Joe Hilton

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Profile

I am a research fellow in mathematical modelling at the Manchester Centre for Health Economics (MCHE). My research uses mathematics and statistics to address questions in public health, with a particular focus on infectious disease dynamics, cancer screening, and Bayesian inference.

Employment

2024-	**Research fellow in mathematical modelling, MCHE, University of Manchester** I have contributed mathematical models to cost-effectiveness analyses of risk-stratified breast cancer screening, radiotherapy scheduling, pharmacogenetic testing in antiplatelet prescription, and home HPV testing in cervical cancer prevention. I also work with colleagues in the Department of Mathematics on projects in infectious disease epidemiology and statistical inference.
2023-2024	**Postdoctoral research associate, Department of Livestock and One Health, University of Liverpool**
2019-2023	**Research Fellow, SBIDER, University of Warwick**
2016	**Research Internship, Mathematics Institute, University of Warwick**

Education

2015–2019	**PhD, MathSys CDT, University of Warwick, UK.** Thesis title: *Stochastic Models of Infectious Disease in Heterogeneous Populations*. Supervisors: Matt Keeling (University of Warwick) & Ian Hall (University of Manchester).
2014–2015	**MSc in Mathematics of Systems with Distinction, University of Warwick, UK.**
2010–2014	**Master of Mathematics (MMath) with 1st class honours, University of Warwick, UK.**

PhD supervision

2024-	Bowen Yang, PhD candidate in MCHE. Modelling the health economic impact of long-term opioid prescription.
2023-	Joe Brooks, PhD candidate in mathematics (University of Manchester). Developing inference methods and best-practice recommendations for household-level epidemiological studies.
2023-	Irene Garcia-Munoz, PhD candidate in mathematics (University of Manchester). Developing simulation and inference techniques for longitudinal infection data.

Other supervision

2026	Renxun Zhang, Health Data Science MSc candidate (University of Manchester). Conduting Bayesian inference of tumour genesis times from age-incidence data.
2021	Joe Brooks, undergrad summer student in mathematics (University of Warwick). Modelling the wellbeing impact of infectious disease controls. This project was published in Reinvention: an International Journal of Undergraduate Research.

Teaching

2019–2021	Workshop coordinator: GeMVi Capacity Building Course, University of Warwick and KEMRI-Wellcome Trust. This was a remote learning course aimed at researchers based in East Africa consisting of seven half-day workshops. I was responsible for planning the overall structure of the course, as well as writing and delivering two of the workshops.
2017–2018	Teaching assistant: Population Dynamics, University of Warwick. Responsible for planning and leading weekly problem sessions for final year undergraduates and MSc students. Content focused on mathematical modelling in ecology and epidemiology, including compartmental models, spatial structure, and stochasticity.
2013–2014	Supervisor: 1st year undergraduate mathematics students, University of Warwick. Responsible for marking assignments and leading biweekly tutorial sessions for a group of four students. Topics covered included algebra, analysis, geometry and differential equations.
2011	Teaching assistant: 1st year undergraduate analysis classes, University of Warwick Responsible for providing support and guidance to first-year undergraduates working on analysis assignments in a classroom setting.

Committee involvement

SIAM Exec 2015–2017	Member of executive committee for Warwick's student chapter of the Society for Industrial and Applied Mathematics. Responsible for organising seminars and symposia, including contacting speakers, promotion, and arranging catering.

Policy contributions and media

2020 – present	Contributions to the UK's Scientific Pandemic Influenza Group on Modelling (SPI-M) and the SPI-M Operational Subgroup (SPI-M-O), providing modelling input on non-pharmaceutical interventions against COVID-19 and situational awareness for MPox.
May 2020	Quoted in Times article "Coronavirus: Why some countries seem to have escaped its grip" on the impact of family structures on COVID-19 transmission.
March 2020	Preprint *"Estimation of country-level basic reproductive ratios for novel Coronavirus (COVID-19) using synthetic contact matrices"* listed in the collection "Scientific evidence supporting the government response to coronavirus (COVID-19)" on the `gov.uk` website.

Awards and prizes

Oct 2025	JUNIPER fellowship scheme. Awarded by the JUNIPER epidemic modelling consortium to support leadership skills development and fellowship applications.
Nov 2022	Weldon Memorial Prize. Awarded jointly to SPI-M-O (Scientific Pandemic Influenza Group on Modelling, Operational sub-group) by the University of Oxford for "noteworthy contributions to the development of mathematical or statistical methods applied to problems in Biology".
Oct 2022	SPI-M-O Award for Modelling and Data Support. Awarded by the Department of Health and Social Care and the Government Science Office to recognise those people who have made an exceptional contribution to the work of SPI-M-O outside of their usual work activity.
July 2021	School of Life Science Post-Doctoral Research Prize for the Faculty of Science, Engineering, and Medicine (Âč100). Awarded by the university of Warwick in recognition of my work on COVID-19, specifically the paper *Estimation of country-level basic reproductive ratios for novel Coronavirus (SARS-CoV-2/COVID-19) using synthetic contact matrices*.
Sep 2020	IBM Science for Social Good grant (Âč20,000). Awarded by IBM to support my research on models of non-pharmeceutical interventions against COVID-19.
Dec 2018	IMA Small Grant Scheme (Âč420). Awarded by the Institute of Mathematics and its Applications to support my attendance at the 10th Swedish Meeting on Mathematics in Biology.

Conferences and talks

Invited talks

July 2026	Invited talk: *Identifying environmental and ecological risk factors for highly pathogenic avian influenza in wild birds* Minisymposium on Modeling Avian Influenza Dynamics at European Conference of Mathematical and Theoretical Biology, Graz, Austria.
Jan 2026	Invited talk: *Bringing mathematical models into health economic analyses: self-sampling for HPV* Workshop on Multiscale Modelling in Infectious Diseases, University of Warwick, UK.
Sep 2025	Invited seminar: *Evaluating the impact of self-sampling for HPV in cervical cancer prevention* UKHSA economics team weekly seminar series, online.
May 2024	Invited seminar: *Environmental and ecological drivers of highly pathogenic avian influenza infections in European wild birds: a geospatial machine learning study* JUNIPER seminar series, online.
Feb 2019	Invited seminar: *Endemic diseases with household structure and demography* Epidemiology seminar series, Imperial College London, UK.

Contributed talks

July 2026	Contributed talk: *Household-level patterns of vaccine uptake during the COVID-19 pandemic in the UK* European Conference of Mathematical and Theoretical Biology, Graz, Austria.
Jul 2024	Contributed talk: *Identifying environmental and ecological risk factors for highly pathogenic avian influenza in wild birds* European Conference of Mathematical and Theoretical Biology, Toledo, Spain.
Sep 2023	Contributed talk: *Predicting avian flu outbreaks in Europe: what can ecological methods do for infectious disease modellers?* IDDconf, Ambleside, UK.
Dec 2019	Contributed talk: *A household-structured approach to endemic infections* Epidemics 7, Charleston, USA.
Sep 2019	Contributed talk: *A household-structured approach to endemic infections* Workshop on Stochastic Modelling in Health & Disease, University of Leeds, UK.
Dec 2018	Contributed talk: *Endemic diseases with household structure and demography* 10th Swedish Meeting on Mathematics in Biology, Stockholm, Sweden.
July 2018	Contributed talk: *Household models for endemic diseases* European Conference of Mathematical and Theoretical Biology, Lisbon, Portugal.
Dec 2017	Contributed talk: *Extending household models to endemic settings* Epidemics 6, Sitges, Spain.
Sep 2017	Contributed talk: *Extending household models to endemic settings* Conference on Infectious Disease Dynamics, Ambleside, UK.
July 2017	Contributed talk: *Modelling near-critical diseases with branching processes* University of Melbourne-University of Manchester joint research workshop: New approaches to infectious disease modelling for epidemiological understanding and public health impact, Manchester, UK.

Posters

July 2026	Poster: *Applying applied maths: mathematical biology in health economics* European Conference of Mathematical and Theoretical Biology, Graz, Austria.
Dec 2023	Poster: *Analysing an outbreak of ebolavirus disease using stochastic simulation and Bayesian inference* Epidemics 9, Bologna, Italy.
Nov 2023	Online poster: *Mapping the risks of avian influenza outbreaks across Europe via machine learning* ESCAIDE, Barcelona, Spain.
Sep 2023	Poster: *Mapping the risks of avian influenza outbreaks across Europe via machine learning* 9th ESWI Influenza Conference, Valencia, Spain.
Jun 2022	Poster: *A household-structured approach to modelling interventions during the COVID-19 pandemic* Modelling the Covid-19 Pandemic: Achievements and Lessons event at the Royal Society, London, UK.
Dec 2021	Poster: *A household-structured approach to modelling interventions during the COVID-19 pandemic* Epidemics 8, Online conference.
Sep 2018	Poster: *Modelling endemic infections with households and demography* IDDconf, Ambleside, UK.
Sep 2017	Poster: *Extending household models to endemic settings* Zeeman Institute Launch Event: Mathematical Challenges From The Life Sciences, Warwick, UK.
April 2017	Poster: *Modelling emerging diseases using branching processes* Conference: Developing efficient methodologies for modelling stochastic dynamical systems in biology, Bath, UK.
March 2017	Poster: *Modelling emerging diseases using branching processes* Public Health England Research and Applied Epidemiology Conference, Warwick, UK.

Publications

2026 Wright S, **Hilton J**, Rogers G, Gray E, Donten A, McWilliams L, Evans DGR, French DP, Payne K
Implementing a Risk-Stratified National Breast Screening Programme in the United Kingdom: a model-based cost-effectiveness analysis
Cancer Epidemiology, Biomarkers & Prevention 2026

2025 Hayes S, **Hilton J** (joint first authorship with S. Hayes), Mould-Quevedo J, Donnelly C, Baylis M, Brierley L
Ecology and environment predict spatially stratified risk of H5 highly pathogenic avian influenza clade 2.3.4.4b in wild birds across Europe
Nature Scientific Reports 16, 997.

2024 **Hilton J**, Hall I
A beta-Poisson model for infectious disease transmission
PLoS Computational Biology 20(2).

2023 Brand SPC, Cavallaro M, Cumming F, Turner C, Florence I, Blomquist P, **Hilton J**, Guzman-Rincon LM, House T, Keeling MJ, Nokes DJ
The role of vaccination and public awareness in medium-term forecasts of Mpox incidence in the United Kingdom
Nature Commununications 14, 4100.

2022 **Hilton J** *et al*
A computational framework for modelling infectious disease policy based on age and household structure with applications to the COVID-19 pandemic
PLoS Computational Biology 18(9).

2021 Parisi A, Brand SPC, **Hilton J**, Aziza R, Keeling MJ, Nokes DJ
Spatially resolved simulations of the spread of COVID-19 in three European countries
PLOS Computational Biology 17(7).

2020 Leng, T., White, C., **Hilton, J.**, Kucharski, A., Pellis, L., Stage, H., Davies, N. G., Centre for Mathematical Modelling of Infectious Disease 2019 nCoV Working Group, Keeling, M. J., & Flasche, S.
The effectiveness of social bubbles as part of a Covid-19 lockdown exit strategy, a modelling study
Wellcome Open Research 5, 213.

2020 **Hilton J**, Keeling M
Estimation of country-level basic reproductive ratios for novel Coronavirus (SARS-CoV-2/COVID-19) using synthetic contact matrices
PLOS Computational Biology 16(7).

2019 **Hilton J**, Keeling M
Incorporating household structure and demography into models of endemic disease
Journal of the Royal Society Interface Volume 16, Issue 157.

Preprints

2026 Brooks J, House TA, Pellis L, **Hilton J**
Bayesian Inference for Epidemic Final Size Datasets with Hidden Underlying Household Structure
arXiv.

2020 Brand SPC, Aziza R, Kombe IK, Agoti CN, **Hilton J**, Rock KS, Parisi A, Nokes DJ, Keeling MJ, Barasa EW
Forecasting the scale of the COVID-19 epidemic in Kenya
medRxiv.

In submission

Mahboub-Ahari1 A, **Hilton J**, Rodrigues M, McDermott J, Body R, Newman WG, Payne K
Implementing a CYP2C19-guided approach for prescribing dual antiplatelet therapy in acute coronary syndrome for patients undergoing percutaneous coronary intervention: a cost-effectiveness analysis
In submission at BMC Pharmacology and Toxicology.