

# Preface

This volume emerged from Ordered Data Analysis, Models and Health Research Methods: An International Conference in Honor of H.N. Nagaraja for His 60th Birthday that was held from March 7 to 9, 2014 at the University of Texas at Dallas. Over 200 participants from 14 countries attended the conference which broadly focused on the areas in which Prof. H.N. Nagaraja has made significant contributions. The papers in this book are arranged in accordance with the conference themes, starting with order statistics, followed by stochastic modeling and estimation, and concluding with developments in statistical methods for health research.

## Biography

Haikady Navada Nagaraja was born in 1954 in a small village in Karnataka, India. He received his Bachelor's degree in Mathematics and Statistics in 1972, and his Master's degree in Statistics in 1974, both from the University of Mysore. After teaching at the university as a lecturer for 3 years, he began his doctoral studies at Iowa State University in 1977, where he received his Ph.D. in Statistics in 1980. His dissertation, entitled *Contributions to the Theory of the Selection Differential and Order Statistics*, was completed under the supervision of Prof. H.A. David. He joined the Department of Statistics at The Ohio State University after graduation, where he remained ever since. H.N. Nagaraja became a biostatistician for the General Clinical Research Center at The Ohio State University College of Medicine in 1993, resulting in a joint appointment with the College of Medicine. In 2010, he moved from the Department of Statistics to the Division of Biostatistics, College of Public Health, as the Chair of the division. After 35 years at Ohio State, he retired in 2015 and is now Professor Emeritus of Biostatistics. He remains a prolific researcher (and dedicated teacher) with over 180 research publications, split among theoretical, methodological, and applied topics.

He started his career by studying order statistics and related subjects, including record values, concomitants of order statistics, stochastic modeling, and characterizations of distributions. For example, Nagaraja [1], the first paper drawn from his doctoral thesis, focuses on asymptotics for order statistics. Nagaraja [2] is one of his fundamental contributions to order statistics for discrete populations. Bunge and Nagaraja [3], one of his first papers with a doctoral student, is on record values. Nagaraja and David [4] is on distributions of the maximum of concomitants. Abo-Eleneen and Nagaraja [5] provides an important contribution to Fisher Information for censored samples. Even after his move to the College of Public Health, he has been able to find time for theoretical work such as his recent paper on spacings of neighboring order statistics, Nagaraja, Bharath, and Zhang [6].

H.N. Nagaraja is among the few statisticians who can work with equal mastery on problems involving statistical theory and methodology as well as on applications. His collaborative work at The Ohio State University College of Medicine, and later at the College of Public Health, generated new types of statistical problems to solve for a variety of applications such as cognition and nephrology. For example, Choudhary and Nagaraja [7] provides a methodology for agreement studies, motivated by a question about comparing devices for measuring daily caloric expenditure in exercise physiology. Berntson et al. [8] develops a framework to standardize methods on how to study heart rate variability. One of the most cited papers in genetics, Yang et al. [9] is an important contribution to the study of lupus. Zhang et al. [10] develops an equation to predict kidney injury. Most recently, Scharre et al. [11] validates a self-administered cognitive test called SAGE.

H.N. Nagaraja has coauthored three books and coedited two volumes. Arnold, Balakrishnan, and Nagaraja [12] and David and Nagaraja [13] are both on order statistics while Arnold, Balakrishnan, and Nagaraja [14] focuses on record values. In 1996, he edited a book with Profs. P.K. Sen and D.F. Morrison [15], a compilation in honor of his doctoral advisor, Prof. H.A. David. In addition, he edited a second compilation volume honoring Prof. S. Panchapakesan with Profs. N. Balakrishnan and N. Kannan, published in 2005 [16].

In recognition of his influential work in statistics, H.N. Nagaraja was selected to be a Fellow of both the American Statistical Association (2000) and the American Association for the Advancement of Science (2012). He is also an elected member of the International Statistical Institute (1993). H.N. Nagaraja has contributed substantially to the service of the statistical profession, including as President of the International Indian Statistical Association (2010–2011).

In addition to being a distinguished researcher, H.N. Nagaraja is an outstanding teacher and mentor, winning the Powers Award for Excellence in the Teaching of Statistics at Ohio State in 1993. He often tells students, “Statistics is never a ‘Love at first sight’ subject. If you only take one statistics class, you most likely would have hated it. Take another one, and you will sign up for many more.” His intellect, humility, integrity, and humor, along with his caring nature, inspire his students,

bringing out their best. While at Ohio State, H.N. Nagaraja has supervised 18 Ph.D. students and co-supervised two others. He has also developed many courses, especially for non-statisticians, to improve statistical literacy and statistical practice. For the past 3 years, he has taken undergraduate students from Ohio State to Karnataka, India, to teach them about public health issues in developing countries.

At home in Columbus, he lives with Jyothi, his wife of 34 years, and has two daughters, Chaitra and Smitha. He enjoys traveling, reading about history, and cheering on the Ohio State Buckeyes.

## Outline of This Volume

This volume brings together 15 invited research papers written by authors drawn from the conference participants. These papers are categorized as follows: Ordered Data Analysis (Part I), Stochastic Modeling and Estimation (Part II), and Statistical Methods for Health Research (Part III). All papers underwent a rigorous peer-review process.

Part I of this book contains six papers on both theoretical and applied topics in ordered data analysis. Arnold and Villaseñor investigate the direction of bias of the estimated sample Lorenz curve. Balakrishnan, Davies, Keating, and Mason discuss the Pitman closest estimators based on convex linear combinations of two contiguous order statistics. Hosking studies different methods of constructing joint confidence regions for  $L$ -skewness and  $L$ -kurtosis. The last three papers in this part discuss some recent results on progressively censored order statistics. Ng, Duan, and Chan provide simple computational methods of the conditional single and product moments of progressively censored order statistics under a time constraint. Cramer and Iliopoulos generalize adaptive progressive censoring to a scheme that allows for arbitrary inspection times and possible removals of units. Finally, Abo-Eleneen and Almohaimed discuss computational approaches of the Renyi entropy in sets of consecutive progressively Type-II censored order statistics.

The theme for Part II is stochastic models and estimation methods, and the papers are inspired by a range of applications from contagion in financial networks to estimating the number of species in a population. We start with Burkschat, Kamps, and Kateri, who develop three approaches for estimating hazard rates of sequential order statistics within the context of connected systems. Next, Barlevy and Nagaraja examine a framework to study banking networks using a discrete spacings model. Bunge then develops a framework to improve estimates of the number of classes in a population using distributions based on generalized hypergeometric functions. The next contribution is by Serhiyenko, Ravishanker, and Venkatesan, who model multivariate counts data over time using a level correlated, zero-inflated Poisson model. They apply their method to prescription drug sales data. This part concludes with a paper by Sengupta, Choudhary, and Cassey, who propose a larger class of models that enables one to model skewed and heavy-tailed data. They illustrate their robust mixed model on crab claw measurements.

Part III is composed of four papers focusing on health research methods. Rettiganti and Nagaraja study a model for analyzing brain lesion counts in multiple sclerosis patients. Mukhopadhyay and Banerjee focus on constructing confidence intervals for the probability of success in a Bernoulli trial using a sequential approach. Papachristou follows by developing a method to detect a subset of single nucleotide polymorphisms on a genetic map that may be associated with a quantitative phenotype. Finally, Park and Lin propose a model to reconstruct the underlying three-dimensional spatial structure of a species' genome.

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## References

1. Nagaraja, H.N. 1982. Some asymptotic results for the induced selection differential. *Journal of Applied Probability* 19:253–261.
2. Nagaraja, H.N. 1986. Structure of discrete order statistics. *Journal of Statistical Planning and Inference* 13:165–177.
3. Bunge, J.A., and H.N. Nagaraja. 1992. Exact distribution theory for some point process record models. *Advances in Applied Probability* 24:20–44.
4. Nagaraja, H.N., and H.A. David. 1994. Distribution of the maximum of concomitants of selected order statistics. *Annals of Statistics* 22:478–494.
5. Nagaraja, H.N., and Z. Abo-Eleneen. 2008. Fisher Information in order statistics and their concomitants in bivariate censored samples, *Metrika* 67:327–347.
6. Nagaraja, H.N., K. Bharath, and F. Zhang. 2015. Spacings around an order statistic. *Annals of the Institute of Statistical Mathematics* 67:515–540.
7. Choudhary, P.K., and H.N. Nagaraja. 2005. Selecting the instrument closest to a gold standard. *Journal of Statistical Planning and Inference* 129:229–237.
8. Berntson, G.G., J.T. Bigger, Jr., D.L. Eckberg, P. Grossman, P.G. Kaufmann, M. Malik, H.N. Nagaraja, S.W. Porges, J.P. Saul, P.H. Stone, and M.W. van der Molen. 1997. Heart rate variability: Origins, methods, and interpretive caveats. *Psychophysiology* 34:623–648.
9. Yang, Y., E.K. Chung, Y.L. Wu, S.L. Savelli, H.N. Nagaraja, B. Zhou, M. Hebert, K.N. Jones, Y. Shu, K. Kitzmiller, K.A. Blanchong, K.A. McBride, G.C. Higgins, R.M. Rennebohm, R.R. Rice, K.V. Hackshaw, R.A.S. Roubey, J.M. Grossman, B.P. Tsao, D.J. Birmingham, B.H. Rovin, L.A. Hebert, and C.Y. Yu. 2007. Gene copy-number variation and associated polymorphisms of complement component C4 in human systemic lupus erythematosus (SLE): Low copy number is a risk factor for and high copy number is a protective factor against SLE susceptibility in European Americans. *American Journal of Human Genetics* 80:1037–1054.
10. Zhang, X., H.N. Nagaraja, T. Nadasdy, H. Song, A. McKinley, J. Prosek, S. Kamadana, and B.H. Rovin. 2012. A composite urine biomarker reflects interstitial inflammation in lupus nephritis kidney biopsies. *Kidney International*, 81:401–406.
11. Scharre, D.W., S.I. Chang, H.N. Nagaraja, J. Yager-Schweller, and R.A. Murden. 2014. Community cognitive screening using the self-administered gerocognitive examination (SAGE). *Journal of Neuropsychiatry and Clinical Neurosciences* 26:369–375.

12. Arnold, B.C., N. Balakrishnan, and H.N. Nagaraja. 1992. *A first course in order statistics*. John Wiley & Sons. 279 p. (SIAM Reprint 2008).
13. David, H.A., and H.N. Nagaraja. 2003. *Order Statistics*, 3rd Edition. John Wiley. 458 p.
14. Arnold, B.C., N. Balakrishnan, and H.N. Nagaraja. 1998. *Records*. John Wiley. 312 p.
15. Nagaraja, H.N., P.K. Sen, and D.F. Morrison, (eds.). 1996. *Statistical theory and applications —Papers in Honor of Herbert A. David*. Springer-Verlag, 334 p.
16. Balakrishnan, N., N. Kannan, and H.N. Nagaraja, (eds.). 2005. *Advances in Ranking and Selection, Multiple Comparisons, and Reliability*. Birkhäuser, 412 p.

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