1. Infectious Disease - Discretionary Award application

Reference number	UNS142282
Applicant name	Prof Anna Levin
Title of application	Centres for Antimicrobial Optimisation Network – Brazil (CAMO-Net Brazil)
Total amount requested	USD 1,489,230.00

2. Application summary

Application title
Centres for Antimicrobial Optimisation Network – Brazil (CAMO-Net Brazil)

Proposed duration of funding (months)
36

Proposed start date	01/12/2022

Administering organisation type: Select the relevant administering organisation type.	Not-for-profit

Name of administering organisation If your application is successful, this is the organisation that will be responsible for administering the award (including receiving the funds).
Fundação Faculdade de Medicina

Lead applicant's address at host organisation If your application is successful, we will use this address in your award letter.	
Department/Division	Infection Control Department
Organisation	Hospital das Clinicas-University of Sao Paulo
Street	Rua Ovidio Pires de Campos, 225- 6o andar -sala 629
City/Town	São Paulo-SP
Postcode/Zipcode	05403-010
Country	Brazil

Research subject area Select the most relevant area, based on the key aims of the research. This information is used to report on our funding.

Population and Public Health

Are you applying as an individual researcher or with coapplicants?	With coapplicants

3. Proposal summary

Proposal summary
Provide a summary of your proposed research, including key goals.

Purpose: To conduct research for optimising antimicrobial use in humans through three interlinked themes identified through a research roadmap and landscape review (medicines management; technology and innovation for optimised prescribing; culture, context, and behaviours).

Structure: Researchers will be connected via a global network built on existing collaborations between National Hubs (UK, Uganda, South Africa, India, Brazil) with complementary research theme expertise. Opportunities for geographic (South-South and North-South) bilateral learning in research projects will maximise implementation and translational activities, facilitated by a comprehensive programme for knowledge mobilisation, capacity strengthening, and co-production for local context-specific, sustainable interventions. National Hubs will link with existing structures and supported by quality-assured technology and research and development laboratories (Malawi, Ghana, Thailand) to support activities. Development of an Antimicrobial Resistance Data Warehouse will provide underpinning network infrastructure for the global good.

Network growth: Shadow national sites (Pakistan, Bangladesh, Timor Leste) will participate in network activities to actively build research collaborations and capacity with the National Hubs. In years 1-2, they will identify national research priorities and conduct a pilot project in year 3. The goal for a future iteration of CAMO-Net is that shadow national sites would become National Hubs, and new shadow sites would be identified.

4. The proposal

Describe your programme of work. Ensure that you provide any further additional information requested on the call's webpage or by your Wellcome contact. In your description make sure you include:

- Aims and key deliverables;
- Background and justification;
- Details of the planned activities;
- Timetable and milestones (as appropriate).

If more than one organisation will be involved in the project, indicate what work will be undertaken at each organisation.

The CAMO-Net proposal

The proposed Centres for Antimicrobial Optimisation Network (CAMO-Net) is a global collaborative research network focused on antimicrobial optimisation for use in humans, underpinned by the values of equity, local leadership, co-production of activities, knowledge mobilisation, mutual cross-regional learning, training, capacity and capabilities strengthening, and output sharing. Its vision is a world where the appropriate, evidence-based use of antimicrobials is commonplace, supported by equitable availability and accessibility.

CAMO-Net's mission is to complement and enhance the existing ecosystem of global programmes designed to alleviate the global burden and impact of antimicrobial resistance (AMR) and poorly treated infections by creating and nurturing a sustainable and equitable ecosystem for global research to optimise the use of antimicrobials in humans. This will be achieved through producing contextually relevant tools, technologies, guidelines, and practices that can be readily implemented with the support of governments and policymakers.

Aims and key deliverables

Aim: To address the global impact of AMR on human health through **optimising antimicrobial use** by establishing a **sustainable global research ecosystem, developed across low- and middle-income countries (LMICs) and high-income countries (HICs)**. New knowledge will be developed, related to the better use of existing and newly developed antibiotics, to help prevent and treat bacterial infections and minimise AMR. This will be co-produced within the context of specific epidemiological, cultural, structural, and economic factors; supported by expertise in innovation adoption and implementation.

The following guiding **objectives** will be delivered through a robust capacity strengthening and knowledge mobilisation programme across the network, providing reciprocal South-South and North-South as well as urban-rural contextual learning and development.

1. **A comprehensive, contextual understanding of situational data** in each National Hub on the progress of interventions to tackle AMR in human populations to identify opportunities to address existing gaps/challenges, with respect to: **(i) technology and innovation for optimised prescribing; (ii) context, culture and behaviour; and (iii) medicines management**.
2. **Harnessing the power of data (quantitative and qualitative) through strategic and targeted studies** to generate new knowledge related to optimising antimicrobial use in human populations.
3. **Implementation of co-produced**, contextually fit, and sustainable solutions to optimise antimicrobial use targeting innovation, systems and behaviours.
4. **Evaluation** of interventions and strategies targeting optimised antimicrobial use through an intersectional approach.

The **research themes** being addressed by the CAMO-Net proposal are based on an extensive process of international consensus and the development of a commissioned research roadmap (see Appendix 1 for executive summary) and subsequent key opinion-building Lancet European Health publication in 2021.[1] They include:

Technology and innovation for optimised prescribing, which includes (i) artificial intelligence (AI), including machine learning, for individual and population-level clinical decision support, data and diagnostics, and integrating host and pathogen dynamics; (ii) point of care (PoC) and laboratory-based diagnostics, lab-on-chip technology, antimicrobial biosensing and drug sensing for medicine quality; (iii) use of data, including standardised pooling; and (iv) innovation adoption and implementation.

Context, culture and behaviours which includes (i) organisational and individual behaviour change; (ii) health-seeking and health provision behaviours; and (iii) intersection of the socio-cultural determinants of health and health literacy with AMR.

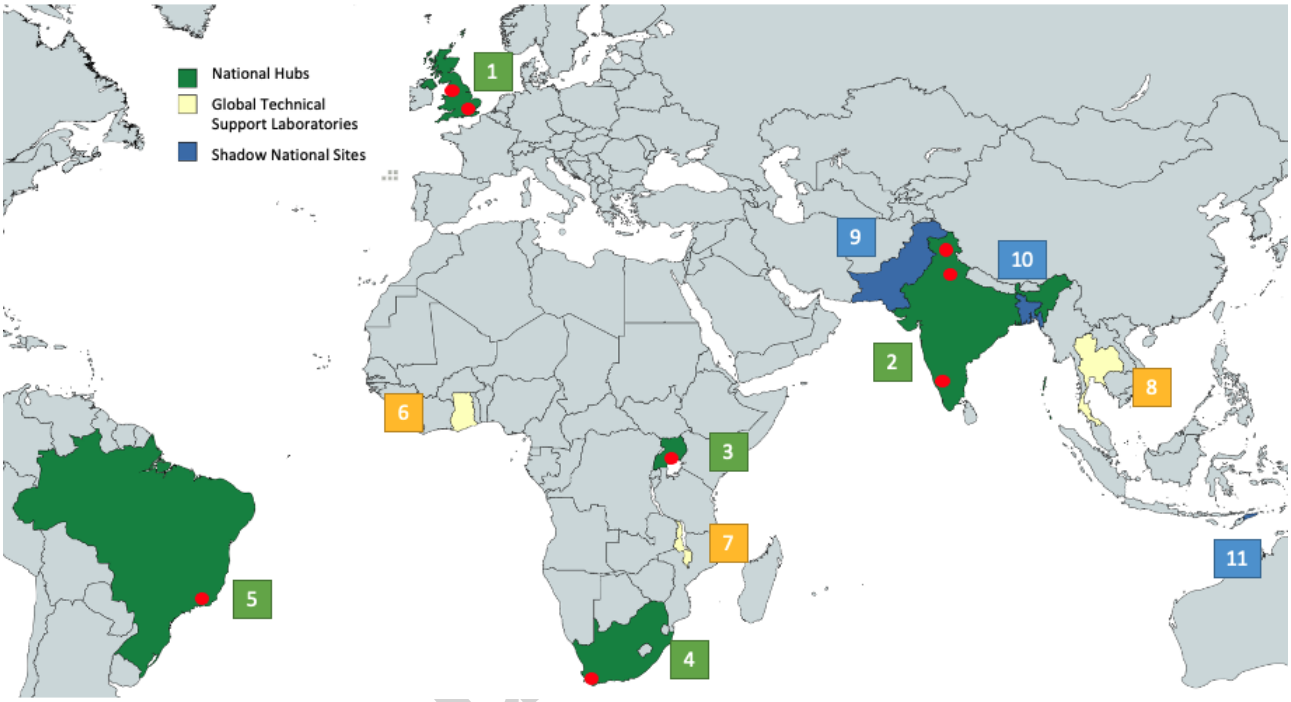
Medicines management, which includes (i) supply chains and distribution, addressing and forecasting shortages; (ii) prescribing systems and monitoring frameworks; (iii) quality assurance testing; and (iv), addressing comorbidities, polypharmacy, and drug-drug interactions.

Data from partnerships with industry (IQVIA) and not-for-profit organisations (ProMED-AMR) will be made available to enhance the research in these themes and provide expert local intelligence.

Essential data infrastructure
Nowhere in the world exists a collated and standardised repository for antimicrobial pharmacokinetic-pharmacodynamic (PK-PD) and other antimicrobial optimisation-related data. CAMO-Net will develop a sustainable open-source central data repository where data collected from multiple investigators and studies can be stored and curated for the longer term. Using PK-PD data as an entry point, the proposed CAMO Global Data Resource (CAMO-GDR) will enable data to be combined, analysed and reanalysed. It will also facilitate high-quality studies, education and training.

Key deliverables of CAMO-Net
(1) Integrated global approach to antimicrobial optimisation via a sustainable structure with global representation and leadership as well as shared learning.
(2) New knowledge/information on antimicrobial prescribing and use.
(3) National policy influence across each National Hub with regard to antimicrobial optimisation across technology innovation; context, culture and behaviours; and medicines management.
(4) CAMO-GDR as an open resource with curated data and models to underpin an understanding of the emergence of AMR.

Structure
We will establish a network to achieve the proposed objectives through co-production, shared learning, and capacity strengthening, consisting of:
National Hubs (1-5) – organisations with existing research collaborations and expertise relevant to this proposal;
Global technical support laboratories (6-8) – globally recognised quality-controlled laboratories with existing collaborations and strong links to the technology and innovation theme; and
Shadow national sites (9-11) – organisations with tangential collaborations we wish to explore further and develop expertise relevant to this proposal.



1) UK: Alison Holmes and William Hope – Centre for Antimicrobial Optimisation at Imperial College London (CAMO) & Centre of Excellence in Infectious Disease Research at the University of Liverpool (CEIDR)
2) India: Sanjeev Singh and Nusrat Shafiq – Amrita Institute of Medical Sciences – Delhi and Kochi (AIMS) & Postgraduate Institute of Medical Education and Research (PGIMER) Chandigarh
3) Uganda: Andrew Kambugu – Infectious Diseases Institute (IDI) at Makarere University
4) South Africa: Marc Mendelson – Division of Infectious Diseases & HIV at University of Cape Town (UCT)
5) Brazil: Anna Levin and Silvia Costa – Faculty of Medicine of University of São Paulo (USP)

6) Ghana: Gordon Awandare – West African Center for Cell Biology of Infectious Pathogens at the University of Ghana (WACCBIP)
7) Malawi: Henry Mwandumba – Bacteriology & diagnostics laboratory at Malawi-Liverpool-Wellcome Clinical Research Programme (MLW)
8)Thailand: Phornpimon Wong – Clinical Pharmacology Laboratory at Mahidol Oxford Research Unit (MORU)

9) Pakistan: Izhar Hussein – Dow University of Health Sciences
10) Bangladesh: Senjuti Saha – Child Health Research Foundation Bangladesh
11) Timor Leste: Nelson Martins – Unversidade da Paz

Figure 1. Map and table of the proposed CAMO-Net research partners

Background and justification

CAMO-Net: fulfilling a global need

Drug-resistant infections (DRI) and lack of access to effective antimicrobials pose a global threat to human health and to the delivery of safe healthcare, as well as threatening medical advances. While it is recognised that investment in the discovery and development of new agents is long overdue, the costly and formidable challenge of bringing new antimicrobials to market is only a small part of the solution to AMR. There is an urgent need for research to better understand how the efficacy of existing antimicrobials can be preserved and sustained, and how to identify mechanisms to assure the efficacy and longevity of future antimicrobials. Existing programmes that exist (such as CARB-X) focus on drug development and those that aim to build in other relevant approaches such as diagnostics (such as Value-Dx), do so in a relatively limited and siloed fashion.[2] These initiatives are also centred around Europe and other high-income countries (HICs). Integrated, multidisciplinary systems approaches are needed that consist of strategic, reciprocal, long-term partnerships among collaborators in HICs and low-and middle-income countries (LMICs).

A major driver of DRI is the suboptimal use and prescribing of antimicrobial agents, which contribute to the emergence and spread of antimicrobial resistance (AMR) and poor clinical outcomes. Optimising antimicrobial use is complex and needs to be considered within the contexts of the entire healthcare system as well as prescribing in general and medicines management, acknowledging co-morbidities and polypharmacy. Optimal antimicrobial use goes beyond simply providing single or even bundles of interventions such as evidence-based guidelines, better diagnostics, and new antimicrobial agents for the treatment of infection. These alone do not consider structural and social determinants of health including macro-level polices, complex socioeconomic factors, fragmented healthcare systems, human behaviours and a lack of access to expertise and resources in many countries that exacerbate suboptimal antimicrobial use.

To achieve and sustain optimisation in the use and prescribing of antimicrobials system wide thinking and action is required that incorporates wider aspects of patient care such as patients' access to healthcare, public perceptions, health seeking behaviours and patient safety. Closing the implementation gap in strategies aimed at tackling AMR, and specifically antimicrobial optimisation, requires a holistic approach across health professionals, sectors of care and scientific disciplines to successfully transform policy and practice to be aligned with individual patients' needs, wherever they are. To successfully bridge the gap in AMR efforts, interdisciplinary, inter-sector, as well as inter-country collaborations are needed. Interventions must consider the individual, organisational and national, global factors that influence antimicrobial prescribing and use. Strategies must account for the individual patient, prescriber, microorganism (acknowledging resistance mechanisms and local epidemiology), health system within which antimicrobials are prescribed, and national and global drivers of AMR.

Details of the planned activities

Contents:

1. Formation of a global network

The main body of CAMO-Net will comprise five National Hubs in the UK, India, Uganda, South Africa, and Brazil. Each National Hub will have its own National Leadership Team, have representation in cross-network Research Planning Groups, as well as a representative on the overarching CAMO-Net Management Board. National Hubs will drive the national research activities as well as contribute to the activity of the network. Research activities will be guided by theme-based Research Planning Groups (RPGs) that will be led by designated leadership teams and comprised of relevant CAMO-Net members.

There will be three Technical Support Laboratories (tech labs), comprised of existing excellent and quality-assured laboratories in Ghana, Malawi, and Thailand. The tech labs will support training and capacity strengthening across CAMO-Net as well as provide project-level expertise through engagement with the theme-based research planning groups.

CAMO-Net will also be comprised of three Shadow National Sites (shadow sites) in Pakistan, Bangladesh, and Timor Leste. Each shadow site will have a representative on the overarching CAMO-Net Management Board as well as participate in network activities. In the first two years of CAMO-Net, shadow sites will plan a pilot project within a CAMO-Net research theme to be conducted in year three, based on nationally- and locally-identified priorities, site strengths, expertise and development needs. Network hubs will support the capacity and capabilities strengthening of shadow sites and teams at shadow sites will be involved in training network activities.

Two non-academic organisations will also contribute to CAMO-Net. The non-commercial partner (International Society for Infectious Diseases' (ISID) Program for Monitoring Emerging Diseases (ProMED) AMR) will support each Hub with detailed, contextual understanding of local and national intelligence on transmission patterns, resistance rates, etc. to inform specific projects. Commercial partner IQVIA will support each Hub with detailed understanding of national and local antibiotic buying, distribution pathways, prescribing practices, etc. to inform specific projects.

CAMO-Net will benefit from a programme management structure with a Chief Operating Officer post to oversee the entirety of the network and lead a project manager in each Hub. There will be a dedicated Communications Manager across the team to manage website, social media, and other PR issues. The management team will also liaise with the Knowledge Mobilisation (KM) Fellows in each Hub, who will work across all teams and groups of CAMO-Net to ensure co-production and shared learning is maximised (see section 2.1 for more information on KM). This will also include a working group, chaired by the CAMO-Net KM lead, of external representatives responsible for Monitoring, Evaluation, and Learning of CAMO-Net, ensuring the network is fulfilling its purpose and keeping diversity, inclusion and well-being as a central value.

See section 1.5 for governance structure.

1.1 The National Hubs

The National Hubs proposed for CAMO-Net are comprised of global research groups who have strong, established track record of research collaborations over many years and extensive expertise across the three research themes. Examples include:

1) Building upon the 2019 CAMO launch in London and the involvement of leads from Liverpool, Kampala and S Africa, continued collaborative discussions and links, and subsequent co-authorship of invited Nature Microbiology review on challenges, advances and opportunities for using innovation to support precision antimicrobial prescribing.
2) Building upon the collaborations and planned alliance between the two DHSC AMR Capital funded centres at Imperial and Liverpool, including interest in developing comorbid/multimorbid populations as well as the development of a cadre of clinical research fellows (Rawson, Wilson, Stott, Darlow, Gerada).
3) Development of massive open online courses in AMR research and patient and public involvement (Uganda, India, South Africa, UK collaboration).[3]
4) Building a cadre of healthcare professionals with expertise in AMR research including developing and supporting fellowships and PhD studentships in South Africa and India. Extensive research on antibiotic use along perioperative pathways in surgical populations in India and South Africa (ESRC-funded: Optimising antibiotic use along surgical pathways: addressing antimicrobial resistance and improving surgical outcomes' [ASPIRES] 2017).
5) Building on the CEIDR dose optimisation in LMICs: algorithms and approaches to precision dosing, population PK-PD modelling of antibacterial, antifungal and antiparasitic agents, specific approaches to antimicrobial use and AMR in neonates, children and the critically ill.
6) UCT and IDI collaborations.
7) Building on collaborations between London and Kampala on Tropical Health Education Trust bid.
8) Academy of Health Sciences Hamied Foundation Visiting Professorship to strengthen UK-India AMR research collaboration (Charani).
9) Our research to date has involved patients, carers and citizens and has been sensitive to the socio-cultural nuances of patient participation in research and in health, having identified empirical evidence on the need to approach patient, carer, and public involvement according to contextual needs and norms.[4,5]
10) Membership of various WHO Expert Panels for infectious diseases, including Infection, Prevention, and Control, AMS, and AMR Research Strategy (Holmes, Levin, Padoveze, Mendelson, Charani).
11) Membership of the GARDP Specialist Advisory Committee and underpinning research in GARDP's neonatal sepsis program (Hope).
12) Liverpool is an ESCMID Collaborative Centre for international observership (Hope)

Strengths of individual National Hubs:

UK: Liverpool and London

Brings together the Centre for Antimicrobial Optimisation (CAMO) at Imperial College London and the Centre of Excellence in Infectious Diseases Research (CEIDR) at the University of Liverpool. Professors A Holmes and W Hope will lead the UK National Hub with combined world class research excellence, including in the cultivation of multidisciplinarity, global collaborations, and technological advances for optimising antimicrobial use; including artificial intelligence (AI) for clinical decision support systems (CDSS—T Rawson, P Herrero, B Hernandez Perez) and diagnostics (J Rodriguez Manzano), point-of-care (PoC) biosensor technology (D O'Hare, P Georgiou) and electrochemistry (T Cass), epidemiology and datasets (P Aylin, I Buchan), pharmacokinetics and pharmacodynamics and individualisation

of antimicrobial therapy (S Das, M Pirmohamed). Expertise in medication management systems and patient safety (B Dean Franklin, M McLeod). The Imperial group also pioneered the application and use of applying social sciences to AMR (E Charani, R Ahmad, N Zhu). Specific local interest: innovation in technology and data usage and the application of behaviour change.

India: Delhi and Chandigarh

Combined strengths of Amrita University in both Delhi and Kochi and the Postgraduate Institute of Medical Education and Research in Chandigarh. With the development of one of the largest data hubs at one of India's top universities and network of hospitals, collaborators in India (Singh, Shafiq) have extensive experience in data management and informatics (N Verma, clinical medicine including neonates (S Dutta), clinical pharmacology (V Gota, A Kakkar, S Malhotra), PoC technology (S Bhattacharya), PK-PD studies (S Mallayasamy), microbiology (P Mathur, S Sengupta, N Taneja, C Wattal) and community care medicine (D Kumar, P Lakshmi). Consolidated experience in behavioural and social science research (M Kaur) particularly related to surgery (G Chandy). Specific local interest: AI for clinical decision-making embedding pragmatic, sustainable hospital surveillance at the point of care.

Uganda: Kampala

The Infectious Diseases Institute (IDI) has an outstanding national and international reputation for excellence in infectious diseases research and capacity development (B Castelnuovo). Strength in clinical pharmacology with expertise in pharmacokinetics of antimicrobials (C Sekaggya-Wiltshire) and managing polypharmacy (R Galiwango, A Mujugira) and bioinformatics (D Jingo), as well as global health security (F Kakooza) and implementation of m-Health (S Okoboi, R Parkes-Ratanshi). Leaders in the region with existing datasets for priority diseases to focus on the key aspects of AMR. Specific local interest: personalised prescribing for the optimal management of infection in the context of common comorbidities (e.g., TB and HIV) and polypharmacy.

South Africa: Cape Town

Collaborators in South Africa bring world-leading work in AMR and advocacy as well as strong links to national and global policy (M Mendelson, A Brink, N Schellack, S Maswime). Ground-breaking work on implementation of antimicrobial stewardship programmes in LMICs (Mendelson, Brink, Schellack, van Den Bergh) and expertise in organisational and individual behaviour change, the role and visual mapping of team dynamics, and innovation adoption (E Charani, M Mendelson). The Centre for Infectious Diseases Epidemiology and Research (CIDER, A Boulle, N Tiffin) internationally recognized for HIV and Tuberculosis surveillance programmes now focusing on antimicrobial surveillance (A Boulle, N Tiffin, A Brink). Patient and public health advocacy and communication (R Hodes, F Venter, A Koch) leaders bring strength to addressing a specific local interest: investigating the intersection of sociocultural determinants of health (S Dlamini) and AMR and building a global civil society that is invested in optimising antimicrobial behaviours.

Brazil: São Paulo

Collaborators in Brazil combine strengths in medicine (A Levin, S Costa) and nursing (M Padovese) and have strong links with the 600+ hospitals in the state of São Paulo, as well as across primary care. Research excellence in healthcare associated infections and AMR with a specialty in infection prevention and control, PK/PD, and antimicrobial stewardship programmes. Furthermore, AMR in the environment and how it interacts with the population of different social settings complements the human health aspects (T Razzolini, M Dropa). Specific local interest: antibiotic prescribing decision support in the community, antibiotic prescribing interventions in urban and slum populations in primary care, and surveillance of wastewater and asymptomatic carriers for measuring impact.

See additional document upload "CAMO-Net Key Researchers" for short biographies of the key researchers from each National Hub site.

1.2 Technical support laboratories

The identified technical support labs (tech labs) have existing partnerships/collaborations with the National Hubs, including formal collaboration between institutes, individual grants, joint publications, and joint committee membership.

Tech labs will support training and capacity strengthening across CAMO-Net as well as provide project-level expertise through engagement with the technology and innovation theme research planning group.

Expected deliverables across each tech lab:

- Creation of learning content (i.e. short course or professional development training) within training and capacity strengthening network for all CAMO-Net members.
- Contribution of expert knowledge to specific research projects as required.

The tech labs for CAMO-Net are:

Ghana: West African Center for Cell Biology of Infectious Pathogens (WACCBIP)

Led by Program Director (G Awandare), the research mission of WACCBIP is to conduct cutting-edge research and innovation to guide development of new approaches to disease diagnosis, prevention, and control. One of their primary objectives is determining the molecular bases for differences in host susceptibility to infectious diseases to guide better disease prevention and management. WACCBIP will be particularly aligned with CAMO-Net through its priority research themes of biomarkers and molecular diagnosis as well as molecular epidemiology for disease surveillance and drug resistance monitoring.

Malawi: Bacteriology and diagnostics laboratory at the Malawi-Liverpool-Wellcome (MLW) Clinical Research Programme

The Infection Biology Theme within MLW brings together research groups with a wide range of expertise in pathogen surveillance, microbial genomics, immunology, virology, vaccinology and antimicrobial resistance linked to the cutting-edge laboratory facilities at MLW. Their research bridges the gap between the laboratory and clinical spheres, promoting research excellence and leadership in the biological science of infection to benefit health. Along with academic and clinical microbiologists, the bacterial and drug resistant infection team includes social scientists, molecular biologists, epidemiologists, parasitologists and infectious disease physicians. This group will be the primary focus in CAMO-Net as it operates an environmental microbiology laboratory and uses culture and molecular techniques. The group is rolling out its sequencing capacity, enabling it to provide fine scale resolution of bacteria in our transmission studies.

Thailand: Clinical Pharmacology Laboratory at Mahidol Oxford Research Unit (MORU)

Based at MORU Bangkok, the Clinical Pharmacology Laboratory conducts its own research and supports the MORU Tropical Health Network and external research groups with study design, drug measurements, pharmacometrics analysis and interpretation of pharmacological results. CAMO-Net will engage most closely with the Biochemistry & Discovery team which focuses on omics-based research (metabolomics/proteomics/lipidomics), drug measurement, methodology development and medicine quality research. The team develop novel LC-MS methods to quantify drugs in biological samples, with a particular focus on filter paper methodologies to facilitate and enable pharmacokinetic field studies. The metabolomic, proteomic and lipidomic research

use in vitro and clinical patient samples in combination with high-resolution/high-accuracy LC-MS measurements to characterise and identify unknown metabolites, develop improved diagnostics, understand pathophysiology, and describe mechanisms of drug action and resistance. The medicine quality research use LC-MS techniques and handheld analytical devices to develop novel methodologies to detect substandard and falsified medicine.

1.3 Shadow National Sites

Shadow national sites (shadow sites) are identified organisations which already have some links with the National Hubs which aim to be developed in this pilot of CAMO-Net. It is an important opportunity to combine the availability of existing expertise and development of new expertise, capacity and capabilities relevant to the proposal and research space. Current links between National Hubs and Shadow National Sites include individual research links between each of the institutes, including specific individual projects and collaboration on workshops about antimicrobial optimisation.
Expected deliverables for Shadow National Sites:

- Participation in network activities (e.g., knowledge mobilisation and training/capacity strengthening network).
- Pilot project related to CAMO-Net research theme commences end of Year 2.

The shadow sites are:

Pakistan

Lead: Dr Izhar Hussain
Dr Izhar Hussain brings expertise in health management and innovation with a background in pharma and early work on rational prescribing of antimicrobials and surveillance of resistance as project coordinator at the WHO Eastern Mediterranean Region (1981-86). He now heads up the Institute of Business and Health Management at Dow University of Health Sciences in Pakistan. Dr Izhar is committed to promoting rational prescribing, strengthening the tracking and surveillance of resistant strains — both for community-acquired and nosocomial infections – and implementation of antimicrobial stewardship as a systems and policy priority.

Organisation: Dow University of Health Sciences (DUHS)
Dow University of Health Sciences is a multi-faculty university with schools of medicine, nursing, midwifery and dentistry that works collaboratively with industry partners and a network of 15 public and private hospitals in Sindh, which has high social disparities and rural and urban populations. Their vision is to bring innovation in the biological, clinical and pharmaceutical sector by providing research which improves patient quality of life. Their mission is to provide outstanding patient centred education, training and clinical care which is informed by cutting edge research and innovation.

Research interest related to CAMO-Net:
As part of CAMO-Net, IBBPS is interested in exploring a project to investigate the existing capacity and preparedness of Pakistan in terms of developing, implementing, and scaling up technological innovations and solutions to combat AMR. They are interested in conducting a systematic assessment of the wider systems, policy, cultural and sociological context—with focus on readiness for technology including artificial intelligence—as well as the organisational and management contexts of the ‘adopting’ health system organisations and structures.

Bangladesh

Lead: Dr Senjuti Saha

Dr Senjuti Saha is the Director of the Child Health Research Foundation Bangladesh and is a global leader in research equity across countries. Her work is grounded in advancing the cause of health and research equity, based on her vision that everyone across the world should have equal access to the practice and benefits of science. Her research focuses on developing novel therapeutics against the bacteria Pseudomonas aeruginosa, which causes multidrug-resistant infections. Dr Saha is embarking on a career that bridges the gap between molecular biology and its implementation in resource-poor countries, advancing the cause of health equity.

Organisation: Child Health Research Foundation Bangladesh

The mission of Child Health Research Foundation is to improve child health in Bangladesh and around the world by facilitating appropriate policy decisions through research and advocacy.

The idea for setting up CHRF came from the realisation of the founding group of researchers that developing countries like Bangladesh often lack the evidence needed for rational and timely policy decisions due to inadequate and improper use of limited resources. Scarcity of evidence, in turn, discourages the investment in child health. CHRF works to make sure that evidence about disease burden and causes is generated through high quality research conducted using limited resources.

In addition to research, CHRF also works with other non-profit hospitals to facilitate low cost diagnostic services for poor patients to improve child health while simultaneously collective valuable evidence for policy designs. Through an association with the Department of Microbiology at Dhaka Shishu Hospital and through a consortium of urban and rural hospitals, CHRF has access to research facilities that enables it to contribute to scientific and medical knowledge and their applications in South Asia to improve public health approaches.

Research interest related to CAMO-Net:

Dr Saha's current work is focused on paediatric preventable infectious diseases, with the goals (i) of using state-of-the-art technology like on-site metagenomics to identify etiologies that elude standard laboratory testing in LMICs and (ii) of understanding the indirect impacts of interventions like vaccines on the overall health system. She advocates for equal access to scholarly literature and science education. With her team at CHRF, their mission is to break free of the vicious cycle of limited resources that lead to lack of data required for evidence-based policy decisions, which lead back to limited resources; instead, they are committed to building virtuous cycles of data-generation, that are sustainable and cost-effective.

Timor-Leste

Lead: Professor Nélson Martins

Professor Nélson Martins has been a national leader at the forefront of improving the health of Timor-Leste citizens from the time the country's independence was won. He began his career as a community doctor in Timor Leste. His work with the poor populations of the country led him to the Menzies School of Health Research where he completed his PhD to help understand and manage the tuberculosis epidemic. Prof. Martins established the first National Tuberculosis Programme. From 2007-2012, Prof. Martins served as Minister of Health for Timor Leste, where he led the country's development in the areas of reproductive and maternal health as well as infectious diseases. He applied the learnings from his PhD programme to create an integrated health system with the capacity to deliver health services to people living in villages, despite the lack of human, financial, and logistics resources.

Organisation: Unversidade da Paz via Menzies School of Health Research
Unversidade da Paz (UNPAZ) in Timor-Leste has been slowly rebuilding itself after the violence in Timor-Leste following the war in the 1990s. The Menzies School of Health in Darwin, Australia works closely with the Timor-Leste Government and partners to strengthen health systems for responding to infectious diseases challenges. Their projects in Timor-Leste have been designed to build capacity in clinical, surveillance and laboratory settings, emphasising the importance of the health system working together to improve response to infectious diseases at both the individual patient and the public health level. There are Research Clinicians in Timor-Leste who manage significant numbers of individuals with community-acquired and nosocomial infection. Until recently, there has been a lack of access to diagnostic testing. Furthermore, there has been unreliable supply of medicines including antimicrobials to Timor-Leste. Therefore, treatment decisions are often made empirically, and based on which medicines are available. Consequently, there may be overuse or inappropriate use of antimicrobials, particularly in more remote areas of the country. Research into the optimisation of infection treatment in Timor-Leste is therefore of utmost importance to guide local practice. We are particularly interested to perform studies in healthcare facilities and community settings outside Dili. Findings will likely be immediately transferrable to similar remote and/or resource-limited locations in the tropics, which are so rarely studied.

Research interest related to CAMO-Net:
Timor-Leste offers a unique opportunity to study the optimisation of antimicrobials in remote areas where access to diagnostics and therapeutics are limited. A recent observational study of individuals presenting to community health centres in Timor-Leste identified a high level of antimicrobial prescription, including many cases where multiple antimicrobials were used in a single patient episode. Furthermore, a significant proportion of key medications were unavailable (40%).

In this setting, simple interventions such as point-of-care diagnostic technologies, clinical decision support systems, antimicrobial stewardship education or programmes which address medicines quality and supply could have a huge impact locally. They could also have relevance to other similar locations in Southeast Asia and further afield. Through the tiered system of healthcare facilities, staffed by a network of government-employed healthcare workers, this type of practical, interventional research will be immediately feasible in Timor-Leste. Regional hospitals where clinicians have expressed interest in collaborating in research include Oecuse, Malina and Baucau.

1.4 Non-academic support

For a systems approach to antimicrobial optimisation, rich datasets are required. Both the International Society for Infectious Diseases' (ISID) Program for Monitoring Emerging Diseases (ProMED) and IQVIA are organisations with existing extremely rich datasets related to antimicrobial optimisation: ProMED on transmission patterns, resistance rates, etc; IQVIA on local antibiotic buying, distribution pathways, prescribing practices, etc. Bringing these organisations into CAMO-Net will enhance data and local/national expertise, offering opportunities for specific/heightened reports for each National Hub and aid data linkage with aspiration to involve more countries in the future.

Proposed deliverables from non-academic support:

- Specific expertise to each National Hub to help guide research activities where appropriate.
- Contribution of local, contextual data to support CAMO-Net research activities, where appropriate.

ISID ProMED-AMR

Background

The International Society for Infectious Diseases' (ISID) Program for Monitoring Emerging Diseases (ProMED) is an innovative infectious disease surveillance service utilising informal data sources to relay first alerts about emerging and re-emerging infectious disease outbreaks. Supported by 53 subject matter experts (SMEs) stationed in 33 countries, ProMED is the right combination of technology with the human touch to keep pace with the dynamic field of infectious diseases.

To meet the needs of its 80,000 users, ProMED curates content across ten separate networks, explicitly focusing on geographic regions, topics, and breaking alerts. One of these networks is ProMED-AMR. Established in 2020, ProMED-AMR shares alerts about antimicrobial resistance (AMR) events affecting humans, animals, and the environment, specifically highlighting event-based reporting of unusual resistance patterns (including outbreaks involving resistant organisms, cases of infectious diseases failing to respond to antimicrobials, or new resistance phenotypes), clinical human/veterinary reporting of drug resistant infections, and reporting from the academic sector on novel resistance mechanisms.

ProMED-AMR network has the flexibility to scale additional reporting in other sectors for topic areas of interest while capitalising on the well-established, trusted, global network (ProMED-mail) started 26 years ago. All reports shared on the network are supplemented with commentary by our SMEs, putting the information reported in the context of historical events and the relevance of the new information. ProMED is the sentinel for AMR event-based surveillance.

Contribution to CAMO-Net

Given ProMED-AMR's mission to deliver near-real time curated global AMR data 24/7, this network is an ideal match to support the research work of CAMO-Net. Furthermore, the SMEs comprising the ProMED-AMR network can assist with efforts to change antibiotic use behaviours, set guidelines and policies, involve key thought leaders at relevant stages, and impact medicine management practices.

To achieve these outputs, ProMED-AMR would undertake work in the following key areas:

1. Hand-select five ProMED-AMR expert moderators to align with the interests of each of the National Hubs (UK, Uganda, South Africa, India, and Brazil). In addition, one global lead for the ProMED-AMR network will coordinate all ProMED-AMR activities for this group. The global network lead will conduct regular assessments to understand gaps in the reporting information, regions, and usage demographics.
2. Regional-level support informed by Promed-AMR expertise of early warning signals and how to test them. Providing enhanced, local data for deep learning within context in each National Hub.
3. Contributing to the training and capacity strengthening network (Section 2.3) through developing open-access educational content addressing AMR polypharmacy, inappropriate use behaviours, behaviour change techniques, and pressing issues in the field of AMR such as poor-quality antibiotics, supply chain limitations, and cross-over use of veterinary antibiotics in human medicine.

These actions are specifically designed to incorporate the three CAMO-Net research themes:

- Technology and innovation – The human in the loop AI component of ProMED-AMR is designed to inform clinical decision-making so healthcare providers utilise antimicrobial therapies that are effective, safe, and appropriate for their patient's health while reducing the overuse of inappropriate therapies or those that are no

longer effective. Furthermore, ProMED's data and the technology supporting visualisations, information extraction, and data sharing will help professionals understand the scope of AMR outbreaks through easy to digest informatics that detail how AMR infection distributions have changed over time, patient populations/species, and geographic regions.

- Context, culture, and behaviours – ProMED-AMR's SMEs stationed in the National Hubs will advise on current provider use behaviours, patient use behaviours, how to engage patients in a culturally appropriate manner, and what leaders/stakeholders can do to help change use behaviours.
- Medicines management – Addressing use behaviours, polypharmacy, poor-quality drugs, inappropriate cross-over use/unintended use, supply chain challenges, and decision-making practices are all components of the IKEEP education modules. These modules will equip users with new skills to better understand AMR challenges, work with patients and other providers to ensure medicines are dispensed and used correctly.

Collectively, these actions and the themes they are tied to will improve the quality of AMR research generated over the coming years, impact policies, and equip a new cohort of global professionals with vital skills to limit the development of AMR.

IQVIA

IQVIA is a world leader in using data, technology, advanced analytics, and expertise to help customers drive healthcare forward. Together with CAMO-Net, they will support the medicines management theme by providing local experts in South Africa, India, Brazil and the UK. This would include the provision of local knowledge and expertise about markets, distribution flows, etc., where information already exists (within data supply teams or production). CAMO-Net would have access to existing data with the potential to generate new data, if needed, as well as conduct the analysis as appropriate. The following are examples of the expertise IQVIA would bring to CAMO-Net.

South Africa

In South Africa IQVIA collects monthly pharmaceutical sales data from wholesalers supplying the private sector. These data represent approximately 95% of the private market and are captured at outlet level (e.g., pharmacy, hospital, or dispensing doctor). IQVIA's annual validation of these data suggests that IQVIA under-estimates volumes by 0.6% with 93% of product packs lying between 0.6% ± two standard deviations. A second system collects information on products dispensed by pharmacies (and some dispensing doctors and private clinics). These data represent approximately 85% of the private market and can enable analysis of prescriptions by age and by gender. IQVIA also receive data from 4 provincial depots and combine this with direct wholesaler supplies to public facilities to enable limited trend analysis of medicine supplies in those 4 provinces. IQVIA has collaborated with the MoH recently as part of the private sector initiative to understand demand for and supply of pharmaceuticals required to treat the symptoms of COVID-19.

India

In India IQVIA collects pharmaceutical sales data on a monthly basis from approximately 6,000 stockists selected through a mixture of stratified and purposive sampling from the stockist universe. Data are available at national, zonal, state, town class and for some cities (~30). The same data source is also used to estimate sales in private hospitals and clinics. IQVIA does not collect any data relating to Government procurement. A separate data source however allows analysis of prescribing trends by doctors in the private sector by patient age, gender and diagnosis. 4,747 doctors supply data through each quarter, doctors being selected at random according to a sampling frame stratified by region and specialty.

IQVIA is supporting the Government of India in developing and implementing the National Digital Health Mission. IQVIA also operates the Project Management Unit for Ayushman Bharat – India's government health insurance system, the largest of such schemes in the world. In addition IQVIA is also working with multiple state governments on health system strengthening projects (e.g. in Madyha Pradesh (COVID Response), Meghalaya (HR for Health) and Nagaland (Health InfraStructure)). Also, IQVIA has worked with Niti Aayog (Planning Commission of Gov of India) on a project on enhancing access to affordable medicines in India. We have also worked with the Department of Pharmaceuticals on pricing policy.

Brazil
In Brazil IQVIA collect monthly pharmaceutical sales data from 684 wholesalers to estimate sales into private pharmacies. Data are collected at outlet level. IQVIA's annual validation of these data suggests that IQVIA under-estimates volumes by 1.5% with 93% of product packs lying between 0.6% ± two standard deviations. The wholesaler data are combined with information collected from manufacturers, couriers etc to also estimate sales into private hospitals and clinics. A separate data source allows analysis of prescribing trends by doctors in the private sector by patient age, gender and diagnosis. 1,471 doctors supply data through each quarter, doctors being selected at random according to a sampling frame stratified by region and specialty.

UK
In the UK IQVIA collects dispensed prescriptions from 78% of retail pharmacies. IQVIA's annual validation of these data suggests that IQVIA over-estimated volumes in 2019 by 3.8% with 94% of product packs lying between 3.8% ± two standard deviations. IQVIA also collects data from almost all hospital pharmacies, these data also being used, with others, by Public Health England to monitor hospital prescribing of antibiotics. Hospital pharmacy data are also combined with the Department of Health's Hospital Episode of Statistics data to give some understanding of prescribing in hospitals by patient age, gender, diagnosis/procedure. In the case of antibiotics, given many antibiotics will be dispensed from ward stock (as opposed to by the pharmacy to an individual patient), this database will be most useful for analysis of To Take Out medication (which are always prescribed to an individual patient). Further databases enable IQVIA to conduct medical research on historical and active records of 18 million non-identified UK patient health records in primary care. IQVIA is a valued partner to the UK Government. It launched the first real world research platform with Genomics England for integrated clinical and genomic data; it provides technology and support for the Health Data Research UK Hub for Cancer; it is running the COVID-19 Active Research Experience (CARE) project and supporting the ONS COVID infection survey. IQVIA works with 98% of all NHS Acute Trusts providing software (including patient-level costing systems in approximately half of all UK Trusts), consultancy and research services.

Uganda
IQVIA has recently set up data supply contracts with about 30% of the wholesalers in Uganda and are working on growing that number. In addition, they have just started discussions with the Ugandan Ministry of Health and the Joint Medical Store on another project. We hope that this CAMO-Net proposal will be a useful driver to accelerate partnerships in Uganda.

1.5 Governance and operations

CAMO-Net will benefit from a strong programme management structure which has been discussed and agreed by members of the network via a Principles of Partnership document.

Senior Strategic Advisory Board
This Board will be comprised of global leaders across research themes; leaders linked to relevant global programmes; global policy leaders; and representatives of civil society, consumers, and AMR advocates. The ethos of CAMO-Net is equity, diversity, and inclusion which will be reflected in the membership of this Board. Potential global members have already been identified. Organisations represented may include WHO, GARDP, industry, finance, business, etc. and will include Wellcome Trust representation. The Board will provide external guidance and ensure CAMO-Net activities align with and enhance its vision and mission.

Meetings of this board will occur annually and be hosted by National Hubs on a rotating basis. Quora will be half the number of members plus one and each member will represent one vote for their organisation. This Board will be responsible for overarching vision and strategy of CAMO-Net based off reports and recommendations from the Management Board. They will be responsible for decisions such as (but not limited to) Shadow National Sites being transitioned to National Hubs, identifying potential new Shadow National Sites, evaluating the success and potential impact of CAMO-Net, providing feedback on ways to enhance network activities, and assessing value for money of CAMO-Net and supporting with the identification of other funding sources and potential future partners. The Chair will be appointed for the first two years of CAMO-Net, and subsequently put to a vote every two years to the Senior Strategic Advisory Board and Management Board.

Management Board
This Board will consist of Principal Investigators from each Party of CAMO-Net as well as a Wellcome Trust representative. The management board will meet quarterly and will focus on providing operational guidance, review and approval of budgets and work plans, monitoring progress of and providing guidance on research activities, discussing and resolving disputes between network members within the network, providing strategic guidance. Quora will be half the number of members plus one and the number of representative votes for each institution is detailed in Point 3. Wellcome Trust will take responsibility for ensuring adequate representation, mediation and conflict resolution if and when needed.

Programme Management team
This team will consist of 3 cross network members of staff and Project Managers, Data Managers and Knowledge Mobilisation fellows from each of the National Hubs. The Programme Management Team will be responsible for coordinating and managing cross-network activities on a day-to-day basis and feed information to all other levels of the governance structure.

Training and Capacity Strengthening Board
This board is responsible for developing and managing cross-network training and capacity strengthening activities, including workshops, peer-to-peer networks and internships.

Commercialisation and Entrepreneurial Board
This Board will oversee all commercial strategy, including promoting local entrepreneurship and local manufacturing, and manage Intellectual Property and Technology Transfer. Members will include legal representation from all parties as well as experts in this field.

National Hub local meetings
Each National Hub will establish its own management structure responsible for the local research activities. These groups will meet monthly or quarterly. The CAMO-Net annual meeting will take place at one of these meetings on a rotating basis.

Theme-based Research Planning Groups
These RPGs will be established to correlate with the research themes (technology and innovation; culture, context and behaviour; and medicines management). The RPGs will meet on a quarterly basis with an appointed Chair for each theme and a subject-matter expert representing Wellcome Trust. They will guide theme-based research activities, ensure shared learning across partners, and ensure theme activity alignment with CAMO-Net vision.

See Appendix 2 for CAMO-Net project matrix by National Hub and theme

Technology and innovation theme RPG
Chair (first two years): Professor Pantelis Georgiou
Shadow Chair: TBD
Research projects in this theme will be based around:

- Use of technology to support antimicrobial optimisation in specific patient populations:
    - This will include, for example, focusing on neonates as a specific patient population (UK, India)
- Building on the moment of mHealth and other electronic technologies being readily adopted in LMICs:
    - This will include, for example, PoC platforms for pathogen detection (Brazil, India), and for therapeutic drug monitoring (UK, Uganda) making use of the tech lab in Ghana with digital diagnostic expertise (Brazil, India) as well as ProMED-AMR and IQVIA for enriched datasets
- Investigating how new technologies for targeted and optimised antibiotic use can be implemented with the least disruption to existing pathways:
    - This will include, for example, integrating and developing datasets for enhanced surveillance of antibiotic resistance and consumption (South Africa, Brazil), using ProMED-AMR expertise

Context, culture and behaviours RPG
Chair (first two years): Professor Carolyn Tarrant
Shadow Chair: TBD
Research projects in this theme will be based around:

- Investigating power dynamics in the context of AMR and infection, to generate the knowledge to promote inclusivity, enable greater participation in health and facilitate capacity and develop a better understanding of the extent to which these factors intersect with one another in high, low- and middle-income countries
    - This will include, for example, how decision support tools can support community antimicrobial stewardship (Brazil)
- Characterising the way in which relative power and hierarchies across social constructs determine health-seeking and health-provision behaviours
    - This will include, for example, looking at this in the context of the intersection of the sociocultural constructs and AMR (South Africa,)
- Optimising health-seeking and health-provision behaviours through advocacy for contextually and culturally sensitive and responsive strategies for societal engagement on AMR accounting for the identified inequalities
    - This will include, for example, contextualised communication about AMR (South Africa, India)

Medicines management RPG
Chair (first two years): Professor Bryony Dean Franklin
Shadow Chair: TBD
Research projects in this theme will be based around:

- Investigating effective combinations of approaches to balance timely access with reducing inappropriate use
    - This will include, for example, addressing inequalities and inequities in medicines management and antimicrobial consumption (UK, Brazil, Uganda)
- Investigating the quality of medical products and the challenges to supply and distribution of products in LMICs, including how to strengthen supply chains and potential access to falsified medicines
    - This will include, for example, PoC drug quality sensing (India) and understanding supply chains through existing datasets from IQVIA

Oversight and Development Board for the CAMO Global Data Resource (CAMO-GDR)
This Board will oversee the scoping, planning and development of the CAMO-GDR making considerations of all elements including data management, data protection and ethics. It will include CAMO-Net partners involved in the CAMO-GDR activities as well as leading external experts in the field. See Section 2.4 for more information.

Knowledge Mobilisation; Monitoring, Evaluation and Learning; and Reflections Committee
This committee will be devoted to knowledge mobilisation, shared learning, and a reflective review process. This Team will be responsible for the Theory of Change as well as the Monitoring, Evaluation, and Learning across CAMO-Net; it will be chaired by the KM lead and include 2-3 external members for objective reflection and review. See Section 2.1 for more information.

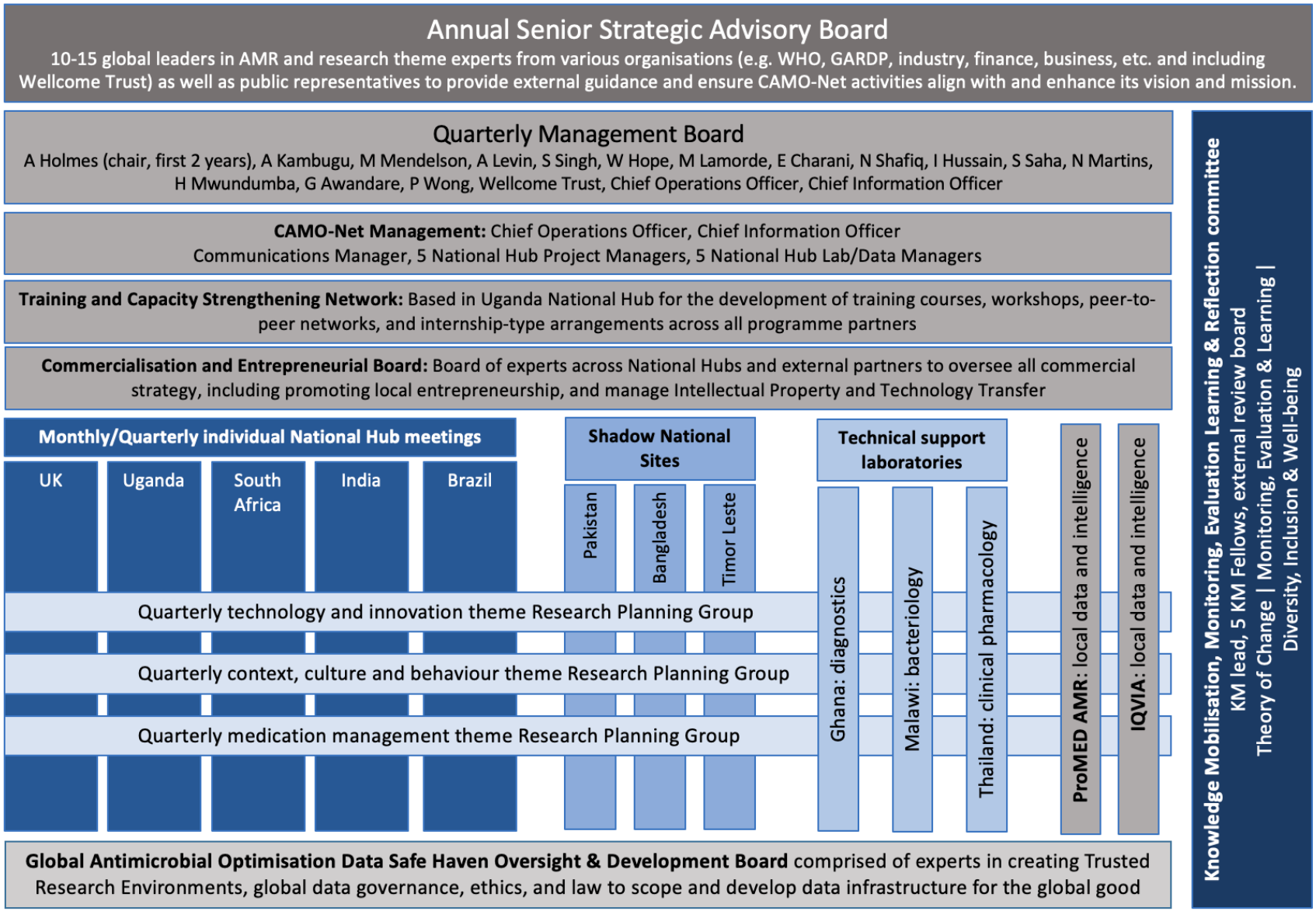


Figure 2. Proposed governance structure of CAMO-Net.
Further detail on the research projects across individual themes and countries can be found in Appendix 2

New models of global health research equity: splitting up budgets across National Hubs

As our research roadmap found, balancing research funding and allocating resources for cost-effective solutions is a major gap in global health research equity. CAMO-Net proposes a new model for equitable global network funding: instead of a single application with funding controlled by and managed through a single high-income country (UK) institution, we propose there are separate awards for each National Hub. This will enable enhanced ownership and responsibility for the research activities and outputs within each National Hub as well as facilitate global capacity strengthening in research project management.[6]

To ensure/enable funding equity across partners, the National Hubs will budget the following:

- 20% full time equivalent (FTE) Principal Investigator/Applicant time (costed directly); 10% FTE co-applicant/co-Investigator time (costed directly)
- Each of the 7 National Hub institutes will budget the following staff: 3x 100% FTE postdoctoral posts; 100% FTE of a senior research fellow; 100% FTE senior project manager; 100% FTE infrastructure/data manager; 100% FTE technician; 100% FTE knowledge mobilisation fellow
- Each of the 7 National Hub institutes will budget non-staff costs based/dependent on the specific research project activities in that, as well as specific costs for national training, network activities, and dissemination (including patient and public involvement)
- As per Wellcome Trust standard grant conditions, each of the National Hub institutes located in LMICs may include up to 20% indirect costs; UK-based institutes will be eligible for the Charity Research Support Fund (CRSF)
- In addition to the above research activities budgets, the National Hub sites will each be responsible for administering the budget for cross-network activities, as per the following:
    - University of Liverpool, UK: primary UK budget holder (subaward to Imperial College London, UK); shadow national site budgets; technical R&D centre budgets; coordination and network activities including annual meeting expenses, communications, and overall network coordination; planning and development of the data sharing platform, including the Global PK-PD Warehouse
    - Amrita Institute of Medical Sciences, India: primary India budget holder (subaward to the Postgraduate Institute of Medical Education and Research, India)
    - Infectious Diseases Institute, Makerere University, Uganda: training and capacity strengthening network
    - University of Cape Town, South Africa: ISID ProMED AMR's budget, IQVIA's budget
- Any funds to be spent from one grant holder to another will be administered through the budget-holding institution in line with its institutional invoicing policy

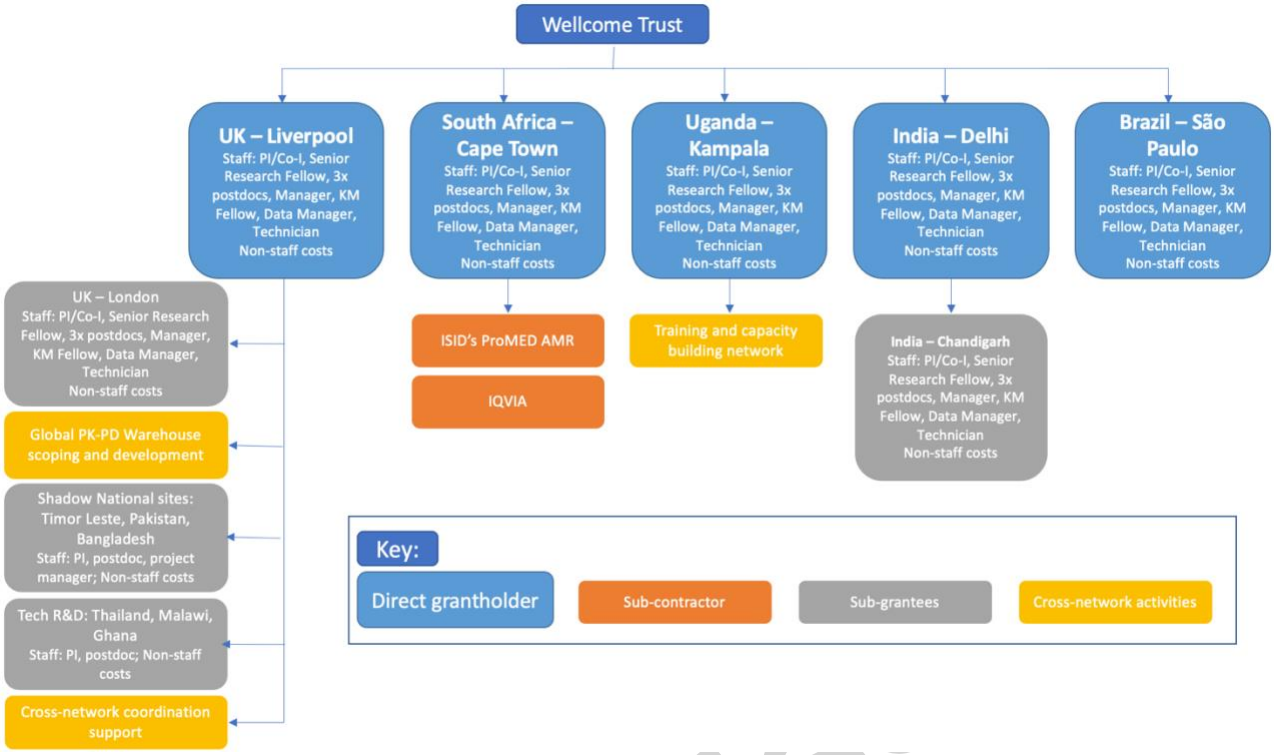


Figure 3. Proposed budget flow for CAMO-Net

1.6 Sustainability/Future of CAMO-Net

CAMO-Net has been designed with the future in mind – not just the three-year Wellcome funded pilot in this proposal, but thinking about how this network could last for the next 10+ years with the support of other funders. This is intrinsically linked with our governance structure.

Senior Strategic Advisory Board
The proposed Senior Strategic Advisory Board (focusing on equitable representation from LMICs) will include world-renowned experts in their field who have a strong policy interface to have greater impact.

Management Board and their research teams: National Hubs, Shadow National Sites and Technical Support Labs
The strength of this proposal comes from multidisciplinary and interdisciplinary collaborative global research team. There is a strong LMIC research, participation, and leadership focus with emphasis on creating local and context-specific solutions. Our network will create shared, sustained learning across partners and an amalgamation of global resources for optimising antimicrobial use in humans. CAMO-Net's sustainability will be through learning and linking to other relevant global programmes as well as national programmes in each National Hub. The research included in this proposal is based on local priorities/needs supported by local intelligence to co-develop context-specific solutions which will last.
We will work with non-academic organisations to enhance the quality and sustainability of the individual projects (described in Section 3) and the wider network.

CAMO-Net programme management
A key aspect to CAMO-Net is the capacity strengthening of global research programme management. This will be a crucial step in sustainability of CAMO-Net, as we will strengthen capacity for identifying, applying for, and managing local, national, and global funding opportunities.

Additionally, the naming of “CAMO-Net” provides a unified brand to start building a global identity for researchers. This sense of identity will promote researcher sense of belonging and therefore their long-term engagement with the research and its outputs and impacts. The proposed funding model of directly funding each National Hub will increase buy-in as well as promote joint ownership across the network. We will promote the global research community we develop and strengthen using CAMO-Net branding via the dedicated network Communications Manager.

Training and Capacity Strengthening Network
Strengthening global capacity and training the next generation of researchers with knowledge, skills and abilities to optimise antimicrobial use in humans is how we will ultimately achieve sustainability of the research aims of CAMO-Net.

Commercialisation and Entrepreneurial Board
The Commercialisation and Entrepreneurial Board will be established from the beginning of the programme in order to foresee and manage any potential commercial interest in the CAMO-Net research activities. It will also serve to help promote local and national entrepreneurship where possible.

CAMO-Global Data Resource
The proposed CAMO-GDR (Section 2.4 of this proposal) will be developed for the aim of providing a secure, open access data resource, shared for the benefit of all people to improve global knowledge related to antimicrobial dosing to treat infections and prevent AMR. CAMO-GDR will provide foundational infrastructure for CAMO-Net and be an essential resource for the lasting and future impact of CAMO-Net research.

Knowledge Mobilisation; Monitoring, Evaluation & Learning; Reflection Committee
We will embed knowledge mobilisation as a central value. The Knowledge Mobilisation; Monitoring Evaluation & Learning; & Reflection Committee will lead a network-wide MEL/reflection process at the end of year 2 to ensure the activities of CAMO-Net reflect its aims and objectives. The dedicated KM Fellows in each National Hub will ensure engagement and integration with national policymakers and the wider research community.

Planning for the future
The growth model of CAMO-Net is that shadow sites, in any potential future iterations of the programme, become National Hubs (subject to Management Board approval); and new shadow sites are identified and incorporated into the network. There is also massive scope to expand the research remit of CAMO-Net beyond bacterial infections to include fungal infections, viral infections, and protozoal infections.

2. Foundational Network activities

Network activities will include the development of collaborative research projects, strategic and work-in-progress team meetings, and patient and public involvement events. There will also be comprehensive mentoring/capacity building; activities will include one-to-one mentorships, peer-to-peer learning, workshops, and opportunities for public dissemination of work. Activities will be across CAMO-Net as a whole, and there will also be National activities.

The main foundational activities of CAMO-Net, described below, are:

- 2.1 Knowledge mobilisation; monitoring evaluation and learning; and reflection
- 2.2 Policy engagement
- 2.3 Global capacity strengthening: a training network
- 2.4 Development of a CAMO Global Data Resource

2.1 Knowledge mobilisation; monitoring, evaluation and learning; and reflection

The function of the committee will be to oversee activities related to knowledge mobilisation, evaluation, monitoring, and methodological reflexivity. The committee will also review the National Hubs performance in terms of inclusivity, diversity, and network team wellbeing.

Knowledge mobilisation (KM) is the process of optimising the use of research generated knowledge.[7] Accelerating uptake of research-based knowledge requires collaborative problem definition and outcomes which lead to the benefit of society. KM is broader than this, and encompasses, dissemination, knowledge transfer (emphasis on knowledge-push), and knowledge exchange (with less emphasis on action) which can be complex.[8,9] We will connect academic research with decision makers including public policy and healthcare professionals and patients and the public early and throughout the research cycle. At the macro population level, enhancing health literacy across the life course are considerations needed in all countries but particularly when inequalities exist within countries.[10]

We aim to strengthen capacities of all involved in the use and production of research-based knowledge as early as possible in the research design process. Multidisciplinary research is at risk of being a collection of disciplinary experts looking at a problem from different perspectives but not synthesising results using a common framework; transdisciplinary research addresses this gap. This committee will help mitigate that risk and be transparent about methodological biases (methodological reflexivity) and ensure perspectives from different lived worlds (personal reflexivity). Participatory action research in its most authentic application requires the research questions and problems themselves to be collaboratively arrived at and our previous work shows that efforts to engage with citizens and members of the public to help set AMR research agendas show potential, if engagement is early on and also can be incorporated across the technical spectrum.[11] For example, systems thinking modelling approaches, when applied in a participative collaborative way, facilitate KM if modellers work closely with those within the system ensuring that simulations are valid and relevant.[12]

The committee composition will be representative based on geography, disciplines and expertise and the following members will be invited to participate: Dr Senjuti Saha (Director, Child Health Research Foundation, Bangladesh), Dr. Shabnum Sarfraz, Member, Planning Commission, Ministry of Planning, Development & Reform, Government of Pakistan, and from the first cohort of Women in Global Health LEAD Fellows at Harvard.

The role of the five KM fellows in each of the National Hub sites will provide a structure and focal point for supporting KM early and throughout the research cycle and lead processes to

enhance KM capacity and practice. A strategy for KM will be refined in the first 6 months and the iterative process of developing the Theory of Change will be initiated.

The initial aims are:
A1. Consider the role of KM throughout the research cycle including the original research question(s)
A2. Strategically engage stakeholders including policy makers, policy influencers, practitioners (health and industry), patients, public and civil society groups.
A3. Evaluate and learn from impact

Our specific objectives mapped to these aims are:
O1. Identify potential beneficiaries when developing research questions (A1, A2)
O2. Strengthen leadership capacity for effective KM within the multi-disciplinary research teams (A1, A2, A3)
O3. Co-develop a Theory of Change for selected stakeholders (A2, A3)
O4. Maximise learning through data integration and linkage (A3)
O5. Maximise learning across the hub and shadow sites (A2, A3)

The monitoring and evaluation will include a 'Hub health' tool applied across CAMO-Net to gauge the culture for exchange, learning, collaboration, representation and equity in opportunities. All staff across the network will be asked to participate so that a 360-degree review can be gathered including network management, early career and experienced researchers and principal investigators.

CAMO-Net will adhere to and promote good practice for fostering healthy research environments which are inclusive and free from geographical, cultural or disciplinary biases and which are resilient.[13] CAMO-Net will build upon our existing adoption of the ESSENCE principles and examples of track record in equitable partnerships in research such as The European & Developing Countries Clinical Trials Partnership (EDCTP).[14] This builds on the strategy we have developed for equitable funded partnerships in global health research.[6]

The outputs of this committee will be:
1. The Theory of Change (macro-level draft enclosed) as a 'live' tool for capturing the processes which are facilitating change. The Theory of change will pan in and out at three levels: a. Intra - across CAMO-Net; b. At each hub site including health system level interactions; c Inter – in relation to other global AMR and Public Health Programmes;

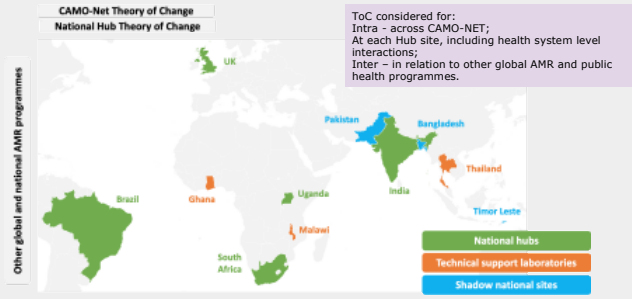
2. Periodic review of the adapted KM maturity model to assess each site for progress in KM activities including level of confidence of researchers in KM practice. The KM fellows will use appropriate tools (e.g. The 'river diagram') to identify and roll out appropriate team training in collaboration with the Training and Capacity Strengthening Network (Uganda National Hub);

3. Periodic review of Hub-health: quantitative and qualitative measures including case studies.

At the global level, the challenge of optimising antimicrobials is to employ approaches that retain richness and contextual detail but are also not so bound in time and geography that transfer of learning across settings diminishes. Ultimately, the aim of the committee will be to reduce waste in research and contribute to sustained impact of CAMO-Net. From a social justice perspective, CAMO-Net will subscribe to a core principle of KM which is the democratisation of knowledge.

Collaboration for Antimicrobial Optimisation Network (CAMO-Net): Initial Theory of Change

The Theory of Change is a 'live' tool for capturing the processes to facilitate change and address the global impact of AMR on human health via **optimised antimicrobial use** by establishing a **sustainable global research ecosystem, developed across LMICs and HICs**.



ToC considered for:
Intra - across CAMO-NET;
At each Hub site, including health system level interactions;
Inter – in relation to other global AMR and public health programmes.

Objectives

A comprehensive, contextual understanding of situational data in each National Hub on the progress of interventions to tackle AMR in human populations in order to identify opportunities to address existing gaps/challenges, with respect to: (i) technology and innovation; (ii) context, culture and behaviour; and (iii) medicines management

Harnessing the power of data (quantitative and qualitative) through strategic and targeted studies to generate new knowledge related to optimising antimicrobial use in human populations.

Implementation of co-produced, contextually fit, and sustainable solutions to optimise antimicrobial use targeting innovation, systems and behaviours.

Evaluation of interventions and strategies targeting optimised antimicrobial use through behaviour and innovation.

Establish a network through **co-production, shared learning, and capacity building** to achieve objectives in three research themes

Activities

National Hubs	Technical support laboratories	Shadow national sites
UK / Uganda / South Africa / India / Brazil	Ghana / Malawi / Thailand	Pakistan / Bangladesh / Timor Leste

Research Theme 1 - Technology and innovation: individual and population-level clinical decision support, data and diagnostics using artificial intelligence and machine learning.

Research Theme 2 - Context, culture and behaviours: organisational and individual behaviour change; innovation adoption and implementation; and health-seeking and health provision behaviours.

Research Theme 3 - Medicines management: supply chains and distribution; prescribing systems; and addressing comorbidities, polypharmacy, and drug-drug interactions.

CAMO-Global Data Resource (CAMO-GDR): develop a sustainable open-source central repository to support PK-PD data linkage, analysis, education and training in bioanalytics and modelling.

Outputs

Strategic and needs-based research activities identified by network theme planning groups

Research Theme 1 - Technology innovation
Robust and sustainable mechanism for surveillance and clinical tools
Rapid, affordable, sensitive and specific diagnostic solutions
Fit for context clinical decision support systems (CDSS) and Point-of-Care (PoC) diagnostics

Research Theme 2 - Context, culture and behaviours
Accounting power dynamics, enabling participation, building research and operational capacity
Understanding social constructs on health seeking and provision and addressing inequities
Co-production, implementation and evaluation of campaigns for social action for AMR

Research Theme 3 - Medicine management
Analysis of medicines supply and management
Strategies to balance access and reduce inappropriate antimicrobial use

CAMO-Global Data Resource (CAMO-GDR)

- Design service for PK studies
- Global resource for antimicrobial compounds bioanalysis
- Global resource for PK-PD modelling
- ISO-compliant cloud-based Trusted Research Environment (TRE)

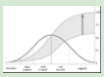
- The ToC as a 'live' tool for capturing the processes which are facilitating change. The ToC will pan in and out at three levels: a. Intra - across CAMO-NET; b. At each hub site including health system level interactions; c Inter – in relation to other global AMR and public health programmes;
- Periodic review of the adapted KM maturity model to assess each site for progress in KM activities including level of confidence of researchers in KM practice. The KM fellows will use appropriate tools (eg. The 'river diagram to identify and roll out appropriate team training in collaboration with the Training and Capacity Strengthening Network (Uganda National Hub);
- Periodic review of Hub-health – quantitative and qualitative measures including cases studies

Mechanisms of Change

National Hubs (UK / Uganda / South Africa / India / Brazil)
Technical support laboratories (Ghana / Malawi / Thailand)
Shadow national sites (Pakistan / Bangladesh / Timor Leste)

Co-production, shared learning, capacity building

Local stakeholders to support investment, development, implementation and evaluation



Adoption and scale up of contextually fit, innovative tools to support surveillance and clinical decisions

Non-academic partners (IQVIA/ProMED AMR)

Shared local intelligence

CAMO-Global Data Resource (CAMO-GDR)

Shared data and improved global knowledge

Strategic planning through international, multisectoral, multidisciplinary co-production and participation

Research and operational capacit strengthening for sustainable improvement

Outcomes

Patient and population	Local and global health systems	Research and network
PK-PD data shared through the Global PK Data Warehouse benefit all population. Improved global knowledge in antimicrobial optimisation to treat resistant infections and prevent AMR	Strengthened global and local systems with improved medicines supply chains and distribution channels Contextually fit policies accounted for macro level economic, regulatory drivers and constraints Mechanisms, infrastructures and platforms for innovation adoption and diffusion across health systems	Integrated global approach to antimicrobial optimisation via a sustainable structure with global representation and leadership as well as shared learning. New knowledge/information on antimicrobial prescribing and use. Policy influence across National Hubs for antimicrobial optimisation across technology innovation; context, culture and behaviours; and medicines management.

Impact

A sustainable global research ecosystem, developed across low/middle-income countries and high-income countries

- Improved, personalised dosing of antimicrobial therapies
- Standardised central PK/PD and antimicrobial optimisation data repositories
- Efficient medicine management systems
- Retain richness and contextual detail but also enable transfer of learning beyond geography
- Reduce waste in research
- Sustained impact of CAMO-Net in host and shadow sites
- From a social justice perspective, the democratisation of knowledge across stakeholder groups
- Direct and indirect impacts to SDGs
- Direct impacts to implementation of National Action Plans for AMR, and global strategic objectives for patient safety

Direct and indirect impact on Sustainable Development Goals

Beneficiaries

Standardised global data warehouse

Whole-health economy approach

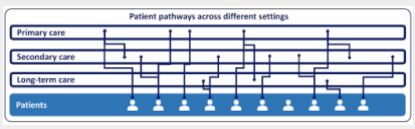


Figure 4. Initial CAMO-Net Theory of Change

2.2 Policy engagement

Strategies and tools to support national-level interventions include the development and implementation of national action plans (NAPs) for AMR, based on best available evidence. The process by which NAPs are developed is shaped by political forces as much as the scientific or technical evidence base.[15] Given the societal impact of AMR and the suite of interventions required to tackle the issue at individual, organisational and societal level, the evidence base for informing policy and management strategies requires a multidisciplinary approach including risk assessment, meta-analysis, and cost-effectiveness analysis.

Globally in 2011, the World Health Organization (WHO) initiated a situation analysis of country progress in addressing AMR against four objectives: (1) Improve awareness and understanding of AMR through effective communication, education and training; (2) Strengthen the knowledge and evidence base through surveillance and research; (3) Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures; and (4) Optimise the use of antimicrobial medicines in human and animal health.[16] This recommended approach to analysis has been important as a start-up framework, but the detail and quality of analyses to underpin national and local strategies may benefit from management and strategy, especially as addressing AMR is inextricably linked to other public health and health system level processes and outcomes.

The research roadmap identified policy and strategic planning research as a priority, however the scope of CAMO-Net is not to conduct AMR policy research. And though we won't be doing policy research, engagement with policymakers throughout the programme is essential to sustainability of CAMO-Net research activities. There will be global policy representatives on the Strategic Advisory Board. There will also be country-specific policy representatives part of each individual National Hub leadership team meetings and policymakers at annual meetings. Teams will also seek to develop new relationships with policymakers in CAMO-Net countries through continual engagement and utilise existing relationships partners (e.g. IQVIA) have with local and national governments.

Some examples of engagement with national policy include:

UK

- Professor A Holmes is Director of the UK National Institute for Health Research's Health Protection Research Unit for Healthcare Associated Infections and Antimicrobial Resistance (HPRU in HCAI and AMR) which is a partnership with UK Health Security Agency (UKHSA). She is also WHO R&D Expert Advisory Group for COVID-19: Infection prevention and Control, and the WHO Health Emergencies Program (WHE) Experts Advisory Panel for Infection Prevention and Control (IPC) Preparedness, Readiness and Response to COVID-19. She was Chair, Technical Advisory Group (TAG), Fleming Fund (Department of Health and Social Care) 2018-2020, was a Board member on Wellcome Trust Surveillance and Epidemiology of Drug Resistant Infections Consortium (SEDRIC), 2017-2020; and she is often called as a National Expert Witness to various House of Commons Select Committees.
- Professor W Hope is NIHR Co-Lead for Infectious Diseases and is responsible for leading and managing the UK's portfolio of clinical research for infection. The NIHR Clinical Research Network is currently leading a multi-stakeholder approach for clinical AMR research to develop a national learning system for antimicrobial use.

India

- Dr S Singh spearheaded the development of the State government Good Antibiotic Prescribing Practices across primary, secondary, and tertiary sectors and has championed the establishment and sustained scale up of the antimicrobial stewardship (AMS) programme in the State of Kerala in India; he was previously Regional Coordinator at WHO-India in a Disease Eradication Program.

- Professor N Shafiq has initiated work on antimicrobial shortages which aims at establishing a consortium for ensuring access to essential antimicrobials, with the support of the Global Antibiotic Research and Development Partnership (GARDP) Also, the Department of Pharmacology was designated Advanced Center of Clinical Pharmacology for Antimicrobial Stewardship (AMS) by Indian Council of Medical Research.

Uganda

- Dr A Kambugu is Vice President of the Researchers for Global Health (R4GH) group and chair of the Uganda Society for Health Scientists Board.
- Dr Lamorde is the President of the International Society for Pharmacoeconomics and Outcomes Research Uganda Chapter; and he is a member of the advisory panel of the leading international HIV drug-drug interactions website and of the African Research Network for Neglected Tropical Diseases.

South Africa

- Prof. Mendelson is chair of the Ministerial Advisory Committee on Antimicrobial Resistance, the founding co-chair (with Prof Brink) of the South African Antibiotic Stewardship Programme, and South African lead for the Global Health Security Agenda Antimicrobial Resistance work package. He is also Director of the National Antibiotic Stewardship Training Centre at Groote Schuur Hospital. Hence, he is engaged in determining and directing international policy on AMR and AMS, both on the national and international stage
- Prof. Maswime is head of Global Surgery at University of Cape Town and president of the South African Clinician Scientists Society. She is at the forefront of advocacy for women's health rights, and equity in surgical and maternal care.

Brazil

- Both the Faculty of Medicine and the School of Nursing of the University of São Paulo have positions in the Healthcare-Associated Infection Prevention Committees at São Paulo State and at National Level (in cooperation with Brazilian Health Regulatory Agency - Anvisa).
- The Faculty of Public Health of the University of São Paulo (MT Razzolini) has a close cooperation with the State of Sao Paulo Environmental Agency (CETESB), responsible for the environmental management of water, pollution and sanitation
- There are strong connections between the researchers of the University of São Paulo and members of Hospital Infection Division in the São Paulo State Health Department aiming to foster the improvement of prevention measures in the state.

Other examples

- Lead from Timor-Leste, Prof. N Martin, is the former Minister of Health of Timor-Leste and a has strong links with research and policy in the country.

2.3 Global capacity strengthening: training network

Led from partners in Uganda, CAMO-Net will develop a network for reciprocal learning across National Hubs, tech labs, and shadow national sites. The Infectious Diseases Institute, Makerere University (IDI) aspires to provide a foundation for excellence at all stages of research career development. IDI aims to deliver a full cycle of collaborative, skills-based training and capacity development activities that meet the needs of its CAMO-Net partners. This will be done by leveraging on IDI's demonstrated experience in training and capacity development as well research capacity to contribute to reciprocal South-South and North-South as well as urban-rural contextual learning and development on AMR.

Key deliverables: Central Training Hub (CTH) and CTH Steering Committee formed; Needs assessment; programmes and curricula designed, reviewed and revised; programme development (online, physical and blended trainings, placements, peer-to-peer seminars, global workshops); monitoring and evaluation reports.

IDI as world-leader in training and capacity strengthening activities

IDI has a fully-fledged Training and Capacity development department which has trained over 27,000 health practitioners and managers from at least 28 countries in a variety of health service, health management and disease-specific clinical and research skills courses. IDI has robust training infrastructure including over 10 training classrooms equipped with high-speed wireless internet and modern conference facilities and a robust e-learning programme through which health workers and researchers access learning material and post-training support. Physical and online courses are often blended to provide a rounded experience. This is backed by IDI's Advanced Treatment Information Centre (ATIC) a free call-in service primarily for health workers but can be easily customized to fit the needs of any target group, including researchers. IDI trainees have a global footprint, with some courses translated into French and IDI has experience in conducting courses on location across the world, where necessary.

Research capacity-building has historically been a pillar of IDI programming and all research studies conducted at IDI are required to have a capacity-strengthening component. Additionally, IDI partners with a range of international institutions in implementing projects exclusively dedicated to research capacity strengthening. IDI has over 20 ongoing research capacity-strengthening grants supported by a wide range of partners including Wellcome Trust, the US NIH, USAID, CDC, and others.

In 2016, under the leadership of Dr Castelnuovo, a dedicated research Capacity Building Unit (CBU) was formally established to meet the specific needs of researchers across career stages. The unit is committed to providing mentorship paired with economic, infrastructural and skills-building support to ensure a pipeline of scholars with steady career paths, peer-reviewed publications, and demonstrated application of research to policy/practise pathway. The unit has to date successfully embedded 12 post-doctoral Fellows, 31 PhD and 63 Masters students within its research and supported them through to successful completion of their respective study programmes.

Reflecting the strategic importance of data science, IDI additionally co-hosts the African Centre of Excellence in Data Intensive Sciences in Uganda (ACE-Uganda) with the College of Computing and Information Sciences (COCIS), Makerere University. The ACE-Uganda is one of only two such centres in Africa supported by the Foundation of the National Institutes of Health (FNIH). It provides advanced computing infrastructure and software to enable storage, retrieval and analysis of data from high-throughput sequencing, microarrays, proteomics and imaging studies and experiments. The ACE offers access to a wide range of stored samples, academic and skills-based short courses in computational methods and tools (including artificial intelligence and machine learning) as well as access to a global

network of mentors and facilitators. The core ACE functions are backed with a state-of-the-art tele-learning centre which supports advanced onsite and offsite training at various levels as well as a Virtual Reality (VR) training room, which introduced the first VR learning environment in Makerere University.

For CAMO-Net, IDI's Research Capacity Building Unit (CBU) will pair with IDI's Training and Capacity Building department to deliver a full cycle skills-based training and capacity strengthening programme that meets the needs of the CAMO-Net partners. We will bring to bear our experience in building scientific expertise, rigorous grants management environment, robust training infrastructure and exposure to various facets of infectious diseases. We will also build on our experience implementing and managing a variety of dedicated research capacity-building grants (such as GloCal Health Fellowships, EDCTP Senior and Junior Fellowships, Wellcome Trust and NIH Fogarty grants) as well as hosting international scholars from its existing collaborations such as those with the University of Minnesota, University of Zurich, University of Turin, Johns Hopkins University and the University of California San Francisco, among others.

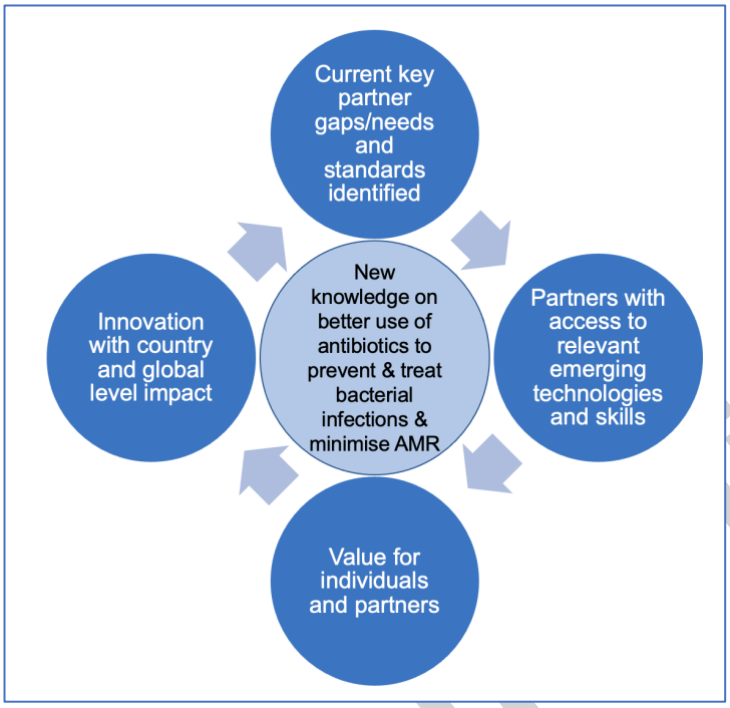


Figure 5. Proposed Theory of Change for Training

New knowledge will be developed, related to the better use of existing and newly developed antibiotics, to help prevent and treat bacterial infections and minimise AMR.

Proposed activities of the global capacity strengthening network

1. Online global mentoring program

Short online courses will be hosted on the IDI e-learning platform. The courses will be highly interactive with breakout sessions, discussion fora and chat rooms to encourage discussion of case studies, concepts, and sharing of knowledge and experiences among trainees. This will be complemented with presentations in plenary moderated by the online facilitators.

The e-learning platform and content will be customised to enable mobile device-responsiveness and will have offline capability to enable trainees continue learning activities even with internet challenges. In case of unstable connections, their devices will synchronise with the live servers to update content and upload their assignments and contributions to discussions when they get a stable internet connection. Also, trainees with difficulties in internet access will be supported with appropriate needs-driven internet data packages procured using project resources in addition to being guided on how to study using the offline modules.

Additionally, IDI's ACE will be utilised to deliver any training that is data intensive (such as AI/ML driven training) or that is amenable to virtual simulations of scenarios in practical AMR problem-solving.

Online training will be used specifically for:

- Individual soft skills building (e.g. presentation skills, time management, developing individual development plans)
- Scientific writing including abstracts, manuscripts, and grants writing
- Basic biostatistics
- Data visualization
- Literature research and systematic reviews
- Research projects operationalization (all stages from protocol writing to implement the study and reporting)
- Good clinical practices (GCP) and regulatory aspects of research.

2.Training

Where a general skills gap is identified at a partner site which can be addressed through a short course, physical training for groups of up to 25 trainees will be conducted at partner sites or at IDI. Groups from two or three sites with the same needs may be combined as necessary. The CTH will coordinate curriculum development or adaptation, select trainees and materials and coordinate the logistics with the partner site. Attendees will have the opportunity to form a strong learning community as they interact with each other through group work during the face-to-face session, strengthening their collaborative network and learning from case studies from other countries. This learning community will continue in an alumni network supported by the CTH. Online training and physical, on-site training may be blended as needs dictate so that skills are reinforced.

Specific Training and Capacity Building Content for Technical Skills Development

The following is an illustrative list of specific training themes and content for technical skills-based training with proposed methods and lead partners (where they have been identified)

CAMO-Net theme	Sub-theme	Illustrative training and capacity strengthening activities
Technology Innovation Theme Lead: IDI **Lead Subject Matter Expert/TCH Member: TBD**	Appropriate and inappropriate use of antibiotics	**Blended Training:** **Expert project:** Development of antimicrobial use surveillance tools in both healthcare and non-hospital settings.
	Emergence and selection of resistant bacteria	**Mentored Research Fellowship/Visiting Expert project:** Validation of Point of care diagnostics (eg. Biofire BCID2 paPnel, Xpert) to reduce delay for optimization of antimicrobial use in specialist settings.
	Spread of resistant bacteria in hospitals and communities	**Mentored Research Fellowship /Visiting Expert project**: Development of validated multiple bioanalytical assays (LC-MS/MS) for measures levels of specific antibiotics and conduct targeted PK evaluation.
	Higher risk of treatment failure with standard therapy	**Physical Training:** Development of PK/PD/PG models including identification of target exposure data (MICs) and association with clinical/ laboratory biomarkers (Christine Sekaggya).
	Innovation to support the introduction of new broad-spectrum antibiotics	**Short Online Course**: Artificial intelligence and machine learning to identify novel drug combinations for optimal management of drug resistance infections (Daudi Jingo)

CAMO-Net theme	Sub-theme	Illustrative training and capacity strengthening activities
Context, Culture and Behaviours **Theme Lead: IDI** **Lead Subject Matter Expert/TCH Member: TBD**	Appropriate and inappropriate use of antibiotics	**Short Online course:** Discussion of case studies, concepts, knowledge and experiences on culture and behaviour around antibiotic use/misuse.
	Emergence and selection of resistant bacteria	**Short Online course:** Presentations with moderated plenary on emergence and selection of resistant bacteria.
	Spread of resistant bacteria in hospitals and communities	**Mentored Research Fellowship Projec**t: Health-seeking and health provision behaviours and community surveys on health seeking behaviour for management of potential drug resistance (e.g. gonorrhoea in adolescents and adults) (Rosalind Parkes Ratanshi)
	Higher risk of treatment failure with standard therapy	**Physical Training:** Develop and validate population pharmacokinetic-pharmacodynamic models for selected antibiotics.
	Innovation to support the introduction of new broad-spectrum antibiotics	**Blended Training:** Technological barriers to development of broad-spectrum antibiotics

CAMO-Net theme	Sub-theme	Illustrative training and capacity strengthening activities
Medicines management **Theme Lead: IDI** **Lead Subject Matter Expert/TCH member: TBD**	Appropriate and inappropriate use of antibiotics	**Mentored Fellowship Project**: Use of hospital antimicrobial consumption and use data identify opportunities and design interventions to mitigate high burden of inappropriate use and to improve patient safety (Ronald Galiwango).
	Emergence and selection of resistant bacteria	**Research Fellow Placement:** Patterns and trends in the use of antibiotic drugs in PLWH presenting in outpatient settings.
	Spread of resistant bacteria in hospitals and communities	**Global Workshop:** Evaluate pharmacy-led interventions to optimise use of antibiotics in hospital settings.
	Higher risk of treatment failure with standard therapy	**Research Expert Placement:** Appropriateness of antimicrobial use (indication, choice, dose and duration)
	Innovation to support the introduction of new broad-spectrum antibiotics	**Peer-to-Peer Seminar:** Design, implement and evaluate the impact of a pharmacy-led audit and feedback on antibiotic consumption and drug use indicators.

3. Placements for research capacity strengthening

We propose two types of placements

(a) **Research Fellow placements.** Research Fellows will be identified from partner sites based on the needs assessment and attached to other sites with a subject matter expert who will mentor them on-site or online to implement a skills-building project using structured methodology and deliverables approved by the CTH. For example, scientists will be placed in a laboratory to learn how to develop bioanalytical assays or advanced statistical methods or database development.

(b) **Visiting Expert placement.** With this type of placement, we expect an expert scientist from one institution to be placed in another partner institution with a structured methodology and deliverables approved by the CTH for developing a training program in his area of expertise as well as soft skills for junior researchers. We also expect the scientist to have individual mentoring sessions with junior staff to provide career guidance.

4. Peer to peer seminars

The IDI has a weekly virtual research forum where researchers at different career stages present their research at a pre-determined stage of the research cycle (concept, research proposal, results dissemination). Using this model, IDI will organise monthly virtual seminars to highlight topical research issues faced by scientists selected by the CTH from the different CAMONET partner sites. These virtual seminars will showcase their progress in implementing projects in their specific field of research and provide an opportunity for other scientists to learn but also to critique and advise the presenter/s. Each seminar will consist of one hour of formal presentation and 30 minutes for feedback, and question-and-answer.

5. Global workshops

Annual global workshops (to align with annual CAMO-Net meetings) will be conducted for each CAMO-Net thematic area on a rolling basis with a proposed duration of two days. Each workshop will be held at the partner site leading a specific CAMO-Net theme but with broad representation from global subject matter experts within and outside CAMO-Net as proposed by the theme lead partner and approved by the CTH. Prior to each global workshop, the thematic lead will work with the CTH to review research concepts that will be presented and develop learning objectives for both the main workshop and more focused break-out groups based on network members' needs. Workshops will be virtual, physical or blended and will enable networking, dissemination of current updates and identification of potential collaborators for future projects.

Evaluation of the proposed activities

In summary, effectiveness of the proposed activities will be assessed as follows:

- **Needs assessment**: Strength of consensus amongst CAMONET partners (represented by the CTH Steering Committee) on priority gaps across sites and strengths within network and non-network sites.
- **Programme design**: Strength of consensus amongst CAMONET partners (represented by the CTH Steering Committee) on common definition of a complete package of training and capacity-building activities that address major gaps across the AMR cycle.
- **Curriculum adaptation and/or development**: Sound review leading to production of relevant curricula to international standard backed by modern teaching aids, materials and methods.
- **Joint development of training materials and courses**: High quality materials produced (endorsed by trainee evaluations and international QA).
- **Conducting training:** Participation by at least 300 trainees; and their evaluation of the trainings.

- **Effectiveness of training**: Number and quality of projects implemented by trainees and publications resulting from implementation.
- **Impact of training**: Dissemination of actionable policy or practise research findings as well as development and adoption of resulting innovations by targeted users.
- **M&E reports**: Timely production and presentation of reports and demonstrated feedback into course design and delivery.

2.4 Developing a Global Data Resource for Antimicrobial Optimisation resource (CAMO-GDR)

CAMO-Net will develop and implement a resource for global good to share reliable, high-quality data and code for optimising antimicrobial therapies, starting with tools for antimicrobial pharmacokinetic (PK) and pharmacodynamic (PD) approaches.

Antimicrobial PK/PD is the discipline that quantifies antimicrobial dose-exposure-response relationships and uses that information to maximise antimicrobial activity, while minimising toxicity and the emergence of resistance. PK/PD data are essential for informing population-based drug dosing recommendations and offering precision therapy for better clinical outcomes and reduced risk of AMR emergence. A better understanding of PK/PD, especially from underserved and priority patient populations, is central to antimicrobial optimisation in humans. However, many barriers need to be overcome.

Despite needing a single reliable source of PK/PD data, there are currently no standardised approaches to the collection, curation, analysis and sharing of PK/PD for antimicrobials nationally or internationally to support clinical practice. Instead, PK/PD data are collected and published ad hoc for research purposes from small cohorts. The absence of global data standards or source limits the validity and generalisability of findings across patient groups, settings and countries. Key groups are also under-represented in existing databases, including patients with multi morbidity and polypharmacy. These gaps impede global understanding of PK/PD and the ability to optimise treatments. Furthermore, poor integration of PK/PD, clinical and public health data limits scientific innovation and responses to emerging infectious disease and AMR threats.

CAMO-Net will develop a sustainable central data repository with standardised methods for collection, curation, analysis, sharing and storage of PK/PD and other antimicrobial optimisation-related data at global scale. Such data will be provided to support research and inform the development of evidence-based guidelines for optimising antimicrobial therapies. The technical platform underpinning these activities will have its development costs met by this proposal, and thereafter its much lower maintenance cost can be sustained in the core business of stakeholders.

CAMO-Net will offer sustainable access to well-curated datasets and tools (including open-source code), which can be extended and expanded as needed. Those who deposit their local data in this global resource will have access to bigger datasets, improving the likely impact of their work. Access to data, expertise and tools facilitates vital knowledge transfer, which is currently very limited.

We will develop a Centres for Antimicrobial Optimisation Global Data Resource (CAMO-GDR) comprising a global data safe haven with a Trustworthy Research Environment (TRE) and support services for study design and data analysis in two phases: First, to establish a TRE and secure, cloud-based data spaces for Liverpool, IDI, and PGIMER/Amrita to store and manage their own data. Second, to link data across Hub sites and expand them in a central repository of integrated data and use this to inform optimisation of antimicrobial therapies.

The potential impacts of CAMO-GDR include:

- **Data Sharing:** The GDR will provide a secure repository for data on antimicrobial agents to help grow the knowledge base for the optimal and sustainable use of these drugs. This is especially important for agents listed on the EML for which there is a dangerous gap in understanding. Better knowledge of the pharmacology of these agents is critical for designing regimens that maximise antimicrobial activity and minimise resistance liabilities. The GDR will enable data to be progressively accumulated and important differences

from diverse clinical populations to be described – this information can be used to design mitigating strategies for those specific populations and scenarios.
- **Data Quality:** The GDR will support state-of-the-art study design (using optimal sampling theory) and other quality processes that yield maximally informative data. The collection of information poor samples is common and results in biased pharmacological models that can misidentify regimens, impairing clinical care and AMR measures.
- **Knowledge Exchange:** The GDR will provide a globally accessible source of data and tools for learning, training, and advancing knowledge promptly in this field. The current environment is badly fragmented with disconnected communities (e.g., those with data are unable to access quantitative skills and training and vice versa; there are frequently difficulties accessing necessary software or computing power). Progressive improvements in videoconferencing now mean training can occur regardless of geography in an efficient and manner with ready access to data, expertise and tools (code and compiled software).

CAMO-GDR will have the following key functions:
- **Surfacing the Challenges and Opportunities for Sharing Data:** The inaugural CAMO-Net partners and the Oversight Board will define opportunities and resolve barriers related to data sharing for antimicrobial agents and AMR, including the ways that software can be made freely available for investigators. We envisage that the models/code will be open source after ownership and licensing have been considered.
- **Defining Priorities for Antimicrobial Agents and AMR:** A systemic review will be performed to define current knowledge related to antimicrobials on the EML including for diverse and underserved populations.
- **Acquiring & Curating Currently Available PK-PD Data:** Publicly accessible data will be gathered. Corresponding authors for published datasets will be contacted and invited to submit raw data. Investigators and organisations (e.g., GARDP) conducting relevant PK studies will be contacted to negotiate data sharing agreements.
- **Building the necessary infrastructure:** The TRE will be designed by the CAMO-Net partners and the Oversight Board. Appropriate modelling software will be identified and implemented, with code curated openly wherever possible.
- **Identifying relevant experts in PK-PD and mathematical modelling:** Pairing experts with early career researchers in 1:1 training via remote videoconferencing and developing working groups and training materials.
- **Designing and implementing a PK and PD study design and bioanalytical service:** Using optimal design theory (e.g. D-optimal design) to guide informative sampling and address practical issues related to sample collection, storage and analyte stability.

Governance:
CAMO- GDR will be overseen by an Advisory and Oversight Committee. Committee members will be appointed for a 3-year term with the opportunity for extension in potential future phases of CAMO-Net beyond this proposed pilot. The initial Chair will be Professor Richard Peck. Other members, including global leaders in the field and other stakeholders (e.g., GARDP, WHO), will be chosen by the CAMO-Net Management Board with additional consideration given to diversity, expertise and geographical representation. The Committee will oversee data governance, integrity and sharing and will ensure that appropriate steps are taken to comply with relevant data protection legislation and regulations. The Committee will be responsible for resolving significant issues related to the primary function(s) of the GDR (e.g. secure data management; data sharing; open sharing of metadata, code and guidance).

Coordination of CAMO-GDR will be performed by an Operations team, initially led by Professor Hope and CAMO-Net representatives from Uganda (Dr Kambugu) and India (Dr Shafiq). This group will make day-to-day decisions regarding data storage and movement of data in-and-out of the facility in accordance with data sharing guidelines. The operations will be supported by a Chief Information Officer who will assume responsibility for data compliance and work closely with a Quality Assurance Manager, Bioanalytical Lead, and the Scientific Lead for data analytics, computation, and modelling.

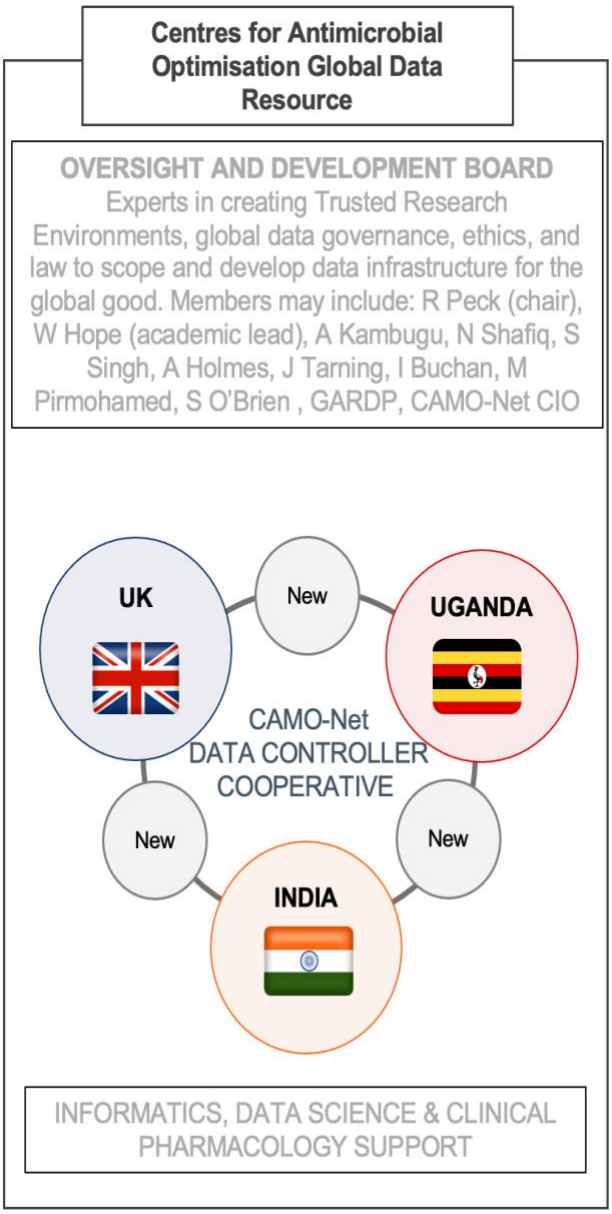


Fig 6. Governance of the CAMO-Global Data Resource

CAMO-GDR will be carefully designed with external facing configuration and maximal data interoperability, to ensure/future proof potential opportunities to link with other important and relevant parallel global data resources. For example, the HDRUK database, which looks at population-scale pharmacological studies and trends in all medication data. Also, Professor David Aanensen (Director of the Centre for Genomic Pathogen Surveillance, Big Data Institute, Oxford) will particularly advise on this regarding data linkage with global bacterial genomics surveillance databases. Prof. Aanensen is also Director of the NIHR funded Global Health Research Unit on Genomic Surveillance of Antimicrobial Resistance, working with partners leading National AMR strategies in The Philippines, Colombia, Nigeria and India to implement genomic surveillance and linking to routine phenotypic and epidemiological data for priority pathogens.

Implementation plan

2.4.1. Trusted Research Environment (TRE)

CAMO-NET will provide a GDR of antimicrobial optimisation data and software, and codebooks for appropriate utilisation in research, evaluation and analysis within a secure Trusted Research Environment (TRE). The ISO27001-compliant cloud-based TRE will have associated information governance frameworks developed collaboratively across CAMO-Net, supported by investigators with expertise in developing TREs for use with sensitive NHS data.[17] We will select a secure cloud computing vendor with global expertise in healthcare data regulatory compliance – the "Data Processor" and the CAMO-Net members from the UK, India and Uganda will be "Joint Data Controllers".
The GDR platform will hold the main data resources:

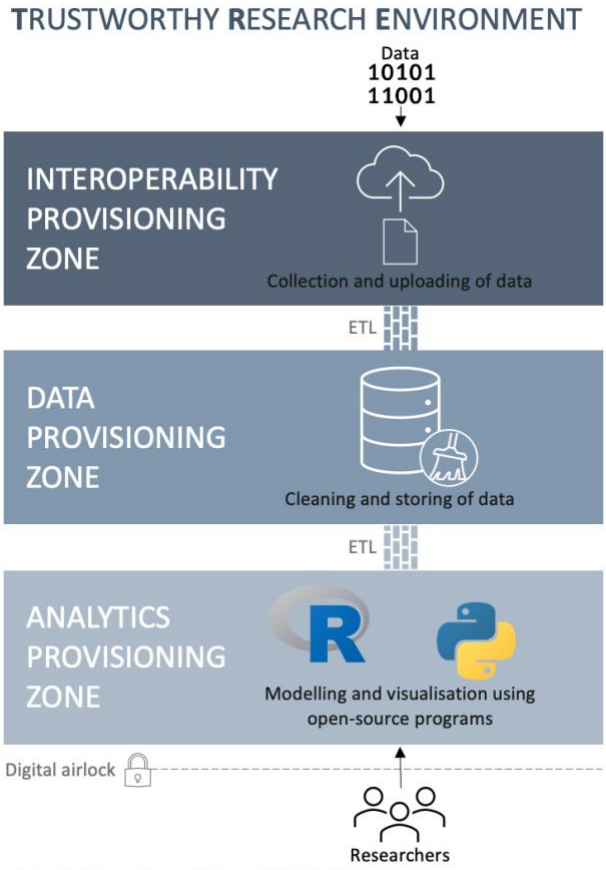


Fig 7. Function of the CAMO-GDR Platform

During Phase I, data relating to PK/PD will be collected in the UK, Uganda, and India National Hub sites and securely stored for use within each respective country.

During Phase II, a broader spectrum of data to include other antimicrobial optimisation-related data will be collected. Specific projects will be conducted to pilot data integration within the UK, Uganda and India, with the aim to pilot the capacity for integration across countries.

A global repository of PK data obtained within the consortium will be hosted within a TRE to enable PK-PD modelling and simulation. Data will be stored, and analysis will be conducted within the secure environment within which activity can be monitored and audited.

The TRE will have an interoperability provisioning zone (collection and uploading of data); a data provisioning zone (place where data are stored) and an analytics provisioning zone (place where data can be cleaned, analysed, and shared using open-source software such as R and Pmetrics) using a secure virtual machine. The TRE will have digitally secure file transfer protocols (SFTP) via a “digital airlock” to enable data to be uploaded to the TRE, as well as enabling files required for reporting and publication to be exported out of the TRE. The types of files allowable will be defined by the Joint Data Controllers. The airlock ensures the integrity of the data held within the TRE.

CAMO-GDR will be supported by the University of Liverpool from the Civic Data Cooperative team who have extensive expertise in TRE design and implementation, including the multi-award-winning Combined Intelligence for Population Health Action (www.cipha.nhs.uk) platform for the UK's National Health Service (NHS).[18,19] As the GDR will initially be hosted in the UK, it will adhere to relevant UK best practices and data laws such as UK-GDPR and NHS TRE standards. The GDR will be developed with the necessary international legal expertise and support. Consideration of laws and permissions in other countries (India, Uganda) for data transfer purposes will be an integral aspect of development, including the involvement of specific legal expertise.

The initial CAMO-GDR technical configuration is expected to be: Secure analytics virtual machine (16 nodes with 4 CPU 16 GB RAM); encrypted data storage (1.2 TB); Additional Linux servers (4 CPU 8GB RAM with 100 GB storage for 10 applications that include Pmetrics, ADAPT 5, RStudio, etc.); security features and monitoring (2-factor authentication; roles-based access controls; antivirus and malware protection; SSL certification; secure backup), along with ongoing support and maintenance. Additional compute and storage can be added as required.

In Phase I, fully partitioned firewalled data repositories and access will be constructed for the UK, Ugandan and Indian Hubs. Data and algorithms will be shared after the terms and conditions for data sharing have been negotiated and agreed. We anticipate substantial

preliminary work to understand each country's data laws and the implications (pathways) for data and information sharing [ga4gh, understanding patient data].[20,21] Once individual laws and regulations have been identified, we will implement the pooled or federated data processing required to enable international collaboration.

Algorithms and other quantitative tools developed by CAMO-Net partners (National Hubs) will be developed within the TRE to be exported out of the GDR with necessary quality control measures and implemented within local environments (i.e., the GDR will not accept and manage identifiable data or operate in real-time—that will only occur in appropriate local contexts following initial development and training of models).

Data security
To ensure data security, the data will be available in a fully de-identified format transiting in and out of the TRE. The environment will be managed to ISO27001 standards for hosting and managing the data, as well as meeting the national data protection requirements of the participant countries.[17]

FAIR data practices
CAMO-Net's GDR will facilitate the making of GDR resources Findable, Accessible, Interoperable and Reusable (FAIR).[22] This will include harmonisation of data dictionaries/terminologies, development of standard operating procedures, standardised/optimised approaches to study design using optimal design theory, and defining FAIR digital phenotypes. This will ensure data better data and code can be used to build models with fewer systematic errors that are safter for use in regimen planning.

2.4.2. Resources within the TRE

PK Study Design: CAMO-GDR will provide a design service for PK studies conducted by the consortium. Optimal design for sample collection times will be identified using Pmetrics. CRFs for clinical studies will be designed within the TRE and ensure all relevant data fields are captured. The TRE will design and provide SOPs for sample collection (e.g., types of collection tubes), sample preparation, sample storage and sample transport to the relevant bioanalytical hub.

Bioanalysis: CAMO-GDR will provide a global resource for the bioanalysis of antimicrobial compounds. This resource will be provided in several different ways.

- Where required, shipment of samples to Liverpool in contexts where measurement at a local site is not possible and once the necessary material transfer agreements have been negotiated and measurement of antimicrobial drug concentrations in the NIHR AMR Laboratories. As part of the capacity strengthening we aim for each of the three sites (UK, India, Uganda) to provide identically quality-assured bioanalysis.
- National Hub labs (UK, India, Uganda) which can act as hubs for analytics locally with QC and QA mechanisms in place.
- Development of GCP quality assays and associated SOPs with storage of relevant analytical grade compounds for 15 commonly used antimicrobial agents on the WHO essential medicines list (i.e., antibacterial agents).
- Details of the assay validation and characterisation will be stored in the TRE.

PK-PD modelling: CAMO-GDR will provide a global resource for the quantification of dose-exposure-response relationships for antimicrobial compounds. From this understanding, the relationships can be used for regimen planning and optimising patient care.

- PK-PD modelling expertise will be available in CAMO-GDR operational team with dedicated researchers to fit PK-PD models to the data.
- This will include "top down" models using Pmetrics and ADAPT 5, but other quantitative approaches such as physiologically based (PB-PK) models and AI will be possible,

providing open-source licence agreements can be secured. If these licences cannot be placed within the TRE, the data controller will pass data outward via a digital airlock.

- CAMO-GDR will develop a manual of worked examples for PK-PD modelling.

Global expertise and capacity strengthening: The CAMO-GDR team will provide training and capacity strengthening opportunities.

- A bioanalysis training facility either on site in Liverpool or remotely via Zoom. Members of the consortium can travel to Liverpool and run their own samples or receive training in, e.g., study design, methods, sample analysis, other bioanalytical procedures, data ethics, etc. Alternatively, Liverpool will provide remote support via teleconferencing on all aspects of sample preparation, analyte extraction, assay development (e.g., conditions, appropriate internal standards, analyte stability, quality controls, assay sensitivity and performance characteristics).
- CAMO-GDR will act as a global resource for education and training. Specific funding is available for members of the consortium to receive direct or remote training in bioanalysis and PK-PD modelling (as described above).
- The Hub will organise 4 workshops per year, to be conducted remotely via Zoom, over 2-3 days and using the TRE's virtual desktop.

2.4.3. CAMO-Net research projects to inform the development and test the utility of CAMO-GDR

The three countries spearheading the development of CAMO-GDR (UK, India, Uganda) have a range of pilot projects that will test and inform its utility.

2.4.4. Sustainability of CAMO-GDR

While the Global Antimicrobial Optimisation Data Safe Haven will initially be led by Liverpool, there will be ample opportunity to those in India and Uganda to take on more responsibility and leadership, including nominating a shadow academic lead. This will help instil ownership from all parties and investment in the future by way of a capacity strengthening legacy. Additionally, if the Data Safe Haven proves successful, a potential future iteration of CAMO-Net would include increasing the countries as Joint Data Controllers, though this would need to be a step-wise process to ensure data/protection/privacy laws of each country was understood and managed appropriately.

The Oversight and Development Board would be responsible for considering future and sustainable funding models for the CAMO-GDR with the Wellcome Trust at the end of year 2 of CAMO-Net. This would also be the time that the Oversight and Development Board would be including new additional CAMO-Net sites to join Uganda, UK and India in the further development enriching and testing of the CAMO-GDR.

3. CAMO-Net Brazil National Hub: addressing national priorities

Antimicrobial resistance (AMR) is considered an increasing threat to public health and a cause of great concern to various sectors and countries. The direct consequences of infections by resistant microorganisms can be serious, including increased mortality and length of hospital stay. On the other hand, the indirect impact extends beyond the increased health risks, with consequences to the global economy generating economic losses due to the reduction of productivity caused by the disease (in humans as well as in animals).[23]

Relevant research priority areas defined by the Brazilian Government in the 2018 Ministry of Health guidance document included:[24]

- Access to drugs and their rational drug use
- Evaluation of the social and economic impact of AMR
- Evaluation of healthcare professional training programmes of the national Unified Healthcare System (SUS)
- Evaluation and incorporation of innovative health technologies Development and evaluation of strategies to improve access in primary health care settings, particularly within remote settings. Evaluation of the impact on human health of antimicrobial drugs in wastewater and sources of water.

The focus of the research of CAMO-Net Brazil is directed towards these national priority areas and will evaluate tools and strategies that have potential to be widely used throughout Brazil's national healthcare system. Brazil has a national health system (SUS- Sistema Único de Saúde) which provides universal healthcare to all citizens. It is one of the largest public health care systems in the world. Approximately 28% of the population has private health insurance, thus SUS is responsible for the entire health care of 72% of the Brazilian population.

Strength of São Paulo as CAMO-Net Brazil site

São Paulo state is the most populous state in Brazil with approximately 42 million inhabitants. In 2004 a surveillance system, coordinated by the São Paulo State Health Department (CVE), was implemented to monitor health-care-associated infection (HAI) rates and antimicrobial resistance.[25] This system covers 95% of the hospitals in the state and in 2018, the surveillance system received data from 416 Intensive care Units (ICU) representing 2,001,302 patients-days. AMR monitoring is based on agents isolated in central-line associated bloodstream infections (CLABSI) that occur in adult ICUs.

The research group in São Paulo has a very close and extensive collaboration with the State Health Authority, especially the Division of Hospital infection which interacts directly with the health services of the entire state, including from primary to tertiary health care. Furthermore, there is also a very close partnership with the State's Environmental Company (CETESB) which is one of 16 reference centres for the World Health Organization.

Since the beginning of the COVID-19 pandemic, the municipality of São Caetano do Sul, with 162,000 inhabitants, and the University of Sao Caetano do Sul have worked in a successful cooperation with the University of São Paulo to organise healthcare and mitigate the effects of the pandemic. We have now established a

formal cooperation agreement between the city and the 2 universities for the project focusing on antimicrobial drug prescribing, resistance and its effect on potable water and wastewater. This provides a unique opportunity for integrated research on AMR across an urban environment.

CAMO-Net Brazil has a strong track record in microbiological research in both human and environmental microbiology, from classical methods to emerging methodologies with advanced sequencing and bioinformatic analysis. We also have significant strength in data science, and our data scientists will develop and direct the data extraction and the analysis from electronic patient records and data repositories, and will develop a decision support tool for antimicrobial prescribing in the community.

Research priorities for CAMO-Net Brazil

Our proposed research projects address the national priorities described above and have been informed by existing national evidence and our group's expertise, as well as through collaborative discussions with CAMO-Net partners.

Recently, a statewide programme to reduce blood stream infections in adult ICUs in the state of São Paulo had a significant impact on reducing the rates of this type of infection, showing the importance of the government leadership and coordination in collaborative projects.[26,27] However, an increase in the resistance rates from 2005 to 2018 in adult ICUs was observed, with 75% of microorganisms classified as multi-drug resistant (MDR) in 2018. The proportion of carbapenemen-resistant *K. pneumoniae* and *A.baumannii* increased from 14% to 53%, and from 20% to 89%, respectively, from 2005 to 2018.

Connectivity amongst all health care institutions results in a single health care network through which resistant bacteria may spread.[28] Thus, strategies for prevention and control of AMR could be more effective when applied at hospitals and primary care units within the same health care network.

Optimising the prescribing of antimicrobials is an effective strategy for the reduction of AMR and antimicrobial stewardship programmes (ASPs) have proven effective in hospitals.[29,30] However, the majority of antimicrobial prescriptions occur in primary and up to half of antibiotic prescriptions are inappropriate. [30–34] Although there is strong evidence of an association between antibiotic prescribing in primary care and antimicrobial resistance, there is little evidence supporting the long-term sustainability and environmental impact of ASPs in primary care.[35] Transmission of drug resistant organisms or associated resistance elements can occur between interconnected healthcare institutions and primary care units.

Bacterial AMR is a complex one health issue, which incorporates clinical impacts and the role of agriculture, livestock, and the environment. Transmission of organisms and resistance genes occurs across these pathways and antibiotics and their metabolites reach the environment via a range of routes, including directly from humans or through waste. The accumulation of antimicrobials within the environment can contribute to selective pressures for the acquisition or development of AMR.[36,37]

Irregular settlements are a major source of water contamination, particularly for the introduction of untreated domestic sewage and hospital wastewater into water bodies. In addition, there is severe social and economic deprivation in these regions, which is associated with increased prevalence of AMR genes.[38] Crowded, deprived, irregular settlements are a particular challenge within Brazil. Analysis of water samples in Sao Paulo identified numerous resistance genes, including those associated with carbapenem-resistance.[39] Within this proposal we will focus on the Metropolitan Region of Sao Paulo (MRSP), a highly populated, deprived urban area where 8.8% of the population does not have access to the sewer grid and an estimated 2.1 million people live in irregular settlements, with evident lack of environmental health infrastructure.[38]

Furthermore, irregular settlements constitute a major source of water contamination bringing sanitary and public health concerns, besides inequality and social exclusion, where domestic sewage and hospital wastewater are directly discharged into water bodies. According to Hendriksen et al (2019) AMR gene abundance strongly correlates with socioeconomic, health and environmental factors. Researchers from Sao Paulo, analysed water samples from rivers in the Sao Paulo city and the results revealed the presence of strains of KPC carrying resistance genes to aminoglycosides, including (blaOXA-1, blaSHV-11, blaCTX-M-15 and blaKPC-2); fluoroquinolones; fosfomycin; macrolides; phenicols; sulfonamides (sul1); and trimethoprim.[38,39]

These integrated projects will examine the local behavioural and cultural contexts of antimicrobial drug prescribing within an entire municipality to improve practice and to identify facilitators and barriers to optimising antimicrobial use in complex, crowded, urban environments. In addition, a context appropriate CDSS will be developed, based upon local data, guidelines and practice to support evidence based prescribing. The impact of the interventions identified as part of Project 1, will be evaluated in Projects 2 and 3 by examining the effect on: (i) asymptomatic carriage of drug-resistant organisms in the urban population, (ii) the prevalence of drug resistant organisms and the levels of antimicrobials detected in drinking water and wastewater.

CAMO-Net Brazil will focus on integrated community interventions to improve antimicrobial use in a highly populated urban environment (the entire municipality, São Caetano do Sul, with 162,000 inhabitants). The impact on infection and asymptomatic carriage, and on the water supply and wastewater will be studied.

Overall scope of activities: Developing urban community stewardship interventions and investigating their impact on drug resistant infection and carriage as well as their impact on urban water.

Project 1:
Optimising prescribing in urban communities through contextually-informed antimicrobial stewardship and decision support tools.

Links across other CAMO-Net Hubs: Reciprocal learning to be shared between this project and the projects in CAMO-Net South Africa health-seeking and health-provision behaviours

Project 2:
Understanding the epidemiology of asymptomatic and symptomatic carriage of resistant microorganisms in urban communities to assess the impact of stewardship interventions.

Links across other CAMO-Net Hubs: Reciprocal learning to be shared between this project and the projects in CAMO-Net India and UK around frugal, point-of-care and digital diagnostic technologies

Project 3:
Assessing the prevalence of antimicrobials, drug-resistant organisms and resistant genes in urban water supplies and wastewater and to estimate the impact of the stewardship interventions.

Links across other CAMO-Net Hubs: Reciprocal learning to be shared between this project and the projects in CAMO-Net India and UK around frugal, point-of-care and digital diagnostic technologies for drugs and microbes

The linking of research projects across National Hubs will be coordinated through the cross CAMO-Net theme-based research committees.

Project 1. Optimising prescribing in urban communities through contextually-informed antimicrobial stewardship and decision support tools.

Background and justification

São Caetano do Sul is part of the metropolitan area of the city of São Paulo, within the State of São Paulo, Brazil. It has an estimated population of 162.763 inhabitants and has one of the highest scores in the country for the human development index (HDI): 0.862.[40] However, there are wide within region social and economic inequalities and extremes of deprivation and poverty. Approximately 30% of inhabitants are covered by private insurance, with the remainder accessing the public healthcare system, which comprises 12 primary healthcare units with family health clinics providing preventative care 29 (1 multidisciplinary team per 4,000 inhabitants). Each team comprises 4 community health workers and one each of a general practitioner/family health specialist, nurse generalist, nursing assistant/technician. Specialist and dental care can be accessed via referral by the family health team (FHT) and specialist care by referral to the public hospital. There is a walk-in emergency care unit for residents, but this unit does not provide follow-up care. Antimicrobial drugs are prescribed in each of these units. Patients receive these drugs free at the point of service, if they are included in the list of available drugs for primary health care: amoxicillin; amoxicillin/clavulanate; azithromycin; benzathine, procaine and crystalline penicillin; cephalexin; cefuroxime; ceftriaxone; ciprofloxacin; clarithromycin; clindamycin; doxycycline; levofloxacin; metronidazole; norfloxacin; spiramycin; and sulfamethoxazole/trimethoprim. If necessary, patients can receive parenteral drugs in the hospital or daily at the health units, including piperacillin/tazobactam, vancomycin, teicoplanin, meropenem cefepime, cefazolin, gentamicin, amikacin, and polymyxin B.

Aim

To evaluate the implementation of **a multi-component antimicrobial stewardship intervention including a decision support tool for antimicrobial prescribing in primary care.** Evaluation will include the extent of implementation success, and the measurable changes in healthcare worker and patient behaviours and prescribing decisions. Measurable outcomes will include: Acceptability and uptake of the intervention, reduced volume of inappropriate antimicrobial prescriptions; enhanced knowledge, skills and attitudes of healthcare workers (HWs) about the role of antimicrobials and other preventative interventions; enhanced knowledge, beliefs and expectations of patients about antimicrobial use.

Methods and workplan

This will be a prospective quasi-experimental study of implementation that will be carried out in the municipality of São Caetano do Sul. Our study will focus on all 12 primary care units and multi-disciplinary teams: 247 HW: 29 doctors; 29 university-level nurses; 30 nurse technicians; 104 community health workers; 18 dentists; and 37 dental technicians. However, education and training will be extended to the wider cadre of 543 HWs.

WP1. Evaluation of pre-implementation baseline antimicrobial use and health-seeking and health-provision behaviours. This pre-intervention phase will be 18 months and the following project steps will be completed: securing ethical approval and access, adaptation of data collection questionnaires, base line of HW and patient beliefs and behaviours, baseline antimicrobial drug use**,** co-development of the multi-component intervention – guidelines, training and decision support tool.

Evaluating perceptions of antimicrobial use and prescription: An in-depth analysis of the context including deep set beliefs and practices of different stakeholders is needed to address over or misuse of antimicrobials. We will evaluate the relative magnitude and

cumulative effects of multiple professionals, patients and the wider public. We will use the concept of 'rigor-within-context' - where rigor emanates from "the internal logic" and researchers modify their study process through contextualization in methods and analysis.[41] This reframing will produce temporally and spatially situated knowledge, explain phenomena, enhance validity and theoretical generalisability and inform relevant and robust interventions that will achieve sustained impact.

This project will draw on well-established qualitative and quantitative methods of perception evaluation applied in the fields of medical humanities and social sciences.[42,43] Using a participatory approach involving key informants in the research design will allow for careful scrutiny of the findings and interpretation and will reduce the risk of neglecting situated meanings and mis interpretation of social norms.

Quantitative methods will involve cross-sectional self-completed surveys with HWs. Questions included in the surveys will draw on questionnaires previously validated in English, which will be translated to Portuguese and contextually adapted using the Delphi technique, for clarity, relevance of the content, and validation of the survey.[43,44] Questions will build on findings of an exploratory study of 151 health workers' perceptions in the local context conducted by the investigators involved in this proposal.

Qualitative methods will complement the survey findings by adding depth to the evaluation and provide insights on how and why the confluence of different stakeholders' perceptions emerge. Thematic analysis of focus groups conducted with physicians, patients, health workers and extended stakeholders including government officials and industry representatives will help understanding of the 'outer context' and to triangulate findings.

Following ethics and consent, data from patient respondents will be collected via questionnaire-based interviews conducted by trained researchers. Data from HW respondents will be collected via questionnaire-based interviews or by self-completion online.
This evaluation will occur before and after the intervention period.

Co-development of guideline for antimicrobial prescription and treatment of most common community-acquired infections in São Paulo and context of this proposal: A group of healthcare workers from the health system of the municipality and of infectious diseases specialists will work together to develop literature-based guidelines for the use of antimicrobial drugs and for the treatment of infections. These guidelines will be in accordance with the State of São Paulo guidelines.

Development of a tool to support decisions on antimicrobial prescription: Based on the guidelines, a team led by computer scientists from the University of São Paulo will develop a user-friendly tool to support antimicrobial prescribing decisions. From data collected from partners, this team will apply computational techniques such as graphics processing, machine learning and human-computer interaction to build a computational system that provides an intelligent and interactive data visualization to assist healthcare professionals in decision making. Innovative ways of interacting and visualizing data will be studied in order to allow the use of the tool with minimal effort, as well as the understanding of pre and post intervention data quickly and effectively.

Evaluation of antimicrobial drug prescriptions: The quality and volume of antimicrobial prescriptions will be evaluated pre and post intervention. Adequate prescription is defined as a prescription that is in concordance with the São Paulo State guidelines for treatment. Evaluation will be undertaken by reviewing electronic medical records. The volume of

antimicrobial days prescribed will be obtained through the evaluation of pharmacy drug dispensing reports and presented as daily defined doses (DDD) per 1,000 inhabitants per year according to the Anatomical Chemical Classification system.[45] This reflects the number of daily defined doses consumed per 1,000 inhabitants in one year as follows: (quantity of antimicrobial in a given year (g) X 1,000) / (DDD for that drug X population). The collected data will be subjected to data science techniques in order to prepare and process them to build models capable of evaluating and predicting intervention results. First, the data will be analysed to detect the need for standardisation and normalisation. Second, machine learning techniques will be applied to classify the data considering the previously mentioned guidelines. After classification, models will be built to help predict intervention outcomes.

Key deliverables: **(1)** Guideline for antimicrobial prescription (Months 1-18). **(2)** Tool to support decisions for antimicrobial prescription. (Months 6-12). **(3)** Description of perceptions of HW and patients on antimicrobial use. (Months 6-18). **(4)** Description of the adequacy of antimicrobial prescriptions (Months 6-18)

WP2. Implementation of interventions to promote antimicrobial stewardship in urban communities. This will include the implementation of the guidelines and decision tool, using strategies that will be defined based on the results of the questionnaires.

Implementation strategy: The implementation strategy will be informed by the Expert Recommendations for Implementing Change (ERIC).[46] All primary care units will be formally invited to an initial meeting, by means of a letter sent to the director of the units. The director should appoint two representatives, one from the medical service and another one from the nursing team for the meeting. In this first meeting, coordinated by the project team, the project and its justifications will be presented. The primary care units will be oriented to form working groups that will act as facilitators for the implementation of the project in the units' territory.

The State of São Paulo guideline for antimicrobial prescriptions and the tool to support decisions on antimicrobial prescription and treatment will be presented to the working groups at a second meeting. In addition, strategies to facilitate adherence to the state guideline will be discussed.

Workshops will be conducted with patients to enhance knowledge and understanding of the importance of prudent use of antimicrobials, role of and the current and potential role that patients can play including improving preventative health. Graphic material and a communication channel for questions from the public and community leaders will be made available in the units. An online page will be created for frequently asked questions and answers

A final meeting will be held to present the project results to the unit teams in aggregate form. Each unit will have access to its results individually and graphic material will be produced to disseminate these results in the units.

Key deliverables: **(1)** Systematic organization of input from healthcare units (Months 19-24). **(2)** Release of informative material for HW and patients. (Months 19-24). **(3)** Implementation of guideline and decision support tool in all healthcare units. (Months 19-24).

WP3. Monitoring, evaluation and learning of behaviour change and prescribing practices urban community antimicrobial stewardship intervention. The duration of post-intervention period will be 1 year during which the following steps will be completed: re-evaluation of HW and patient beliefs, re-evaluation of antimicrobial drug use**.**

Key deliverables: **(1)** Description of perceptions of HW and patients on antimicrobial prescription post intervention (Months 25-36). **(2)** Description of the adequacy of antimicrobial prescriptions (Months 25-36). **(3)** Evaluation of the impact of the intervention (Months 25-36).

Data analysis
Prescribing rates, behaviours, beliefs and perceptions will be measured at multiple time points before and after implementation of the stewardship intervention. Segmented Poisson regression will be performed to assess the impact of the multi-component intervention. Co-variates such as location of the urban healthcare facilities and patient demographic will be adjusted.

Project 2. Understanding the epidemiology of asymptomatic and symptomatic carriage of resistant microorganisms in urban communities to assess the impact of stewardship interventions.

Background and justification
Whilst international surveillance mechanisms exist for clinically identified AMR, including the European Antimicrobial Resistance Surveillance Network (EARS-Net) and the Global Antimicrobial Resistance Surveillance System (GLASS), the prevalence of AMR in commensal organisms is less well understood. However, carriage of drug resistant organisms is central to the global AMR burden and reservoirs of resistance genes across humans, the environment and livestock provide opportunities for spread and evolution. Data on the role of asymptomatic carriage of resistant organisms is particularly scant in resource poor settings where access to patient samples and centralised laboratories is limited.

To better understand the prevalence of AMR organisms within the community and to assess the impact of interventions aimed optimising antimicrobial use we will define the rate of AMR carriage amongst HWs working in primary care settings and amongst patients with urinary tract infections receiving treatment within primary care settings.

The study will also provide opportunities to evaluate the utility of novel responsive, multiplex PCR based methods developed with our UK CAMO-NET partners. This will provide an extended AST panel to rapidly identify and screen over 190 key antimicrobial genes including those associated with ESBLs and CPOs using conventional PCR platforms.

Aim
Understand the impact of interventions, defined in WP1, on the symptomatic and asymptomatic carriage of microorganisms and associated resistance genes using classical, sequencing and PCR based epidemiological approaches.

Methods and Workplan
WP1. Understanding carriage and epidemiology of resistant bacteria among asymptomatic and symptomatic HW and patients in urban settings. WP1 will examine the carriage and epidemiology of circulating microorganisms and associated resistance genes within the community.
Samples will be collected from:
-Patients presenting with urinary tract infection symptoms (pre and post intervention)
-HCWs (ideally encompassing the same personnel for the pre and post intervention phase)

Mid-stream urine samples will be collected from patients with a clinical indication of urinary tract infections and analysed according to routine clinical pathways and methods (including culture on chromogenic media). Antimicrobial susceptibility testing will be performed on all isolates at the Microbiology Laboratory of the FMABC University Center according to CLSI (2019-2021) or EUCAST (2019-2021) guidelines.

Asymptomatic healthcare workers from 29 FHT will also be included by culturing nasal, inguinal and/or anal swabs. Samples will be collected as point prevalence at two different times 1 year apart, before and after the intervention described in WP1.

Over a period of 6 months, all consenting patients (in each of the study periods) will be included. Variables such as sex, age, occupation and previous use of antimicrobials will be obtained. We hope to include all asymptomatic 257 HW from the 29 FHT. Carriage of the following organisms will be evaluated: methicillin-resistant *Staphylococcus aureus* (MRSA), extended-spectrum beta-lactamase (ESBL)-producing Enterobacteriales, quinolone-resistant

Enterobacteriales (QRE), carbapenem-resistant Enterobacteriales (CRE), and vancomycin-resistant *enterococcus* (VRE).

Briefly, nasal (for MRSA) and inguinal/anal swabs (for Enterobacteriales and *Enterococcus*) will be collected and cultured onto selective media. For rectal swabs; CHROMID® ESBL (bioMérieux, Marcy-l'Étoile, France), Agar Mueller Hinton supplemented with imipenem 2ug/mL and CHROMID® VRE (bioMérieux, Marcy-l'Étoile, France). ESBL production will be confirmed phenotypically using POLISENSIDISC ESBL (DME, São Paulo, Brazil) according to manufacturer's instructions. Carbapenemase production will be confirmed using β-CARBA test (BioRad, Marnes-la-Coquette, France). Microbial identification will be performed by mass spectrometry through MALDI-TOF (acronym for Matrix Assisted Laser Desorption/Ionisation Time of Flight) (Bruker Daltonics, Germany). The antimicrobial susceptibility of all isolated organisms will be determined according to CLSI guidelines.

Genetic characterisation, including the identification of plasmids, lineages, high risk clones, sequence types and the presence of virulence genes/resistance genes will be performed by whole genome sequencing using the MinION platform (Oxford Nanopore Technologies, UNITED Kingdom) according to the parameters established by Baltrus et al (2019).[47]

The generated files will be evaluated by fastqc v 0.11.3 and Trimmomatic v. 0.33 programs, and genome assembly performed using the Spades v. 3.5.0 program, also using the 'Plasmid' option for extracting plasmid *reads. Contigs* will be ordered by Abacas v. 1.3.1, noted with Prokka v. 1.11 and viewed with Artemis v. 16.0.11. The assembled files will be released on online platforms of the *Center for Genomic Epidemiology* in search of acquired resistance genes, types of plasmids, *Multi Locus Sequence Type* (MLST) and virulence genes in databases: *ResFinder*, *PlasmidFinder*, *MLSTFinder* and VFDB, respectively. *The Comprehensive Antibiotic Resistance Database* (CARD) baltrusinion will also be used to search for resistance genes and flow pumps.[48–51] Curation will be performed manually to verify better gene identity between platforms through the Artemis v. 16.0.11 tool. Phage research will be carried out using the Phaster web tool platform.[52]

To determine the epidemiology and evolutionary relationship of the isolates, a Bayesian Phylogenetic analysis will be performed and the phylogeny and divergence time of the genomes alignment will be assessed using the Bayesian genealogical inference package, BEAST v2.5.

Key deliverables: **(1)** Define the epidemiology and genetic relationships of circulating strains to better understand their emergence, transmission and persistence. (Months 0-12). **(2)** Determine the prevalence of carriage of drug-resistant organisms and associated genetic resistance elements among asymptomatic community HCWs and symptomatic patients (Months 6-18).

WP2. Monitoring the impact of the antimicrobial stewardship intervention on asymptomatic and symptomatic carriage of resistant bacteria in healthcare workers (HW) and patients in urban settings. During 6 months of the post-intervention period procedures described in Project 1 will be repeated in asymptomatic HW and patients with urinary tract infections.

Key deliverables: **(1)** Estimate the prevalence of drug-resistant organisms in healthcare workers and patients before the implementation of the multi-component intervention (guidelines, training, and decision support tool). (Months 25-36). **(2)** Evaluate the prevalence of the resistant organisms after implementing the intervention to assess the impact. (Months 25-36).

Data analysis
Resistant rates will be measured at multiple time points before and after implementation of the stewardship intervention. Segmented Poisson regression will be performed to assess the impact of the multi-component intervention. Co-variates such as location of the urban healthcare facilities and patient demographic will be adjusted.

WP3. Developing and piloting innovative technology for surveillance/monitoring of asymptomatic carriage of resistant bacteria (HW and patients) in urban settings. In WP3, we will explore opportunities to assess the utility and analytical performance of technologies co-developed with our UK CAMO-Net partners for the identification of microorganisms and associated resistance genes. Retrospective analysis of samples collected during WP1 will be analysed using the novel approaches and compared to genomic and phenotypic data to assess their sensitivity, specificity and LOD. Additionally, feedback from end users, biomedical scientists, laboratory managers and patients will be collected and organisational and behavioural factors influencing acceptability and adoption of the technology, including laboratory/POC/clinical, infrastructure workflows, will be considered to understand facilitators and barriers to adoption, acceptability and implementation.

Key deliverables: **(1)** Retrospective analysis of samples collected from WP1 to determine the performance characteristics of technologies (Months 24-30). **(2)** Co-development through end user feedback sessions with stakeholders to ensure contextual suitability. (Months 24-36).

Project 3. Assessing the prevalence of antimicrobials, drug-resistant organisms and resistant genes in urban water supplies and wastewater and to estimate the impact of the stewardship interventions.

Background and justification
The prevalence of drug resistant organisms, resistance genes and the levels of antimicrobials within water supplies provides critical insights of environmental contamination as well as antimicrobial usage in the community. The impact of water and environmental contamination, antimicrobial usage and human behaviour on the emergence, transmission and persistence of AMR has previously been explored.[38,39] Evaluating water supplies is particularly useful in resource poor settings where patient level testing and access to centralised laboratories can be challenging. The area of study is highly urbanised, deprived, regions with many living in irregular settlements and 8.8% of residents not having access to sewage collection.

Aim
Within phase one of project three, we will address important knowledge gaps on the prevalence and impact of AMR/antimicrobial usage in urbanised, deprived communities by, (i) evaluating levels of key antimicrobial agents, including ceftriaxone, azithromycin, quinolones, aminoglycosides, and meropenem; and (ii) estimating the prevalence of drug-resistant organisms within drinking water, wastewater and stream water collected from the metropolitan Region of Sao Paulo (MRSP).

WP1. Understanding levels of antimicrobial agents and resistance genes in drinking water, raw and treated wastewater, and stream water. Sampling: Samples (2000mL) will be collected monthly for one year in 10 points in the city of São Caetano do Sul. This volume will be distributed according to each analysis: 500mL for ATB concentration assays, 500mL for culture-independent molecular methods and 1000mL for microbiological analyses.

Physicochemical parameters: pH and temperature will be measured in accordance with the Standard Methods for Examination of Water and Wastewater (2012).[53] Antimicrobial concentrations: The levels of the gentamicin, levofloxacin, meropenem, chlorhexidine, ceftriaxone and azithromycin will be determined using LC-MS as a gold standard.

Microbiological analysis: microbial culturing and phenotypic identification of organisms will be performed on all isolates and a thermotolerant coliform and Escherichia coli count performed using Colilert. ESBL producers will be confirmed by PCR. MRSA isolates will be identified by culture on selective agar and confirmation by PCR. Antimicrobial susceptibility testing will be performed according to CLSI Guidelines and where required, PCR screening for antimicrobial resistance genes will be performed.

AMR gene screening: Qualitative PCR will be performed to detect class 1 integrases (*IntI1*) and genes encoding resistance for β-lactams, Fluoroquinolones, Polymyxins, Aminoglycosides and Fosfomycins, using previously described methods.[54–61] Real time absolute quantification (qPCR) will be carried out to enumerate the total bacterial load (16S rRNA gene), Escherichia coli load (*uid* gene), and groups of endemic resistance genes for gram-negative (blaCTX-M) and gram-positive (*mecA*) bacteria.

Key deliverables: Assessment and genomic examination of antimicrobial concentrations and resistance genes in drinking water, raw and treated wastewater, and stream water within the metropolitan Region of Sao Paulo. (Months 6-18).

WP2. Monitoring the impact of the antimicrobial stewardship interventions on the antimicrobial concentration and drug-resistant organisms in water in urban settings. Collection and analysis of drinking water, stream water, and raw and treated wastewater described in WP1 will be repeated after implementation of the multi-component stewardship intervention.

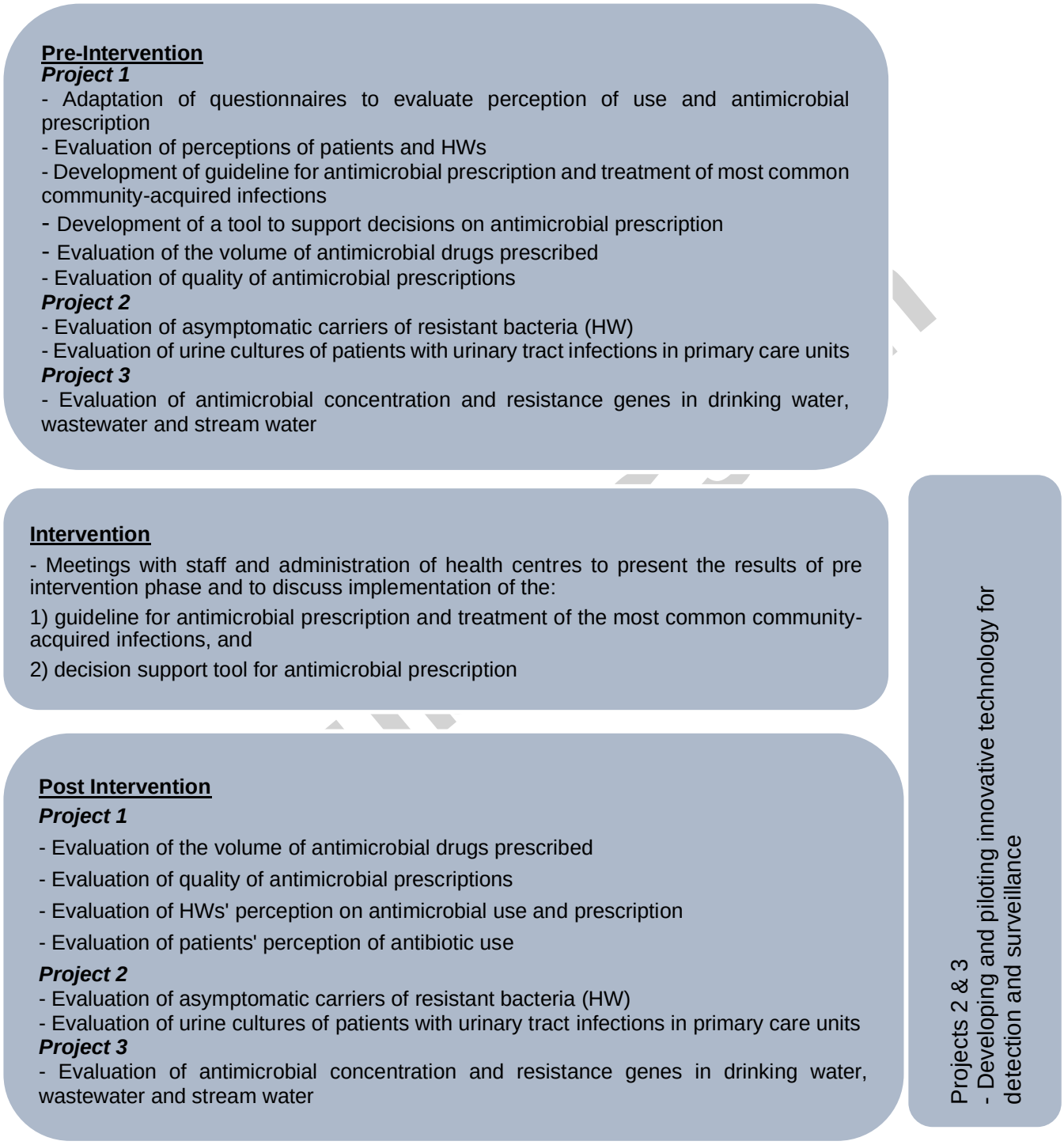
Key deliverable: Estimate the impact of interventions on antimicrobial concentration and prevalence of resistant genes within urban water. (Months 25-36).

WP3. Developing and piloting innovative technology for surveillance/monitoring of pathogens and antibiotics in water reservoirs in urban settings. In WP3 we will evaluate the novel multiplex technologies developed with our CAMO-Net UK and India partners. These will be developed to provide rapid screening of over 190 genes using conventional PCR platforms and will provide deep genetic information from environmental screening samples, without the costs and technical obstacles associated with whole genome sequencing. We will also assess the utility of innovative PoC tools, developed as part of our CAMO-Net Indian proposal, which aim to provide rapid, on-site testing of antimicrobial levels.

Currently, antimicrobial levels are determined using Mass Spectrometry (MS), which requires significant laboratory infrastructure and trained personnel. Portable tools for the quantification and detection of antimicrobials could provide a useful solution for environmental studies, particularly for resource limited or remote regions with limited access to centralised laboratories. In addition, Iterative implementation research through semi-qualitative evaluations will performed to identify, examine and address factors associated with the acceptability, adoption and sustainability of the proposed technologies for environmental testing. The performance characteristics of each technology will be assessed through comparison with gold standard methods (PCR, culture, mass spectrometry and sequencing) and feedback will be gathered from end users and stakeholders.

Key deliverables: **(1)** Co-develop a responsive multiplex PCR methodology with UK CAMO-Net partners) and a portable antimicrobial testing platform for water testing (linked to Indian CAMO-Net proposal). (Months 1-24). **(2)** Evaluation of performance characteristics and suitability of technologies for environmental applications (Months 12-36).

Figure 1. Summary of the 3 projects linked in the study. (HW: healthcare worker)



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Appendix 1. Executive summary of the Wellcome Trust "Optimising antimicrobial use in humans: a research roadmap"

Drug-resistant infection and lack of access to effective antimicrobials pose a global threat to human health, the delivery of safe healthcare, and medical advances. Suboptimal prescribing and misuse of antimicrobial agents are major drivers of antimicrobial resistance (AMR). The threat of AMR has driven collaborative international action to raise awareness of the critical need to develop targeted and focused strategies to preserve antimicrobial effectiveness and encourage investment in the development of new agents. While much investment and research focus has taken place in the sphere of drug discovery and development, strategies to preserve and optimise the use of existing agents have received less attention. **The scope of this report is to provide an overview of the research landscape in optimising antimicrobial use in humans and provide a research roadmap to address the identified research priorities.**

The multidisciplinary team, led by Imperial College London, includes expertise from medicine (with extensive experience in general infectious diseases, microbiology, tuberculosis and HIV), surgery, pharmacy, clinical pharmacology, epidemiology, social science, economics, engineering, public health, patient safety, healthcare management and policy research, along with consumer, patient and public advocates and representatives. This document was co-produced with diverse expertise from high-, middle-, and low-income country partners with a strong track record in effective research collaborations tackling AMR across human populations.

This report which provides a review and proposed roadmap is intended for healthcare professionals, policymakers, and advocacy groups involved in research and communication in the field of AMR. The evidence-based roadmap was developed using a three-phase approach: 1) a scoping review of existing published and grey literature, 2) virtual roundtable discussions with experts, and 3) surveys with stakeholders ranging from policymakers to patient advocates. This process identified four distinct research themes in optimising antimicrobial use in humans:

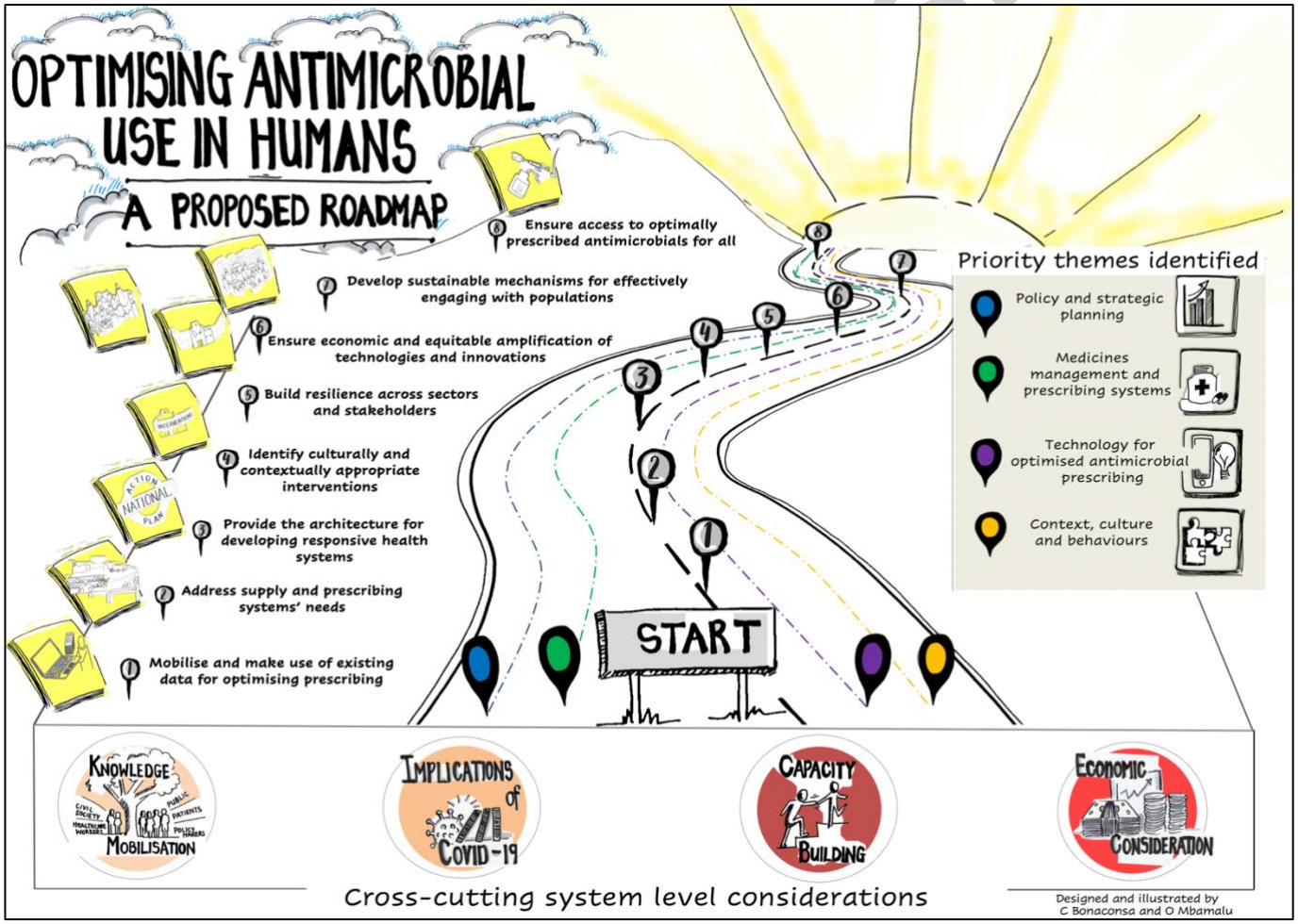
1) **Policy and strategic planning**;
2) **Medicines management and prescribing systems**;
3) **Technology for optimised antimicrobial prescribing**; and
4) **Context, culture and behaviours**.

Additionally, three cross-cutting systems-level considerations were identified: the need to capture the **economic impact** both of AMR and of proposed solutions, the **impact of external shocks** on the problem of AMR and the ability to sustain societal focus and research (using the COVID-19 pandemic as an example), and **equitable capacity building and knowledge mobilisation**.

In order to optimise antimicrobial use in humans, future global research streams need to:

1. **Mobilise and make use of existing data for optimising prescribing** across community, hospital, and social care sectors.
2. **Address supply and prescribing systems' needs** for antimicrobials together with other economic incentives that influence the access to and use of antimicrobials.
3. Address greater governmental and cross-sectoral collaboration to strengthen healthcare capacity and **provide the architecture for developing responsive health systems** to deal with the threat of AMR and other emerging infectious diseases.

4. **Identify culturally and contextually appropriate interventions**, including behavioural and technological approaches, and how they can be implemented into healthcare systems with least disruption to existing structures.
5. **Build resilience across sectors and stakeholders** through capacity building. This includes building capacity in civil society and across systems for wider engagement, effective and contextualised communication strategies, and awareness of the threat of AMR, in order to engender a culture of civil responsibility and sustained accountability.
6. **Ensure economic and equitable amplification of technologies and innovations** (e.g. rapid point-of-care diagnostic tests, innovative monitoring of antimicrobial levels, and development of biomarker tests to assess response) with appropriate and standardised mechanisms for evaluation using suitable outcome measures.
7. Identify how AMR-focused interventions **develop sustainable mechanisms for effectively engaging with populations** at greatest risk/concern of the consequences of AMR.
8. **Ensure access to optimally prescribed antimicrobials for all,** through a better understanding of how social constructs and vulnerabilities (race, gender, class, deprivation) affect infection-related health-seeking and health-providing behaviours.



Appendix 2. CAMO-Net Project Matrix

<table>
<tr><th></th><th>UK: Innovation in technology and data usage</th><th>Brazil: Urban community and environment</th><th>South Africa: Innovation in methods on the influence of social determinants</th><th>Uganda: Clinical pharmacology and unique patient populations</th><th>India: Supply chains and medicines quality, data; behaviours</th></tr>
<tr><td>Tech and innovation</td><td>Harnessing novel methods for using molecular data to achieve high-throughput qPCR profiling of AMR Genes</td><td>Understanding the epidemiology of asymptomatic carriage of resistant microorganisms in urban communities</td><td>Integrating and developing data sets for enhanced surveillance of antibiotic resistance and antibiotic consumption to optimise antibiotic use</td><td>Assessing the Implementation and impact of Antibiotic Therapeutic Drug Monitoring Programme for Selected Antibiotics among PLHIV in an Out-patient HIV Treatment Facility</td><td>Enriching data and data linkage to: (i) inform relevant CDSS; (ii) address gaps on dosing for priority populations, antimicrobial agents and infections; (iii) investigating capacity to integrate information from POC digital diagnostics</td></tr>
<tr><td rowspan="2">Context, culture and behaviour</td><td>Use of innovative POC technologies for real-time therapeutic drug monitoring and host biomarker monitoring</td><td>Understanding the epidemiology of pathogens and antibiotics in urban community water reservoirs</td><td>Investigating the intersectionality of power dynamics, hierarchies, and health-seeking and health-provision behaviours</td><td>Investigating patterns and trends in antibiotic prescribing among People Living with HIV</td><td>Investigating the socio-cultural drivers for health-seeking and health provision behaviours across healthcare settings</td></tr>
<tr><td>Quantitative Pharmacological Approaches: improving use of drugs on the Essential Medicines List</td><td rowspan="3">Optimising prescribing in urban communities through contextually-informed antimicrobial stewardship and decision support tools</td><td rowspan="3">Investigating context-specific communication methods for AMR to inform an optimal mixed medium global language framework</td><td rowspan="3">Understanding trends/patterns in antibiotic consumption and use among patients attending six regional referral hospitals in Uganda to inform and evaluate pharmacy staff led interventions</td><td>Investigating supply chain interruptions and shortages across healthcare systems: mapping, monitoring, forecasting, and targeting interventions</td></tr>
<tr><td rowspan="2">Medicines management</td><td>Developing learning systems for optimised prescribing for complex prescribing scenarios</td><td rowspan="2">Addressing antimicrobial quality and the challenge of falsified meds through contextually directed POC drug testing technology</td></tr>
<tr><td>Using data to address gaps in sectoral surveillance, creating systems that identify, monitor and address antimicrobial use</td></tr>
</table>

Appendix 3. National Hub GANTT chart

Brazil		2023				2024				2025				Key deliverables
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Project 1	**Optimising prescribing in urban communities through contextually-informed antimicrobial stewardship and decision support tools**													
WP1	Evaluation of pre-implementation baseline antimicrobial use and health-seeking and health-provision behaviours	D1,D2,D3,D4												**(D1)** Guideline for antimicrobial prescription. **(D2)** Tool to support decisions for antimicrobial prescription. **(D3)** Description of perceptions of HW and patients on antimicrobial use. **(D4)** Description of the adequacy of antimicrobial prescriptions
WP2	Implementation of interventions to promote antimicrobial stewardship in urban communities							D5,D6,D7						**(D5)** Systematic organization of input from healthcare units. **(D6)** Release of informative material for HW and patients. **(D7)** Implementation of guideline and decision support tool in all healthcare units
WP3	Monitoring, evaluation and learning of behaviour change and prescribing practices urban community antimicrobial stewardship intervention									D8,D9,D10				**(D8)** Description of perceptions of HW and patients on antimicrobial prescription post intervention. **(D9)** Description of the adequacy of antimicrobial prescriptions. **(D10)** Evaluation of the impact of the intervention
Project 2	**Understanding the epidemiology of asymptomatic and symptomatic carriage of resistant microorganisms in urban communities to assess the impact of stewardship interventions**													
WP1	Understanding carriage and epidemiology of resistant bacteria among asymptomatic and symptomatic HW and patients in urban settings	D1				D2								**(D1)** Define the epidemiology and genetic relationships of circulating strains to better understand their emergence, transmission and persistence. **(D2)** Determine the prevalence of carriage of drug-resistant organisms and associated genetic resistance elements among asymptomatic community HCWs and symptomatic patients
WP2	Monitoring the impact of the antimicrobial stewardship intervention on asymptomatic and symptomatic carriage of resistant bacteria in healthcare workers (HW) and patients in urban settings									D3,D4				**(D3)** Estimate the prevalence of drug-resistant organisms in healthcare workers and patients before the implementation of the multi-component intervention (guidelines, training, and decision support tool). **(D4)** Evaluate the prevalence of the resistant organisms after implementing the intervention to assess the impact
WP3	Developing and piloting innovative technology for surveillance/monitoring of asymptomatic carriage of resistant bacteria (HW and patients) in urban settings									D5		D6		**(D5)** Retrospective analysis of samples collected from WP1 to determine the performance characteristics of technologies. **(D6)** Co-development through end user feedback sessions with stakeholders to ensure contextual suitability
Project 3	**Assessing the prevalence of antimicrobials, drug-resistant organisms and resistant genes in urban water supplies and wastewater and to estimate the impact of the stewardship interventions**													
WP1	Understanding levels of antimicrobial agents and resistance genes in drinking water, raw and treated wastewater, and stream water									D1				**(D1)** Estimate the impact of interventions on antimicrobial concentration and prevalence of resistant genes within urban water
WP2	Developing and piloting innovative technology for surveillance/monitoring of pathogens and antibiotics in water reservoirs in urban settings					D2				D3				**(D2)** Co-develop a responsive multiplex PCR methodology with UK CAMO-Net partners) and a portable antimicrobial testing platform for water testing (linked to Indian CAMO-Net proposal). **(D3)** Evaluation of performance characteristics and suitability of technologies for environmental applications

Additional information

Key Researchers from CAMO-Net UK

AHMAD, Raheelah ***(1)*** *Knowledge Mobilisation Lead: NIHR Health Protection Research Unit in Healthcare Associated Infections and Antimicrobial Resistance, Imperial College London and Honorary Senior Lecturer;* ***(2)*** *Director for Global Engagement, School of Health & Psychological Sciences, City, University of London;* ***(3)*** *Knowledge Mobilisation Lead: NIHR Health Protection Research Unit Respiratory Infections, Imperial College London; (4) Senior Lecturer Health Management & Leadership, City, University of London;* ***(5)*** *Honorary Professor, Dow University of Health Sciences, Karachi, Pakistan*

Qualifications: PhD Health Management (Imperial College London); MSc Health Services Management (LSHTM), MSc Medical Informatics (City University of London) BSc Mathematics (University College London)

Project Role: Knowledge Mobilisation (KM) Network Lead; Chair of CAMO-Net KM Committee

ORCID ID: 0000-0002-4294-7142

Grants Awarded: **(1)** NIHR, Health Protection Research Unit for Healthcare Associated infections and Antimicrobial Resistance at Imperial College (Co-I) 2020-2025 **(2)** NIHR, Health Protection Research Unit in Respiratory Infections (Co-I) 2020-2025 **(3)** NIHR Health Protection Research Unit in Modelling and Health Economics 2020-2025 **(4)** Public Health England, Evaluation of antibiotic use in out of hours settings (PI) 2019–2020 **(5)** Public Health England, Evaluating Pharmacy led advise for Urinary Tract Infections (PI) 2018-19 **(6)** NIHR, Optimising knowledge mobilisation - antibiotic utilisation in the community setting (PI) 2016–2019 **(7)** Research England Grand Challenges Research Fund (GCRF), Improving surgical outcomes and reducing mortality and morbidity in maternal, neonatal and paediatric populations: optimising antibiotic use and infection prevention (Co-I) 2018–2019, **(8)** ESRC, Antibiotic use across Surgical Pathways - Investigating, Redesigning and Evaluating Systems; India, South Africa, Rwanda, England, Scotland (Co-I) 2017–2022) **(9)** World Bank/MoH, Evaluation of family medicine reforms in Turkey (PI) 2011-2012

Positions, Scientific Appointments and Honours: **(1)** Steering group member AMR policy accelerator unit at The Global Strategy Lab, York University, Canada **(2)** Deputy Chair: The Surveillance and Epidemiology of Drug-resistant Infections Consortium (SEDRIC) – The Wellcome Trust **(3)**Technical Advisor: The Fleming Fund - DHSC UK **(4)** Member: All-Party Parliamentary Group for Patient Safety **(5)** Reviewer: MRC, NIHR Health Services and Delivery Research, Health Research Board Ireland **(6)** Senior Associate Editor, international peer review journal: Public Health (**6)** Fellow of the Royal Society for Public Health.

Contributions to Field: (1) Addressing AMR through systems level frameworks and strategic management approaches Her work has seen the adoption of novel thinking, methods and practice to better understand the public health challenges and collective actions required around AMR. This has included the application of whole systems thinking, systems dynamics modelling and first application of a strategic management lens to addressing AMR at the national level (BMJ Global Health 2019;4(5)) **(2) Knowledge mobilisation** She is a leader in advancing both knowledge mobilisation practice and theoretical understanding providing leadership in Knowledge Mobilisation as lead for three NIHR Health protection Research Unit and as a member of the NIHR KM network. She is the lead for the Knowledge mobilisation and policy working group at The Surveillance and Epidemiology of Drug-resistant Infections Consortium (SEDRIC) – The Wellcome Trust and have been invited by the BMJ to analyse research infrastructure which enables knowledge mobilisation.

Key Researchers from CAMO-Net UK

AYLIN, Paul *1. Professor of Epidemiology and Public Health: Dept. Primary Care and Public Health/School of Public Health, Imperial College London. 2. Theme Lead, Health Protection Research Unit, Imperial College London 3. Co-Director of the Dr Foster Unit at Imperial.*

Qualifications: MBChB

Project Role: data linkage and epidemiology

ORCID ID: **0000-0003-4589-1743**

Grants Awarded: (1) NIHR, Health Protection Research Unit in HCAI and AMR at Imperial (Co-I and Theme Lead) first commission 2014-2020, second commission 2020-2025 **(2)** NIHR, NW London Applied Research Collaboration (Co-I and Theme Lead) first commission 2019- 2024 **(3)** Dr Foster Ltd. Explaining variations in outcome in healthcare across England (PI) 2019-2021**(4)** RCUK, Centre for Infection Prevention and Management (Co-I and Theme Lead) 2009-2014 **(5)** NIHR, Research to Determine the Impact of the National Antimicrobial Stewardship Programmes On Clinical Outcomes and Patient Safety and Establish Sustainable Systems (Adverse impact of National Prescribing Policy (Co-I) 2016-2017

Positions, Scientific Appointments and Honours: (1) Fellow of the Faculty of Public Health **(2)** Fellow of the Royal College of Physicians Edinburgh **(3)** member of the Directorate of Public Health and Primary Care management board (**4)** non-executive director on the board of the West London NHS Trust **(5)** Expert member, SHMI Technical Sub-Group, NHS Digital, 2018

Contributions to Field: (1) Innovative statistical and computational methods using routine administrative data to identify quality of care issues at Bristol Royal Infirmary, Mid Staffordshire and as part of the Shipman Inquiry **(2) Indicators of healthcare performance based on hospital mortality patient safety indicators** leading to design of the Real-Time Monitoring System for hospital outcomes across a range of diagnosis and procedure **(3)** M**ethodologies to determine the Impact of National Antimicrobial Stewardship programmes and COVID-19**, these illuminated the impact and unintended consequences of policy decisions on antimicrobial prescribing and on clinical outcomes.

BARAHONA, Mauricio *(1) Professor of Applied Mathematics & Chair in Biomathematics, Department of Mathematics, Imperial College London (2) Director, EPSRC Centre for Mathematics of Precision Healthcare, Imperial College London*

Qualifications: PhD (MIT, Applied Mathematics & Theoretical Physics)

Project Role: Mathematical modelling; data analysis; machine learning; algorithm development

ORCID ID: 0000-0002-1089-5675

Grants Awarded: **(1)** UKRI, Centre for Doctoral Training in Artificial Intelligence for Healthcare (EP/S023283/1; Co-I) 2019-27 **(2)** EPSRC, Physics of Life - Statistical Physics of Cognition (EP/W024020/1 Co-I) 2021-24 **(3)** EPSRC, Centre for Mathematics of Precision Healthcare (EP/N014529/1, PI) 2016-21 **(4)** NIHR Long Covid Multidisciplinary consortium: Optimising Treatments and ServIces Across the NHS (COV-LT2-0016, Co-I) 2021-24

Positions, Scientific Appointments and Honours: **(1)** Fulbright Scholarship **(2)** Edison International Fellowship **(3)** Whitaker Prize of the US Biomedical Engineering Society.

Contributions to Field: **(1) Applied mathematics, data science and machine learning** for biological, social and engineering systems using methods from graph theory, dynamical systems, stochastic processes, optimisation and computational algebraic geometry: has conducted Foundational work on synchronisation and consensus on graphs, and community detection in graphs allowing multiscale clustering of datasets **(2) Algorithms for nonlinear dynamics, signal processing, network analysis** this work has applications to: detection of congestive heart failure, prediction of infection risk, social network analytics, text analysis, patient sharing networks, topic detection and document classification in healthcare records, single-cell clustering, etc **(3) Methods for graph-based learning**: extensions of graph convolutional neural networks.

BUCHAN, Professor Iain Edward *(1) Chair in Public Health and Clinical Informatics, University of Liverpool (2) Associate Pro Vice Chancellor for Innovation, University of Liverpool*

Qualifications: BSc (Pharmacology) MB ChB (GMC: 3541320) DPH MD FFPH FACMI FBCS FFCI

Project Role: Clinical informatics

ORCID ID: 0000-0003-3392-1650

GRANTS AWARDED: (1) NIHR, DynAIRx: AIs for dynamic prescribing optimisation and care integration in multimorbidity, 2022-24 **(2)** NIHR, PHIRST @ LiLaC: Public Health Intervention Responsive Studies Team, 2022-27 **(3)** NIHR, RESTORE – Research for Equitable SySTem RespOnse and REcovery, 2021-23 **(4)** LCR Combined Authority, Liverpool City Region Civic Data Cooperative (PI), 2020-25 **(5)** NHSX, Combined Intelligence for Population Health Action (PI) 2020-21 **(6)** MRC, HOD2: Toward Holistic Approaches to Clinical Prediction of Multi-Morbidity, 2020-23 **(7)** Wellcome Trust, C-GULL: Children Growing Up in Liverpool, 2020-2025 **(8)** NIHR, GM Patient Safety Translational Research Centre, 2017-2022 **(8)** NIHR, Manchester Biomedical Research Centre, 2017-22 **(9)** DHSC, Connected Health Cities (PI) 2016-18 **(10)** MRC, Manchester Molecular Pathology Innovation Centre, 2015-19 **(11)** NIHR, Development and evaluation of an intervention to support Adherence to treatment in adults with Cystic Fibrosis, 2015-20 **(11)** MRC, Manchester Academic Health Science Centre Technology Hub: Clinical Proteomics Centre for Stratified Medicine, 2015-20 **(12)** MRC, Psoriasis Stratification to Optimise Relevant Therapy, 2014-18 **(13)** MRC, MRC North West Hub for Trials Methodology Research 2014-18 **(14)** NIHR, NIHR Research Methods Opportunity Funding Scheme, 2013-14 **(15)** MRC, Farr Institute - North of England 2013-2018 (PI) 2013-18 **(16)** MRC, Health e-Research Centre (PI) 2013-18 **(17)** MRC, Careloop, 2012-15

Positions, Scientific Appointments and Honours: (1) Director of Healthcare Research, Microsoft Research, Cambridge, UK 2017–18 **(2)** Clinical Professor in Public Health Informatics, 2008–17, University of Manchester & MRC Health eResearch Centre Director **(3)** MRC Farr Institute Co-Director; Faculty Domain Director Clinical Senior Lecturer in Public Health Informatics 2003–08, University of Manchester

Contributions to the Field: (1) Health informatics: Has established one of the UK's most successful health informatics research groups, the forerunner of the UK's national health data research organisation and, since 2019, have led Liverpool's Institute of Population Health delivering world-leading urgent evidence to inform Covid-19 pandemic policies (BMJ 2021;372:n208) **(2) Digital tools for integrated care systems:** Originated the Connected Health Cities project and drove the #DataSavesLives movement, paving the way for the data-sharing now needed to advance health security and form integrated care systems capable of borrowing strength as a network. To advance clinical trials informatics, he conceived patented methods and co-founded the NW eHealth spin-out and drive a network of methodology to help advance predictive care for patients and populations on near-real-time (Methods Inf Med 2015;54(06):479-487, Statistics in Medicine 2018;37(28):4142-4154) **(3) Social epidemiology,** I have conducted research on England's geographical disparities in wealth, mortality, morbidity, and public investment (J of Epi & Community Health 2018;71(9))

CASTRO- SANCHEZ, Enrique 1. *Associate Professor: Richard Wells Research Centre, University of West London; 2. Infection Prevention and Control Clinical Fellow, NHS England; 3. Honorary Lecturer, Imperial College London*

Qualifications: BSc (Cordoba, Nursing) | DipTropNurs (LSHTM) | DLSHTM (Public Health) | PgCert (City University, Education) | MPH (LSHTM) | MA (Seville, Public Policy Analysis) | (PhD (Alicante, Health literacy)

Project Role: IPC nurse, AMS

ORCID ID: 0000-0002-3351-9496

Grants Awarded: (1) NIHR, 70@70 Senior Nurse and Midwife Research Leader Programme (PI) 2019-2022 **(2)** Research England Global Challenges Research Fund (GCRF), Exploring contextual determinants of leadership and policy engagement of nurses in Pakistan: development and piloting of educational interventions and a policy engagement toolkit'(Co-I) 2021-2021 **(3)** AHRC, Re-envisaging Infection Practice Ecologies in Nursing (AH/R002126/1; Co-I) 2018-2020 **(4)** Impact Accelerator/ESRC, Exploiting serious electronic games to modify behaviour (Principal-Investigator) 2017-2018 **(5)** Imperial College BRC, Development and implementation of innovative roles for nurses in antimicrobial stewardship (PI) 2015-2016

Positions, Scientific Appointments and Honours: (1) Lecturer, MSc Planetary Health. UOC (Catalonian Open University), Barcelona, Spain **(2)** Clinical Associate. Primary Care International London, United Kingdom **(3)** Visiting Faculty. Shifa al-Tameer Millat University, Islamabad, Pakistan; **(4)** Consultant, Antimicrobial Stewardship. World Health Organization, Geneva, Switzerland **(5)** Editor in Chief, Infection Ecology & Epidemiology journal **(6)** NIHR Health Technology Assessment Programme expert reviewer **(7)** Expert Adviser, NICE Centre for Guidelines **(8)** Reviewer, NIHR Health Technology Assessment Programme **(9)** Expert, Spanish National Antimicrobial Stewardship Programme **(10)** Editorial Board, BMC Health Services Research **(11)** Research Editor, JAC-AMR **(12)** Academic Editor, PLOS One; Associate Editor, BMC Public Health **(13)** Future-Focused Leader. NIHR, London, United Kingdom **(14)** Emerging Leader in International Infectious Diseases, International Society for Infectious Diseases.

Contributions to Field: (1) Patient and citizen participation on infection-related behaviours, **(2) Influence of health literacy**, including health communication, policy instruments, and co-design of interventions; **(3) Expansion worldwide of workforce competencies in IPC/AMS**, with identification of educational gaps, development of national and international competencies and curricula, implementation and evaluation of new roles.

DARLOW, Christopher A. ***(1)*** *NIHR Academic Clinical Lecturer, Institute of Systems, Molecular and Integrative Biology, University of Liverpool*

Qualifications: MB BChir, MA (Cantab), MRCP, PhD (Pharmacology)

Project Role: Neonatal sepsis

ORCID ID: 0000-0002-5400-3413

Grants Awarded: **(1)** MRC, North-West Pharmacology Fellowship Award (MR/N025989/1, PI) 2018–22 (**2)** Global Antibiotic Research and Development Partnership, Pre-clinical investigation into neonatal sepsis (co-applicant, investigator) 2021-22

Positions, Scientific Appointments and Honours: (1) MRC Clinical Research Fellow 2018-22 **(2)** British Infection Association Early Career Researcher Committee Secretary **(3)** Member of the ESCMID PK/PD of anti-infectives study group **(4)** Member of the British Society of Antimicrobial Chemotherapy

Contributions to Field: (1) Antimicrobial Dose Optimisation: He has defined three potential antimicrobial regimens for the empiric treatment of neonatal sepsis that are affordable in low- and middle-income settings and likely efficacious in the context of rising antimicrobial resistance compromising the standard of care for neonatal sepsis, as evidenced by recent publications. All three are the main comparators in an upcoming international neonatal sepsis treatment trial conducted by GARDP.

DAS, Shampa (1) *Professor of Antimicrobial Therapeutics, Deputy Head of Department of Pharmacology and Therapeutics, Institute of Systems, Molecular and Integrative Biology, University of Liverpool (2) Director Shampa Das PKPD Ltd*

Qualifications: PhD (Child Health, University of Sheffield)

Project Role: PK-PD studies

ORCID ID: 0000-0002-2540-4816

Grants Awarded: (1) GARDP Foundation, Expansion of assessment of pharmacodynamics of combinations for neonatal sepsis (PI) 2022-23 **(2)** The Rosetrees Trust UK, Expanding the antibiotic spectrum of novel teixobactins to target MDR bacteria (Co-I) 2022-24 **(3)** Spero Therapeutics, Further assessment of pharmacodynamics of SPR206 (PI) 2021-22 **(4)** MRC CIC, Hit to lead development of MMV screening hits for the treatment of fungal infection cryptococcus neoformans (Co-I) 2021-23 **(5)** MRC CIC - Synthetic teixobactins a new class of antibiotics against MDR Gram negative bacterial pathogen (Co-I) 2021-2022 **(6)** Bioversys, PK-PD assessment of BV100 in the hollow fibre infection model (PI) 2021-24 **(7)** GARDP Foundation – Investigation of combinations for neonatal sepsis (Co-I) 2020-21 **(8)** Phico Therapeutics Ltd, Investigation of PK-PD of PT3 (PI) 2021-22 **(9)** F2G, Investigation into interaction between olorofim and triazoles (PI) 2021-22 **(10)** UKRI Strength in Places, Development of clinically relevant model platforms for PKPD analysis of new Antibiotics (Co-I) 2020-25 **(11)** CF Trust – An evidence-based preclinical framework for the development of antimicrobial therapeutics in cystic fibrosis (Co-I) 2021-25 **(12)** Spero Therapeutics, Pharmacodynamics of SPR206 (PI) 2020 **(13)** Antabio, Assessment of the PD of ANT3310 (PI) 2020 **(14)** Bugworks Research, Assessment of the PK-PD of BWC0977 (PI) 2019-22 **(15)** European Commission, GNA NOW: Novel Gram-Negative Antibiotic Now (PI) 2019-25 **(16)** Innovate UK, Unlocking the potential of teixobactin analogues to target MDR bacteria (Co-I) 2019-21 **(17)** Spero Therapeutics – Assessment of tebipenem in the hollow fibre (PI) 2016-18 **(18)** Allecra Therapeutics, PK-PD analyses of cefepime and AAI101 against MDR Enterobacteriaceae (Co-I) 2017-18 **(19)** Antabio – PK-PD analyses of novel metallo-beta-lacatamase inhibitors, (PI) 2018-19

Positions, Scientific Appointments and Honours: (1) PK-PD Expert on European Committee on Antimicrobial Susceptibility Testing (EUCAST) steering committee **(2)** Programme Chair for European Society for Clinical Microbiology and Infectious Diseases / American Society of Microbiology **(3)** ESCMID Fellow **(4)** Contributing Expert for REVIVE by Global Antibiotic Research and Development Partnership

Contributions to Field: (1) Development of new antimicrobial agents: Expertise in PK-PD modelling and clinical pharmacology and has guided the development of a number of antimicrobial agents, resulting in the licensing and positive Phase III clinical success of a number of novel agents. Through her role EUCAST committee role provided scientific recommendations to the European Medicines Agency on breakpoints to distinguish which pathogens can be treated with which antimicrobial agent. **(2) Supporting the antimicrobial development pipeline**: Panel reviewer and scientific expert for CARB-X global non-profit partnership, for the investment of the £480 M funding portfolio for the development of new antibiotics. As partner, steering committee, and panel review member of the IMI AMR accelerator consortium GNA NOW she also supports the investment of multi-million euro investments. Consultant to a number of biotech and pharmaceutical companies. **(3) Dissemination of drug development experience**: As the current chair of the ESCMID-ASM joint meeting, she runs their conference on Antimicrobial Drug Development to Meet the Challenge of AMR. She is a regular invited speaker to both conferences and postgraduate education meetings including EMA and FDA workshops focused on antimicrobial development.

FRANKLIN, Bryony Dean *(1)Executive Lead Pharmacist (Research), Imperial College Healthcare NHS Trust (2) Professor of Medication Safety, UCL School of Pharmacy (3) Theme Lead, NIHR Imperial Patient Safety Translational Research Centre and HPRU in HCAI and AMR (4)[4]Co-Editor-in-Chief, BMJ Quality and Safety.*

Qualifications: BPharm (Bath), BA (Theology; Durham), MSc (Clinical Pharmacy; London), PhD (Pharmacy Practice; London) FFRPS FRPharmS

Project Role: Chair of Medicines management theme research planning group

ORCID ID: 0000-0002-2892-1245

Grants Awarded: (1) Wellcome Trust, Optimising Antimicrobial use in Humans: a review of the research landscape and a proposed roadmap (Co-I) 2020 **(2)** NIHR, Health Protection Research Unit (HPRU) in Healthcare Associated Infection and Antimicrobial Resistance at Imperial College London (Co-I and theme lead) 2019-25 **(3)** NHS England, Knowledge and evaluation of the Global Digital Exemplar programme (Co-I) 2018 **(4)** NIHR i4i to investigate the clinical benefits of On Demand Clinical Decision Support for administration of intravenous medication in paediatrics (Co-I) 2018 **(5)** Pharmacy Research UK, The use of Patient-Held Information about Medication to support medicines optimisation (the PHIMed study (PI) 2017 **(6)** NIHR, Imperial Patient Safety Translational Research Centre (Co-Applicant and theme lead) 2017-22 **(7)** NIHR HS&DR, ECLIPSE study of intravenous infusion errors and the role of smart pumps in the NHS (Co-PI) 2014 **(8)** EPSRC, Doing Digital Drugs (Co-Applicant) 2014 **(9)** The Health Foundation, Inpatient involvement in medication safety in both paper-based and electronic prescribing systems (PI) 2013 **(10)** The Health Foundation, Improving patient safety through providing feedback to junior doctors on prescribing errors (PI) 2012

Positions, Scientific Appointments and Honours: **(1)** Fellow of the Royal Pharmaceutical Society **(2)** Faculty Fellow, Royal Pharmaceutical Society **(3)** Lead on the 2022 revision of the World Health Organization Medication Safety Curriculum Guide **(4)** Expert witness for the House of Commons Select Committee Inquiry on Patient Safety 2009 **(5)** International advisor on studies of medication errors in Germany, Belgium, Canada, Slovenia, Saudi Arabia, Brazil and the USA.

Contributions to Field: (1) Medication errors research including; the first comparison between the UK ward pharmacy system and the US unit dose system in terms of incidence and types of medication administration errors, the first study of the use of mathematical modelling to study drug distribution systems, the first evaluation of the impact of "one stop dispensing" on administration errors, the development of the first validated method for assessing the clinical significance of medication errors and the first UK studies to explore the potential impact of direct observation on administration errors and the incidence and causes of prescribing errors in a UK hospital. **(2) Evaluation of technologies to improve medication Safety** work has included evaluation of the impact of various developments in pharmacy practice such as a ward-based closed loop electronic prescribing, automated dispensing, bar-code verification system; two different pharmacy-based dispensing "robots"; an internet-based educational package on medication safety, and the electronic prescription service in English primary care. As well as medication errors, these studies have explored changes in work patterns, stock utilisation and views of both staff and patients. **(3) The roles of patients and carers in medication safety** more recent work has looked at the concerns of patients and carers compared with those of healthcare professionals and medicines management at home during COVID-19. Research interest in equity in patient safety.

GARCIA-FINANA, Marta *(1) Professor of Biostatistics, Head of the Department of Health Data Science*
Institution of Population Health, University of Liverpool

Qualifications: PhD in Biostatistics, MSc statistics, BSC in Theoretical Physics

Project Role: Biostatistician

ORCID ID: 0000-0003-4939-0575

Grants Awarded: (1) DHSC & National Institute for Health Research, Understanding Mechanisms of Thrombosis and Thrombocytopenia in COVID-19 and with SARS-CoV-2 Vaccines (Co-I) 2021-22 **(2)** MRC Neuroscience and Mental Health Board**,** Brain architecture and function at epilepsy diagnosis: markers of pharmacoresistance and cognitive dysfunction (Co-I) 2019-23 **(3)** Horizon 2020 - EXCELLENT SCIENCE - Marie Sklodowska-Curie Actions, Developing novel tools and technologies to assess the safety and efficacy of cell-based regenerative medicine therapies, focusing on kidney disease RenalToolBox (Co-I) 2018-22) **(4)** MRC DPFS, Development of a novel blood test to aid the diagnosis of bacterial meningitis (Co-I) 2019-23 **(5)** DCMS**,** Covid-19 Risk assessment for the re-opening of events (Co-I) 2021-22 **(6)** NIHR, Developing implementation of ISDR variable-interval risk-based screening for diabetic retinopathy - external validation, implementation protocols and failsafe systems (Co-I) 2020-21 **(7)** DHSC, Liverpool COVID-SMART Pilot: Systematic Meaningful Asymptomatic Repeated Testing Evaluation (Co-I) 2020-21 **(8)** CRUK, Volatile OrganIc compounds for the Detection of Colorectal Cancer (Co-I) 2018-21 **(9)** Epilepsy Research UK, Neurodevelopment after prenatal exposure to seizures (Co-I) Study 2017-20 **(10) E**PSRC, Centre for Mathematical Sciences in Health Care (Co-I) 2016-20) **(11)** Horizon 2020, Repair of tissue and organ damage in refractory chronic graft versus host disease after hematopoietic stem cell transplantation by the infusion of purified allogeneic donor regulatory T lymphocytes. (643776, TREGeneration Co-I & PI for the UoL), 2015-21 **(12)** MRC, Discriminant Function Analysis for Longitudinal Data: Applications in Medical Research (DiALog, MR/L010909/1, PI) 2014-17

Positions, Scientific Appointments and Honours: (1) Fellow of the Royal Statistical Society **(2)** Head of the Department of Health Data Science, University of Liverpool, UK **(3)** Panel member of the MRC DPFS Funding Scheme Committee 2015-22 **(4)** Panel member of the NC3Rs grants assessment panel 2018-22 **(5)** Leader of the Liverpool Multivariate Modelling Research Group 2013-present. **(6)** Joint Editor of the journal Statistical Methods in Medical Research (2020-present

Contributions to Field: (1) Prediction models and statistical methodologies: Contributed to the development of prediction models and statistical methodologies using spatial and time-dependent information, with applications in the areas of infection, cancer, diabetes, age-related macular degeneration, pharmaco-resistance, among others **(2) Evaluation of the first trial of lateral flow tests for surveillance of COVID-19:** Led the statistical assessment of the performance of the SARS-CoV-2 antigen rapid lateral flow versus polymerase chain reaction testing in the asymptomatic general population conducted in Liverpool. **(3) Supporting the development and testing of medical devices, diagnostics and new therapies** as member of several funding panels (including the MRC Developmental Pathway Funding Scheme and the NC3Rs grants assessment panel). This has also alllowed her to play a part in changing practice, policy and regulations of animal experiments, with the aim to improve research reproducibility, minimise the use of animals and improve animal welfare.

GEORGIOU, Pantelis *(1)Professor of Biomedical Electronics: Imperial College London, Department of Electrical and Electronic Engineering (2) Director of Metabolic and Infection technology lab, Centre for Bioinspired Technology, Institute of Biomedical Engineering (3) Chief Scientist, Centre for Antimicrobial Optimisation*

Qualifications: ACGI, DIC, MEng, CEng, PhD, MIET, SMIEEE

Project Role: Chair of Tech and innovation theme research planning group

ORCID ID: 0000-0003-2476-3857

Grants Awarded: **(1)** The Wellcome Trust, Multi-dimensional Diagnostics for Rapid Detection of Infectious Diseases in Developing Countries (PI) 2020-2023 **(2)** BBSRC**,** Development and integration of a cortisol sensor with real-time read-out to an ambulatory microdialysis sampling system (Co-I) 2021-2023 **(3)** H2020, The Diamonds Project (Co-I) 2019-2024 **(4)** The Wellcome Trust, Innovative biomedical engineering and computational science to improve the management of critical illness in resource-limited settings, (PI) 2019-2022 **(5)** Global Challenges Research Fund, A novel rapid malaria diagnostic linking detection and surveillance (Co-I) 2019-2020 **(6)** BBSRC, PERP-ID- PoC diagnostic for lung pathogens of pigs (Co-I) 2019-22 **(7)** Rosetrees Trust Interdisciplinary Award, Development of an RNA-based test for accurate diagnosis of bacterial infection in children (Co-I) 2019-21 **(8)** EPSRC Intelligent Healthcare, ARISES: An Adaptive, Real-time, Intelligent System to Enhance Self-care of chronic disease" (EP/P00993X/1, PI) 2016-20 **(9)** NIH, Validation of transcriptomic Biomarkers for paediatric TB and development towards diagnostic tests (Co-I) 2017-21 **(10)** Imperial Confidence in Concept, Next generation diagnostics for rapid discrimination of Influenza at the point-of-care using Ion-FET digital Quantification on CHIP (PI) 2017-18 **(11)** NIHR i4i, Enhanced, Personalized and Integrated Care for Infection Management at Point of Care (Co-I) 2015-18 **(12)** EPSRC GCRF, Engineering Rapid and Sensitive Electronic Diagnostics for Infectious Diseases (PI) 2016-17

Positions, Scientific Appointments and Honours: **(1)** Steering Committee, EPSRC eFutures (https://efutures.ac.uk) 2019-Present **(2)** Chair, IEEE Biomedical Circuits & Systems (BIOCAS) Technical Committee, 2018- Present **(3)** Member at Large, IEEE Sensors Council, Circuits and Systems Representative. 2015-present, **(4)** Technical Committee Member, Biomedical Circuits & Systems (BIOCAS), IEEE Circuits & Systems Society 2008-present **(5)** Technical Committee Member, Sensory Systems (SS), IEEE Circuits & Systems Society 2012-present **(6)** Rosetrees Trust Interdisciplinary Prize 2018 **(7)** IEEE Sensors Council Technical Achievement Award 2017 **(8)** IEEE Circuits and Systems Distinguished Lecturer 2017-2018 **(9)** Institution of Engineering and Technology (IET), Mike Sergeant achievement award – 2013 Awarded to an engineering profession for outstanding achievement over a number of years **(10)** Imperial College London, Department of Electrical and Electronic Engineering – 2004 Governor's MEng Prize awarded to outstanding students

Contributions to Field: **(1) Novel Lab-on-Chip technology for rapid diagnostics** Expertise includes Lab-on-chip technology, molecular methods which allow the rapid detection of infectious diseases at the point of care. These methods have shown the fast (<20min from sample to result) and affordable detection of several pathogens (DOI: 10.1038/s41598-020-64612-1) **(2) Wearable Bio-inspired Microsystems** - Includes bio-inspired systems for management of chronic disease, closed-loop systems of optimizing antimicrobial delivery and wearable syndromic monitors for non-invasive risk prediction of infection severity (DOI:10.1109/TBME.2017.2787423) **(3) AI methods and decision support systems targeted towards infectious disease** including machine learning techniques for infection risk inference which can be used to create portable platforms for AMR management through the integration of clinical decision support systems with diagnostics (DOI: 10.3390/antibiotics10101267)

MASKELL, Simon *(1) Professor: Signal Processing/Electrical Engineering and Electronics, University of Liverpool*

Qualifications: MA, MEng, CEng, FIET , PhD (Engineering)

Project Role: Simulation scenarios

ORCID ID: 0000-0003-1917-2913

Grants Awarded: (1) EPSRC, Big Hypotheses (EP/R018537/1, PI) 2018-24 **(2)** EPSRC, Centre for Doctoral Training in Distributed Algorithms (EP/S023445/1 Director) 2019-27 **(3)** Fusion and Information Theory (DSTLX-1000143908, PI) 2020-21.

Positions, Scientific Appointments and Honours: (1) Editor, Applied AI Letters **(2)** Senior Area Editor, IEEE Signal Processing Letters **(3)** Associate Editor, IEEE Transactions on Aerospace and Electronic Systems **(4)** President, International Society of Information Processing **(5)** Senior QinetiQ Fellow, 2011-2013 **(6)** Royal Commission for Exhibition of 1851 Industrial Fellow, 2001-2003 **(7)** Winner of IEEE Donald G Fink Prize in 2019.

Contributions to Field: (1) Bayesian Statistics: My Research focuses on efficient simulation, particularly in challenging scenarios involving parameters that are high-dimensional. I am co-author of the most cited paper on “particle filters” (14,697 citations) which provides a tutorial on Particle Filters for On-line Nonlinear/Non-Gaussian Bayesian Tracking (DOI:10.1109/78.978374.) **(2) State-of-the-art data science techniques:** My research interests alo include Big Data, autonomous systems, tracking and data fusion. I have developed a model that is one of those used by UK government to calculate R-number for COVID-19, and the only one developed by engineers and not epidemiologists; Patent (0315349.1) on performing an exponentially large calculation in approximately-linear time.

O'HARE, Danny *(1) Professor of Biosensor Technology, Imperial College London*

Qualifications: BSc Chemistry, Associate Royal College of Science, Diploma of Imperial College, PhD Biomedical Engineering, Chartered Chemist, Fellow of the Royal Society of Chemistry

Project Role: microneedle and other biosensor technology

ORCID ID: 0000-0002-0820-2999

Grants Awarded: (1) Innovate UK Smart Award ReCare - A Smart Point-Of-Care Breath Analyser (PI) 2020-2022 **(2)** Innovate UK Smart Award, BioPAD: Biosensors for Personalised Antimicrobial Dosing (PI) 2018-2020 **(3)** Cancer Research UK. Engineering and validation of a modular and non-invasive screening tool for cancer (Co-I) 2018-2020

Positions, Scientific Appointments and Honours: **(1)** Professor of biosensor technology, Department of Bioengineering, Imperial College **(2)** Director, MRes Medical Device Design & Entrepreneurship **(3)** Member of the Royal Society of Chemistry (4) Member of the Electrochemical Society **(5)** Member British Society for Matrix Biology

Contributions to Field: **(1) Strong, unidirectional, redox-responsive promoter to improve the performance of electrogenetic systems** (DOI: 10.1126/sciadv.abm5091) **(2) Proof-of-principle probes which can detect short nucleic acids from liquid biopsies** to be used as a diagnostic biomarker for prostate cancer (DOI:10.1016/j.bios.2020.112891) **(3) Exhaled breath condensate based breath analyser using a disposable hydrogen peroxide sensor and smart analyse**r (DOI: 10.1039/c9an02438g)

PIRMOHAMED, Munir (*1) David Weatherall Chair of Medicine, University of Liverpool, and Consultant Physician, Liverpool University Hospital NHS Foundation Trust.*

Qualifications: MBChB (Hons, Univ of Liverpool), PhD (Pharmacology, Univ of Liverpool), FRCP (London), FMedSci (Academy of Medical Sciences).

Project Role: Medicines management, workflows for personalised therapies

ORCID ID: **0000-0002-7534-7266**

Grants Awarded: (1) EU Commission, **Instand-NGS4P: Integrated and standardized NGS workflows for personalised therapy (**Co-applicant) 2019-24 **(2) H**ealth Data Research UK, **HDR-UK North: Better Care Northern Partnership (Director)** 2020-23 **(3)** MRC/NIHR, **Multimorbidity mechanism and therapeutics research collaborative** (Co-I, Liverpool lead) 2021-23 **(4)** NIHR HTA, **An adaptive-design randomised placebo-controlled trial of baclofen in the treatment of alcohol use disorder in patients with liver cirrhosis (**Co-chief investigator) 2021-26 **(5)** NIHR Program Grant, **Personalising renal function monitoring and interventions in people living with heart failure** (PI) 2021-26 **(6)** MRC DPFS, **AGILE: Seamless Phase I/IIa Platform for the Rapid Evaluation of Candidates for COVID-19 treatment** (co-applicant) 2021-23 **(7)** Wellcome Therapeutics Accelerator, **AGILE: Seamless Phase I/IIa Platform for the Rapid Evaluation of Candidates for COVID-19 treatment** (co-applicant) 2021-23

Positions, Scientific Appointments and Honours: (1) David Weatherall Chair of Medicine, 2013–to date **(2)** Director of the NW England MRC Clinical Pharmacology Training Scheme, 2010–to date **(3)** Director MRC Centre for Drug Safety Science, July 2014–to date **(4)** Director Wolfson Centre for Personalised Medicine, 2009 – to date **(5)** Director HDR UK North, 2020-to date **(6)** NHS Chair of Pharmacogenetics, 2007-to date **(7)** Honorary Consultant Physician, 1996 –to date **(8)** Knights Bachelor, Queen's Birthday Honours, June 2015, for services to Medicine **(9)** Non-Executive Director, NHS England/Improvement, 2019-to date **(10)** Member, Governing Council of the Medical Research Council, 2018- to date **(11)** Member, REF sub-panel UoA1: Clinical Medicine 2018-22 **(12)** President, British Pharmacological Society, 2020-21 **(13)** Chair, Commission on Human Medicines, 2021 – to date

Contributions to Field: (1) Defining the problem of adverse drug reactions (ADRs) to healthcare: I have led the largest studies in the world in both adults and children highlighting the public health and financial costs of ADRs. The full text of our seminal 2004 article (DOI: 10.1136/bmj.329.7456.15) has been viewed over 105,000 times and the findings have informed regulatory interventions worldwide **(2) Identification of genetic predisposing factors for ADRs:** We have been pioneers in identifying genetic predisposing factors for both immune-mediated (including HLA gene predisposing factors for abacavir, carbamazepine, flucloxacillin, clozapine, nevirapine and amoxicillin), and non-immune mediated (warfarin dosing, aspirin-induced peptic ulceration and corticosteroid-induced adrenal suppression in children). A warfarin dosing algortithm was shown to have a clinical utility in a randomised trial, while a trial of a multi-gene pharmacogenetic panel (PREPARE) has just been completed and reduced ADRs by 33%. **(3) Protecting public health**: Because of my expertise in clinical pharmacology and pharmacovigilance, I was Commissioner of Human Medicines from 2002 to 2021, and Chair of its Pharmacovigilance Expert Advisory Group. I took over as Chair of the Commission on Human Medicines in March 2021. This has led to evaluation, advice, licensing and label changes for many drugs including those with safety issues (with withdrawal of some medicines where the benefit-risk was negative to protect public health). I also chaired the Vaccine Benefit-Risk Expert Working Group for the MHRA which was responsible for licensing the COVID-19 including the first licences globally for the Pfizer and AstraZeneca vaccines.

RAWSON, Timothy *1. NIHR Academic Clinical Lecturer, Imperial College Healthcare NHS Trust 2. Honorary Clinical Lecturer Imperial College London Centre for Antimicrobial Optimisation and Health Protection Research Unit in HCAI and AMR*
Qualifications: MBBS (Imperial College London), BSc (hons, Imperial College London), PG Diploma Medical Education (Cardiff University), Diploma in Tropical Medicine & Hygiene (DTM&H, Royal College of Pathologists), MRCP UK, PhD (Imperial College London).

Project Role: CDSS, biosensor technology, PK-PD, closed loop control

ORCID ID: **0000-0002-2630-9722**

Grants Awarded: **(1)** British Infection Association, Exploring therapeutically beneficial drug-drug interactions to support the optimised use of oral antimicrobial agents**, (**PI**)** 2021-2022 **(2)** World Health Organisation**,** Infection prevention and control in the context of the COVID-19 epidemic, understanding, monitoring and mitigating the impact of the pandemic on HCAI and antimicrobial resistance in in acute care, for both COVID-19 and non-COVID-19 patient populations. **(**Co-I**)** 2020-2021 **(3)** National Institute for Health Research, Health Protection Research Unit in HCAI and AMR at Imperial College (Theme Lead Researcher) 2020-2025 (**4)** Department of Health and Social Care**,** Centre for Antimicrobial Optimisation. **(**Co-I), 2020–2022 **(5)** Wellcome Trust, Optimising Antimicrobial use in humans: a roadmap (Co-I**)** 2020-2020 **(6)** Imperial College COVID-19 Rapid Research Fund**,** Electronic Clinical Decision Support for Antibiotic Use with COVID-19 Patients. (Co-I) 2020-2020 **(7)** Merieux Foundation Research Grants, Imperial College Real-time Enhanced Antimicrobial Control Trial. (Co-I) 2017-2019 **(8)** Imperial Biomedical Research Centre, Real-time Enhanced Antimicrobial Control (Co-I) 2017 - 2019 **(9)** EPSRC EMBRACE Pump Priming Seed Project Award**,** Real-time Enhanced Antimicrobial Control (PI) 2016-/2017 **(10)** Imperial BRC PPI/E strategic grant, Setting Priorities for Research: Involving citizens (Co-I**)** 2016-2016

Positions, Scientific Appointments and Honours: **(1)** European Society of Clinical Microbiology and Infectious Diseases, Young Investigator Award. 2022 **(2)** Editor, Communication Medicine, Springer Nature 2021 onwards **(3)** Research Editor, Frontiers in Digital Health – 2020 onwards **(4)** European Society of Clinical Microbiology and Infectious Diseases (ESCMID) European Committee on Infection Control (EUCIC) working group. 2017 – 2018 **(5)** EUCIC-ESGAP-EUCAST working group on selective antimicrobial reporting working group member 2018 – 2019 **(6)** ESCMID Trusted Reviewer. 2017 onwards **(7)** ESCMID PK/PD of Anti-Infectives Study Group (EPASG) member. 2016 onwards

Contributions to Field: **(1) First-in-human Clinical Trial of an Investigational Medicinal Product in antimicrobial PK-PD (2) First-in-human trials of microneedle-based biosensors and closed loop controllers for AMR** providing proof-of-concept of real-time, microneedle sensing of penicillin in vivo. **(3) AI-based clinical decision support for antimicrobial prescribing**. A suite of projects developing case-based reasoning algorithms using routine data and demonstrating their utility for decision support in prescribing and diagnostics.

SCULPHER, Mark (1) *Professor of Health Economics, Director of the Centre for Health Economics, University of York (2) Co-Director of the NIHR Policy Research Unit in Economic Methods of Evaluation in Health and Social Care Interventions (EEPRU).*

Qualifications: BA (Hons) Economics, MSc Health Economics, PhD.

Project Role: Health economist

ORCID ID: 0000-0003-3746-9913

Grants Awarded: (1) GCRF/ Medical Research Council, Thanzi la Onse (Health of All): Frameworks and analysis to ensure value for money health care - developing theory, changing practice (PI) 2017-21 **(2)** NIHR Policy Research Programme, Economic Methods of Evaluation in Health and Social Care Interventions (PI) 2019-23 **(3)** NIHR Policy Research Programme, Public Health Policy Research Unit (Co-I):2019-23 **(4)** NIHR Policy Research Programme Economic Methods of Evaluation in Health and Social Care Interventions, Evaluation of two antibiotics as a pilot study for a NICE appraisal programme (PI)2021-22

P**ositions, Scientific Appointments and Honours: (1)** Member of the National Institute of Clinical Excellence Technology Appraisal Committee, 2003-08 **(2)** Member of the NHS Health Technology Assessment Programme Commissioning Board, 2003-08 **(3)** Member of the National Institute of Health and Clinical Excellence Public Health Interventions Advisory Committee, 2005–09 **(4)** Member of the UK Clinical research Collaboration Clinical Trials Unit Registration Review Committee, 2007 **(5)** Member of the Methodology Working Party for the methods for health technology assessment for the National Institute of Clinical Excellence, 2007 **(6)** Member of the National Institute for Health Research/Medical Research Council's Methodology Research Panel, 2008-11 **(7)** Member of the National Institute for Health Research Methodology Review Panel, 2008-09 **(8)** Member of the NICE Diagnostics Advisory Committee, 2010-20 **(9)** Member of the Department of Health's Policy Research Programme Commissioning Panel, 2011-14 **(10)** President and Board Member for the International Society for Pharmacoeconomics and Outcomes Research, 2010-11 **(11)** Member of the International Advisory Panel for the Agency for Care Effectiveness, Singapore Ministry of Health 2017-19 **(12)** Member of National Screening Advisory Body Group, 2020- to date

Contributions to Field: (1) Health Economics: I have worked in the field for over 30 years and have conducted on economic evaluations of a range of technologies including heart disease and various cancers. I have also contributed to methods in the field, in particular relating to decision analytic modelling and handling uncertainty. My work in antimicrobial resistance has been in the context of the Government's novel funding arrangements for selective new antimicrobial products. I led a project to develop a framework for assessing the value of new antimicrobials under a programme of evaluation at NICE. I also led a pilot project to evaluate two new specific antimicrobials that published in 2022.

SOFAT, Recha (*1) Breckenridge Chair in Clinical Pharmacology & Therapeutics, University of Liverpool (2) Head of Department, Pharmacology and Therapeutics, University of Liverpool (3) Associate Director and Cohort Theme Lead, British Heart Foundation Data Science Centre, led by Health Data Research UK*

Qualifications: Fellow of the Royal College of Physicians, PhD, University College London, MBBS, University College London, MSc Epidemiology, London School of Hygiene and Tropical Medicine

Project Role: clinical pharmacologist

ORCID ID: 0000-0002-0242-6115

Grants Awarded: (1) HDRUK, Creating a Medicines Resource for analysis of medicines data in electronic health records (PI) 2022-22 **(2)** HDRUK, How can routine linkage of medicines to health outcomes enable better understanding of the direct and indirect effects of COVID-19 on clinical pathways. (PI) 2022-23 **(3)** Wellcome Trust Collaborative Award, Prediction of complications of diabetes mellitus utilising novel retinal image analysis, genetic and linked electronic health record data (Co-I) 2022-25 **(4)** MRC, Multimorbidity Mechanism and Therapeutic Research Collaborative, 2021-(Co-I) 2024 **(5)** MRC, Consortium Against Pain inequity, The impact of adverse childhood experience of chronic pain and response to treatment (Co-I) 2021-25 **(6)** Medicines Discovery Catapult, Assessing a multi-modal approach to drug repurposing, 2020-21 **(7)** UCLH Charitable Trust, Redefining stroke biologically to prioritise accurate diagnosis of stroke (PI) 2019-20 **(8)** Dunhill Medical Trust, Investigating the causal role of lipid pathways in age-related macular degeneration (PI) 2018-21

Positions, Scientific Appointments and Honours: (1) Vice President Clinical, British Pharmacological Society **(2)** Member, Pharmacovigilance Expert Advisory Group, MHRA **(3)** Member, UK Longitudinal Linkage Collaboration Advisory Committee **(4)** Chair, Joint Specialist Committee, Royal College of Physicians **(5)** Associate Editor, British Journal of Clinical Pharmacology **(6)** NIHR CRN lead North Thames, Genetics **(7)** FLIER programme, Academy of Medical Sciences **(8)** Chair, Joint Formulary Committee North Central London Awards and positions of Esteem

Contributions to the field: (1) Data to understand disease: My research looks to fully utilise the rich health data that is already collected within the NHS to better understand the causes and consequences of disease and so improve health outcomes. I develop methods to create custom disease cohorts as well as investigating individualised treatment strategies (DOI: 10.2139/ssrn.4103143, 10.1056/NEJMc2005396, 10.1101/2021.12.31.21268587) **(2) Drug development:** I am interested in making and using medicines better by embedding research into routine health care. Mechanisms for funding and access are also of relevance (DOI: doi.org/10.1111/bcp.15094, 10.1111/bcp.14409. **(3) Use of medicines:** As well as publishing on efficacy, safety, and cost effectiveness of various treatment strategies, my work also encompasses better use of medicines more generally, including addressing overprescribing and policy (DOI: 10.1111/bcp.14291, doi: 10.1111/bcp.14546)

STOTT, Katherine *(1)* NIHR Academic Clinical Lecturer in Infection Pharmacology, Antimicrobial Pharmacodynamics and Therapeutics Group, University of Liverpool, UK

Qualifications: MBChB (honours; University of Liverpool), PhD (Infection Pharmacology; University of Liverpool), MRCP (London), Diploma Tropical Medicine & Hygiene (Liverpool School of Tropical Medicine), MSc (Liverpool School of Tropical Medicine), MRes (Distinction; University of Liverpool)

Project Role: infection pharmacology, PK-PD

ORCID ID: 0000-0001-7079-7957
Grants Awarded: (1) NIHR Academic Clinical Lectureship (PI) June 2021 – Present **(2)** Wellcome Trust Clinical PhD Fellowship to address health needs in resource limited settings (203919/Z/16/Z, Clinical Research Fellow) 17 – 21

Positions, Scientific Appointments and Honours: (1) NIHR Academic Clinical Lecturer in Infection Pharmacology, University of Liverpool **(2)** Specialist Registrar in Clinical Pharmacology and Internal Medicine, Liverpool University Hospitals NHS Foundation Trust

Contributions to the Field: (1) Infection Pharmacology. She has researched and published on the Pharmacokinetics and pharmacodynamics of several drugs including Itraconazole, Amphotericin B Deoxycholate, Fluconazole, rifampicin and on antifungal agents for HIV-associated invasive fungal infections.

TARRANT, Carolyn (1) *Professor: Department of Health Sciences, University of Leicester*

Qualifications: BSc (Psychology), University of Leicester; PhD (Psychology), University of Leicester

Project Role: Chair, Context, Culture and Behaviour theme research planning group

ORCID ID: 0000-0001-7356-5342

Grants Awarded: **(1)** CREATE NIHR, Global Health Research Group on collaborative care for cardiometabolic disease in Africa. (Co-I) 2021-24 **(2)** MRC, Strategies to Reduce the Burden of Antibiotic Resistance in China (Co-I), 2019-23 **(3)** Joint Research Councils UK/ESRC, Antimicrobial resistance as a social dilemma: Approaches to reducing broad-spectrum antibiotic use in acute medical patients internationally. (PI) 2017-18 **(4)** Joint Research Councils UK/ESRC, Improving antibiotic usage and post-operative outcomes along the surgical pathway (Co-I) 2017-21

Positions, Scientific Appointments and Honours: (1) Charted psychologist, British Psychological Society (2008) **(2)** Assistant Editor for the journal BMJ Quality & Safety.

Contributions to Field: (1) Lead of the Social Science Applied to Healthcare Improvement Research (SAPPHIRE) Group, University of Leicester, with expertise in qualitative methods, including ethnographic methods in applied healthcare research **(2) Expert in research into infection control, antibiotic overuse and AMR** with a track record spanning 12 years and significant experience of leading qualitative work packages within large interdisciplinary projects in the UK and internationally.

TURNER, Mark *(1) Professor of Neonatology and Research Delivery, Institute of Life Cycle and Medical Sciences (2) Director of Research, Development, and Innovation and Honorary Consultant Neonatologist, Liverpool Neonatal Partnership and Liverpool Women's NHS Foundation Trust.*

Qualifications: BSc (St. Andrews), MBChB(Hons) (Manchester), PhD (Manchester), DRCOG, MRCP(UK), FRCPCH, FFPM(Hon)

Project Role: neonates

ORCID ID: 0000-0002-5299-8656

Grants Awarded: (1) Innovative Medicines Initiative*,* conect4children, (co-Coordinator, lead for two Work Packages and external stakeholder management) 2018–24 **(2)** Horizon 2020, European Joint Programme for Rare Disease co-fund *(825575;* lead for paediatrics) 2018–23 **(3**) Horizon 2020, European Paediatric Translational Research Infrastructure (*777554*; lead for paediatrics), 2018–21 **(4)** EME, The efficacy and mechanism of surfactant therapy for critically ill infants with bronchiolitis: the Bronchiolitis Endotracheal Surfactant Study (15/21/01; neonatal lead) 2017-23 **(5)** Horizon 2020, PedCRIN: paediatric enhancements to ECRIN (731046)*.* 2017–2021

Positions, Scientific Appointments and Honours: (1) co-Coordinator, pan-European paediatric clinical trials network conect4children (c4c) 2018 - present **(2)** Honorary Fellow of the Faculty of Pharmaceutical Medicine 2017 for outstanding contributions to pharmaceutical medicine, particularly industry-academic collaborations **(3)** European Director of the International Neonatal Consortium 2016–present, leadership of the leading global pan-stakeholder, pre-competitive forum to develop regulatory science in neonatal medicine **(4)** Commissioner, Lancet Child and Adolescent Health Commission on the future of Neonatology 2022–present; **(5)** President, European Society for Developmental, Perinatal, and Paediatric Pharmacology 2019–22 **(6)** Chair, European Network for Paediatric Research at the European Medicines Agency (2013–19)

Contributions to Field: (1) European pan-speciality paediatric clinical trials research network: I conceived and implemented this network integrating 21 national hubs that support clinical trial implementation by coordinating a public-private partnership accounting for the needs of 10 large originator Pharmaceutical companies. The network provides expert advice, training, data science, and PPI across paediatrics with similar efforts in North America and Japan and in rare diseases **(2) Clinical studies of 18 molecules in neonates.** I have led / contributed to Phase 0, microdosing, Phase 1, first in human, – Phase 3 trials including 7 antimicrobials and 3 excipients **(3)** C**linical pharmacovigilance** expertise in neonates and children; experienced with regulatory processes, including contributing to five paediatric investigation plans.

Key Researchers from CAMO-Net India

BHATTACHARYA, Sanjay *(1) Senior Consultant in Microbiology Tata Medical Center, Kolkata (2) Head of the Department of Microbiology*

Qualifications: MBBS (North Bengal Medical College), MD (Medical Microbiology from JIPMER), DNB, DipRCPath, FRCPath (Microbiology and Virology), CCT (UK)

Project Role: Molecular diagnostics

ORCID ID: **0000-0003-4139-1039**

Grants Awarded: (1) DBT, Application of real-time PCR for the diagnosis of invasive candidiasis and aspergillus's in immuno-compromised patients in an oncology centre. Department of Biotechnology, India (No.BT/PR4884/MED/29/394/2012) **(2)** ICMR, Regional Centre for Antimicrobial Resistance Surveillance Network. Indian Council of Medical Research (AMR/RC/63/2014-ECD-II) 2017-22 **(3)** CDC grant: Capacity Building and Strengthening of Hospital Infection Control to detect and prevent antimicrobial resistance in India. 2017-2021

Positions, Scientific Appointments and Honours: (1) With WHO> Priority Pathogen List for Antibiotic Resistant Bacteria. **(2)** With WHO> On implementation strategies for the WHO Guidelines for the prevention and control of Carbapenem-Resistant Organisms> working group member of Environmental Cleaning and **Disinfection (3)** Expert in the WHO Technical Consultation on In Vitro Diagnostics for AMR **(4)** With the UK-PHRST CLEAN Workshop: 21st - 22nd June 2022 on Research questions in Environmental Cleaning and Disinfection of Healthcare Organizations > This workshop was convened by the UK Public Health Rapid Support Team (UK-PHRST) in partnership with Stellenbosch University. The UK Public Health Rapid Support Team is funded by UK Aid from the Department of Health and Social Care and is jointly run by UK Health Security Agency and the London School of Hygiene & Tropical Medicine. **(5)** Editor in Chief, Journal of the Academy of Clinical Microbiologists

Contributions to Field: (1) Diagnostic Microbiology: Facilitated the development, validation and clinical use of several low cost molecular tests in at Tata Medical Center, Kolkata **(2) Capacity Building:** Started a Clinical Microbiology Fellowship program for post MD/DNB Microbiology doctors in India at Tata Medical Centre, Kolkata and an MSc-PhD course in Molecular Medical Microbiology at Tata Medical Centre in Kolkata with Indian Institute of Technology at Kharagpur, India **(3) Infection Prevention and AMR** Contributed to the National Guidelines for Infection Prevention and Control in Healthcare Facilities, National Centre for Disease Control, Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India. Edited the Standard Operating Procedures. Bacteriology. Antimicrobial Resistance Surveillance and Research Network 2nd Edition, 2019. Indian Council of Medical Research (ICMR), New Delhi. https://main.icmr.nic.in/sites/default/files/guidelines/Bacteriology_SOP_2nd_Ed_2019.pdf

CHANDY, George *(1) Director and CEO*, BELIEVERS CHURCH MEDICAL COLLEGE HOSPITAL, Kerala *(2) Professor of Gastroentrology*

Qualifications: MD, DM (Gastro), PGDHA, FRCP, FIHS, Fellowship in Liver Transplantation

Project Role: Infection prevention, health economics, surgical pathways

ORCID ID: 0000-0002-7742-0383

Grants Awarded: (1) ICMR, Advanced Centre for Liver Diseases at CMC, Vellore (PI and Head) 2007-12 **(2)** BMS Foundation Award for a National Hepatitis B Awareness Programme AHBAAS, 2007-10

Positions, Scientific Appointments and Honours: (1) Life Member - Indian Society of Gastroenterology **(2)** Life Member - Indian National Association for Study of the Liver **(3)** Fellow of the Royal College of Physicians **(4)** Panel Member, Medical Council of India expert Committee for Post Graduate Education **(5)** University Grant Commission (2009-2010) + Member of Governing Committee - to recognise Institute of Liver and Biliary Sciences, New Delhi **(6)** Life Member - Christian Medical Association of India **(7)** Dr. B.C. Roy National Award awarded by the Medical Council of India and presented by the President of India for the year 2006, for excellence in leadership in healthcare. This is the highest award in the field of Medicine.

Contributions to Field: **(1) Hepatology and Liver Transplantation in India:** I have been a pioneer in this field raising awareness regarding HBV infection and the value of vaccination in eradicating the infection. I have established sustainable liver transplant programmes for India setting up a chain of mission hospitals in the country to serve the poor, the needy and the marginalized. **(2) Capacity Building:** Networking with other centres in the country offering training and opportunities to share expertise. I have helped train leaders for cost effective, efficient healthcare for our country **(3) Identifying cost effective strategies** to improve quality of care in the healthcare sector, including identifying and initiating programmes to contain and prevent hospital infection

Key Researchers from CAMO-Net India

DUTTA, Sourabh *(1) Professor, Division of Neonatology, Dept of Pediatrics, Post Graduate Institute of Medical Education and Research PGIMER, India.*

Qualifications: MBBS, MD (Pediatrics), PhD (Neonatology)

Project Role: Neonatal sepsis, with particular reference to diagnostics, antibiotic regimens

ORCID ID: 0000-0002-5595-8289

Grants Awarded: **(1)** Department of Biotechnology India, The effect of maternal nutrient intake and nutritional status on breastmilk microbiome and early infancy growth, among preterm mother-infant dyads (BT/PR43196/MED /97/592/2021) 2022-Ongoing **(2)** Department of Health Research India, Fully automated device for performing exchange transfusion through umbilical venous route in neonates: evaluation of safety and efficacy (R.11013/12/2021-GIA/HR) 2021-Ongoing **(3)** ICMR, Identification and characterisation of specialised cells in human milk which harbour commensal bacteria (RBMH/FW/2020/25) 2021-Ongoing **(4)** ICMR, Comparison of the efficacy of a 7-day versus a 14-day course of intravenous antibiotics in the treatment of uncomplicated neonatal bacterial sepsis: a randomized controlled non-inferiority trial (5/7/329/2009) 2018-Ongoing **(5)** ICMR, Effectiveness Of A Multicentric Randomized Population Based Trial For Prevention And Control Of Oral Diseases In 0-6 Year Old Children In Rural India (5/4/2-1/TF/Chandigarh/2018-NCD-II) 2018-Ongoing **(6)** ICMR, Factors affecting the composition of breast milk microbiome of Indian mothers delivering preterm (Project ID: 2019-5759) 2019-Ongoing **(7)** Department of Science and Technology (DST)-PGI Biomedical instrumentation hub, Machine for performing double volume exchange transfusion through umbilical route in neonates: prototype development) 2018-21 **(8)** ICMR-DBT Joint Working Group, Pathogenic bacteria in maternal breast milk and their role in neonatal gut colonization and sepsis (BT/DBT-ICMR/JWG/02/2018, 5/7/1593/2017-RBMH&CH, PI) 2018-21 **(9)** DBT, Diagnosis of neonatal bacterial meningitis by 16S rRNA gene-based universal primer PCR and procalcitonin assay of CSF (BT/PR 13462/MED/29/957/2015, PI) 2016-20 **(10)** Chandigarh DST, Determination of association between Glucose-6-Phosphate Dehydrogenase Deficiency and Retinopathy of Prematurity in Chandigarh: a case-control study, India (S&T&RE/RP/147(18-19)/sanc/10/2018/1498-1505, PI 2018-19 **(11)** Chandigarh DST, Diagnostic accuracy of cell surface biomarkers (CD64, CD11b, HLA-DR) in late onset neonatal sepsis in preterm neonates, (S&T/sanc/07/2015/738-743) 2015-16 **(12)** Translational Health Sciences and Technology Institute, Diversity of milk microbiota in lactating mothers (PI) 2015-19 **(13)** Hamilton Academic Health Sciences Organization, Effect of Cohorting Patients by Level of Acuity to Designated Areas within a Neonatal Intensive Care Unit (PI) 2013-17 **(14)** DBT India, Comparison of stool colonization in premature infants by 3 dose regimes of a probiotic combination: a randomized controlled trial (BT/PR-6020/PID/20/226/2005, PI) 2005-09 (15) ICMR, Delhi, A study of the role of Polymerase Chain Reaction in the Diagnosis of Vertically Acquired Newborn Sepsis (RFC No. Adhoc/RHN/12/02-03, PI) 2003-06

Positions, Scientific Appointments and Honours: **(1)** Fellow of the National Academy of Medical Sciences **(2)** Fellow of the National Neonatology Forum **(3)** President NNF's award for rendering Outstanding Service For Promotion Of Newborn Health Care in the year 2021

Contributions to Field: **(1)** Several publications and projects in the field of neonatal sepsis, with particular reference to diagnostics, antibiotic regimens, meningitis **(2)** Several ongoing projects in the field of breast milk microbiome **(3)** Several publications in the field of retinopathy of prematurity

GOTA, Vikram *(1) Professor, Department of Clinical Pharmacology, Advanced Centre for Treatment, Research and Education in Cancer (ACTREC), Tata Memorial Centre (2) Associate Professor, Division of Life Sciences, Homi Bhabha National Institute, Mumbai, India - 400094*

Qualifications: MBBS, MD Pharmacology, Post Graduate Diploma in Clinical Trials

Project Role: Clinical pharmacology

ORCID ID: **0000-0001-6348-6667**

Grants Awarded: **(1)** Fogarty International Centre, NIH, USA. (Ref # R01TW010651-01; Co-I) 2017-22 **(2)** TMC- Research Administrative Council Intramural Grant. (Ref # NA; Co-PI) 2017-22

Positions, Scientific Appointments and Honours:

Contributions to the Field: **(1) Clinical pharmacology and experimental therapeutics:** having established a therapeutic drug monitoring laboratory in our hospital he has conducted several early phase clinical trials including first-in-human studies of anticancer drugs. Devised strategies for optimal dosing of anticancer drugs anti-infectives and immunosuppressants through clinical pharmacokinetic studies. **(2) Development of therapeutic interventions for various cancers** Developed a drug for the prophylaxis and treatment of graft versus host disease (GvHD), a complication of bone marrow transplantation. Phase II studies will soon be initiated. Have also established animal models of radiation injury. One of the radioprotectors developed in-house is currently in phase II clinical trials. Having established the need for pediatric friendly liquid formulations of anticancer drugs, two liquid formulations are currently under development in collaboration with a pharmaceutical company **(3) Capacity Building and training in Pharmacology** Commenced a fellowship in oncotherapeutics: impart training on the application of clinical pharmacology in cancer therapeutic. Currently supervise 5 doctoral students.

Key Researchers from CAMO-Net India

KAKKAR, Ashish Kumar ***(1)*** *Associate Professor, Clinical Pharmacology Unit, Dept. of Pharmacology, Postgraduate Institute of Medical Education and Research, Chandigarh, India*

Qualifications: **MBBS** (Maulana Azad Medical College, University of Delhi), **MD (Pharmacology**, Lady Hardinge Medical College, University of Delhi), **DM (Clinical Pharmacolo**gy, All India Institute of Medical Sciences, New Delhi)

Project Role: Clinical pharmacology

ORCID ID: 0000-0001-7768-7304

Grants Awarded: (1) Department of Science and Technology, India (PI), 2018-22 **(2)** ICMR Advanced Centre for Clinical Pharmacology for Antimicrobial Stewardship and Research (Co-PI) 2018-22 (3) ICMR Product Development Centre (Co-PI), 2019-24)

Positions, Scientific Appointments and Honours: Convener, Institute Ethics Committee (Extramural - Biomedical and Health Research), PGIMER

Contributions to field: (1) Development and piloting of tool for assessment of rationality of antimicrobial prescriptions in resource limited settings (Antibiotics 2021;10(2)) **(2) Multicentre point prevalence survey** of antimicrobial use amongst admitted patients in tertiary care centres in India (J Antimicrob Chemo 2021;76(4):1094-1101) **(3) Antimicrobial use guidelines:** Participated in guideline development for Antimicrobial Usage in Intensive Care Units and Inpatients and Outpatients of PGIMER

Key Researchers from CAMO-Net India

KAUR, Manmeet *(1) Professor of Health Promotion at the Department of Community Medicine and School of Public Health, Post Graduate Institute of Medical Education and Research, Chandigarh*

Qualifications: Ph.D. (Sociology), M.A. M.Phil. (Sociology) | M.A. (Economics) PG Diploma in Nutrition & Health Education

Project Role: Health promotion

Google scholar profile: https://scholar.google.com/citations?user=saijeNEAAAAJ&hl=en

Grants Awarded: **(1)** WHO India, Training to implement multisectoral actions for prevention and control of NCDs: A pilot testing and finalization of training modules, 2021-21 **(2)** UNICEF New Delhi, Comprehensive National Nutrition Survey, 2015-18 **(3)** Respectful Maternal Care in Punjab: A Qualitative Study for Advocacy. Centre for Catalysing Change, 2016–20 **(4)** National Rural Health Mission, Haryana, External Evaluation of Impact of BCC/IEC Activities on Health Indicators with a special focus on Sakshar Mahilla Samooh (SMS) groups in Haryana, 2012-14 **(5)** ICMR, Reducing Health Inequalities among Sexual Minorities in India, 2016-19 **(6)** NRHM, Chandigarh administration, Reproductive and Child Health: A study on beliefs and practices of people from rural and slums of Chandigarh to develop a health communication strategy, 2012-13

Positions, Scientific Appointments and Honours: **(1)** Honorary Professorial Fellow at the George Institute for Global Health, Sydney, Australia **(2)** Council member of Global White Ribbon Alliance and Regional Coordinator of White Ribbon Alliance, India **(3)** Member of the Board of Studies, Central University of Himachal Pradesh, Dharamshala **(4)** Member Technical Advisory Group on Respectful Maternity Care, Indian Council of Medical Research, New Delhi **(5)** Member of the State Appropriate Authority and Advisory Committee of Pre-natal Diagnostic Techniques Act of two states and Gender-Based Violence, State Health System Resource Center, Haryana, India **(6)** Consultant (Process Change), European Commission, Haryana, 2002-2008 **(7)** Technical Specialist (Gender) Health & Nutrition Program, CARE INDIA, New Delhi, 2001-2002 **(8)** Project Officer (NPPPO), District Reproductive Health Project. United Nations Population Fund (UNFPA), New Delhi, 1997-2000.

Contribution to field: **(1) Health promotion and social demography** using both qualitative and mixed method approaches, he has large body of work examining beliefs and practices of defined groups and other risk factors that impact health seeking behaviours, decision making or disease **(2) Intervention development, piloting and assessment.** This aspect of research has seen the development of targeted interventions for HIV prevention and control but also projects designing the social (qualitative) component for interventions related to tackling antimicrobial resistance (AMR) in the environment and community in India and developing a communication and training package for health staff and patients related to antibiotic prescription and adherence **(3) Capacity building** as part of his interest in developing interventions with a number of projects which have looked to enhance human and institutional capacity for counselling in India.

Key Researchers from CAMO-Net India

KUMAR, Dinesh ***(1)*** Associate Professor, Community Medicine **Institution-** Dr. Rajendra Prasad Government Medical College, Himachal Pradesh, India.

Qualifications: MBBS, MD (community medicine)

Project Role: Health systems delivery and community medicine

ORCID ID: 0000-0003-3580-4415

Grants Awarded: (1) ICMR, A pilot study to assess community participation in National Tuberculosis Elimination Program (NTEP) using TB Community Score Card (TB-CSC) in Himachal Pradesh, India, 2022 **(2)** ICMR, Measuring association between birth weight and early childhood obesity in more than 6 years of age in an established birth cohort of rural area of Himachal Pradesh, 2001 **(3)** Tribal Development Department (TDD), Government of Himachal Prades, Predictors of Spontaneous Abortions, Still Births and Early neonatal deaths in tribal areas of Himachal Pradesh, 2020 **(4)** Intramural Research Grant, Government of Himachal Pradesh, Capacity and trend assessment for maternal and neonatal care services of selected health facilities implementing Quality of Care (QoC) approach in Himachal Pradesh.

Positions, Scientific Appointments and Honours: (1) Vice-Chairman, State Task Force in involving medical colleges in National TB Elimination Program (NTEP), Himachal Pradesh, India **(2)** Member Secretary, Research Advisory Committee, Model Rural Health Research Unit, Himachal Pradesh, India **(3)** Member Secretary, Institute Ethics Committee, Dr. Rajendra Prasad Government Medical College, Himachal Pradesh, India **(4)** Member, State HIV Surveillance Committee, Himachal Pradesh, India **(5)** Lifetime member of Indian Association of Preventive and Social Medicine (IAPSM). Lifetime member of Indian Association of Public Health **(6)** Member, Self-Care Trail Blazer Group (SCTG): Evidence and Learning; Evidence Mapping and Prioritization. Member, Community Engagement Task Force, New Diagnostic Working Group (NDWG), Stop TB Partnership.

Contributions to Field- As an academic professional, the contribution to society is reflected through capacitating strengthening health care professionals in managing both communicable and non-communicable diseases through health care delivery system development. Research activities included community awareness campaigns for diseases and their risk factors, communicated to patients and the public in lay terms to enhance understanding.

Key Researchers from CAMO-Net India

LAKSHMI, PVM *(1) Professor of Epidemiology, Department of Community Medicine and School of Public Health, PGIMER, Chandigarh*

Qualifications: MBBS, MD (Community Medicine)

Project Role: Epidemiology

ORCID ID: 0000-0002-6921-9794

Grants Awarded: **(1)** Population Health Research Institute Canada, Prospective Urban and Rural Epidemiology (PI) 2009-to date **(2)** National AIDS Control Organisation India, Regional Institute for HIV Sentinel Surveillance in North India, 2010-11 **(3)** Ministry of Environment, Forest and Climate Change, National Environmental Health Profile 2019-to date

Positions, Scientific Appointments and Honours: (1) Member of Technical Resource Group of HIV Surveillance & Estimation **(2)** Member of High-level multidisciplinary team (MoHFW) for implementation of COVID-19 management **(3)** Nodal Officer In-charge of National Rabies control program **(4)** Nodal officer of Capacity Building for Public Health Emergency Management Training

Contributions to Field: (1) Community based Surveillance PI of the three largest community-based surveys namely Prospective Urban and Rural Epidemiology (PURE study), the Regional Institute for implementing HIV Sentinel Surveillance in Chandigarh, Punjab, Haryana, Himachal Pradesh, Jammu & Kashmir (North India), and the National Environmental Health Profile in North India. Has also undertaken multiple rounds of surveillance among key population groups, including, injecting drug users (IDUs), behavioural surveillance surveys (BSS), integrated bio-behavioural surveillance (IBBS), serosurveys, and mortality surveillance.

Key Researchers from CAMO-Net India

MALHOTRA, Samir (*1) Professor, Department of Pharmacology, PGIMER, Chandigarh*

Qualifications: MD, DM (Clinical Pharmacology)

Project Role: Clinical Research Pharmacology

Google scholar ID: https://scholar.google.com/citations?user=O6l-IXcAAAAJ&hl=en

Grants Awarded: (1) The ICMR centre for Advance Research proposal on Product Development.
(65/11/2018-PD/ICMR-CAR/BMS/CENTRE-3, PI) 2019-24 **(2)** Repurposing Econazole and adding to the shorter WHO regimen for MDR Tuberculosis (5/8/5/12/ITRC-THERAPEUTICS /2019/ECD-I, PI) from 2019-23 **(3)** Effectiveness and Safety of Nefopam Hydrochloride versus Tramadol in patients with Acute/Acute-on-Chronic pain: A Randomized, Parallel group Non-Inferiority study (PGI/IEC/2020/001258, PI) 2020-22 **(4)** Repurposing Clofazimine as part of the first-line Anti-Tb regimen in order to shorten the overall duration of treatment in patients with susceptible TB-CORTAIL (5/8/5/39/2018/ECD-I, PI) 2019-22

Positions, Scientific Appointments and Honours: **(1)** Professor and Head, Pharmacology, PGIMER, Chandigarh **(2)** Member of British Pharmacology Society **(3)** Member American College of Clinical Pharmacology **(4)** Recipient of the UK Seth Prize for Best paper presenter (**5)** Awarded Major Amir Chand Silver Medal for his work

Contributions to Field: (1) Pharmacokinetic and pharmacodynamic evaluation studies (Bone Marrow Transplantation 2019;54:2088-2095, Journal of Hypertension 2020;38(8):1593-1602 **(2) Antibiotic prescribing** (Therapeutic Advances in ID 2018;5(4):63-68, Indian J Med Res 2020;151(2-3):190-199) **and resistance patterns** (Therapeutic Advances in ID 2019;6) (**3) multicentric projects.**

Key Researchers from CAMO-Net India

MALLAYASAMY, Surulivelrajan ***(1)*** *Professor and Head: Department of Pharmacy Practice, Manipal College of Pharmaceutical Sciences, Manipal Academy of Higher Education, Manipal, India (2) Coordinator, Centre for Pharmacometrics*

Qualifications: MPharm | PhD (Population Pharmacokinetics-Pharmacometrics)

Project Role: PK-PD for individualised dosing

ORCID ID: 0000-0003-2568-5096

Grants Awarded: **(1)** ICMR Adhoc grant (5/7/1694/CH/Adhoc/RBMCH-2020, PI) 2021-23 **(2)** Extra Mural Fund by DST-SERB (EMR/2017/000458, Co-PI) 2018-20

Positions, Scientific Appointments and Honours: **1)** Vice-President, Society of Pharmacometrics and Health Analytics- SOPHAS https://sophas.net/ **(2)** Research Award by American College of Clinical Pharmacology, 2018 at annual symposium held at Maryland, USA **(3)** Secretary of Population Approach Group in India, an organization dedicated for training student and research community in India in the area of pharmacometrics from 2008 to 2020 **(4)** Member of Board of director for the Asian Pharmacometrics Network and organization dedicated for developing pharmacometrics in the Asia region **(5)** Coordinator of Centre for Pharmacometrics at Manipal Academy of Higher education, Manipal, which focuses on training, collaborative research and building human resource in the area of pharmacometrics

Contributions to Field: **(1) Population pharmacokinetics/pharmacometrics** including pharmacometrics focusing research in the area of dose individualization in the therapeutic areas in nephrology, neonatology and oncology. Part of the Consortium of Dose optimization (CODE), a consortium aimed for fostering collaborative research in the area of clinical pharmacology focussed on dose optimization

PALLAB, Ray *(1) Doctor of Medical Microbiology Postgraduate Institute of Medical Education and R3esearch, Chandigarh*

Qualifications: MD (Microbiology) from PGIMER, Chandigarh; Dip NB (Microbiology) from National Board of Examinations.

Project Role: Medical microbiologist

ORCID ID: 0000-0003-3369-2640

Grants Awarded: **(1)** PI: ICMR nodal center for surveillance of antimicrobial resistance in members of family Enterobacterales, since 2013. **(2)** Mapping of the mobile genetic elements and exploring alternative therapeutic options in carbapenem resistant Enterobacteriaceae- ICMR funded**. (3)** The resistome, mobilome and virulome of multi-drug resistant Escherichia coli from clinical, environmental and poultry isolates from India- ICMR funded.

Positions, Scientific Appointments and Honours: Life Member: 1)Founder Member Gastrointestinal Infection Society of India. 2)Hospital Infection Society of India. 3)Indian Association of Medical Microbiologists. President of the society 2020-2021. 4)Clinical Infectious Disease Society. 5)Indian Association of Mycoplasmalogists. 6) Indian Association of Pathologists and Microbiologists.7) Indian Biotechnology Society. 8)Indian Immunology Society. 9)Indian Medical Association.
10) Indian Society of Antibiotic Chemotherapy

Contributions to Field: Five recent publications:
An integrated surveillance network for antimicrobial resistance, India. Vijay S, Sharma M, Misri J, Shome BR, Veeraraghavan B, Ray P, Ohri VC, Walia K.Bull World Health Organ. 2021 Aug 1;99(8):562-571. doi: 10.2471/BLT.20.284406. Epub 2021 Jun 1.PMID: 34354311
Phenotypic and genotypic antimicrobial resistance in clinical anaerobic isolates from India. Sood A, Ray P, Angrup A.JAC Antimicrob Resist. 2021 Apr 17;3(2):dlab044. doi: 10.1093/jacamr/dlab044. eCollection 2021 Jun.PMID: 34223113
Impact of broad-spectrum antibiotic exposures and multidrug-resistant gram-negative bacteremia on hematopoietic cell transplantation outcomes. Kaundal S, Jandial A, Singh H, Chopra M, Kasudhan KS, Khaire N, Khadwal A, Prakash G, Jain A, Suri V, Patil A, Arora A, Sharma V, Ray P, Malhotra P, Lad DP.Transpl Infect Dis. 2021 Oct;23(5):e13717. doi: 10.1111/tid.13717. Epub 2021 Aug 29.PMID: 34431187
Evaluation of Antimicrobial Susceptibility Profile in Salmonella Typhi and Salmonella Paratyphi A: Presenting the Current Scenario in India and Strategy for Future Management. Veeraraghavan B, Pragasam AK, Ray P, Kapil A, Nagaraj S, Perumal SPB, Saigal K, Thomas M, Gupta M, Rongsen-Chandola T, Jinka DR, Shastri J, Alexander AP, Koshy RM, De A, Singh A, Evelyn Ebenezer S, Dutta S, Bavdekar A, More D, Sanghavi S, Nayakanti RR, Jacob JJ, Amladi A, Anandan S, Abirami BS, Bakthavatchalam YD, Sethuvel DPM, John J, Kang G.J Infect Dis. 2021 Nov 23;224(Supplement_5):S502-S516. doi: 10.1093/infdis/jiab144.PMID: 35238369
Comparative evaluation of agar dilution and broth microdilution by commercial and in-house plates for Bacteroides fragilis group: An economical and expeditious approach for resource-limited settings. Sood A, Angrup A, Ray P, Bala K.Anaerobe. 2021 Oct;71:102443. doi: 10.1016/j.anaerobe.2021.102443. Epub 2021 Sep 4.PMID: 3449236

PRINJA, Shankar *(1) Professor Health Economics, Institution (2) Department of Community Medicine and School of Public Health, Post Graduate Institute of Medical Education and Research, Chandigarh, India*

Qualifications: MBBS, MD (Community Medicine), DNB, MSc. (Health Policy, Planning and Financing)

Project Role: Health Economics

ORCID ID: 0000-0001-7719-6986

Grants Awarded: (1) Costing of Health Services in India (F.NO.T.11011/02/2017-HR; PI) 2018-22 **(2)** Support to conduct Online courses in Basic Health Economics and Economic Evaluation for HTA (R.12019/01/2018-HR; Course Coordinator) 2019-24 **(3)** Medical Technology Assessment Board (F.NO.T.11011/08/2017-HR/3136744; PI) 2017-26 **(4)** Price Regulation and Value Based Pricing for anti-cancer Drugs: Implications for Patients, Industry, Insurer and Regulator (F.No.T.11011/02/2017-HR/3100291; PI) 2020-22 **(5)** Comprehensive Primary Health Care: Innovation and Learning Centre (F.207/EI(IV)-PGI-2019; PI) 2020-25 **(6)** Strengthening Health Economics Evidence for India (CGDE 00521; PI) 2021-22 **(7)** Evaluation of implementation of Beti Bachao Beti Padhao (B3P) Programme in Haryana state, India (10249, SRCW/WCD/2021; PI) 2021-22 **(8)** Exploring The Content Validity of The Eq-5d Across Cultures Using Standardized Qualitative Methods (EQ Project 20190600; PI) 2021-22 **(9)** Intra-Partum Care Bundle to Prevent Epilepsy Caused by Birth (9869; Co-PI) 2021-25 **(10)** Estimation of Cost-effectiveness Threshold (CET) for India (F.NO.T.11011/02/2017-HR (Part-1)/3176774; PI) 2022-23 **(11)** Cost-effectiveness of Pradhan Mantri Janaushadhi Pariyojna (PMBJP) and its impact on Financial Risk Protection in India (F.NO.T.11011/02/2017-HR (Part-1)/3176774; PI) **(12)** Centre for Health Insurance Evidence Synthesis & Financing (81279727; PI) 2021-2023.

Positions, Scientific Appointments and Honours: (1) Executive Director (HP&QA), National Health Authority, Ayushman Bharat PM-JAY, Government of India **(2)** Dr. M.K Seshadri Award for health economic research for policy making and universal health coverage, by the Indian Council of Medical **(3)** Member: Advisory Board, Health Economics, Management and Policy program, University of Newcastle, Australia **(4)** Lead Economist for the World Bank East Asia Pacific Region to develop the mid-term strategic plan for universal health coverage in the People's Democratic Region of Laos **(5)** Member of the National Taskforce on Evaluation of Health and Wellness Centres, National Health System Resource Centre, Ministry of Health and Family Welfare **(6)** Member of the Cost-Effectiveness Data Across Settings (CEDAS) working group of the DECIDE Hub of WHO Geneva **(7)** Member of the National Taskforce on COVID Research (Operations Research Group) Ministry of Health and Family Welfare **(6)** Member of the Technical Group of the COVID-19 Multi-Model Comparison Collaboration of the WHO and World Bank.

Contributions to Field: (1) Economic evaluation of health care interventions and programs, including costing of health care services, and analyzing impact of health financing policies in the context of universal health coverage. At the PGIMER School of Public Health, has set up a Resource Centre for India's Health Technology Assessment Board.

RAMASUBRAMANIAN, Dr V *(1) Consultant Infectious Diseases & Tropical Medicine, Apollo Hospitals (2) Adjunct Prof Infectious Diseases - Sri Ramachandra Institute of Higher Education & Research*

Qualifications: MD, FRCP (Glas), DTM & H(Lon), DGUM (Lon) FESCMID

Project Role: Critical Care Medicine

ORCID ID: 0000-0001-8566-2035

Grants Awarded: AMSP grants from ICMR for Implementation & Expansion of AMSP in Indian Hospitals

Positions, Scientific Appointments and Honours: (1) Indian Medical Association **(2)** Association of Physicians of India **(3)** Infectious Diseases Society of **America (4)** Indian Society of Critical Care Medicine **(5)** Royal College of Physicians & Surgeons of Glasgow **(6)** Clinical Infectious Diseases Society **(7)** European Society of Clinical Microbiology & Infectious Diseases (**8)** International Society of Travel Medicine **(9)** International Society of Infectious Diseases **(10)** Aids Society of India **(11)** Society of Indian Human & Animal Mycologists (**12)** Society of Healthcare Epidemiology of America **(13)** President - Clinical Infectious Diseases Society of India **(14)** Director - The Capstone Clinic **(15)**

Contributions to Field: (1) Infectious Diseases: Has played a pioneering role in establishing Infectious Disease as a specialty in India and is a specialist in adolescent and adult vaccinations and travel medicine. Spearhead the Infectious Diseases Educational Foundation (IDEF) and Forum for Adult Immunization Towards Health (FAITH), both NGO's which play an active role in spreading awareness about antimicrobial resistance and stewardship initiatives and the pro-active role of adult immunization **(2) Antibiotic Use and Infection Control:** Is passionate about judicious antimicrobial use and have been instrumental in laying down the principles of Infection Control and Antimicrobial stewardship in several hospitals. Is an advisor to the Antibiotic Stewardship initiative of the Indian Council of Medical Research.

RODRIGUES, Camilla *(1) Consultant Microbiologist and Chairperson of Infection Control the P.D. Hinduja Hospital and Medical Research Centre*

Qualifications: MBBS, MD

Project Role: IPC

ORCID ID: Link to Camilla Rodrigues TB Manuscripts on PubMed

Grants Awarded: **(1)** FIND, Multicentre clinical trial to assess the performance of culture free, End to End targeted NGS solutions for Diagnosis of Drug Resistant TB (PI) 2021-22 **(2)** BU /NIH, Predictors of Resistance Emergence Evaluation in Multidrug Resistant-Tuberculosis Patients on Treatment, PREEMPT (R01 R Horsburgh (PI) 2019

Positions, Scientific Appointments and Honours: (1) Member, Honorary Clinical Infectious Disease Society, India CIDS. **(2)** Scientific Advisory Committee Member, National Institute of Research Tuberculosis NIRT **(3)** Expert on TB Diagnostic Research Committee ICMR. **(4)** Member National Operational Research Committee on TB, Central Tuberculosis Division **(5)** Member Early Career Fellowship Selection Committee India Alliance DBT Wellcome.2020-present **(6)** Member of the RePORT International Committee RICC **(7)** USA Expert WHO Technical Expert Group for M tuberculosis Mutation Catalogue in 2020 **(8)** President Indian Association Medical Microbiology **(9)** Accredited Maharashtra State Medical Council Speaker: Speaker code :MMC/ MAS / 00117 / 2013

Contributions to Field: (1) Rapid detection of Drug Resistance Tuberculosis. Has worked on several novel diagnostic tests that can evaluate not only rifampin resistance, but other drugs of clinical importance. After developing a Reverse Line Blot Hybridisation assay for isoniazid, rifampin and streptomycin resistance, work focused on detecting resistance to second-line drugs, particularly fluoroquinolones and aminoglycosides. This line of investigation has included generating supportive evidence to validate of the MTBDR plus line probe assay for second-line TB drugs and pyrosequencing as a clinical diagnostic tool. Her team is now studying genotype-phenotype correlations, comparing specific second-line mutations with drug susceptibility testing. They currently test 14 drugs for susceptibility, and in research settings are evaluating the minimum inhibitory concentrations (MICs) of 14 drugs, including the new drugs bedaquiline and delamanid. They have demonstrated significant variability in drug susceptibility results of clinical samples, particularly by testing moxifloxacin MIC. **(2) Detection of Non-Tuberculous Mycobacteria.** Non-tuberculous mycobacteria (NTMs) represent a unique and often under-recognized problem for TB diagnostics. Many diagnostic tests identify features such as acid fast staining that are common between multiple members of the Mycobacterium genus, with particular differences in drug resistance profiles common to distinct members. In the interest of differentiating patients with “drug resistant TB” from those with chronic lung infection from other related bacteria, she has developed a PCR assay to evaluate restriction fragment length polymorphisms and a reverse line blot hybridization assay to speciate NTMs in clinical samples. This work is increasing the awareness of NTMs in India and other parts of the world that are endemic for TB, which often assume that patients failing treatment do so due to drug resistant TB, rather than by another organism for which different treatment regimens might be considered.

SENGUPTA, Dr Sharmila *(1) honorary consultant to the Medanta Institute of Education and Research (2) Head of the Department of Clinical Microbiology at Medanta, the Medicity Hospital*

Qualifications: MBBS, MD – Medical Microbiology

Project Role: Medical Microbiology

ORCID ID: 0000-0001-8706-8355

Grants Awarded: PI (Joint Coordinator for India) – Global Point Prevalence Study for Antimicrobial Usage, Professor Herman Goossens, University of Antwerp, Belgium (2014 - 2018)

Positions, Scientific Appointments and Honours: (1) Permanent Member Indian Association of Medical Microbiologists/ Hospital Infection Society – India **(2)** Annual Member Society for Healthcare Epidemiologists since 2008 **(3)** Infectious Diseases Society of America **(3)** International Society for Infectious Diseases **(4)** British Society for Antimicrobials and Chemotherapy **(5)** European Society for Clinical Microbiology and Infectious Diseases (ESCMID)

Contributions to Field: (1) Healthcare Epidemiology & Infection Prevention & Control Has specialist & technical expertise with over 25 years of hands-on experience in development of guidelines, implementation and dissemination strategies in Infection Prevention and Control, patient and HCW safety, integration of quality in health services and outbreak response. Has experience leading and collaborating with both national and international research teams in IPC and AMR prevention **(2) Antimicrobial Resistance:** Has undertaken research on the prevention of AMR and antimicrobial stewardship, including work on social determinants of antibiotic misuse, the drivers of inappropriate antibiotic prescribing and a study of antimicrobial consumption and resistance in 53 countries. **(3) Clinical & diagnostic microbiology** especially related to hospital-associated infections and outbreak detection and incorporating rapid diagnostic tests of public health importance. Has published on multi-drug resistant organisms and emerging pathogens.

SWAMINATHAN, Subramanian Dr *(1) Director, Infectious Diseases and Infection Control and honorary consultant to the Medanta Institute of Education and Research.*

Qualifications: MBBS, MD

Project Role: IPC, clinical pharmacology

ORCID ID: 0000-0001-7971-6842

Grants Awarded: (1) Pfizer, Ceftazidime-avibactam for treatment of bacteremic infections due to Enetrobactereceae producing Oxa-48; (PI) 2019-2020 **(2)** Cipla/Roche, Safety and efficacy of casirivimab/imdevimab in the treatment of high risk COVID infected patients in India (PI) 2021(

Positions, Scientific Appointments and Honours: (1) Clinical Infectious Diseases Society of India- past speaker, currently Chair, Transplant ID subcommittee **(2)** Fungal Infection Study Forum, **(3)** Infectious Diseases Society of America **(4)** National Academy of Medical Sciences **(5)** AIDS society of India **(6)** Indian Medical Association **(7)** Association of Physicians of India **(8) member of the** governing council of the Fungal Infection Study Forum **(9)** advisor for the Jeevasarthakathe, the nodal transplant body of Karnataka **(10)** advisor for the Government of Tamil Nadu for the COVID task force, as well as the mucormycosis task force

Contributions to Field: In ten year tenure at GGHC, has been involved in training fellows, nursing staff and paramedical staff; involved in studies and clinical trials; involved in developing infection control protocols specific to solid organ transplantation. Developed an antimicrobial stewardship program and introduced a clinical pharmacy service and coauthored numerous journal articles and textbook chapters. Has the scientific chair for the national ID conference for the year 2020 and have been organizing chair of the yearly transplant infectious disease conference, conducted in collaboration with the Indian Society of Organ Transplant.

Key Researchers from CAMO-Net India

TANEJA, Neelam *(1) Professor and in charge-Enteric laboratory, PGIMER Chandigarh*
Qualifications: MD Microbiology, FIMSA, Dip Vaccinology (Pasteur Institute Paris) Clinical Microbiology

Project Role: Diagnostics for surveillance, One Health, AMR, global policy leader

ORCID ID: 0000-0003-1198-6138

Grants Awarded: (1) DBT-UKRI, Resolving the fate and studying the impact of pharmaceutical wastes on the environment and local community of a pharmaceutical manufacturing hub (9119 || BT/IN/Indo-UK/AMR-Env/05/NT/2020-21 PI, Indian side) 2021-24 **(2)** ICMR-FIND, Impact of improved diagnostic tools, practices, training and communication on acute fever case management and antibiotic prescriptions for children, adolescents and adults presenting at outpatient facilities in Civil Hospital, Manimajra, Chandigarh, North India (AMR/FIND/221/ICMR/ECD-2020, PI) 2021-2022 **(3)** DHR, Analysis of antibiotic resistance gene flow between the environment and host: a Metagenomic 'One Health' study (GIA/2019/000063/PRCGIA, PI) **(4)** Wellcome Trust-UK and DFID, Understanding the nature and diversity of Vibrio cholerae at its global source 2019-21 (BGT/521/2019, Co-PI) 2020-2023 **(5)** DBT, A cocktail of phages effective against urinary tract infections caused by biofilm forming MDR uropathogenic E.coli. (BT/PR31941/MED/ 29/1406/20192019-2021, PI) 2021-24

Positions, Scientific Appointments and Honours: (1) Appointed Advisor to the WHO on AMR as a member of advisory committee of Bacterial pathogens of Priority List **(2)** Expert Member of National Action Plan of India on AMR **(3)** Expert to Centre for Science and Environment, Delhi **(4)** Member Scientific Advisory Board of NICED Kolkata **(5)** WHO consultant for Nepal ESBL-EC tricycle grant **(6)** UK strategic partner for AMR at Cambridge **(7)** Global typhoid consortium member **(8)** External expert for ICMR **(9)** DBT India-Allianze expert **(10)** External expert evaluator for Wellcome Trust, Pasteur Institute and other various international grants **(11)** International Development award for young woman scientist-Internation Society of Infectious Diseases (2008) **(12)** Fellow of International Medical Sciences Academy ASM CME award on AMR

Contributions to Field: (1) Diagnostic (conventional as well as molecular) surveillance with special focus on epidemiology and drug resistance. As part of a WHO funded to strengthen district public health laboratories for surveillance she developed 11 labs of Punjab, Haryana, Uttarakhand and established a stool referral system for gastroenteritis and typhoid. Her work constantly monitors antimicrobial resistance in enteric and urogenital pathogens at community and hospital level by both phenotypic and molecular assays **(2) One Health and AMR** with a major Focus on AMR at the human–animal-environment interface, she has a multi-disciplinary team of health administrators, veterinarians, poultry/cattle farm owners established in WHO-AGISAR India pilot project on antimicrobial resistance of foodborne pathogens. She has generated pilot data on antibiotic utilization in livestock and has access to data on therapeutics in animals, both livestock and pets. She also has an extensive expertise in molecular mechanisms and epidemiology. Currently, she is looking at the gene flow of ARGs from the environment to humans and the impact of environmental AMR in a pharmaceutical hub of Baddi. She is also working on the ecology of cholera and studying the diversity of V.cholerae in freshwater environs of north **(3) Combating diarrhoeal and foodborne illnesses** as part of an international team developing projects on *Salmonella Typhi* and Nontyphoidal Salmonellae which aim to study the clinical presentation, complications, risk factors, antimicrobial resistance and circulating genotypes in isolates collected through network laboratories. She is running an ICMR-FIND diagnostic accelerator trial on comparing the impact of a package of interventions on clinical outcomes and antibiotic prescriptions, with standard-of-care practices.

VERMA, Nipun *(1) Associate Professor, Department of Hepatology, Postgraduate Institute of Medical Education and Research, Chandigarh, India*

Qualifications: MBBS, MD (Internal Medicine), DM (Hepatology), PGDip. (Machine Learning)

Project Role: Artificial intelligence and AMS

ORCID ID: 000-0003-4328-0914

Grants awarded: (1) APASL ACLF Research Consortium, Asia Pacific region, Artificial Intelligence Model Precisely Predict Outcomes in Acute-on-Chronic Liver Failure Patients (PI) 2020-2021 **(2)** iHub Anubhuti-IIITD Foundation, Development, validation and deployment of a novel prediction model utilizing artificial intelligence on clinical and proteomic features to predict mortality among patients with acute-on-chronic liver failure (PI) 2021-2024 **(3)** ICMR, Early Empirical versus Pre-emptive Systemic Anti-fungal therapy in Acute-on-chronic liver failure patients with suspected invasive fungal infections: a randomized controlled trial (PI) 2022-2025 **(4)** PGI/INT/Thesis, Prevalence and impact of multi drug resistant bacterial colonization on in-hospital mortality among patients with cirrhosis admitted in liver intensive care unit: an observational study (PI) **(5)** PGI/INTRAMURAL, Untargeted Proteomics and Clinical Profile in Acute on Chronic Liver Failure Patients With And Without Sepsis Due to Bacterial or Fungal Infections: A Prospective Case-control Study (PI) 2019-2021 **(6)** APASL ACLF Research Consortium: Asia Pacific region, Comparative accuracy of prognostic models for short-term mortality in acute-on-chronic liver failure patients: CAP-ACLF (PI) 2020-2021 **(7)** APASL ACLF Research Consortium: Asia Pacific region, Dynamic Assessments of Hepatic Encephalopathy and Ammonia Levels Predict Mortality in Acute-on-Chronic Liver Failure (PI) 2021-2022 **(8)** PGI/INT, Machine learning can guide suitability of consultation and patient referral through telemedicine for hepatobiliary diseases (PI) 2020-2022

Positions, Scientific Appointments and Honours: (1) Contributor for antimicrobial treatment guidelines from the department of Hepatology for “Antibiotic Policy for Management of Infections in Outpatient Department and Wards of PGIMER, Chandigarh (2) Member for the INTENT network for conducting multi-centric clinical trials in India hosted by the ICMR (3) Member American College of Gastroenterology (4) Awarded **Indian** Society of Clinical Research – Academic clinical consortium 3rd National Award for Excellence in Academic Clinical Research 2022 in the early-career category during 15th Annual ISCR Conference, 2022 held virtually between 14-15th March, 2022

Contributions to field: (1) Artificial Intelligence research including developing AI models for predicting significant fibrosis in non-alcoholic fatty liver disease patients across 15 Asian centres in Gut and Obesity in Asia working group, AI models to predict suitability of telemedicine in hepatology services and AI models to predict asthma severity in paediatric patients. Successfully conducted a project on AI models in a multi-centric study across 50 Asia Pacific Centers **(2) Antibiotic Stewardship and guidelines** Contributed to the development of antimicrobial treatment guidelines from the department of Hepatology for “Antibiotic Policy for Management of Infections in Outpatient Department and Wards of PGIMER, Chandigarh. Collaborator and working actively for antimicrobial stewardship programs in hepatology services at PGIMER Chandigarh

WALIA, Dr Kamini *(1) senior scientist at Division of Epidemiology and Communicable Diseases, Indian Council of Medical Research, New Delhi*

Qualifications: MBBS, MS (PUBLIC HEALTH), PhD

Project Role: Epidemiology, surveillance, diagnostics and implementation science

ORCID ID: 0000-0002-1494-6919

Grants Awarded: (1) ICMR, Implementation of AMSP in tertiary care centres across India (PI) **(2)** ICMR, Understanding availability of Essential Diagnostics in health care systems: identifying barriers and facilitators ICMR funded (PI) **(3)** ICMR funded Task force on rapid methods for antimicrobial susceptibility testing at point-of-care (PI) 2019-22 **(4)** FAO, To build capacity for integrated surveillance of antimicrobial resistance (AMR) in pathogen / commensals in food producing animals, food of animal origin and their environment and foodborne pathogens in humans (PI) 2017-19

Positions, Scientific Appointments and Honours: (1) WHO Scientific Advisory Group of Experts on AMR Diagnostics. **(2)** Scientific Advisory Committee of GARDP **(3)** Commissioner on Lancet Commission on Diagnostics **(4)** Recipient of ICMR's Shakuntala Amir Chand award **(5)** Indian National Science academy, Young Scientist Award and NIH's Fogarty Fellowship. **(6)** Member SEDRIC project review board, Wellcome Trust, UK 2021- till date **(7)** Member, WHO Scientific Advisory Group of Experts on Essential Diagnostics 2018-20 **(8)** Member, WHO Scientific Advisory Group of Experts on AMR diagnostic 2018-20 **(9)** Member, Scientific Advisory Committee of GARDP 2016-till date **(10)** Commissioner on Lancet Commission on Diagnostic 2019-21 **(11)** Expert Reviewer: EDCTP 2018 Call for proposals on Diagnostic tools for poverty-related diseases **(12)** Expert Reviewer: EDCTP 2019 Research and Innovation Call for proposals on New drugs and vaccines for priority pathogens in antimicrobial resistance **(13)** Director, Research and Development PATH 2010-12

Contributions to Field: (1) Infectious diseases, including HIV/AIDS programs and heath technologies including vaccines and diagnostics. **(2) Antimicrobial Resistance** Currently leading the Antimicrobial Resistance Initiative of ICMR which focuses on various aspects of AMR, including surveillance, antimicrobial stewardship and One Health aspects **(3) Diagnostics:** Curated the National Essential Diagnostics for the country to improve availability of diagnostics at all levels of health care and is a former member WHO Scientific Advisory Group of Experts on Essential Diagnostics.

WATTAL, Chand *(1) Senior Consultant & Chairman Dept. of Clinical Microbiology, Sir Ganga Ram Hospital, Rajinder Nagar, New Delhi, India*

Qualifications: MBBS, MD ,PhD

Project Role: Clinical microbiologist, IPC

ORCID ID: NA

Grants Awarded (1) FIND, Multicentre clinical trial to assess the performance of culture free, End to End targeted NGS solutions for Diagnosis of Drug Resistant TB (PI) 2021-22 **(2)** BU /NIH, Predictors of Resistance Emergence Evaluation in Multidrug Resistant-Tuberculosis Patients on Treatment, PREEMPT (R01 R Horsburgh, PI) 2019

Positions, Scientific Appointments and Honours: (1) technical advisory committee, Ministry of Health, Government of India & on several Task Forces for Rational Antibiotic Use (AMR) MoH and its Researchable Areas with ICMR **(2)** Guest Editor, Journal of International Medical Sciences Academy **(3)** Editor-in-chief of Indian J of Medical Microbiology **(4)** immediate past President of the Indian Association of Medical Microbiology (Delhi Chapter) and Chairman, IAMM EQAS for Medical Microbiology as PTP.

Contributions to Field: **(1) Antimicrobial Stewardship:** Has published widely on the implementation of IPC in Indian hospitals, IPC structures in healthcare facilities nationally and on the need for education and training among human and animal healthcare professionals. Other work has considered prescribing patterns and the association of antibiotic use with resistance **(2) Molecular Microbiology of AMR:** As a microbiologist, has a body of work on the genome sequence of various drug resistant pathogens in particular, carbapenem resistant A. baumannii**(3) Diagnostic stewardship:** Has a keen interest in diagnostic stewardship which is an integral part of antibiotic stewardship programmes and also essential for infection prevention and control activities. Has published on the use of MALDI-TOF MS for rapid identification of microorganisms in the routine clinical microbiology laboratory and its use with VITEK 2 for automated susceptibility testing from positive blood cultures and on newer diagnostics test and their application to TB.

CASTELNUOVO, Barbara *(1) Research Department, Head of Department, Infectious Diseases Institute, Makerere University, Uganda*

Qualifications: Doctorate in Medical Sciences University of Antwerp, Belgium. Master of Infectious Diseases University of Milan, Italy, Bachelor of Medicine and Bachelor of Surgery (M.B.Ch.B.) University of Milan, Italy

Project Role: Leading the training and capacity strengthening network

ORCID ID: 0000-0001-7756-5032

Grants Awarded: (1) EDCTP Senior fellowship, Diagnosis and treatment of non-communicable diseases and geriatric syndromes in the HIV aging population in sub-Saharan Africa **(**#TWA2017GSF-1936, PI) 2019-2024 **(2)** NIH, HIV and co-infection (#D43TW009771, Co-PI) 2019-2024 **(3)** NIH, East African IeDEA Regional Consortium (#UO1AI069911-16 site PI) 2016-2026

Positions, Scientific Appointments and Honours: (1) Senior fellowship, EDCTP #TWA2017GSF-1936 **(2)** Editor in chief AIDS research and therapy 2020-present **(3)** Honorary Senior Lecturer, Makerere University, Uganda 2011-present

Contributions to Field: (1) Evaluation of the pharmacokinetics of antituberculosis drugs and tuberculosis treatment outcomes in HIV-Tuberculosis co-infected Ugandan adults (SOUTH)" the SOUTH cohort study (2012, ongoing). PI. This study aimed to correlate the antituberculosis drugs levels to the outcomes (TB cure and adverse events) in a cohort of 268 HIV-TB co-infected patients. **(2) Antiretroviral treatment Long-Term (ALT) cohort-** Co-PI. This study aims to describe long term outcomes on HIV infected patients on ART for at least 10 years and followed up for another 10 years Outcomes of patients aging with HIV This study aims to describe non-communicable diseases and geriatric syndromes in a cohort of 500 patients older than 60 years and an ART

Key Researchers from CAMO-Net Uganda

GALIWANGO, Ronald *(1) Bioinformatics scientist, African Center of Excellence in Bioinformatics and Data Intensive Sciences, Infectious Diseases Institute-Makerere University (2) Member, Center for Computational Biology, Uganda Christian University*

Qualifications: BSC-Mathematics, Statistics (Makerere University) | MPhil in Computational Biology (University of Cambridge, UK) | PhD in Computational Epidemiology-Epidemiology, Bioinformatics (University of Georgia, USA)

Project Role: Bioinformatician, Global Antimicrobial Optimisation Data Safe Haven

ORCID ID: 0000-0002-5962-151X

Grants Awarded: **(1)** End-to-end AI and data systems for targeted surveillance and management of COVID-19 and future pandemics affecting Uganda (COAST) (*109630-001/002*; co-lead of the Modelling work stream) 2021-2022 **(2)** Makerere University Data Science Research Training to Strengthen Evidence-Based Health Innovation, Intervention and Policy (MakDARTA) (1U2RTW012116-01.; Mentor/Faculty), 2021-2026.
Positions, Scientific Appointments and Honours: **(1)** Postdoctoral Fellow, NIH funded BRecA (Nurturing Genomics and Bioinformatics Research Capacity in Africa) programme 2020-2021 **(2)** NIH-Forgaty PhD fellowship for Computational Epidemiology of HIV and TB, 2016-2019 **(3)** Commonwealth Scholarship and Cambridge Commonwealth European and International Trust Scholarship for MPhil study at the University of Cambridge, UK.

Contributions to Field: **(1)** C**omputational approaches and data to aid understanding of the transmission of infectious diseases** (including patterns and drivers) and the interplay between infectious and non-communicable diseases. His work on Africa's contribution to the global influenza ecology highlighted the need to expand influenza surveillance across Africa and prioritize routine whole-genome sequencing and genomic analysis to detect new strains early for effective viral control (Microorganisms 2022;10(5):900) **(2) Social and contact networks** including mobility patterns and air quality or meteorological data, my paper on validity of Air Quality as a Measure of Human Mobility in Uganda highlighted the power of combining multiple datasets in a Big Data Science (BDS) (preprint) **(3) Bioinformatics mentorship in a resource limited setting.** Here, we pioneered and tested a bioinformatics training/mentorship model that effectively uses the available expertise and computational infrastructure to deliver an in-person hands-on skills training experience (Briefings in Bioinformatics 2021;23(1):bbab399).

Key Researchers from CAMO-Net Uganda

JINGO, Dajdi *(1) Director, African Center of Excellence in Bioinformatics (2) Senior Bioinformatics Scientist & Lecturer, College of Computing, Makerere University*

Qualifications: PhD, Bioinformatics The Georgia Institute of Technology, USA, MSc Bioinformatics, University of Leeds, UK, BSc Biochemistry, Makerere University, Uganda

Project Role: Bioinformatician

Grants Awarded: **(1)** NIH/ Forgaty H3Africa Bioinformatics Training Grant, PI **(2)** NIH/Wellcome Trust, NIH H3BioNET Uganda node (Co-I) **(3)** Uganda Government, Prototyping VR Technology for COVID-19 training (PI) **(4)** IDRC, COAST: End-to-end AI and data systems for COVID-19 and pandemics surveillance in Uganda (Co-I)

Positions, Scientific Appointments and Honours: **(1)** Director African Center of Excellence in Bioinformatics (ACE), Uganda **(2)** Bioinformatics Scientist & Lecturer Makerere University, Uganda **(3)** Research Affiliate Makerere/UVRI Infection & Immunity Center of excellence **(4)** Fulbright Scholar For doctoral study and research *2008-2013* **(5)** Carnegie Award PhD completion grant for the advancement of teaching **(6)** Member African Society for Computational Biology **(7)** Member American Association for the Advancement of Science **(8)** Member International Society of Computational Biologists **(9)** Member Society of Molecular Biology and Evolution **(10)** Member East African Society of Computational Biology

Contributions to Field: **(1) Capacity Building in Bioinformatics-** A core objective is building genomics and bioinformatics capacity in Uganda and the African continent with a number of publications and invited talks on the subject (Briefings in Bioinformatics 2021;23(1):bbab399) **(2) Epigenetics of TB/HIV and cancer** I have published on the presence and role of human gene-body DNA methylation, on MIR-derived enhancers and the regulation of human gene expression and compound cis-regulatory elements with both boundary and enhancer sequences in the human genome. Other work has considered the effect of the transposable element environment of human genes on gene length and expression, transcriptional activity, chromosomal distribution and expression effects of transposable elements in Coffea genomes and prediction of transposable element derived enhancers using chromatin modification profiles

Key Researchers from CAMO-Net Uganda

KAKOOZA Francis *(1) Deputy Head Global Health Security Department-Infectious Diseases Institute-Makerere University*

Qualifications: Bachelors of Biomedical Laboratory Technology (BLT), Makerere University Masters of International Infectious Diseases Management-Mak, PhD candidate (Molecular Epidemiology and Pathogen Genomics)-Mak

Project Role: Biosafety/biosecurity

ORCID ID: 0000-0003-4047-6620

Grants Awarded: (1) US Centers for Diseases Control and Prevention, Sentinel Surveillance of Acute Febrile Illness (AFI) in Regional Referral and District Hospitals in Uganda 2021 to June 2025 **(2)** World Health Organization, Molecular Epidemiology and Antimicrobial resistance determinants of Neisseria gonorrhoeae among males with urethritis in Kampala, Uganda (PI) 2019-2022 **(3)** European and Developing Countries Clinical Trials Partnership/ Pfizer Co. Ltd, Current and Prior Viral Zoonotic Infections among Adults with Acute Febrile Illness in Northern and Central Uganda (Co-I) 2018- to date **(4)** National Institutes of Health through Bio-fire Défense and Henry Jackson Foundation, Clinical evaluation of the Global Fever Panel Bio-fire study (Study Coordinator) 2018- 2019 **(5)** Centres for AIDS Research (CFAR), National Institutes of Health, Testing Medicinal plants in Uganda for HIV Latency Reversing Agents (Co-I) 2018- 2022 **(6)** Centres for AIDS Research (CFAR), National Institutes of Health, Global gene array, secretome analyses, and HIV infection analyses of foreskin epithelial cells upon exposure to cervicovaginal fluid from healthy vs. women with bacterial vaginosis (Co-I) 2016- 021

Positions, Scientific Appointments and Honours: (1) Senior Project Officer for Biosafety and Biosecurity Global Health Security Programme at the Infectious Diseases Institute **(2)** Project Coordinator for WHO Enhanced Gonococcal Antimicrobial Surveillance Programme **(3)**Technical Advisor for Antimicrobial Resistance Thematic Area (**4)** Programme Manager for the UK-funded Fleming Fund Country Grants

Contributions to Field: (1) Capacity Building Involved in the building of teams that support research in Especially Dangerous Pathogens (Health Secur 2019;17(3):169-173) and CDC-funded nation-wide GHSA capacity building projects and supported the Government of Uganda develop the National harmonized Biorisk Management curriculum and the National Microbiology In-service training curriculum (J Bioterror Biodef 2018;9:3) (2) **AMR Surveillance** in collaboration with the National AMR Coordinating Centre, has supported the implementation of standardised quality-assured data (2017 to 2021) to WHO for international reporting (JMIR Public Health and Surveillance 2021;7(10)) (**3) National Action Plans and monitoring** Participated in the Joint External Evaluation (JEE), 2017 of Uganda's capacities and capabilities in the progress of achieving the targets set by the International Health Regulations (IHR), 2005. Provided technical input to the development of strategic GHSA plans including the National Action Plan for Health Security, National Action Plan for AMR and Multi-hazard Preparedness and Response Plan

MUJUGIRA, Andrew *(1) Senior Research Scientist, Makerere University Infectious Diseases Institute* **Qualifications:** MBChB (Makerere University), MSc (University of London) | MPH (Epidemiology), PhD Epidemiology (University of Washington)

Project Role: Epidemiologist

ORCID ID: 0000-0001-6646-6733

Grants Awarded: (1) National Institute of Mental Health, Peer-Delivered HIV Self-Testing, STI Self-Sampling and PrEP for Transgender Women in Uganda (PI) 2019-2022 **(2)** National Institute of Mental Health, Transgender Men and HIV in Uganda: PrEP Uptake and Persistence (R34 MH121084-02S1, PI) 2021-2022 **(3)** Fogarty International Center, HIV Self Testing to Empower Prevention Choices in Sex Workers (K43 TW010695, PI) 2017-2022 **(4)** Gilead Sciences, Inc. Same-Day PrEP Initiation and Sexual Health for Transgender Women (IN-US-428-5878, PI) 2021-2024 **(5)** University of Washington/Fred Hutch Center for AIDS Research, Characterizing PrEP adherence patterns in African sex workers (P30 AI027757, Project PI) 2018-2021

Positions, Scientific Appointments and Honours: (1) Affiliate Assistant Professor, Department of Global Health, University of Washington **(2)** Associate Director, UW/Fred Hutch Center for AIDS Research Developmental Core

Contributions to Field: (1) HIV prevention for key populations. Pioneering mixed-method research among transgender people in Uganda found that self-controlled HIV prevention tools, such as HIV self-testing and oral PrEP, are empowering for sex workers and their clients, and help circumvent healthcare stigma and discrimination. However, intersecting stigmas - individual, interpersonal, and structural - negatively impact health and increase vulnerability to HIV and other sexually transmitted infections. **(2) Antiretroviral therapy for HIV treatment and prevention.** Led secondary analyses of data from HIV-positive heterosexual women and men enrolled in the Partners PrEP Study, a randomized clinical trial of daily oral preexposure prophylaxis (PrEP) in Kenya and Uganda. Found that younger age was associated with delayed ART initiation, failure to achieve viral suppression, and increased risk of virologic rebound after initial suppression. We demonstrated that HIV transmission risk persists during the period between ART initiation and complete viral suppression. Showed that seminal HIV RNA shedding was infrequent and low quantity in HIVinfected African men with suppressed blood plasma HIV RNA. These studies contribute evidence of ART effectiveness for HIV treatment and prevention. **(3) Oral antiretroviral pre-exposure prophylaxis for HIV prevention**. A significant proportion of new HIV infections in sub-Saharan Africa occur in serodiscordant couples. The Partners PrEP Study was the only clinical trial to demonstrate the efficacy of PrEP for HIV prevention in heterosexual serodiscordant couples. Data from this study informed the decision of the US FDA and WHO to approve Truvada PrEP for HIV prevention.

OKOBOI, Stephen *(1) Deputy Head Research Department, Infectious Diseases Institute, College of Health Sciences, Makerere University*

Qualifications: Doctorate in Medical Sciences, University of Antwerp, Belgium, Master of Public Health, Clarke International University, Uganda, Bachelor of Health Services Management, Islamic University in Uganda

Project Role: m-Health, Overseeing the project administration and regulatory oversight

ORCID ID: 0000-0002-8738-0397

Grants Awarded: (1) NIH, Controlled Trial of Game Changers: A Group Intervention to Train HIV Clients to be Change Agents for HIV Prevention in Uganda (IG11TWO1109-01, Co-PI) 2021-2026 **(2)** NIH, Association of Anti-Retroviral Therapy Adherence Measurement Methods and Virological Failure in HIV infected Ugandan on long-term ART: A Cohort Study (D43TW009343 PI) 2021-2021 **(3)** Canadian African Preventive Trial network, Sexual Behavior and HIV transmission risk among long term experienced ART patients in Uganda for over 8 year (PI) 2016-2019 **(4)** NIH, HIV self-testing and linkage to care among Men having sex with Men (MSM). A trial Distribution through MSM in TASO Uganda (P30-AI027763, PI) 2017–2018

Positions, Scientific Appointments and Honours: (1) Adjunct Lecturer, Clarke International University **(2)** Ugandan Coordinator, the East African Consortium for Clinical Research 2 (EACCR2) **(3)** Project Manager, Leveraging capacity for early phase clinical trials for filoviruses in Uganda **(4)** Deputy Head Research Programme, Infectious Diseases Institute, Makerere University **(5)** Post Doctorate GloCal Fellow, University of California Global Health Institute

Contributions to Field: (1) ART treatment, retention and adherence. Led secondary analyses of data from the Home-based care projects and TASO program data of HIV-infected persons who have been on ART for longer periods. Results showed that good retention in care among patients on long time ART and demonstrated that community-based ART delivery models can effectively facilitate long term ART retention and low rates of death and virological failure in Uganda. These studies contribute evidence of ART differentiated care models, ART adherence, Retention and HIV prevention and treatment **(2) HIV prevention and Social network.** HIV self-testing is a way to reach more people with undiagnosed HIV and represents a step forward to empower individuals, diagnose people earlier; m health is a promising strategy of scaling up HIV prevention particularly priority populations. Conducted HIV self-testing study among men who have sex with men in Uganda and found that HIVST were acceptable. These studies contribute evidence on acceptability of M-health and HIV self-testing

Key Researchers from CAMO-Net Uganda

PARKES-RATANSHI, Rosalind *(1) Principal Research Associate, University of Cambridge, UK [2]Research Lead, Academy for Health Innovation, IDI (2) Honorary Consultant, Cambridge University Foundation Hospital*

Qualifications: MBBS, MA, PhD (Tropical Medicine/HIV), DipGUM, DFSRH

Project Role: Clinician specializing in global mHealth innovations, PoC tech

ORCID ID: 0000-0001-9297-1311

Grants Awarded: (1) ERHLA Comparing Primary care models in conflict affected settings in Nigeria and Cameroon (#70179; PI) 2021-2023 **(2)** IDRC COVID-19 Global South Artificial Intelligence (GA-04-2020E; Co-PI) 2021-2024 **(3)** COVIDAction FCDO. Digital PCT for HIV support during COVID (21108, PI) 2020-2021 **(4)** UNCDF Emerging Technologies for COVID response; Medical Drones (PI) **(5)** Cambridge GCRF HIV nutrition during COVID (Co-I) 2020-2021 **(6)** Cambridge GCRF MHealth for Outbreak Support. (G102642, PI) 2020-2021 **(7)** Wellcome Trust Public Engagement. History of HIV in Uganda. (218063/Z/19/Z20; Co-I) 2019-2022 **(8)** J&J Supply Chain Medical Drones for ART. **(9)** Cambridge GCRF Network AI for public health in resource limited settings (PI) 2018-2019 **(10)** NIH U54 Centre for PoC Technologies Research for STDs (U54EB007958, Co-I) 2018-2023 **(11)** AHRC - MRC GCRF Partnership Grant A Picture of Ageing in Uganda (AH/R005990/1, Co-I) **(12)** UK MRC– DFID Development of new paradigm in differentiated care for HIV patients; Community pharmacy drug refill using novel mhealth innovations (MR/R00420X/1; PI)

Positions, Scientific Appointments and Honours: (1) Fellow of Royal College of Physicians (FRCP) UK, 2015 **(2)** Elected Fellow of Faculty of Public Health (FFPH), UK **(3)** Cambridge-Africa Strategic Advisory group member (2018-) **(4)** Global Heath co-lead Cambridge Public Health **(5)** C-19 Global Task Force, Aga Khan Development Network, Testing sub-committee **(6)** Chair, Board of Directors, Aga Khan Health Services, Uganda

Contributions to Field: (1) Mhealth technologies: developed mHealth Call for Life tool (drug adherence and health information by interactive voice response) showed improved quality of life in PLHIV, and has been adapted for use in TB patients, sexually transmitted infections. It was added to Uganda Ministry of Health COVID -19 guidelines and is supporting post discharge care countrywide. As PI, developed and piloted a Health Systems tool (ARTAccess) which has supported 5000 people living with HIV (PLHIV) in Kampala City Council Authority (KCCA) clinics; currently we are scaling up nationally with support from US government and Uganda Ministry of health (currently >20,000 participants). JMIR mHealth and uHealth 2021;9(6), Trials 2021;22:391, JMIR mHealth and uHealth 2021;9(2) **(2) Sexually transmitted infections and syphilis:** Collaboration with Johns Hopkins Point of Care technologies group work on syphilis testing has Uganda has led to routine inclusion of syphilis testing alongside HIV testing in KCCA and 4 other districts in Uganda. Work on gonorrhea anti-microbial resistance prevalence has led to prioritization of gonorrhea by World Health Organisation and MOH within the national anti-microbial resistance surveillance programme. DOI: Sex Health 2020;17(3):214-222, Int Journ of STD & AIDS 2019;30(4):404-410, Int Journ of STD & AIDS 2018;30(3):256-263. **(3) HIV care and opportunistic infections.** Developed screening tools for Ebola that were adopted by organisations around Uganda in the 2013 Ebola outbreak in Uganda. PhD work on use of prophylactic fluconazole in Cryptococal disease in HIV was referenced in the WHO Rapid Guidance on Cryptococcal Disease (2012), and several national guidelines, including the Ugandan national guidelines. In 2017 the intervention was included in the MRC REALITY trial as a component of the prevention package in advanced HIV (decreased mortality by 27%.) As head of HIV clinic at IDI, developed and rolled out models of HIV care to 300 IDI supports across Uganda. Lancet HIV 2015;2(7):e261-e262, Nature 2015;528:S68-S76, Mycoses 2015;58(S5):85-93, PLoS One 2015;0126236 and Lancet ID 2011;11(12):933-941.

SEKAGGYA-WILTSHIRE, Christine *(1) Senior Research Scientist: Infectious Diseases Institute (2) Physician, Mulago National Referral Hospital (3) Senior lecturer (Hon), Makerere University College of Health Sciences*

Qualifications: MBChB (Mak), MMed(Internal Med, Mak), PhD (Mak/UZH)

Project Role: Drug-drug interactions

ORCID ID: 0000-0001-9247-2950

Grants Awarded: **(1)** NIH, Clinical Predictors of weekly Rifapentine/isoniazid related adverse drug reactions during national roll-out of tuberculosis preventive therapy (R01: 1R01AI160434-01, PI) 2021-2026 **(2)** EDCTP, Safety and Efficacy of High Dose Rifampicin in HIV-infected patients (CDF1580, PI) 2018-2021 **(3)** Makerere University Research and Innovations Fund, Pharmacogentic guided dosing for Isoniazid (PI) 2020-2021

Positions, Scientific Appointments and Honours: (1) Vice president, Association of Physicians of Uganda **(2)** Ministry of health ministerial scientific advisory sub-committee on COVID-19 **(3)** Stephen Lawn TB/HIV Research Leadership Award

Contributions to Field: **(1)** Led ground-breaking research evaluating for drug-drug interaction between high-dose rifampicin and dolutegravir which demonstrated the two drugs can be used together safely without compromising virological control **(2)** Led projects that aimed at increasing TB case detection involving private pharmacies and drug shops by training pharmacists to diagnose TB **(3)** Participated in writing the Ministry of health COVID-19 treatment guidelines

Key Researchers from CAMO-Net South Africa

BOULLE, Andrew *(1) Professor: School of Public Health and Family Medicine, University of Cape Town (2) Group leader, Centre for Infectious Disease Epidemiology and Research (CIDER), University of Cape Town; (3) Platform co-lead, Data Integration Platform, Wellcome Centre for Infectious Diseases in Africa (CIDRI-Africa), University of Cape Town (4) Public Health Medicine Specialist and Technical Lead, Provincial Health Data Centre, Western Cape Department of Health and Wellness, Western Cape Government.*

Qualifications: MBChB (UCT) | MSc (Public Health in Development Countries, LSHTM) | PhD (Public Health, UCT)

Project Role: Surveillance

ORCID ID: 0000-0002-7713-8062

Grants Awarded: (1) South African Medical Research Council, C-SHARP: Cape Surveillance in Heath Action Research Project. The Cape Town Demographic and Surveillance node of the South African Population Research Infrastructure Network (PI) 2022-2025 (**2)** Global Challenges Research Fund Digital Innovation for Development in Africa African Health Information Exchange: Transforming chronic disease care (EP/T029323/1 PI) 2020-2021 **(3)** NIH (NICHD) B positive: A population-based evaluation of expanded ART access in pregnancy (R01 HD080465, PI) 2014-2022 **(4)** Bill & Melinda Gates Foundation, African Health Information Exchange Project (Grant# 1164272 PI until mid-2021) 2017-2022 **(4)** Wellcome Trust, Wellcome Centre for Infectious Diseases Research in Africa (203135/Z/16/Z Co-PI) 2017-2023 **(5)** South African Medical Research Council, Monitoring, Evaluation and Surveillance of HIV (MESH) Consortium II Ascertainment of Antibiotic Resistance in the Western Cape Province of South Africa (SHIP program 33329 Joint PI) 2022-2023

Positions, Scientific Appointments and Honours: 1) B2 (considerable international recognition) rating from the National Research Foundation of South Africa (2016).

Contributions to Field: (1) Routine health information systems: Leading development of nationally-deployed electronic systems for HIV and TB patient management, and the establishment of the Western Cape health information exchange. Helped develop digital platforms for community health workers; led the establishment of a pregnancy exposure registry and birth defects surveillance system in the Western Cape, and currently leading on the establishment of an urban health and demographic surveillance site in Cape Town. **(2) HIV cohort epidemiology:** Over two decades research in HIV cohorts from effectiveness and clinical epidemiology based on facility-based cohorts (Khayelitsha cohort), to establishing cohort collaborations for multi-cohort comparative effectiveness and clinical epidemiological analyses (IeDEA-SA), to population-based evaluations of interventions based on representative routinely-collected population-wide cohort data (Western Cape). Methodological contributions have been focussed on methods for dealing with differential cohort retention. (**3) COVID-19 clinical epidemiology:** Involved in analyses on the risk factors for severe COVID-19 outcomes, including the relative severity of emergent variants, and the effectiveness of vaccines to protect against COVID-19 disease in South Africa.

Key Researchers from CAMO-Net South Africa

BRINK, Adrian *(1) Professor, Chair, and Head of the Division of Medical Microbiology, Faculty of Health Sciences, Cape Town, South Africa; (2) Head Medical Microbiology laboratory, National Health Laboratory Services, Groote Schuur hospital, Cape Town, South Africa.*

Qualifications: MBChB (UP) | MMed (Clin Micro) (UP)

Project Role: AMR transmission dynamics

ORCID ID: 0000-0002-5350-9690

Grants Awarded: (1) Pfizer. Clinical and molecular epidemiology of carbapenemase-producing Enterobacteriales in hospitalized patients in the Cape Town Metropole (PI) 2019 – 2023 (2**)** EDCTP - RIA2017S-2007, TB CAPT Clos+C13:C24e the Gap, Increase Access, Provide Adequate Therapy, (Co-I) 2019-2023 **(3)** CNINE - Multicentre clinical performance evaluation for rapid and inexpensive sMAC lateral flow assay (Co-I) 2020-2022 **(4)** FIND - Evaluation of the performance of novel rapid diagnostics for SARS-CoV-2 at point-of-care (I), 2020-2022 **(5)** CIDRI-Wellcome Trust - Saliva as a non-invasive specimen for detection of SARS-CoV-2 in adults: a diagnostic validity study (PI) 2019-2021 **(6)** Oppenheimer Generations - Metagenomic sequencing of CSF in COVID-19 patients presenting with brain involvement (PI) 2020-2022

Positions, Scientific Appointments and Honours: (1) Appointment Ministerial Advisory Committee for AMR**;** 2) European Society Clinical Microbiology and Infectious Diseases - International Affairs Committee member.

Contributions to Field: (1) Implementation of large-scale antibiotic stewardship and infection prevention and control interventions in low and middle-income countries, including a number of AMS-related research studies on public health (specifically antibiotic) seeking behaviour using cross-sectional surveys in urban and semi-urban populations with a focus on predictors such as gender, education level, employment level, household asset/wealth, history of illnesses, and comorbidities. **(2) Context-specific perceptions and attitudes towards commonly used terms in the field of AMR**, research amongst the commuter community (mini-bus drivers and passengers) and expertise in using data mining tools to investigate, how messages relating to AMR are used on different social media platforms, in 11 official SA languages. (**3) Resistome and AMR transmission dynamics** Will be involved in specifying and writing the algorithm logic and description of determinants that may be associated with the risk of different types of AMR.

Key Researchers from CAMO-Net South Africa

DLAMINI, Sipho *(1) Division of Infectious Diseases and HIV Medicine, Groote Schuur Hospital Observatory*
Qualifications: MBChB FCP Cert ID(SA)Phys

Project Role: AMR and clinical translation

ORCID ID: 0000-0003-0582-5987

Grants Awarded: (**1)** NIH, Clinical and mechanistic research on immune-mediated drug hypersensitivity reaction in persons living with HIV [Collaboration UCT and Vanderbilt University K43 TW 011178-04 and NIH 5R01AI152183-02 Co-I (**2)**: Structural and Functional basis of Severe Hypersensitivity associated with Nevirapine, 2016-2022, Co-I **(3)** Fogarty D43 Research Training Grant; introduction of medical students to research and training programme (Co-I) 2017-2022

Positions, Scientific Appointments and Honours: (1) Chairperson of Expert panel for Vaccination Guidelines for Adults and Adolescents committee for the Southern African HIV Clinicians Society (2016-2021); **(2)** Member of the ESCMID Professional Affairs Subcommittee (PAS) for infectious Diseases.

Contributions to Field: **(1) How differences in individual-level risk factors help explain the differential spread of HIV in South Afric**a, including looking at sexual network structures between different racial or ethnic groups. **(2) The severity of respiratory infections in pregnancy** and the clinical outcomes including intensive care admission. **(3) Establishing effective multidisciplinary stewardship working with surgical teams to optimise care** including instrumental work in supporting the South Africa-UK-India research investigating antibiotic use in surgical pathways, providing the research team with clinical input and leveraging access to team and bringing clinical and organizational leadership skills to ensure contextualised development of interventions.

Key Researchers from CAMO-Net South Africa

HODES, Rebecca (*1) Director, Centre for Sexualities, AIDS and Gender, Associate Professor, Department of Historical and Heritage Studies, University of Pretoria.*

Qualifications: M.Sc (Oxon), History of Medicine, Science and Technology; D.Phil (Oxon), History of Medicine and African Studies

Project Role: Social science and PPIE

ORCID ID: 0000-0002-2502-803X

Grants Awarded: (1) Building Research in Inter-Disciplinary Gender and HIV through the Social Sciences (BRIDGES) (D43 TW011308 Co-I) 2019-2024 (**2)** Medicines Research Council and Human Sciences Research Council, South Africa Adolescents Living with HIV in South Africa 2002- 2017: An in-depth analysis of the South African National Prevalence, Incidence, Behaviour and Communication Surveys (Co-I) 2019-2020 **(3)** Medical Research Council, UK, From Stop to Go! Overcoming barriers to healthcare utilisation for high-risk adolescent mothers and their children in Southern Africa (MR/R022372/1 Co-PI **(4)** European Research Council, Helping Empower Youth Brought up in Adversity with their Babies and Young children (Co-I) 2017-2019 **(5)** Evidence for HIV Prevention in Southern Africa, The missing link in HIV prevention: Helping HIV-positive adolescents to reduce transmission in Southern and Eastern Africa. (MM/EHPSA/UCT/05150014 Co-PI) 2016-2018 (**6)** Investigating adherence to antiretroviral medicines among adolescents, Collaborative Initiative for Paediatric HIV education and research (PI) 2014-2016

Positions, Scientific Appointments and Honours: (1) Director, Centre for Sexualities, AIDS & Gender, University of Pretoria **(2)** Director, AIDS and Society Research Unit, University of Cape Town; 3) Director, Policy, Communications and Research, Treatment Action Campaign. In 2020, awarded the University of Cape Town's Social Responsiveness Award, the university's highest honour for research that has a positive social impact.

Contributions to Field: **(1) 20 years of experience in health advocacy and research in Africa** with extensive publications within the fields of social science and healthcare, including in, among others, in the *Journal of the International AIDS Society*, *Global Public Health*, *Critical Public Health*, the *African Journal of AIDS Research*, the *Journal of Southern African Studies*, *African Studies* and *AIDS Care* and a current research focus on histories of race, science, sexualities and pandemics **(2) Research at the intersection of social and health sciences** resulting in a publication, teaching and supervision record which spans disciplines including social science, reproductive health, bioethics, medical history, media studies and African Studies. Hodes was the Chair of the 2015 Social Sciences, Economics and Human Rights Track at the Southern African AIDS Conference, evincing her commitment to the production of strong and collaborative social science research in the health domain.

Key Researchers from CAMO-Net South Africa

KOCH, Anastasia (*1) Co-director, Eh!woza; (2) Honorary Lecturer, Division of Medical Microbiology, Faculty of Health Sciences;*

Qualifications: PhD (UCT)

Project Role: Social science and PPIE

ORCID ID: 0000-0002-5897-4196

Grants Awarded: (1) South African National Research Foundation COVID-10 Africa Rapid Grant Fund: Hey come with us + scrutinize (Eh!woza + Bhekisisa) (130268 PI) 2021–2022 **(2)** Wellcome Trust Discretionary Award in Public Engagement: *Eh!woza (*219398/Z/19/Z PI) 2020–2023 (**3)** South African National Research Foundation Community Engagement Funding Instrument: Beyond the lab and the clinic: Eh!woza and knowing tuberculosis (116273. Co-I) 2019–2021 **(4)** Carnegie Corporation Developing Emerging Academic Leaders Fellowship (PI) 2017–2021

Positions, Scientific Appointments and Honours: (1) Falling Walls Engage Advisory Board Member (2022); **(2)** Falling Walls Engage Winner (top 20); 3) Co-director, Eh!woza 2020 – present **(2)** Molecular biology advisor Desmond Tutu Health Foundation (independent contractor 2020 – present) **(3)** Honorary Lecturer, MMRU, Division of Medical Microbiology, FHS, UCT 2020 – present (**4)** Junior Research Fellow, Molecular Mycobacteriology Research Unit (MMRU), FHS, UCT 2017 – 2109

Contributions to Field:

Eh!woza public engagement (PE) programme (www.ehwoza.com), formed with artist, Ed Young, in 2013 to engage with communities who were most greatly affected by TB. Eh!woza's inaugural project, a film describing youth attitudes towards TB, formed the basis for the development of several distinct but inter-related PE projects that were developed over the subsequent six years. In a major shift for Eh!woza, the organization was awarded a Wellcome Trust Discretionary Award in PE in 2020, facilitating its transition towards independence. Eh!woza views participants as active partners and aims to facilitate access to accurate information while stimulating discussion and dialogue around infectious diseases. Over the long term, the organization aims to decrease stigma and increase positive health-seeking behaviour. While focused on implementation, the production of scholarly knowledge around public engagement is a core component of Eh!woza's programming, with a selection of publications provided below.

a. Young E. and **Koch A.** 2022. Reasons for Knocking at an Empty House: Visualisation, representation and dissemination of health-related public engagement media. Biomedical Visualisation within the Advances in Experimental Medicine and Biology, Springer, Berlin (*Book chapter, in press*)
b. Young E. and **Koch A**. 2021. My Rhodes has no nose: COVID-19 and the two cities of Cape Town. COVID-19 and Co-production in Health and Social Care Research, Policy and Practice. URI: https://library.oapen.org/handle/20.500.12657/48756
c. Masuku B., Mkhwanazi N., Young E., **Koch A.,** Warner D.F. 2018. Beyond the lab: Eh!woza and knowing tuberculosis. BMJ Medical Humanities. 44:285-292. DOI: 10.1136/medhum-2018-011479.

Key Researchers from CAMO-Net South Africa

MASWIME, Salome (1) *Professor and Head: Global Surgery Division, Department of Surgery, Faculty of Health Sciences, University of Cape Town*

Qualifications: MBChB (UKZN) | FCOG(SA) | MMED (Obstetrics and Gynaecology | PhD (Obstetrics and Gynaecology)

Project Role: AMR and clinical translation

ORCID ID: 0000-0003-4013-5164

Grants Awarded: (**1)** National Institutes of Health U54 Award Data science for injuries, equity and Surgery (Co-I) 2021- 2025 (**2)** South African Medical Research Council, Midcareer-Scientist Award (PI) 2019 – 2024 **(3)** UNICEF Stillbirth mapping study in Africa (PI) 2021– 2022

Positions, Scientific Appointments and Honours: (1) Member of the Academy of Sciences South Africa **(2)** World Economic Forum Young Scientist **(3)** World Laureates Forum Young Scientist **(**4) Next Einstein Fellow.

Contributions to Field: Research investigating the post-partum clinical outcomes for women in LMICs. Her research has described how pregnant women in Africa are 50 times more likely to die from caesarean section related complications, than women in high-income countries. Most recently she has led research in pregnant women with Covid-19 in South Africa. She advocates for women's health rights, equity in surgical and maternal care, and providing adequate health services to remote and underserved populations. She advises and consults for many institutions, including the World Health Organisation. In 2017, she was honoured with the Trailblazer and Young Achiever Award. In her role as Global Surgery Lead at UCT, Maswime will enable the translation of this research into clinical pathways targeting populations most vulnerable to the consequences of AMR.

Key Researchers from CAMO-Net South Africa

SCHELLACK, Natalie *(1) Head of the Department of Pharmacology, University of Pretoria*

Qualifications: BCur (Pret), B.Pharm (UL), PhD (Pharmacy) (UL)

Project Role: AMR and clinical translation

ORCID ID: 0000-0001-9690-6285
Grants Awarded: (1) Newton Grant ENhancing Appropriate Antimicrobial use via mHeaLth and other techniques in the Republic of South Africa (ENAABLERS Project) Application for Part 3 in humans - New technology innovations to improve surveillance and use of antimicrobials (PI) (**2)** MERCK - grant towards the approved protocol A pharmacist driven collaborative study on adherence to the South African Community Acquired Pneumonia guidelines in selected hospitals in the private and public health care sector of South Africa (Co-I) 2017

Positions, Scientific Appointments and Honours: (1) School of Pharmacy, Sefako Makgatho Health Sciences University, Professor/Clinical Pharmacist **(2)** Woman of the year – health care category for "woman of stature" in South Africa **(3)** Elected as a member of the South African Pharmacy Council 2019–2023 **(4)** Member of the Sefako Makgatho Health Sciences Institutional Research and Ethics Committee 2015/2020 **(5)** Editorial Board of the Journal of Hospital Administration – International Peer Reviewed Journal 2011-2014 **(6)** Member of the Ministerial Advisory Board for Antimicrobial Resistance (2021 - Current)

Contributions to Field: Surveillance and preservation of antimicrobials starting with guidelines for the use of the last resort Gram-negative antibiotic, colistin. She has established a successful collaboration with University of Strathclyde in Scotland through a Newton Grant at the Medicine Research Council investigating surveillance of antibiotic consumption. **(2) Development of technology to capture and quantify antimicrobial use with big data.** Her research team continue the research quantifying antimicrobial use using technology for big data. The application that was developed allowed infectious diseases specialists, administrators and International agencies such as the WHO to access patient level data, allowing for the first time in a setting such as South Africa, that is largely reliant on paper-based data sets, to capture real time data on infectious diseases at the bedside. Her team also incorporated appropriateness data sets for key indicator diseases including diarrhoea and sepsis. **(3) Investigation of emerging trends contextualised to South Africa** e.g. language barriers and over the counter use of antibiotics. Currently she is leading a mystery shopper study in community pharmacies, to improve antimicrobial use in a multicultural country such as South Africa

Key Researchers from CAMO-Net South Africa

TIFFIN, Nicki *(1) Professor: Health Data Integration Group, South African National Bioinformatics Institute, University of the Western Cape, South Africa*

Qualifications: B Sc, B Sc (Hons) (UCT) | PhD (Molecular Oncology) (University of London), MPH (Epidemiology) (UCT)

Project Role: Surveillance

ORCID ID: 0000-0001-5083-2735

Grants Awarded: (**1)** Calestous Juma Fellowship, Bill & Melinda Gates Foundation (INV-037558 PI) 2021-2026 **(2)** H3Africa Bioinformatics Network (U24HG006941 Co-I and Node PI) 2018-2022

Positions, Scientific Appointments and Honours: (1) Professor, University of the Western Cape **(2)** Honorary Professor, University of Cape Town **(3)** Fellow of the African Academy of Sciences **(4)** Member of the Global Health EDCTP3 Scientific Committee **(5)** Member of the Executive Committee of the International Common Disease Alliance **(6)** Hugo African Award 2020

Contributions to Field: (1) Health data analytics: Expertise in the analysis of large health datasets, for example routine health data used for research purposes, as well as large bioinformatics health datasets. Using epidemiological approaches combined with her skills in SQL, R and python, her research work analyses risk factors and outcomes in health care clients in the Western Cape of South Africa. She will bring epidemiological and data analytics skills and familiarity working with the statistical analysis of large health data sets to the proposed work. (**2) Health informatics:** experience at the Provincial Health Data Centre at the Western Cape Department of Health, under the leadership of Boulle, bringing a combination of data analysis and data management skills, epidemiological skills and knowledge in ethics and governance to assist with the management and analysis of routine health data for public sector health care clients in the Western Cape Province. She continues to collaborate with this team and is currently involved in a pilot AMR programme at the PHDC that will be realised through the current project. Her ability to synthesise and analyse these data and facilitate their ongoing use will contribute to the success of the proposed work. **(3) Ethics and data governance for health data**: She has extensive experience in data governance and the management of ethical risks when working with both routine health data and research health data. She will bring to the current project expertise in overseeing the ethical use and appropriate management of routine health data to ensure that patient confidentiality is upheld, and that ethical and legal requirements are met when working with these data.

Key Researchers from CAMO-Net South Africa

Van den BERGH, Dena (*1) CEO and founder DnaVISION, Independent Healthcare Systems Improvement Leader | AMR/AMS Implementation Researcher | Strategic Business Advisor | Large Scale Change Implementation | Certified Coach and Transformational Facilitator | Co-founder Best Care Always Campaign - Johannesburg and Cape Town, South Africa (2) Division of Infectious Diseases & HIV Medicine, Department of Medicine University of Cape Town, South Africa.*

Qualifications: EngD | MSc(Med) Pharmacology| BPharm

Project Role: Social science and PPIE

ORCID ID: 0000-0003-4057-4925

Grants Awarded: **(1)** Merck USA, Neonatal antibiotic stewardship implementation study across 14 public and private hospitals (Co-I) 2021-2022 **(2)** Merck USA, Antibiotic stewardship in Community Acquired Pneumonia across 39 hospitals in South Africa (Co-I) 2017-2018

Positions, Scientific Appointments and Honours: **(1)** South African Antibiotic Stewardship Programme (SAASP) founding committee 2014 to date. **(2)** National Core Standards for Quality in Healthcare – National Department of Health Task Team. **(3)** JAC AMR Senior editor 2021 to date. **(4)** Lifetime Achievement Award for Outstanding Leadership in Quality Improvement in South Africa by Discovery Health, South Africa's largest administrator of medical schemes. **(5)** Board of Hospital Association of South Africa

Contributions to Field: **(1) Large scale Antimicrobial Stewardship quality improvement interventions in South Africa across public and private healthcare settings**. She led the implementation of a multi-faceted framework for proprietorship of hand hygiene compliance in a network of South African hospitals. She has been instrumental in involving pharmacists and nurses in infection management and stewardship interventions in South Africa. She is currently co-supervising with Mendelson and Charani a PhD student at UCT investigating team communication in relation to stewardship and the quality improvement interventions across multidisciplinary teams. **(2) Cross-sectional studies in knowledge, attitudes and perceptions of antibiotic use and resistance among patients in South Africa.** Currently, with Mendelson, Charani, and other colleagues she is the quality improvement lead for a multisite interventional study investigating infection management in neonatal pathways.

Key Researchers from CAMO-Net South Africa

VENTER, Francois *(1) Ezintsha, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa*
Qualifications: MBBCh, FCP (SA), DTM&H, Dip HIV Man, MMED, PhD

Project Role: Social science and PPIE

ORCID ID: 0000-0002-4157-732X

Grants Awarded: **(1)** Bill and Melinda Gates Foundation. COVID-19 Test and Treat Study (PI) **(2)** South African Medical Research Council. Characterising long-COVID in a large sample of South African adults (PI) **(3)** Janssen/Joint Clinical Research Centre (JCRC) Uganda. Cabotegravir and rilpivirine: efficacy and safety study: The CARES Study (Co-I) (**4)** Janssen. Long-acting injectable antiretrovirals (LAIs) administered in pharmacies in South Africa: A Supportive Clinical Trial (Co-I)

Positions, Scientific Appointments and Honours: **(1)** Research Professor, School of Clinical Medicine, University of the Witwatersrand **(2)** Honorary Consultant, Charlotte Maxeke Johannesburg Academic Hospital Infectious Diseases Unit **(3)** Current: Moderator Diploma in HIV Medicine and Diploma in Sexual Health and HIV; both Colleges of Medicine **(4)** WHO Committees/Working Groups including those relating to: ARV Advocacy, HIV ResNet, HIV Self Testing, HIV Resistance, ARV Guidelines for treatment and prevention of HIV; ARV trials in pregnant women **(5)** South African Government/Department of Health Committees and Advisory Boards including for the National Strategic Plan for HIV, TB and STI's (2004, 2011, 2017-2022); ARV Procurement Committee (HIV Sub group), Ministerial Advisory Committee on COVID (2020).

Contributions to Field: (**1) Characterising local HIV resistance patterns and predictors of virological failure among people using antiretrovirals on first and subsequent-line therapy** (>20 in last 5 years) including modern integrase inhibitors. Venter's emphasis has been on broadening local African population representation in trials documenting antiretroviral side-effect profiles. Venter's studies have demonstrated unexpected effects among black women (obesity with newer regimens) or higher levels of known side-effects (peripheral neuropathy with stavudine), while challenging side-effect profiles seen in high income country studies (insomnia or unexpectedly high levels of the immune reconstitution syndrome with dolutegravir use). As a leading figure in the ART development field, Venter has established rich collaborations locally and internationally, including long standing collaborations with the University of Liverpool, the London School of Hygiene & Tropical Medicine, Emory, and Harvard Universities. Long term alliances with the Bill & Melinda Gates Foundation, USAID and UNITAID have been fruitful. **(2) Cultural practices of different populations** He is the founder of Ezintsha, which is a consortium of researchers working to harness networks and work with global partners and stakeholders to improve population health and extend capacity building. Ezintsha has a long history of fostering community engagement and working with local (Treatment Action Campaign (TAC), Section 27) and international (Afrocab, i-Base) advocacy groups and media houses (Spotlight, Daily Maverick, Groundup, Bhekisisa), around issues pertaining to HIV, public health and more recently, COVID-19 advocacy, with members of their staff having a strong television, radio and social media presence across multiple platforms. The ADVANCE antiretroviral study, done in consultation with community groups across Africa, and led by Prof Venter, has been seen as a successful academic-activist partnership, allowing for the introduction of new antiretroviral regimens into the continent.

BRANDAO DE ASSIS, Denise *(1)* Technical Director of Division of Nosocomial Infections, Center for Epidemiologic Surveillance "Prof. Alexandre Vranjac", Center of Disease Control, São Paulo State Health Department.

Qualifications: PhD Faculdade de Medicina da Universidade de São Paulo, Master of Public Health Faculdade de Saúde Pública da Universidade de São Paulo, Medicine, Pontifícia Universidade Católica de Campinas.

Project Role: IPC doctor

ORCID ID: 0000-0002-5200-4121

Grants Awarded: N/A

Positions, Scientific Appointments and Honours: Infectious disease physician. Coordinator of the State Program for the Prevention and Control of Infections Related to Health Care (IRAS) in the State of São Paulo. Coordinator of the Hospital Infection Control Subcommittee at the HCFMUSP Institute of Psychiatry.

Contributions to Field: (1) Implementation and evaluation of infection prevention interventions: including tailored interventions in a statewide programme to reduce central line-associated bloodstream infection (J Hosp Infec. 2018;100(3):E163-168) healthcare associated infections (J Hosp Inf. 2010:76(4):311-315 and American Journ of Infection Control. 2014;42(4):e47-53) and coronavírus (Clinics (São Paulo).2021;76:e3299 and Environmental Pollution 2021;290) **(2) Surgical Site Infection** research, considering spatial and sociodemographic factors (J Hosp Infect 2021;108:181-184) as well as microbiological factors (Future Microbiology 2010;5(6)) **(3) Antimicrobial resistance,** research identifying resistance patterns (Brazilian J of Infect Dis. 2020;24(6):479-488) and individual cases (N Engl J Med 2014;370:1524-1531). Also consideration of treatment (Clin Microbio Infect 2015;21(2):179.E1-179.E7).

DE OLIVEIRA, Maura Salaroli *(1) Coordinator of the Hospital Infection Control Service at Hospital Sírio Libanês, São Paulo (2) Assistant Physician at the Hospital Infection Control Service of Hospital das Clínicas of the Faculty of Medicine of the University of São Paulo*

Qualifications: PhD Infectious and Parasitic Diseases, Masters degree, Medicine University of São Paulo

Project Role: Infectious disease specialist

ORCID ID: 0000-0001-8508-2612

Grants Awarded*:* N/A

Positions, Scientific Appointments and Honours: Infectious disease physician. Supervisor of Infection control department of HCFMUSP. Manager of the Infection Control Service of Hospital Sirio Libanês. Consultant on IPC to the National Surveillance Agency (ANVISA).

Contributions to the field: (1) Pharmacokinetics/Pharmacodynamics and Therapeutic Drug Monitoring: She has conducted studies assessing the use of therapeutic drug monitoring to optimise treatment in burn patients and studies on the pharmacokinetic and pharmacodynamic characteristics of Vancomycin and Meropenem in critically ill patients receiving sustained low-efficiency dialysis. **(2) Optimising prescribing for drug resistant infections:** including KPC-producing Enterobacteriaceae and carbapenem-resistant Acinetobacter. **(3) Antimicrobial stewardship and implementation and evaluation of interventions to reduce healthcare associated infections:** In addition to writing clinical guidelines for the treatment and prevention of infection she has a research interest in interventions to reduce HCAIs and have implemented (J Hosp Infec. 2018;100(3):e163-168) and assessed the efficacy of continuous tailored education versus one basic lecture to reduce catheter-associated bloodstream infection (Amer J of Infect Control 2010;38(6):440-448). She has also conducted work on prevention of COVID-19 in healthcare facilities.

DROPA, Milena *(1) Research Technician at the Environmental Health Department, School of Public Health, University of São Paulo*

Qualifications: BSc in Pharmacy & Biochemistry, Specialist in Microbiology, MSc in Public Health, PhD in Public Health

Project Role: Public health

ORCID ID: 0000-0003-1459-915X

Positions, Scientific Appointments and Honours: **(1)** Research Assistant at Microbiology and Antimicrobial Resistance Laboratory (MicroRes Lab), School of Public Health, University of São Paulo, Brazil, since 2001. **(2)** Member of graduation, master and doctoral evaluation boards since 2013. **(3)** Design and development of funded projects involving collaborations with several institutes. **(4)** Reviewer for scientific manuscripts: https://publons.com/researcher/1311416/milena-dropa/. **(5)** Guest Topic Editor for Frontiers in Cellular and Infection Microbiology. **(6)** Review Editor for Frontiers in Antimicrobials, Resistance and Chemotherapy.

Grants Awarded: **(1)** Molecular and biochemical characterization of the new D240G beta-lactamase CTX-M-131 (PI), University of Buenos Aires, School of Pharmacy & Biochemistry; University of São Paulo, School of Public Health; Location: Buenos Aires, Argentina; Area: Biochemistry of Antimicrobial Resistance Proteins; Funding: FAPESP – São Paulo State Funding Agency US$ 12,500.00, 2013. **(2)** Assessment of Dissemination and Removal of Antimicrobial Resistance Genes after Wastewater, Secondary and Tertiary Treatments in the city of São Paulo (PI). University of São Paulo (School of Public Health, School of Veterinary, Institute of Biomedical Sciences and University Hospital); São Paulo State Environmental Company. Funding: FAPESP – São Paulo State Funding Agency R$ 148,000.00, 2017-2019.

Contributions to Field: **(1)** She has been working on clinical and environmental antimicrobial resistance (AMR) since 2004. At MicroRes Lab she developed diversified research projects focusing on the sanitary surveillance and antimicrobial resistance of several sources (clinical samples and surfaces, natural environments, food chain sources), using Microbiology and Molecular Biology methods, including quantitative PCR, bacterial whole-genome sequencing analysis and metagenome analyses. Front Cell Infect Microbiol. 2021 Aug 24;11:722536, J Water Health. 2020 Oct;18(5):654-664, Mol Ecol. 2020 May;29(10):1919-1935, Environ Entomol. 2017 Dec 8;46(6):1381-1389, Antimicrob Agents Chemother. 2017 Aug 24;61(9):e00592-17, Sci Total Environ. 2017 Nov 15;598:910-915, Antimicrob Agents Chemother. 2017 Mar 24;61(4):e02474-16, Virulence. 2018 Jan 1;9(1):281-286, Environ Sci Pollut Res Int. 2017 Feb;24(5):4828-4834. **(2)** With the COVID pandemic she been working on the detection and surveillance of SARS-CoV-2 in wastewater treatment plants (WWTPs) and streams at informal underprivileged urban settlements in São Paulo, Brazil, in collaboration with the State Environmental Company of São Paulo (https://cetesb.sp.gov.br/sars-cov-2/; Environ Pollut. 2021 Dec 1;290:118003).

FERREIRA, Joao Eduardo (*1)* *Full Professor of Computer Science Department at University of São Paulo, Brazil (2) Coordinator of Centre for Research and Development on Live Knowledge (3) Chief Information Office at University of Sao Paulo*

Qualifications: Ph.D, Computational Physics, M.Sc. Computational Physics B.Sc. Philosophy of Education, B.Sc. 1982-1987 Physics University of São Paulo, Sao Carlos, SP, Brazil

Project Role: Data scientist

ORCID ID: 0000-0001-9607-2014

Grants Awarded: (1) FAPESP, Centre for Research and Development on Live Knowledge (FAPESP 2020/06950-4, PI), 2021-26. **(2)** PRP-USP and GaTech-USA, Automated detection and tracking of events and entities in Cybernetic Physical Systems (2020/0555-7, PI) 2019-2022.

Positions, Scientific Appointments and Honours: (1) Associate Editor of the Journal IEEE Transactions on Services Computing. **(2)** Member of program committees last 10 years including IEEE Web Services, WISE, ICSOC, ICWS, ICDE, IEEE Big Data, ENASE, SBBD and SCF. **(3)** Head of the Database Modelling, Transactions, and Data Analysis (DATA) research group at the Institute of Mathematics and Statistics. University of São Paulo. **(4)** Member of the Brazilian Computer Society, IEEE and ACM. **(5)** CNPq Research Productivity scholarship level 2 in Computer Science Committee, since March 2007, processes numbers 301404/2006-2; 306769/2009-3; 304150/2012-6; 308476/2015-8; 305886/2018-5. **(6)** Best Student Paper Award: "Modelling Time-Critical Processes with WED-flow", ICWS 2020, Student Rodrigo Alves Lima. **(7)** Outstanding Services Awards for SCF 2018, Services Conference Federation. **(8)** CIO Award 2017, 2018, 2019, 2020 IT4CIO. **(9)** Best Paper in Brazilian Database Symposium (SBBD), 2017, "Main components in ordering ads: one experiment in real computing advertising environment". Society Brazilian Computer Science, 2017.

Contributions to Field: (1) Big Data and live knowledge: Use of an evidence-based knowledge acquisition approach, illustrated by the LITMUS landslide information system to automatically acquire real-time, validated, and actionable information overcoming the diverging technical challenges of big noise and concept drift (ACM Transactions on Internet Technology. 2020;20(1)). **(2) Novel interventions to improve mortality data:** Reliable mortality data are essential for the development of public health policies. He evaluated the performance of an adapted and reduced version of Verbal Autopsy in identifying the underlying causes of non-forensic deaths, in São Paulo, Brazil. (BMC Public Health 2022;22(748)). **(3) Linked data to study Drug Resistance:** A linked donor-recipient study was conducted during epidemics in 2 cities in Brazil to investigate transfusion-transmitted dengue virus (DENV) by DENV RNA–positive donations.

FREIRE, Maristela Pinheiro *(1) Physician at Hospital das Clinicas, University of São Paulo and Instituto do Cancer do Estado de São Paulo*

Qualifications: MD, MSc Infectious Diseases, PhD Infections Diseases

Project Role: Infection prevention and control

ORCID ID: 0000-0002-9691-192X

Positions, Scientific Appointments and Honours: **(1)** Infectious diseases physician of infection control department at Hospital das Clinicas, University of São Paulo. **(2)** Physician at Infectious Diseases service of Instituto do Cancer do Estado de São Paulo.

Grants Awarded: **(1)** Award/Grant name (*402470/2018-4*; Reduction of *bla*KPC-producing *K. pneumoniae* transmission among kidney transplant patients: the role of real-time PCR) 2019-2021. **(2)** Award/Grant name FAPESP (São Paulo State Funding Agency) 2019/06840-7; The intestinal microbiota and its relationship with colonization and infection by multidrug-resistant bacteria after liver transplantation) 2019-2022.

Contributions to Field: **(1)** Knowledge and experience in infection in immunocompromised patients. **(2)** Knowledge and experience in hospital epidemiology and study designs. **(3)** Knowledge about bacterial resistance. **(4)** 10 most relevant scientific results: Infect Control Hosp Epidemiol. 2013 Jul;34(7):671-7; Transplantation. 2015 Mar;99(3):521-7; Clin Microbiol Infect. 2016 Apr;22(4):352-358; Transplantation. 2017 Apr;101(4):811-820; Liver Transpl. 2016 May;22(5):615-26; Clin Infect Dis. 2021 Aug 16;73(4):e955-e966; Infect Dis (Lond). 2021 Jun;53(6):430-439; Am J Transplant. 2019 Dec 31; Antimicrob Agents Chemother. 2018 Aug 27;62(9):e00569-18; Infection. 2022 May 9.

Key Researchers from CAMO-Net Brazil

LEAL, Fabio E *(1) Researcher of the Oncovirology Program at the Brazilian National Cancer Institute (2) Professor of Medicine, Universidad Municipal de Sao Caetano do Sul (3) Director of Laboratory Professor of Medicine, Universidade Municipal de Sao Caetano do Sul CPC-USCS (4) Researcher at Centro de Pesquisa Clínica da Universidade Municipal de São Caetano do Sul - CPC USCS*

Qualifications: D.Phil, Immunology/Infectious Diseases, University of Sao Paulo, Sao Paulo, Brazil, MD Medicine and Surgery, Federal University of Parana Medical School, Curitiba, Brazil

Project Role: Physician (liaison between study and primary care)

ORCID ID: 0000-0003-1986-3765

Grants Awarded: (1) George Washington University and Foundation for Research Development, Burkitt Lymphoma Genome Sequencing Project (36002/1/EENS91237F), 2014-19. **(2)** Brazilian Federal Agency for Research, Risk of cancer in people living with HIV: new aspects of HIV/AIDS epidemic (PI) 2019-20. **(3)** AIDS Malignancy Consortium – Latin American Site, Cancer Treatment and Prevention Trials for HIV/AIDS-related Malignancies in Latin American Countries (2UM1CA121947-14, PI) 2021-25. **(4)** NIH/Weill Cornell Medicine New York, Regulatory Crosstalk Between Human Endogenous Retroviruses, HIV, and EBV, in Lymphoma (Co-I) 2021-2026. **(5)** Janssen-Cilag Farmaceutica Ltda, A Randomized, Double-blind, Placebo-controlled Phase 3 study to Assess the Efficacy and Safety of Ad26.COV2.S for the Prevention of SARS-CoV-2 mediated COVID-19 in Adults Aged 18 Years and Older (VAC31518COV3001, PI) 2020-22. **(6)** Instituto Butantan, Double-blind, randomized, placebo-controlled Phase III Clinical Trial for Evaluation of Efficacy and Safety in Healthcare Professionals of the adsorbed COVID-19 (inactivated) Vaccine produced by Sinovac (COV-02-IB, PI) 2021-22. **(7)** Instituto Butantan, Randomized double-blind clinical trial with active controls to evaluate safety, immunogenicity and consistency of immune response by batches of tetravalent influenza vaccine (inactivated and fragmented) from Instituto Butantan (FLQ-01-IB, PI) 2021-22

Positions, Scientific Appointments and Honours: (1) Member Brazilian Society of Infectious Diseases. **(2)** Reviewer Journal of Clinical Immunology. **(3)** Reviewer Clinical Microbiology and Infection. **(4)** Reviewer Cytotherapy. **(5)** Reviewer AIDS Research and Human Retroviruses. **(6)** Reviewer PLoS Neglected Tropical Diseases
Honours. **(7)** Research Fellow, CFAR/Fogarty, UCSF, San Francisco

Contributions to Field: (1) Primary care approach to COVID-19 pandemic coordinating an innovative online platform based on epidemiological intelligence to provide remote and home-based healthcare including PCR diagnosis and clinical follow-up by telemedicine (medRxiv. 2020 Jan 1). **(2) Characterization of a novel CD4+ T-cell inducer subset with potent immunostimulatory properties**: collaborating with Dr. Ndhlovu, they were the first to identify that CD39, a marker of Tregs, was also expressed on a subset of CD4 T cells with opposite function. The results of this work in samples from healthy individuals led them to investigate the role of this T inducer subset in lymphoproliferative diseases, such as HTLV-1 associated myelopathy. **(3**) **Preexposure chemoprophylaxis for HIV prevention in men who have sex with men**: Working at the Clinical Research Center at University of Sao Paulo as a subinvestigator in clinical research group, he was part of a team that helped determine the efficacy of preexposure prophylaxis for HIV prevention. The results of this work where published in N Engl J Med 2010; 363:2587-2599. (**4) HIV/AIDS Associated Malignancies**: Since his return to Brazil, Professor Leal has focused on the development of regional and international collaborative initiatives to study the role of HIV and other viral infections in Cancer

NUNES, Fátima L. S. (*1) Professor: Laboratory of Computer Applications for Health Care, School of Arts, Sciences and Humanities, University of São Paulo*

Qualifications: PhD (Sciences)

Project Role: Computer science

ORCID ID: 0000-0003-0040-0752

Grants Awarded: **(1)** Centro de Pesquisa e Desenvolvimento sobre Conhecimento ao Vivo (FAPESP 2020/06950-4, PI) 2021-2026 **(2)** Instituto Nacional de Ciência e Tecnologia – Medicina Assistida por Computação Científica (INCT-MACC) (Fapesp 2014/50889-7, directed to this researcher; coordinator of associated laboratory) 2016-2022 **(3)** Abordagem híbrida para auxílio ao diagnóstico de Cardiomiopatias (CNPq, coordinator) 2020-2023 **(4)** Síntese de expressões faciais com diferentes intensidades para representação de emoções em imagens e vídeo (Capes/ Fulbright, coordinator) 2019-2023 **(5)** Adaptação automática de aplicações computacionais a partir da análise da personalidade do usuário (Capes; coordinator) 2017-2022 **(6)** Segmentação automática do ventrículo esquerdo em exames de Ressonância Magnética Cardíac (Fapesp 2019/22116-7, coordinator) 2020-2022 **(7)** Recuperação de imagens médicas tridimensionais por conteúdo (Fapesp 2011/15949-0, coordinator) 2012-2013 **(8)** Proposição, implementação e validação de técnicas para treinamento médico virtual interativo (Fapesp 2010/15691-0, CNPq 559931/2010-7, 304012/2010-6, 305288/2007-5; coordinator) 2007-2011 **(9)** Recuperação de imagens médicas tridimensionais por conteúdo (Fapesp 2010/15691-0, coordinator) 2012-2013 **(10)** Content-based three-dimensional medical model retrieval (CNPq 401745/2013-9, coordinator) 2014-2015

Positions, Scientific Appointments and Honours **(1)** Professor at the University of São Paulo **(2)** Coordinator of the Academic Performance Indicator Management Office (EGIDA) – University of São Paulo **(3)** Director of the Information Technology Center – São Paulo – University of São Paulo, July 2017 to January 2022 **(4)** Member of the University Council of the University of São Paulo – 2018 to 2019. **(5)** President of the Graduate Commission of the School of Arts, Sciences and Humanities – University of São Paulo, February 2018 to January 2022 **(6)** Coordinator of the Postgraduate Program in Information Systems – University of São Paulo – June 2012 to June 2014

Contributions to Field **(1) Computational tools to aid diagnosis** in various areas (breast cancer, autism spectrum disorder, cardiology, lung diseases) using graphics processing and machine learning. **(2) Computational models for predicting discharge** from patient data, clinical exams and imaging exams. **(3)** Tools for virtual training of procedures in the health area.

Key Researchers from CAMO-Net Brazil

PADOVEZE, Maria Clara (1) Associate Professor. School of Nursing, University of São Paulo (2) Research Group: Public Policies, Epidemiology and Technology for the Prevention of Healthcare-associated Infection

Qualifications: RN, MSc microbiology, PhD molecular epidemiology

Project Role: Nurse and epidemiologist

ORCID ID: 0000-0002-1912-7293

Positions, Scientific Appointments and Honours: (1) Member of Global Infection Prevention and Control Network coordinated by World Health Organization since 2012. **(2)** Member of National Committee of Healthcare-associated infections prevention and Control since 2012. **(3)** Member of board of Brazilian Association of Infection Prevention and Hospital Epidemiology 2021-2023, former vice-president 2018-2020. **(4) T**emporary consultant for the Infection Prevention and Control team at the World Health Emergency. **(5)** Former president of São Paulo Association of Professional in Healthcare Associated Infection Prevention, 2015-2017 and former vice-president 2013-2015. **(6)** Staff member in the Infection Prevention and Control Unit at World Health Organization 2019-2020

Grants Awarded: (1) Danish International Development Agency, One Health – Strengthening Health Care Management. Project in cooperation with University of Copenhagen (technical coordinator, Brazil) 2020-2022. **(2)** CNPq. National council for scientific and technological development Brazil, Implementation of strategies to improve public policies in the prevention of healthcare-associated infections: a multi-methods approach (Coordinator) 2022-2022. **(3)** CNPq. National council for scientific and technological development, PREVCOVID-BR – Enhancing the prevention and control to respond to COVID-19 in Brazil (Coordinator). **(4)** Academy of Medical Science, UK. Academic GCRF Networking Grant, Tackling the global challenge of antimicrobial resistance by engaging nurses in antibiotic stewardship: building capacity through a Brazil-UK collaboration (GCRFNGR5\1417, Coordinator) 2020-/2021. **(5)** CNPq. National council for scientific and technological development, Programs of Prevention and Control of Healthcare-Associated Infection in the Brazilian States: situation analysis. Project in cooperation with National Sanitary Agency (Coordinator), 2019-2021. **(6)** World Health Organization via University of East Anglia, COVID-19 droplet protection using face shields: development of methods to measures effectiveness of face shields for local production and adoption in low resource settings (R209921, Coordinator Brazil), 2020-2021. **(7)** World Health Organization, Perceived workload of carrying out clinical tasks, using different PPE combinations and the difference in number of readjustments and physiological signals between separate PPE and integrate PPE WHO (2020/1071566-0, Coordinator Brazil) 2020-2021

Contributions to Field: (1) Research Capacity Building in the nursing workforce: supervision of masters and PhD students in infection prevention and control, including acute healthcare facilities and primary care. **(2) Research in infection prevention and control:** particularly epidemiology of communicable diseases, with a focus on Healthcare-associated Infections (HAIs), cleaning and disinfecting surfaces and vulnerability to HAIs with publication in national and international scientific journals. **(3) National and international co-ordination** of agencies to support for outbreak investigation and implementation of improvement strategies including; evaluation of the dialysis unit in Nassau, technical support for infection prevention and control in Haiti, technical support for infection prevention and control in Iran, including evaluation and advise on infection and control measures in healthcare settings for MERS-CoV.

RAZZOLINI, **Maria Tereza Pepe** *(1) Associate Professor, Department of Environmental Health, University of São Paulo (USP)*

Qualifications: PhD Collective Health, masters Environmental Sanitation, Graduate Biologia Universidade Presbiteriana Mackenzie

Project Role: Environmental microbiology

ORCID ID: 0000-0003-3308-9550

Grants awarded: 1) University of Surrey FASS Academic Disruption Fund KV1201C.How individual and organizational factors can help, or hinder, tackling AMR (Co-applicant). 2) FAPESP (2019/23393-4) and Belmont Forum.Theory of Change Observatory on Disaster Resilience (Co-applicant). 3) Gabriel Network. Multicentre evaluation of the Impact of COVID-19 pandemic on 4 the spread of antimicrobial and biocide resistance from wastewater to the environment (Co-applicant). 4) FAPESP (2018/26246-0). Occurrence and identification of enteric pathogens Campylobacter, Cryptosporidium and Giardia recovered from groundwater supply and from animal faeces surrounded of the reservoirs and health impact assessment (PI). 5) Partnership Network UGPN Consortium. One Health Approach to Address the Global Burden of Antimicrobial Resistance (PI). 6) FAPESP (2015/05882-7). Occurrence of *Toxoplasma gondii* oocysts, *Giardia* spp. cysts Cryptosporidium spp. oocysts in wastewater reuse sample (PI). 7) FAPESP (2010/50797-4). Model for evaluating the impact of enteric pathogens in public watershed water supply. (Coapplicant). 8) FAPESP (2014/50016-3). Assessment of pesticides and pathogenic protozoa in water supply in São Paulo State.(Co-applicant)

Positions, Scientific Appointments and Honours: (**1)** Vice-head of Environmental Health Department *University of São Paulo.* **(2)** Vice-president of the Research Committee of the School of Public Health/USP. **(3)** Ethical for Human Research Committee. **(4)** Member of the International Water Association. **(5)** Member of the Society of Risk Analysis. (**6)** Member of the Society of Risk Analysis of Latin America. **(7)** Member of the Brazilian Society of Microbiology. **(8)** Reviewer Water Research. **(9)** Reviewer Journal of Water. **(10)** Reviewer Health and Science of the Total Environment.

Contributions to Field: (1) Environmental Microbiology: Her work has included detection of pathogens for better understanding of prevalence of etiological agents of enteric infections by using multiplex PCR, real time PCR as well as other genomic techniques. All of the results obtained by the Laboratory of Environmental Microbiology and Antimicrobial Resistance (MicroRes), coordinated by Prof Maria Tereza, are shared with the Centre for Sanitary Surveillance (CVS) of the Secretary of Sao Paulo State and the Environmental Company of Sao Paulo State (CETEB) and to scientific communities (Front Cell Infect Microbiol. 2021 Aug 24;11:722536, J Water Health. 2020 Oct;18(5):654-664, Environ Sci Pollut Res Int. 2020, Environ Pollut. 2020 Feb;257:113545, Water Supply (2019) 19 (6): 1823–1830, Environ Sci Pollut Res Int. 2018 May;25(15):15191-15203, Environ Sci Pollut Res Int. 2017 Feb;24(5):4828-4834, Environ Pollut. 2020 Nov;266(Pt 3):115143, Microbial Risk Analysis. 2016 Dec 1;4:1-6, Sci Total Environ. 2016 Oct 15;568:66-74, BMC Microbiol. 2014 Oct 22;14:263, Sci Total Environ. 2013 Jan 1;442:389-96). **(2) Water Quality Surveillance to reduce human health risks**: With the COVID pandemic she has been working on the detection of the SARS-CoV-2 in a stream running through an underprivileged, underserved, urban settlement in São Paulo, Brazil (Environ Pollut. 2021 Dec 1;290:118003), which provided a picture of the level of exposure this sensitive population faces. Recently, she took part of a big project whose aim was to assess the level of pharmaceutical pollution of the world´s rivers (Proc Natl Acad Sci U S A. 2022), which was a massive challenge, but it was a collective work with global interest.

SABINO, Ester *(1) Associate Professor infectious Disease Faculdade de medicina da USP*

Qualifications: MD, PhD Immunology

Project Role: Genomics and Epidemiology

ORCID iD: 0000-0003-2623-5126

Grants Awarded: **(1)** NIAID, Sao Paulo-Minas Gerais Center for Chagas Disease Treatment (PI) 2022-20227. **(2)** Bill & Melinda Gates, Unifying COVID-19 Serology, Genomics and Epidemiology in Brazil (PI) 2021-22. **(3)** NIH/ NHLBI, Recipient Epidemiology and Donor Evaluation Study REDS-IV-Pediatric (Co-PI) 2019-2024. **(4)** FAPESP/ MR/S019510/1, UK-Brazil Joint Centre for Arbovirus Discovery, Diagnosis, Genomics and Epidemiology (CADDE) (Prinicipal Investigator) 2019-2023. **(5)** NIH**,** São Paulo- Minas Gerais Neglected Tropical Disease Research Center for Biomarker (PI) 2017-2022

Positions, Scientific Appointments and Honours: Director of The Institute of Tropical Medicine of the University of Sao Paulo from 2015 to 2019 Research focus: blood safety, Chagas disease, Sickle cell disease, HIV diversity, emerging infectious disease.

Contributions to the Field: **(1) Establishment of large cohort studies across a range of infectious diseases** including a web based platform to allow the treatment of all COVID-19 patients in the city of Sao Caetano (BMJ Open 2021;11:e042745) and work with the Brazilian Ministry of Health AIDS Program to establish a laboratory network to perform viral load and drug resistant testing. **(2) Blood Bank networks and blood donor cohorts** allowed participation in the NHLBI/NIH REDS program and a linked donor recipient study to define the risk and impact of dengue virus transmission through blood transfusion. Her establishment of large cohorts of blood donors has also allowed a better understanding of the rate of disease progression for Chagas disease, and the impact of Benznidazole treatment. She has also established a large sickle cell disease cohort in Brazil that is defining several aspects of the effect of blood transfusion on disease evolution. **(3) New emerging threats:** She is participating in the international effort to establish a rapid research responses to emerging threats. Studies helped define the dates of Zika virus introduction and spread in Brazil as well as a comprehensive description of the dispersion of yellow fever virus during the 2016 epidemic. These studies established the capacity for real time and large-scale virus sequencing at the University of Sao Paulo and my group was the first to publish the complete genome sequence in Latin America, 2 days after the notification of the case. She has also coordinated the studies that have described the epidemic in Manaus and characterized the spread of the gamma variant in Brazil.

Team composition and management
Describe the roles of all applicants and how the project will be managed and led.

Professor Alison Holmes (UK: Liverpool/Imperial College) will be network coordinator for all of CAMO-Net. She is responsible for establishing the network and leading in the development of network structure/framework (including the Network Agreement and CAMO-Global Data Resource). She will be the primary liaison with Wellcome Trust and across network Parties, and to lead in the establishment of programme management and operations across the network. She will work closely with CAMO-Net Chief Operating Officer (COO), Mrs Kerri Hill-Cawthorne, who will lead the programme management of CAMO-Net, as well as the team of project managers in each National Hub.
Senior Strategic Advisory Board: will be comprised of global leaders across research themes; leaders linked to relevant global programmes; global policy leaders; and representatives of civil society, consumers, and AMR advocates. The ethos of CAMO-Net is equity, diversity, and inclusion which will be reflected in the membership of this Board.
Management Board: will consist of Principal Investigators from each Party of CAMO-Net as well as a Wellcome Trust representative. The management board will meet quarterly and will focus on providing operational guidance, review and approval of budgets and work plans, monitoring progress of and providing guidance on research activities, discussing and resolving disputes between network members within the network, providing strategic guidance.
Programme Management team (led by COO): will consist of 3 cross network members of staff and Project Managers, Data Managers and Knowledge Mobilisation fellows from each of the National Hubs. The Programme Management Team will be responsible for coordinating and managing cross-network activities on a day-to-day basis and feed information to all other levels of the governance structure.
Training and Capacity Strengthening Board: is responsible for developing and managing cross-network training and capacity strengthening activities, including workshops, peer-to-peer networks and internships.
Commercialisation and Entrepreneurial Board: will oversee all commercial strategy, including promoting local entrepreneurship and local manufacturing, and manage Intellectual Property and Technology Transfer. Members will include legal representation from all parties as well as experts in this field.
National Hub leadership: Each National Hub will establish its own management structure responsible for the local research activities. These groups will meet monthly or quarterly. The CAMO-Net annual meeting will take place at one of these meetings on a rotating basis.
Theme-based Research Planning Groups: will be established to correlate with the research themes. They will meet on a quarterly basis with an appointed Chair for each theme and a subject-matter expert representing Wellcome Trust. They will guide theme-based research activities, ensure shared learning across partners, and ensure theme activity alignment with CAMONet vision.
Oversight and Development Board for CAMO-GDR: will oversee the scoping, planning and development of the CAMO-GDR making considerations of all elements including data management, data protection and ethics. It will include CAMO-Net partners involved in the CAMO-GDR activities as well as leading external experts in the field.
Knowledge Mobilisation (KM); Monitoring, Evaluation and Learning (MEL); and Reflections Committee: This committee will be be chaired by the KM lead and include 2-3 external members for objective reflection and review.

Select any of the following that apply to your proposed work:
(Proposal involves human participants, Proposal involves the use of human biological material, or identifiable/potentially identifiable data, Neither of the above)

Proposal involves the use of human biological material, or identifiable/potentially identifiable data

Who has, or will, review the ethics of the project and when? Detail any other regulatory approvals you

have obtained, or will seek. We reserve the right to see relevant approval documents at any point during the grant and after it has ended. This is in accordance with our research involving human participants policy.
Ethics will be sought by PI Anna Levin within the first six months of the project, if awarded.

Will you be using facilities, staff or patients within the National Health Service (NHS) in the UK?	No

Which organisation(s) has/have agreed to act as the formal sponsor(s) for your project?
Fundação Faculdade de Medicina on behalf of Faculty of Medicine, University of São Paulo, Brazil

Confirm you have in place, or you will seek, appropriate informed consent to use any potentially commercially exploitable results from tissues or samples derived from human participants. Where data has the potential to be used beyond its initial purpose or beyond the end of the study, include details for how the consent will be managed.
Informed consent will be obtained for all samples/ data collected.

Does your proposal involve a clinical trial?	No

5. Outputs management and sharing

Provide an outputs management plan All Wellcome-funded researchers are expected to manage their research outputs in a way that will achieve the greatest health benefit, maximising the availability of research data, software and materials with as few restrictions as possible. Our guidance on developing an outputs management plan, which includes a link to some good examples, is available here. If an outputs management plan is not required, please briefly explain why below.
No commercialisable outputs for this proposal, though the governance structure of CAMO-Net includes and Entrepreneurial and Commercialisation Board whose role it will be to foresee and manage any potential IP or outputs management issues.

6. Collaborations

Are any collaborations essential for this proposal? This could be through sharing facilities, providing access to resources (essential reagents, samples, data) or sharing subject-specific knowledge and guidance.	Yes

List any key collaborators (name and organisation) and provide a very brief outline of their role in the proposed research.		
Name	**Organisation**	**Outline of role in proposed research (50 words max)**

List any key collaborators (name and organisation) and provide a very brief outline of their role in the proposed research.		
Name	**Organisation**	**Outline of role in proposed research (50 words max)**
Professor Alison Holmes	UK: University of Liverpool and Imperial College London	Lead for UK National Hub and CAMO-Net programme. She leads a large multidisciplinary infectious disease research programme focusing on infection management, AMR; epidemiology; public health; precision medicine; antibiotic optimisation; and development of emerging, innovative technologies to address infection prevention and management globally. Global leader in AMR, IPC, and AMS.
Dr Andrew Kambugu	Uganda: Infectious Diseases Institute, Makarere University	Lead for Uganda National Hub. Executive Director at IDI, co-founder of Researchers for Global Health, established the African Center of Excellence (ACE) in Bioinformatics & Data Sciences at IDI. Aims to strengthen health systems in Africa, with a strong emphasis on infectious diseases, through research and capacity development.
Professor Marc Mendelson	South Africa: University of Cape Town	Lead for South Africa National Hub. Founding chair of the South African Antibiotic Stewardship Programme, chaired the SA Ministerial Advisory Committee (MAC) on AMR since 2016, research: developing models of antibiotic stewardship that are operational in low- and middle-income countries coupled with developing national and international policy in the field.
Dr Sanjeev Singh	India: Amrita Institute for Medical Science	Lead for India National Hub. Established Evidence Based Antibiotic Prescription by training (Kerala), standardisation of treatment guidelines (India), member of the Drug Safety Council of India, Ambassador from India to the Society of Healthcare Epidemiology of America, international surveyor at International Society for Quality and member of Drug Safety

List any key collaborators (name and organisation) and provide a very brief outline of their role in the proposed research.		
Name	**Organisation**	**Outline of role in proposed research (50 words max)**
		Council.
Dr Izhar Hussain	Pakistan: Dow University of Health Sciences	Lead for Pakistan Shadow National Site. Previous WHO Project Coordinator for Antibiogram development and Regional Director, Business Excellence for Abbott Laboratories Pakistan supporting rational use of antimicrobials. Currently tracking surveillance of resistant strains in community-acquired and nosocomial infections, uptake of antimicrobial stewardship in policy and public advocacy about AMR.
Professor Nélson Martins	Timor-Leste: Unversidade da Paz via Menzies School of Health Research	Lead for Timor-Leste Shadow National Site. Previous Minster for Health where he developed the country's community health services. Established the Cabinet of Health Research and Development (CHRD), Timor Leste's first health research institute, with the mission of making evidence-based practice the norm in both medical interventions and policy.
Dr Senjuti Saha	Bangladesh: Child Health Research Foundation Bangladesh	Lead for Bangladesh Shadow National Site. Director of CHRF, her work is focused on paediatric preventable infectious diseases. Global advocate for bridging the gap between molecular biology and its implementation in resource-poor countries, advancing the cause of health equity and facilitating low-cost diagnostics for poor patients to improve child health.
Professor Henry Mwandumba	Malawi: Malawi-Liverpool-Wellcome Trust Research Programme	Lead for Malawi Tech Centre, connecting CAMO-Net to MLW bacterial sequencing labs. Deputy Director of MLW research programme and on International Society for Infectious Diseases Council; he looks to better understand the mechanisms behind susceptibility and

List any key collaborators (name and organisation) and provide a very brief outline of their role in the proposed research.		
Name	**Organisation**	**Outline of role in proposed research (50 words max)**
		resistance to TB in an effort to reduce the occurrence of HIV-associated TB.
Dr Phornpimon Tiphthara	Thailand: Mahidol-Oxford Research Unit	Lead for Thailand Tech Centre, connecting CAMO-Net to the MORU clinical pharmacology labs. Her expertise is in the application of omics-based approaches. She has demonstrated that complex biomolecules in various organism can be identified and quantified at low concentrations using liquid chromatography - high resolution mass spectrometry (LC-HRMS).
Professor Gordon Awandare	Ghana: West African Center for Cell Biology of Infectious Pathogens	Lead for Ghana Tech Centre, connecting CAMO-Net to WACCBIP digital diagnostics labs. Director of WACCBIP, Chairman of the West African Network of Infectious Diseases ACEs, research: integrating genomic surveillance data into the routine activities of control programmes to inform the design of strategies to mitigate the spread of drug resistance.

I confirm that the collaborators named above have agreed to be involved, as described, in the proposed research and are willing for their details to be included as part of this application.
Confirmed

7. Location of activity

Will the funded activity take place at more than one location? List any locations outside of your host organisation where you will be conducting research or redirecting funds. This includes, but is not limited to, anywhere in receipt of indirect funding, Wellcome Trust supported facilities, fieldwork sites, and time spent working in another organisation/laboratory. This does not include conference attendance.	No

Will the project be based in one of the following Wellcome Trust supported facilities:	No

• the Wellcome Trust Sanger Institute • a Wellcome Trust Centre • an Africa and Asia Programme • the Francis Crick Institute? If the project will be based at one of these facilities, add the facility as a location above.	

Will you require funds to be awarded directly to more than one location? We will only consider requests for funds to be awarded directly to more than one location if: • your award includes a request for multiple currencies. Any request for additional currencies must be at least the equivalent of £750,000; and/or • your award involves an organisation based in a low- or middle-income country. We will assess the financial capacity of the organisation to manage the award. If we award directly to more than one location, we will not move funds between organisations after we have issued the award letter.	No

8. Research involving animals

Select any of the following that apply to your proposed work: *(Proposal involves the use of animals, Proposal involves the use of animal tissue, Neither of the above)*
Neither of the above

9. Risks of research misuse

Confirm that you have considered whether your proposed research could generate outcomes that could be misused for harmful purposes.
Confirmed

Have you identified any tangible risks of this type?	No

10. Freedom to operate/conflicts of interest

Describe any freedom to operate or other intellectual property related issues that might affect your ability to carry out the proposed research and/or to use, share or commercialise the research outputs. Explain how you will address these.

If you are satisfied that there are no such issues, enter N/A. If you have fully addressed such issues in your outputs management plan under the question on "Outputs management and sharing", then you may refer to that answer.

In particular, consider the following:

• Will your research use technology, software, databases, materials or patented inventions that are owned or controlled by others and which you do **not** already have written permission to use? • Will the ownership, use, commercialisation and/or sharing of research outputs with the wider research community, be subject to agreements with commercial, academic or other organisations? This includes arrangements with collaborators named in this application.
N/A

Describe any conflicts of interest which might affect your ability to carry out the proposed research and/or to share or commercialise the research outputs. For each conflict: • explain how you and your organisation will manage the conflict • explain how you will comply with your organisation's requirements in relation to conflicts of interest • confirm whether the identified conflict has been disclosed to your organisation. If you are satisfied there are no issues, enter N/A. Refer to our policy on conflicts of interest related to Wellcome-funded researchers and commercial organisations. In particular, consider whether anyone involved in your project holds any consultancies, advisory roles, or equities in, or directorships of, companies or other organisations that might have an interest in the results of your proposed research.
N/A

11. Lead applicant details

Lead applicant details	
Full Name	Prof Anna Levin
Department	Department of Infectious Diseases and Tropical Medicine
Organisation	Universidade de São Paulo

ORCID iD	
ORCID iD	0000-0003-2427-8368

Career history (current/most recent first)			
From	**To**	**Position**	**Organisation**
06/2019	06/2023	Head of Division	Hospital das Clinicas da Faculdade de Medicina da Universidade de Sao Paulo
04/2019	03/2034	Full Professor	Universidade de Sao Paulo
02/2013	12/2022	President	Hospital das Clinicas da Faculdade de Medicina da Universidade de Sao Paulo
05/2003	04/2018	Associate Professor	Universidade de Sao Paulo

Career history (current/most recent first)			
From	**To**	**Position**	**Organisation**
05/1999	05/2003	Assistant Professor	Universidade de Sao Paulo
12/1987	05/1999	Doctor	Hospital das Clinicas, Universidade de Sao Paulo

Education/training				
From	**To**	**Qualification**	**Subject**	**Organisation**
09/1997	12/1997	Fellowship	Research in Infectious diseases	Wake Forest University
06/1993	08/1996	MB/PhD	Infectious diseases	Universidade de São Paulo
03/1988	12/1992	Master of Science (MSc)	Infectious Diseases	Universidade de São Paulo
02/1984	05/1987	Residency/Fellowship	Infectious Diseases	Hospital das Clinicas da Faculdade de Medicina da Universidade de Sao Paulo
03/1978	12/1983	Doctor of Medicine (MD)	Medicine	Universidade de São Paulo

Career breaks Have you taken any breaks from research that you wish us to take into consideration? This can include periods of parental or long-term sick leave, caring responsibilities, part-time work, secondments, volunteering or time spent in different sectors. You can also include any periods where you were unable to work because of the COVID-19 pandemic.	No

Do you wish to undertake this award part time? If you wish to undertake this award part-time, either from the start or part way through the grant, your host organisation must employ you on a part-time basis during that time.	No

Source(s) of personal salary support State all your sources of salary funding (for example, through your organisation’s block grant from a higher education funding body), and the percentage of your salary they contribute. Answer 'not applicable' if you are not currently employed.
University of São Paulo

Are you a healthcare professional? This information is used to understand salary requests (where eligible), research time commitments and to report on our funding.	Yes

Indicate your healthcare profession
Medical graduate

Are you clinically active?	Yes

What is your specialty?
If your specialty is not on the list, select 'Other' and specify.

Infectious Diseases

Career contributions
In relation to this application, summarise what you consider to be your key experience and achievements/contributions (e.g. publications, patents, impacts on policy). For each, provide details of when it came about, why you think it is important and what impact it has had.

Therapy for resistant infections: In the 1990s Brazil had a very difficult problem with treating multi-drug resistant gram-negative bacterial infections and no therapeutic options. A Levin and team started to use a long-forgotten drug called colistin with reasonable results. The publication of the first case series led to a change in the standard therapy for these infections and to a revived interest in this drug class. Publications on this subject worldwide increased many-fold after this first publication.
Interventions to reduce Healthcare Associated Infections (HCAIs): The state of São Paulo has 44 million inhabitants and 750 hospitals and has monitored healthcare-acquired infections since 2004. A Levin, working in close collaboration with the State Health Department implemented a programme to decrease the incidence of infections in intensive care units. Healthcare workers from each unit participated actively in the evaluation of their practices and in the decisions on what actions should be taken. In a pilot study with 56 hospitals, representative of the hospitals of the state, infection rates decreased by more than 30% in the first year. Further work with the 126 hospitals with the worst performance obtained the same results. During the COVID-19 pandemic she also developed work on control of transmission, policies in relation to the health of healthcare workers and reprocessing of PPE- all areas transferable to AMR.
Antimicrobial prescribing practices: In 2010, Brazil controversially banned over-the-counter sales of antimicrobials, a measure recommended by the WHO. A Levin evaluated the sales of antimicrobial drugs in the country before and after the ban and showed that there was an important decrease, although not homogeneous. Some drugs' sales were very affected, and others showed an increase despite the law. In addition, there were very important regional differences, and resistance to the two most sold oral antibiotics decreased as sales decreased. Regional structure of the healthcare system was the most important factor for the effect of the law, suggesting that laws alone are not effective in regions without a solid system. These results strongly support the need to investigate the drivers of antibiotic use in the community as a basis for interventions.

Positive and inclusive working/research culture
Describe your approach to developing and supporting a positive and inclusive working/research culture, including examples from previous and current groups. This could include, for example:

- mentoring
- supporting collaboration and interdisciplinarity
- leadership and people management
- promoting research integrity.

A Levin has a strong track record in supporting collaborations. Her CADDE grant expands an excellent existing UK-Brazil Partnership with the aim of anticipating and preventing future arbovirus epidemics in Brazil.
She has consistently mentored and trained other supervising 15 master's dissertations and 7 doctoral theses in the area of infectious diseases.

Current and recent funding (including Wellcome grants)
List any funding you have received in the last five years, including current funding.

List the most recent first. State the name of the funder, name(s) of grantholder(s), title of the project, total amount awarded (and how much of this you received), your role in the project, and the start and end dates. State the percentage of your time spent on the research.
US$ 1.00=R$ 5.11; BRL 1.00= R$ 6.29) R$: Brazilian real 1. Sao Paulo Foundation for Research-FAPESP, in cooperation with UK Research and Innovation, Medical Research Council and Newton fund Ester C. Sabino UK-Brazil Joint Centre for Arbovirus Discovery, Diagnosis, Genomics and Epidemiology (Co Investigator). R$ 1,313,312.83 (US$ 1.00=R$ 5.40) + US$ 629,661.91. 2019-2022 2. Sao Paulo Foundation for Research-FAPESP Anna S. Levin Prospective study on clinical features and etiologic agents of community-acquired pneumonia in HIV-infected agents (Principal investigator) R$ 327,890.02 , 2017-2020 3. FINEP (Brazilian Agency for Innovation) 17 researchers, Virtual Biobank of the University of Sao Paulo (Principal Recipient) R$ 499,942.00 2019-2021 4. JBS (agro-business multinational company) Silvia F. Costa/Anna S. Levin/Ester C. Sabino Evaluation of proteomic markers and genetic polymorphisms of interleukins in patients with COVID-19 in Brazil (Co-Principal investigator) R$ 496.743.20 2020-2021 5. Biomerieux Silvia F. Costa/Anna S. Levin/Ester C. Sabino Evaluation of proteomic markers and genetic polymorphisms of interleukins in patients with COVID-19 in Brazil (co- principal investigator) R$1,500,000.00 2202-2021 6. BTG Bank Silvia F. Costa/ Anna S. Levin, Evaluation of immune response to COVID-19 of healthcare workers in tertiary care public and private hospitals (co principal investigators) R$ 400,000.00 2020-2021 7. World Health Organisation Maria Clara Padoveze/ Anna S. Levin, Perceived mental workload using separate and integrated personal protective equipment of respiratory protection (co principal investigator) US$ 240,000.00 2020-2021

Describe how the currently active grants listed above relate to this application. If you hold grants related to the topic of this application, explain how these differ and confirm there is no overlap in funding.
There is no overlap in funding. Several of the awards have established essential infrastructure, networks and expertise that will be used in the current proposal. The existing award to evaluate 2 methods to detect Fusarium directly from water, provides tried and tested approaches for project 3 Understanding the epidemiology of pathogens and antibiotics in urban community water reservoirs to assess the impact of stewardship interventions. The currently active grant for the Joint Centre for Arbovirus Discovery, Diagnosis, Genomics and Epidemiology which established active surveillance in vectors and reservoirs combined with novel portable genome sequencing protocols and real-time epidemiological analyses for arbovirus, provides a template and capabilities to do the same for AMR. This relates most specifically to project 2 which is seeking to understanding the epidemiology of asymptomatic carriage of resistant microorganisms in urban communities.

12. Coapplicant details

Coapplicant	
Full Name	Prof Silvia Costa
Department	Department of Molestias Infecciosas e Parasitárias
Organisation	Universidade de São Paulo

Career history (current/most recent first)			
From	**To**	**Position**	**Organisation**
01/2015	12/2020	Technical Director	Instituto Medicina Tropical da Universidade de São Paulo
01/2012	11/2013	Associate Professor	Universidade Federal do Rio de Janeiro
07/2007	02/2021	Associate Professor	Universidade de São Paulo
01/2005	12/2006	Coodinator	Pan American Organization

Education/training				
From	**To**	**Qualification**	**Subject**	**Organisation**
12/1998	01/2001	Doctor of Philosophy (PhD;DPhil)	COSTA, S; MICELI, M ; ANAISSIE, E . Mucosa or skin as source of coagulase-negative staphylococcal bacteraemia?. Lancet Infectious Diseases, , v. 4, n.5, p. 278-286, 2004.COSTA, S; BARONE, A ; MICELI, M ; VANDERHEIJDEN, I ; SOARES, R ; LEVIN, A ; ANAISSIE, E . Colonization and molecular epidemiology of coagulase-negative Staphylococcal bacteremia in cancer patients: A pilot study. American Journal of Infection Control, v. 34, p. 36-40, 2006.	Universidade de São Paulo
12/1999	12/2000	Doctor of Philosophy (PhD;DPhil)	COSTA, S; BARONE, A ; MICELI, M ; VANDERHEIJDEN, I ; SOARES, R ; LEVIN, A ; ANAISSIE, E . Colonization and molecular epidemiology of coagulase-negative Staphylococcal bacteremia in cancer patients: A pilot study. American Journal of Infection Control, v. 34, p. 36-40, 2006.	University of Arkansas
01/1995	08/1998	Master of Science (MSc)	Outer-membrane proteins pattern and detection of ?-lactamases in clinical isolates of imipenem-resistant Acinetobacter baumannii from Brazil. International Journal of Antimicrobial Agents (Print), v. 13, n.3, p. 175-182, 2000.	Universidade de São Paulo
08/1995	03/1996	Fellowship	Infectious Diseases	City Hospital-Birmigham

Education/training				
From	**To**	**Qualification**	**Subject**	**Organisation**
02/1992	06/1995	Fellowship	Infectious Diseases Fellowship	Hospital das Clinicas da Universidade de São Paulo
03/1986	12/1991	Doctor of Medicine (MD)	MD, PhD	Universidade Federal Fluminense

Career breaks Have you taken any breaks from research that you wish us to take into consideration? This can include periods of parental or long-term sick leave, caring responsibilities, part-time work, secondments, volunteering or time spent in different sectors. You can also include any periods where you were unable to work because of the COVID-19 pandemic.	No

Do you wish to undertake this award part time? If you wish to undertake this award part-time, either from the start or part way through the grant, your host organisation must employ you on a part-time basis during that time.	No

Source(s) of personal salary support State all your sources of salary funding (for example, through your organisation's block grant from a higher education funding body), and the percentage of your salary they contribute. Answer 'not applicable' if you are not currently employed.
USP

Are you a healthcare professional?	Yes

Indicate your healthcare profession
Medical graduate

Are you clinically active?	Yes

What is your specialty? If your specialty is not on the list, select 'Other' and specify.
Infectious Diseases

Career contributions In relation to this application, summarise what you consider to be your key experience and achievements/contributions (e.g. publications, patents, impacts on policy). For each, provide details of when it came about, why you think it is important and what impact it has had.
Antimicrobial resistance including whole genome sequencing (WGS): Dr Costa's research has focused on the WGS of a number of drug resistant pathogens including carbapenem-resistant Serratia marcescens (DOI: 10.1016/j.ijantimicag.2021.106463) multidrug-resistant Acinetobacter baumannii. (DOI:10.1016/j.meegid.2021.104943) and Clostridioides difficile (DOI:10.1016/j.micinf.2022.10495).

Outbreak investigation[AR1] **:** During the first year of the COVID-19 pandemic, Dr Costas' research focused on diagnosis, transmission and prevention of SARS-Cov-2, resulting in publications on the evolution and epidemic spread of SARS-CoV-2 in Brazil (DOI: 10.1126/science.abd21611) and SARS-CoV-2 seroprevalence and risk factors among oligo/asymptomatic healthcare workers to estimate the impact of community transmission (DOI: 10.1093/cid/ciaa1845). Other work examined SARS-CoV-2 in a stream running through an underprivileged, underserved, urban settlement in São Paulo, which was followed-up 7-months later (DOI:10.1016/j.envpol.2021.118003)

Healthcare associated infection: other areas of resarch have looked at common noscomial infections, coagulase-negative staphylococci (DOI: 10.1016/S1473-3099(04)01003-5) and Clostridioides difficile, (DOI: 10.1007/s10096-021-04189-3) including a prospective diagnostic performance study of loop-mediated isothermal amplifaction assay for the detection of the latter. (DOI: DOI: 10.1016/j.anaerobe.2021.102410
Publication not used 2- Brazil needs a coordinated and cooperative approach to tackle COVID-19. Nat Med. 2021 Jul;27(7):1133-1134. doi: 10.1038/s41591-021-01423-5.Equal author. [AR1]

Describe your approach to developing and supporting a positive and inclusive working/research culture, including examples from previous and current groups.
This could include, for example:

- mentoring
- supporting collaboration and interdisciplinarity
- leadership and people management
- promoting research integrity.

Dr Costas has been an associate Professor and Head of the Laboratory of Medical Research since 2007 delivering teaching and research at the Department of Infectious Diseases of the Faculty of Medicine of the Universidade de São Paulo. She has supervised 14 master's students, 10 PhD students, 3 Postdoctoral researchers and 12 Scientific Initiation students to date and is currently supervising a further 2 scientific initiation students, 2 master's students, 6 PhD students, and 2 Postdoctoral researchers. She has an extensive track record in mentoring others and in addition to teaching both undergraduate and graduate students, she is responsible for the Infectious diseases trainee fellowship medical residence at Hospital das Clinicas da Universidade de São Paulo-Brazil. She has also consistently demonstrated her ability to support collaborations having successfully worked with several universities and centres in Brazil as part of two networks in antimicrobial resistance and stewardship. These networks consisted of 21 participating hospitals from different states, while the antimicrobial stewardship network is also part of an international initiative coordinated by the University of Antwerp. Dr Costas is also the Brazilian PI of a multicentre study that involves Brazil, Cameroon and Madagascar and aims to evaluate the impact of the COVID-19 pandemic on the spread of antimicrobial and biocide resistance in the environment from the sewage of healthcare facilities receiving patients with COVID-19. She also has a number of other international collaborative studies including; those with Professor Richard Stabler of the London School of Hygiene and Tropical Medicine, UK on whole genome sequencing, studies with Professor Nuno Faria – University of Oxford and Imperial College-London-UK on COVID-19, studies with Professor Herman Goossens of the University of Antwerp, Belgium on antibiotic stewardship and collaborative studies on antimicrobial resistance with professor Ramendra Pati Pandey SRM University, Delhi-NCR, Haryana, India and professor Xiaoming Lyu, from the Third Affiliated Hospital Southern Medical University, China.
Dr Costas promotes interdisciplinarity and is responsible for the post-graduate multidisciplinary course "The Crisis of Health and The Opportunities for Building a Safer, Less Unequal and Sustainable World" (2020-2023) at Universidade de São Paulo. This course brings together Sociology and Medicine. She is also on the committee of the Rede de Pesquisa Solidaria (Net of Solidary Research) a multidisciplinary, multi-institutional network of centres of excellence abroad, including Oxford University and the Texas A&M University (https://redepesquisasolidaria.org).
Finally Dr Costas demonstrates her research leadership in ensuring inclusive working through her membership of the Women in the Science (Brazilian network) https://mulheresnaciencia.com.br and the committee of Science in Health, two Brazilian initiatives that aim to strengthen the participation of the

female gender in the science.

13. Costs requested and justification

Select the currency in which you want to apply. Submit costs in the currency you think will best enable you to undertake the activity. This will probably be your local currency; if not, explain why not.
USD - US Dollar

Is this your local currency?	No

What is your local currency?	BRL

Explain why you are requesting costs in the selected currency and what exchange rate you have used.
Brazilian Real fluctuates too much against the pound.

Staff Are you requesting staff?	Yes

Staff

Cost type	Number of staff requested for	Staff category	Name (if known)	Basic starting salary (p.a.)	Salary grade / scale	Period on project (months)	% time	Total (USD)
Salary	1	CAMO-Net Brazil PI	Anna Levin	60000	PI	36	20	72,000
Salary	1	CAMO-Net Brazil Co-I	Silvia Costa	60000	Co-I	36	10	36,000
Salary	1	Senior Research Fellow		19245	Senior Research Fellow	36	100	57,736
Salary	3	Postdoc x3		19245	postdoc	36	100	173,208
Salary	1	KM Fellow		13585	KM Fellow	36	100	40,755
Salary	1	Data Manager		11321	data manager	36	100	33,962
Salary	1	Technician		6793	technician	36	100	20,377
Salary	1	Project Manager		15849	project manager	36	100	47,547

Justification for staff Specify the role and responsibilities for the staff requested. Justify the type and seniority, including the

level of salary requested, of each post.
National Hub site posts: To ensure/enable funding equity across partners, the National Hubs will budget the following: i. 20% full time equivalent (FTE) Principal Investigator/Applicant time (costed directly); 10% FTE coapplicant/co-Investigator time (costed directly) ii. Each of the 7 National Hub institutes will budget the following staff: 3x 100% FTE postdoctoral posts; 100% FTE of a senior research fellow; 100% FTE senior project manager; 100% FTE infrastructure/data manager; 100% FTE technician; 100% FTE knowledge mobilisation fellow

Adjustment support Are you requesting adjustment support?	No

Training and continuing professional development Are you requesting training and continuing professional development?	No

Materials and consumables Are you requesting materials and consumables?	Yes

Materials and consumables

Description	**Total (USD)**
Lab consumables	471,996

Justification for materials and consumables.

CONSUMABLES Laboratory	
ESBL agar	**$1,792.45**
VRE agar	**$1,603.77**
CRE agar	**$245,283.02**
Blood agar	**$1,037.74**
Mueller Hinton agar	**$943.40**
Coliforms and *E. coli* count kit	**$954.86**
Enterococcus count kit	**$2,506.36**
E. coli and Enterococcus count trays	**$4,920.76**
sterile filter membranes (0.45 µm mixed esters of cellulose)	**$360.67**
pre-filter membranes	**$902.63**
MacConkey Agar	**$1,788.23**
MacConkey Bromocresol Broth Purple	**$783.42**
Mannitol Salt Phenol Red Agar	**$1,419.23**
Luria-Bertani broth	**$635.82**
Cation-adjusted Mueller-Hinton Agar	**$1,666.18**

Cation-adjusted Mueller-Hinton Broth	**$1,336.92**
Cefotaxime sodium salt	**$2,736.84**
Cefoxitin sodium salt	**$3,108.68**
Antibiotic assay discs	**$1,021.85**
	$1,021.85
ESBL production assay	**$1,816.62**
Minimal inhibitory concentration (MIC) assay	**$2,365.38**
Formic Acid	**$355.00**
Acetonitrile	**$213.45**
Ultrapure water	**$454.15**
	$281,029.27
plastics (petri dish, falcon, loop, tips...)	**$31,912.20**
maldi tof	**$1,132.08**
Sampling swabs	**$236.54**
	$33,280.81
e-test (3 drugs per sample)	**$13,207.55**
imunocromatografic test	**$10,566.04**
DNA extraction kit	**$1,698.11**
sequencing	
KIT library FRAG ION XPRES MENTOS ION PLUS 10 R	**$13,207.55**
KIT QUANT Library FRAG ION TAQMAN	**$9,622.64**
E GEL SIZESELECT II 2 (10 geis)	**$830.19**
E GEL 1 KB PLUS EXPRESS DNA LADDER	**$773.58**
Ion 510™ & Ion 520™ & Ion 530™ Kit – Chef (1 sequencing run per initialization)	**$27,122.64**
REAGENTE ION 520 CHIP KIT 4	**$7,547.17**
QUBIT tubes	**$566.04**
QUBIT 1X DSDNA HS 500 ASSAYS	**$566.04**
AGENCOURT AMPURE XP, 60 ML	**$2,476.42**
MicroAmp™ Optical 96-Well Reaction Plate	**$2,122.64**
MicroAmp™ Optical Adhesive Film com 25	**$320.75**
	$90,627.36
Bacterial DNA extraction kit	**$5,676.92**
Sewage DNA extraction kit	**$6,055.38**
WGS Library preparation kit (bacterial genome)	**$18,862.52**
WGS Index adaptors (bacterial	**$2,243.52**

genome)	
Long sequencing kit	**$5,535.00**
Flow cell wash kit	**$487.08**
Real-time assay for ARGs	**$14,381.54**
Primers	**$1,703.08**
Probes	**$1,513.85**
Reaction mix	**$3,371.15**
Synthetic DNA fragments	**$1,892.31**
Calibration kits	**$2,603.82**
Exogenous Positive Control	**$2,732.49**
	$67,058.65

Animals Are you requesting animals?	No

Equipment Are you requesting equipment?	Yes

Equipment

Type	Type of equipment	No. of items	Cost per item	Cost of maintenance contract	Contribution from other sources	Total (USD)
Equipment purchase	Freezer (-80) for samples storage	1	15094	0	0	15,094
Computer equipment	Computer for bioinformatics analysis	2	1132	0	0	2,264
Equipment purchase	Densichek	1	1019	0	0	1,019
Computer equipment	Notebooks	5	1887	0	0	9,435
Computer equipment	Desktop computer (https://deals.dell.com/pt-br/productdetail/de8x)	3	1830	0	0	5,490
Computer equipment	Laptop https://www.br.vaio.com/notebook-vaio-z-intel-core-i7-11geracao-ssd-1tb-16gb-windows-11-pro-t	2	3586	0	0	7,172
Equipment purchase	vacuum pump	1	606	0	0	606
Equipment purchase	Pipettes	3	700	0	0	2,100
Equipment	biological safety cabinet	1	5000	0	0	5,000

Type	Type of equipment	No. of items	Cost per item	Cost of maintenance contract	Contribution from other sources	Total (USD)
maintenance						
Equipment purchase	Electrophoresis supplies	1	2839	0	0	2,839
Equipment purchase	Pre-configured compute module for long sequencing	1	2000	0	0	2,000

Justification for equipment.

Equiment

Freezer (-80) for samples storage	R$ 100,000.00		1
Computer (bioniformatics analysis)	R$ 6.000,00		2
Densicheck	R$ 5.400,00		1
Notebooks	R$	10000	5
Computador desktop com a configuração a seguir (ou similar): https://deals.dell.com/pt-br/productdetail/de8x	Real	R$ 9,700.00	3
Computador laptop com a configuração a seguir (ou similar): https://www.br.vaio.com/notebook-vaio-z-intel-core-i7-11geracao-ssd-1tb-16gb-windows-11-pro-tela-ultra-hd-14-preto/p	Real	R$ 19,007.12	2
vacuum pump	US$	605.54	1
Pipettes	US$	700.15	3
biological safety cabinet	US$	5000	1
Electrophoresis supplies	US$	2838.46	1
Pre-configured compute module for long sequencing	US$	2000	1

Are you requesting a piece of equipment with a list price of £100,000 or more?	No

Access charges Are you requesting access charges?	No

Overheads Are you requesting overheads?	Yes

Overheads

Description	Total (USD)
10% OH for FFM	136,574

Justification for overheads.
FFM falls under the eligible overheads policy and is there : From 1 October 2019, researchers can now ask for overheads if their grant will be based at a: ? university outside the UK or Republic of Ireland ? research organisation that does not receive core funding for overheads ? charitable or not-for-profit organisation ? small or medium-sized commercial organisation. This applies to all grant applications submitted from 1 October 2019. Researchers can also ask for overheads on any part of the grant that is sub-contracted to any of the organisations listed above. Researchers who are based at a UK university cannot ask for overheads for sub-contracted activity if their university will include the sub-contracted funding in its annual report to the UK Charity Research Support Fund. Overheads can include: ? estates, for example building and premises ? non-project dedicated administrative and support staff ? administration, for example finance, library, and room hire. The total cost for overheads should not be more than: ? 20% of the direct research costs if you’re based in a low- or middle-income country ? 15% of the direct research costs if you’re based anywhere e

Upload a letter from the Finance Director of each organisation. If there is more than one letter, upload these as a single PDF. Each letter must include: • a full breakdown of costs requested (you can't ask for a percentage of the project costs) • an explanation of why these costs are necessary for the project • confirmation that the breakdown is a true representation of the costs incurred.
(overheads letter PDF - overhead statement FFM-papel timbrado.pdf) is included as an appendix within this file.

Are you based at a UK university and requesting overheads on subcontracted costs?	No

Travel and subsistence Are you requesting travel and subsistence?	Yes

Travel and subsistence

Type	Description	How much carbon will this offset (in tonnes)?	Total (USD)
Collaborative	Travel and subsistence		27,000

Type	Description	How much carbon will this offset (in tonnes)?	Total (USD)
travel			
Conference attendance	International and National conference registratoins		3,453

Justification for travel and subsistence.
Given the international scope of this proposal, travel and subsistence costs estimated at: Plane ticket (3 per year) daily cost (US$ 400/daily x 5 days/year 3 people/year

Overseas allowances Are you requesting overseas allowances?	No

Fieldwork expenses Are you requesting fieldwork expenses?	No

Clinical research Are you requesting clinical research?	No

Public engagement and patient involvement Are you requesting public engagement and patient involvement?	Yes

Public engagement and patient involvement costs

Description	Total (USD)
Patient Public engagement costs ($6k/yr)	18,000

Justification for public engagement and patient involvement.
Patients, carers and the public can bring particular knowledge and insights to research based on their personal experiences as users of health and social care services and treatments. Members of the public without experience of healthcare and other services can also offer a valuable perspective and the involvement of these groups in the design, execution and management of research can help to improve its quality, relevance and the wider dissemination of its results. PPIEP will include community engagement activities to understand the efforts of the surveillance in the communities, and will be a large aspect to measuring and monitoring behaviour changes before/after the AMS intervention.

Contract research organisations Are you requesting contract research organisations?	No

Other	Yes

Are you requesting other?	

Other

Type	Description	Total (USD)
Computing	Statistical programmes, incl SPSS	1,321
Conference/seminar hosting	Project-specific office supplies/printing etc	943
Specialist publications	Publication costs for specialist publications for research-relevant publications that aren't available in institutional libraries.	6,000
Consultancy fees	Consultancy for scientific research/databases/interviewers for community health intervention	145,426
Consultancy fees	Consultancy for development of the CDSS	143,913

Justification for other.
Programming for biostatistics; project-specific office supplies for community engagement activities. Special publ collecting data (Projects 2&3) and analysing it (Projects 2&3) Consultancy for Proj 1: **THIRD PARTY SERVICES** Translation R$ 6000 Samples transport R$ 50 space cloud Information Tecnology - database Real R$ 8,478.40 Information Tecnology - Artificial Inteligency Real R$ 8,478.40 Information Tecnology - App development Real R$ 8,478.40 Physicochemical analysis US$ 189.23

Summary of costs requested	
	Total (USD)
Staff	481,585
Adjustment support	0
Training and continuing professional development	0
Materials and consumables	471,996
Animals	0
Associated animals costs	0
Equipment	53,019
Access charges	0
Overheads	136,574

Travel and subsistence	30,453
Overseas allowances	0
Fieldwork expenses	0
Clinical research	0
Public engagement and patient involvement	18,000
Contract research organisations	0
Other	297,603
Total	**1,489,230**

14. Full economic costing

Is your organisation based in the UK?	No

15. Appendices

1) overheads letter PDF - overhead statement FFM-papel timbrado.pdf

FUNDAÇÃO
FACULDADE DE MEDICINA

29 July 2022

Grants Adviser
Wellcome Trust
Gibbs Building,
215 Euston Road
London NW1 2BE, UK

Re: Wellcome Trust guideline for Research Management and Support Cost

Wellcome Trust Guidance states that requests for research management and support costs from low- and middle-income country institutions must be accompanied by a letter from the Finance Director of the institution, confirming the request is a true representation of the costs incurred.

As Financial Director of Fundação Faculdade de Medicina I hereby confirm that the following research governance, management and support costs are included in the proposal budget: Infrastructural support costs comprise of the following costs:

- Administration Services which processes all financial, legal, regulatory and staff transactions:
  - Project department (US$22,574),
  - Purchases department (US$22,000),
  - Legal support (US$16,500)
  - Fiscal and accounting support (US$16,500)
  - Financial department (US$ 20,000)
  - Human resources (US$ 20,000)
- Other costs necessary for the research:
  - Computing and Internet Access Cost (US$ 8,000),
  - Facility and running cost: utilities (US$5,000),
  - Facility and running cost: building maintenance (US$ 6,000).

The list above are the expected costs necessary to support the grant activity.

Yours sincerely,

Amaro Angrisano
Financial Director

GGPP/panm