Application of AI to optimise the management of infectious diseases and the use of antimicrobials: CAMO-UK researchers meeting

Date: 21st June 2024
Location: Ground Floor Meeting Room, William Henry Duncan Building, CEIDR

09:00 – 09:15	Welcome and Introduction, Professor Alison Holmes - Welcome participants. - Overview of the meeting's objectives. - Brief introduction of the agenda.
09:15 – 09:45	**Updates from past sessions** **Session 1:** Leveraging time series dependencies for clinical management of acute febrile illnesses using machine learning, Damien K. Ming, Imperial College London **Session 2:** Data-driven diagnosis of serious bacterial infection: what are we predicting, when and why? Stephen Aston, University of Liverpool **Session 3:** Patient risk stratification in dengue with 2D latent space mapping using unsupervised learning, Bernard Hernandez, Imperial College London **Session 4:** Hospital-in-a-box an update. Computer Simulation Model of patients with Bloodstream infection, Sepsis and systemic Infection (CSM-BSI), Alessandro Gerada and Anoop Velluva, University of Liverpool
09:45 – 10:15	**Presentation session 1** Title: Introduction to Pharmacokinetic-Pharmacodynamic (PKPD) modelling Speaker: Christopher Darlow, University of Liverpool Talk (~20 min), Q&A (10 min)
10:15 – 10:45	**Presentation session 2** Title: Towards the development of a continuous model for the assessment of bacteremia, bloodstream infection and sepsis. Speaker: Oscar Escudero-Arranz, Rey Juan Carlos University Talk (~20 min), Q&A (10 min)
10:45 – 11:00	Break
11:00 – 11:30	**Presentation session 3** Title: Personalised Antimicrobial Susceptibility Testing: A microsimulation study Speaker: Alexander Howard, University of Liverpool Talk (~20 min), Q&A (10 min)
11:30 – 12:00	**Presentation session 4** Title: Dynamic graph machine learning for early detection and characterisation of antimicrobial resistance outbreaks Speaker: Oskar Fraser-Krauss, Imperial College London Talk (~20 min), Q&A (10 min)

12:00 – 13:00	Lunch
13:00 – 14:30	**Activity I: Group discussion and feedback session. (confirm)** Topic: Outbreaks and Interventions Lead(s): Oskar Fraser-Krauss, Imperial College London **1. Introduction** (10-15 minutes) Welcome participants, explain the purpose and establish ground rules. **2. Icebreaker / Warmup** (10-15 minutes) Get comfortable and open by starting with a casual icebreaker or warm-up activity. **3. Main discussion** Delve into the key topics and gather insights (preferences, challenges, suggestions). **4. Wrap-up and debrief** (10-15 minutes) Summarize key points, allow participants to share any additional thoughts, and thank them for their participation. Also, debrief participants on the next steps or any follow-up activities.
14:30 – 14:45	Break
14:45 – 15:00	**Talk 1** Title: Designing, evaluating and integrating AI decision support systems in healthcare Speaker: William Bolton, Imperial College London Talk (~10 min), Q&A (5 min)
15:00 – 16:15	**Activity II: AI evaluation study group for CDSS. (confirm)** Topic: AI to support decisions around antimicrobial switch from IV to oral. Lead(s): William Bolton, Imperial College London **1. Welcome and Introduction** (5 minutes) Welcome participants, introduce the objective of the session and outline desired outcomes. **2. Background** (10 minutes) Overview of decision support systems and research, demo of current aps and Q&A. **3. Quick fire 'How Might We' questions on mentimeter** (10 minutes) Participants answer the questions online. **4. Interactive breakout session** (45 minutes) - Split in group to discuss and come up with ideas (8 minutes). Objective is to come up with 5 statements of the form: User – Need/Goal – Benefit/Insight. E.g., "*As a doctor, I want the AI system to automatically integrate with our EHR, to enable real-time decision support as I don't have time to manually enter patient data.*" - Each group presents their statements (2 minutes). Then groups rotate topics. - Topics: design, clinical evaluation and integration and infrastructure
16:15 – 16:30	**Concluding remarks and synthesis** - Summarize key insights from group discussions. - Thank speakers for their presentations. - Revisit areas of collaboration and potential future work. - Announce next steps and follow-up activities.
16:30 – 17:00	**Networking and informal discussions (optional)**

Notes

Directory of attendees and affiliated institutions

 #AI/ML #GNN #AMR	**Oscar Escudero-Arnanz** PhD, Artificial Intelligence and Machine Learning Department of Signal Theory and Communications Rey Juan Carlos University Óscar Escudero Arnanz is a Telecommunication Technologies Engineer with a Master's degree in Telecommunication Engineering obtained from the Universidad Rey Juan Carlos (URJC). Currently, he is immersed in the process of pursuing a Ph.D. in the Doctoral Program in Information and Communication Technologies at URJC. His doctoral research focuses on the development and programming of algorithms in the field of signal processing on graphs, machine learning, and data science. Óscar Escudero Arnanz is dedicated to exploring the practical application of these algorithms in real-world databases.
 #AI/ML #ethics	**William Bolton** PhD, AI4Health CDT Programme Department of Computing Imperial College London Will's research focuses on creating artificial intelligence (AI) based clinical decision support systems (CDSS), that utilise routinely collected electronic health record (EHR) data to improve antibiotic prescribing. His research also focuses on ensuring responsible and ethical AI and improving infection management in complex multimorbid patients.
 #AI/ML #GNN	**Ashleigh Myall** PhD in Applied Mathematics Department of Mathematics Imperial College London He is a quantitative researcher interested in global health and reducing the impact of preventable diseases. In particular, he is working on using graph neural networks to model the transmission dynamics of antimicrobial-resistant pathogens in healthcare settings.
 #microbiology #molecularbiology	**Alaa Riezk** Research Associate | Pharmacist Department of Infectious Diseases Imperial College London Alaa is a pharmacist, has a master's degree in 2011 in Microbiology from Damascus university and a PhD degree in 2020 in microbiology and drug delivery from the London School of Hygiene and Tropical Medicine, and joined Imperial College as a post doc researcher in the Centre for Antimicrobial Optimisation (CAMO). His expertise includes microbiology and immunology methods, molecular biology, imaging, analytical methods and cell-based assays related skills.

 #microonedles #chemistry	**David Freeman** Postdoctoral Research Associate | Chemistry Department of Infectious Diseases Imperial College London His research interests revolve around advancing biotechnological solutions for health management and general biosensor development. This has been achieved through point-of-caNire devices and microneedle-based sensors, measuring analytes such as lactate, glucose, pH, penicillin, and luteinising hormone.
 #AI/ML #dengue	**Damien K. Ming** Clinical Research Fellow Department of Infectious Diseases Imperial College London Infectious diseases and general internal medicine trainee focused on the use of digital health and novel data methodologies applied to acute febrile illnesses in low- and middle-income settings. His interests include the implementation of digital health interventions and the use of clinical datasets within decision-support systems, clinical wearables, and novel minimally invasive biosensors for the management of febrile presentations including dengue and bacterial bloodstream infections.
 #data analysis #amr surveillance	**Nina Zhu** Postdoctoral Research Associate NIHR Health Protection Research Unit Department of Infectious Diseases Imperial College London Research Lead for Population Health & Policy Theme in the National Institute of Health Research Health Protection Research Unit in Healthcare Associated Infection and Antimicrobial Resistance. Currently working linked datasets at regional and national level to assess the impact on the epidemiological patterns. She is also interested in systems dynamics modelling to inform design, implementation, and evaluation of antimicrobial stewardship (AMS) interventions
 #data analysis #amr surveillance	**Winnie Lee** Postdoctoral Research Associate School of Public Health Department of Medicine Imperial College London Winnie is a Research Associate in the School of Public Health. Previously, she was a PhD student at University of Bristol, focusing on surveillance and bacterial genomics. Her research involved optimising antimicrobial therapy through local genomic surveillance of resistance patterns among bacteria from patients who have bloodstream and urinary tract infections. Her non-academic interests and hobbies include realism drawing (particularly animals), dancing and snowboarding.

	**Paul Arkell** PhD | Clinical Research Fellow Imperial College London
 #PKPD	**Richard Wilson** PhD | Pharmacist University of Liverpool Imperial College London Research Pharmacist currently undertaking a PhD in the development and integration of novel technologies and interventions to improve antimicrobial prescribing. Interested in the application and translation of point-of-care devices, pharmacometrics and AI. He continues to work clinically for the NHS and has a background in Critical Care Medicine and Infectious Diseases.
 #AI/ML #AMR #carapenem	**Paul Vasikasin** PhD NIHR HPRU | Clinician Department of Infectious Diseases Imperial College London He is an assistant professor and consultant in infectious diseases from Phramongkutklao Hospital and Phramongkuklao College of Medicine, Thailand. He is also a senior military physician of the Roal Thai Army. His PhD is under the theme of precision prescribing, focusing on optimising carbapenem use and the treatment of resistant Gram-negative infections.
 #PKPD #microneedles #ESBL	**Jennifer Lawrence** PhD NIHR HPRU Department of Infectious Diseases Imperial College London Her research focuses on two key areas; extended spectrum beta lactamase (ESBL) quantification and the development of a point of care device to model antimicrobial concentration-time profiles, thus mimicking individual pharmacokinetic profiles. Both areas fill existing knowledge gaps and could become a vital part of improved antimicrobial stewardship (AST).
 #AI/ML #CDSS	**Bernard Hernandez** Research Fellow | Computer science Department of Infectious Diseases Imperial College London Development of point-of-care decision support systems that leverage the existing data and resources through Machine Learning and AI to provide personalized, accurate and effective diagnostics focusing specially on detection of infectious diseases and antimicrobial resistance in low- and middle-income countries.

 #microbiology #PCR	**Jesus Rodriguez-Manzano** Senior Lecturer | Microbiology Department of Infectious Diseases Imperial College London Developing and implementing innovative methods for molecular diagnosis of infectious diseases and antimicrobial resistance (AMR). Working at the intersection of hardware, software, and molecular science, the capabilities, and technologies we are creating are on the verge of transforming the field of medicine by facilitating swift diagnosis across different environments.
 #maths #GNN	**Oskar Frasser-Krauss** PhD, AI4Health CDT Programme Department of Computing Imperial College London His work focuses on the development and implementation of mathematical models that capture complex interactions between individual to better understand the spread of infectious diseases to develop more effective strategies for prevention and control He has graduated from the University of Edinburgh with an Integrated master's in mathematics. Before starting his PhD, he worked in software development and data science for the European Space Agency and is a member of the Digital Twin Antarctica consortium.
 #precision prescribing #sensors	**Ellen Stadler** PhD NIHR HPRU Department of Infectious Diseases Imperial College London Her work focuses on precision prescribing and optimisation of antimicrobial therapy using novel biosensor technologies. Ellen graduated with an MSc in biomedical engineering from ETH Zurich in 2022. Before starting her PhD, she gained technical experience during internships at Johnson&Johnson and Sensirion, a swiss company specialising in sensor innovation and development.
 #bioinformatics #omics	**Yu Wan** Tenure Track Fellow | Bioinformatics Pharmacology and Therapeutics University of Liverpool Bioinformatician working on bacterial genomic epidemiology. His expertise focuses on using whole-genome sequencing data to understand success of bacterial pathogens in causing infectious disease. His research interests include: (i) antimicrobial resistance and virulence, (ii) horizontal gene transfer and mobile genetic elements and (iii) evolution and transmission of bacterial pathogens.
	**Louis Kreitmann** PhD | Clinician Department of Infectious Diseases Imperial College London

 #datascience #AI/ML	**Luca Migglietta** Postdoctoral Research Associate Department of Infectious Diseases Imperial College London He has industry experience in Data Science, Molecular Biology, Bioinformatics, and product development for diagnostics. His main research focus is on the development of novel data-driven methodologies to analyse information encoded in biological signals with the support of Artificial Intelligence and Machine learning algorithms.
 #precision prescribing #closed loop #PKPD #AI/ML	**Ryan Armiger** PhD Department of Electrical and Electronic Engineering Imperial College London His research is in developing precision drug delivery systems, with a focus on closed-loop antimicrobial dosing algorithms. The aim of this work is to personalise treatment, to improve patient outcomes and help optimise the use of existing antimicrobials. A major component of this work is investigating the challenges to translating algorithms, validated on Pharmacokinetic models, into safe and effective systems for widely varying populations in the real world.
 #Data	**Anil Gunesh** Research data manager School of Public Health Imperial College London Data Manager for the Immunology Core Lab that we run for International AIDS Vaccine Initiative (IAVI). The IAVI Core Laboratory within Imperial College, manage the GCLP accredited clinical facilities that conduct the immunogenicity for Phase I/II HIV clinical trials. It also supports the wide network of IAVI field sites in Africa/India/Europe/US.
 #AI/ML #sepsis	**Steve Aston** Senior Clinical Lecturer | Consultant physician in Infectious Diseases University of Liverpool Following PhD work based in Malawi on diagnosis and management of community-acquired pneumonia in adults living with HIV in low-resource settings, I returned to Liverpool to complete my clinical training in infectious diseases and general internal medicine. Through my experience as my Trust's clinical lead for sepsis and seeing the limitations – both in terms of accessibility and accuracy – of available data to guide policy and practice, I became interested in the use of integrated data flows to support better antimicrobial prescribing and clinical pathway development. Having returned to a clinical academic role, within CAMO-Net and related ventures in Liverpool, I am working on series of projects developing data-driven diagnoses of infection syndromes at both the individual and health system levels.
 #AI/ML	**Alex Howard** PhD/Microbiologist University of Liverpool Alex is a Microbiology Consultant in Liverpool. Formerly antimicrobial stewardship lead for Liverpool University Hospitals and infection control lead for the Clatterbridge Cancer Centre, he now divides his time between immunocompromised infection in haemato-oncology/immuno-oncology and an artificial intelligence PhD at the University of Liverpool.

 #CSM-BSI #DES #AI/ML #AMR	**Alessandro Gerada** PhD / Microbiologist University of Liverpool Alessandro Gerada is a consultant microbiologist and doctoral student on the University of Liverpool AI for Future Digital Health programme. His research and specialist interests include machine learning applications in AMR and laboratory diagnostics, simulation modelling, and brucellosis.
 #BigDataSolutions #DataEngineering #DataPipelines #AzureCloud #Analytics	**Anoop Velluva** Senior Data Engineer University of Liverpool Senior Data Engineer at the University of Liverpool excels in designing and implementing robust big data solutions. With experience in software development and a focus on data engineering, Anoop specializes in designing intricate data pipelines that power organizational insights. His contributions span discrete event simulation modelling, visualization, and software development in CAMO-NET project. Anoop is adept at processing vast dataset to derive critical research insights.
	Chris Deputy Communications Officer University of Liverpool
 #pharmacology #therapeutics	**Vineet Dubey** Postdoctoral Research Associate University of Liverpool His research focuses on dose optimisation of antibacterial drugs by understanding antibiotic treatment induced resistance network analysis in Gram-negative pathogens.
 #AI/ML	**Conor Rosato** Postdoctoral Researcher University of Liverpool Postdoctoral researcher in the Department of Pharmacology and Therapeutics at the University of Liverpool focusing on Bayesian inference and data fusion using Markov Chain Monte Carlo and sequential Monte Carlo methods and machine learning, with specific application to healthcare and epidemiological related problems.
	**Esha Sheth** Clinical Research Support Officer University of Liverpool Assisting with project coordination, regulatory compliance, and protocol development.

	**Jacky Crowley** Senior Research Project Officer University of Liverpool
 #PKPD	**Chris Darlow** Clinical Lecturer / Clinical Research Fellow University of Liverpool His research focuses on use of in silico and in vitro models, including physiology based pharmacokinetic modelling, to optimise antimicrobial use, particularly in low- and middle-income countries.
 #AI #uncertainty	**Peter Green** Senior Lecturer School of Engineering / School of Medicine University of Liverpool Director of Engineering Data Analytics Ltd Peter is a cross disciplinary researcher who develops Machine Learning solutions for risk averse applications across e.g. engineering, healthcare and defence. His current work is focused on the reduction of carbon associated with glass production and preventing the spread of antimicrobial resistance.
 #geograpy #health inequalities #public health	**Dr Xingna Nina Zhang**, BSc, MSc, PhD Tenure Track Fellow Department of Public Health, Policy and Sysems Department of Health Data Science I was trained as a geographer and am now researching on health inequalities. I have thematic and methodological interests in many aspects of public health, data science, and statistical methods and modelling in causal inferences, particularly the geographies of health inequalities, and spatial measures of demographic processes and population dynamics. I have been actively involved in multiple research projects on COVID-19 responses and gastrointestinal (GI) infections. In my recent work, I have focused on using natural experiments to evaluate the impact of local and national socio-economic and public health policies upon health inequalities; a niche area in the intersection of Human Geography and Public Health.
	**Paul Aylin** Professor of Epidemiology and Public Health Faculty of Medicine Imperial College London Leading and managing a team of researchers investigating variations in performance and safety in healthcare delivery through the analysis of routinely collected clinical and administrative data. This includes the use of this information with focus on primary care and mental health, data linkage and AMR and providing research expertise in measurement methods, public health informatics, and advanced statistics.

#micro-electronics
#circuits
#diagnostics

Pantelis Georgiou
Professor of Biomedical Electronics
Department of Electrical and Electronic Engineering
Imperial College London

His research includes ultra-low power micro-electronics, bio-inspired circuits and systems, lab-on-chip technology, and application of micro-electronic technology to create novel medical devices. Application areas of his research include new technologies for treatment of diabetes such as the artificial pancreas, novel Lab-on-Chip technology for genomics and diagnostics targeted towards infectious disease and antimicrobial resistance (AMR), and wearable technologies for rehabilitation of chronic conditions.