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Antonio Remiro-Azócar, PhD

Curriculum Vitae

Education

PhD Statistical Science, *University College London*. **2018–2021**

Based at the Statistics for Health Economic Evaluation Group, a research group in the Department of Statistical Science. See the final page for a description of the thesis.

MRes Financial Computing, *University College London*, *Distinction*. **2017–2018**

Full 4-year (1+3) MRes+PhD scholarship from the EPSRC Centre for Doctoral Training in Financial Computing and Analytics, a joint collaboration between UCL, LSE and Imperial College London. PhD-level courses in computational statistics. Advanced programming and software development modules in Python and C++.

MSc Machine Learning, *University College London*, *Merit (68.4%)*. **2016–2017**

Dissertation on the hierarchical Bayesian modelling of decision-making tasks based at the Gatsby Computational Neuroscience Unit under the supervision of Oliver J Robinson and Peter Dayan. Deep and reinforcement learning courses taught by Google DeepMind.

BSc (Hons) Mathematics and Physics, *University of Bath*, *2:1*. **2013–2016**

Experience

Industry

Lead, Medical Affairs Statistics, *Bayer Pharmaceuticals*, United Kingdom. **2021–**

- Leading statistical input to life-cycle management strategies, publication plans, reimbursement requirements, HTA studies and analyses for payers
- Leading statistical cross-functional teams to generate publications, presentations and posters
- Scientifically appraising study protocols and study proposals
- Providing statistical and methodological consultation and contributing to multi-disciplinary teams
- Developing and implementing innovative statistical methodology for payer and reimbursement needs
- Keeping abreast of HTA regulations and methodological guidance
- Leading scientific strategies for Real-World Evidence projects
- Overseeing and ensuring the accurate and timely delivery of statistical work outsourced to external collaborators such as HEOR providers

Director and Quantitative Researcher, *SORA Ltd*, United Kingdom. **2021**

SORA is a boutique research consultancy that specializes in the statistical aspects of evidence synthesis, health technology assessment and outcomes research, providing statistical support to the pharmaceutical, biotechnology and healthcare consultancy sectors.

Statistical Consultant (contract), *Hospital for Sick Children (SickKids)*, Remote. **2020–2021**

Development of methodological guidelines for population-adjusted indirect treatment comparisons for the Canadian Agency for Drugs and Technologies in Health (CADTH).

Statistical Consultant (contract), *ICON plc*, Remote. **2019–2020**

Development of cure survival modelling methodology in immunotherapy trials. Disease areas: oncology.

Statistical Consultant (contract), *IQVIA*, London. **2019–2020**

Survival analysis, meta-analysis, systematic literature reviews, statistical support for submission of evidence dossiers to HTA authorities (NICE and SMC), mixed models, discrete event simulation, Markov modelling, utility mapping, Bayesian analysis, preparation of conference abstracts and manuscripts for publication of research papers. Disease areas: oncology, hematology, hepatology, neurology, and addiction.

Statistical Consultant (contract), *IQVIA*, London. **2018–2019**

Survival analysis, indirect treatment comparisons in the absence of head-to-head clinical trials, population adjustment and economic modelling. Disease areas: oncology, hepatology.

Academia

Graduate Teaching Assistant, *London School of Economics*. **2018–2021**

Taught "Statistical Models and Data Analysis" and "Applied Regression" to statistics undergraduates.

Graduate Teaching Assistant, *University College London*. **2018–2019**

Taught "Introductory Statistical Methods and Computing" to life sciences undergraduates. Co-supervisor for MSc research projects. Development of R and Stan programming material for a course in Bayesian methods in health economics.

Research Intern, *Imperial College London*. **2016**

Received a NERC grant to mine under-exploited plant information resources at the Royal Botanic Gardens, Kew. Explored global and regional biodiversity patterns using R and developed statistical models to estimate future species discovery rates and biodiversity hotspots.

Research

Papers

- **Remiro-Azócar, A.**, Heath, A., and Baio, G. "Methods for Population Adjustment with Limited Access to Individual Patient Data: A Review and Simulation Study". *Research Synthesis Methods*, 12 (6), 2021. Available at: `https://doi.org/10.1002/jrsm.1511`
- **Remiro-Azócar, A.**, Heath, A., and Baio, G."Marginalization of Regression-Adjusted Treatment Effects in Indirect Comparisons with Limited Patient-Level Data". Working Paper. Available at: `https://arxiv.org/abs/2008.05951`
- **Remiro-Azócar, A.**, Heath, A., and Baio, G. "Parametric G-computation for Compatible Indirect Treatment Comparisons with Limited Individual Patient Data". Submitted to Research Synthesis Methods. Available at: `https://arxiv.org/abs/2108.12208`
- **Remiro-Azócar, A.** "Target estimands for population-adjusted indirect comparisons". Submitted to Statistics in Medicine. Available at: `https://arxiv.org/abs/2112.08023`
- **Remiro-Azócar, A.**, Heath, A., and Baio, G. "Conflating marginal and conditional treatment effects: Comments on "Assessing the performance of population adjustment methods for anchored indirect comparisons: A simulation study"". *Statistics in Medicine*, 40(11), 2021. Available at: `https://doi.org/10.1002/sim.8857`
- **Remiro-Azócar, A.**, Heath, A., and Baio, G. "Effect modification in anchored indirect treatment comparisons: Comments on "Matching-adjusted indirect comparisons: Application to time-to-event data"". *Statistics in Medicine*, 41(8), 2022. Available at: `https://doi.org/10.1002/sim.9286`
- **Remiro-Azócar, A.**, Heath, A., and Pechlivanoglou, P. "A catalogue of assumptions and potential sources of bias in matching-adjusted indirect comparisons". Report commissioned by the Canadian Agency for Drugs and Technologies in Health (CADTH).
- van Oostrum, I., Ouwens, M., **Remiro-Azócar, A.**, Baio, G. Postma, M., Buskens, E., and Heeg, B. "Comparison of parametric survival extrapolation approaches incorporating general population mortality for adequate health technology assessment of new oncology drugs". *Value in Health*, 24 (9), 2021. Available at: `https://doi.org/10.1016/j.jval.2021.03.008`

Poster presentations

- Mohr, P., Larkin, J., Paly, V. F., **Remiro-Azócar, A.**, …, Middleton, M. "Estimating long-term survivorship in patients with advanced melanoma treated with immune-checkpoint inhibitors: Analyses from the phase III CheckMate 067 trial". ESMO Virtual Congress 2020.
- Paly, V. F., Mohr, P., Larkin, J., Middleton, M., Youn, J., **Remiro-Azócar, A.**, …, Kurt, M. "Assessing the impact of modeling non–disease-related mortality on long-term survivorship rates in previously untreated advanced melanoma: a case study from CheckMate 067". ISPOR 2021.
- **Remiro-Azócar, A.**, Heath, A., and Baio, G. "Predictive-adjusted indirect comparison (PAIC): A novel method for population-adjusted indirect comparison". ISPOR Europe 2019.

Invited presentations

- R for Health Technology Assessment (R-HTA) Workshop. July 2021. Available at: `https://r-hta.org/events/workshop/2021/remiro-azocar.pdf`
- UCL Priment Clinical Trials Unit Statistical Seminar. November 2020.
- UCL Statistics for Health Economic Evaluation Seminar. June 2020.
- Health Economics Study Group Winter Meeting, Newcastle, UK. January 2020
- Spanish Health Economics Association Conference, Albacete, Spain. June 2019

Computing

R (dplyr, RStudio), Python (NumPy, Pandas), Stan/BUGS/JAGS, Git, VBA, SQL

Languages

Spanish: Native; **English**: Fully bilingual; **French**: Advanced (*Grade A at AS level*).

PhD thesis

Title: *Population-Adjusted Indirect Treatment Comparisons with Limited Patient-Level Data*

Supervisors: Gianluca Baio (University College London) and Anna Heath (University of Toronto, Hospital for Sick Children, University College London)

Impact Statement: There are two sides to the story told by this thesis. One addresses a substantive problem in health technology assessment, which is the application of population-adjusted indirect comparisons. These are regularly used to adjust for cross-trial differences in covariates where there is limited access to patient-level data. The other side of the story highlights the importance of carefully considering whether a marginal or conditional treatment effect is of interest in health technology assessment. Different methodologies estimate different measures of effect, yet marginal effects should be the preferred inferential target for decisions at the population level. The typical usage of regression adjustment, in the context of indirect treatment comparisons, targets a conditional treatment effect. I propose methods for marginalizing out this regression-adjusted effect, so that it is compatible in indirect treatment comparisons and relevant for population-level decision-making. The methods are applicable, more generally, in the wider context of health technology assessment.

Keywords: Health technology assessment, biostatistics, evidence synthesis, indirect treatment comparison, Bayesian statistics, health economics, outcomes research, oncology, clinical trials, comparative effectiveness research; causal inference; survival analysis; standardization