

# **The Statistics of Discrimination**

**Using Statistical  
Evidence in  
Discrimination Cases**

---

**2013-2014 Edition**

---

---

---

---

---

---

**Ramona L. Paetzold  
Steven L. Willborn**

---

# The Statistics of Discrimination

Using Statistical  
Evidence in  
Discrimination Cases

2013-2014 Edition

Issued in October 2013

---

---

---

By

**RAMONA L. PAETZOLD**

*Texas A&M University*

and

**STEVEN L. WILLBORN**

*University of Nebraska*



THOMSON REUTERS™

*For Customer Assistance Call 1-800-328-4880*

© 2013 Thomson Reuters

For authorization to photocopy, please contact the **Copyright Clearance Center** at 222 Rosewood Drive, Danvers, MA 01923, USA (978) 750-8400; fax (978) 646-8600 or **West's Copyright Services** at 610 Opperman Drive, Eagan, MN 55123, fax (651) 687-7551. Please outline the specific material involved, the number of copies you wish to distribute and the purpose or format of the use.

This publication was created to provide you with accurate and authoritative information concerning the subject matter covered; however, this publication was not necessarily prepared by persons licensed to practice law in a particular jurisdiction. The publisher is not engaged in rendering legal or other professional advice and this publication is not a substitute for the advice of an attorney. If you require legal or other expert advice, you should seek the services of a competent attorney or other professional.

ISBN 978-0-314-60872-7

*For  
Steve*

*RLP*

*For  
Elizabeth, again*

*SLW*

## About The Authors

**Ramona L. Paetzold** is a Professor of Management at Texas A & M University. She holds affiliated appointments with the Department of Women's and Gender Studies and the Department of Psychology, and her research interests are at the nexus of statistics, discrimination, and psychology, particularly in the areas of sexual harassment and disability. She has published extensively in law reviews, social psychology journals, and statistics journals. She received her B.A. (1974, mathematics), M.B.A. (1977, quantitative methods), M.A. (1978, mathematics), and D.B.A. (1979, applied statistics) degrees from Indiana University, Bloomington. She also received a J.D. (1990, University of Nebraska-Lincoln). She has previously taught at Carnegie-Mellon University and the University of Maryland. At Texas A & M, she has held both the Muse Research Fellowship and the Mays Research Fellowship.

**Steven L. Willborn** is the Judge Harry A. Spencer Professor of Law at the University of Nebraska College of Law. Among many other activities, he has been Dean of the Law College at Nebraska; Chair of the Board of Directors of the Law School Admission Council; President of the International Association of Labor Law Journals; Chair of the United States Branch of the International Society for Labor and Social Security Law; and one of Nebraska's Commissioners on the Uniform Law Commission. He has published widely on topics relating to labor, employment, and discrimination law. He received his undergraduate degree from Northland College (1974) and M.S. and J.D. degrees from the University of Wisconsin-Madison (both in 1976).

# Acknowledgements

This is a book written by people from different institutions; about a range of subjects that, although unified by discrimination, is broad; and for a class of readers that includes lawyers without any statistical training, statisticians without any legal training, and every possible combination in between. As a result, we owe debts to a broader than usual assortment of people and institutions.

We asked many people to review various portions of the manuscript. We imposed on our friends and even had the temerity to seek reviews from the leading authorities in several areas, often people whom we barely knew. (Let us hasten to add, of course, that our friends are often leading authorities as well!) Everyone we asked agreed to help (well, almost) and the book has been much improved by the comments we received. Special thanks, then, to David C. Baldus (Iowa), C. Steven Bradford (Nebraska), James W. L. Cole, Leonard D. Fromm (Indiana), Rafael Gely (Texas A&M), Samuel Issacharoff (Texas), Roger W. Kirst (Nebraska), James A. Kushner (Southwestern), Josephine R. Potuto (Nebraska), Robert F. Schopp (Nebraska), Stewart J. Schwab (Cornell), Robert G. Schwemm (Kentucky), and William E. Thro (Colorado Attorney General's Office).

We also had the help of a fine group of student research assistants who, as usual, provided inadequately compensated, but thoroughly diligent assistance. Thanks in this category go to Christine Abraham, David Addison, Jarrod Boitnott, Ann Bose, Yvonne Eixman, and Steven Murray.

We also received substantial assistance from a variety of institutions. Special thanks in this category go to the University of Nebraska College of Law and to the Texas A&M University Department of Management.

We are grateful for the permission of Shepard's/McGraw-Hill, David C. Baldus, and James W. L. Cole to draw on portions of David C. Baldus & James W. L. Cole, *Statistical Proof of Discrimination* (1980 & 1987 Supp.).

# Introduction

For the rational study of the law the black-letter man may be the man of the present, but the man of the future is the man of statistics and the master of economics.

Oliver Wendell Holmes (1897)<sup>1</sup>

The odds were, we suppose, that a book on statistical proof of discrimination would begin with this famous Holmes quotation. Holmes' crystal ball was clearly clouded on some of the detail. The term "man" turned out to be quite underinclusive, as was the apparent assumption that statistics would be important only for the study of law and not for its most intimate internal workings as well. But, as usual, the general thrust was right. Holmes' future is now—statistical analysis has become a central means of proving discrimination in a wide variety of settings. In broad terms, the purpose of this book is to assist those who are grappling with that present and to ease the transition into a future that is likely to provide further confirmation of Holmes' prediction.

Statistical analysis is an important and potent way to prove discrimination. "Figures speak," the Fifth Circuit has said, "and when they do courts listen."<sup>2</sup> In Title VII<sup>3</sup> cases, the value of statistical evidence has increased over time because, as the more blatant forms of discrimination became

---

<sup>1</sup> *The Path of the Law*, 10 Harv L Rev 457, 469.

<sup>2</sup> *Brooks v. Beto*, 366 F2d 1, 9 (CA5 1966), cert den 386 US 975 (1967). Many courts have made similar statements. See, e.g., *Teamsters v. United States*, 431 US 324, 339, 97 S Ct 1843, 52 L Ed 2d 396 (1977) ("[s]tatistical analyses have served and will continue to serve an important role' in cases in which the existence of discrimination is a disputed issue") (quoting *Mayor of Philadelphia v. Educational Equality League*, 415 US 605, 620, 94 S Ct 1323, 39 L Ed 2d 630 (1974)); *Alabama v. United States*, 304 F2d 583, 586 (CA5 1962), affd per curiam, 371 US 37 (1962) ("Statistics often tell much, and Courts listen"); *NAACP v. Corinth*, 83 FRD 46, 59 (ND Miss 1979) ("[s]tatistical proof has often assumed a significant, if not dominant, role in the conduct of [employment discrimination] litigation").

<sup>3</sup> Civil Rights Act of 1964, Title VII, as amended, 42 USCA §§ 2000e to 2000e-17 (hereinafter cited as Title VII).

rarer,<sup>4</sup> the power of statistical analysis to detect and quantify less obvious patterns of behavior became more important. But, of course, statistical analysis in discrimination cases did not begin with Title VII, nor has it been restricted to employment cases. In one sense, this book is an extended argument that statistical analysis is an important way to prove discrimination in a broad range of settings: it cites literally hundreds of cases, arising over a long period of time and from many different substantive areas, that rely on statistical analysis to prove discrimination. At the same time, the book emphasizes the crucial importance of using statistical analysis properly, of paying due attention to its limitations as well as to its strengths.<sup>5</sup>

This book is directed to both of the principal groups involved in this enterprise: lawyers and social scientists. One of our goals is to provide lawyers interested in discrimination law with a sufficient background in statistical analysis to comprehend and assess the numbers they encounter. This group includes practicing lawyers who litigate cases and advise clients, of course, but it also includes judges, academics, and policy makers. The task is especially important because lawyers, to some extent, are self-selected to be uncomfortable with numbers; many bright undergraduates who are comfortable with numbers head toward medical school or other scientific disciplines (perhaps to become statistical experts in discrimination cases). We also hope to provide social scientists and statisticians interested in discrimination issues with a background in discrimination law sufficient to guide them in shaping their analyses.

---

<sup>4</sup> In the early days of antidiscrimination laws, direct statements of discriminatory intention were not uncommon. See, e.g., *Butta v. Anne Arundel County*, 473 F Supp 83, 87 (D Md 1979) (employer told white applicant that he would prefer to fill position with black person); *Slack v. Havens*, 1973 WL 339, 7 FEP Cases 885 (SD Cal 1973), *affd* as modified 522 F2d 1091 (CA9 1975) (black workers told they should "stay in their place"). As employers have become more aware of the costs of discrimination (and, perhaps, as discrimination itself has lessened), such blatant statements have become less common.

<sup>5</sup> Although the courts have relied heavily on statistical analysis, see note 2, they have also pointed out the importance of carefully considering such evidence. See, e.g., *Teamsters v. United States*, 431 US 324, 340 (1977) ("statistics are not irrefutable . . . their usefulness depends on all the surrounding facts and circumstances"); *Bryant v. International Schools Services*, 675 F2d 562, 573 (CA3 1982) ("the story statistics tell depends, not unlike beauty, upon the eye and ear of the beholder, and [thus] we must apply a critical and cautious ear to . . . statistical presentation").



Ultimately, statistical analysis can only be useful in the law to the extent it focuses on issues that are legally relevant; we hope this book helps social scientists to understand what falls within that category.

Finally, by assisting both groups, we hope this book improves the interaction between lawyers and social scientists. The struggle against discrimination, which is one of this nation's most important and long-standing efforts, can only benefit to the extent the two groups can work together, with a minimum of misunderstanding, to plan and execute studies which generate useful quantitative evidence.

The two chapters in the first segment of the book (Part 1: Introduction to Statistics and Discrimination) are directed to these two groups. Chapter 1 is directed primarily to social scientists. It discusses the models developed by the law to prove discrimination. The models isolate the legally relevant issues, the issues that any useful statistical analyses must bear upon. Chapter 2 is a brief introduction to statistical reasoning, directed primarily to lawyers. The basic structure of statistical modeling and inference is described and discussed. The discussion highlights the limits of statistical inference in legal settings and the possibility of conflict between legal and statistical reasoning.

The second segment (Part 2: Using Statistics to Prove Discrimination) is the heart of the book. It discusses how statistical analysis is used to prove discrimination by focusing on Title VII employment discrimination cases. The segment is divided into chapters that discuss statistical analysis primarily within particular legal models of discrimination. Chapter 3 focuses on the individual disparate treatment model, Chapter 4 on systemic disparate treatment, Chapter 5 on disparate impact, Chapter 6 on discrimination in compensation, and Chapter 7 on age discrimination.

Finally, Chapter 8 discusses a statistical approach based on a competing philosophy—Bayesian Analysis—and compares both the approach and the philosophy with the current methods used in discrimination cases. The chapter sheds light on underlying assumptions of current approach and indicates one possible direction for developments as we head further into Holmes' future.

# WestlawNext™

## THE NEXT GENERATION OF ONLINE RESEARCH

WestlawNext is the world's most advanced legal research system. By leveraging more than a century of information and legal analysis from Westlaw, this easy-to-use system not only helps you find the information you need quickly, but offers time-saving tools to organize and annotate your research online. As with Westlaw.com, WestlawNext includes the editorial enhancements (e.g., case headnotes, topics, key numbers) that make it a perfect complement to West print resources.

- FIND ANYTHING by entering citations, descriptive terms, or Boolean terms and connectors into the WestSearch™ box at the top of every page.
- USE KEYCITE® to determine whether a case, statute, regulation, or administrative decision is good law.
- BROWSE DATABASES right from the home page.
- SAVE DOCUMENTS to folders and add notes and highlighting online.

SIGN ON: [next.westlaw.com](http://next.westlaw.com)

LEARN MORE: [store.westlaw.com/westlawnext](http://store.westlaw.com/westlawnext)

FOR HELP: 1-800-WESTLAW (1-800-937-8529)

## RELATED PRODUCTS

---

### LITIGATION

**Avoiding and Defending Wrongful Discharge Claims (*ADWDC*)**

Stephen P. Pepe and Sott H. Dunham

**Defense of Equal Employment Claims, 2nd (*DEFEECL*)**

John F. Buckley and Michael R. Lindsay

**Disability Discrimination in Employment (*DISDE*)**

John J. Coleman, III

**Disability Discrimination in the Workplace (*DISDW*)**

Gary E. Phelan and Janet Bond Arterton

**Employment Discrimination Coordinator (*EDC*)**

**Employment Discrimination Coordinator—Primary Source Material**

**Employment Discrimination Law 3d**

Abigail Cooley Modjeska

**Employment Discrimination Law and Litigation (*EMPLL*)**

Merrick T. Rossein

**Employment Discrimination PowerLink CD-ROM**

**Employment Law Checklists and Forms (*EMPL-CF*)**

Andrew J. Ruzicho and Louis A. Jacobs

**ERISA Practice and Litigation (*ERISA-PL*)**

Lee T. Polk

**Litigating Age Discrimination Cases (*LITADCS*)**

Andrew J. Ruzicho and Louis A. Jacobs

**Litigating Wrongful Discharge Claims (*LITWDCS*)**

Paul H. Tobias

**Manual on Employment Discrimination and Civil Rights Actions  
(*MEDCRA*)**

the Honorable Charles R. Richey

**Pattern Discovery: Employment Discrimination (*PDED*)**

Douglas Danner and Larry L. Varn

**Pattern Discovery: Employment and Labor Law**

Douglas Danner and Larry L. Varn

**Sex-Based Employment Discrimination (*SBEDIS*)**

Susan M. Omilian and Jean P. Kamp

**The Statistics of Discrimination (*STATDIS*)**

Ramona I. Paetzold and Steve L. Willborn

## THE STATISTICS OF DISCRIMINATION

### **The USERRA Manual: Uniformed Services Employment & Reemployment Rights (*USERRA*)**

Kathryn Piscitelli and Edward Still

### **COMPLIANCE**

#### **Disability Law Compliance Manual 2d (*DLCM*)**

Gary S. Marx

#### **Disability Law Compliance Report (*DLCR*)**

Gary S. Marx

#### **Drug Testing Law, Technology and Practice (*DRUGTEST*)**

David G. Evans

#### **Employment Law (*EMPLOYLAW*)**

Mark A. Rothstein

#### **Employment Practices Manual (*EMPPM*)**

Andrew J. Ruzicho and Louis A. Jacobs

#### **Employment Practices Update (*EMPPU*)**

Andrew J. Ruzicho and Louis A. Jacobs

#### **Federal and State Guide to Employee Medical Leave Benefits and Disabilities Laws (*FSGEML*)**

David G. Evans

#### **Occupational Safety and Health Law (*OSHL*)**

Mark A. Rothstein

#### **Occupational Safety and Health Law: Compliance & Practice (*OSCP*)**

J. Larry Stine, Mark A. Waschak, and Elizabeth K. Dorminey

#### **Wage and Hour Law: Compliance and Practice (*WHLCP*)**

Les A. Schneider and J. Larry Stine

### **GENERAL LABOR AND EMPLOYMENT**

#### **Age Discrimination 2d**

Howard G. Eglit

#### **Americans With Disabilities Act Annotated**

Arlene Mayerson

#### **Employee Privacy Law (*EMPPL*)**

L. Camille Hébert

#### **Employment Alert (*EMPALERT*)**

#### **Employment Coordinator (*EMPC*)**

#### **Employment PowerLink CD-ROM**

#### **Guide to Employment Law and Regulation 2d (*GELR*)**

#### **Investigating Employee Conduct (*IEMPC*)**

William E. Hartsfield

#### **Labor and Employment Law: Compliance Litigation 3d (*LELCL*)**

## RELATED PRODUCTS FROM WEST

Frederick T. Golder and David R. Golder

### **LABOR PRACTICES**

**Employee and Union Member Guide to Labor Law** (*EUMGLL*)  
the National Labor and Employment Committee of the National Lawyers Guild

**Federal Labor Law: NLRB Practice** (*FEDNLRB*)  
Lee Modjeska and Abigail Cooley Modjeska

**Labor-Management Relations: Strikes, Lockouts and Boycotts**  
(*LABMANREL*)  
Douglas E. Ray, Christopher David Ruiz Cameron,  
William R. Corbett

### **BENEFITS PRACTICE**

**Employee Fringe and Welfare Benefit Plans** (*EMPFRINGE*)  
Michael J. Canan and William D. Mitchell

**ERISA Practice and Procedure** (*ERISA-PP*)  
Ronald J. Cooke

**Nonqualified Deferred Compensation Plans** (*NQDCOMPPL*)  
Bruce S. McNeil

**Qualified Retirement Plans** (*QRP*)  
Michael J. Canan

**Welfare Benefits Guide: Health Plans and Other Employer  
Sponsored Benefits** (*WELFAREBG*)  
Paul J. Routh

### **HUMAN RESOURCES**

**Employee Relations in Action**

**Employment Law Deskbook** (*EMPDESK*)  
Merrick T. Rossein

**Essential Facts: Employment** (*EFE*)  
Robert J. Nobile

**Guide to Employee Handbooks** (*GTEH*)  
Robert J. Nobile

**Guide to HR Policies and Procedures Manual** (*GTHRPP*)  
Robert J. Nobile

**HR Advisor Journal** (*HR-ADV*)  
Alan Weitzman, Editor in Chief

**HR Series Policies and Practices** (*HRS-PP*)  
**Human Resources Guide** (*HRGD*)  
Robert J. Nobile

**Legal Guide to Human Resources** (*LGHR*)  
Steven C. Kahn and Barbara Berish Brown

## THE STATISTICS OF DISCRIMINATION

### **Termination of Employment** (*TERMEMPL*)

James O. Castagnera, Patrick J. Cihon, and Andrew P. Morriss

### **Termination of Employment Bulletin** (*TERMEMPB*)

James O. Castagnera, Patrick J. Cihon, and Andrew P. Morriss

## **HR COMPENSATION AND BENEFITS**

### **Benefits Guide** (*BNGD*)

Michael B. Snyder

### **Employee Benefits Handbook**

Jeffrey D. Mamorsky

### **HR Series Compensation and Benefits** (*HRS-CB*)

### **Journal of Compensation and Benefits**

Jeffrey D. Mamorsky

### **Workers' Compensation Guide** (*WCGD*)

## **EEO**

### **HR Series Fair Employment Practices** (*HRS-FEP*)

## **INTERNATIONAL**

### **International Human Resources Guide** (*IHRGD*)

Roger Herod

### **International Human Resources Journal** (*INTLHRJ*)

Thomson Reuters® thanks you for subscribing to this product. Should you have any questions regarding this product please contact Customer Service at 1-800-328-4880 or by fax at 1-800-340-9378. If you would like to inquire about related publications or place an order, please contact us at 1-800-344-5009.



THOMSON REUTERS™

Thomson Reuters  
610 Opperman Drive  
Eagan, MN 55123

<http://legalsolutions.thomsonreuters.com>

# **Table of Contents**

## **PART 1. INTRODUCTION TO STATISTICS AND DISCRIMINATION**

### **CHAPTER 1. MODELS OF DISCRIMINATION: AN OVERVIEW**

#### **I. INTRODUCTION**

- § 1:1 Introduction to models of discrimination

#### **II. INDIVIDUAL DISPARATE TREATMENT**

- § 1:2 Individual disparate treatment
- § 1:3 —McDonnell-Douglas
- § 1:4 —Discrimination as a motivating cause
- § 1:5 —Discrimination as a but-for cause
- § 1:6 Defenses
- § 1:7 —Voluntary affirmative action
- § 1:8 —Bona fide occupational qualifications

#### **III SYSTEMIC DISPARATE TREATMENT**

- § 1:9 Systemic disparate treatment

#### **IV. DISPARATE IMPACT**

- § 1:10 Disparate impact

#### **V. OTHER DISCRIMINATION MODELS**

- § 1:11 Other discrimination models
- § 1:12 —Reasonable accommodation
- § 1:13 —Workplace harassment

#### **Bibliography**

## **CHAPTER 2. STATISTICS: AN INTRODUCTION**

- § 2:1 What is statistics?
- § 2:2 Descriptive statistics
- § 2:3 Legal, situational, and statistical models
- § 2:4 The logic underlying statistical proof of discrimination
- § 2:5 The problem of causation
- § 2:6 Tensions between law and statistics
- § 2:7 Statistics and legal procedure

### **Bibliography**

## **PART 2. USING STATISTICS TO PROVE DISCRIMINATION**

### **CHAPTER 3. INDIVIDUAL DISPARATE TREATMENT**

- § 3:1 Statistical evidence and pretext within the McDonnell-Douglas model
- § 3:2 Statistical evidence within the mixed motives model
- § 3:3 Statistical evidence and the Gross/Nassar model
- § 3:4 Statistical evidence and the voluntary affirmative action defense

### **Bibliography**

### **CHAPTER 4. SYSTEMIC DISPARATE TREATMENT**

- § 4:1 Introduction
- § 4:2 Identifying availability
- § 4:3 —Considerations regarding qualification and interest
- § 4:4 —The role of geography in proxy data
- § 4:5 —Considerations regarding time
- § 4:6 Measurement issues
- § 4:7 —Measurement of actual treatment
- § 4:8 —Measurement of ideal treatment
- § 4:9 —Measuring disparity in treatment
- § 4:10 Statistical tests for inferring systemic disparate treatment



## TABLE OF CONTENTS

- § 4:11 —Binomial test for representation rates
- § 4:12 —Limitations on interpretation of test results
- § 4:13 — —Correct statistical meaning of significance
- § 4:14 — —Appropriateness of alternative hypothesis
- § 4:15 — —Power of the test
- § 4:16 — —Appropriateness of underlying assumptions
- § 4:17 —Combining binomial evidence across levels
- § 4:18 —Hypergeometric test for selection rates
- § 4:19 —Combining hypergeometric evidence across levels
- § 4:20 Logistic regression analysis in systemic disparate treatment cases
- § 4:21 Estimation inference of systemic disparate treatment
- § 4:22 Statistical inference of discrimination in time until promotion

## Bibliography

## CHAPTER 5. DISPARATE IMPACT

- § 5:1 Introduction
- § 5:2 Identifying the effects on favored and disfavored groups
- § 5:3 —Identifying the neutral employment practice
- § 5:4 —Identifying the relevant populations for comparison
- § 5:5 Comparing impact on favored and disfavored groups
- § 5:6 —The four-fifths rule
- § 5:7 —Statistical inference regarding extent of impact
- § 5:8 —Statistical inference in more complex situations: Combining data across strata
- § 5:9 —The joint effect of multiple components
- § 5:10 —Limitations on statistical inference
- § 5:11 Tests
- § 5:12 —Reliability
- § 5:13 —Test validation
- § 5:14 — —Criterion-related validity
- § 5:15 — —Content validity
- § 5:16 — —Construct validity
- § 5:17 —Fairness issues

## Bibliography