published in high risk patients confirms a significant odds reduction of vascular events of 27%. In low risk patients (only three trials) the benefits are less clear. In absolute terms, this means the prevention of between 23 and 38 further events for every 1,000 high risk patients. There is no significant prevention of events for low risk groups. As to the type of vascular event prevented, there is a similar odds reduction for non-fatal myocardial infarction (MI) in high and low risk patients (35% and 29% respectively) but for CVAs benefit is only seen in high risk patients. There is an increase in haemorrhagic stroke in low risk patients taking aspirin. The risk of vascular death is reduced by 18% in high risk patients but there is no effect in low risk patients.

The role of aspirin in disease groups other than arterial disease (eg peripheral vascular disease, cardiac disease) is less clear—there may be some benefit but further studies are required. Age, sex, hypertension and diabetes mellitus have no effect on the benefit from antiplatelet therapy. Unresolved issues include the use of aspirin in acute MI and the relative benefits of aspirin and anticoagulation in acute CVA. Recent studies suggest that aspirin is beneficial in the setting of acute MI but further studies are underway to evaluate its role relative to that of anticoagulation in acute stroke.

Getting research into practice

Medicine is a complex hybrid of art and science, based on collected experience and wisdom which has been passed down from one generation of doctors to the next. This tends to make medicine a conservative profession with an accumulated body of 'facts' which acts as its guidance system for decision-making. New insights and approaches, including the application of modern scientific thinking, are encouraged but when they yield results that suggest change, it can take a long time for them to become accepted and incorporated into mainstream practice. At the same time, medicine sometimes suffers from fashion, and new interventions are occasionally adopted with enthusiasm even though they have never been proved effective or safe. This is not just a thing of the past: in recent years a number of widely practised interventions have turned out to be valueless, while other interventions have only reluctantly been taken up, long after sufficient evidence of their effectiveness had become available. Devising proper mechanisms for translating clearcut evidence into clinical practice, without being carried away by premature adoption of new forms of treatment for which the evidence is less substantial, is a major challenge for doctors and health policy-makers alike.

The recent proliferation of randomised controlled trials and other clinical studies has resulted in a rapid increase in the quantity and quality of clinical evidence relating to all aspects of patient care, from history taking to diagnosis and treatment. This makes it theoretically possible to move away from making clinical decisions based on the knowledge acquired during initial training and subsequent personal clinical experience, and adopt up-to-date research findings as the basis of clinical decision-making and patient care. Ironically, this increase in available information has made it increasingly difficult for medical professionals to identify and read those studies that are relevant to their practice.

At this time, there is also growing pressure from the general public, from the GMC and from within the profession itself for doctors to be more willing to keep up to date and to show evidence that they have done so. This has led to adoption of continuing medical education (CME) programmes for general practitioners and specialists, strongly encouraged by the Royal Colleges. Challenging questions still remain about the most effective forms of CME and how best

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to regulate and assess the knowledge and performance of postgraduates.

A central strand in all these areas of concern is how to translate research findings into clinical practice. A conference held at the College in December 1995 brought together a panel of experts to discuss and explore the state of the art and to suggest possible ways forward.

Dr Graham Winyard (Medical Director, NHS Executive) outlined the government view of the purpose of the NHS, namely to provide the greatest possible improvement in the physical and mental health of the UK population within the limits of the resources available to the service. Given the finite nature of these resources, it follows that government and the NHS Executive have a responsibility to ensure that those resources are expended on services that are effective, by doctors and other professionals who know what they are doing and how to do it efficiently. Ideally, decision-making within the NHS should be driven by evidence of clinical effectiveness and cost-effectiveness and monitored by systematic assessment of actual outcomes rather than surrogate measures. 'Clinical effectiveness' has been identified as one of six medium-term priorities for the NHS; to achieve it, fundamental changes will have to take place across the whole NHS, not just among clinicians. Three distinct components can be identified: first, an increased knowledge base about clinical effectiveness and cost-effectiveness; second, the use of this knowledge in decision-making; third and most important of all, the development of appropriate and valid mechanisms for judging the benefit of any decisions in terms of actual clinical outcomes rather than changes in the process of care.

Professor John Gabbay (Director, Wessex Institute of Public Health Medicine) considered the role played by commissioners of health care in narrowing the gap between research findings and clinical practice. His central thesis was that both existing and novel technologies should be subjected to formal evaluation, and where necessary, appropriate research should be commissioned to guide decision-making. Health technology assessment is currently being undertaken at national, regional and local levels. At the national level there is the work of the Standing Group on Health Technology Assessment (SGHT), the Cochrane Centre and the NHS Centre for Reviews and Dissemination, whose work includes the Effective Health Care Bulletins. Such initiatives are long-term and many of the studies commissioned by the SGHT have yet to produce results. While national data remain in short supply, purchasers have immediate and pressing needs for advice. Regional initiatives, such as Getting Research into Practice (GRiP) in Oxford and the Development and Evaluation Committee in the South and West, are helping purchasers make the best of what information is available to make decisions now on the implementation or decommissioning of technology.

Professor Gabbay described in detail the work of the Development and Evaluation Committee (DEC) established in 1991 in the erstwhile Wessex region. The DEC reviews new and established technologies identified locally as important topics for evaluation. The assessment is conducted as a systematic review of the existing evidence, using an algorithm which takes into account the quality of the evidence together with the 'cost-utility' of the technology [1]. Decisions available to the committee range from strongly recommended (eg cardiac rehabilitation), through beneficial but high cost (eg the use of high purity factor VIII for haemophilia) to not recommended (eg screening for prostatic cancer). Where there is inadequate evidence for a decision or where a local demonstration project is required, the DEC can advise purchasers accordingly and add the topic to the local or national R&D agenda. This 'quick and clean' approach to health technology assessment has deterred the uncritical acceptance of medical innovations in Wessex, but its relationship to national initiatives and the potential cost of replicating such regional initiatives throughout the country is less clear.

Professor Roger Jones (Department of General Practice, UMDS London) spoke on the place of research in primary care. Although much NHS research has been driven by priorities which originate in the secondary care sector, the overwhelming majority of patient contacts take place in primary care. This disparity will become even less justifiable as we move towards a 'primary care led NHS'. Unlike senior hospital doctors, most general practitioners have not had any formal training in research methods and this is generally true of other members of the primary care team also. On the other hand, UK primary care has enormous, and largely untapped, strengths as a research arena. With almost universal patient registration, the general practitioners' list system, and their role as gatekeepers to secondary care, it is possible to conduct population-based health services research, a feature which is available neither in secondary care nor in most other countries.

A multipronged approach will be needed if we are to build research into primary health care. Academic departments have an important role to play in raising the profile of general practice and teaching but are not ideally placed to educate established GPs, nor can they readily invest in research ideas outside their immediate area. Individual GPs with research ideas are often defeated by the combination of inexperience, limited patient numbers and lack of time. The MRC research practice framework offers GPs the opportunity to participate in other people's research but does not currently offer them the chance to develop their own research ideas. The development of primary care research networks in the Northern and Wessex regions has for the first time brought together GPs with

common interests to undertake research topics that would be impossible to prosecute in a single practice, while the Wessex network offers NHS GPs the chance to compete for 'time-out' bursaries to provide locum cover and thinking space for protocol development and preparation of funding applications. Time will tell how successful these networks are in developing an evaluative culture within primary care, but together with the other types of primary care research, the networks represent an important investment in involving GPs and other primary care team members in thinking about practice and changing it for the better.

Dr Elizabeth Scott (Nursing Officer (Research), NHS Executive) highlighted the potential contribution of the nursing and therapy professions to health services R&D. The importance of research evidence in guiding nursing practice has been recognised by the profession, but as with medicine, there is a significant gap between the rhetoric and the reality. This gap is (probably) greater in the non-medical professions because their research culture is less well developed, perhaps because most of their professional training is service-based and a greater proportion of their teaching is didactic. Historically, the focus of nursing research has been on intimate patient care, which is an area of great concern to the main NHS users, ie patients and their carers. Such research has often been small scale, with a low level of investment, but has nevertheless employed the full range of available research methods. The present dilemma for nursing research is whether to build on its unique features, or to move towards collaborative, interprofessional health services research with a focus on patient care. Overall, there is clearly an urgent need to harness the interest and enthusiasm in these professions both to evaluate and deliver evidence-based care and to identify and reduce the barriers to implementation of research findings. As in medicine, the initiatives to support clinical practice and development will have to include education, training, and organisational and professional support.

Professor Charles Warlow (Department of Clinical Neurosciences, University of Edinburgh) emphasised the need for clinical trials and systematic reviews to change practice. Properly designed clinical trials are necessary to judge new treatments and to protect patients from treatments which ought to work but do not (eg prophylactic lignocaine after myocardial infarction, or decompression surgery for ischaemic optic neuropathy). Nevertheless, clinicians, researchers and policy-makers are now inundated with unmanageable amounts of information and lack the necessary time or tools to make personal evaluations of the virtues, shortcomings and applicability of existing and new trials in the medico-scientific literature. Systematic reviews of the literature can integrate existing information and thereby facilitate rational decision-making. Performing a systematic review is not a once and forever thing and it is necessary to revisit and update the conclusion in the light of new information. Meta-analysis (statistical synthesis of the review) can help to increase the power and precision of estimates of treatment effects and risk of exposure by combining the results of separate but related studies.

Dr Muir Gray (R&D Director, Anglia and Oxford Regional Health Authority) agreed that the uptake of research findings into practice is significantly impeded by the volume and inaccessibility of information. Of the 22,000 medical serial titles (16,000 journals) in print, only about 3,700 are accessible on Medline. In addition, it is impossible to identify all the published trials in those journals that are indexed by Medline because of inadequacies in the assignment of medical subject headings. When using Medline, untrained searchers are likely to miss a high proportion of the trials that are there, but their ability to identify relevant articles can be doubled with training in search strategies. However, even a trained searcher will miss a proportion of trials, compared with a 'gold standard' systematic hand-search of the literature. Fortunately, high quality distillates of the literature are gradually becoming available from the York and Cochrane initiatives and in the fast growing family of evidence-based journals of secondary publication, such as Evidence-Based Medicine and the ACP Journal Club. Dr Muir Gray advocated the wider use of electronic reference manager systems and suggested that doctors should carry their own personal library of references around on diskette. Quite how one would do this and access the information when faced with a difficult decision is less clear, but there is obviously a need for readier access to information. Our principal problem now is finding the time to carry out library searches at all, let alone at night when faced with a problem patient! Notwithstanding these concerns, there is a definite challenge for medical libraries of the 21st century to provide information in a useable format when and where one needs it.

Professor Andrew Haines (R&D Director, NHS Executive North Thames) described ways of expediting the implementation of research findings, citing the classical example of the use of vitamin C to prevent scurvy. In 1601 James Lancaster showed that lemon juice was effective and although the experiment was replicated in 1747, it was not until 1865 that the merchant marine took the evidence on board. In the case of thrombolytic treatment in the management of myocardial infarction, meta-analysis of randomised controlled trials demonstrated effectiveness at least 13 years before the treatment appeared in standard textbooks as the recommended option. Effective approaches in speeding up the process of implementation into clinical practice include the influence of opinion leaders, development of evidence-based guidelines, and the use of computer-based decision support systems.

While it is not always clear who the opinion leaders are in any given group, uptake of new ideas and

technologies seems to follow a fairly standard pattern. People can be classified on the basis of the speed with which they take up innovations: thus there are the vanguard innovators, early adopters, early majority, late majority and laggards. In this classification the opinion leaders belong in the 'early adopter' group and once their support is gained, there follows a sudden upsurge in interest as most of their remaining colleagues join in. Hence there is a very real sense in which the way that we practise medicine may be directly influenced by the people with whom we work. The principal weakness of relying on opinion leaders is that it depends on opinion leaders themselves being well informed and making correct decisions. If they are just following fashion then they are as likely to be wrong as lesser mortals.

Most physicians have mixed feelings about guidelines. We want other people to follow *our* best practice but want to retain the freedom to practise as we see fit. At the same time, few would defend the right to use outdated or inappropriate treatments. Properly constructed, evidence-based guidelines should be an effective means of encouraging the use of appropriate and effective therapies and technologies. In a review of 87 studies on the impact of guidelines on clinical practice, 81 of the studies (93%) showed that properly developed guidelines can significantly change clinical practice and thus have the potential to improve patient outcomes [2]. The key seems to be to secure and retain the support of relevant professional groups.

Clinical decision support systems (CDSS) or expert systems use patient information to generate case-specific advice. CDSS have also been shown to improve physician performance [3] but further evaluation is required to assess the amount of benefit that can be obtained and at what cost. Separate issues related to CDSS include the range of conditions that can be covered and the costs of development.

Other methods of promoting the implementation of research findings include: audit, financial incentives, participation in clinical trials, educating clinicians, and providing information direct to the public. **Dr Gifford Batstone** (Director, Medical Development Programme, King's Fund Development Centre, London) suggested that clinical audit should be a major contributor to linking evidence and practice, by providing systematic and critical analysis of the quality of clinical care, including procedures used for diagnosis and treatment. The current vogue is for multi-professional, patient-focused audit which is supposed to be the way to deliver cost-effective, high-quality care by clinical teams. The key issue seems to be the need for accurate information to start from, thus allowing standards to be based on sound evidence. This would allow appropriate changes in clinical practice to be recommended, and enable clinical audit to assess the utility and effectiveness of these changed practices. Again, the focus of evaluation here ought to be improved clinical outcomes rather than altered process, as history is littered with examples where compliance with well-meant protocols has not actually delivered the benefits which were supposed to accrue from adherence to the new protocol. Dr Batstone also pointed out how evaluation of educational programmes tends to focus on the participants' reaction to the activity rather than the dissemination of knowledge or the effect of the day's activities on clinical practice or clinical outcomes. He also touched on the tension in clinical audit between wanting to maintain a patient-focused approach and the need to evaluate clinical effectiveness, which demands a group-oriented approach.

Professional education might seem to be an important means of changing practice but traditional didactic CME programmes seem to have little effect on practitioners' behaviour. Methods such as reminders, outreach visits, patient-centred approaches, multifaceted strategies are more effective, but these are currently less widespread than the formal lecture [4]. One hybrid method which does seem to work is to use CME sessions to develop or adapt guidelines for local use, then apply them to local clinical audit.

Professor David Sackett (Centre for Evidence-Based Medicine, Oxford) discussed how clinical behaviour may be changed through education. He felt that the proliferation of randomised trials has led to an increase in the quality and quantity of clinically valid evidence on diagnostic tests, treatments and other interventions, but at the same time this information had become less accessible because it was now buried under piles of information that was doubtless worthy but less immediately relevant. A major challenge for all physicians is how to integrate their personal 'internal' clinical experience with 'external' evidence from research. Most doctors prize experience and there is no doubt that diagnostic skills and judgement increase with clinical experience. Nevertheless, as time elapses from qualification, knowledge of current clinical evidence decreases and actual clinical performance also tends to decline.

Field studies indicate that general physicians need some new 'external' clinical evidence twice for every three patients seen, but only recognise the need for information on one-third of those occasions. If asked, physicians say that they would obtain such information from their journals or textbooks, but in reality these are either disorganised or out of date so physicians usually ask a passing colleague! It has become clear that formal CME programmes that focus on teaching new facts are ineffective as a means of keeping clinical performance up to date. To make the best use of the available evidence demands that physicians learn evidence-based medicine, and either seek and apply evidence-based summaries generated by others, accept evidence-based protocols developed by others, or identify areas of ignorance and learn how to gather information for their own summaries [5]. Where inadequate information exists, it is important to recognise

the uncertainty and encourage the commissioning of appropriate clinical trials.

Few would argue that unacceptable delays still occur in the implementation of research findings into clinical practice or that suboptimal care for our patients will ensue as a result of such delays. Improving clinical effectiveness through evidence-based health care is everyone's business, from purchasers, providers, through professional organisations and educational bodies, librarians and publishers, to patients, the general public, and the policy-makers who ultimately take the responsibility for providing the best health care system within the financial and political constraints of the real world. Developing appropriate forms of CME is clearly a central issue in converting good intentions into reality. One very clear conclusion from the conference was that traditional didactic CME is not the solution. The direct costs and the opportunity costs of CME are astronomical and if we want improved patient care to result from our investment, we must invest wisely in those forms of CME which have the potential to affect practitioners' behaviour.

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