

SSC SPECIAL INVITED SESSION IN HONOUR OF THE RETIREMENT OF J.N.K. (JON) RAO

Patrick Farrell¹

As President of the Survey Methods Section of the Statistical Society of Canada for 2000/01, I was honoured to have the opportunity to organize for the Society's Annual Meeting in 2001, a special invited session in recognition of the retirement of Professor J.N.K. (Jon) Rao. I wish to thank David Bellhouse, Mike Hidioglou, and Randy Sitter (jointly with Jeff Wu) for speaking in the session. Their talks are summarized below.

Jon obtained his Bachelor's degree from Andhra University in 1954, his Master's from Bombay University in 1956, and his PhD from Iowa State in 1961 under Professor Hartley. While studying towards his doctorate degree, he received the George W. Snedecor Award in Statistics for "Outstanding PhD Student of the Year". Jon has held positions at Iowa State, Texas A & M, the Indian Statistical Institute, the University of Manitoba, and most recently at Carleton University since 1973.

Jon's research contributions to statistics span many areas. He has published well over 100 articles, in addition to numerous monographs and books. His major contributions in sampling include unequal probability sampling (most notably the Rao-Hartley-Cochran method), rotation sampling, resampling methods, foundations of inference, the analysis of survey data (including Rao-Scott methods), small area estimation, and imputation for missing data (including Rao-Shao methods).

In the area of foundational issues, Jon published a paper in *Biometrika* in 1968 with Professor Hartley entitled "A New Estimation Theory for Sample Surveys". The paper introduces a method called the scale-load approach that is now called empirical likelihood by Art Owen.

In 1967, Jon published another paper with Professor Hartley on maximum likelihood estimation for general ANOVA models. To quote Searle, Casella, and McCulloch in their 1992 book entitled *Variance Components*: "The landmark paper for ML estimation

in general is Hartley and J.N.K. Rao wherein a methodology is developed for a very wide class of models." In 1969, Jon published a paper with Hartley and Kiefer in the *Journal of the American Statistical Association* entitled "Variance Estimation with one Unit per Stratum" that motivated C.R. Rao to develop his minimum quadratic unbiased estimation (MINQUE) method in 1970.

Jon's contributions also encompass the analysis of cluster-correlated data that occur in biostatistical applications. A paper with Alistair Scott in 1992 in *Biometrics* and one in *Statistics in Medicine* in 2000 provide a simple method that is based on the idea of design effects and that permits the use of standard methods after preprocessing the data.

Jon is an Elected Fellow of the Royal Society of Canada, the American Statistical Association, the American Association for the Advancement of Science, and the Institute of Mathematical Statistics. He was awarded the Gold Medal from the Statistical Society of Canada for outstanding research in 1993. He gave the Special Address on Survey Research Methods at the Annual Meeting of the Society in 1999, the Gold Medal Lecture in 1993, and the President's Specially Invited Address in 1989. Over his career, he has served as an Associate Editor for such journals as the *Annals of Statistics*, the *Canadian Journal of Statistics*, *International Statistical Review*, *Sankhya Series C*, *Survey Methodology*, the *Journal of Statistical Planning and Inference*, the *Journal of the Indian Statistical Association*, the *Journal of the American Statistical Association*, *Statistica Sinica*, and the *Journal of Applied Statistics*. He is also on the Board of Directors of the Laboratory for Research in Statistics and Probability at Carleton University.

Unfortunately, Jon was unable to attend the invited session in his honour due to illness. As such, the session was videotaped and presented to him shortly thereafter. He did, however, write the following passage that I was privileged to read to the participants at the session.

¹ Patrick Farrell, School of Mathematics and Statistics, Carleton University, Ottawa, Ontario, K1S-5B6, pfarrell@math.carleton.ca.

Dear Friends,

I am very disappointed that unexpected health problems have prevented me from attending the SSC session in honour of my retirement. I will look forward to reading the papers, or at least the overheads, presented by David Bellhouse, Jeff Wu, and Mike Hidioglou. I would like to thank Pat Farrell for organizing this session.

I have collaborated with all the three speakers. David was my first (unofficial) PhD student in Canada and I am very proud of his professional achievements in survey sampling and other areas. Jeff was very interested in sampling in the early 80's and we wrote two interesting papers on resampling methods for surveys. But I lost him to industrial statistics after the Japanese success story. He became an authority on designs for industry. Maybe Jeff will return to sampling now that the Japanese success is a passe! I have known Mike for the past 25 years and I thank him for introducing me to many interesting research problems at Statistics Canada. Mike is a pioneer in the development of software for survey data. I have worked as a consultant at

Statistics Canada for the past 27 years and have enjoyed the collaboration with many researchers there (including several of my past graduate students).

I started my academic career at Iowa State in 1961. Forty years of teaching, research and consulting were very rewarding but also exhausting. I am enjoying my early retirement, free of teaching duties and departmental headaches. But I am still very busy with research and supervision of graduate students. Hopefully, I will slow down and find time to enjoy other activities including travelling and yoga. My wife and I try to visit Cleveland as often as possible to spend time with our two adorable grand children.

Finally, I want to thank my PhD supervisor, the late Professor Hartley, for encouraging me to work in survey sampling, linear models and other areas of practical importance. I was also fortunate to have collaborated with him for over 15 years.

In closing, I hope you will enjoy the talks in the session