

KAYE, D. H. (1987). Hypothesis tests in the courtroom. In *Contributions to the Theory and Application of Statistics* (A. Gelfand, ed.). Academic, Orlando, Fla.

LYKKEN, D. (1987). The validity of tests: Caveat emptor. *Jurimetrics J.* **27** 263-270.

SAKS, M. and KIDD, R. (1980-1981). Human information processing and adjudication: Trial by heuristics. *Law and Society* **15** 123-160.

SHAFER, G. (1986). The construction of probability arguments. *Boston Univ. Law Rev.* **66** 799-816.

## Comment: Base Rates and the Statistical Precision of Polygraph Tests in Various Applications

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In his analysis of the precision of medical screening procedures, Gastwirth discussed the effects of low base rates on the accuracy and utility of test data. The problem of low base rates has been discussed for many years in the psychologic literature (Meehl and Rosen, 1955). In general, when the prevalence of a characteristic such as AIDS or deception in the population is low, it is difficult for a test to improve upon the accuracy that would be obtained if only information about the base rate were used to make diagnoses. If the base rate of a disease is only 0.1%, then diagnosing all patients as disease-free would produce a diagnosis accuracy of 99.9%. To improve upon the accuracy attainable using only base rate information, the accuracy of a test to detect the disease would have to exceed 99.9%. Unfortunately, tests with that level of diagnostic accuracy are extremely rare, and populations with extreme base rates such as those encountered in screening situations are not uncommon.

In the polygraph literature, Raskin (1984) first called attention to the problem of low base rates in hearings before the Committee on Armed Services of the United States Senate on the proposed Department of Defense counterintelligence polygraph program. The Department of Defense was considering widespread testing of federal employees and defense contractors concerning unauthorized disclosures of sensitive information. The base rate issue was particularly important in that context because the vast majority of federal employees and contractors do not make unauthorized disclosures of sensitive information. The base rate of guilt in that population is

probably less than 1 in 1000. As discussed by Raskin (1984, 1986) and as Gastwirth's analyses clearly confirm, deceptive polygraph outcomes under those circumstances would be considerably less than 50% correct, even if it is assumed that the polygraph is 90-95% accurate on populations with equal base rates of truthful and deceptive individuals.

Gastwirth focused on a different but related problem. His work reveals that the sampling error of estimates of test accuracy increases as the incidence of the trait in the tested population departs from 50%. In addition to reducing confidence in test outcomes, skewed base rates increase the error in estimating test validity. This makes an already bad situation worse. To our knowledge, this important issue has not been addressed in the polygraph literature, nor has it been discussed in the broader literature on psychologic assessment.

Although we agree with the statistical conclusions drawn by Gastwirth, the implications of his work for applications of polygraph techniques merit further comment. Polygraph tests are used in many different contexts. Law enforcement and private polygraph examiners administer polygraph tests to suspects, defendants and witnesses during criminal investigations. Businesses make extensive use of polygraph tests to screen job applicants and to test employees periodically. Government agencies use polygraphs in criminal investigations and in cases involving risks to national security. The base rate of deception and the costs associated with false positive decision errors are more problematic in some contexts than in others.

Analyses of data from the United States Secret Service for a 2-yr period suggest that the base rate of guilt is about 45% in their criminal investigations (Raskin, 1986). Raskin also reported findings from 292 polygraph tests that he had conducted over a 12-yr period on a confidential basis for defense attor-

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