CV: PAUL R. ROSENBAUM

Position

Robert G. Putzel Professor Emeritus
Department of Statistics and Data Science
The Wharton School of the University of Pennsylvania

Education

BA, Statistics, 1977, Hampshire College
AM, Statistics, 1978, Harvard University
PhD, Statistics, 1980, Harvard University

Employment

2021-Present, Robert G. Putzel Professor Emeritus,
Department of Statistics and Data Science, The Wharton School
2001-2021, Robert G. Putzel Professor
Department of Statistics, The Wharton School
2008-2021, Senior Fellow, Leonard Davis Institute of
Health Economics, University of Pennsylvania
2016, Sabbatical, Nelder Fellow,
Imperial College, London
2000-2001, Sabbatical, Fellow, Center for Advanced
Study in the Behavioral Sciences, Stanford, California
1990-2001, Professor of Statistics, Department of Statistics, The
Wharton School of the University of Pennsylvania
1986-1990, Joseph Wharton Term Associate Professor of Statistics,
Wharton School of the University of Pennsylvania.
1983-1986 Research Scientist/Senior Research Scientist, Research
Statistics Group, Educational Testing Service, Princeton, NJ.
1981-1983 Assistant Professor of Statistics and Human
Oncology, University of Wisconsin at Madison, Wisconsin.
1980-1981 Statistician, Office of Radiation Programs,
U. S. Environmental Protection Agency, Arlington, Virginia.

Honors

IMS Medallion Lecture, 2020
R.A. Fisher Award and Lecture from COPSS, 2019
Long-Term Excellence Award from the Health Policy Statistics
Section of the American Statistical Association, 2018
Nathan Mantel Award from the Section on Statistics in
Epidemiology of the American Statistical Association, 2017
Nelder Lecture, Imperial College, 2016
George W. Snedecor Award from COPSS, 2003
Fellow of the American Statistical Association, Elected 1992

PUBLICATIONS

BOOKS

Observational Studies. Springer Series in Statistics, New York, Springer. First edition 1995, second edition 2002.

Design of Observational Studies. Springer Series in Statistics, New York, Springer. First edition, 2010. Second edition 2020. Chinese translation of the first edition published by Higher Education Press in 2016.

Observation and Experiment: An Introduction to Causal Inference. Cambridge, MA: Harvard University Press, 2017. Paperback edition, 2019. Japanese translation by Manabu Iwasaki and T. Abe, 2021, Kyoritsu Shuppan Co. Ltd.

Replication and Evidence Factors in Observational Studies. Chapman and Hall/CRC, 2021.

Causal Inference. (MIT Press Essential Knowledge Series). MIT Press, 2023.

EDITED VOLUME

Handbook of Matching and Weighting Adjustments for Causal Inference. Edited by Jose R. Zubizarreta, Elizabeth A. Stuart, Dylan S. Small and Paul R. Rosenbaum. Chapman and Hall/CRC, 2023.

ARTICLES

1981

Prognostic importance of anginal symptoms in angiographically defined coronary artery disease. (With P. Cohn, P. Harris, W. Barry, R. Rosati, and C. Waternaux) American Journal of Cardiology, 1981, 47, 233-237.

The two-scale plot: An exploratory display of data with heterogeneous variances. American Statistician, 1981, 35, 265-266.

1983

The central role of the propensity score in observational studies for causal effects. (With D.B. Rubin) Biometrika, 1983; 70, 41-55.

Assessing sensitivity to an unobserved binary covariate in an observational study with binary outcome. (With D.B. Rubin) Journal of the Royal Statistical Society, Series B, 1983; 45, 212-218.

1984

From association to causation in observational studies: The role of tests of strongly ignorable treatment assignment. Journal of the American Statistical Association, 1984, 79, 41-48.

Estimating the effects caused by treatments: Discussion of a paper by J. Pratt and R. Schlaifer. (With D. B. Rubin) Journal of the American Statistical Association, 1984, 79, 26-28.

Reducing bias in observational studies using subclassification on the propensity score. (With D.B. Rubin) Journal of the American Statistical Association, 1984, 79, 516-524.

Conditional permutation tests and the propensity score in observational studies. Journal of the American Statistical Association, 1984, 79, 565-574.

The consequences of adjustment for a concomitant variable that has been affected by the treatment. Journal of the Royal Statistical Society, Series A, 1984, 147, 656-666.
Case definition and power in case-control studies. Statistics in Medicine, 1984, 3, 27-34.
Difficulties with regression analyses of age-adjusted rates. (With D.B. Rubin) Biometrics, 1984, 40, 437-443.
Cisplatin, doxorubicin, cyclophosphamide, lomustine, vincristine (PACCO) in the treatment of nonsmall cell bronchogenic carcinoma. (With R. Whitehead and P. Carbone) Cancer Treatment Reports, 1984, 68, 771-773.
Sensitivity of Bayes inference with data-dependent stopping rules. (With D.B. Rubin) American Statistician, 1984, 38, 106-109.
Aggressive combined modality therapy for advanced local-regional breast carcinoma. (With C. Loprinzi, P. Carbone, D. Tormey, W. Caldwell, J. Kline, R. Steeves, and G. Ramirez) Journal of Clinical Oncology, 2, 157-163.
Testing the conditional independence and monotonicity assumptions of item response theory. Psychometrika, 1984, 49, 425-435.

1985
The bias due to incomplete matching. (With D.B. Rubin) Biometrics, 1985, 41,106-116.
Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. (With D.B. Rubin) American Statistician, 1985, 39, 33-38.
Comparing distributions of item responses for two groups. British Journal of Mathematical and Statistical Psychology, 1985, 38, 206-215.
Discussion of "On State Education Statistics": A difficulty with regression analyses of regional test score averages. (With D.B. Rubin) Journal of Educational Statistics, 1985, 10, 326-333.

1986
Conditional association and unidimensionality in monotone latent variable models. (With P.W. Holland) Annals of Statistics, 14, 1523-1543.
Dropping out of high school in the United States: An observational study. Journal of Educational Statistics, 1986, 11, 207-224.

1987
Sensitivity analysis for certain permutation tests in matched observational studies. Biometrika, 1987, 74,13-26.
Smoothing the joint and marginal distributions of scored two-way contingency tables in test equating. (With D. Thayer) British Journal of Mathematical and Statistical Psychology, 1987, 40, 43-49.
Comparing item characteristic curves. Psychometrika, 1987, 52, 217-233.
Model-based direct adjustment. Journal of the American Statistical Association, 1987, 82, 387394.
Probability inequalities for latent scales. British Journal of Mathematical and Statistical Psychology, 1987, 40, 157-168.
Review of Statistical Methods for Meta-Analysis by L. Hedges and I. Olkin. Journal of the American Statistical Association, 1987, 82, 350-351.
The role of a second control group in an observational study (with Discussion). Statistical Science, 1987, 2, 292-316.
A nontechnical introduction to statistical power and the control of bias. In: Preventing Mental Disorders: A Research Perspective, eds., J. A. Steinberg and M. M. Silverman. Rockville, Maryland: National Institute of Mental Health, pp. 174-185.

1988
Sensitivity analysis for matching with multiple controls. Biometrika, 1988, 75, 577-581.

Review of Statistical Design for Research by Leslie Kish. Journal of the American Statistical Association, 83, 568-569.
Permutation tests for matched pairs with adjustments for covariates. Applied Statistics, 1988, 37, 401-411.
Item bundles. Psychometrika,1988, 53, 349-359.

1989
Criterion-related construct validity. Psychometrika, 54, 625-633.
Sensitivity analysis for matched observational studies with many ordered treatments. Scandinavian Journal of Statistics, 16, 227-236.
An exploratory plot for paired data. American Statistician, 43, 108-109.
On permutation tests for hidden biases in observational studies: An application of Holley's inequality to the Savage lattice. Annals of Statistics, 17, 643-653.
Optimal matching for observational studies. Journal of the American Statistical Association, 85, 1024-1032.
The role of known effects in observational studies. Biometrics, 45, 557-569.

1990
Sensitivity analysis for two-sample permutation inferences in observational studies. (With Abba Krieger) Journal of the American Statistical Association, 85, 493-498.

1991
A characterization of optimal designs for observational studies. Journal of the Royal Statistical Society, Series B, 53, 597-610.
Some poset statistics. Annals of Statistics, 19, 1091-1097.
Sensitivity analysis for matched case-control studies. Biometrics, 47, 87-100.
Discussing hidden bias in observational studies. Annals of Internal Medicine, 115, 901-5.

1992
Detecting bias with confidence in observational studies. Biometrika, 79, 367-374.

1993
Hodges-Lehmann point estimates of treatment effect in observational studies. Journal of the American Statistical Association, 88, 1250-1253.
Sampling the leaves of a tree with equal probabilities. Journal of the American Statistical Association, 88, 1455-1457.
Confident search. Journal of Computational and Graphical Statistics, 2, 381-403.
Comparison of multivariate matching methods: Structures, distances and algorithms. (With Sam Gu) Journal of Computational and Graphical Statistics, 2, 405-420.
Discussion of a paper by Draper, Hodges, Mallows, and Pregibon, Journal of the Royal Statistical Society, Series A, 156, 135.

1994
Coherence in observational studies. Biometrics, 50, 368-374.
Dispersion effects from fractional factorials in Taguchi's method of quality design. Journal of the Royal Statistical Society, Series B (Methodological), 1994, 56, 641-652.
A stochastic comparison for arrangement increasing functions (With Abba M. Krieger). Combinatorics, Probability and Computing, 1994, 3, 345-348.
How a court accepted an impossible explanation. (With J. Gastwirth and A. Krieger) The American Statistician, 1994, 48, 313-315.

1995

Comparing the contributions of groups of predictors: Which outcomes vary with hospital rather than patient characteristics? (With J. Silber and R. Ross) Journal of the American Statistical Association, 1995, 90, 7-18.

Letter: Measuring the quality of hospital care (With J. Silber). Journal of the American Medical Association, 273, 4 January 1995, 21.

Quantiles in nonrandom samples and observational studies. Journal of the American Statistical Association, 1995, 90, 1424-1431.

Evaluation of the complication rate as a measure of quality of care in coronary artery bypass graft surgery (With J. Silber, S. Schwartz, R. Ross, and S. Williams). Journal of the American Medical Association, 1995, 274, 317-323. Related letter, 1995, 274, 1674-1675.

Discussion of "Causal diagrams for empirical research" by J. Pearl. Biometrika, 1995, 82, 698699.

Ranking hospitals by the quality of care for medical conditions: The role of complications. (With S. Williams, M. Pauly, R. Ross, S. Schwartz, A. Shpilsky, and J. Silber) Transactions of the American Clinical and Climatological Association, 107, 263-274.

1996

Some useful compound dispersion experiments in quality design. Technometrics, 1996, 38, 354364.

A quasi-experimental comparison of the effectiveness of 6 versus 12 hour per week outpatient treatments for cocaine dependence. (With A. Alterman, E. Snider, J. Cacciola, D. May, G. Parikh, I. Maany) Journal of Nervous and Mental Disease, 184, January 1996, 54-56.

Discussion of "Identification of causal effects using instrumental variables" by Angrist, Imbens & Rubin. Journal of the American Statistical Association, 1996, 91, 465-468.

Observational studies and nonrandomized experiments. In: Handbook of Statistics, volume 13, Chapter 6, eds., S. Ghosh and C. R. Rao. New York: Elsevier, pp. 181-197.

1997

Discussion of "Inference for non-random samples" by J. B. Copas and H. G. Li. Journal of the Royal Statistical Society, Series B, 59, 90.

Signed rank statistics for coherent predictions. Biometrics, 53, 556-566.

A spurious correlation between hospital mortality and complication rates: The importance of severity adjustment (with J. Silber). Medical Care, 1997, v35, #10, os77-os92, supplement.

The relationship between choice of outcome measure and hospital rank in general surgical procedures -- Implications for quality assessment (with J. Silber, S. Williams, R. Ross, and S. Schwartz). International Journal for Quality in Health Care, 1997, 9, 193-200.

Reply: Unquestionably Impossible (with J. Gastwirth and A. Krieger). American Statistician, 51, 115-6. Reply: Hypotheticals and Hypotheses (with J. Gastwirth and A. Krieger). American Statistician, 51, 120-1. (Responses to comments by Charles Poole and Sander Greenland, and to Jim Mintz and Wilfred Dixon, published in the same issue of this journal.)

1998

Dual and simultaneous sensitivity analysis for matched pairs. (With Joe Gastwirth and Abba Krieger) Biometrika, 85, 907-920.

Multivariate matching methods. In: Encyclopedia of Statistical Sciences, Update Volume 2, eds., S. Kotz, C. R. Read, and D. Banks, New York: John Wiley, pp. 435-438.

Propensity score. In: Encyclopedia of Biostatistics, Volume 5, eds., P. Armitage and T. Colton, New York: John Wiley, 1998, pp. 3551-3555.

Cornfield's Inequality (With Joe Gastwirth and Abba Krieger). In: Encyclopedia of Biostatistics, Volume 1, eds., P. Armitage and T. Colton, New York: John Wiley, 1998, pp. 952-955.

1999

Using quantile averages in matched observational studies. Applied Statistics, 1999, 48, 63-78.

Blocking in compound dispersion experiments. Technometrics, 1999, 41, 125-134.
Choice as an alternative to control in observational studies (with Discussion). Statistical Science, 14, 259-304.
Conditional length of stay (with J. H. Silber, L. F. Koziol, N. Sutaria, R. R. Marsh, and O. EvenShoshan). Health Services Research, 1999;34:349-363.
Propensity scores (with M. Joffe). American Journal of Epidemiology, 15 August 1999, 150, 327-333.
Quantile plots, partial orders and financial risk (with J. Kuczmarski). American Statistician, 53, 239-246.
Reduced sensitivity to hidden bias at upper quantiles in observational studies with dilated treatment effects. Biometrics, 55, 560-564.
Holley's inequality. Encyclopedia of Statistical Sciences, Update Volume 3, eds., S. Kotz, C. B. Read, D. L. Banks, New York: John Wiley, 1999, pp. 328-331.

2000
Substantial gains in bias reduction from matching with a variable number of controls (with Kewei Ming). Biometrics, 56, 118-124.
Asymptotic separability in sensitivity analysis (with Joseph Gastwirth and Abba Krieger). Journal of the Royal Statistical Society, Series B (Methodological), 62, 545-555.

2001
Stability in the absence of treatment. Journal of the American Statistical Association, 2001, 96, 210-219.
Effects attributable to treatment: Inference in experiments and observational studies with a discrete pivot. Biometrika, 2001, 88, 219-231. (Received the 2003 Snedecor Award)
A note on optimal matching with variable controls using the assignment algorithm (with Kewei Ming). Journal of Computational and Graphical Statistics, 10, 2001, 455-463.
Matching and thick description in an observational study of mortality after surgery (with Jeff Silber), Biostatistics, 2, 2001, 217-232.
Replicating effects and biases. American Statistician, 2001, 55, 223-227.
Balanced risk set matching (with Y. P. Li and K. J. Propert). Journal of the American Statistical Association, 2001, 96, 870-882.
Multivariate matching and bias reduction in the surgical outcomes study (with J. H. Silber, M. E. Trudeau, O. Even-Shoshan, W. Chen, X. Zhang, and R. E. Mosher). Medical Care, 2001, 39, 1048-1064.
Matching with doses in an observational study of a media campaign against drug abuse (with Bo Lu, Elaine Zanutto, and Robert Hornik), Journal of the American Statistical Association, 2001, 96, 1245-1253.
Observational studies: overview. International Encyclopedia of the Social and Behavioral Sciences, eds., N. J. Smelser and Paul B. Baltes, 2001, New York: Elsevier, pp. 10,81010,815.

2002
Attributing effects to treatment in matched observational studies. Journal of the American Statistical Association, 2002;97:183-192. (Received the 2003 Snedecor Award)
Comment on: "Chain graph models and their causal interpretation," by S. Lauritzen and T. Richardson. Journal of the Royal Statistical Society, Series B, 2002;64:356-357.
Rare outcomes, common treatments: Analytic strategies using propensity scores (an editorial with Len Braitman). Annals of Internal Medicine, 2002;137:693-695.
Covariance adjustment in randomized experiments and observational studies (with Discussion). Statistical Science, 2002;17:286-327.

2003
Does a dose-response relationship reduce sensitivity to hidden bias? Biostatistics, 2003;4:1-10.

(This article was presented in a "Spotlight" piece by Jonathan Sterne in the International Journal of Epidemiology, 2003;32:1129.)

Exact Confidence Intervals for Nonconstant Effects by Inverting the Signed Rank Test. American Statistician, 2003;57:132-138.

Length of Stay, Conditional Length of Stay, and Prolonged Stay in Pediatric Asthma (with Jeffrey H. Silber, Orit Even-Shoshan, Mayadah Shabbout, Xuemei Zhang, Eric T. Bradlow, Roger R. Marsh), Health Services Research, 2003;38:867-886.

2004

Design sensitivity in observational studies. Biometrika, 2004; 91: 153-164.

The case-only odds ratio as a causal parameter. Biometrics, 2004; 60: 233-240.

Randomization inference with imperfect compliance in the ACE-inhibitor after anthracycline randomized trial (with Robert Greevy, Jeffrey Silber, and Avital Cnaan) Journal of the American Statistical Association, 2004; 99: 7-15.

Optimal matching before randomization (with Robert Greevy, Bo Lu, and Jeffrey Silber). Biostatistics, 2004; 5: 263-275.

Optimal matching with two control groups (with Bo Lu). Journal of Computational and Graphical Statistics, 2004; 13: 422-434.

Matching in observational studies. In: Applied Bayesian Modeling and Causal Inference from Incomplete-Data Perspectives, eds. A. Gelman and X. L. Meng, 2004, New York: John Wiley, pp. 15-24.

Equivalent lengths of stay of pediatric patients hospitalized in rural and nonrural hospitals (with Scott Lorch, Xuemei Zhang, Orit Evan-Shoshan, and Jeffrey Silber). Pediatrics, 2004, 114, e400-e408.

2005

Robust, accurate confidence intervals with a weak instrument: Quarter of birth and education (with Guido Imbens). Journal of the Royal Statistical Society, A, 2005, 168, 109-126.

Exact, nonparametric inference when doses are measured with random errors. Journal of the American Statistical Association, 2005, 100, 511-518.

Attributable effects in case^2 studies. Biometrics, 2005, 61, 246-253.

Reasons for effects. Chance, 2005, 18, 5-10.

Heterogeneity and causality: Unit heterogeneity and design sensitivity in observational studies. American Statistician, 2005, 59, 147-152.

Changes in prognosis after the first postoperative complication (with Jeffrey Silber, Martha Trudeau, Wei Chen, Xuemei Zhang, Rachel Rapaport Kelz, Rachel Mosher, Orit EvenShoshan). Medical Care, 2005, 43, 122-131.

Observational study. In: Encyclopedia of Statistics in Behavioral Science, 2005, eds., B. S. Everitt and D. C. Howell, New York: John Wiley and Sons, pp. 1451-1462.

Sensitivity analysis in observational studies. In: Encyclopedia of Statistics in Behavioral Science, 2005, eds., B. S. Everitt and D. C. Howell, New York: John Wiley and Sons, pp. 1809-1814.

Preoperative antibiotics and mortality in the elderly (with with Jeffrey Silber, Martha Trudeau, Wei Chen, Xuemei Zhang, Scott Lorch, Rachel Rapaport Kelz, Rachel Mosher, Orit EvenShoshan) Annals of Surgery, 2005, 242, 107-114.

An exact, distribution free test comparing two multivariate distributions based on adjacency. Journal of the Royal Statistical Society, B, 2005, 67, 515-530.

Comment (with Alan Salzberg) on: "Local model uncertainty and incomplete-data bias" by J. Copas and S. Eguchi Journal of the Royal Statistical Society, Series B, 2005, 67, 507-508.

2006

Differential effects and generic biases in observational studies. Biometrika, 2006, 93, 573-586.

Comment on a paper by Donald B. Rubin: The place of death in the quality of life. Statistical Science, 2006, 21, 313-316.

Variation in chemotherapy utilization in ovarian cancer: The relative contribution of geography (with Daniel Polsky, Katrina A. Armstrong, Thomas C. Randall, Richard N. Ross, Orit EvenShoshan, Jeffrey H. Silber) Health Services Research, 2006, 41, 2201-2218.

R-estimates vs GMM: A theoretical case study of validity and efficiency (with Dylan Small, Joe Gastwirth, and Abba Krieger). Statistical Science, 2006, 21, 363-375.

2007

Minimum distance matched sampling with fine balance in an observational study of treatment for ovarian cancer (with Richard N. Ross and Jeffrey H. Silber). Journal of the American Statistical Association, 2007, 102, 75-83.

Interference between units in randomized experiments. Journal of the American Statistical Association, 2007, 102, 191-200.

Sensitivity analysis for m-estimates, tests and confidence intervals in matched observational studies. Biometrics, 2007, 63, 456-464.

Confidence intervals for uncommon but dramatic responses to treatment. Biometrics, 2007, 63, 1164–1171.

Combining propensity score matching and group-based trajectory analysis in an observational study (with A. Haviland and D. S. Nagin). Psychological Methods, 2007, 12, 247–267.

Propensity score. Encyclopedia of Clinical Trials, eds., R. D'Agostino, L. Sullivan, J. Massaro, New York: John Wiley, 2007.

Does ovarian cancer treatment and survival differ by the specialty providing chemotherapy? (With Jeffrey H. Silber, Daniel Polsky, Richard N Ross, Orit Even-Shoshan, Sandy Schwartz, Katrina A. Armstrong, Thomas C. Randall). Journal of Clinical Oncology, 2007, 25, 11691175.

Estimating anesthesia and surgical time from medicare anesthesia claims. (With Jeffrey H. Silber, Xuemei Zhang, Orit Even-Shoshan.) Anesthesiology, 2007, 106, 346-355.

The influence of patient characteristics on anesthesia time in Medicare patients undergoing general and orthopedics surgery. (With Jeffrey H. Silber, Xuemei Zhang, Orit Even-Shoshan.) Anesthesiology, 2007, 106, 356-364.

Mortality among hospitalized Medicare beneficiaries in the first 2 years following ACGME resident duty hour reform (with Kevin G. Volpp, Amy K. Rosen, Patrick S. Romano, Orit EvenShoshan, Yanli Wang, Lisa Bellini, Tiffany Behringer, and Jeffrey H. Silber) Journal of the American Medical Association, 2007, 298, 975-983.

Mortality among patients in VA hospitals in the first 2 years following ACGME resident duty hour reform (with Kevin G. Volpp, Amy K. Rosen, Patrick S. Romano, Orit Even-Shoshan, Anne Canamucio, Lisa Bellini, Tiffany Behringer, and Jeffrey H. Silber) Journal of the American Medical Association, 2007, 298, 984-992.

2008

Testing hypotheses in order. Biometrika, 2008, 95, 248-252.

Randomization inference in a group-randomized trial of treatments for depression: covariate adjustment, noncompliance and quantile effects (with D. Small and T. Ten Have). Journal of the American Statistical Association, 2008, 103, 271-279.

Aberrant effects of treatment (with J. H. Silber), Journal of the American Statistical Association, 2008, 103, 240-247.

Combining group-based trajectory modeling and propensity score matching for causal inferences in nonexperimental longitudinal data (with Amelia Haviland, Daniel S. Nagin and Richard Tremblay). Developmental Psychology, 2008, 44, 422-436.

War and wages: the strength of instrumental variables and their sensitivity to unobserved biases (with D. Small), Journal of the American Statistical Association, 2008, 103, 924-933.

An algorithm for optimal tapered matching, with application to disparities in survival (with S. Daniel, K. Armstrong, J. H. Silber), Journal of Computational and Graphical Statistics, 2008, 17, 914-924.

2009

Sensitivity analysis for equivalence and difference in an observational study of neonatal intensive care units (with Jeffrey H. Silber). Journal of the American Statistical Association, 2009, 104, 501-511.

Split samples and design sensitivity in observational studies (with Ruth Heller and Dylan Small). Journal of the American Statistical Association, 2009, 104, 1090-1101.

Hospital teaching intensity, patient race, and surgical outcomes (with Jeffrey H. Silber, Amy Rosen; Orit Even-Shoshan, Yun Teng, Yanli Wang, Michael Halenar, Kevin Volpp and Patrick Romano). Archives of Surgery, 2009, 144, 113-120.

Simultaneous sensitivity analysis for observational studies using full matching or matching with multiple controls (with Dylan Small, Joseph Gastwirth, and Abba Krieger), Statistics and its Interfaces, 2009, 2, 203-212 (Special issue in honor of Joseph Gastwirth).

Additional maturity at discharge and subsequent health care costs (with J. H. Silber, S. L. Lorch, B. Medoff-Cooper, S. Bakewell-Sachs, A. Millman, L. Mi, O. Even-Shoshan, G. E. Escobar) Health Services Research, 2009, 44, 444-463.

Error-free milestones in error prone measurements (with Dylan Small). Annals of Applied Statistics, 2009, 3, 881-901.

Therapeutic effect of sentinel lymph node biopsy in melanoma remains an open question (with Phyllis Gimotty, Frank Yoon, Rachel Hammond, and DuPont Guerry). Journal of Clinical Oncology, 2009, 27, 4236-4238.

Prolonged hospital stay and the resident duty hours rules of 2003 (with J.H. Silber, A.K. Rosen, P.S. Romano, K.M.F. Itani, L. Cen, L. Mi, M.J. Halenar, O. Even-Shoshan, and K.G. Volpp.) Medical Care, 2009;47:1191-1200.

Amplification of sensitivity analysis in observational studies (with Jeffrey Silber). Journal of the American Statistical Association, 2009;104:1398-1405.

2010

Evidence factors in observational studies. Biometrika, 2010;97:333-345.

Design sensitivity and efficiency in observational studies. Journal of the American Statistical Association, 2010, 105, 692-702.

Building a stronger instrument in an observational study of perinatal care for premature infants (with Michael Baiocchi, Dylan Small and Scott Lorch). Journal of the American Statistical Association, 2010, 105, 1285-1296.

Sensitivity analysis for the cross-match test with applications in genomics (with Ruth Heller, Shane Jensen and Dylan Small). Journal of the American Statistical Association, 2010, 105, 1005-1013.

Using the cross-match test to appraise covariate balance in matched pairs (with Ruth Heller and Dylan Small). American Statistician, 2010, 64, 299-309.

The Hospital Compare mortality model and the volume-outcomes relationship (with J. H. Silber, T. J. Brachet, R. N. Ross, L. J. Bressler, O. Even-Shoshan, S. A. Lorch, and K. G. Volpp). Health Services Research, 2010, 45, 1148-1167.

Observational studies. In: International Encyclopedia of Education, 3rd Edition, Eds. E. Baker, P. Peterson and B. McGaw. New York: Elsevier 2010, volume 7, pp. 354-359.

2011

Some approximate evidence factors in observational studies. Journal of the American Statistical Association, 2011, 106, 285-295.

Using split samples and evidence factors in an observational study of neonatal outcomes (with Kai Zhang, Dylan S. Small, Scott Lorch, and Sindhu Srinivas), Journal of the American Statistical Association, 2011, 106, 511-524.

A new u-statistic with superior design sensitivity in observational studies. Biometrics, 2011, 67, 1017-1027.

Structured testing of 2 x 2 factorial effects: an analytic plan requiring fewer observations (with D. S. Small and K. G. Volpp). American Statistician, 2011, 65, 11-15.

What aspects of the design of an observational study affect its sensitivity to bias from covariates that were not observed? In: Looking Back: Proceedings of a Conference in Honor of Paul W. Holland, eds., N. Dorans and S. Sinharay, New York: Springer, 2011, pp. 87-114.

Estimating anesthesia time using the medicare claims: a validation ctudy (with J. H. Silber, O. Even-Shoshan, L. Y. Mi, F. A. Kyle, Y. Teng, D. W. Bratzler, and L. Fleisher). Anesthesiology 2011, 115, 322-333.

Matching for several sparse nominal variables in a case-control study of readmission following surgery (with José R. Zubizarreta, Caroline Reinke, Rachel R. Kelz, and Jeffrey H. Silber). American Statistician, 2011, 65, 229-238.

2012

Testing one hypothesis twice in observational studies. Biometrika, 2012, 99, 763-774.

An exact adaptive test with superior design sensitivity in an observational study of treatments for ovarian cancer. Annals of Applied Statistics, 2012, 6, 83-105.

Contrasting evidence within and between institutions that supply treatment in an observational study of alternative forms of anesthesia (with Jose R. Zubizarreta, Mark Neuman, and Jeffrey H. Silber), Journal of the American Statistical Association, 2012, 107, 901-915.

Inference with interference between units in an fMRI experiment of motor inhibition (with Xi Luo, Dylan S. Small, Chiang-shan R. Li), Journal of the American Statistical Association, 2012, 107, 530-541.

Optimal matching with minimal deviation from fine balance in a study of obesity and surgical outcomes (with Dan Yang, Dylan S. Small and Jeffrey H. Silber). Biometrics, 2012, 68, 628636.

Optimal matching of an optimally chosen subset in observational studies. Journal of Computational and Graphical Statistics, 2012, 21, 57-71.

Nonreactive and purely reactive doses in observational studies. In: Causality: Statistical Perspectives and Applications, eds., C. Berzuini, P. Dawid, L. Bernardinelli. New York: John Wiley, chapter 19, pp. 273-289.

Medical and financial risks associated with surgery in the elderly obese (with Jeffrey H. Silber, Rachel R. Kelz, Caroline E. Reinke, Mark D. Neuman, Richard N. Ross, Orit Even-Shoshan, Guy David, Philip A. Saynisch, Fabienne A. Kyle, Dale W. Bratzler, Lee A. Fleisher). Annals of Surgery, 2012, 256, 79-86.

2013

Effect of the 2010 Chilean earthquake on posttraumatic stress: Reducing sensitivity to unmeasured bias through study design (with Jose R. Zubizarreta and Magdalena Cerda), Epidemiology, 2013, 24, 79-87.

Effect modification and design sensitivity in observational studies (with Jesse Hsu and Dylan Small). Journal of the American Statistical Association, 2013, 108, 135-148.

Case definition and design sensitivity (with Dylan S. Small, Jing Cheng and M. Elizabeth Halloran). Journal of the American Statistical Association, 2013, 108, 1457-1468.

Impact of multiple matched controls on design sensitivity in observational studies. Biometrics, 2013, 69, 118-127.

Using the exterior match to compare two entwined matched control groups (with Jeffrey H. Silber). The American Statistician, 2013, 67, 67-75.

Stronger instruments via integer programming in an observational study of late preterm birth outcomes (with Jose R. Zubizarreta, Dylan S. Small, Neera K. Goyal, and Scott A. Lorch). Annals of Applied Statistics, 2013, 7, 25-50.

Characteristics associated with differences in survival among black and white women with breast cancer (with Jeffrey H. Silber, Amy S. Clark, Bruce J. Giantonio, Richard N. Ross, Yun Teng,

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R Packages

DOS, DOS2, evident, informedSen, sensitivitymult, sensitivity2x2xk, senstrat, exteriorMatch, sensitivitymv, sensitivitymw, sensitivityfull, submax, testwice, dstat, dstat2x2xk, tailTransform, weightedRank.

WORK FOR THE NATIONAL ACADEMY OF SCIENCES

Member, Committee on National Statistics of the Commission on Behavioral and Social Sciences and Education of the National Research Council of the National Academy of Sciences, 1996-1999.

Member of the Committee on Data and Research for Policy on Illegal Drugs, Commission on Behavioral And Social Sciences and Education, the National Research Council of the National Academy of Sciences, 1998-2000. The panel published two reports, *Assessment of Two Cost Effectiveness Studies on Cocaine Control Policy*, National Academy Press, Washington, DC, 1999, and *Informing America's Policy on Illegal Drugs*, National Academy Press, Washington, DC, 2001.

Member of the Panel to Review Evaluation Studies of Bilingual Education, Committee on National Statistics, U.S. National Academy of Sciences, 1991. The panel published a report, *Assessing Evaluation Studies: The Case of Bilingual Education*, National Academy Press, Washington, DC, 1992.

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Advisory Board of the Methodology, Measurement and Statistics Program of the National Science Foundation, 1999-2001.

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