

Title of PhD project	Improving Estimation and Analysis of Epidemiological Delays for Infectious Disease Outbreaks
Supervisory team	<p>LSHTM: Sebastian Funk sebastian.funk@lshtm.ac.uk https://www.lshtm.ac.uk/aboutus/people/funk.sebastian</p> <p>Imperial: Anne Cori a.cor@imperial.ac.uk https://profiles.imperial.ac.uk/a.cor</p> <p>UKHSA: Christopher Overton christopher.overton@ukhsa.gov.uk Christopher E. Overton - Google Scholar</p>
Brief description of project / theme	<p>Epidemiological delays, such as incubation periods, generation times, and reporting delays, are key to understanding infectious disease dynamics and informing outbreak responses. Despite advances, existing methods often struggle with biases, including incomplete data, and are limited in their ability to account for time-varying changes or to scale effectively for large datasets.</p> <p>This project aims to address these challenges through methodological improvements and case studies on recent outbreaks of diseases such as COVID-19, mpox, and others. It will do so by identifying biases that could arise from common approaches and implications for model-based predictions, as well as by assessing the impact of changes over time and epidemiological factors that could explain them. This project will involve refining existing statistical approaches to delay estimation and developing tools that enhance accessibility and scalability, building on efforts like the epidist and primarycensored R packages, in order to improve critical decision-making during the initial stages of disease emergence.</p>

	<ol style="list-style-type: none"> 1. Charniga, K., Park, S. W., Akhmetzhanov, A. R., Cori, A., Dushoff, J., Funk, S., Gostic, K. M., Linton, N. M., Lison, A., Overton, C. E., Pulliam, J. R. C., Ward, T., Cauchemez, S., & Abbott, S. (2024). Best practices for estimating and reporting epidemiological delay distributions of infectious diseases using public health surveillance and healthcare data. <i>arXiv [Stat.ME]</i>. https://arxiv.org/abs/2405.08841 2. Park, S. W., Akhmetzhanov, A. R., Charniga, K., Cori, A., Davies, N. G., Dushoff, J., Funk, S., Gostic, K., Grenfell, B., Linton, N. M., Lipsitch, M., Lison, A., Overton, C. E., Ward, T., & Abbott, S. (2024). Estimating epidemiological delay distributions for infectious diseases. <i>bioRxiv</i>. https://doi.org/10.1101/2024.01.12.24301247
<p>The role of the different institutions in this collaborative project</p>	<p>The student will be supervised by a team of supervisors representing all participating institutions and part of a team of researchers that spans the institutions. The Imperial College and LSHTM supervisors will bring the substantial methodological expertise and breadth of their institution as well as experience in bringing these to bear on public health problems. UKHSA will bring the UK-specific public health focus and ensure the project is firmly grounded in the application to data and problems as they are present in the UK.</p>
<p>Particular <i>prior</i> educational requirements and skills for a student undertaking this project</p>	<p>A postgraduate degree, ideally in a quantitative subject (e.g. Biostatistics, Bioinformatics, Mathematics, Statistics, Computer Science or Physics) or a related discipline (e.g. Epidemiology or Biology) with a strong quantitative element either awarded or imminent or equivalent training. Also some coding experience, ideally in R.</p>
<p>Skills we expect a student to develop/acquire whilst pursuing this project</p>	<p>Insights into the application of quantitative techniques in public health contexts, specifically advanced analytics applied in epidemiological contexts; inference with mathematical models applied to infectious disease data set.</p>

Title of PhD project	<p>Improving Infectious Disease Forecasts and Forecast Evaluation</p>
Supervisory team	<p>LSHTM: Sebastian Funk sebastian.funk@lshtm.ac.uk https://www.lshtm.ac.uk/aboutus/people/funk.sebastian</p> <p>Imperial: Anne Cori a.cor@imperial.ac.uk https://profiles.imperial.ac.uk/a.cor</p> <p>UKHSA: Edwin van Leeuwen <Edwin.VanLeeuwen@ukhsa.gov.uk> https://researchportal.ukhsa.gov.uk/en/persons/edwin-vanleeuwen</p>
Brief description of project / theme	<p>Infectious disease forecasting plays a critical role in outbreak response, guiding public health interventions and resource allocation. However, many existing forecasting models rely on oversimplified assumptions, such as constant reproduction numbers (R_t), which limit their utility for long-term predictions. Furthermore, while ensemble methods have proven effective in other fields, their systematic application to epidemiological forecasting, including learning from past performance, remains underexplored. Evaluation approaches often lack focus on the specific aspects of predictive performance that are most relevant to decision-making.</p> <p>This project seeks to improve infectious disease forecasting by addressing three interconnected areas. First, it will develop models that move beyond stationary assumptions, enabling forecasts to better account for dynamic changes in disease transmission. Second, it will</p>

	<p>systematically investigate ensemble methods, including advanced weighting schemes such as those implemented in tools like the graensemble and lopensemble R packages or using machine learning (ML) / artificial intelligence (AI) methods, to combine predictions from multiple models more effectively. Third, it will design evaluation frameworks tailored to decision-making, focusing on practical metrics such as outbreak peak timing, magnitude, and critical thresholds. The research will be applied to case studies including COVID-19, mpox, influenza and other infectious diseases, ensuring the methods are rigorously tested and broadly applicable, and aim to improve the utility of infectious disease forecasts in future epidemics.</p> <ol style="list-style-type: none"> 1. Sherratt K et al. (2023) Predictive performance of multi-model ensemble forecasts of COVID-19 across European nations. eLife https://doi.org/10.7554/eLife.81916 2. Bosse NI, Abbott S, Cori A, van Leeuwen E, Bracher J, Funk S (2023) Scoring epidemiological forecasts on transformed scales. PLoS Comput Biol 19(8): e1011393. https://doi.org/10.1371/journal.pcbi.1011393
<p>The role of the different institutions in this collaborative project</p>	<p>The student will be supervised by a team of supervisors representing all participating institutions and part of a team of researchers that spans the institutions. The Imperial College and LSHTM supervisors will bring the substantial methodological expertise and breadth of their institution as well as experience in bringing these to bear on public health problems. UKHSA will bring the UK-specific public health focus and ensure the project is firmly grounded in the application to data and problems as they are present in the UK.</p>
<p>Particular <i>prior</i> educational requirements and skills for a student undertaking this project</p>	<p>A postgraduate degree, ideally in a quantitative subject (e.g. Biostatistics, Bioinformatics, Mathematics, Statistics, Computer Science or Physics) or a related discipline (e.g. Epidemiology or Biology) with a strong quantitative element either awarded or imminent or equivalent training. Also some coding experience, ideally in R.</p>

Skills we expect a student to develop/acquire whilst pursuing this project

Insights into the application of quantitative techniques in public health contexts, specifically advanced analytics applied in epidemiological contexts; as well as broader understanding of forecasting and forecast evaluation.