted. The results will provide pointers to the utility of this approach and the resources needed to develop such practice guidelines.

Four hurdles stand in the way of evidence-based work on other facets of occupational health practice, but all can be cleared given determination:

- developing an agreed priority list for future reviews and guidelines, with an acceptable broker as custodian and initiator of new projects;
- funding from industry for this work—a matter of demonstrating the real benefits of codifying practice and making the case that funded work will pay back significant dividends in terms of effective prevention and improved efficiency both in work performance and in the use of occupational health advice;
- a willingness of competent reviewers to work on such projects and the professions to assist with the preparation of evidence-based guidance;
- above all, a readiness from practitioners to accept the indefensibility, inconsistency and doubtful benefits of much current practice and grasp new approaches as probably the only means to secure a valid future for their specialities.

REFERENCES


