

Graduate Faculty Interests and Research

Department of Statistics - University of South Carolina

- **Don Edwards**, Ph.D., Professor, Fellow of the ASA

Website: <http://www.stat.sc.edu/~edwards/>

Areas of Research: Environmetrics, Multiple Comparisons, Response Surface Methodology, Sampling in Medicare Fraud Investigations.

Research Activities: I love the diversity of application of statistics. Much of my research has involved statistical methods for simultaneous inference in a variety of forms and settings. I am also fortunate to have interfered with the research of a number of fine ecologists and environmental scientists. I have a growing new interest in statistical methods for Medicare Fraud investigations, and in the measurement of agreement in subjective judging scenarios.

Why I Like Being a Statistician: In a word, the variety. I've had the good fortune to work collaboratively with scientists in virtually every University of South Carolina department in the physical sciences, engineering, public health, and business schools, for example. In other words, I've never really had to decide "what I'm going to do when I grow up".

Selected Publications:

- Edwards, Donald G. and Hsu, J.C. (1983). Multiple comparisons with the best treatment. *Journal of the American Statistical Association*, 78, 965-971.
- Edwards, Don (1987). Extended-Paulson sequential selection. *Annals of Statistics* 15, 449-455.
- Edwards, Don and Berry, Jack J. (1987). The efficiency of simulation-based multiple comparisons, *Biometrics* 43, 913-928.
- McCann, Melinda and Edwards, Don (1996). A path-length inequality for the multivariate-t distribution, with applications to multiple comparisons, *Journal of the American Statistical Association* 91, 211-216.
- Piegorsch, Walter W., E.P.Smith, D.Edwards, and R.L.Smith (1998). Statistical advances in environmental science. *Statistical Science* 13, 186-208.
- Edwards, Don, G.Ward-Besser, J.Lasecki, B.Parker, K.Wieduwilt, F.Wu, and P.Moorhead (2005). The Minimum Sum Method: a Distribution-Free Sampling Procedure for Medicare Fraud Investigations. *Health Services and Outcomes Research Methodology* 4: 241-263.

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- **Nancy Glenn**, Ph.D., Assistant Professor

Website: <http://www.stat.sc.edu/~glenn>

Major Research Areas: My major research areas are Nonparametric Statistics, Computer Engineering, and Mathematical Optimization.

Research Activities: My research activities related to nonparametric statistics include Robust Empirical Likelihood, Bootstrap Methods, and Density Estimation. Research activities related to Computer Engineering includes Steganalysis and Random Graphs.

Why I Like Being a Statistician: I like being a statistician because it allows me to be on the cutting edge of many different fields. Practically every field uses statistics, so I can be a jack of all trades and a master of all.

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- **John M. Grego**, Ph.D., Associate Professor

Website: <http://www.stat.sc.edu/~grego/>

Major Research Areas: Design of Industrial Experiments, Semiparametric Mixture Models, Environmental Applications

Research Activities: I initially worked on mixture models for attitudinal surveys and aptitude tests; mixture models assume that subjects come from more than one population and the population of origin is unknown. I have recently had the opportunity to apply mixture concepts to an environmental application with interesting policy applications-determining the magnitude of a 100-year flood for a watershed when floods can be caused by different types of meteorological events.

In developing an industrial design of experiments short course with Prof. Lynch and Prof. Edwards, I became interested in simultaneous modeling of process mean and variance. In addition to research in this area, I have also been studying feedback control. Statistical modelling of a continuous production process can be used to make adjustments to the process more efficient. In my capacity as a statistical consultant, I am currently applying this work to local industry.

About Statisticians: Statisticians have a unique opportunity to be a resource for the community, running the gamut from assisting on scientific issues within the university, helping local industry, or providing expertise on environmental issues.

Selected Publications:

- Bruce G. Lindsay, Clifford C. Clogg and John M. Grego (1991). Semi-Parametric Estimation in the Rasch Model and Related Exponential Response Models, Including a Simple Latent Class Model for Item Analysis, *JASA*, 86-86-97.
- John M. Grego (1993). Generalized Linear Models and Process Variation, *Journal of Quality Technology*, 25, pp. 288-295.
- E. Ezra, J.A. Wells, R.H. Gray, F.M.P. Kinsella, G.O. Orr, J.M. Grego, G.B. Arden and Z.J. Gregor (1997). Incidence of Idiopathic Full Thickness Macular Holes in Fellow Eyes: A Five-Year Prospective Natural History Study, *Ophthalmology*, 102, 353-359.
- W.B. Driggers, III, J.M. Grego, and J.M. Dean (1998). Age and Growth of Yellowfin Tuna, *Thunnus albacares*, in the Western North Atlantic Ocean, *Int. Comm. Conserv. Atl. Tunas SCRS/98/123*, 10p.
- John M. Grego, Trevor Craney and James F. Lewis (2000). Quantile Plots for Mean Effects in the Presence of Variance Effects for Fractional Factorial Designs, *Comm. Stat. B*.
- K.L. Clark, J.H. Oliver, Jr., J.M. Grego, A.M. James, L.A. Durden, and C.W. Banks (2001). Host Associations of Ticks Parasitizing Rodents at *Borrelia burgdorferi*-enzootic Sites in South Carolina, *J. Parasitol.* 87(6), 1379-1386.

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- **Brian Habing**, Ph.D., Associate Professor

Website: <http://www.stat.sc.edu/~habing/>

Areas of Research: Psychometrics - Item Response Theory and Educational Measurement

Research Activities: Psychometrics is the application of statistical methods and theory to educational and psychological measurement. (Psychometry on the other hand is the ability to tell the history of an object just by touching it... a much more lucrative ability that I have, unfortunately, yet to master.) While psychometricians use a variety of multivariate methods (and I am interested in most of them) my particular area of expertise is item response theory (IRT) and its application to large-scale educational tests. My research has focused on statistically examining how many different abilities such tests measure and how

well they are measured. I have also conducted research on the related questions of bias in standardized tests and the dimensionality of more general psychological instruments. Research in IRT allows for the application of virtually every area of statistical theory, and mine has ranged from clustering algorithms to nonparametric regression to theoretical probability.

Why I Like Being a Psychometrician: I was first attracted to statistics, and psychometrics in particular, because of the opportunity to apply my theoretical mathematics training to actual sets of numbers. (If you've taken lots of advanced math courses you'll know what I mean!) One of the great benefits of doing research in this area is that much of the research is of immediate interest to those who produce the major educational and psychological exams. You thus have the potential for your work to quickly play a part in something that eventually touches the lives of almost everyone in the country. That psychometricians (whether from statistics, psychology, or educational psychology backgrounds) are often eager and friendly collaborators is an added bonus.

Selected Publications:

- Habing, B., Finch, H. & Roberts, J.S. (2005) A Q_3 statistic for unfolding item response theory models. *Applied Psychological Measurement*, 29, 457-471.
- Finch, H. & Habing, B. (2004). Comparison of NOHARM and DETECT in item cluster recovery: counting dimensions and allocating items. *Journal of Educational Measurement*, 42, 149-169.
- Habing, B., & Roussos, L.A. (2003). On the need for negative local item dependence. *Psychometrika*, 68, 435-452.
- Habing, B. (2001). Nonparametric regression and the parametric bootstrap for local dependence assessment. *Applied Psychological Measurement*, 25, 221-233.
- Douglas, J., Kim, H.R., Habing, B., & Gao, F. (1998). Investigating local dependence with conditional covariance functions. *Journal of Educational and Behavioral Statistics*, 23, 129-151.
- Stout, W., Habing, B., Douglas, J., Kim, H.R., Roussos, L., & Zhang, J. (1996). Conditional covariance based nonparametric multidimensionality assessment. *Applied Psychological Measurement*, 20, 331-354.

• **David B. Hitchcock**, Ph.D., Assistant Professor

Website: <http://www.stat.sc.edu/~hitchcock/>

Areas of Research: Functional Data Analysis, Smoothing Methods, Multivariate Data Analysis, History of Statistics.

Research Activities: Functional data are characterized by being generated from some underlying continuous process, so that the data arise conceptually as curves, rather than simply sets of numbers. With modern sophisticated monitoring equipment, this type of data is becoming more common. Smoothing methods, particularly nonparametric regression, involve finding patterns in one or several variables without making such restrictive assumptions about the distribution of the data as classical parametric regression requires. My research has investigated the effect of smoothing functional data on the clustering and the estimation of dissimilarities among the data. I am currently interested in developing novel methods of analyzing functional data sets, including inference about the median curve and outlier detection. I also enjoy investigating the history of statistics and seeing what the insights of the great pioneers in our science can still teach us today.

Personal Statement: I have always enjoyed investigating data and trying to see patterns and draw conclusions from data. I am excited about developing

novel methods for learning from complicated data, as well as teaching students the beauty and applicability of statistical methods.

Selected Papers:

- Hitchcock, D. B., Casella, G., and Booth, J. G. (2006). Improved Estimation of Dissimilarities by Smoothing Functional Data. *Journal of the American Statistical Association*, 101, 211-222.
- Hitchcock, D. B. (2006). Bandwidth Based Nonparametric Inference. To appear in *Statistical Methodology*.
- Hitchcock, D. B., Booth, J. G., and Casella, G. (2006). The Effect of Pre-smoothing Functional Data on Cluster Analysis. To appear in the *Journal of Statistical Computation and Simulation*.
- Agresti, A. and Hitchcock, D. B. (2005). Bayesian Inference for Categorical Data Analysis. *Statistical Methods and Applications: Journal of the Italian Statistical Society*, 14, 297-330.
- Hitchcock, D. B. (2003). A History of the Metropolis-Hastings Algorithm. *The American Statistician*, 57, 254-257.

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- **Xianzheng (Shan) Huang**, Ph.D., Assistant Professor

Website: <http://www.stat.sc.edu/~huang/>

Major Research Areas: Joint Modeling, Robust Statistical Inference, Longitudinal Data Analysis

Research Activities: My research interest has been modeling survival response and longitudinal response jointly in order to gain insight into the longitudinal process and to predict the survival time. Because such joint modeling involves at least two component models, this topic introduces me to many research areas such as survival analysis and mixed effect model. I am currently continuing on joint-modeling research while discovering new research topics as new questions emerge in the component models.

Why I Like Being a Statistician: I am still asking myself if being a statistician is what I like best or not. I suspect there will be an either-yes-or-no answer for me ever. But I feel the joy when I solve a statistical problem after staying at my desk for hours programming or deriving on paper, when I see the person to whom I explain some statistical idea sees the beauty of that idea as I did, when I encounter new statistical problems to be solved, and when I realize what I have resolved can be applied to different disciplines. I do not know whether I would have so much joy if I were an architect or a physician. I may. But I know for sure that I enjoy being a statistician for all the joy I feel almost everyday now.

Selected Publications:

- Huang, X., Stefanski, L. A. and Davidian, M. (2006) Latent-model robustness in structural measurement error models. *Biometrika*, 93, 53-64.

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- **James D. Lynch**, Ph.D., Professor, Director of Reliability Center

Website: <http://www.stat.sc.edu/~lynch/>

Areas of Research: Probability, Applied Probability, Stochastic Processes, Reliability, Industrial Problems. Currently have interests in complex systems, reliability and industrial problems.

Personal Statement about my Profession: I suckered someone into paying me for doing my hobby. (Being an administrator is not my hobby so I haven't enjoyed what I have been doing lately.)

Selected Papers:

- J. U. Gleaton and J. D. Lynch (2004). On the distribution of the Breaking Strain of a Bundle of Brittle Elastic Fibers. To appear in *Advances of Applied Probability*. (Uses thermodynamic - max entropy/information theoretic concepts in a fracture setting.)
- S.D. Durham, and J.D. Lynch (2000). A Threshold Representation for the Strength Distribution of a Complex Load Sharing System, *Journal of Statistical Planning and Inference*, 83, 25-46 (Shows that a complex systems of Weibulls has a mixed distribution representation)
- J. D. Lynch (2000). The Galton-Watson Process Revisited: Some Martingale Relationships and Applications, *Journal of Applied Probability*, 37, 1-7. (Shows that the irregularity of the GW Process is equivalent to the closability of a related martingale sequence)
- J. D Lynch and J. Sethuraman (1999). On the ergodicity of General State Markov Chains, Unpublished. (Relates L1-convergence of a reverse martingale to the variational norm convergence of the chain distribution to its equilibrium distribution.)
- Lee, S.J., Durham, S.D. and Lynch, J.D. (1995). On the calculation of the reliability of a general load sharing system, *Journal of Applied Probability* 32, 777-792. (Formulas are given for the reliability of monotone load sharing systems.)

• **Kerrie Nelson**, PhD, Assistant Professor

Website: <http://www.stat.sc.edu/~nelson/>

Major research areas: Analysis of correlated data, biostatistics, environmental statistics

Research Activities: While generalized linear mixed models have become a common form of statistical modelling in many situations involving correlated or longitudinal data, methods currently available are either very computer intensive or often inconsistent. One such method is an iterative bias correction method developed originally in 1995 by Kuk, which takes biased starting estimates of the regression coefficients and variance components and iteratively corrects the bias to result in consistent estimates. I have improved the method to make it computationally faster.

In addition, little has been done to date to investigate the performance of the various fitting procedures used in estimating the regression coefficients and variance components, including exact and approximate maximum likelihood and iterative bias correction methods. In my recently acquired PhD I compared the properties of these methods with regard to the effects of sample size and variability present in a model for auto-correlated count data. Current work is examining the behavior of the methods for commonly seen binary data models. I have also examined the modelling of left- and doubly-censored data in an environmental setting, based on the exposure of children to a pesticide.

Why I Like Being a Statistician: I enjoy working in statistics mainly because of its usefulness in a wide range of fields of research and day-to-day situations. New statistical issues arise in many different settings, providing the opportunity to find solutions to both theoretical and applied questions.

Selected Papers:

- Thompson, M.L. and Nelson, K.P. Linear regression with Type I interval and left-censored response data. Accepted by *Environmental and Ecological Statistics* (October 2001).
- Tappin DM, Ford RPK, Nelson KP, et al., Breathing, sleep state, and rectal temperature oscillations. *Archives of Disease in Childhood* 74 (1996) 427-431.

- Ford R.P.K., Nelson K.P. Higher Rates of SIDS persist in low-income groups. *Journal of Paediatrics and Child Health* 31 (1995) 408-411.
- Mitchell EA, Nelson KP, Thompson JMD, et al. Travel and changes in routine do not increase the risk of Sudden Infant Death Syndrome. *Acta Paediatrica* 83 (1994) 815-818.

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- **Edsel A. Peña**, Ph.D., Professor, Fellow of the ASA

Website: <http://www.stat.sc.edu/~pena/>

Areas of Research: Reliability; Survival Analysis; Non- and Semi-parametric Inference; Mathematical Statistics; Applied Stochastic Processes and Probability.

Research Activities: One of my current research pertains to the stochastic modeling and the development of statistical methods appropriate for recurrent events arising in public health and biomedical areas, reliability and engineering settings, and in many other areas such as economics, finance, sociology and political science.

Jointly with Prof. M. Hollander (Florida State Univ.), we have developed a very general model for recurrent events, and jointly with co-workers are in the process of developing appropriate statistical methods for analyzing such data under this general model. Currently, jointly with Prof. E. Slate (Medical Univ. of South Carolina), we are developing stochastic models for relating marker or surrogate processes to the occurrence times of recurrent events.

I am also interested in goodness-of-fit problems and residual analysis particularly those with incomplete data. This research also leads to the important issues of the impact of estimating nuisance parameters when developing estimation and testing procedures, and touches on the important issues of inference after model selection. I have been recently involved with the problem of inference after model selection, and through a recent manuscript, joint with Prof. V. Dukic (Univ. of Chicago), have examined different strategies for making inference after model selection. My research has been and is currently supported by grants from the National Science Foundation and the National Institutes of Health.

Why I Like Being a Statistician: Being an academic statistician is an ideal job for me because it allows me to do mathematical research, which I enjoy immensely, through the development of new statistical methods which have potential applicability in many areas such as in biomedical and public health research and in the engineering and reliability settings. Probabilistic and statistical research also suits my temperament because it is certainly non-trivial mathematically and so it challenges and forces me to exercise my mental capabilities and creativity to the utmost. There is also an inherent philosophical nature to the subject of probability (“the only certain thing in this universe is that everything is uncertain!”), and it still amazes me that one is able to make very accurate inferences about unknown parameters through the use of sample data that is quite minuscule relative to the population of interest, through the exploitation of “order emanating out of the chaos of randomness!”.

Selected Publications:

- Aban, I. and Pena, E. (1995). Properties of Hazard-Based Residuals and Implications in Model Diagnostics. *Journal of the American Statistical Association*, 90, 185-197.
- Agustin, Z. and Pena, E. (1999). Order Statistic Properties, Random Generation, and Goodness-of-Fit Testing for a Minimal Repair Model. *Journal of the American Statistical Association*, 94, 265-272.
- Agustin, M. and Pena, E. (1999). A Dynamic Competing Risks Model. *Probability in the Engineering and Informational Sciences*, 13, 333-358.

- Pena, E. (1998). Smooth Goodness-of-Fit Tests for Composite Hypothesis in Hazard-Based Models. *The Annals of Statistics*, 26, 1935-71.
- Pena, E. (1998). Smooth Goodness-of-Fit Tests for the Baseline Hazard in Cox's Proportional Hazards Model. *Journal of the American Statistical Association*, 93, 673-692.
- Pena, E., Strawderman, R. and Hollander, M. (2001). Nonparametric estimation with recurrent event data. *Journal of the American Statistical Association*, 96, 1299-1315.

- **John D. Spurrier**, Ph. D., Professor and Undergraduate Director, Fellow of the ASA.

Website: <http://www.stat.sc.edu/~spurrier/>

Major Research Areas: Multiple Comparisons, Nonparametrics, Statistics Education

Research Activities: I love to develop statistical methods that will be useful to practitioners of statistics. The field of multiple comparisons involves comparing three or more treatments. Early work in this field involved comparing mean responses for the treatments. My most recent work involves comparing the treatments based on the regression relationship between Y and x . For example, is the relationship between the amount of a chemotherapy agent absorbed in the kidneys (Y) over time (x) affected by the administration of other drugs? The mathematical tools that I most often use in multiple comparisons research are calculus, linear algebra, and numerical analysis. The field of nonparametric statistics deals, in part, with analyzing data without assuming that the data follow a normal distribution. My recent work in this field has involved developing nonparametric multiple comparisons methods, forming new approximations to the distribution of a famous nonparametric test statistic, and developing bounds on a probability that arises in nonparametric statistics. The mathematical tools that I most often use in nonparametric statistics are combinatorics and recursive functions. My work in statistical education has centered on developing hands-on learning activities for use in elementary statistics and in a capstone course for senior statistics majors. These help students better understand the role of statistics and the statistician in scientific investigations.

Why I Like Being a Statistician: I love wearing three hats. As a researcher, I use computers and mathematics to tackle interesting and challenging problems. As a teacher, I have the opportunity to help students reach their full potential. As a consultant, I learn about exciting research in numerous fields.

Selected Publications:

- Spurrier, J.D., and Solorzano E. (2004). Multiple Comparisons with More Than One Control. In *Recent Developments in Multiple Comparison Procedures* (ed. Yoav Benjamini, Frank Bretz, and Sanat Sarkar) IMS Lecture Notes Monograph Series, Vol. 47, 119-128.
- Bhargava, P. and Spurrier, J.D. (2004). Exact Confidence Bounds for Comparing Two Regression Lines with a Control Regression Line on a Fixed Interval. *Biometrical Journal*, 46, 720-730.
- Spurrier, J.D. (2005). Multiple Comparisons with the Best Control in a One-Way Layout. *Communications in Statistics - Theory and Methods*, 34, 651-660.
- Spurrier, J.D. (2005). Improved Upper Bounds for Hollander's μ and Lehmann's λ . *Communications in Statistics - Theory and Methods*, 34, 1851-1855.
- Spurrier, J.D. (2006). Additional Tables for Steel-Dwass-Critchlow-Fligner Distribution-Free Multiple Comparisons of Three Treatments. *Communications in Statistics - Simulation and Computation*, 35, 441-446.

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- **Joshua M. Tebbs**, Ph. D., Assistant Professor.

Website: <http://www.stat.sc.edu/~tebbs/index.htm>

Major Research Areas: Group Testing, Order-Restricted Inference, Multiple Comparisons, Bayesian Methods, Public-Health Issues.

Research Activities: My statistical research focuses primarily on group testing, order-restricted inference, and (now that I'm at USC) multiple comparisons. At the moment, I'm especially interested in biomedical applications, particularly those involving sexually transmitted diseases. A recent grant submission proposes to find more efficient protocols for identifying infected (positive) individuals through group testing and regression modeling. This methodology can be used in other applications as well, including drug discovery, agro terrorism, genetics, and environmental risk assessment. My order-restricted inference research is more on the "theoretical side." Currently, I am interested in nonparametric tests for stochastic orderings. Such orderings are common in engineering/reliability applications, diagnostic screening, and queuing theory.

Professional Statement: As a professional statistician, my recent history, since 2001, appears to be somewhat ambulant, having two other academic positions (Oklahoma State and Kansas State) and a position in industry. However, I am very glad to now be at USC; it is a great research institution and the department is a great place to interact with top colleagues in their areas. Few careers enable one to apply his or her mathematical prowess to both theoretical and applied problems. A career as a statistician is one of these professions. I enjoy working with students at all levels, and I always aim to instill in others the enthusiasm I have for statistics and my research endeavors.

Selected Publications:

- Kim, J., Tebbs, J., and An, S. (2006). Extensions of Mangat's randomized-response model. *Journal of Statistical Planning and Inference*, 136, 1554-1567.
- Carolan, C. and Tebbs, J. (2005). Nonparametric tests for and against likelihood ratio ordering in the two-sample problem. *Biometrika*, 92, 159-171.
- Tebbs, J. and Bilder, C. (2004). Confidence interval procedures for the probability of disease transmission in multiple-vector-transfer designs. *Journal of Agricultural, Biological, and Environmental Statistics*, 9, 75-90.
- Moser, B. and Tebbs, J. (2004). A new interim monitoring statistic for group sequential clinical trials. *Communications in Statistics: Theory and Methods*, 33, 153-164.
- Tebbs, J. and Swallow, W. (2003). Estimating ordered binomial proportions with the use of group testing. *Biometrika*, 90, 471-477.