CHARLES WHITTAKER PhD
Postdoctoral Research Fellow

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PROFILE

Sir Henry Wellcome Research Fellow in the School of Public Health and MRC Centre for Global Disease Analytics at Imperial College working on infectious disease dynamics, mathematical modelling and epidemic preparedness. Work has received over 20,000 citations to date and been published in *Nature*, *Science* and *The Lancet*.

Highly experienced in infectious disease modelling and machine learning methodologies. Primary research interests centred around the ecology of emerging infectious diseases; development of inferential methodologies reconciling diverse data-streams to elucidate fundamental dynamics of epidemic processes; and leveraging these insights for public health impact.

EDUCATION

PhD Infectious Disease Epidemiology & Mathematical Modelling | Imperial College London
2017-2022
PhD focussed on using mathematical modelling to better understand heterogeneity in malaria dynamics across settings, with a particular focus on *Anopheline* mosquito seasonality and the impact of invasion of the urban malaria vector *Anopheles stephensi* into the Horn of Africa. Involved development of mathematical models of malaria transmission to characterise the vector's invasion, with the results contributing to World Health Organization guidance on the threat posed by *Anopheles stephensi* to malaria control efforts in the region.

MSc Infectious Disease Epidemiology | Distinction | Imperial College London
2016 – 2017
Ranked 1st out of 50 students and awarded Faculty of Medicine Dean's Prize for Epidemiology. Thesis involved mathematical modelling of loiasis transmission dynamics across Central African settings.

BSc Biological Natural Sciences | Double First Class Honours | University of Cambridge
2012 – 2015
Ranked 1st in final year examinations (83% average). Awarded Scholarship of Jesus College and John Gulland Prize for best overall performance. Held senior position within the Global Health think tank Polygeia.

PROFESSIONAL EXPERIENCE

Sir Henry Wellcome Research Fellow | MRC Centre for Global Infectious Disease
2022 – Present
Highly competitive postdoctoral research fellowship working with Dr Nuno Faria and Professor Samir Bhatt focussed on modelling SARS-CoV-2 transmission dynamics across a range of different settings. This has included:
- Development of novel stochastic branching process-based methodologies to expand the range of epidemiological data sources that can be utilised for inference.
- Leveraging state-of-the-art machine learning methodologies for inference of large-scale (>1 million sequences) phylogenetic trees.
- Optimising design of public health (genomic) surveillance systems for pandemic and globally catastrophic biological risk mitigation.

Reservist Field Epidemiologist | PHRST, United Kingdom Health Security Agency
2022-Present
Reservist epidemiologist with UKHSA's Public Health Rapid Support Team (PHRST). Role includes:
- Regular field deployments in response to acute infectious disease outbreaks, with an emphasis on designing and scaling epidemiological surveillance systems to inform outbreak response.
- Capacity building and training development in resource poor settings, including mentorship of epidemiologists from the global south in analytical skills, statistics and mathematical modelling.

Lead Researcher – Imperial College London COVID-19 Response Team
2020 - 2021
Paused PhD and took up position as lead researcher managing a team responding to the COVID-19 cris and providing analytical support to Ministries of Health and governments around the world during the pandemic. Work included:

- Generation of the first estimates of the COVID-19 Infection Fatality Ratio, with results that informed governmental emergency planning during the UK's epidemic (published in *Lancet Infectious Diseases*).
- Development of an open-source mathematical model of COVID-19 transmission used Ministries of Health in Senegal, Nigeria, Zimbabwe, Malawi, Sierra Leone, Colombia, India, Indonesia and Kenya to support policy decisions. Subsequently led and managed integration of this model into the WHO's Essential Supplies Forecasting Tool.
- The first identification and characterisation of the Gamma variant in Brazil, in work that was published in *Science* and went on to inform WHO and Public Health England technical policy.

Field Epidemiologist – World Health Organization Health Emergencies Programme
Aug – Oct 2019
Field deployment with GOARN and the WHO to Democratic Republic of Congo to provide analytical support as part of ongoing efforts to control Ebola outbreak in North Kivu province. During this time, I:

- Carried out analysis of syndromic-based alert and surveillance system to identify likely areas of under-reporting and possible missed Ebola cases.
- Prepared weekly situation reports including key epidemiological parameters (such as R0) that were disseminated to incident response leaders and Director General's office.
- Carried out in-depth examination of nosocomial transmission at Ebola Treatment Centres and evaluated IPC measures implemented to limit it.

COMPUTER SKILLS

Programming: Advanced R, C++ and Python coding ability, as well as probabilistic programming languages Stan and NumPyro. Competent in Bayesian and Frequentist statistical methods.
Applications: Microsoft Office (Word, Excel, PowerPoint, Outlook, Teams), Github, Illustrator.

SELECTED PUBLICATIONS

- Brizzi A*, **Whittaker C*,** Servo L*, Hawryluk I*, Prete C*, de Souza W, Aguiar R et al. *Spatial and temporal fluctuations in COVID-19 fatality rates in Brazilian hospitals*. **Nature Medicine (2022)**
- **Whittaker C**, Winskill P, Sinka M, Pironon S, Massey C, Weiss D et al. A novel statistical framework for exploring the population dynamics and seasonality of mosquito populations. **Proceedings of the Royal Society B (2022)**
- **Whittaker C**, Walker PG, Alhaffar M, Hamlet A., Djaafara B, Ghani A & Watson OJ. *Under-reporting of deaths limits our understanding of true burden of covid-19.* **British Medical Journal (2021)**
- **Whittaker C**, Slater H, Nash R, Bousema T, Drakeley C, Ghani A, & Okell L. Global patterns of submicroscopic Plasmodium falciparum malaria infection: insights from a systematic review and meta-analysis of population surveys. **The Lancet Microbe (2021)**
- **Whittaker C**, Watson OJ, Alvarez-Moreno C, Angkasekwinai N, Boonyasiri A, Carlos Triana, L & Hallett TB *Understanding the Potential Impact of Different Drug Properties on Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Transmission and Disease Burden: A Modelling Analysis.* **Clinical Infectious Diseases (2021)**
- Faria NR*, Mellan T*, **Whittaker C***, Claro I*, Candido D*, Mishra S*, Crispim, M.A., Sales, F.C., Hawryluk, I., McCrone, J.T. and Hulswit, R.J., 2021. *Genomics and epidemiology of the P. 1 SARS-CoV-2 lineage in Manaus, Brazil.* **Science (2021)**
- Walker PG*, **Whittaker C***, Watson OJ, Baguelin M, Winskill P, Hamlet A & Ghani AC (2020). *The impact of COVID-19 and strategies for mitigation and suppression in low-and middle-income countries.* **Science (2020).**
- Verity R*, Okell LC*, Dorigatti I*, Winskill P*, **Whittaker C***, Imai N, Cuomo-Dannenburg G, Thompson HA, Walker PG, Fu H, Dighe A. *Estimates of the severity of coronavirus disease 2019: a model-based analysis*. **The Lancet Infectious Diseases (2020)**
- Flaxman S, Mishra S, Gandy A, Unwin J, Mellan T, Coupland H, **Whittaker C** & Bhatt, S. (2020*). Estimating the effects of non-pharmaceutical interventions on COVID-19 in Europe.* **Nature (2020)**.

* Indicates co-authorship.