



Exponent®

Engineering & Scientific Consulting

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Professional Profile

Mr. Zhao has more than 26 years of specialized experience in statistical analysis in the areas of consumer product and medical device failure risk investigation, occupational health problems, traffic accident risk, and medical device development. His research also focuses on reliability analysis, particularly in terms of failure mode detection, validation of root cause and contributing factors, failure incident forecast, and failure rate comparison.

Mr. Zhao's areas of statistical expertise include machine learning, classification algorithms in data mining and data analytics, regression, logistic regression, life data regression, experimental design, power calculation, categorical data analysis, statistical hypothesis testing, confidence interval calculation, and epidemiological mortality analysis. His computing expertise covers SAS, R, Reliasoft Weibull++, WinSmith Weibull, and administration of very large databases.

Mr. Zhao works with companies addressing the statistical aspects of product recalls as well as reporting to regulatory agencies such as Consumer Product Safety Commission (CPSC) and FDA. He performs statistical failure analysis investigations and addresses issues related to product field performance and reliability, including time-to-failure analysis, Weibull mixture model, warranty claims prediction, contributing factor analysis, identification of susceptible product populations, EU rapid alert system (RAPEX), and incident forecasting. He also performs Monte Carlo simulations, sampling analyses using Bootstrap methods, and predictive analytics.

He has presented his technical findings to CPSC staff for companies facing product recall concerns. He has also taught statistical risk assessment to design and safety managers of multinational manufacturers of consumer products. He provides statistical analysis in occupational health, automotive, mechanical, biomechanical, and electrical device consulting services to clients. Systems and devices in his statistical failure analysis experience include appliances, computers and consumer electronics, implanted medical devices, and semiconductor components. Large databases he has used in his research include NFIRS, NEISS, FDA MAUDE, FARS, NASS CDS/CISS, GES/CRSS, and traffic accident records from various states.

Prior to re-joining Exponent, Mr. Zhao was a Senior Database Application Engineer at AppGenesys Inc., in San Jose, California, where he provided analytical services with application databases to various clients.

Academic Credentials & Professional Honors

M.S., Wild Land Resources Management, University of California, Berkeley, 1992

M.A., Statistics, University of California, Berkeley, 1992

B.S., Electrical Engineering, Northeast Forestry University, China, 1982

Oracle 8i Certified Professional Database Administrator

Licenses and Certifications

ASQ Certified Reliability Engineer (CRE)

Oracle 8i Certified Professional Database Administrator

Professional Affiliations

American Statistical Association (ASA member)

American Society for Quality (ASQ member)

National Fire Protection Association (NFPA 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

Zhao K, Steffey D. Practical applications of mixture models to complex time-to-failure data. Proceedings, 59th Annual Reliability and Maintainability Symposium, RAMS, 2013.

Zhao K, Steffey D. Practical Applications of Mixture Models to Complex Time-to-Failure Data. Proceedings, 59th Annual Reliability and Maintainability Symposium, RAMS, 2013.

Shum M, Kelsh MA, Sheppard AR, Zhao K. An evaluation of self-reported mobile phone use compared to billing records among a group of engineers and scientists. Bioelectromagnetics 2011 Jan; 32(1):37-48.

Zhao K, Steffey D, Loud J. Incorporating product retirement in field performance reliability analysis. Proceedings, 56th Annual Reliability and Maintainability Symposium, RAMS, 2010.

Heller MF, Imler SM, Zhao K, Watson HN, Corrigan CF. The effect of frontal collision delta-V and restraint status on injury outcome. Society of Automotive Engineers (SAE) Technical Paper 2010-01-0145, 2010.

Zhao K, Steffey D. Analysis of field performance using interval-censored incident data. Annual Reliability and Maintainability Symposium, Fort Worth, TX, January 26-29, 2009.

Ong K, Lau E, Zhao K. Future young patient demand for primary and revision joint replacement: National Projections from 2010 to 2030. ORS 54th Annual Meeting, San Francisco, CA, March 2-5, 2008.

Zhao K, Steffey D. To recall or not to recall? Statistical assessment of consumer product failure risk. Joint Statistical Meetings, Salt Lake City, UT, July 29-August 2, 2007.

Kurtz S, Lau E, Zhao K, Mowat F, Ong K, Halpern M. The future burden of hip and knee revisions: U.S. projections from 2005 to 2030. Scientific Exhibit No. SE21. 73rd Annual Meeting of the American Academy of Orthopedic Surgeons, Chicago, IL, March 22-26, 2006.

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

Shum M, Kelsh MA, Zhao K, Erdreich LS. A comparison of recall of mobile phone use with billing record

data. Presented at BioEM, University College, Dublin, Ireland, June 19-24, 2005.

Steffey D, Zhao K, Grossman H, Le-Resnick H. Vehicle rollover risk analysis: metrics and methods. Joint Statistical Meetings, Minneapolis, MN, August 9, 2005.

Kurtz S, Villarraga M, Edidin A, Zhao K. Static and fatigue mechanical behavior of bone cement with elevated barium sulfate content for treatment of vertebral compression fractures. *Biomaterials*, 2004.

Donelson A, Zhao K. Driver injury risk in crashes with frontal impact—Predictive value and relative importance of NHTSA's NCAP test scores. Society for Risk Analysis Annual Meeting, Baltimore, MD, December 2003.

Kelsh MA, Morgan RW, Zhao K, Exuzides KA. Occupational radiofrequency exposure and cancer mortality. Presented at the Bioelectromagnetics Society Annual Meetings, Munich, Germany, June 16, 2000.

Morgan RW, Kelsh MA, Zhao K, Exuzides KA, Heringer S. Radiofrequency exposure and mortality from cancers of brain and lymphatic/hematopoietic system. *Epidemiology* 2000; 11, March.

Donelson A, Ramachandran K, Zhao K, Kalinowski A. Rates of occupant deaths in vehicle rollover: the importance of fatality risk factors. *Transportation Research Record* 1999; 1665:109-117.

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

Morgan RW, Kelsh MA, Zhao K, Heringer S. Mortality of aerospace workers exposed to trichloroethylene. *Epidemiology* 1998; 9:424-431, July.

Morgan RW, Amsel J, Enders LJ, Meyers G, Zhao K. Risk of asbestos-related pulmonary disease in maintenance workers vs. Operators: Results from a study of chemical manufacturing workers. Report, 1995.

Morgan RW, Zhao K. Study of occupational lung cancer in asbestos factories in China. *Letter, Occup Environ Med* 1994; 51:719-20.

Book Chapters

Iyer M, Zhao K, Steffey D. Managing risks of consumer products. pp. 1040-1044. In: *Encyclopedia of Quantitative Risk Assessment*. Melnick E and Everitt B (eds), John Wiley & Sons Ltd, Chichester, UK, 2008.

Donahue D, Zhao K, Murray S, Ray R. Accelerated life testing. In: *Encyclopedia of Quantitative Risk Assessment*. Melnick E and Everitt B (eds), John Wiley & Sons Ltd, Chichester, UK, 2008.

Zhao K, Steffey D. Statistical design of accelerated fatigue life tests for qualification. *Proceedings, 65th Annual Reliability and Maintainability Symposium, Preprint, CD-ROM*, 2019.

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

Project Experience

Investigated consumer product failure incidents and manufacturing defects at a factory site in Japan. Developed and executed statistical analysis plans to determine production factors contributing to sudden

outbreak of field failure incidents. Presented technical investigation results to US Consumer Product Safety Commission (CPSC).

Investigated consumer product failure incidents for a US distributor that imported power tools with defective components made in China. Provided statistical analysis and evidence to support a proposed corrective action plan, and later presented to CPSC staff who accepted the plan.

Characterize time-to-failure distributions of medical devices made by a Japanese manufacturer. Estimated product hazard rate, forecasted future incidents, and provided statistical support in preparing a report to US Food and Drug Administration (FDA).