The Open University Statistics Group

2020 Report

1. Membership

Dr K. Adhikari
Professor S. Biedermann (from September)
Miss A. Bromley
Miss C. Calvert
Dr F. Elfadaly
Dr Á.E. Faria
Professor P.H. Garthwaite (to December)
Dr R.M. Hilliam
Mrs R. Neal
Dr C.M. Queen
Dr M. Riaz (to February)
Mx R. Thomas
Dr N.T. Trendafilov
Dr S.K. Vines

Long-term associates

Professor C.P. Farrington [Emeritus Professor]
Professor P.H. Garthwaite [Emeritus Professor] (from December)
Professor M.C. Jones [Emeritus Professor]
Professor K. McConway [Emeritus Professor]
Dr A. Noufaily (Warwick Medical School) [Visiting Research Fellow]
Dr Y.G. Weldeselassie (Warwick Medical School) [Visiting Research Fellow]
Dr H.J. Whitaker (Public Health England) [Visiting Research Fellow]

Full–time research students

Mr M. Khokan
Mrs M. Moustafa
Mr S.S. Paria (from October)

2. Introduction

Although 2020 was not the best year for the whole globe, the Statistics Group has managed to keep its excellent work going as usual! To prove this claim, here is an overview of the substantial activity in Statistics at the Open University in 2020, in both research and teaching.

On the research side, all our usual activities and outputs are described in Section 4 onwards of this report. During the year, members of the group published 15 papers in refereed journals, along with a number of other outputs (see Section 5). Pre-publication papers can be found in our technical report series, at

https://www.open.ac.uk/stem/mathematics-and-statistics/research/annual-reports

On the teaching side, over 3760 students were enrolled on the Statistics modules presented for study from dates in 2020 (see Section 3).

Our excellent colleague, Prof Paul Garthwaite, retired in December after more than 20 years of service at the Open University. Paul was a highly valued and admired colleague for his outstanding teaching and his exceptional research that covers wide areas of both Bayesian and frequentist statistics. Paul is still research active and his excellent research contribution is still ongoing. Best wishes to Paul for a long and happy retirement.

We are very pleased to welcome Prof Stefanie Biedermann to the group as Professor in Statistics from September. Stephanie joined us from the University of Southampton with a formidable and distinguished career in both research and teaching. She is a valuable addition to the group. In the other direction, we wish Dr Muhammad Riaz a successful career in his new permanent position in Pakistan. Muhammad has spent a few months with the group as a Research Associate. But his excellent research work is to be continued with some members of the group.

The Statistical Advisory and Consultancy Services continue, supporting research in other disciplines across the Open University. These were run by Álvaro Faria and Paul Garthwaite. Two web pages explain the services:

https://openuniv.sharepoint.com/sites/units/stem/maths-stats-intranet/Pages/Statistics-Advisory-Service.aspx (only available internally)

https://openuniv.sharepoint.com/sites/units/stem/maths-stats-intranet/Pages/Statistical-Consultancy-Service.aspx (only available internally)

Further information on the Group's research activities is available through our general web pages

https://www.open.ac.uk/stem/mathematics-and-statistics/research/research-groups/statistics

3. Teaching

Presentation

The Group continued to present six modules of 30 CATS points each with one of them (M140) being presented twice in the year. These, with numbers of students starting the presentations of each module in 2020 given in square brackets, are:

- M140 *Introducing statistics* (Chairs: Calvert, Bromley) [February 734; October 1467]

- M248 *Analysing data* (Chair: Hilliam) [561]

- M249 *Practical modern statistics* (Chairs: Faria) [259]

- M343 *Applications of probability* (Chair: Trendafilov) [345]

- M346 *Linear statistical modelling* (Chair: Trendafilov) [228]

- M347 *Mathematical statistics* (Chair: Elfadaly) [168].

The first level mathematics module, MU123 *Discovering Mathematics,* also contains a little statistical material.

There was a markedly increase in students numbers starting all statistics modules in 2020. An increase of more than 30% of the last year numbers were recorded in the 20J presentation of both M140 and M249.

Recognised amount of work has been done in modifying the computer books of M140 and M248 following an update of the Minitab software. The work was done by Kaustubh Adhikari and was checked by Paul Garthwaite.

Many changes were also applied to M347 from the 20J presentation to increase student's satisfaction and retention rates. These included, for example, a new assessment strategy with a new set of TMAs and a Handbook for the module. This work was led by Fadlalla Elfadaly with remarkable contribution from Rachel Hilliam, Catriona Queen, Rowan Thomas and Kaustubh Adhikari.

Production

Work on M348 *Applied Statistical Modelling* has continued, with the aim to replace M346 *Linear Statistical Modelling* in October 2022. The new module represents a very considerable update compared with the old, prompted partly by its prominent roles in our new undergraduate degree in Data Science (see below) and a new degree in Economics. Karen Vines is the production Module Team Chair and Catriona Queen is the Deputy Chair. Both are senior writers on the module and are efficiently leading and managing the production process.

Qualifications

Our modules are compulsory components of degrees in Mathematics and Statistics, Mathematics, Computing & IT and Statistics, Mathematics and its Learning, Economics and Mathematical Sciences and Data Science, as well being specified options in certain other qualifications. The Mathematics and Statistics degree was awarded to 42 students in 2020. Other joint degrees that include a substantial element of statistics were also awarded.

We also award a Professional Certificate in Practical Statistics, for successful study of M140, M248, M249 and M346, and a Graduate Certificate in Theoretical Statistics and Probability, for M343 and M347. In 2020, these two qualifications were awarded to 4 and 5 students, respectively.

The new undergraduate degree in Data Science continued and there were 810 students registered in 2020. The degree features all our statistics modules, some compulsory, some optional, as well as others from computing and mathematics. M140, M248 and M348 are compulsory modules in the new Economics degree with 406 students registered in 2020.

4. Research interests

Research in the Statistics Group has been centred for many years around three main themes: *Bayesian Statistics, Medical Statistics* and *Multivariate Statistics*. Clearly, these three general areas cover a huge variety of research projects in Statistics. *Statistical Genetics* is a promising topic that is currently blossoming in the group. The diversity of research interests has been enriched by our new colleague, Steffanie Biedermann who is leading the work on *optimal design of experiments*. Research also continues on topics not directly covered by these research themes, of which single case studies, distribution theory, time series forecasting, improved confidence intervals and statistics in the media are but a

selection. Ongoing collaborations continue in areas such as medicine, psychology, and earth sciences.

For details, see https://www.open.ac.uk/stem/mathematics-and-statistics/research/research-groups/statistics and the publications, talks and other items to follow.

5. Publications

5.1 Publications in refereed journals

Adaikalakoteswari, A., Wood, C., Mina, T.H., Webster, C., Goljan, I., **Weldeselassie, Y.**, Reynolds, R.M. & Saravanan, P. (2020) Vitamin B12 deficiency and altered one-carbon metabolites in early pregnancy is associated with maternal obesity and dyslipidaemia. *Scientific Reports*, **10**, 11066.

Burke, K., **Jones, M.C.** & **Noufaily, A.** (2020) A flexible parametric modelling framework for survival analysis. *Applied Statistics*, **69**, 429-457.

Elfadaly, F.G. & **Garthwaite, P.H.** (2020) On Quantifying Expert Opinion about Multinomial Models that Contain Covariates. *Journal of the Royal Statistical Society-Series A*, **183**, 959-981.

Forbes, H., Douglas, I., Finn, A., Breuer, J., Bhaskaran, K., Smeeth, L., Packer, S., Langan, S.M., Mansfield, K.E., Marlow, R., **Whitaker, H.** & Warren-Gash, C. (2020) Risk of herpes zoster after exposure to varicella to explore the exogenous boosting hypothesis: self controlled case series study using UK electronic healthcare data. *BMJ*, 368: 6987.

Hoschler, K., Maharjan, S., **Whitaker, H.**, Southern, J., Okai, B., Baldevarona, J., Turner, P.J., Andrews, N.J., Miller, E. & Zambon, M. (2020) Use of traditional serological methods and oral fluids to assess immunogenicity in children aged 2-16 years after successive annual vaccinations with LAIV. *Vaccine*, **38**, 2660-2670.

Jones, M.C. (2020) On univariate slash distributions, continuous and discrete. *Annals of the Institute of Statistical Mathematics*, **72**, 645-657.

Jones, M.C., Noufaily, A. & Burke, K. (2020) A bivariate power generalized Weibull distribution: a flexible parametric model for survival analysis. *Statistical Methods in Medical Research*, **29**, 2295-2306.

McConway, K. (2020) Cancer and five chemicals: why we still don't know *whether* there is a risk to humans. *Lancet Oncology*, **21**, 20-21.

Pebody, R.G., **Whitaker, H.**, Ellis, J., Andrews, N., Marques, D., Cottrell, S., Reynolds, A.J., Gunson, R., Thompson, C., Galiano, M., Lackenby, A., Robertson, C., O'Doherty, M.G., Owens, K., Yonova, I., Shepherd, S.J., Moore, C., Johnston, J., Donati, M., McMenamin, J., de Lusignan, S. & Zambon, M. (2020) End of season influenza vaccine effectiveness in primary care in adults and children in the United Kingdom in 2018/19. *Vaccine*, **38**, 489-497

Pebody, R., **Whitaker, H.**, Zhao, H., Andrews, N., Ellis, J., Donati, M. & Zambon, M. (2020) Protection provided by influenza vaccine against influenza-related hospitalisation in >=65 year olds: early experience of introduction of a newly licensed adjuvanted vaccine in England in 2018/19. *Vaccine*, **38**, 173-179.

Pebody, R.G., Zhao, H., **Whitaker, H.J.**, Ellis, J., Donati, M., Zambon, M. & Andrews, N. (2020) Effectiveness of influenza vaccine in children in preventing influenza associated hospitalisation, 2018/19, England. *Vaccine*, **38**, 158-164.

Ritchie, S.J., Morris, A.J. & **McConway, K.** (2020) Comment: Association Between Maternal Fluoride Exposure and Child IQ. *JAMA Pediatrics*, **174**, 213-214.

Sinnathamby, M.A., **Whitaker, H.**, Coughlan, L., Lopez Bernal, J., Ramsay, M. & Andrews, N. (2020) All-cause excess mortality observed by age group and regions in the first wave of the COVID-19 pandemic in England. *Eurosurveillance*, **25**, 2001239.

Song, C., Fuentes-Guajardo, M., **Adhikari, K.**, Sun, C., Zhang, M., Li, Q., Yang, G., Gonzalez-José, R., Schüler-Faccini, L., Bortolini, M., Acuña-Alonzo, V., Canizales-Quinteros, S., Gallo, C., Poletti, G., Bedoya, G., Rothhammer, F. & Ruiz-Linares, A. (2020) Genome-wide Association Study for the Facial Morphology of Peruvians. *Genomics and Applied Biology*, **3**, 1-16.

van Dorp, J.R. & **Jones, M.C.** (2020) The Johnson system of frequency curves – historical, graphical and limiting perspectives. *The American Statistician*, **74**, 37-53.

5.2 Other publications

McConway, K. (2020) Coronavirus 'excess deaths': why England and Wales have been hardest hit in Europe – new study, *The Conversation*, available at https://theconversation.com/coronavirus-excess-deaths-why-england-and-wales-have-been-hardest-hit-in-europe-new-study-147952

McConway, K. & Spiegelhalter, D. (2020) Is SARS-CoV-2 viral load lower in young children than adults? Jones et al provide evidence that it is (in spite of their claims to the contrary), *Medium,* available at https://d-spiegel.medium.com/is-sars-cov-2-viral-load-lower-in-young-children-than-adults-8b4116d28353

Spiegelhalter, D. & **McConway, K.** (2020) Live Facial Recognition: how good is it really? We need clarity about the statistics, *Medium*, available at https://medium.com/wintoncentre/live-facial-recognition-how-good-is-it-really-we-need-clarity-about-the-statistics-5140bd3c427d

6. Seminars at The Open University

Over the year we heard the following seminar speakers:

Mohamed Bennasar (The Open University) *Machine Learning Based System for Detecting Dementia at the early Stage Using Clock Drawing Test*

Rebecca Killick (Lancaster University) Introducing the Mean Locally Stationary Wavelet Process and its applications

Kevin McConway (The Open University) *Communicating numbers and uncertainty to non-statisticians*

Sayantan Banerjee (IIM Indore) *Change-point Analysis in Financial Networks*

Alex Diana (University of Kent) *A vector of softcore processes for modelling interactions between species using capture-recapture data*

We also had our Internal Research Day, organised by K. Adhikari, where the speakers were: M. Khokan, C. Calvert, A. Bromley, K. Adhikari, R. Hilliam, Á.E. Faria, K. Vines, N.T. Trendafilov and P.H. Garthwaite.

7. External conference papers and posters given

S. Biedermann

Statistics Research Students' Conference RSC2020, Nottingham *New Modelling Approaches for Constrained Mixture Experiments* [plenary talk]

F. Elfadaly

Third International Conference of Mathematics and Statistics, Sharjah, UAE *Locally correct confidence intervals for a binomial proportion*

Á.E. Faria

International Symposium of Forecasting, Rio de Janeiro, Brazil *Dynamic Bayesian Smooth Transition Autoregressive models for non-linear non-stationary processes*

International Symposium of Forecasting, Rio de Janeiro, Brazil *Forecasting tailings dam displacement with the WARIMAX-GARCH model*

K. McConway

Radical Statistics 2020, London. *Statistical work: the changing occupational landscape*

Bournemouth University/Royal Statistical Society/Association of British Science Writers symposium on Coronavirus, Statistical Chaos and the News (online) *Will the new coronavirus lead to new ways of reporting on statistics?* [Invited keynote talk]

8. Other external seminars and talks given

R. Hilliam

Horizons in STEM He Conference, online hosted by Nottingham University (joint talk with G. Arrowsmith, A. Siddons, D. Goldrei and C. Brown) *Supporting mathematics and statistics students at a distance from beginning to end*

Advance HE STEM conference, Manchester *Providing skills through an online Mathematics and Statistics learning community*

K. McConway

Seminar for the School of Environment, Earth and Ecosystem Sciences, OU *Some pitfalls of presenting science and statistics in the media*

'Ask the Experts' online event *Trusting Statistics in Today's News* [joint talk with **K. Adhikari** & K. Chicot]

Isaac Newton Institute workshop on Future Pandemics, part of the programme on 'Infectious Dynamics of Pandemics: Mathematical and statistical challenges in understanding the dynamics of infectious disease pandemics' (online) *How do we get appropriate change?* [invited discussion leader]

PA Media, London *Dealing with statistics*

9.   Editorial roles

S. Biedermann

- Associate Editor: *Statistics – A journal of theoretical and applied statistics*
- Associate Editor: *Journal of the Royal Statistical Society, Series B*
- Guest Editor: *Special issue of Statistical Papers* (for mODa conference 2022)

M.C. Jones

- Associate Editor: *Statistica Neerlandica* (from May)
- Associate Editor: *Statistics and Probability Letters*
- Member, Editorial Board: *Statistical Methods in Medical Research* (to end 2020)

K. McConway

- Statistical Advisor: *Endocrine-Related Cancer*
- Statistical Advisor: *Journal of Endocrinology*
- Statistical Advisor: *Journal of Molecular Endocrinology*

N.T. Trendafilov

- Associate Editor: *Behaviormetrika* (Springer)
- Associate Editor: *Computational Statistics* (Springer)
- Associate Editor: *Japanese Journal of Statistics and Data Science* (Springer)

10. Other activities

K. Adhikari

- delivered two statistics Masterclasses organised by The Royal Institution

- wrote articles on OpenLearn about Covid-19 available at
  https://www.open.edu/openlearn/profiles/ka5894

- hosted the M&S Christmas public lecture for school students.

- gave a presentation about incorporating research into teaching to ALs at a staff professional development event at the OU

- gave a talk at the OU Students Conference 2020: *Trusting Statistics in Today's News*

- is a statistics consultant for the BBC radio program 'More or Less'

- is a named collaborator on two grants:
  - *Clinical trial of Photodynamic Therapy for horse skin cancers*, Open University Pump Priming Fund
  - *GenoMorph – Tracking the evolution of human craniodental structures,* L'Agence nationale de la recherche (ANR) (French National Research Agency)

- achieved the Senior Fellowship of the Higher Education Association (SFHEA) status.

S. Biedermann

- reviewed several proposals for the College of Experts: DHSC/UKRI COVID-19 rapid response rolling call

- is associate member of the EPSRC Peer Review College

C. Calvert

- gave a talk at the OU eSTEeM conference (2020) *A qualification world* [joint work with **R. Hilliam**]

F. Elfadaly

- is Honorary Lecturer, National Heart and Lung Institute, Imperial College London

Á.E. Faria

- chaired the Bayesian forecasting session in the International Symposium of Forecasting, Rio de Janeiro, Brazil

C.P. Farrington

- is expert adviser to the Tribunal de Grande Instance de Paris (France) in litigation over the teratogenicity of valproic acid

P.H. Garthwaite

- is external examiner for MSc in Applied Statistics with specialisation in Actuarial Science at the University of Mauritius

R. Hilliam

- Co-organised and ran the TALMO (Teaching and Learning Mathematics Online: http://talmo.uk/) events throughout 2020 to support Mathematics and Statistics Departments move their teaching online during the Covid19 pandemic.

- gave a talk at the OU eSTEeM conference (2020) The Mathematics & Statistics Study Site: Facts, figures and further plans [joint work with G. Arrowsmith, C. Brown, D. Goldrei and A. Siddons]

- gave a talk at the OU STEM teaching conference: Celebrating our success (2020) Building a study site community [joint work with G. Arrowsmith]

- had a blog posting at Advance HEA https://www.advance-he.ac.uk/news-and-views/online-student-experience-more-learning-online

- is an RSS accreditation assessor

- is a visiting Research Fellow in Medical Statistics at the University of Derby, running statistics and research design training for doctor of professional practice students

- is the RSS Vice-President for Professional Affairs and chairs the Professional Affairs Committee

- is a committee member of Teaching Statistics, Special Interest Group, RSS

- is Honorary Associate Professor in Statistics, University of Warwick

- is a statistical reviewer for BMJ paediatrics

K. McConway

- is a member of the Advisory Committee and a Trustee of the Science Media Centre, writing invited comments on statistical aspects of scientific papers, and contributing in other ways to the work of the Centre. He contributed 119 comments on new research and statistical bulletins, etc., the great majority of them about SARS-CoV-2. These were quoted in almost all the national newspapers, in many regional newspapers, and in several online news websites.

- was interviewed for several TV programmes (BBC2 Newsnight, BBC News Channel, ITV News at Ten, Sky News), radio programmes (BBC Radio 4 *More or Less*, BBC Radio 5 live, BBC Three Counties Radio, BBC Radio Scotland,

BBC Radio Kent, LBC News, TalkRadio, Times Radio), and news podcasts (Daily Mail, Times).

- is a member of the Public Data Advisory Group, which advises the Cabinet Office on the public understanding of data during the pandemic

- is a committee member of the RSS Data Ethics Special Interest Group

- is external examiner for MSc in Data Analytics for Government, University College London

- is external member, appointment panel for Professor of Data Science and Statistical Learning, University of Limerick

N.T. Trendafilov

- is elected member of the Board of Directors, European Regional Section of the International Association for Statistical Computing (IASC)

S.K. Vines

- achieved the Senior Fellowship of the Higher Education Association (SFHEA) status.

- delivered a training session for eSTEeM

- is external examiner for undergraduate statistics modules at Kingston University, London