The uses and abuses of statistics

Roy Carr-Hill gives examples of how statistics have been used and misused in the formation of policy and in the practice of law.

The origin of statistics and its development has been guided by the development of nation states. Thus, the major developments in statistical infrastructure have come about through war or preparations for war. Examples over the centuries are: William Petty being asked to assess the power and wealth of the English crown vis-à-vis the French State in the 16th Century; the term 'stat-istics' itself comes from preparations for war between Prussian statelets in the 19th century; Keynes' methods of national accounting won out over more logical organisations because it was an appropriate method of managing the British debt during the Second World War; and so on.

Although the systematic recording of socio-economic data can be traced back at least to William the Conqueror's Domesday Book, the modern interest in reporting on social progress (or the lack thereof) can probably be attributed to people like Quetelet, a Belgian statistician working in the middle of the nineteenth century (see Lazarsfeld, 1961). Although he was eventually concerned with the development of an administrative system required by the embryonic welfare states, at first he was simply concerned to document the downside of industrialisation and in particular the extent of 'criminality'. Criminal statistics have therefore been a crucial part of the state's attempt to control its population. It is not surprising that there are frequent arguments about criminal statistics: the most recent was the call by the Statistics Commission for an independent body to publish criminal statistics (see box 1).

Box 1

"Independence and Objectivity – Home Office Criticised for Breaching Code

The Home Office should be stripped of responsibility for publishing crime statistics because public trust in the figures has been eroded, partly by departmental manipulation of their timing and context, the government's official statistics watchdog has ruled. The deeply embarrassing finding by the Statistics Commission follows a long debate between the Commission, the Home Office and the government's official national statistician. Trends in crime figures have always been one of the great battlegrounds of British politics, with media and political parties often drawing very different conclusions as to whether crime is falling or rising."

Source: Patrick Wintour, Political Correspondent, Friday December 30th, 2005, *Guardian*

Statistics and the law

On another level, there is superficially a very close relation in the practice of criminal law between probability theory that is the basis of statistics and the judgement of guilty beyond reasonable doubt. But, although it looks as if prosecution lawyers are following what is known in probability and statistical theory as a Bayesian procedure of incrementally adding to the probability that the offender is guilty in order to reach a high level of probability (beyond reasonable doubt), and the defence lawyers are trying to show that some of the pieces of evidence cannot be used (and so decrease the probability to be less than that), this only rarely happens when a case goes to court. Indeed when formal statistical argument is brought into court it often causes problems. The more usual situation is that either the evidence is overwhelming such that the defendant pleads guilty or what the prosecution and defence lawyers in fact try to do is to build contrasting pictures of the situation that is the subject of the case. It is not a case of arguing over one piece of evidence but of comparing the plausibility of two different jigsaws that are meant to represent what actually happened.

Beyond reasonable doubt

There have been some high profile cases where statistical evidence has been presented. The most recent in England are the cases where parents have been charged with the murder of their babies in cases of unusual 'cot deaths'.

It was the theory of Professor Sir Roy Meadow that, unless proved otherwise, "one cot death is a tragedy, two cot deaths are suspicious but three are murder" that was fundamental in sending women such as Angela Cannings to prison. Another soundbite from the paediatrician, damaging to accused mothers including Sally Clark and Donna Anthony, was that the chance of two babies dying naturally within a family was "one in 73 million".

Both of those were shown to be nonsense because the likelihood of a second child dying given that one child has died from cot death is much higher than the population likelihood of a child dying from cot death.

But there is also another serious mistake that Meadow made, and this is now called the 'prosecutor's fallacy'. You commit this fallacy if you think that the odds of an event happening are the same as the odds that a person accused of the crime is innocent. This sort of fallacy often occurs in connection with DNA evidence. Suppose our DNA evidence tells us that only 1 in 10 million people have the sort of DNA found at the scene of the crime (and suppose we know that this definitely came from the perpetrator). We can't just assume that anyone who has that sort of DNA therefore has only a 1 in 10 million chance of being innocent. These odds aren't the same thing at all. If 1 in 10 million people has that DNA, then (given our population of roughly 60 million people) there are probably 6 people in Britain who could have done it. So any accused person has, on this DNA evidence, a 5 in 6 chance of being innocent, not a 1

in 10 million chance, because there are 5 other people who are equally likely to have done it. The point is to distinguish between the probability of the evidence given innocence, which might be very large (as in the cited cases) and the probability of innocence given the evidence, which can be well within the 'reasonable doubt' range.

This is not to cast doubt on the general use of DNA evidence. If there is other, independent evidence against X, then if you have DNA evidence showing that only a very small number of people have that type of DNA (in the above example, only 6 in Britain), then that's a very powerful reason, statistically speaking, to think that X is guilty. This is the reason why the prosecutor's fallacy happens, because in most cases involving statistical evidence, such as DNA evidence, there usually is extra, independent evidence, but the DNA evidence changes the balance of probabilities enough to justify a guilty verdict, hence the impression is created that the DNA evidence itself was enough. This was not the case with Sally Clark.

Conspiracy, probability and statistical argument

The development of the group Radical Statistics (see box 2) has been concerned with criminal justice systems since its origin. Thus, one of the reasons for the foundation of the group was that one of the future founding members had been asked to give evidence in the 1972 trial for conspiracy to plant bombs of a group of anti-war student radicals known at the time as the 'Angry Brigade'. (*Editor's note: the incidents took place before the IRA's mainland bombing campaign. Small explosive charges were targeted at the British establishment, including the homes of Tory politicians. See Bright, M. 2002.*) An important part of the evidence against them was a statistical argument along the lines that, among all bomb incidents that had been recorded during 1968-1971 (some 1000 apparently), the 25 which were the subject of the conspiracy charge were 'statistically different'

Box 2

Radical Statistics Group

Members of Radstats are concerned at the extent to which official statistics reflect governmental rather than social purposes. They are 'radical' in being committed to helping build a more free, democratic and egalitarian society. Particular concerns are:
The mystifying use of technical language to disguise social problems as technical ones.
The lack of control by the community over the aims of statistical investigations, the way these are conducted and the use of the information produced.
The power structures within which statistical and research workers are employed and which control the work and how it is used.
The fragmentation of social problems into specialist fields, obscuring connectedness.

For more information, see: www.radstats.org.uk/about.htm

(using a 'chi square test') on a number of criteria (composition, modus operandi, size, type of target, etc); so that if each one of the group being charged could be linked (with circumstantial evidence) to just one of the incidents, they were 'therefore' guilty of the conspiracy charge of the whole group of incidents.

This statistical approach was used because there was only limited evidence linking each of the individuals with any of the alleged incidents in the first place; and because the State wanted to crush what they saw as a dangerous oppositional group by increasing the number of incidents for which each individual could charged. But, the chi square test only demonstrated that the 25 were different from the other 975 and not that there is any particular link between the individual incidents making up the 25. Apparently the same nonsense had already been deployed, successfully, against another person suspected of the same 'conspiracy' (who had received a sentence of 25 years), and several gangs of safe-breakers. The main outcome measures (as we would say these days) of the evidence given was that four of the eight were found not guilty and the other four received 'only' ten year sentences (which led to the reduction of the previous 25 year sentence handed down). In addition, the Home Office 'statistician' who had given the prosecution evidence was 'moved'.

Under globalised New Labour, these issues are being repeated through the development of conspiracy charges to 'deal with' terrorism. There seems to be no irony in this terrorism of the rich and powerful ("War is the terrorism of the rich; terrorism is the war of the poor" as Ustinov put it), despite increasing evidence from World Bank researchers that 'terrorism' is based on poverty (Do and Iyer, 2005).

Ethnicity and criminal statistics

In 1965, McClintock brought out one of the Cambridge studies apparently showing that the Afro-Caribbean population (they weren't called that then!) were much more likely to be convicted of violent offences than the native white population. He 'forgot' to standardise for age and sex. His report was on the desk of the Home Secretary when the first *Race Relations Act* by James Callaghan was passed limiting the number of immigrants.

In the 1970s, there was a 'mugging' panic in London (Hall *et al*, 1978) when the *Daily Mail* was making a lot of mileage out of Metropolitan Police crime figures. Here the problem was victims reporting their assailants as black, even when they had not seen the assailants (presumably because the *Daily Mail* had told them that muggers were black!).

A similar situation arose in the second half of the 1990s, when the Metropolitan Police began to publish statistics on racial attacks. They suspended these in 2000 because it became clear that classifying an incident as a racist crime depended as much on the attitude of the victim to different ethnic groups as on what actually happened.

Conclusions

The message I want to finish with is that interpretation of both probability statements and crime figures is complex.

Probabilty statements depend on the careful examination of evidence. Although this is of course what lawyers are meant to do, their approach is usually antithetical to that of a statistician; more that of an artist presenting a coherent picture. Unfortunately, although frequently argued for, there is no clear

regulation governing the appearance of expert witnesses nor any control on what they say.

Crime figures reflect reported crime, not actual crime levels. Most scholars have argued that the numbers of incidents that are unreported far exceed those that are reported, including the current Head of Research, Development and Statistics, the research division of the Home Office (Bottoms and Wiles, 1985). There is therefore considerable scope for inaccuracies and drawing of spurious conclusions (Carr-Hill and Stern, 1980).

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Roy Carr-Hill is Professor of Medical and Social Statistics at the Centre for Health Economics at York University.

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