is also needed is evidence of the effectiveness of medical interventions, preferably collected in carefully controlled experiments. The same "evidence based" rigour should be striven for in public health.

Scientifically valid evidence of the effectiveness of the type of interventions advocated by the reports mentioned above is extremely scarce.¹⁵ Randomised controlled trials will usually be impossible, but other powerful research designs are available,^{16,17} and advantage should also be taken of the results of "natural" experiments, in which favourable changes occur for reasons other than to reduce inequalities in health (for example, changes in employment opportunities, housing, or prices of cigarettes). Whenever possible, effects should be expressed in terms of changes in the size of socioeconomic inequalities in health; various such measures are available.¹⁸

Political will should be mobilised, not only to implement some of the recommendations of the King's Fund's and similar reports but also to sponsor the research necessary to evaluate the effects. After researchers have documented the existence of inequalities in health and have studied the explanation of inequalities in health there is one further contribution that they can make to health policy: studying the effectiveness of interventions aimed at reducing inequalities in health. This is a substantial undertaking, for which international cooperation is likely to be required: no single country can provide all the "natural" and induced variation that is necessary to evaluate the relevant policy options.

In the Netherlands a government sponsored five year programme aimed at evaluating several possible interventions to reduce inequalities in health is already under way¹⁹; the World Health Organisation's discussion paper contains other examples of national, regional, and local initiatives.² Attempts at reducing inequalities in health cannot be but illustrations of Rudolf Virchow's famous dictum "Medicine is a social

science and politics nothing but medicine on a grand scale."²⁰ Let's try to make this a rational form of medicine.

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Amblyopia: could we do better?

Doctors need to pay as much attention to treatment and compliance as to detection

Amblyopia is a common cause of visual loss affecting between 1 and 4% of the population.¹ In most cases it is unilateral and is associated with either misalignment of the eyes (strabismus) or a difference in refraction between the two eyes (anisometropia). Treatment, which is effective only in childhood, consists of prescribing glasses when appropriate and occluding the good eye to force the child to use the amblyopic eye. There is no doubt that this treatment can be highly effective, and a recent prospective study reported cure—that is, visual acuity within one line of that in the unaffected eye—in 89% of patients.² Despite this, amblyopia remains widely prevalent in adults. Why is this? How important a problem is it? And, what, if anything, needs to be done?

Most people with amblyopia are barely aware of their disability since they rely on their good eye. Certainly their visual loss does not seem to interfere with academic performance. However, visually demanding tasks for which perception of distance is important are much more difficult, and people who suffer from amblyopia are excluded from many positions in the armed forces, and in fire and police services and the transport industries.

Of even more concern than this loss of vision in one eye is the devastating disability suffered by people with amblyopia if they lose vision in their good eye. Few epidemiological data exist on the frequency of this. Nevertheless, a retrospective

study in Finland concluded that patients with amblyopia are at greatly increased risk of blindness,³ and 11.8% of blind eyes in the population based Framingham study were blind from amblyopia alone.⁴ Taylor's calculation of 2000 people blinded in the United Kingdom by amblyopia and subsequent loss of the good eye⁵ may underestimate the visual morbidity since most patients will have significant visual impairment that does not meet the criteria for registration as blind. In addition, patients with amblyopia who develop cataract may have surgery delayed because of fear of the risk of surgery to their only good eye.

Ophthalmologists and orthoptists believe that the earlier that treatment for amblyopia is started the better the results. This view is based on the demonstration of a sensitive period in animal models of amblyopia beyond which amblyopia cannot be treated and on the observation that the speed of response to amblyopia treatment is inversely proportional to the age of the child: beyond the age of about 7 children respond poorly to treatment. Thus there has been great enthusiasm for early detection by vision screening programmes; Stewart-Brown *et al* found that 94% of health authorities in England and Wales were doing preschool vision screening.⁶ Unfortunately, although the effectiveness of different screening programmes at detecting amblyopia has been investigated,⁷ there have been no controlled studies comparing the

final outcome in children who have been screened with that in those who have not, and the value of these screening programmes has therefore not been properly evaluated.⁸

In contrast with the issue of the early detection of amblyopia, the outcome of treatment has received almost no attention outside the ophthalmological and orthoptic journals. In clinical practice it is clear that children do not like having their eye occluded, and achieving compliance is a serious challenge. Many studies attest to the size of this problem, with as many as 59% of patients in one large study being excluded from analysis because of failure to comply with treatment or failure to attend.⁹ In a recent multicentre study of nearly 1000 patients treated for amblyopia in the United Kingdom, in which all patients starting treatment were included, only 48% of patients achieved a final acuity of 6/9 and 17% of children achieved an acuity of less than 6/18.¹⁰ The children in this series were of a similar age to those described by Lithander and Sjostrand in their prospective study with an 89% success rate² but were less intensively treated and supervised.

While there are good reasons for thinking that delay in detection contributes to the high prevalence of visual loss from amblyopia in the community, this is clearly not the only cause. We need prospective controlled studies to investigate the whole management of amblyopia from diagnosis to out-

come, which should look at screening, methods of treatment, and factors affecting compliance. Public health advisers, paediatricians, community medical officers, health visitors, and general practitioners should be concerned about not only the detection of amblyopia but also the outcome of treatment.

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Calculating drug doses

Doctors need to be drilled to calculate doses accurately in emergencies

See p 1153

About 70-80% of undergraduates entering medical training in Britain have passed mathematics at A level, and virtually all will have passed the subject at O level. Yet, as Rolfe and Harper show, among a representative sample of 150 doctors asked to perform simple calculations converting drug doses from a percentage or dilution to mass per volume the success rate was as low as 16% (p 1173).¹ The results showed that senior doctors (consultants and senior registrars) were better at calculating the correct answer, and anaesthetists were notably better. While these data seem to suggest a hierarchy in numerical skill among doctors, in terms of both age and specialty, clearly there are other more likely reasons.

The five questions used in the survey concerned tasks regularly performed by anaesthetists, most of whom would have known the answers even if unable to perform the calculation. It would have been interesting to see if the anaesthetists tested would have scored as highly if the questions had been more abstract—for example, how much drug is there in a one in 350 000 solution? In any event, all anaesthetists are regularly required to convert drug doses in this way and—perhaps more important—have this skill reinforced with frequent practice. Nurses are another group who are regularly called on to calculate drug doses, and Adams and Duffield found that their accuracy in doing so improved with regular drills and testing.² That study concluded, not surprisingly, that drills and experience in clinical practice have an important effect on nurses' ability to calculate drug doses accurately. Furthermore, after a relatively short break from this aspect of training nurses' skills deteriorated rapidly. The published study of Rolfe and Harper effectively reaches the same conclusions for doctors.¹

Having drug ampoules universally labelled in mg/ml would not necessarily eliminate confusion or the need to convert doses since many drugs—electrolytes, for example—are regularly considered and prescribed in terms of amount

(millimoles), while biological substances such as insulin are usually measured in units of activity.

What may we draw from this and a previous, similar study?³ Firstly, when drug doses are usually prescribed in terms of mg or mmol/kg body weight the ampoule containing these drugs should be labelled with the concentration of the contents in mg or mmol/ml. This labelling could be provided in addition to more traditional information about dilution or percentage content. One possible difficulty with dual labelling is ensuring legibility. Unlike the United States, Britain has no standard for the size of lettering in labelling on ampoules,⁴ so squeezing more information on to ampoules, particularly smaller ones, could increase illegibility. Adopting similar labelling standards to those in existence in the United States might prevent this potential problem.

Secondly, drills for calculating doses of those drugs that make up the first line of treatment in resuscitation should be taught as rigorously and as dogmatically as other topics when advanced cardiac life support and advanced trauma life support are taught. Finally, if the situation is not an emergency and the doctor is unsure of the dose or contents of an ampoule the advice to "look it up first" or ask for advice holds especially true. With repeated reference to the *British National Formulary* the doctor will in effect be performing his or her own drill and with time will become adept at the calculations needed to convert drug doses.

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