



MISUSE OF STATISTICS IN THE COURTROOM: THE SALLY CLARK CASE

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The Center for Statistics and Applications in Forensic Evidence Director and Distinguished Professor of Statistics Dr. Alicia Carriquiry walks us through a landmark case that got statistics wrong.

When forensic practitioners, lawyers and other expert witnesses use statistics appropriately, juries have a tool that can help them make a more informed decision about the guilt or innocence of a suspect. However, misrepresenting statistics in the courtroom can come at a high cost.

The Sally Clark Case is an infamous criminal case from the United Kingdom that illustrates how the use of inaccurate statistics in forensic science can lead to grave injustices.

WHO WAS SALLY CLARK?

In December 1996, Sally Clark was home alone with her apparently healthy baby Christopher, aged 2 and half months. Sometime during the evening, Sally found her baby unresponsive and called an ambulance. Resuscitation attempts failed and the baby was pronounced dead. A post-mortem report suggested death of natural causes and a possible lower tract respiratory infection.

Less than two years later in January of 1998, Sally's second baby Harry died at age two months under almost identical circumstances. The post-mortem report described signs of recent bleeding at the back of the eyes and in the spinal cord. Harry was an apparently healthy baby who was carefully observed by the UK's Care of Next Infants program, which provides resources to families who have previously experienced the sudden death of an infant.

Alerted by the same pathologist who had performed the autopsy on Christopher, the police arrested Sally and her husband on murder charges. Officials quickly dropped the charges against Steve Clark, but accused Sally of smothering her two children.

Aside from the two dead infants, there was no other evidence to suggest murder. Sally's friends and family praised her character and her mothering. Much of the evidence presented at trial for the prosecution came from medical experts, including renowned pediatrician Sir Roy Meadows.

The statistical argument

Using epidemiological data from the UK, Sir Meadows argued that two unexplained infant deaths (SIDS deaths) are extremely rare in a family such as the Clarks.

In the 1990s, the incidence of SIDS in the UK was approximately 1 in 8,500 in middle-class families with no known risk factors. Sir Meadows further argued that the two deaths could be considered to be independent events and that the probability of observing two SIDS deaths in the Clark family could be computed as $1/8,500$ squared, or 1 in 75 million.

The question is, can these two deaths really be treated as independent? Two SIDS deaths occurred in the same home under the supervision of the same two parents. How likely is it that those are unrelated events?

Jury confusion: The Prosecutor's Fallacy

It's not hard to see that these statistics could easily be misunderstood and are likely prejudicial. Many people believe that the chance of a rare event happening is the same as the chance of a suspect's innocence, an error known as the Prosecutor's Fallacy. In reality, these two probabilities are not equal: saying that there is a 1 in 73 million chance that the babies died of SIDS is not the same as saying that there is a 1 in 73 million chance that the mother did not kill them.

Understanding the Correct Statistical Applications

In Sally's case, we have two extremely rare events to examine. Either the two babies died of SIDS, or the two babies were murdered. The probabilities of both events are difficult, if not impossible, to compute precisely, and both are likely to be extremely small. Luckily, we do not need precise estimates for those probabilities. Instead, we just need a reasonable estimate of their ratio.

Using UK crime statistics and the exact same reasoning that Sir Meadows used in his testimony against Sally, we find that the probability that two infants will be murdered in the same household is just 1 in 2 billion.

When considering the likelihood of two SIDS deaths and the likelihood of two murders, the odds of Sally's guilt are very small, about 4%. It is in fact much more likely (about 95% more likely) that the babies died of SIDS than that they were murdered by their mother.

What happened to Sally?

In 2003 Sally's conviction was overturned on the basis of additional medical evidence of a possible bacterial infection in Harry. Sir Meadows used the same statistical arguments in other similar cases and was found guilty of professional misconduct in 2005, though the verdict was later overturned.

Sally Clark died on March 15, 2007, from a suspected heart attack thought to be a result of alcohol abuse. She was 42 and spent four years in prison because neither the judge nor the jurors could correctly interpret the significance of the numbers put forth by the expert witnesses.

LESSONS WE CAN LEARN

The Sally Clark case urges caution when using statistics in the courtroom. All parties must remember that there are always two (or more) sides to the story. Forensic scientists, jurors, lawyers and judges need to consider the probability of the evidence under the two competing hypotheses: the suspect is guilty or the suspect is not guilty. The ratio of these two probabilities is the likelihood ratio, and it can be approximated, if not explicitly calculated, in many cases. High values of the likelihood ratio would tend to support the hypothesis of guilt, while low values would tend to support the hypothesis of not guilty.

Armed with an accurate understanding of this key statistical concept, courts can prevent wrongful convictions such as Clark's through the correct interpretation of evidence.