PROBABILITY SAMPLING IN LITIGATION

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Random sampling is a widely used and well-established techniques used to reduce the cost of providing interpretable data. This paper discusses examples in the several different kinds of litigation in which random sampling has been useful. The paper concludes with speculation about the possible use of random sampling in mass tort litigation.

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This paper aims to contribute to a discussion of the possibility of using statistical methods to handle mass tort cases efficiently. After reviewing the basics of sampling, the paper summarizes cases involving sampling that the author participated in. The conclusion gives some thoughts on how mass tort litigation might be approached statistically.

I. PROBABILITY SAMPLING

The purpose of random sampling is to allow inference from the items observed to items unobserved. It is usually used to save the effort of having to observe each member of a population.

It is important to distinguish random sampling from other kinds of sampling. The hall-mark of random sampling is the use of a random number table or an equivalent computer program to choose units. The reason for the use of random numbers is to make transparent the process by which items are chosen for observation. This is important because without randomization, biases can creep in, whether advertent or inadvertent, that can destroy the validity of the inference to unobserved members of the population. While often random sampling is implemented in which each item has the same probability of selection, this is not necessary. What is necessary is that the probability of selection of each item be known in advance.[1]

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Perhaps an example would illustrate this important point. Imagine a clinical trial of two treatments for a particular medical condition. Suppose that the physician (we'll call her Phyllis) who actually treats the patients observes the health of the patients in two categories, healthy and not, but this observation will not be available to those responsible for analyzing the results. Suppose also that healthy patients do better, whatever treatment is assigned to them, than do unhealthy patients. If Phyllis believes that one treatment is suitable for healthy patients and the other for unhealthy patients, and assigns treatments that way, the results of the trial will favor the treatment she assigns to healthy patients. If Phyllis wishes one treatment to be favored in the results, she can achieve this by her treatment assignments. In the first case her motives were pure, she was simply assigning treatments to help her patients as best she could. In the second case, her motives could be malign, for example, if she had a financial stake in her favored treatment. But her actions would be the same, and the consequences would be the same. Only by random sampling, where the decision of which treatment is assigned to a patient is removed from Phyllis, can outside observers be confident of lack of bias in the result.[2]

A relative of random sampling is systematic sampling, in which every k^{th} member of a list is used as a sample, starting with some arbitrary member of the list.[3] Whether this is an adequate substitute for random sampling depends on the circumstances and the ordering of items in the list. Often the use of systematic sampling is benign. However, I remember one case in which systematic sampling was used to choose jury venires in Atlantic County, New Jersey.[4] This has the effect that all persons with the same last name are adjacent in the list. Jurors were listed alphabetically starting with the fifth letter of their last name. There had been a previous system found to be discriminatory. A local bank proposed the following replacement. Often the choice of k was small, like 2 or 3. The consequence of this was that there were, more often than would have been true had the sampling been random, people in the same family, with the same last name, chosen for the same jury venire. Attorneys facing such a venire felt that they had to use peremptory challenges on every member of such a family if they challenged any member, to avoid offending potential jurors. The effect was

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[1] *See* WILLIAM G. COCHRAN, SAMPLING TECHNIQUES 10-11 (J. Wiley & Sons 1977).

[2] For more on this example, *see* Scott M. Berry & Joseph B. Kadane, *Optimal Bayesian Randomization*, J. ROYAL STAT. SOC'Y B (1997).

[3] *See* COCHRAN, *supra* note 1, at ch. 8.

[4] State v. Long, 499 A.2d 264 (N.J. Super. Ct. Law Div. 1985).

to reduce the number of useable peremptory challenges available to the parties. This jury challenge was successful.

Sometimes there are special considerations that make it wise to separate a population of interest into various subpopulations, called strata, and to sample from each stratum. This, not surprisingly, is called stratified sampling. There are useful formulae to guide the choice of sample sizes for each such stratum.[5]

Another useful technique is sampling proportional to size. This is especially useful in sampling financial transactions in which the questions of interest center on dollar amounts rather than on typical items. Then if items are chosen for analysis according to the size of the transactions, a more accurate estimate of the dollar consequences of the transactions can result.[6]

Two standard references on random sampling are Cochran (1977)[7] and Kish (1995).[8]

II. AN EARLY LEGAL EXAMPLE

Like new members of many organizations, new scientific methods go through a period of hazing by the legal system before accepted. For example, in *Sears, Roebuck and Co. v. City of Inglewood*, a random sample of days was selected to determine the proportion of sales made to non-residents of Inglewood (and therefore not subject to a sales tax). The best estimate from that sample was $28,250 with a standard deviation of $2,100, or a 95% confidence interval of $24,000 to $32,400 (per quarter for 11 quarters). The judge in the case rejected the sampling evidence, but permitted Sears to do a complete audit, which found the figure of $26,750 per quarter (not counting some unavailable sales tickets).[9]

III. MORE RECENT EXAMPLES

This section is a brief survey of some cases that involve sampling, to display the wide variety of situations in which the technique is a cost-effective method of determining the approximate truth. I begin with

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[5] *See* COCHRAN, *supra* note 1, at ch. 5.

[6] *Id.* at 250.

[7] *Id.*

[8] LESLIE KISH, SURVEY SAMPLING (J. Wiley & Sons 1995).

[9] *See* R. Clay Sprowls, *The Admissibility of Sample Data into a Court of Law: a Case History*, 4 UCLA L. REV. 222 (1956-57) I did not participate in this case, and have no other source about it than Sprowls.

some disclaimers. First, this is nothing like a random sample of cases. Many of them are cases about which I have personal knowledge, because I was involved in them as an expert witness. Because many cases settle without a public record and few legal opinions say much about the sampling methods used, personal experience with cases seems an essential source of information. Second, some of the cases alluded to are still being litigated, and I am necessarily restricted in what I can say about them. Table 1 displays the topics to be discussed.

A. REMITTITURS

When a plaintiff has won a tort case, and damages have been awarded by a jury, the defendant can ask for a remittitur, under which the judge requires the plaintiff to accept a smaller damage award or a new trial, sometimes only on damages, sometimes on liability as well. The choice of a new trial seems required by the Seventh Amendment in federal cases, although this choice has been criticized as a sham.[10] While the traditional criterion for awarding a remittitur is whether the jury award "shocks the conscience of the court", New York, in a new law adopted in 1986 requires comparison with other similar cases. This requires the court to identify the cases it considers to be comparable, and then to analyze the amounts awarded to find the appropriate amount of remittitur in the case before it. Judge Weinstein, applying New York law, did this in the case of *Geressy v. Digital Equipment Corporation*.[11]

There are several issues raised by this procedure. The first is the criteria used to determine comparability. A second is the database of cases available for study. This is usually cases of record, which omit cases that settled under conditions of confidentiality. Since plaintiffs are one-time players, while insurance companies are not, this asymmetry gives an incentive for secret settlement of cases with large damages. Third, when a list of comparable cases has been assembled, what remittitur should result?[12]

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[10] Suja A. Thomas, *Re-Examining the Constitutionality of Remittitur Under the Seventh Amendment*, 64 OHIO ST. L.J., 731 (2003); Joseph B. Kadane, *Calculating Remittiturs*, 8 L. PROBABILITY & RISK 125-31 (2009).

[11] Geressy v. Digital Equip. Corp., 980 F. Supp. 640 (E.D.N.Y. 1997).

[12] On the latter point, *see* Kadane, *supra* note 10; Joseph B. Kadane, *Response to Professor Haug*, 8 L. PROBABILITY & RISK 137 (2009); Mark Haug, *Comment on Calculating Remittiturs by Kadane*, 8 L. PROBABILITY & RISK 133-35 (2009).

B. CROSS-SECTIONAL JURY CHALLENGES

A jury challenge is a motion to enforce the constitutional right to a jury venire composed of a representative cross-section of the community. Only some groups of people are considered "cognizable", notably those based on race, sex and ethnic origin. Usually such a claim compares the proportion of a cognizable group in a series of venires to the proportion in the community often using census data.[13] Data on the race, sex and ethnic origin of jury venires is often difficult to obtain, even concerning federal juries.[14]

C. STOPS ON THE NEW JERSEY TURNPIKE

The issue in this case is whether blacks were being stopped for traffic violations on the southern end of the New Jersey Turnpike at extraordinarily high rates.

A study from a stationary vantage-point (a bridge over the turnpike) yielded an estimate of 13.5% black drivers. A moving survey (from a car set on cruise-control at or near the speed limit) found roughly 15% black drivers, and that nearly all drivers were speeding, so the police, in principle, could stop whomever they wished. The proportion of black drivers among those stopped was about 46.2%, so the disparity was large, supporting a claim of differential enforcement of the law. The upshot was (1) evidence seized in about 15 stops was suppressed; (2) a consent decree with the Civil Rights Division of the Justice Department; and (3) some reform of the practices of the New Jersey State Police.[15]

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[13] For more on jury challenges generally, *see* David Kairys, Joseph B. Kadane & John P. Lehoczky, *Jury Representativeness: A Mandate for Multiple Source Lists*, 65 CALIF. L. REV. 776 (1977).

[14] N. Chernoff & Joseph B. Kadane, *Preempting Jury Challenges: Strategies for Courts and Jury System Administrators*, JUST. SYSTEMS J. (forthcoming 2012).

[15] *See* Joseph B. Kadane & Norma Terrin, *Missing Data in the Forensic Context*, 160 J. ROYAL. STAT. SOC'Y A 351-57 (1997); Joseph B. Kadane & John Lamberth, *Are Blacks Egregious Speeding Violators at Extraordinary Rates in New Jersey?*, 8 L. PROBABILITY & RISK 139 (2009); JOSEPH COLLUM, THE BLACK DRAGON: RACIAL PROFILING EXPOSED (2010); State v. Soto, 734 A.2d 350 (N.J. Super. Ct. Law Div. 1996).

D. WORKERS COMPENSATION INSURANCE

The law in many states requires employers to carry worker's compensation insurance, in case of an injury in the work-place. Private insurers offer such insurance, and participate in a high-risk pool in proportion to the premia for workers compensation insurance written by that insurer in that year. This gives each insurance company an incentive to under report. In a series of lawsuits, several insurance companies are accused of having done so, for example by attributing more premium to related auto and general liability insurance, so as to minimize their apparent workers compensation premium. Policy/years are being sampled to determine the truth of such allegations, and, if true, their extent. I serve as a court-appointed neutral expert to guide such sampling.

E. SALES TAXES

Pennsylvania sales tax excludes medication. Thus, Scope, which has no medication, is taxed, but Listerine, which has medication, is not taxed. The law requires retailers to collect sales tax. If the retailer fails to collect the tax owed, it must pay the missing tax to the state. If it erroneously collects tax, it must pay those funds to the state as well.

In a sales tax audit, the auditor told his team to be sure to include in the sample any Scope transactions they ran across. Thus, the sample was not random. In defense, I testified that I thought the retailer owed the $6 found in uncollected tax, but not the $300,000 the state wished to extrapolate from the $6 they found. This case raises a general issue that the cost that might be gleaned from a random sample of transactions is a probability distribution for how much the taxpayer owes. But this does not specify how much the check should be.[16]

F. DISABILITY ACCESSIBILITY OF APARTMENTS

The Americans with Disabilities Act requires that apartments be accessible to the handicapped. To enforce this, architects sent to apartment complexes and select certain apartments to be assessed. If the selection of those apartments is not done by a random sample, the results cannot be reliably extrapolated to the apartments that were not inspected.

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[16] For commentary on this issue, *see* Joseph C. Bright, Joseph B. Kadane & Daniel S. Nagin, *Statistical Sampling in Tax Audits*, 13 LAW & SOC. INQUIRY 305 (1988).

G. INDIAN OIL AND GAS CLAIMS

The federal government has a fiduciary responsibility to collect royalties for oil and gas leases on Indian tribal lands. The tribes allege that it has not done so correctly, and have sued. To asses these claims, a random sample of leases is taken, and audited. An important difficulty is that the records kept by the Interior Department are incomplete.[17]

H. MEDICARE FRAUD

This case involved the defense of a physician who was accused of requiring medically unnecessary testing of patients in a laboratory he owned. The government wished to establish its case using a random sample of the patient records of the physician in question. Since the government's case was essentially an allegation of pattern or practice, it seemed that a random sample of carefully reviewed cases could be more informative than a hasty examination of every record. I was asked to testify that this sampling was an inherently unscientific approach, and the government should be required to examine every patient record. This I declined to do. It is possible to me that the law might require every patient record to be examined; scientifically a random sample of adequate size is sufficient.[18] The defendant spent some time in prison.

IV. CONCLUSION

Random sampling is now widely used in litigation. Properly applied, it is an efficient way to find reasonable estimates of the facts, and the theory permits estimation of the sampling error.

There is interest in applying statistical sampling to mass tort litigation. In these cases, a large number of injured people are joined in a class, and liability has been found. The issue is how much to award to each person. Their circumstances and extent of injury (financial, physical, etc.) typically vary. The standard of the law, that each injured person deserves to have their individual case heard and judged, is administratively impossibly burdensome. Roughly the idea is to try a few cases, and use the outcome of

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[17] For one aspect of this work, *see* Mary S. Fowler & Joseph B. Kadane, *Oil and Gas on Indian Reservations: Statistical Methods Help to Establish Value for Royalty Purposes*, 14 J. STAT. EDUC. 3 (2006).

[18] Joseph B. Kadane, *Ethical Issues in Being an Expert Witness*, 4 L. PROBABILITY & RISK 21 (2005).

those cases as guides to settle the rest. An argument is made[19] that deliberate choice would better serve the ends of justice than the present system that allows the parties to speed or delay trials they deem to be helpful or harmful to their clients' interests. I believe that statistical ideas could be used in this setting, but just how to do it would depend on the specific context. I would look for variables that are believed to be important to determining the liability and the extent of damages. These might be used to create strata to be sampled from. More parsimoniously, a regression model (linear or non-linear) might be used. Until there is an actual case to address, these ideas should be taken as speculations.

Table 1: Brief description of the cases discussed

	Nature of Case	Legal Question	Sampled Items	Special Consideration	References
a.	remittiturs	is award in line with awards in comparable cases?	comparable cases	which cases are comparable? 7th amendment vs. due process	Thomas (2003); Kadane (2009a); Kadane (2009b)
b.	cross-sectional jury challenge	is the jury venire an adequate cross-section of the population?	jurors (race, sex, etc.)	date hard to get standards of adequacy	Jury work; Kairys, Kadane & Lehoczky (1977); NJ cases; Chernoff and Kadane (2011)
c.	stops on the NJ turnpike	racially differential law enforcement	drivers (race)	mind of officer missing race data	NJ v. Soto (1996); Kadane & Terrin (1997); Kadane & Lamberth (2009); Collum (2010)

[19] Alexandra Lahav, *Rough Justice* (2011) (unpublished manuscript) (on file with the Connecticut Insurance Law Journal).

d.	workers compensation insurance	premiums appropriately reported to pool	WC insurance contract	availability of hard copy records	in litigation
e.	sales taxes	properly collected?	items sold and taxes collected	right of defendant to have all records examined	Bright, Kadane & Nagin (1988)
f.	disability accessibility of apartments	apartment complex in compliance with ADA?	apartment units	safe harbors	In litigation
g.	Indian oil and gas claims against federal government	proper collection of royalties	lease years	adequacy of records	Fowler & Kadane (2006)
h.	Medicare fraud	patient treatments appropriately billed	patient records	ethical issue	Kadane (2005)