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# Thinking Like a Statistician

## The Report of the American Statistical Association Committee on Training in Statistics in Selected Professions

David H. Kaye

Legal scholars are flirts, or rather, some are. They flirt with one discipline after another, learning a little, distorting a little, and discerning—they say—a lot. At one time, it seemed that law and psychology were threatening to engulf the field of criminal law. In recent years, moral philosophy has infused writing on constitutional law with a new vocabulary. In many subjects, economic analysis has become an apparently indispensable working tool of legal scholarship. Even sociobiology has crept into a few niches in this hospitable environment.

The impetus for many of these interdisciplinary movements has come mostly from legal theoreticians. The application of statistical theory to legal analysis and proof is a different matter. Much recent interest in applying probability and statistics to legal matters has come out of the trenches, from developments in legal practice. Increasingly, in certain fields of practice, statistical argument has become part of the armamentarium of the attorney. Some courts have chastised the parties for using inferior statistical methods,<sup>1</sup> and some members of the bar, in turn, have criticized the law schools for “failing to teach quantification skills.”<sup>2</sup>

In 1983, a subcommittee of the American Statistical Association composed of legal educators and one judge<sup>3</sup> issued a report describing existing

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1. *Coble v. Hot Springs School District No. 6*, 682 F.2d 721, 731-32 (8th Cir. 1982).
2. A.B.A. Section of Legal Education and Admissions to the Bar, *Bar Bench and Bar Look at Legal Education*, Syllabus, November 1981, at 12, 6.
3. The members of the subcommittee were Robert Charrow, University of Cincinnati School of Law; Richard O. Lempert, University of Michigan School of Law; Jack B. Weinstein, Chief Judge of the United States District Court for the Eastern District of New York; Stanton Wheeler, Yale University Department of Sociology and Yale Law School; and Franklin E. Zimring, Director, Center for Studies in Criminal Justice, University of Chicago School of Law. The author of this article served as the chair of the subcommittee. The chairperson of the American Statistical Association's Committee on Training in Selected Professions is George T. Duncan, School of Urban and Public Affairs, Carnegie-Mellon University.

programs for educating law students in statistics and offering recommendations for improving these programs. This article summarizes that report.<sup>4</sup>

### **I. The Need for Statistical Expertise in Law**

The subcommittee's argument for formal statistical training in legal education is straightforward. "The life of the law," Oliver Wendell Holmes once wrote, "has not been logic: it has been experience."<sup>5</sup> Certainly, law is not a closed, deductive system. It is concerned with governing and coordinating human behavior. To be effective, it must assimilate and build on sound knowledge from a broad spectrum of disciplines. In appropriate circumstances, legislators, attorneys, judges, and legal scholars should and do draw on many sources of information. Although the profession has a fondness for anecdote and introspection (partly because in many matters of legal interest no better information is available), it also relies, with increasing frequency, on more systematic forms of empirical research. The discipline of statistics is concerned with organizing and analyzing the data from such research. Techniques of descriptive and inferential statistics offer systematic means for making sense of and drawing conclusions from past experience.

More specifically, the subcommittee identified the following as matters requiring statistical expertise that are important to the legal system: scientific and statistical evidence prepared for specific proceedings; program evaluation; psychological, sociological and economic studies; public health and epidemiologic data and studies; social and economic data.

### **II. Existing Training Programs for the Legal Profession**

#### ***A. Education Available to Law Students***

The time has passed when students entering law school could confidently assume that they had put all quantitative analysis behind them. But what is the extent of curricular offerings in statistics in law schools? To answer this question, the subcommittee wrote to the deans of all schools (170) approved by the American Bar Association as of 1981. It asked them to indicate which of the following three conditions applied at their schools (and to comment as they saw fit):

Response 1: Statistical theory or methods are taught in a class (or classes) specifically devoted to the subject.

Response 2: Statistical theory or methods are taught to some extent in a class (or classes) devoted to a broader or related subject.

Response 3: Statistical theory or methods are not taught in any of our classes.

4. For those interested in greater detail, a copy of the report may be obtained by writing the author.
5. Oliver Wendell Holmes, Jr., *The Common Law*, 5th printing, (Boston, 1923).

After some prodding, 151 schools (90 percent) responded.<sup>6</sup> Figure A displays the pattern of these responses.

Figure A. Distribution of responses  
to law school curriculum census

<i>Response</i>	<i>Frequency</i>
1 and 2 ++	7, or 5 percent
1 only ++	8, or 5 percent
2 only ++++++	22, or 15 percent
3 only ++++++	115, or 76 percent

About three-quarters (115) of the responding law schools provide no training in statistical theory or methods. The proportion for all law schools (including the ones not approved by the A.B.A. and therefore not contacted as well as the ones contacted but not responding to the census) almost certainly exceeds this figure. A few schools, such as the Harvard Law School, explained that law students had access to statistics classes at other units in the university. None indicated how frequently their students exercise this option.

About one-quarter (36) of the responding law schools say they have (or plan to have) *some* course offering that includes *some* instruction in statistical theory or methods (Response 1 or 2). Both public and private, and large and small enrollment institutions are well represented. The group seems to be above average with respect to one measure of the prestige of its members.<sup>7</sup>

A smaller group of 15 schools (about 10 percent) report a course offering whose central focus is statistical methodology (Response 1). These schools also include large and small, and public and private institutions. They tend to occupy high positions in the law school "pecking order," but not all highly rated law schools are included.<sup>8</sup> From their description, these courses,

6. Public and private, large and small, highly selective and less selective, and high and low "prestige" schools can be found among the nonrespondents. However, when the distribution of the rankings described at note 7 for nonrespondents is compared to that of the responding law schools, it appears that the nonrespondents tend to be drawn from the bottom half of the perceived hierarchy of law schools.

7. Efforts to assess the quality of professional schools, whether by objective criteria or by opinion polls, are perilous. Scott Van Alstyne, *Ranking the Law Schools: The Reality of Illusion?* 1982 *Am. B. Found. Research J.* 649-84. Since most proposed criteria tend to be highly correlated with one another and because the subcommittee sought to characterize a pattern rather than to determine the status of any particular school, it simply looked to the rankings in the Cartter Report on the Leading Schools of Education, Law, and Business, *Change* (February 1977), at 44. This poll of law school deans (which had a response rate of only 52 percent) classified the "top" ninety law schools into nine groups of ten. The median group ranking for the schools reporting some instruction in statistics is 4.5, which compares favorably to the median of 8.5 that characterizes all 170 accredited law schools.

8. The median of the Cartter Report group ratings of these law schools is 2.5. The distribution is shown below:

	+	+							
	+	+	+						
	+	+	+	+					
	+	+	+	+	+		+		+
Group rank	1	2	3	4	5	6	7	8	9

for the most part, seem comparable to a condensed, introductory undergraduate applied probability and statistics course for students who have no knowledge of calculus. Not surprisingly, the emphasis appears to be on applications to legal problems. Most of these courses apparently are taught by law professors, while others are taught by social scientists. A few, such as one offered in alternate years at the University of Chicago, are taught by statisticians.

The 32 courses that include some instruction in statistics but are not primarily devoted to the subject (Response 2) included law and economics (5), law and social science or social science methods (12), law and psychology (4), employment discrimination (8), and evidence (3). A few schools said that such classes as antitrust, civil procedure, contracts, and criminal law include instruction in statistical concepts.

In sum, instruction for law students in statistical methods or theory appears to be the exception rather than the norm in law schools. Of course, some students may have had training in statistics in undergraduate or graduate study, but the reason most law schools do not include such instruction in their curriculum is probably not that they fear it would be redundant.

### *B. Education Available to Practicing Attorneys*

Unfortunately, the subcommittee did not study the extent of instruction in statistics directed at practicing attorneys or judges. Some Continuing Legal Education courses probably include discussions of applications of statistics to law, as for example in the employment discrimination area. Symposia or workshops sponsored by private institutions may also give attorneys some exposure to statistical developments. Although the subcommittee presented almost no information on such postgraduate education, these efforts, while valuable in other ways, probably do not constitute systematic, sustained, or widely available instruction in statistics for attorneys.

### **III. What Lawyers Should Know About Statistics**

Because attorneys practice law, not statistics, the subcommittee reasoned that it is more important for them to be critical consumers of statistical arguments than to be statisticians in their own right. The subcommittee suggested that law school graduates should be competent users of descriptive statistics and graphical presentations and that they should understand the basic features of experimental design, survey techniques, statistical inference, and cost-benefit analysis.

### **IV. Recommended Training Programs for Law Students**

In considering the training law students ought to have in statistics, the subcommittee asked how much, where and when. It concluded that the minimum academic training available to law students should equal two semester hours of a basic course in applied probability and statistics. It also suggested that the ability to select and utilize expert statistical advice should be cultivated—in clinical or evidence-related courses, if not in an introductory law school course in statistics itself.

As to where and when law students should obtain such training, the subcommittee observed that a law school might choose to make an applied statistics course taught in a department of mathematics or statistics a prerequisite to a law school course or seminar on legal applications or clinical instruction in coping with expert statistical testimony. This would help ensure that students have a reasonably thorough introduction to basic statistical methods as well as some exposure to any special features of statistical assessments in law.

Insisting on particular prelaw courses, however, would be a major departure from present practice, and the subcommittee did not insist that the completion of an applied statistics course of the sort designed for mathematics and science majors is essential. An alternative is for the law school to offer its own core course. In some respects, this course might be something like a music appreciation course. The students need not train to be composers or soloists, but they should leave the course able to distinguish among a virtuoso performance, an acceptable rendition, and a bad technique. At the same time, attorneys should be prepared to make some statistical assessments of their own. They should realize, for example, that a mean is not generally the same as a median, and they should be able to decide which measure of central tendency is the most revealing for a given application. In terms of the musical metaphor, they are not merely passive listeners, but modest performers. A demonstrated ability to work simple problems may be necessary to acquire this statistics "appreciation and usage" skill, but the law school course could focus from the outset on the legal applications. For instance, the subcommittee pointed out that such a course might cover the following topics:

The meaning of probability: frequentist, personalist, and other interpretations; their applicability to proof in the courtroom;

The rules of probability: independent and dependent events; conditional probability; Bayes' rule;

Random variables and probability distributions: the binomial distribution; the normal distribution;

Describing data: graphical methods of exploratory data analysis; frequency distributions; measures of central tendency and of variability;

Populations and samples: sampling methods; experimental design; bias and the advantages of random sampling;

Sampling distributions: the sampling distribution of the sample mean; types of error;

Likelihood functions: Bayesian inference;

Decision theory: the legal standards of proof;

Multivariate methods: regression and analysis of variance; correlation and causation.

Perhaps optimistically, the subcommittee opined that a well-designed core course can cover these topics, at an introductory level suited to law students and their needs, in one semester. It suggested that where a law school's resources permit it, the law-trained instructor might teach the class together with a statistician or other individual broadly trained in statistics.

Although the report tends to treat the fundamentals of probability and statistics as matters to be taught in their own right, the subcommittee did not insist that this is the only way to teach material considered useful to lawyers

or that no law student would be fit to practice without academic credit in a statistics course. It spoke of "interstitial" treatment of these topics as a possible way to convey some material. In addition, despite the role of statistical proof in certain specialized fields such as trademark and unfair competition and employment discrimination, it recognized that many lawyers can serve their clients quite well without resorting to anything more than rather simple statistical concepts in their daily practice.

Nevertheless, the committee emphasized that statistical thinking is both a valuable part of a general liberal arts education and a useful skill in legal planning and litigation. Law schools, it said, should make special efforts to encourage and facilitate the study of statistics. Such efforts may include publicizing for the students the kinds of practice that will require them to have more than an intelligent layman's knowledge of statistics, giving law school course credit to students who successfully complete courses in statistics outside the law school, offering statistics courses within the law school, and dealing with statistical concepts as they arise in such traditional law school subjects as torts, constitutional law, criminal law, and evidence.

#### **V. Summary of Recommendations**

The bottom line of the report is its summary of recommendations to legal educators:

Law schools, in advising undergraduates about good preparatory courses for law school, should include applied probability and statistics in their recommendations.

Law schools should offer instruction in legal applications of statistics, including some clinical training in dealing with experts.

Law schools that do not themselves offer an introductory survey course in statistics should award academic credit to a law student without prior training in statistics who successfully completes an undergraduate class in the subject.

Law schools that offer an introductory course in statistics should consider staffing the course with a person trained in statistics as well as a person trained in law.