When the target is drawn first you calculate the chance of both arrows hitting the centre of the target. But when the target is drawn round the arrows afterwards you calculate the chance of both arrows hitting the same point, whatever that point. With two independent arrows one probability is the square of the other.

Suspicion was drawn to Sally Clark by the occurrence of two deaths so the probabilities should not have been squared. The odds of 1 in 73 million shrink to 1 in 8500. But this figure is itself meaningless. There is in fact a wall full of arrows with the target drawn around the two that are close together and the others ignored. Mathematical formulas for this situation often surprise people. For example, with only 23 people in a room the odds are better than 50% that two of them have the same birthday.

From whole population data Reese calculates the square of the population risk of cot death as 1 in 2.75 million.[1] There are 378 000 second or subsequent births each year in England. So if cot deaths are random events two cot deaths will occur in the same family somewhere in England once every seven years. But cot deaths are not random events. There have been several studies of recurrence. At least one study did show no increase in recurrence rates.[2] But several others showed recurrence rates about five times the general rate,[3–5] implying recurrence somewhere in England about once every year and a half. Two studies showed even higher rates.[6 7]

The fact that studies of recurrence have been done means this event is not vanishingly rare. In a case series of recurrent infant death Emery classified two cases as recurrent cot death out of 12 cases occurring in Sheffield in 20 years.[8] Wolkind et al found five cases in their unsystematic English case series of 57 recurrent infant deaths.[9] Both these studies distinguished cot death from accident, illness, murder, and neglect.

The prosecution used the figure of 1 in 73 million rather than 1 in 2.75 million because of the family's affluence. Yet taking data from an epidemiological group and applying it stereotypically to all members is an example of the ecological fallacy. Social class is a complex reality of interassociated circumstances—education, work, income, lifestyle, culture, contacts, residence, opportunities, social class of origin, etc—statistically summarised for use in population studies by selecting the one variable which performs best as an indicator. This does not mean that individuals have the attributes of the statistical group.

Guidelines for using probability theory in criminal cases are urgently needed. The basic principles are not difficult to understand, and judges could be trained to recognise and rule out the kind of misunderstanding that arose in this case. Never again must mathematical error be allowed to conflict with mathematical fact as if each were a legitimate expert view.

What is our profession's responsibility for the quality of expert evidence given by doctors? Medical evidence is trusted, and we must retain that situation and ensure that it is not abused. It is possible to be an extremely good doctor without being numerate, and not every eminent clinician is best placed to give epidemiological evidence. Doctors should not use techniques before they have acquainted themselves with the principles underlying them.

When errors occur we expect them to be admitted, learnt from, and corrected. Should clinical governance extend to the courtroom? Expert witnesses can hold a substantial part of defendants' lives in their hands. Defendants deserve the same protection as patients.

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Predisposing biases: SJW is a vice president and immediate past president of the Medical Practitioners' Union, which is predisposed to support the civil liberties movement. He has no personal acquaintance with people involved in this case.

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Managing women with epilepsy

Guideline producers now need to pay attention to implementation

In the mid-1800s Sir Charles Locock first used the earliest antiepileptic drug of modern times, potassium bromide, to treat a group of women with catamenial epilepsy. Such gender selection unintentionally pointed to the future recognition that gender matters in epilepsy. We now know about important interactions between epilepsy and its treatment and women's sexuality, conception, pregnancy, motherhood, and menopause; we also know that the offspring's health and heredity may be affected. Literature for clinicians on women with epilepsy has grown steeply in recent years. The Medline database alone contains over 40 review articles published in English in the past 25 years, almost half of which were published within the past five years. Has this expansive literature resulted in better care for women with epilepsy?

The evidence suggests that information has been slow to influence clinical practice. European and American surveys consistently show that clinicians either lack familiarity with or fail to advise epileptic

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women on issues as common as contraception, drug interaction, and teratogenicity.[1–3] Clinical practice guidelines are an attempt to bridge the gap between evidence and practice. By condensing large amounts of information into practical, systematically developed statements, guideline developers aim at assisting clinical decision making for specific clinical circumstances. It is in this context that practice guidelines for the management of women with epilepsy have been developed.

Early guideline efforts confined their scope to preconception counselling, pregnancy, and birth. In 1993 the International League Against Epilepsy first produced a highly succinct, prescriptive document with no description of the evidence base and no attempt at grading recommendations.[4] An expert symposium on preconception counselling and pregnancy care in epilepsy constructed a set of expert based guidelines at about the same time.[5] Although the evidence was not systematically reviewed and recommendations were not graded, these guidelines did provide links to the evidence and commented on its validity. In 1997 the American College of Obstetrics and Gynaecology created guidelines of similar scope and took the process a step forward by grading the validity of the evidence. However, the strength of recommendations was not stated.[6]

Using current methodological standards for developing clinical practice guidelines, two independent groups in the United Kingdom[7] and the United States[8 9] have assembled wide ranging guidelines for managing women with epilepsy. Methods, target audiences, and objectives are similar in both reports. Their systematic review of the evidence yields somewhat sobering results. All of the evidence is of medium to low validity (class II or III), allowing for recommendations of moderate and low strength, and clearly indicating the need for methodologically sound research. On the other hand, it is encouraging that, despite the dearth of robust evidence, each group's recommendations are remarkably similar in direction and strength. This should reassure clinicians and bolster the validity of the recommendations.

Salient points of congruence include a multidisciplinary approach in caring for women with epilepsy; the usefulness of prepregnancy counselling; the risk of oral contraceptive failure, requiring 50-75 μg of ethinyloestradiol in the presence of enzyme inducing antiepileptic drugs; and the risk of fetal malformations and use of folic acid (0.4-5.0 mg/day) to prevent neural tube defects. Both guidelines also share common ground on antiepileptic drug requirements before and during pregnancy and the puerperium and in their statements on breast feeding. Each group's approach is relevant to its specific societal context. In addition, the UK guidelines address issues of sexuality, adolescence, and the care of children of women with epilepsy.

Will clinicians adopt these recommendations? Many factors underlie the decision to implement guidelines in clinical practice, including clinicians' attitudes, the importance of the topic, the validity of the recommendation, and the method of dissemination. Methods of dissemination that increase the likelihood of guideline use include participation of clinicians in interactive workshops, audits, feedback, reminders, and local consensus processes. Conversely, passive methods of disseminating or implementing guidelines, such as publication in journals, are almost universally ineffective in changing professional behaviour.[10] The crucial next step therefore should be a concerted effort by both the guideline developers and health authorities to disseminate and implement these guidelines.

Will these recommendations result in better care for women with epilepsy? Grimshaw and Russell found that when guidelines are systematically implemented most have a significant clinical effect in the direction intended by the guidelines, although its magnitude may vary.[11] An important determinant of change in clinical practice is whether adoption of guidelines requires special skills from clinicians or the allocation of additional resources. In addition to the time and skills necessary to disseminate and implement these guidelines, costs may also be incurred at other levels—for example, through increased time spent with patients, multidisciplinary care, referral to specialists, and laboratory testing. Neither these nor most published guidelines address issues of the cost of implementation and change in clinical practice, let alone provide estimates of cost effectiveness ratios.

Unavoidably, opportunity cost and resource allocation need to be considered when a change in practice is contemplated. This may reveal that implementing guidelines for the management of women with epilepsy may not necessarily be cost saving. None the less, failure to adopt evidence based practice and accountable decision making and failure to improve patient care are not justifiable alternatives. Guideline developers have completed the first of several stages towards improving the care of women with epilepsy. This should also mark the beginning of the next decisive steps to achieve this goal.

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