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Bayesian life-course modelling of Alzheimer’s Disease progression

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Dave Lunn
Please provide a brief biography for the Presenting author(s)
Dave is a Statistics Director at GSK based in the UK. He holds a degree in mathematics and a PhD in Bayesian biostatistics (Population PK/PD). During a ~20-year academic career (primarily Imperial College London and MRC Biostatistics Unit, Cambridge) he co-authored the BUGS software (in its various forms) and extensions thereof. He is also a Fellow of the Royal Statistical Society and has published both applied and methodological papers across a wide range of areas. Dave joined GSK five years ago. His current work focuses on disease progression, across a range of disease areas, but he also has interests in recruitment models, joint models and dose-response.

Aris Perperoglou
Please provide a brief biography for the Presenting author(s)
Aris Perperoglou is the Head of Predictive Modelling within Statistics and Data Science Innovation Hub (SDS-IH) at GSK, working on a diverse portfolio, focusing on Disease Progression Modelling, E2E processes, and predictive models for drug-disease-trials. Before joining GSK in 2022, Aris worked at AstraZeneca as a Data Science Director where he built and guided teams of data scientists and statisticians, solving various industry problems and integrating academic insights with real-world applications.
Aris got a Ph.D. from Leiden University in 2006. He has an extensive background in academic institutions within the UK, Germany, and Greece, with roles spanning the departments of mathematics, statistics, and medicine. As a researcher, he has published work on statistical models, survival analysis, penalized methods, smoothing, and machine learning. During his academic tenure at Essex University, he built a research portfolio exceeding £3 million. He is a member of the Royal Statistical Society (RSS), an Associate Editor of Statistical Modelling, an international Journal and a co-chair of the STRATOS initiative.

Single topic, multi-speaker session, Workshop or Single presentation submission

A single presentation/poster

Single presentation or poster submission

We present an extension of the Self Modelling Regression work of Raket [Raket, LL, 2020, *Frontiers in Big Data*] to characterise the life-course of Alzheimer’s Disease (AD) using the ADNI data. ADNI is an observational, longitudinal study with substantial between-subject variation in baseline disease progression. When viewed in terms of “study time” it is natural to think of all patients following different trajectories. If we think in terms of “disease time”, however, we might imagine patients to be following a single, common trajectory, with each patient observed at a different point along that trajectory. Our Bayesian hierarchical model includes a “time-shift” random effect for each patient, which translates “study time” into a “disease age”. This disease age is a potentially interpretable quantity for understanding, characterising and predicting patient heterogeneity (based on covariates). We show how the estimated disease ages can be validated by fitting the model to multiple AD endpoints

(both individually and jointly), and we discuss how such a model might be used for simulating clinical trial data for a given patient population.