



**Exponent<sup>®</sup>**  
Engineering & Scientific Consulting

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## Professional Profile

Dr. Ray has extensive experience in data analysis and the application of statistical epidemiological methods to business environments. Her work covers issues related to the evaluation of passenger vehicle field performance, demographic analysis of labor markets, analysis of survey data, development of stochastic models, multivariate analysis, survival analysis, nonparametric statistics, design of experiments, and risk assessment.

Dr. Ray has an extensive background in academics, research, and consulting. She has been on staff at the University of California at Berkeley, the University of Florida, and Northwestern University and has performed analyses for a variety of industrial and commercial companies. Prior to joining Exponent, Dr. Ray was responsible for statistical labor force planning for Pacific Gas and Electric Company.

## Academic Credentials & Professional Honors

Ph.D., Statistics, University of California, Berkeley, 1972

B.S., Psychology, University of California, Berkeley, 1965

Sigma Xi

Evelyn Fix Award for Biostatistics

## Academic Appointments

Assistant Professor of Mathematics, Northwestern University 1972-1974

Assistant Professor of Statistics, University of Florida 1974-1975

Lecturer in Statistics, University of California, Berkeley 1986 - 1987

## Professional Affiliations

American Statistical Association (Risk Analysis Nominating Committee)

American Statistical Association (member; President San Francisco Bay Chapter, 1994-1995)

Society for Risk Analysis (past member)

Biometric Society (past member)

American Association for the Advancement of Sciences (past member)

National Fire Protection Association (past member)

Society of Automotive Engineers (past member)

## Publications

Ray, R, Zhao, K. Evaluation of MLE Method for Selecting the Best Fitting Lifetime Distribution Reliability and Maintainability Systems (RAMS) Conference, January 2022

Ray, R, Zhao, K, Taylor, P, Sarif, V. Evaluation of the Robustness of Statistical Software for Warranty Analysis Reliability and Maintainability Systems (RAMS) Conference, January 2019

Donahoe, D, Zhao, K, Murray, S, Ray, R. Accelerated Life Testing, Encyclopedia of Quantitative Risk, Wiley StatsRef: Statistics Reference Online, and the Publisher John Wiley & Sons Ltd.  
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Fowler G, Ray R, Huang S, Zhao K, Frank T. An examination of motorcycle antilock brake systems (ABS) in reducing crash risk. Proceedings of the ASME 2014 International Mechanical Engineering Congress & Exposition, November 14-20, 2014 Montreal, Canada, IMEC2014-36910.

Zabala M, Yang N, Imler S, Zhao K, et al. Evaluation of ejection risk and injury distribution using data from the large truck crash causation study (LTCCS). SAE Technical Paper 2014-01-0491, 2014, doi:10.4271/2014-01-0491.

Tandy DF, Coleman C, Ray R. An objective analysis of the effect of tire tread depth on crash causation and wet road vehicle dynamics. SAE International Journal of Passenger Cars - Mechanical Systems 2013; 6(1). doi:10.4271/2013-01-0701.

Ray R. Comparative risk assessment. World Finance 2010, February.

Shields LE, Staskal D, Ray R, Birnbaum L, Schelbe RR. Evaluation of risk trade-offs in passenger compartment fire retardant usage—A case study. Society of Automotive Engineers 2009 World Congress, April 2009.

Heckman GM, Jackson GW, Keefer RE, Ray R, Harley EM, Young DE. Mechanisms of automatic transmission console shift selection and driver egress. Society of Automotive Engineers 2009 World Congress, April 2009. Paper judged to be among the most outstanding SAE Technical Papers of 2009 and thus further published in the SAE International Journal of Engines, Volume 2, September 15, 2009.

Moore T, Ray R, Raasch C, Huang S-W, Corrigan C. Police accident report restraint usage accuracy and injury severity. Society of Automotive Engineers 2009 World Congress, April 2009.

McGowan JC, Shkolnikov Y, Sala J, Ray R. Diffuse electrical injury: A questionable phenomenon. Biomedical Engineering, Recent Developments (ISBN 978-1-930636-07-1) 2008; 65-67.

McGowan JC, Shkolnikov Y, Sala J, Ray R. Diffuse electrical injury: Questioning the scientific basis. IEEE Proceedings of the Canadian Conference on Electrical and Computer Engineering, Niagara Falls, pp. 1977-1980, 2008.

Ray R, Ketcham B, Huang S, Kelly C. Fire in large truck crashes: Comparing results from the large truck crash causation study with FARS and NASS/GES data. SAE 2008-01-0225.

Krauss D, Lieberman D, Grossman H, Ray R, Scher I. An evaluation of perceptual experience of skiers

using quantitative image processing. Journal of ASTM International, ISSN: 1546-962X, Published Online: April 8, 2008.

Murray S, Ray R, Grossman H. Using Weibull analysis for cases with unknown susceptible population. Proceedings, IMECE2007 2007 ASME International Mechanical Engineering Congress and Exposition, Seattle, WA, November 11-15, 2007.

Parker D, Ray R, Moore T, Keefer R. Rollover severity and occupant protection: A review of NASS/CDS data. SAE 2007-01-0676, 2007.

Ray R, Ahrens M. Vehicle fire data: Different sources, different goals, different conclusions? SAE 2007-01-0877, 2007.

Kinnell J, Bingham M, Hastings E, Ray R, Craven V, Freeman M. A survey methodology for collecting fish consumption data in urban and industrial water bodies (Part 1). Journal of Environmental & Toxicological Health, Part A 2007; 70:477-495.

Ray R, Craven V, Kinnell J, Bingham M, Freeman M, Finley B. A statistical method for analyzing data collected by a creel/angler survey (Part 2). Journal of Environmental & Toxicological Health, Part A 2007; 70:496-511.

Ray R, Craven V, Bingham M, Kinnell J, Hastings E, Finley B. Human health exposure factor estimates based upon a creel/angler survey of the lower Passaic River (Part 3). Journal of Environmental & Toxicological Health, Part A 2007; 70:512-582.

Ray R, Grossman H, Murray S, Lange R. Evaluation of passenger vehicle crashworthiness using field performance data. Proceedings, IMECE2006, Chicago, IL, November 5-10, 2006.

Grossman H, Ray R, Zhao K, Kytömaa H. Analysis of garage fires. SAE 2006-01-0791, 2006.

Loud J, Murray S, Ray R, Iyer M, Jackson O. Shock injury risk assessment of portable and handheld appliances and use environments. Proceedings, International Appliance Technical Conference, 2006.

Ramachandran K, Fordyce T, Ray R, Le-Resnick H. The relationship between airbags and injuries. SAE 2005-01-123, 2005.

Cher D, Deubner D, Chapman S, Kelsh M, Ray R. Assessment of the Beryllium Lymphocyte Proliferation Test using statistical process control. Inhalation Toxicology 2006; 18(11):901-910.

Ray R, Asuncion N. Matched pair analysis of the relative effectiveness of lap/shoulder seat belts as compared to lap only seat belts in the rear seat. Association for the Advancement of Automotive Medicine, 44th Annual Proceedings p. 473, Chicago, IL, October 2000.

Lau E, Ray R, Parentau. Characteristics of children in rollover collisions. Child Occupant Protection in Motor Vehicle Crashes, Joint Session Organized by the European Vehicle Passive Safety Network, AAAM, and IRCOBI, Barcelona, Spain, September 22, 1999.

Goodman M, Morgan R, Ray R, Malloy C, Zhao K. Cancer in asbestos-exposed occupational cohorts: A meta-analysis. Cancer Causes and Control 1999; 10:453-465.

Lau E, Ray R, Cheng L. Deployment of airbags in traffic accidents: Characteristics and consequences. Proceedings, 41st Annual Association for the Advancement of Automotive Medicine, Orlando, FL, November 1997.

Bjelajac V, Luby E, Ray R. A validation test of a field-based phosphate analysis technique. Journal of Archaeological Science 1996; 23:243-248.

Tarter M, Locke M, Ray R. Conditional Switching: A new variety of regression with many potential environmental applications. Environmental Applications Health Perspectives 1995; 103(7-8), July/August.

Ray R, Lau E. Characterization of the type and severity of traffic collisions in the United States using delta V. American Society of Mechanical Engineers 1995 Winter Conference, SERA-4, Safety Engineering and Risk Analysis, 1995.

Clarke R, Prasad A, Khatua T, Cheng L, Girvan D, Ray R, Werner S. U.S. efforts to improve heavy truck occupant crash protection and reduce aggressivity in frontal truck/car collisions. Proceedings, 14th International Technical Conference on Enhanced Safety of Vehicles, Vol. 2, pp. 1762-1775, Munich, Germany, May 1994.

Padmanaban J, Ray R. Comparison of automatic front-seat outboard occupant restraint system performance. Association for the Advancement of Automotive Medicine, Advances in Occupant Restraint Technologies: Joint AAAM-IRCOBI Special Session, pp. 11-32, Lyon, France, September 1994.

Donelson A, Menich R, Ray R, McCarthy R. Statistical analysis of vehicle rollover: Causal modeling. Proceedings, 38th Annual Association for the Advancement of Automotive Medicine, Lyon, France, pp. 269-294, September 1994.

McCarthy G, Ray R, McCarthy R. In-use effectiveness of child restraints and seat belts for children from birth through age four. American Society of Mechanical Engineers, Winter Conference SERA-Vol. 2, pp. 85-91, 1994.

Donelson A, Ray R, McCarthy R. Statistical analysis of vehicle rollover: Causal modeling. American Society of Mechanical Engineers Winter Annual Meeting, SERA -Vol. 1 pp. 145-153, New Orleans, LA, November 1993.

Padmanaban J, Ray R, Weiss J. Assessment of airbag effectiveness in reducing non-fatal injury risk. American Society of Mechanical Engineers Winter Annual Meeting, New Orleans, LA, November 1993.

Padmanaban J, Kalinowski A, Ray R, McCarthy R. Logistic regression in passenger vehicle rollover research. American Society of Mechanical Engineers Winter Annual Meeting, Anaheim, CA, November 1992.

Padmanaban J, Ray R. Safety performance of rear seat occupant restraint systems. 36th STAPP Car Crash Conference, pp. 193-201, Seattle, WA, November 1992.

Kalinowski A, Lau E, Butler W, McCarthy, Ray R. Statistical analysis of observational data: A study of ATV-related injuries. American Society of Mechanical Engineers Winter Annual Meeting, Anaheim, CA, November 1992.

Ray R, Donelson A, Rice S, Kalinowski A. Fatal motor vehicle accidents: The role of antihistamines with sedating effects. 12th World Congress of The International Association for Accident and Traffic Medicine, The International Association for Accident and Traffic Medicine, pp. 400-404, Helsinki, Finland, June 1992.

Padmanaban J, Ray R. Rear seat belt effectiveness for passenger cars. The International Association for Accident and Traffic Medicine, 12th World Congress, The International Association for Accident and Traffic Medicine, Helsinki, Finland, June 1992.

Padmanaban J, Lange R, Curzon A, Cooperrider N. Automatic seat belt system risk assessment. American Society of Mechanical Engineers Winter Annual Meeting, pp. 39-45, Atlanta, GA, December 1991.

Ray R, Anderson L, Padmanaban J, McCarthy R. Risk analysis of home appliance fires. American Society of Mechanical Engineers Winter Annual Meeting, pp. 47-50, Atlanta, GA, December 1991.

Ray R, Tarter M, Locke M. Mixing parameter regression applied to groundwater contaminant flow. 23rd Annual Symposium on the Interface: Computer Science and Statistics, April 1991.

McCarthy R, Padmanaban J, Ray R. An analysis of the safety-related impact of 'Comfort Feature' introduction in GM vehicles. Association for the Advancement of Automotive Medicine, 33rd Annual Proceedings, October 1989.

McCarthy R, Padmanaban J, Ray R, Lange R. An analysis of fatal rollover risk associated with utility vehicles and selected passenger cars. American Society of Mechanical Engineers Conference, pp. 17-20, December 1989.

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Ray R. A new C(a) test for 2x2 tables. Communications in Statistics 1975; 545-563.

Crocker R, Whitcomb W, Ray R. Effects of sex, development stage and temperature on predation by *Geocoris punctipes*. Environmental Entomology 1975; 4(4):531-534.

Ray R. Maxmin C(a) test against two-sided alternatives. Annals of Statistics 1974; 2(6):175-1188.

## Books

Ray R, Ramcharan S, et al. A Prospective Study of the Side Effects of Oral Contraceptives. Vol. 3, 1980.

## Book Chapters

Ray R. Comparative risk assessment. In: Encyclopedia of Quantitative Risk Analysis and Assessment. Melnick EL, Everitt BS (eds), ISBN: 978-0-470-03549-8, September 2008.

Ray R. Competing risks. In: Encyclopedia of Quantitative Risk Analysis and Assessment. Melnick EL, Everitt BS (eds), ISBN: 978-0-470-03549-8, September 2008.

Ray R. Hazard and hazard ratio. In: Encyclopedia of Quantitative Risk Analysis and Assessment. Melnick EL, Everitt BS (eds), ISBN: 978-0-470-03549-8, September 2008.

Donahoe D, Murray S, Zhao K, Ray R. Accelerated life testing. Encyclopedia of Quantitative Risk Analysis and Assessment. Melnick EL, Everitt BS (eds), ISBN: 978-0-470-03549-8, September 2008.

Rice S, Ray R. Developmental neurotoxicity testing—data evaluation. p. 325-352. In: Handbook of Developmental Toxicology. Hood RD (ed), CRC Press, Tuscaloosa, AL, 1997.

Perlman J, Krauss R, Ray R, Russell-Breifeld R, Lieberknecht G. Smoking, oral contraceptives, and other risk factors for atherosclerotic heart disease. pp. 27-35. In: Smoking and Reproductive Health. Rosenberg J (ed), PSG Publishing Co., Inc., MA, 1987.

## Reports

Lange R, Padmanaban J, Ray R. An assessment of the accident experience of front seat outboard occupants in 1987-1989 motor vehicles equipped with automatic seat belt systems. Failure Analysis Associates, Inc., Report, October 1990.

Ray R. Note on the consistency of C(a) Tests. University of Florida Technical Report No. 75, 1975.

## Presentations

Ray R. Effectiveness of side airbags and FMVSS 214 in injury prevention. International Traffic Medicine Association, Budapest Hungary, September 2003.

Ray R. Driver and passenger safety: Role of occupant protection systems, passenger vehicle mix and occupant safety. International Traffic Medicine Association, Budapest Hungary, September 2003.

Long, RD. Colwell, JD, Ray, R, Grossman, HL, Thomas, B, Strassberger, R . Passenger Vehicle Fires. In NFPA Fire Protection Handbook, Cote, AE (ed), Vol II, Section 21, pp 21.1-21.14, 2008.

Long, RD. Colwell, JD, Ray, R, Grossman, HL, Thomas, B, Strassberger, R . Passenger Vehicle Fires. In NFPA Fire Protection Handbook, Cote, AE (ed), Vol II, Section 21, pp 21.1-21.14, 2008.

## Project Experience

Statistical Consultant, University of California Medical School 1976-1978

Senior Biostatistician, Kaiser Research Contraceptive Drug Study 1976-1978  
Senior Analyst, Pacific Gas & Electric Company 1978-1988