LSTM ANNUAL REPORT

2019/20

LSTM
LIVERPOOL SCHOOL
OF TROPICAL MEDICINE
Since 1898

Vision

To save lives in resource poor countries through research, education and capacity strengthening

Mission

To reduce the burden of sickness and mortality in disease endemic countries through the delivery of effective interventions which improve human health and are relevant to the poorest communities

Values

- Making a difference to health and wellbeing
- Excellence in innovation, leadership and science
- Achieving and delivering through partnership
- An ethical ethos founded on respect, accountability and honesty
- Creating a great place to work and study

Contents

Opposite page: **An IMPROVE trial participant checks on her sleeping child under a bednet in western Kenya.**

The LSTM led IMPROVE collaboration conducts research into alternative drug regimens for women with malaria in pregnancy in Tanzania, Malawi and Kenya.

Photo credit: EDCTP

Chair's Foreword

I write this foreword as the acting interim Chair, having taken over from James Ross in early 2020. I begin by expressing the Board of Trustees' very sincere thanks to James for his 12 years dedicated service to LSTM and for leaving matters of governance, which are the remit of the Board, in good order. I am also delighted to report that James has taken up the Board's offer to become one of LSTM's vice presidents.

Sue Russell

My tenure as acting interim Chair began just as the impact of COVID-19 was beginning to be felt in the UK. COVID-19 has meant a number of different things for LSTM: I am proud to say that our academics have played, and continue to play, a vital role in researching, developing and trialling diagnostic tests, vaccines and therapeutics in response to the pandemic. Clinical staff also responded to the call to help out in NHS hospitals locally when the pandemic was at its peak in the spring of 2020. With our partners in Malawi, LSTM played a key role in the construction and operation of an oxygen plant for the Queen Elizabeth Hospital in Blantyre, Malawi - oxygen supplies being essential to the care of patients.

I would like to take this opportunity to pay tribute to everyone who has played a part in LSTM's response to the COVID-19 pandemic and to thank David Lalloo for his leadership during this extremely challenging time.

Unusual circumstances require additional vigilance in relation to matters of governance. May of this year saw a new Higher Education Audit Committees Code of Practice and September saw the introduction of the new Higher Education Code of Governance, with a Charity Sector update on governance due at the end of 2020.

In addition to the usual areas where the Trustees have oversight, we have recognised that the pandemic has meant that our staff have had to cope with new ways of working, in many cases from home, and that they have also been instrumental in innovating new methods of teaching. For those reasons, LSTM has been concerned to seek to further improve its support to staff and students in matters of mental health.

The past year also confronted us with the ongoing racial inequalities in UK society. LSTM is examining its portfolios of Global Health research and education, as well as its internal structures and processes, in order to become a truly inclusive institution.

The difficulties caused by COVID-19 created delays in our process of recruiting a new Chair of the Board of Trustees of LSTM. However, I am delighted to welcome Jim McKenna who will, following completion of necessary formalities at our AGM, become Chair of the Board from early 2021.

Jim is no stranger to Liverpool having attended University and lived here for 10 years immediately thereafter. He brings to the Board considerable international business experience, previous involvement in Higher Education, and a familiarity of working with both government and charities. The Board looks forward to working with Jim as we continue to chart these unprecedented waters and deal with the consequences of Brexit.

It has been a privilege to serve as LSTM's interim Chair and I am grateful to all of my fellow Trustees for their support and the time they devote to their roles. I will continue as a Trustee and wish our new Chair, and LSTM, all the very best for the future.

Sue Russell

LSTM is examining its portfolios of Global Health research and education, as well as its internal structures and processes, in order to become a truly inclusive institution.

Director's Foreword

Professor David Lalloo

The world seems a very different place to a year ago and inevitably the coronavirus pandemic has dominated LSTM's activities over the last year. The strength of an organisation can be measured by how it deals with a crisis and I'm extremely proud of how LSTM and its staff around the world have been able to respond to the challenges of COVID-19.

We have been forced to react rapidly to changing circumstances; substantially expanding our online teaching, developing new portfolios of research, adapting systems for home working, making premises safe and supporting staff and students. LSTM staff have played a major role in supporting clinical services and the public health response, both locally and nationally in the UK and overseas.

I would like to thank every member of staff for the part they have played in this response. The crisis has highlighted the advantages of being small and flexible enough to respond rapidly to a changing environment. As we grow bigger, it will be key to our ongoing success that we do not lose that agility and responsiveness.

Examples of our successful research are highlighted in the report and whilst COVID-19 has been a focus of the last year, there have been many other examples of research success despite the current challenges. There has also been increasing national and international recognition of LSTM's research with two ministerial visits in the last six months and a highly successful virtual symposium series with DFID. It will be important to ensure that this high profile is maintained over the coming years.

Last year, I highlighted my desire to expand our partnerships, both with overseas partners and within Liverpool. Difficulties with overseas travel has undoubtedly delayed further engagement with overseas partners but an unanticipated benefit of our COVID-19 activity and research is that the relationships within the city have become even stronger and we will continue to work on our partnerships over the next

The crisis has highlighted the advantages of being small and flexible enough to respond rapidly to a changing environment.

year. We also continue to focus on making LSTM a better place to work; the Black Lives Matter movement has highlighted the importance of ensuring equality and diversity in all that we do, of decolonising our curriculum and of acknowledging and understanding LSTM's colonial heritage.

A number of uncertainties remain about the future. We still do not understand the real impact of Brexit. The economic impact of COVID-19 could substantially influence UK research funding and the amalgamation of DFID into the new Foreign, Commonwealth and Development Office (FCDO) leads to uncertainty about overseas development funding. However, it is certain that the economic challenges and disrupting effect of COVID-19 on health care systems will be even more stark in the countries where we work, making our role more critical than ever. There is also no doubt that there is a new appreciation of the importance of infection and the fact that emerging infections need to be tackled globally not nationally. LSTM is ideally positioned to respond to this increased focus upon infection.

When Sue Russell agreed to take over as interim Chair of the Board of Trustees earlier this year, she cannot have anticipated the difficulties that the organisation might face and I'm incredibly grateful for her wise counsel and the support of the Board over these last nine months. I am also delighted that Jim McKenna will soon be appointed as the new Chair of the Board of Trustees after a lengthy process delayed by COVID-19. I look forward to working with him and drawing on his wealth of experience from the commercial, HEI and charity sector.

Like all organisations, LSTM has faced considerable challenges over the last year. However, it has also became clear that LSTM's expertise has never been more relevant to the health problems facing the world. I am confident that we will emerge from this crisis stronger and even better equipped to continue our major impact on the health issues that affect poor populations globally.

Professor David Lalloo

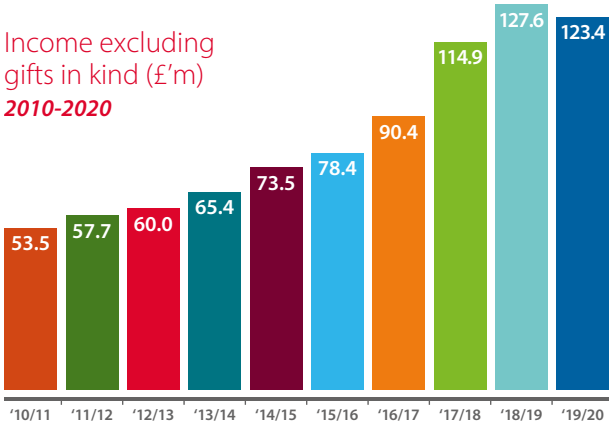
Treasurer's Report

LSTM has continued along its growth trajectory in 2020 and but for the COVID-19 pandemic and the lockdown for the last 4 months of the financial year would have shown further growth in its underlying income excluding gifts in kind. However, although the COVID-19 impact on research income was largely offset by a corresponding decrease in research costs, other income was significantly impacted resulting in an underlying operating deficit of £0.4m. Group net assets of £49m at 31st July remain healthy.

John O'Brien Bcomm FCA

Group income of £228m (2019: £243m) reflects the significant reduction in 'gifts in kind' from £115m in 2019 to the current year of £104m.The gifts in kind were primarily pharmaceutical drugs relating to a DFID (now FCDO) mass drug administration programme in several African countries. Excluding the gifts in kind, LSTM reported total income of £123m (2019: £128m), representing a 3% decrease over the previous year, which without the impact of COVID-19 would have been a small increase.

Income excluding gifts in kind (£'m)
2010-2020



Our reported surplus for the year was £9.7m (2019: Deficit £11.4m). As with the prior years, this figure was significantly impacted by the movement on the pension deficit provision with a £12.6m reversal in the year. However, the pandemic's impact on world markets resulted in an unrealised loss on investments and endowments of £3m. Excluding these items and other non-operational accounting entries we recorded an underlying operational deficit of £0.4m (2019: £3.9m surplus). Without the estimated negative impact on research and teaching from COVID-19 of £0.9m there would have been an underlying operating surplus of £0.5m. This is a very credible performance in the current circumstances and reflects the significant efforts of the LSTM team and the fantastic support of our research funders. So far in 2020/21 LSTM has managed to adapt both its teaching and research activities to the "new normal" and both are proving to be reasonably robust despite COVID-19 restrictions.

Group net assets at the year-end totalled £49m (2019: £39m). Again, this was impacted by the pension provision movement and excluding deferred capital grants of £25m, which are unlikely ever to be repaid, net assets totalled £74m. Additional cashflow and spending monitoring were among a raft of measures brought in by the COVID-19 emergency management team and will continue as long as is required. Overall, the financial condition of LSTM , with the support of our research funders, remains healthy despite the pandemic.

That support is illustrated in the strong pipeline of research projects. During the year over £100m of new research grants were awarded to the Group and at the year-end over £279m (2019: £272m) was yet to be expended from the overall portfolio.

The 2020/21 budget was updated to reflect the impact of the pandemic and is very prudently compiled with a £0.3m group deficit target. It is hoped that at least a breakeven position can be ultimately achieved.

Finally, we continue to invest in our Estates to accommodate future growth plans in education and global research both in the UK and overseas. We continue to look at options to ensure that we have the facilities and infrastructure to maintain our world class leadership in global health service.

***John O'Brien** Bcomm FCA*

The 2020/21 budget was updated to reflect the impact of the pandemic

LSTM's response to the COVID-19 pandemic

LSTM is playing a unique role in the response to COVID-19, covering all of the translational research cycle. From the beginning of the outbreak It has partnered with industry, academic institutions and organisations aimed to have the best possible impact on public health in the UK and overseas.

A lot of LSTM's research is conducted via its Centre for Drugs and Diagnostics (CDD). This Centre comprises an experienced multi-disciplinary group of experts working together researching, developing and validating drugs and diagnostics in response to the COVID-19 pandemic.

Research into vaccines is the only way to find out which vaccines will work. LSTM plays a key role in the various COVID-19 vaccine research programmes that are ongoing, most notably establishing LSTM as a Phase III trial site for the Oxford Vaccine Trial.

LSTM also partners with multiple other institutions and organisations to provide evidence based advisory services to government departments and other interested parties.

COVID Diagnostics

The COVID diagnostics programme at CDD is enrolling patients suspected of COVID-19 for diagnostic evaluation and Dr Emily Adams's team has become the UK evaluation site for FIND, a programme which runs multiple rapid diagnostics for antigen detection, to rapidly identify active infection.

The programme works in partnership with industry that has developed a new rapid test to detect the presence of Coronavirus (COVID-19). Currently, the NHS uses the best test available to detect the virus using a nasal swab. The current test can take up to 4 days before the results are available which can lead to an extended amount of time in quarantine or a prolonged amount of time grouped with other patients that are suspected to have Coronavirus increasing the potential for hospital transmission.

The new tests need to be validated against the current best practice. The programme needs to use the tests with real samples to check if they are as accurate as the current test. If successful, this study may change practice and policy allowing for early detection and appropriate isolation of patients.

Sky science correspondent Thomas Moore talks with Dr Emily Adams about LSTM's validation of the point of care diagnostic test

Evaluation of rapid diagnostic tests for active infection

LSTM is working with FIND, a global non-profit organization driving innovation in the development and delivery of diagnostics to combat major diseases affecting the world's poorest populations, and other industrial partners to assess the sensitivity and specificity of new point-of-care antigen tests. The CDD team are working in a multi-centre study with FIND, Germany and Brazil to assess multiple tests, and data is presented by FIND to the World Health Organization (WHO) to make decisions on large-scale procurement.

These tests have the power to accurately identify active infection in minutes at the bedside of the patient. CDD is now investigating ways to implement these findings in the UK and further afield working with the MALCOV team for rapid screening of infection in Burkina Faso and Kenya.

The CDD team are working with multiple industrial partners, most notably Mologic, funded by Wellcome and DFID (now FCDO), to improve antigen tests by rapid analytical sensitivity and specificity testing to improve prototypes, and rapidly use clinical samples for clinical evaluation.

Evaluation of rapid diagnostic tests for SARS-CoV-2 antibodies

The CDD team are validating several rapid tests to detect SARS-COV-2 antibodies in a finger prick or venous blood sample.

These simple to use tests produce results in 10-15 minutes and can be run from home as well as at the point-of-care. Evaluations are being conducted both within LSTM and on behalf of the Foundation of Innovative New Diagnostics, a not-for-profit specialising in infectious disease diagnostics. LSTM is the only site selected from the UK. Samples collected through the FASTER and with LCL (Liverpool Clinical Laboratories), and a panel of pre-pandemic COVID-19 negative samples are being used to assess test sensitivity and specificity.

Investigating how effective antibodies are at inactivating SARS-CoV-2 virus

A positive antibody test for SARS-CoV-2 does not necessarily equate to immunity. Standards antibody tests may detect antibodies in the blood that are raised in response to SARS-CoV-2 but are not able to inhibit its replication, and therefore are not protective against future infection.

LSTM researchers are using neutralisation assays to detect antibodies that can prevent the replication of SARS-CoV-2. This virus is added to serum samples from patients who have recovered from COVID-19, allowing us to see how effective

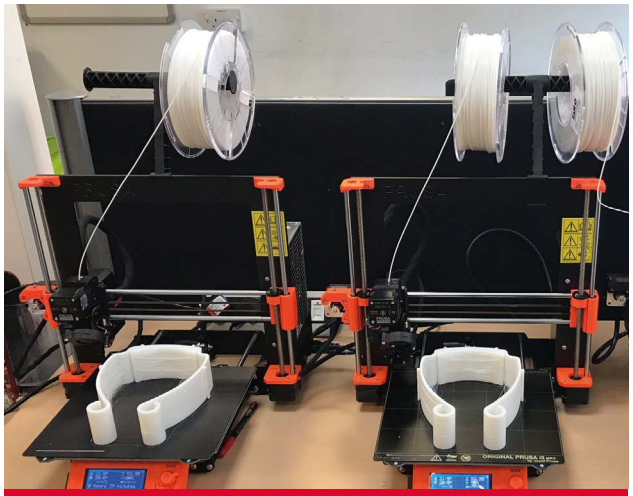
their antibodies are at neutralising the virus. This approach is being used in combination with a range of other rapid and ELISA-based antibody tests, to assess how well they correlate to a neutralising response, so it can be said with certainty if an antibody positive result will be indicative of protection from further infection, and for how long.

COVID-LIV virology study

LSTM's Dr Emily Adams and her team are involved in the COVID-LIV Virology study, alongside colleagues at the University of Liverpool, to assess the impact of SARS-CoV-2 transmission on Liverpool households.

Each member of a household, including children, over a 12-week period, will have regular samples taken from their nose and throat to look for evidence of COVID-19 infection. A blood sample is requested at the beginning and end of the study to look for any changes in the immune response at the start and end of the study.

The team hope to understand the incidence and rate of spread of SARS-CoV-2 in households, what factors control or exacerbate the spread within a household, and the contribution of mild or asymptomatic infections on transmission. In addition, the team will explore the role the immune system plays in disease severity.



Printing Face Shields for the NHS

LSTM's PhD student Sean Tomlinson re-allocated LSTM's 3D printers and used them to print free face shields for NHS staff working on the frontline during the COVID-19 pandemic.

Sean Tomlinson answered the call from DoES Liverpool, a community interest company focused on supporting the local maker community, to produce effective low-cost face shields for North West healthcare workers.

The laser-cut polypropylene face shields produced by DoES Liverpool and the larger network of volunteers have been ordered by hospitals and GP surgeries across the North West including Aintree, Liverpool Royal, Walton, East Lancashire Hospitals and Manchester Royal Infirmary. Sean Tomlinson, who joined the MRC Doctoral Training Partnership scheme with LSTM, had access to LSTM's 3D printers and is used the designs provided by DoES Liverpool to optimise the printing process to increase daily production 80 face shields per day using 4 printers.

Establishment of a COVID-19 Preclinical Pipeline for Therapeutics

CDD's therapeutics team, including staff of Professors Biagini, Ward and Dr Joe Turner groups, have been working with a cross-campus (University of Liverpool) consortium of some 40 scientists to establish a COVID-19 preclinical pipeline to identify, prioritise and validate preclinical candidates for therapeutics suitable for clinical Phase I and Phase II studies. These activities include the set-up and validation of *in vitro* screening platforms and *in vivo* COVID-19 disease models, including pharmadynamic-pharmakinetic (PD-PK) modelling and simulations to predict clinical efficacy. The pre-clinical pipeline has been used to screen drug libraries as well as new chemical entities (NCEs) and new drug combinations.
The results from the pre-clinical pipeline provides evidence-based data to inform onward clinical trial efforts such as the BMGF-funded MALCOV of Professor Feiko ter Kuile.

Dose prediction for repurposing nitazoxanide in SARS-CoV-2 treatment or chemoprophylaxis

Many clinical trials have been initiated with current medications, but assessments of the levels of active drug in the blood plasma and lungs at the selected doses have not featured in the prioritisation process. Recently the team at LSTM and its partners have shown, using PBPK modelling, the anthelmintic nitazoxanide and, importantly, its active metabolite as having broad antiviral activity against SARS–CoV–2 and achieved effective plasma and lung concentrations using proven safe doses of nitazoxanide.

Prioritisation of anti-SARS-CoV-2 drug repurposing opportunities based on ability to achieve adequate target site concentrations derived from their established human pharmacokinetics

The team at LSTM, alongside the University of Liverpool, have prioritised candidates with the best chance for success in therapy or chemoprevention of COVID-19 based upon the currently available in vitro activity and human plasma pharmacokinetic data. Studies will continue to explore the context of achievable active drug exposures in humans, especially within the lungs, in order to maximise the potential for success of proposed human clinical trials.

Establishment of a COVID-19 *in vivo* disease model and investigations of co-infection with flu virus

Coalescence of a second wave of the COVID-19 virus with seasonal respiratory viruses, particularly influenza, is a global health concern. To study this, transgenic mice expressing the human ACE2 receptor driven by the epithelial cell cytokeratin-18 gene promoter (K18-hACE2) were first infected with influenza A virus (IAV) followed by SARS-CoV-2. Whilst the viral load of SARS-CoV-2 appeared significantly reduced in the sequentially infected mice, these mice had a more rapid weight loss, more severe lung damage and a prolongation of the innate response compared to singly infected or control mice. The sequential infection also exacerbated the extra-pulmonary manifestations associated with SARS-CoV-2. This included a more severe encephalitis. Taken together, the data suggest that the concept of 'twinfection' is deleterious and mitigation steps should be instituted as part of a comprehensive public health response to the COVID-19 pandemic.

The glycobiology of COVID-19

Dr Aitor Casas-Sanchez was awarded the Director's Catalyst Fund to investigate the sugars present on viral surface proteins as potential targets for therapy to treat severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), the causative agent of the current COVID-19 pandemic. This work is being done in collaboration with Dr Grant Hughes, Dr Alvaro Acosta Serrano and Dr Ian Patterson.

Dr Casas-Sanchez studies the role of the sugar units, called N-glycans, attached to viral surface proteins. These viral surface proteins are known to control viral entry into host cells, a crucial step in viral replication in the host, and their sugars have an important role in modulating the host immune response, and the efficacy of drugs and vaccines. Dr Casas-Sanchez aims to explore whether the attached sugar units can be a potential target for new and more effective treatments against COVID-19, vital in order to quickly control the current pandemic.

Therapeutic antibodies for COVID-19

Immunoglobulins, also called antibodies, are an important arm of the immune response helping to both eliminate pathogens and stop them causing disease.

While showing recent clinical promise there are considerable hurdles arising from the use of human plasma donors to treat COVID-19, in addition human plasma is costly and the requirements to screen for pathogens and the identification of donors with high neutralising anti-SARS-CoV-2 titres is time consuming.

LSTM's Professor Richard Pleass and team are currently exploring the role of utilising larger domesticated animals to generate therapeutic antibodies to target COVID-19.

While human convalescent sera may not be readily available in outbreak situations, already licenced antisera of animal origin containing high titres of neutralising antibody can be produced in 2-4 months. The availability of animal antisera may be of benefit to those LIC and LMIC countries.

His laboratory, together with Dr Alvaro Acosta-Serrano's, is investigating the repurposing of glycosylated Fc-fragments and/or viruses developed at LSTM for the control of COVID-19 mediated ARDS and cytokine storms. Together with colleagues at the University of Oxford they are also improving the efficacy of therapeutic monoclonal antibodies (mAbs) for COVID-19 and other emerging viral infections.

agile
Coronavirus Drug Testing Initiative

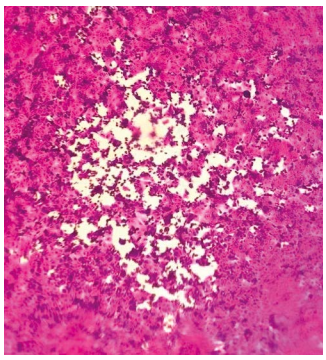
AGILE clinical trial platform

The AGILE clinical trial platform is a new type of study designed for pandemic drug testing which represents a world-first for infectious diseases – capable of testing multiple potential treatments in parallel and speeding up testing by pooling control data across patient groups.

The AGILE clinical trial platform has been launched specifically to test new COVID-19 treatments, faster than ever before. It bridges the gap between non-human trials and large-scale testing, so potential new treatments can go through the important testing stages in a matter of months rather than years, while maintaining a high level of safety at all times.

This provides the potential for one or more suitable treatment options to become broadly available for patients with COVID-19 much sooner, and ultimately, allowing us to restart society.

The MHRA (Medicines and Healthcare products Regulatory Agency) has fully evaluated this platform and given its approval. The UK regulatory body has adapted rapidly to the altered circumstances in the pandemic to help efforts against coronavirus.



A plaque assay used to study the SARS-CoV2 virus. The pink stain is crystal violet – used to identify host cells (VEROs). Clear zones, called plaques, form where host cells have been destroyed as a result of active viral replication. By counting the plaques it can be determined how effective different drugs are against the virus – the fewer plaques, the more effective the treatment.

Culture and study of the COVID-19 virus

Researchers at LSTM are in the unique position to have the capacity to work with infectious SARS-CoV-2 (the cause of COVID-19) and complete assays to quantify infectious virus. There are very few laboratories in the UK which have this capacity and, consequently, LSTM has partnered with other research institutions to provide these skills and capabilities.

The team produces virus to carry out experiments: Knowing how many infectious viruses are in a sample allows the team to determine how well they have inactivated the virus, or how many viruses have been neutralized during the experiment or if specific cell types are susceptible to infection.

Developing organoid model systems for SARS-CoV-2 infections: Establishment of expandable organoid culture systems to model the infection and replication process the COVID-19 virus will lead the way to us discovering aspects of its biology which can be targeted for potential therapeutics and vaccines.

Using neutralising antibody assays to determine previous exposure to the virus in both humans and animals: Virus neutralisation assays detect antibodies that are capable of inhibiting virus replication, and by understanding which neutralising antibodies are mounted following exposure to COVID-19 can support the development of vaccines to target SARS-CoV-2.

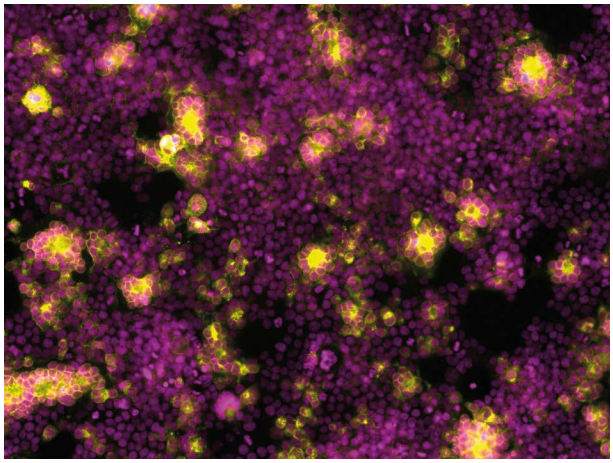
Perform virus inactivation protocols so downstream laboratory approaches can be undertaken at lower biosafety levels: Researchers have examined several methods to inactivate SARS-CoV-2.

Developing novel microscopy-based approaches to examine virus-host cell interactions: Understanding the infection process of SARS-CoV-2 and how it infects host cells is

one avenue of exploration in the development of novel therapeutics and vaccines to this virus. If researchers can prevent SARS-CoV-2 from binding to host cells, infections can be managed more effectively.

MALCOV - malaria as a risk factor for COVID-19

A joint study by LSTM; the London School of Hygiene and Tropical Medicine; National Center for Research and Training for Malaria (CNRFP, Burkina Faso) and the Kenya Medical Research Institute (KEMRI) is assessing whether malaria infection affects the clinical course of COVID-19. Funded by the Bill and Melinda Gates Foundation, this 18-month clinical study, which started in November 2020 in multiple sites in Kenya and Burkina-Faso, will determine whether malaria or the type of antimalarial drugs affects COVID-19 disease progression.



Cells in culture infected with SARS-CoV-2 in a lab setting

Well Travelled Clinics and COVID-19

Since the early days of the pandemic, staff at LSTM's Well Travelled Clinics (WTC) have played a significant role in supporting LSTM and local NHS and PHE health care teams in their response to COVID-19.

The WTC Liverpool branch remained open throughout the pandemic, continuing to offer a vaccination and occupational travel service to ensure that key workers and international staff could continue to be deployed.

WTC's highly experienced staff were utilised for a number of COVID-19 specific roles. This included two Occupational Health nurses to the Liverpool University Hospital Foundation Trust (LUHFT) to get those returning to the NHS as part of the pandemic response into their roles as quickly as possible. More recently, three members of nursing staff have been temporarily seconded to Public Health England to help support the COVID-advisory service, which has been overwhelmed with the volume of enquiries from local councils, schools, colleges, universities, nursing homes as well as companies regarding COVID-19.

In partnership with the Accelerator Research Clinic (ARC) team, administrative, nursing, medical and management staff have been involved in supporting the Oxford COVID-19 vaccine trial. Over the last five months, the WTC team vaccinated over 850 participants for this trial.

With further vaccine trials in the pipeline, WTC is in discussion with the ARC and CRN to provide their experience and expertise in vaccination to provide continued support for these.

WTC nursing staff have also supported other local COVID research studies through the secondment of nursing staff. This included the SAFER and FASTER research trials at LUHFT, being run by the ARC research team, and the University of Liverpool's COV-LIV community study.

WTC's education staff have also been involved in vaccine training and education to support the Northwest Coast Clinical Research Network (CRN), by delivering a bespoke training course to a group of CRN nurses so they can take part in vaccine trials, this is to ensure that we have enough qualified nurses with experience in vaccination for future clinical trials.

Most recently the WTC started offering a new back-up COVID-19 testing service for symptomatic LSTM staff and students who are unable to access NHS rapid testing because of the current pressure on the service. A special testing tent has been set up at the back of WTC and protocols have been put in place to manage the process.

The WTC's commercial agility and flexibility, together with the previous experience in managing the healthcare needs of rapid humanitarian deployments, have proved invaluable in delivering a swift and targeted response to the pandemic.

WTC staff member vaccinates a volunteer as part of the Oxford COVID-19 vaccine trial

COVID Vaccine Development

COVID-19 Oxford vaccine trial

The development of a safe and effective vaccine will be the only way we will be able to get out of the pandemic and resume our normal lives and the Respiratory Infection and Vaccine team at LSTM is working hard towards this.

LSTM is one of the research trial sites testing a new vaccine against COVID-19 in healthy volunteers.

This study will enable researchers to assess if people can be protected from COVID-19 with this new vaccine called ChAdOx1 nCoV-19. It will also give them valuable information on safety aspects of the vaccine and its ability to generate good immune responses against the virus in young and older adults.

LSTM does this by randomly allocating participants to receive the ChAdOx1 nCoV-19 vaccine or a Men ACWY vaccine in addition to doing blood tests and collecting information about any symptoms that occur after vaccination. If a participant develops COVID symptoms they are tested for COVID. To estimate the efficacy of the vaccine the proportion of those who develop COVID in the vaccine and the control arm will be compared. Efficacy data for the trial will be pulled from all 18 sites in the UK and Brazil and presented to regulators for potential licensure of the vaccine. The team is now in discussions with NIHR and industry partners for delivery of two further COVID vaccine studies starting at the end of the year.

In addition, Professor Daniela Ferreira's team has been collaborating with Pfizer, who have an existing vaccine which works against one cause of severe pneumonia and are working on a vaccine for COVID. Viral infections are commonly associated with secondary bacterial infections during winter season, with pneumococcus increasing viral disease severity. Professor Daniela Ferreira and Dr Elena Mitsi were awarded a Pfizer funded grant to investigate the relationship of pneumococcus and SARS-CoV-2 and assess the immunological responses during co-infection. The ultimate aim is to define if pneumococcal vaccine would ultimately also assist the fight against COVID.

The respiratory infection and vaccine team ready to receive the first participants in the Phase III of the Oxford Vaccine Trial in May 2020

Government Office for Science

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UK Government Chief Scientific Adviser & Head of the Government Science and Engineering Profession

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BY EMAIL ONLY

23 June 2020

Dear Andrea,

Clinical trials of the Oxford Vaccine

I wanted to write to thank you and your super team for your commitment and dedication in helping evaluate the COVID19 vaccine that has been developed in Oxford. Your work is critical in investigating the potential role of a vaccine in helping us overcome the pandemic, and your efforts, in this challenging period of our lives, are greatly appreciated. In this programme, working with the Oxford team with funding from NIHR, we are hoping to establish if the vaccine is efficacious and whether booster doses are needed, and to establish the duration of protection. We are also considering whether we could evaluate other vaccine candidates in the UK and so I am delighted to have you working in this national effort and potentially able to help us build the portfolio on vaccines that could provide the exit for the pandemic.

I know there is still much to do but your efforts are greatly appreciated.

Yours sincerely,

Patrick Vallance
Government Chief Scientific Adviser

Kate Bingham
Chair of the UK Vaccine Taskforce

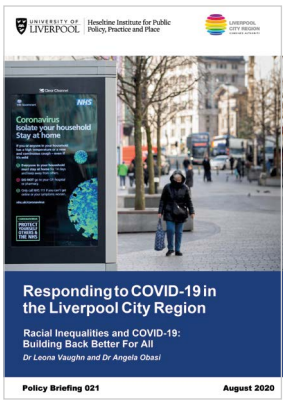
Thank you letter form the Government Office for Science to Dr Andrea Collins, LSTM's site lead for the Oxford Vaccine Trial

The respiratory infection and vaccine team processing blood samples from participants in the Oxford vaccine study. Samples are used to measure antibodies against the vaccine and inform if vaccine is generating immune response in the participants

COVID-19 Advocacy

'Building Back Better for All'

As part of a series of COVID-10 Policy Briefings, commissioned by University of Liverpool's Heseltine Institute to support civic leaders and policy makers in their response to the challenges of the COVID-19 pandemic, LSTM's Dr Angela Obasi was co-author on the Policy Briefing 'Racial inequalities and COVID-19: Building Back Better for All.



The Briefing tackles the urgent and topical issue of the disproportionate impact of COVID-19 on racially minoritised groups. It highlights that this impact is "not only directly felt in terms of health outcomes but compounds and is compounded by unequal social impacts in housing, education, employment social care/welfare and criminal justice".

The Briefing summarises the adverse impacts on Black, Asian and other racially minoritised people and outlines the need for more rigorous exploration and analysis of policy making and policy impacts with regard to racial equity.

The authors highlight the importance of meaningful and well-resourced multi-sector partnership in the design and implementation of strategies for recovery and the need for such strategies to be co-produced with communities to help counteract the impact of racial inequalities.

The recommendations are designed to support Liverpool civic leaders and policy makers to take the opportunity that recovery programming provides to not merely to return to "normal" but to actively remedy inequalities and truly build back better for all.

COVID-19 clinical research coalition

LSTM Director, Professor David Lalloo, joined a group of scientists, physicians, funders and policy makers from over 70 institutions from over 30 countries who launched an international coalition to respond to COVID-19 in resource-poor settings.

The COVID-19 Clinical Research Coalition aims to accelerate desperately needed COVID-19 research in those areas where the virus could wreak havoc on already-fragile health systems and cause the greatest health impact on vulnerable populations.

In a Comment published in The Lancet, the members of the coalition argue that international research collaboration and coordination is needed urgently to support African, Latin American, Eastern European, and certain Asian countries to respond effectively to the worsening pandemic and speed up research adapted to resource-limited settings.

Host Immune Responses to COVID-19 Infection

SAFER and FASTER clinical trials

The SAFER study has examined rates of SARS-CoV-2 acquisition in HCWs at the University College London Hospital (UCLH) and at Liverpool University Hospitals NHS Foundation Trust, at Royal Liverpool University Hospital (RLUH). FASTER is a Liverpool based study, which has been recruiting symptomatic patients suspect of COVID-19 of different age groups, with divergent symptoms and disease severity.

Antibody and cellular responses to SARS-CoV-2 and cross-reactivity with seasonal coronaviruses

Led by the early career researchers Dr Elena Mitsi and in collaboration with Dr Britta Urban, this work is investigating antibody levels and antibody capacity to neutralise live SARS-CoV-2 virus and cellular (T and B cell) responses to SARS-CoV-2 during the acute phase of disease in respiratory and blood samples collected from both SAFER and FASTER study. The team is also interested to assess the quality and duration of antibody, T and B cells responses up to 1 year post the initial infection not only systemically but also at the nasal mucosa- the site where respiratory infections start. The quality and longevity of T and B cells responses in blood and tissues is an important question that remains unanswered. By studying the host responses during the natural infection, we acquire valuable knowledge which can inform future vaccine strategies. Using pre-pandemic samples from seasonal coronavirus infected subjects, the team is also assessing the level of cross-reactive immunity between seasonal and pandemic coronavirus. In addition, together with Dr Andrea Collins the team is also studying lung immune responses to SARS-CoV-2 in COVID-19 infected patients.

Nasal Inflammation and disease outcome

The team is also using a synthetic aborting material (SAM) to examine levels of inflammation in the nose during COVID-19 infection in order to correlate inflammation with disease severity, viral load and acceleration of viral clearance in the upper respiratory tract. This work has the potential to identify biomarkers that can be utilised to prevent disease progression early on the infection.

Viral and bacterial co-infection

The Respiratory Clinical Research team is also interested to know whether the presence of nasal bacteria (specifically the bacterial Streptococcus pneumoniae) is associated with increased risk of SARS-CoV-2 infection and COVID-19 disease. This will better inform staff of risks from working during a pandemic, how to protect them as well as finding ways of reducing the risk of transmission of SARS-CoV-2 to patients. It will inform about the role of asymptomatic carriage, co-pathogens and host immune responses

Improving Health Systems: Adjusting to COVID-19

LSTM researchers, led by Professors Sally Theobald, Miriam Taegtmeyer, Imelda Bates and Dr Laura Dean and partner organisations (University of Liverpool & Ministry of Health, Liberia, and Liverpool Hospitals NHS Foundation Trust) are currently looking into how health systems in Liverpool and Liberia have been adjusting to the ongoing COVID-19 outbreak.

The project hopes to share learning and promote capacity strengthening across geographic boundaries and learn from similar adjustments made by the Liberian health care system during the 2014-2015 Ebola epidemic.

The research explores perspectives of health care workers employed directly in the COVID-19 response, the decision-makers and those working in other key areas of the health system, for example governance stakeholders, laboratory scientists, and other health care staff.

Uniquely, this project brings together social science, bioethics and health systems researchers and apply health systems models of resilience to understand the impacts of COVID-19 on routine delivery of health care systems in different settings such as Liverpool and Liberia.

The project team are working closely with policy makers and front-line staff (including the Ministry of Health in Liberia), to develop useful, evidence-based guidance and resource documents to inform the health systems response and to support governance and accountability to promote equity in decision making.

As of the summer of 2020 LSTM became one of the partners in organising several COVID-19 awareness campaigns, targeting millions of people in West and Central Africa. With UK Aid support these campaigns help audiences to protect themselves from infection and relieve the burden on struggling health systems. This response to COVID-19 is an extension of the UK's Accelerating the Sustainable Control and Elimination of neglected tropical diseases programme (ASCEND) which combats neglected topical diseases.

In addition, in large health systems consortia linked to LSTM's Centre for Health Systems Strengthening, LSTM has been proactively adapting its research in response to new priorities emerging from the pandemic. It also ensured that learning is shared in order to promote future health systems resilience.

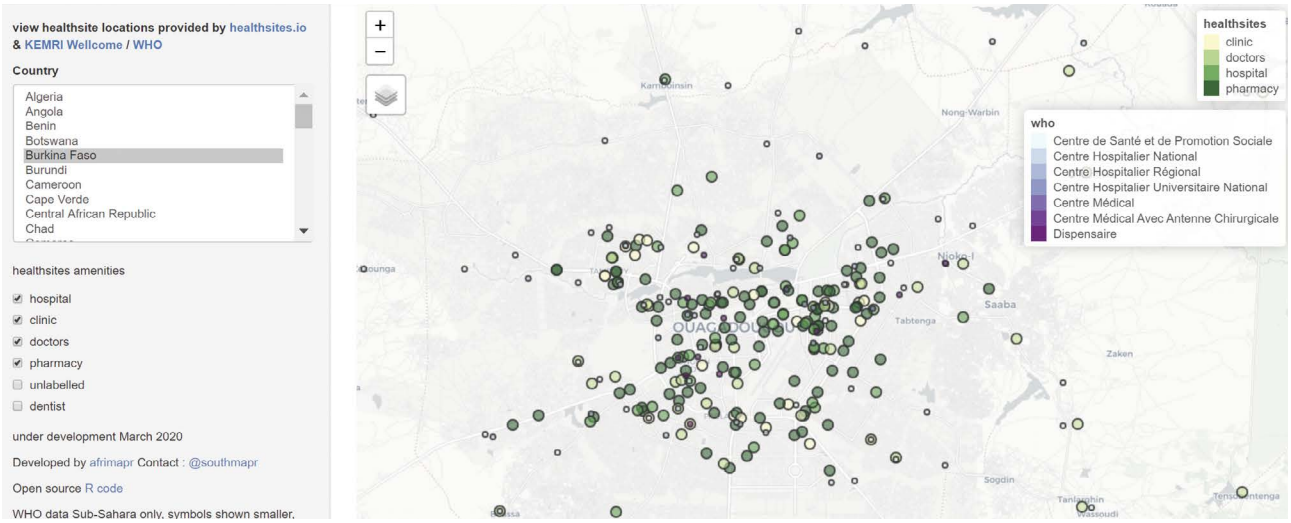
A project led by LSTM researcher, Dr Andy South, is developing open-source software to facilitate the use of health data in Africa. Recent work visualising the distribution of more than 100,000 African health facilities through a web application aims to support the response to the coronavirus pandemic. Afrimapr is a one year project running in 2020, funded by the Wellcome Open Research Fund. Its approach is to create software building-blocks in R, a free software environment for statistical computing and graphics, facilitating others to create data-driven tools and apps. By improving access to existing open datasets this will make it easier for others to develop digital solutions to local problems. The time is right given the rapid expansion of data-science communities in Africa.

The project's initial core team includes members from LSTM; Talarify - a South African company developing research computational skills in Africa; the universities of Bath and Leeds and the Education Strategy centre in Ethiopia. The team has been joined by a collaborator from Senegal and is looking to grow.

K4D Knowledge, evidence and learning for development
COVID-19 Resource Hub

LSTM is leading on the regular K4D COVID-19 Health Evidence Summaries published to signpost FCDO and other UK government departments to the latest relevant evidence and discourse on COVID-19 to inform and support their fight against this pandemic and its consequence. These summaries reach out across the academic and professional community to capture relevant evolving evidence to help DFID (now FCDO) in their evidence-informed decisions. The 100th summary was published at the beginning of November.

The Knowledge, Evidence and Learning for Development Programme (K4D) supports the use of learning and evidence to improve the impact of development policy and programmes. It is funded by UK aid and is designed to assist UK government departments and partners to be innovative and responsive to rapidly changing and complex development challenges. LSTM is a partner in this consortium led by the Institute of Development Studies (IDS) in Brighton, UK.



Screenshot of the afrimapr healthsites viewer

Introduction to the Feature Articles

The past academic year has thrown up unprecedented major global health challenges that have highlighted LSTM's translational strengths in a very visible and practical way. From a standing start our expertise enabled the delivery of a portfolio of COVID-19 research in diagnostics, drugs, vaccines and public health policy that has made significant contributions to the fight against the pandemic.

This work, just like all the other research programmes at LSTM, emphasised again the importance of partnerships and collaborations in addressing these global challenges. As we move towards LSTM's 125th anniversary in 2023, our translational research cycle approach evolves in line with the ever-changing priorities in global health. Through the expertise of our academic, industrial and policy partners and collaborators we continue to develop relevant solutions with global impact.

Innovation with a focus on meaningful impact is key to the delivery of effective global health solutions, as exemplified by the launch of the Infection Innovation Consortium (iiCON) here in Liverpool, the establishment of the oxygen plant and the Clinical Research Excellence and Training Open Resource (CREATOR) with our partners in Malawi and new teaching programmes such as the Leadership Education Academic Partnership (LEAP) project with the University of Manchester and Médecins Sans Frontières (MSF). These initiatives illustrate how we bring together leading and emerging pioneers in global health research and train the next generation of global health leaders.

As highlighted at the beginning of this Annual Report, the COVID-19 pandemic has put an extra-ordinary strain on our research and teaching activities by re-allocating resources, staff and services whilst at the same time keep the ongoing projects and programmes live. Our submission for the forthcoming Research Excellence Framework (REF) 2021 has been postponed due to the COVID-19 implications. In the meantime, we continued to make further strategic changes to our research portfolio. Research themes have been expanded in the areas of HIV and Intervention Discovery & Development, while other themes have been renamed to better reflect the breadth and depth of the research that is undertaken, most notably in the research theme of maternal, newborn and child health

In all, the following feature articles and research departmental updates provide an overview of how we have continued to evolve our translational approach to new discoveries; diagnostics; treatments; practices and policies that have a beneficial effect on patients and populations.

As a research powerhouse we remain outward facing, forward thinking and partnership driven, so we can break the cycle of poor health and poverty.

Professor Steve Ward
Deputy Director

While many disease control programmes around the world have been halted or reduced during the COVID-19 pandemic, the capacity strengthening built into a programme for tsetse fly control in DRC by LSTM and their partners, the Programme National de Lutte contre la Tryaponosomiase Humaine Africaine (PNLTHA), has meant that activities have continued throughout.

While the lockdown policy meant that LSTM and PNLTHA Kinshasa staff were unable to travel to the field to support their colleagues. Local operational teams such as the one pictured in Bandundu-ville, DRC, have continued with activities with support from PATH, a public health NGO.

Despite the challenges imposed, entomological evaluations were completed by the local teams alone for the first time. To support these activities in Liverpool, LSTM's vector control team, together with partners, have produced a contingency plan to continue to build PNLTHA's local team capacities.

Photo: Doddy Mundiono

FEATURE ARTICLE:
Neglected Tropical Diseases

This year saw the creation of a new and expanded Centre for Neglected Tropical Diseases (CNTD) at LSTM. The new CNTD includes all NTD research and implementation activities carried out across LSTM representing more than 100 staff and was launched on World NTD day in January.

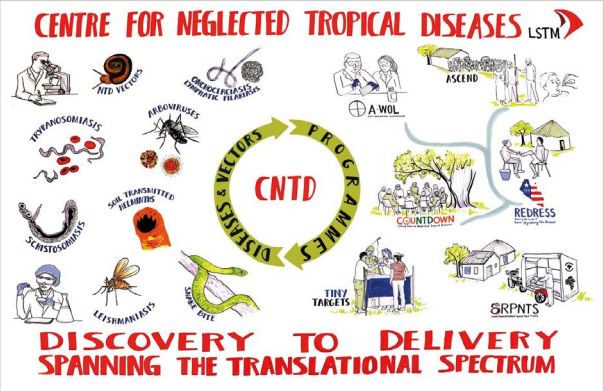


Illustration by morethanminutes.co.uk

Ascend

The original CNTD encompassing the implementation and technical support team for UK Aid NTD programmes now resides within Ascend (Accelerating the Control and Elimination of Neglected Tropical Diseases). This is a £92m Foreign, Commonwealth and Development Office (FCDO) funded programme: a consortium of partners including LSTM, SightSavers, Mott McDonald and the Schistosomiasis Control Initiative. CNTD-Ascend is the technical lead on Lymphatic Filariasis and the consortium hub for data management, monitoring and evaluation and supply chain capacity building.

Health system strengthening is a key component of the Ascend programme, which encompasses building supply chain capacity to improve 'last mile' drug availability and data. The 'last mile' refers to the in-country procedures leading up to the final point of distribution to communities. Over the past year, assessments took place in five countries: Chad, Ghana, Guinea Bissau, Liberia, and Sierra Leone. These countries were selected based on various factors including the overall volume of NTD donated drugs, being representative of varying degrees of national NTD programmes maturity, and the capacity to combine the field visit component with the health system strengthening assessment. The team contributes at the global level through partnerships such as the NTD Supply Chain Forum and the technical working group led by ESPEN and USAID Act to End NTD programme and has been successfully supporting countries remotely, during the first months of the COVID-19 pandemic.

Chad NTD programme supply chain workshop

Cross country capacity building

CNTD-Ascend prioritises sharing learning and skills across Ascend countries to support capacity building with formal mechanisms to ensure knowledge and experience sharing within and between countries. Doctors Peter Mikko and Adrien Loka are both Ascend Country Capacity Builders, within the LSTM DRC team. Their remit is to support and mentor their NTD programme colleagues both within DRC and across other Ascend francophone countries. In the last year they have conducted country visits to Burkina Faso to share their experience of NTD best practice and promote cross-learning in implementing NTD morbidity management and disability prevention activities and to Central African Republic to support the development of the national NTD programme.

Sustainable morbidity management and disability prevention treatment and care

Providing evidence of best practice gained in Bangladesh, DRC and Mozambique under the previous DFID funded LF Elimination Programme enabled the CNTD-Ascend team to negotiate a change in approach to the provision of hydrocele surgeries within the national NTD Programme in Niger. Moving away from an outreach camp format to a health system integrated approach, with surgeries taking place routinely at health facilities will improve sustainability as well as reduce costs for the country. In the period January to March 2020, surgeons were trained, and 200 hydrocele surgeries were completed across four surgical blocks within the health system. Niger's MMDP activities were paused in April, due to COVID-19 restrictions, but are now scheduled to re-start in October 2020.

Dr Louise Kelly-Hope, Senior Technical Adviser to the Ascend programme and a member of the Technical Consultative Committee, published several impactful papers on LF MMDP through enhancing self-care protocols for lymphoedema management (Douglass et al. J Clin Med) and highlighting the profound negative impact of hydrocoele on men across many aspects of their lives and how access to surgery may transform their physical, social, mental and economic well-being (Betts et al. PLoS NTD).

Leaving no one behind

Achieving effective distribution of treatments in a mass drug administration campaign depends on community drug distributors (CDDs) who are often unpaid volunteers. In DRC, the training provided to CDDs has been adapted to include content on avoiding stigma and discrimination and the Ministry of Health have developed a 'Leave No One Behind (LNOB)' strategy to inform the ways in which LNOB principles can be incorporated within the national NTD programme.

Prison bars are no barriers for MDA treatment

The DRC national NTD programme, supported by CNTD-Ascend, took the initiative to break down the barriers previously excluding people from MDA treatments, and delivered drugs to prisoners from the largest prison in the Kasai Central Province (Centrale de Kananga prison). Over a thousand prisoners, consisting of men, women and children, received drugs. Many of whom, it was the first-time they had received treatment. Treatments were welcomed with open hands, and prisoners were extremely grateful for not being left behind.

LSTM DRC team and MoH colleagues distributing NTD treatments within Kananga prison

Impact of COVID-19 on national NTD programmes

In Ascend's first year of implementation, over 109 million treatments were given across hundreds of implementation units in seven countries. In April 2020, WHO called on endemic countries to suspend their NTD activities to concentrate their efforts on responding to the COVID-19 crisis. Following a period of adapting programme approaches to meet the challenges of COVID-19, Ascend supported countries are now gradually moving into resuming their NTD programmes, within carefully planned risk mitigation strategies. DRC has successfully resumed its delayed second stage of mass drug treatment in Tshopo and Nord Ubangi which will complete the country's annual treatment campaign.

One of the original members of the LF Support Centre, Joan Fahy, retired this year after 45 years of service to LSTM. She had a surprise remote 'teams' farewell from many NTD colleagues and friends, including Dr Mwele Malecela, Director of the Department for the Control of NTDs at WHO and LSTM alumni, students and colleagues. Joan Fahy will continue to support the secretariat for Global Alliance for the Elimination of LF (GAELF).

Retirement of Joan Fahy

COU**NTD**OWN

In 2019, the COU**NTD**OWN programme was extended by FCDO for a further two years and in its penultimate year has been applying particular focus to the patient-centred approach, including participatory methods, wellbeing, community based NTD case detection and addressing inequities. COU**NTD**OWN has provided funding to five projects which will generate rapid research on COVID-19 and NTDs in Cameroon, Ghana, Liberia and Nigeria.

COUNTDOWN
Calling time on Neglected Tropical Diseases

This year COU**NTD**OWN has continued to release publications on the detection, treatment and elimination of NTDs, specifically onchocerciasis and schistosomiasis. Other COU**NTD**OWN publications have focused on inequities within NTD programmes, for example 'Neglected Tropical Diseases as a "litmus test" for Universal Health Coverage? (Dean et al. PLoS NTD). Understanding who is left behind in MDA campaigns and why, with lessons from four country contexts, highlighting inequities in programme delivery. A paper by Ozano et al. (PLoS NTD) "A call to action for universal health coverage: Why we need to address gender inequities in the neglected tropical diseases communities" set out five recommendations to address gender inequities, with the aim to 'leave no-one behind'.

COU**NTD**OWN has continued to engage with NTD stakeholders as part of their research, as well as the general public. This year, COU**NTD**OWN took part in a number of activities relating to World NTD Day including a Guardian Roundtable discussion with COU**NTD**OWN's Director Dr Rachael Thomson and NTD awareness walks in Ogun, Nigeria. A World NTD Day webinar was held by the Access and Delivery Partnership (UNDP, COU**NTD**OWN, TDR) on 30th January, and this was based on a discussion paper 'The Gender Dimensions of Neglected Tropical Diseases', co-authored by COU**NTD**OWN researchers.

Arboviruses

November 2019 saw the start of a three-year MRC/BBSRC-funded project, 'Indoor behaviour maps to guide arbovirus vector control', led by Professor Phillip McCall in collaboration with University of Warwick and Fiocruz Brazil, where the aim is to identify preferred house entry and exit routes, resting sites and interior flight paths of the urban arbovirus vector Aedes aegypti. Earlier work in collaboration with vector biologists from Mexico and USA showed how such indoor sites could be crudely targeted using over-the-counter aerosols, enabling households to treat their own homes independently of external agencies and a unique solution to dengue prevention during the COVID-19 pandemic (Dzib-Flores et al. Am J Trop Med Hyg).

The first report on the performance of the 'Barrier Bednet' was published, showing how this innovative design can kill mosquitoes more efficiently than existing nets, in a way that increases the choice of insecticide used, while minimising risk to the person inside the bednet (Murray, et al. Nature Microbiology).

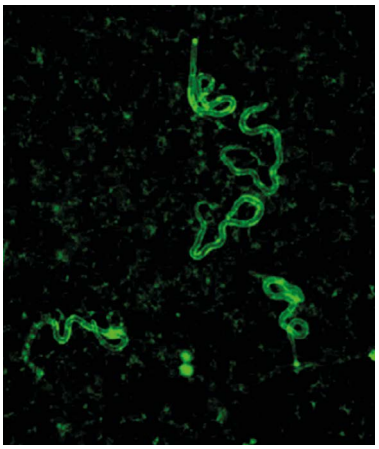
Barrier Bednet

Filariasis

Malawi eliminates LF

The most significant and exciting highlight this year has been the announcement by WHO that Malawi has eliminated lymphatic filariasis as a public health problem. This remarkable milestone was achieved in a partnership between LSTM's CNTD and Malawi's Ministry of Health over the past decade with generous support from UK Aid. It is not often you can report on a country successfully eliminating an NTD and as one of the first countries with a heavy burden of LF to achieve this elimination goal we congratulate Malawi MoH and hope this inspires other LF endemic countries to achieve this goal.

A 'set and forget' sensor for LF



Microfilariae

A CNTD team led by Professor Janet Hemmingway with CNTD Director Professor Mark Taylor, Dr Joe Turner, Dr Mike Coleman and Rinki Debb, in partnership with Prof Andy Shaw's team at Liverpool John Moores University, have been awarded a $1.3 million grant by the Bill & Melinda Gates Foundation to develop an innovative wearable sensor to detect lymphatic filariasis infections in the blood. The current test for parasites requires a night-time blood sample, which is poorly accepted in community settings and requires laboratory infrastructure. The new diagnostic technology uses a microwave electromagnetic wave sensor to detect the unique electromagnetic signature of circulating larval filarial parasites in dermal blood capillaries. The sensor will be engineered so that it can be worn as a skin patch during sleep, with data being download the following day. The goal of this project is to develop a prototype sensor which, if sufficiently validated in laboratory tests, will be trialled on filariasis patients in India.

Loiasis

Closing the loa loop

Deer fly injected with Loa loa

Dr Joe Turner's lab in collaboration with Professor Sam Wanji, University of Buea, Cameroon, have established the complete experimental life cycle of the Loa loa parasite responsible for loiasis (tropical eye worm). The team were successful in producing infectious larvae by trapping, maintaining and experimentally injecting the deer fly vectors (Ndzeshang et al. PLoS NTD). The larvae were then used to successfully establish adult parasite infections in the groups' newly established rodent model of infection, thus completing the life-cycle in the lab (Pionnier, et al. Nature Communication). As the L. loa parasite is difficult to treat safely and is a barrier to river blindness and LF elimination programmes across Central Africa, the group hope the availability of the Loa lab life cycle will facilitate much needed research and development of new therapeutics.

Onchocerciasis and LF

A·WOL drugs enter human trials

The A·WOL programme, led by Professors Mark Taylor and Steve Ward, which is driving the development of new anti-*wolbachia* drugs as curative agents for onchocerciasis and lymphatic filariasis has received further funding from the Global Health Innovative Technology (GHIT) in partnership with the Department of Chemistry of the University of Liverpool (UoL) and Japanese pharmaceutical company Eisai. The £3.25m funding will support a series of Phase I clinical trials, which will assess the safety of the drug AWZ1066S in people. The other candidate macrofilaricide discovered by A·WOL, TylaMac, has now passed phase I testing and will proceed to phase II efficacy trials in Africa in partnership with Abbvie and DNDi.

Schistosomiasis

Research on zoonotic aspects of schistosomiasis in Africa has increased with support from the Wellcome Trust as part of a £ 1.7m Joint Investigator Award to Professor Russell Stothard and Dr Janelisa Musaya. The award will strengthen the laboratory capacity of the NTD group in MLW with a liquid handling robot and real-time PCR machines. These will facilitate large-scale screening for hybrid schistosomes within the Schistosoma haematobium group. Lake Malawi and Shire River are emerging hotspots for several cross-species interactions. In light of the growing importance of Schistosoma bovis in Africa, a 3-year collaborative project of £300K funded by the Royal Academy of Engineering with Dr Gobert, Queen's University Belfast as lead investigator, focusses on developing a lateral-flow antibody detection dipstick for Schistosoma japonicum and Schistosoma bovis in large bovids such as buffalo and cattle. The prototypes

are to be tested in China and Tanzania with the assistance from colleagues from Fudan University and Sokoine University. New developments in better diagnostics for targeted control of schistosomiasis were highlighted by Amoah et al. in Lancet Infectious Diseases. This research was driven by COU**NTD**OWN and colleagues in Cameroon who used remote GPS dataloggers to pin-point and record exposure patterns and times in vulnerable groups currently excluded from mass drug administration. Further efforts to raise the profile of Female Genital Schistosomiasis have led to linkage with Professor Phillips-Howard's and Dr Odiere's menstrual hygiene initiatives in Africa as outlined in the Trends in Parasitology paper "Connecting female genital schistosomiasis and menstrual hygiene management initiatives". New developments in molecular diagnostics for detection of Female Genital Schistosomiasis by genital self-swab sampling methods were published (Sturt et al. PLoS NTDs).

Snakebite

The Centre for Snakebite Research and Interventions (CSRI), in partnership with the University of Bristol and a number of other European institutes, received funding from the EU Horizon 2020 scheme to explore the potential of adenovirus-based 'addomers' as new therapeutics for tackling tropical snakebite. Funding acquired from the NIHR Financial Assurance Fund also enabled CSRI to support its African Snakebite Research Group programme partners in Nigeria and Kenya to achieve Bronze accreditation in Good Financial Grant Practice (GFGP) – the first research accreditations achieved by research units in Africa. The continued research and capacity strengthening growth of the Nigeria, Kenya and eSwatini members of the African Snakebite Research Group is testament to their commitment to snakebite victims but also to their very strong relationships with key Ministry of Health and other governmental and civil society groups – ensuring our research meets, and is informed by, community and national policy needs. CSRI research outputs included a comprehensive data analysis of the preclinical efficacy of snakebite antivenoms available in Africa, and evidence that small molecule drugs may be an effective early intervention for preventing snakebite mortality and morbidity.

Trypanosomiasis

In January, the 'Trypa-NO!' project, funded by the Bill & Melinda Gates Foundation (BMGF), was renewed for a further three years. The project is contributing to the elimination of Gambian sleeping sickness in Chad, Cote d'Ivoire, Guinea and Uganda by combining screening and treatment of human populations with tsetse control. The latter is being achieved through the annual deployment of ~70,000 Tiny Targets across an aggregate area of 7,600 km2 to protect over 1.5 million people (Ndung'u et al. PLoS NTD). A second BMGF-funded project, 'Tryp-Elim', aims to eliminate sleeping sickness in the provinces of Kwilu, Mai-Ndombe and Kwango in the Democratic Republic of the Congo. This project also combines vector control with screening, diagnosis and treatment of cases, and in 2020 ~43,000 Tiny Targets were deployed over an area of ~5,000km2 (Miacka et al. Lancet Neurology). Tsetse control operations managed to continue in all the 'Trypa-NO!' and 'Tryp-Elim' countries despite the constraints caused by the COVID-19 pandemic, testifying to the resilience and strengthened capacity of national control programmes.

Dr Alvaro Acosta-Serrano's team unravelled the mystery of how trypanosomes colonize the tsetse vector. Published in Nature Microbiology, Rose et al. showed that the parasites penetrate the space between the gut wall and peritrophic matrix via the proventriculus where the matrix is formed. This colonization is promoted by factors in parasitised blood causing higher levels of infection in the salivary glands, which potentially increases parasite transmission.

Mainstreaming Disability, Mental Health, Equity and Rights within NTD Programmes and Health Systems

The mainstreaming of disability, mental health, equity and rights within Neglected Tropical Disease programmes and health systems continues to expand. The work spans the continuum of care from disease prevention to disease management and prioritises the needs and rights of persons affected by NTDs and their communities using qualitative and participatory approaches. See for more information the Feature article on Health Policy and Health Systems Research elsewhere in this report.

Tiny targets along a river bed in DRC

Department of Tropical Disease Biology

Tropical Disease Biology (TBD) is a leading national and international research and teaching department with a focus on translational research of tropical infectious diseases. Translational research is at the core of the department, with activities in product discovery and development, translation of knowledge into practice and capacity strengthening. Staff therefore operate across the full spectrum of the translational continuum that typically can be classified as T1 – Basic science, T2 - Human evidence-based research, T3 - Research that moves evidence-based guidelines into health practice, and T4 - Research that seeks to move health practice into population health impact.

Professor Giancarlo Biagini
Head of Tropical Disease Biology

Research Philosophy and Research Focus

The department carries out world leading research across all of the major human infections to address unmet Global Health challenges, these include emerging diseases (e.g. Zika, SARS-Cov-2), multi-drug resistant (MDR) bacteria (e.g. MDR M. tuberculosis and WHO-identified priority AMR pathogens), malaria, and neglected tropical diseases (NTDs) such as intestinal nematodes or soil-transmitted helminths, schistosomes, filarial worms and snake bite.

There are three Centres operating within TDB, the Centre for Drugs and Diagnostics (CDD), the Centre for Neglected Tropical Disease (CNTD) and the Centre for Snakebite Research and Interventions (CSRI). They are key vehicles within TDB that move research into developable solutions e.g. drugs, diagnostics, vaccines, enabling technologies, implementation activities and policies.

Leadership

Professor Mark Taylor stepped down as TDB Head of Department to spend more time on his research and in his role as director of CNTD. During the 12 years that Professor Taylor led TDB, the department consistently delivered exceptional research outputs, not only in terms of academic contributions, but importantly in improving the health and well-being of vulnerable populations living in resource-poor settings.

LSTM thanks Professor Taylor for his outstanding contributions and leadership of the department. Professor Giancarlo Biagini was appointed as the new Head of the Department and Dr Emily Adams as the new deputy.

Research Performance

TDB has achieved another outstanding year of research output, with some 200 peer-reviewed publications across the translational T1-T4 continuum, including publication of step-changing studies in leading journals. Key to TDB's success is recognition that collaboration and partnership are essential for innovation, underlined by the department's formal collaborations in over 30 countries.

TDB active grants countries - red represents 1 grant; green represents more than 1 grant

TDB's reputation as a leading research department of international calibre is further evidenced by its ability to secure significant competitive funding – during this reporting period, TDB's active grant funding is in excess of £76 million split over >50 awards from a broad portfolio of funders.

Selected Highlights

TDB is proud to report that Dr Stuart Ainsworth has been awarded a prestigious UKRI-funded Future Leader Fellowship to design next-generation antivenoms for combatting neurotoxic snake envenomings. Dr Stefanie Menzies and

Dr Michael Abouyannis have received grants from the Royal Society of Tropical Medicine and Hygiene to study snakebite diagnostics and the pathophysiology of envenoming, respectively. TDB also wish to congratulate Drs Rachel Clare, Aitor Casas Sanchez and Shivanand Hegde for securing Director Catalyst Fund (DCF) awards to support pump-priming of their respective early stage projects.

The A·WOL programme of Professors Taylor and Ward, is driving the development of new anti-*wolbachia* drugs as curative agents for onchocerciasis and lymphatic filariasis and has received further funding from the Global Health Innovative Technology (GHIT) in partnership with University of Liverpool (UoL) and Japanese pharmaceutical company Eisai. The £3,250,000 funding will support a series of Phase I human clinical trials, which will assess the safety of the drug AWZ1066S in people.

Further work on NTDs led by Dr Turner in collaboration with Professor Wanji of the University of Buea, Cameroon, has established the complete experimental life cycle of the Loa loa parasite responsible for loiasis. The team were successful in producing human infectious larvae that were then used to successfully establish adult parasite infections in the groups' newly established rodent model of infection, thus completing a lab-maintained life cycle. As the parasite is difficult to treat safely and is a barrier to river blindness elimination programmes across Central Africa, the group hopes the Loa lab life cycle facilitates much needed research and development of new therapeutics.

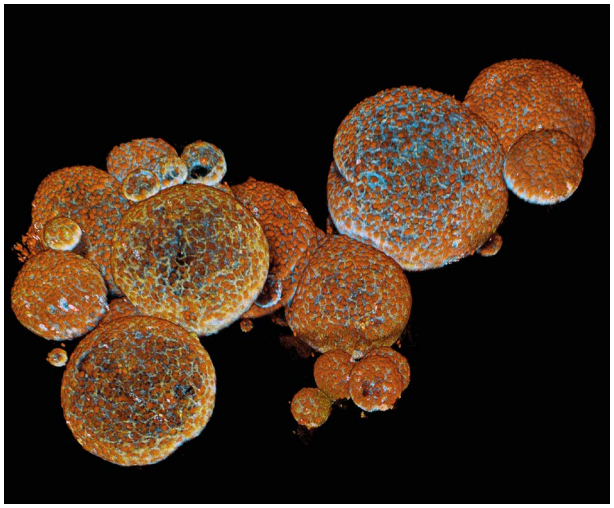
Multidisciplinary studies on schistosomiasis in Malawi headed by Professor Stothard and Dr Musaya (MLW) are continuing to track the unexpected changes in epidemiology of both urogenital and intestinal schistosomiasis in Lake Malawi. Intestinal schistosomiasis, once considered non-endemic in Lake Malawi, is now transitioning from emergence to outbreak. Despite ongoing preventive chemotherapy in 2019-2020 period, the prevalence of both forms of disease has doubled in school children. Following a Wellcome Trust Joint Investigator Award to Profs Stothard and Musaya, the team is set to further study the importance of hybrids schistosomes in endemic communities and associated livestock on the shoreline of Lake Malawi and in the lower Shire River Valley.

COU**NTD**OWN, the UKAID-funded programme (UK Foreign, Commonwealth and Development office, FCDO) of Neglected Tropical Disease (NTD) implementation research received another A+ rating this year in FCDO's annual review and has further supported the planning and adaptation of NTD implementation to make changes to existing practice and enhance programme performance. This year in Nigeria, new stakeholders have inputted into the design and delivery of research, leading to localised funding solutions and new strategies for urban mass drug administration (MDA). In Liberia, the implementation research cycle has continued to pilot intervention solutions to fill programme gaps to enable equitable increases in MDA coverage.

Dr Kelly-Hope received funding from GSK to support operational research in seven countries in Asia and Africa in relation to lymphatic filariasis elimination on three main themes. 1. Quantifying the impact of LF mass drug administration programme and future donor requirements. 2. Developing a framework for LF pre- and post-elimination surveillance strategies. 3. Improving health, quality of life and economic productivity of patients.

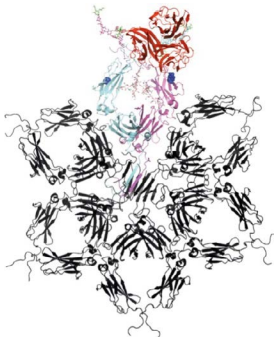
Professors Casewell and Harrison lead LSTM's CSRI, focusing on the development, testing and implementation strategies aimed at mitigating the burden of tropical snakebite. This year the group were involved in developing the first venom gland organoids as a model to culture snake venom toxins in the lab, and they also demonstrated the potential utility of small molecule toxin inhibitors as early, pre-hospital, therapeutics for treating tropical snakebite.

Schistosomiasis research in Lake Malawi - working in water hauling nets



Snake organoids - copyright Princess Maxima Center For Pediatric Oncology

CSRI received major funding from a new EU Horizon 2020 grant to explore the potential of adenovirus-based 'addomers' as new therapeutics for combatting snakebite in Africa, in partnership with collaborators at the University of Bristol and various European institutes. This new research project will run in parallel with CSRI's FCDO-funded 'Scientific Research Partnership for Neglected Tropical Snakebite' (SRPNTS) and NIHR-funded African Snakebite Research Group programmes, which continue to undertake important snakebite therapeutic and public health research.



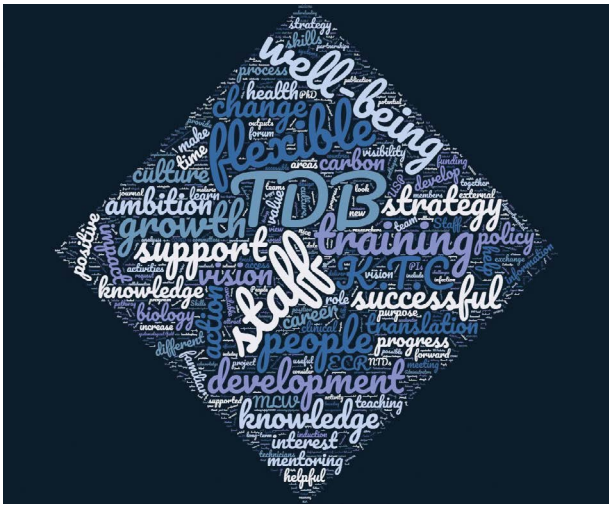
IgG Fc-multimers being developed for use in diagnostics, vaccines and therapeutics

TDB continues with the expansion and innovation of novel antibody platforms. Work led by Professor Pleass has shown that lead compounds can block influenza A and B viruses from binding human receptors required by the virus for infectivity. LSTM also recently assigned one of Prof. Pleass' patents to CSL Behring for the development of IVIG replacement therapies to treat autoimmune disease.

Drs Hastings and Sharma, researching drug- and insecticide-resistance in malaria control, developed and published a protocol and set of recommendations for incorporating the evolution of drug resistance into large-scale computer simulations of malaria transmission. The team used this methodology to investigate how mass drug administration, a common malaria control tool, drives the evolution of resistance. Drs Hastings and Jones used pharmacological simulations of drug clinical trials to optimise methods for detecting the early stages of drug resistance. Drs Hastings, Jones and South investigated insecticide resistance in mosquitoes and how different deployment policies may delay resistance.

Dr Adam Roberts' has published widely this year on mechanisms of resistance from bacteria originating locally, from partner hospitals in the Liverpool area, and from hospitals in LMIC settings including Malawi and Tanzania. Additionally, they have been working on bioinformatic and molecular biology tools to help identify, catalogue and capture mobile genetic elements (discrete segments of DNA that often contain AMR genes) and have set up an AMR:COVID-19 resource hub where they detail many studies looking at the effects of the current pandemic on AMR (https://covid-amr.webnode.co.uk/). The group also contributed to important policy papers on antimicrobial R&D and antimicrobial stewardship; the latter suggesting a set of hallmarks which could make antibiotic policy more efficient and equitable across the world.

In response to the COVID-19 pandemic, TDB has been actively involved with national and international efforts to discover, develop and evaluate diagnostics and with the establishment of a preclinical pipeline to identify, prioritise and validate preclinical candidates for therapeutics suitable for clinical Phase I/Phase II studies. Details can be found within the COVID-19 feature in this report.



TDB Enhancement of Research Culture

As with many academic departments in the UK, LSTM recognises that there is a disparity in the representation of gender, ethnicity and individuals with disabilities, especially at more senior levels. To address this disparity, TDB promotes positive actions for the recruitment, retention and progression of underrepresented groups. The health and well-being of its staff is paramount, and TBD promotes a positive work-life balance and support flexible working arrangements for all. TDB adheres to the San Francisco Declaration on Researcher Assessment, committing to making assessments of research performance based primarily on the quality of the research, judged by peer review. This approach helps to ensure a transparent and fair consideration of research quality, across a broader range of outputs taking into account different career stages. TDB are fully aligned to the Concordat for Research Integrity and have developed an action plan which includes a pro-active approach to standards in the laboratory, research on human subjects and in systematic review-based research.

TDB have pro-actively engaged with the implementation of The Concordat to Support the Career Development of Researchers. As a result, researchers have access to a broad range of training opportunities, internal pump-priming and fellowship awards and there has been integration of early career researcher (ECR) participation within decision-making structures.

FEATURE ARTICLE:

Malaria and other Vector Borne Diseases

LSTM hosts an unparalleled diverse research portfolio in vector borne diseases (VBDs), from mosquito genomics to health economics, and spans the basic science to translational research pathway. While the global burden of malaria has dramatically declined over the past two decades, there is evidence that these gains are stalling, insecticide resistance rising and new tools are urgently needed. The technical expertise, strong collaborations with research partners in disease-endemic countries and ongoing expansion with the next generation of VBD scientists, puts LSTM in a prime position to tackle these issues.

Insecticide Resistance

Detecting resistance mechanisms

The Centre for Research in Infectious Diseases (CRID) led by Wellcome Senior Fellow Professor Charles Wondji, from LSTM's Department of Vector Biology at LSTM, was awarded a $3.7 million grant by the Bill and Melinda Gates Foundation in September 2020. This grant aims at detecting molecular markers of insecticide resistance in malaria vectors.

Malaria-carrying mosquito resting on a bednet due to resistance to insecticide

Professor Wondji's team will develop fast and accurate tools for detecting resistance mechanisms in field-caught mosquitoes. The current method for detecting insecticide resistance in populations of mosquitoes uses labour-intensive bioassays, requiring the collection of hundreds of mosquitoes, rearing in insectaries and testing on several replicates of adult mosquitoes. Consequently, faster and less labour-intensive tools are vital to fully understand the levels of insecticide resistance in mosquito populations and develop ways to help detect and track the spread of resistance.

The work of CRID is focused on fighting infectious diseases in Africa by providing an excellent environment to perform high quality and internationally recognised research in Cameroon and the Central African region, and this award will support its fight against insecticide resistance in mosquitoes with significant support from LSTM.

Since its inception in 2017, CRID has been supported by LSTM with a Research Unit hosted at CRID and several projects obtained collaboratively by both institutions including the GCRF-funded PIIVEC and several Wellcome Fellowships at Training, Intermediate to Senior levels. This BMGF-funded project will strengthen this collaboration and showcase LSTM support to global south partners.

LLINEUP

LSTM's Professor Martin Donnelly co-led research investigating the impact of adding the synergist piperonyl butoxide (PBO) to long lasting insecticidal nets (LLIN) on markers for malaria, as part of the Ugandan national LLIN distribution. The results, published in The Lancet, show that adding PBO reduced malaria parasite prevalence for up to 18 months.

Working with colleagues in London, Uganda and the USA, the team developed a cluster randomised trial - named LLINEUP - the biggest of its kind in the world. Epidemiological and entomological studies were carried out across the clusters, which received either standard nets treated with pyrethroid insecticides or nets additionally treated with PBO, at baseline and at 6, 12 and 18 months after distribution of the nets.

The study covered around 40% of Uganda with 104 clusters being randomly assigned to receive LLINs treated with PBO or conventional LLINs. A subset of households within each cluster were then randomly selected to take part in the studies, looking at the parasite prevalence in children aged between two and 10 years, anaemia and malaria mosquito densities .

MAP-IR

Insecticide resistance, especially pyrethroid resistance in Africa, is a key barrier to effective malaria control. Despite this there has been many unanswered questions on the evolution and spread of resistance, current variation in resistance, and the impact of this resistance on malaria control.

MAP-IR is collaboration between LSTM and Malaria Atlas Project (MAP) that aims to address these questions. Using tools developed by MAP, the MAP-IR project has provided models that account for the heterogeneity in spatial and temporal insecticide resistance data; incorporate covariates to improve predictive accuracy of models and allow investigation of empirical associations; and provide metrics of uncertainty around both predictions and parameter estimates of insecticide resistance.

Malaria control programmes rely on insecticides for vector control which has had a significant impact on the morbidity and mortality of the disease globally. With increasing resistance challenges there is a need for the programmes to develop insecticide resistance management plans. However, there is a paucity of resistance data. MAP-IR were able to demonstrate common spatio-temporal patterns when applying modelling tools to three pyrethroid insecticides as well as DDT. It was also demonstrated that the mutations in the target site of these insecticides, that cause resistance, are a useful partial predictor of resistance.

In order to manage the threat of insecticide resistance to malaria control it is important for control programmes to know where resistance exceeds the WHO thresholds. MAP-IR, using geospatial models and data from Africa showed where thresholds of resistance linked to specific recommended WHO actions are exceeded at the district level. This approach is more accurate than simpler methods and will allow programmes to better target appropriate vector control tools and resources.

In order to produce these models and predictions it was required to generate large data sets on georeferenced Anopheles mosquitos' collections and associated insecticide resistance and mechanisms of resistance.

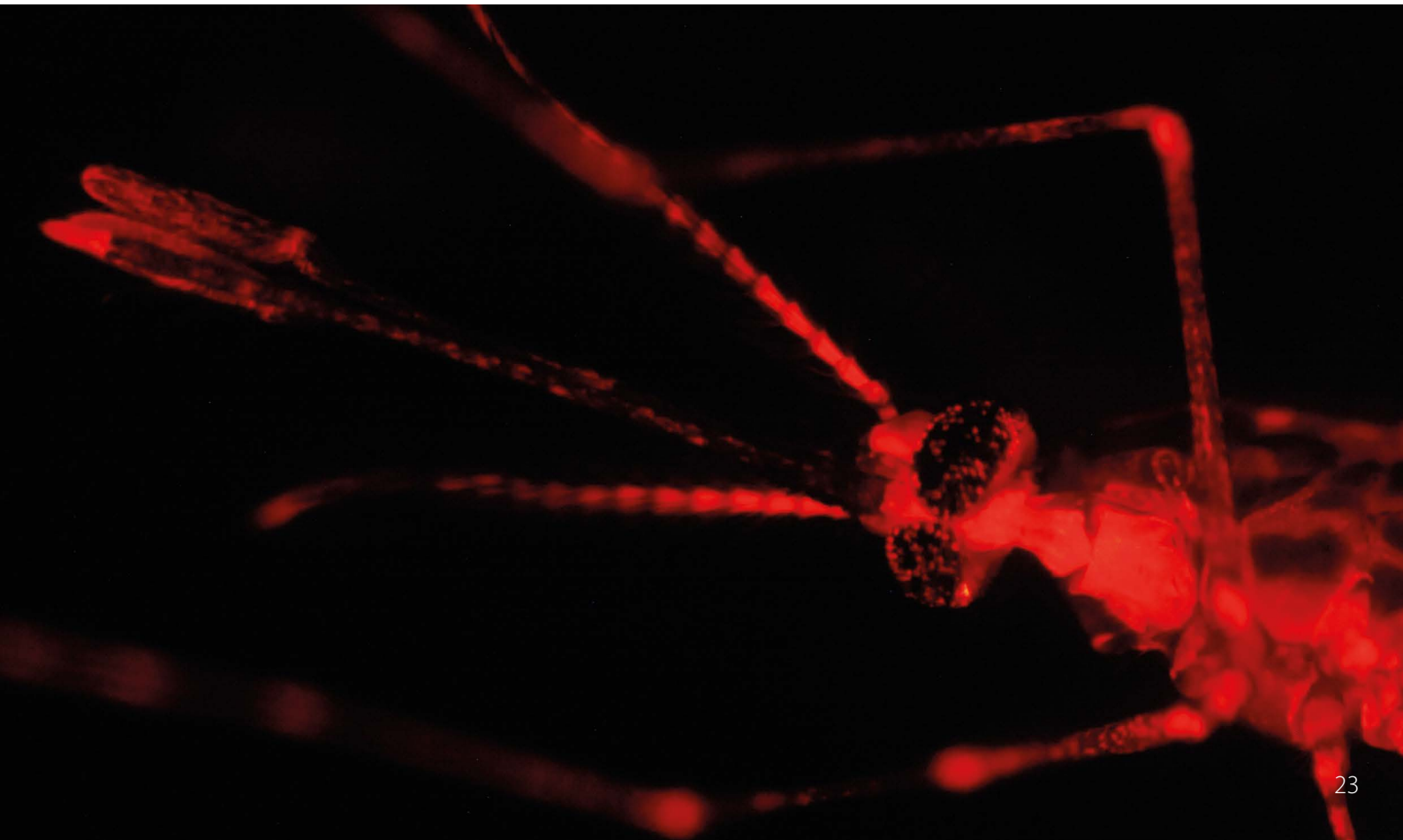
Role of genes in insecticide resistance

LSTM researchers genetically modified malaria carrying mosquitoes in order to demonstrate the role of particular genes in conferring insecticide resistance.

For the first time the team characterised three genes (Cyp6m2, Cyp6p3 and Gste2) most often associated with insecticide resistance directly by their overproduction in genetically modified *Anopheles gambiae*. LSTM's Dr Gareth Lycett, Dr Adriana Adolfi and colleagues generated genetically modified mosquitoes that overproduce specific enzymes that previous work at LSTM had identified as potential candidates in this process of acquiring insecticide resistance. This breakthrough work, as published in PNAS, found that increased production of just these three genes can between them cause the mosquitoes to become resistant to all four classes of public health insecticides currently being used in malaria control.

An LSTM paper published in Nature Biotechnology reported the use of 'gene drive' technology in the human malaria vector *Anopheles gambiae*. LSTM's Dr Tony Nolan, with colleagues from Imperial College London, reported the use of a sex distorter gene drive which has a quicker impact on female mosquito populations than previously developed gene drives targeting female fertility.

Genetically modified Anopheles gambiae female mosquitoes expressing a fluorescent marker were used as tools to identify genes that cause resistance to common insecticides.



Only female insects transmit diseases such as malaria, dengue and Zika; therefore, control methods that skew the sex ratio of insect populations have long been sought. Sex-chromosome drivers are genetic elements that interfere with chromosome segregation during cell division and result in an unbalanced male-to-female ratio among offspring, which can potentially lead to population suppression or extinction. Relatively few sex chromosome drives have been characterized, however the team demonstrated a male-biased sex-distorter gene drive in the human malaria vector *Anopheles gambiae*.

The reported gene drive had a more rapid impact on female mosquito populations than previously developed gene drives targeting female fertility. The team demonstrated that this led to a male-only population in 10 to 14 generations, with population collapse and no selection for resistance supporting its role for malaria vector control.

Role of proteins in insecticide resistance

After studying both *Anopheles gambiae* and *Anopheles coluzzii*, two major malaria vectors in West Africa, LSTM researchers found that a particular family of binding proteins situated in the insect's legs were highly expressed in resistant populations.

Examining the Anopheline mosquitoes, Dr Victoria Ingham and colleagues demonstrated in the Nature journal that the binding protein, SAP2, was found elevated in resistant populations and further elevated following contact with pyrethroids, the insecticide class used on all bed nets. They found that when levels of this protein were reduced, by partial silencing of the gene, susceptibility to pyrethroids were restored; conversely when the protein was expressed at elevated levels, previously susceptible mosquitoes became resistant to pyrethroids.

The increase in insecticide resistance across mosquito populations has led to the introduction of new insecticide treated bed nets containing the synergist piperonyl butoxide (PBO) as well as pyrethroid insecticides. The synergist targets one of the most widespread and previously most potent resistance mechanisms caused by the cytochrome P450s. However, mosquitoes are continually evolving new resistance mechanisms and the discovery of this new resistance mechanism provides an excellent opportunity to identify additional synergists that could be used to restore susceptibility

Urban Spread of *Anopheles Stephensi*

A collaboration of researchers from LSTM and the University of Oxford have mapped the risk posed by an Asian malaria-carrying mosquito that has adapted to urban life and spread to dozens of cities across Africa – estimating that 126 million additional people are now at risk of the disease.

The *Anopheles stephensi*, was revealed to be a new source of infection in Africa after an unusual outbreak in Djibouti City in 2012, which has been followed by severe annual outbreaks since. In a paper published in the journal the Proceedings of the National Academy of Sciences (PNAS), researchers, gauged the risk posed by A. stephensi by collecting data about everywhere it is known to occur to produce maps to places in Africa where the mosquito could also thrive as a population.

Originally dwelling in cities in Asia, it is thought that the A. stephensi spread from Asia to the Arabian Peninsula between 2000 and 2010 moving again to the Horn of Africa, where scientists first discovered it in Djibouti. It has been discovered in Ethiopia and Sudan, where LSTM has received Wellcome funding for a transdisciplinary study into its origins and epidemiological importance.

Looking at known locations and variables such as such as mean temperatures, rainfall and human populations the team modelled where the mosquito could arrive next, reporting that 44 out of 68 African cities with a population of 1 million are potentially suitable habitats for the A. Stephensi. These cities, which include Casablanca, Lagos and Cairo are home to around 126 million people

How Trypanosome Parasites Colonise Tsetse Flies

An LSTM led study, published in Nature Microbiology, showed how the deadly trypanosome parasite colonises tsetse flies. The research, led by Dr Alvaro Acosta-Serrano with colleagues Dr Clair Rose, Dr Aitor Casas-Sánchez and Dr Naomi Dyer, also involved the German University of Würzburg and the University of Liverpool.

These blood-borne trypanosome parasites are transmitted by tsetse flies and cause potentially fatal disease in humans (trypanosomiasis, also known as sleeping sickness) and livestock (Nagana) in sub-Saharan Africa. The key step to trypanosome transmission, following ingestion of the parasite-infected mammalian blood, is the establishment of an infection within the gut of the tsetse fly. The exact location where the parasite "hides" is located between the gut epithelium and the peritrophic matrix (PM). The parasites must multiply within the ES to safely continue through all the development stages before they can migrate to the fly's salivary glands. Only when they colonise the salivary glands can the parasites be released into the fly saliva, ready to be transmitted when the fly takes its next blood meal. The authors decided to investigate an overlooked, but fundamental, biological question: how do the parasites reach the ES in the first place, evade the fly's immune system and impact disease transmission? The team proved that trypanosomes enter the ES by crossing the newly secreted PM in the proventriculus (PV) – a mushroom-shaped organ that continually synthesises the protective PM to surround the incoming blood meal. This route contrasts with previous beliefs adopted more than forty years ago, and this work now fills an important knowledge gap in trypanosome migration processes in tsetse.

Alongside this discovery, the authors also observed that early PV colonisation leads to a greater chance of establishing salivary gland infections. This process is enhanced by factors present in serum from trypanosome-infected mammalian blood. The exact nature of these serum factors is yet to be elucidated; however, understanding these mechanisms could lead to a new tool for disease control.

A close-up of the mouthparts of a female *Anopheles pseudopunctipennis* mosquito, an important vector of malaria in Mexico and several countries in South America.

MOOC

In September LSTM, IVCC and LSHTM's ARCTEC Centre launched a 6-weeks free massive open online course (MOOC) via FutureLearn on the control of vector borne diseases such as malaria, dengue and Zika, to help fight these diseases, which remain as prevalent and dangerous as ever during the current COVID-19 pandemic.

Vector borne diseases account for 17% of all infectious diseases. In recent months, the COVID-19 pandemic has led to the suspension of many national vector control programmes in disease-endemic countries, despite a plea from the World Health Organization (WHO) to government officials discouraging such action. Progress on the control of all vector borne diseases is at great risk and now, more than ever, accurate information and education is needed to ensure vector control is not disrupted.

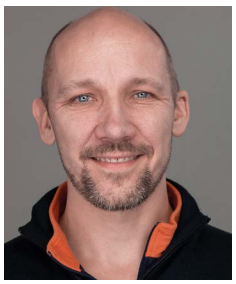
The course allowed participants to explore the wide range of vectors and the diseases they transmit and learn about traditional and modern vector control. It covered state of the art vector control and participants also learned about the suitability of vector control practices in the world today.

Using videos, presentations, articles and discussions, participants heard from a wide range of world-leading experts from around the world, and across disciplines including epidemiology, entomology, vector biology, social science and health systems.

Department of Vector Biology

The third of LSTM's strategic objectives for the years 2017-2023 is to plan for growth. With this aim in mind we have recently recruited six new faculty members to the Department of Vector Biology who diversify our research and teaching portfolio; strengthen the translational impact of our research; and ensure that we have a cohort of research leaders for the coming years.

Professor Martin Donnelly
Head of Vector Biology



Dr Tony Nolan

Dr Tony Nolan is a molecular biologist whose work centres on the development of genetic tools for studying malarial mosquito biology, particularly those aspects that influence the mosquito's capacity to transmit disease. Through 'gene drive' i.e. a genetic modification that biases the inheritance of a particular genetic element, these traits such as those that inhibit parasite production can then be spread rapidly through a wild mosquito population, reducing the spread of malaria.

Dr Nolan joined LSTM from Imperial College, drawn by the opportunity to combine his own skills with leading experts in insecticide resistance. His next venture will be to study how his molecular techniques can be utilised alongside traditional methods of mosquito control. Looking to the future, Dr Nolan has recently been awarded pump priming funds with Charles Wondji to develop genetic tools to modify the genomes of the understudied malaria vector, *Anopheles funestus*. Alongside his research, Dr Nolan has supported efforts to improve literacy in genetic techniques in disease endemic countries by conducting workshops and presentations in Africa-centric events. Closer to home, he is instrumental in developing, with Dr Eva Heinz and Dr Anne Wilson, a new Infectious Disease Control MRes at LSTM that is due to start in October 2022, aimed at enticing those interested in a research career in academia or industry to LSTM to undertake taught courses and a series of research projects.

Dr Michelle Stanton is a spatial epidemiologist studying the spatial patterns of disease risk, focusing on vector-borne diseases in Africa. She collects and curates various sources of environmental data, at the macro- and micro-level: rainfall and temperature data; satellite imagery; vegetation classification; etc. with a view to improving the quality of modelling data that is used to build models of disease transmission and to identify areas where transmission risk is highest. By stratifying disease risk it will be possible to target interventions to maximise impact, especially important where healthcare and vector control resources are scarce. To improve the resolution of these spatial data Dr Stanton has led efforts to build capacity in Africa for working with drones for image capture.

Dr Michelle Stanton

The resolution afforded by these low flying cameras, for example allows a much finer mapping of tiny, yet potentially significant, mosquito breeding sites. She has been involved in setting up these drone programmes in parts of Malawi and taught on a 3 month training course and flying school – a 'Top Gun', if you like - to recruit new drone flyers from the local region that also included how to capture, store and analyse data. Dr Stanton is currently developing interactive dashboards that both facilitate reliable data entry and portray the results in a format that is user-friendly and intuitive to a wide range of stakeholders.

Dr Anne Wilson

Following training at the London School of Hygiene and Tropical Medicine and Durham University, Dr Anne Wilson joined the LSTM career track programme in October 2019. She is an infectious disease epidemiologist specialising in vector-borne diseases such as malaria and dengue. Dr Wilson's research interests are in evidence generation, advocacy and policy to support the use of a broader range of vector control tools including approaches from outside the health sector including larval source management, improving water supplies and waste management, and improvements to the built environment.

She is co-director of a recently awarded Wellcome-Trust Collaborative Award. The project aims to understand the spread, epidemiological significance and control of an

invasive malaria mosquito called *Anopheles stephensi* in the Horn of Africa. Dr Wilson also has ongoing research projects in Cameroon on Aedes-transmitted diseases and in The Gambia on novel housing improvements to reduce malaria transmission. Her research is highly inter-disciplinary and she collaborates closely with social scientists, mathematical modellers, entomologists and policymakers.

Dr Eve Worrall

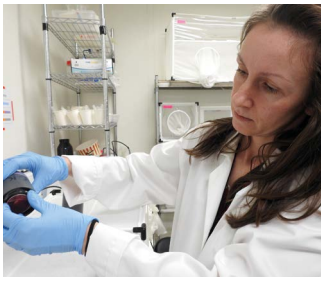
Following a PhD and post-doc positions at LSTM, Dr Eve Worrall had a career in International Health Consultancy and Research Programme Management before transitioning back into academia over the past five years.
Dr Worrall is a Health Economist with a specific interest in conducting economic evaluations and policy analyses. Her focus is on malaria, TB, and the Neglected Tropical Diseases (NTD) in Africa. She has conducted economic evaluations on a range of malaria control interventions including indoor residual spraying, larval source management, housing improvement interventions and insecticide treated nets.

Working closely with colleagues from COU**NTD**OWN, Dr Worrall is involved in supporting evaluations of health systems strengthening initiatives to improve equity and coverage outcomes for NTD programmes. She is also part of the team conducting cost-effectiveness and cost-utility analysis of a new treatment for multi-drug resistant TB. Understanding equity and community or patient costs are central to her work and she is developing a new interest in the neglected role of gender in economic evaluations. For example her recent work on a trial of a new house improvement to prevent malaria revealed that the community costs were predominantly borne by women. Dr Worrall's research interests neatly intersect with her role as Chair of LSTM's Athena Swan self-assessment team.

Dr Eva Heinz

Dr Eva Heinz joined LSTM, as a lecturer in disease genomics, from the Wellcome Sanger Institute at the start of 2019. The initial appeal of the career track at LSTM was the opportunity to pursue interdisciplinary research on antimicrobial resistance. She has already begun to implement this, with funding from Wellcome and Bill and Melinda Gates Foundation, in collaboration with Alejandra Corso (National Institute of Infectious Diseases, Argentina), Professor Nick Thomson (Sanger, LSHTM) and Professor Nick Feasey (LSTM's Dept. Clinical Sciences, based at MLW, Malawi). This funding will enable assessment of long-term population changes of Klebsiella pneumoniae across three very different contexts with respect to resistance: i) UK; ii) Argentina; and iii) Malawi. The project primarily involves genomics but includes working closely with clinicians and epidemiologists. The long-term goal for this area of research is to understand why some bacterial lineages are highly successful and to find a way to be able to target the mechanisms underlying success as a means of control.

While mosquitoes are clearly very different to bacteria, a second motivation for Dr Heinz's move to LSTM was early conversations with members of the Department about the evolution of insecticide resistance in vectors of malaria. Her experience and interests presented a unique opportunity to strengthen links across departments. Dr Heinz therefore holds a joint position between the Department of Clinical Sciences and the Department of Vector Biology. Within Vector Biology, she has recently secured funding from BBSRC and NSF for a five year project, in collaboration with Dr Grant Hughes of the Department and Dr Kerri Coon (University of Wisconsin-Madison), to better understand coadaptation of hosts and their gut bacteria, including what mediates colonization and the formation of stable communities. They will use Aedes aegypti as a study system, motivated by the opportunity in the long-term to apply the findings to novel vector control tools involving bacteria.



Dr Jennifer Lord

Dr Jennifer Lord has been part of the Vector Department since 2015 and was awarded the first Janet Hemingway Fellowship in 2019, enabling her to establish her own team as independent PI. Dr Lord says that the decision to apply for the fellowship was driven by the friendly and collaborative structure within the Department, and the opportunity to expand research in arbovirus transmission and control. She has a strong background in combining empirical studies with mathematical modelling and her team will aim to expand quantitative research in the department.

Whilst Dr Lord will continue working on the ecology and control of tsetse and trypanosomiasis in collaboration with Professor Steve Torr and colleagues, the main focus of her growing portfolio will be to combine her background in entomology with the transmission modelling skills she built during her postdoctoral studies, and apply them to a range of arboviral diseases. Her main project, in collaboration with Shafiul Alam (icddr,b), is to better understand Japanese encephalitis virus (JEV) transmission in Bangladesh, where no country-wide vaccination strategy is implemented, and the virus occurrence highly underreported, especially in rural areas. Dr Lord wants to better understand the transmission between different host reservoirs, and how livestock production and land use change may potentially drive geographic expansion of the virus including to Africa, where a first report of JEV in a human has been published. The question of anthropogenic modification of the landscape is a key part of her growing research portfolio, which is planned to expand towards other main arboviruses such as dengue and chikungunya. More recent work on the mathematical modelling front is also earmarked for expansion, in particular with respect to virus evolutionary dynamics, and to better understand the different fitness costs and evolutionary pressure when viruses cycle between host and vector, and how they can adapt to new mosquito hosts.

FEATURE ARTICLE:

Resistance Research and Management

Whilst things have changed beyond recognition around the globe due to the SARS-CoV-2 pandemic LSTM researchers continued to work relentlessly on another ongoing pandemic which is always in the background; antimicrobial resistance or AMR. Sometimes referred to as the silent tsunami; antimicrobial resistance will continue to compromise our ability to treat infectious disease long after we have learnt and adapted to live with COVID-19.

Additionally, the response to the pandemic may alter the antimicrobial landscape that bacteria find themselves in and therefore may affect resistance at local, national and, when global travel resumes, at international scales.

COVID-19 and AMR

The effect of COVID-19 on AMR may be surprising as COVID-19 is a viral disease and therefore should not be treated with antibiotics. However, even though many more antibiotics have been used in certain contexts e.g. azithromycin in hospitals and other antibiotics for secondary bacterial infections in COVID-19 patients, health seeking behaviour has fundamentally changed. For example the first lockdown in spring 2020 saw a huge decrease in visits to the GP, an increase in telephone GP consultations and subsequent differences in prescribing.

While the numbers of people with COVID-19 continue to increase globally there is more appreciation of the role of secondary infections, the use of antibiotics during COVID-19 patient treatment and the consequences of this for antimicrobial resistance. More information on the relationship between COVID-19 and AMR has been compiled by LSTM's Issra Bulgasim and Ellie Allman and can be found on a specific launched website: https://covid-amr.webnode.co.uk/.

How this will affect antibiotic usage and subsequent resistance will take time to manifest but it needs careful monitoring in order to spot any emerging threats, and intervene, before they become problematic in hospitals.

In order to do this, robust surveillance systems are needed. LSTM's Professor Nick Feasey who is a member of The Surveillance and Epidemiology of Drug-resistant Infections Consortium (SEDRIC); a global think-tank has contributed to a piece of work exploring exactly this. Published in The International Journal of Infectious Disease in June 2020, the work highlights that clinicians in Low and Middle Income Countries (LMICs) often do not feel confident to treat antimicrobial resistant infections, lack local antimicrobial susceptibility data and that current guidance for infection prevention and control is not well adapted to low resource settings.

There are however interventions that can have rapid and positive results. A study published in Clinical Infectious Disease in February 2020 and led by LSTMs Dr Rebecca Lester demonstrates a sustained reduction in third-generation cephalosporins (an antibiotic often prescribed for adult inpatients) following the introduction of an antimicrobial stewardship programme in a large hospital in Malawi. Mr Edwin Panford-Quainoo a pharmacist and LSTM PhD student, under the supervision of Dr Martha Chinouya and Dr Adam Roberts, who has been involved in the Commonwealth Partnership for Antimicrobial Stewardship (CwPAMS), and recently gained the Chief Pharmaceutical Officer Global Health Fellowship, published a study in the Journal Antibiotics. They showed that the development and implementation of a smartphone/mobile app for antimicrobial prescribing guidelines (the Commonwealth Partnerships for Antimicrobial Stewardship-CwPAMS App) in Ghana, Tanzania, Uganda and Zambia was positively received by healthcare professionals and is likely to improve prescription practices and another, in the same journal showing that delayed prescriptions are able to bring down the amount of antibiotics used without patient harm.

These interventions are important not only at local levels, where they are more easily implemented and evaluated, but also make a difference at national and international levels if they are comparable and linked up in a logical manner.

To this end LSTM's Dr Adam Roberts participated in a study published in BMJ Global Health in September 2020 where a group of experts proposed a set of multidisciplinary hallmarks for "structural, equitable and tracked" antibiotic policy which can be considered in order to aid the design and evaluation of international antibiotic policies with maximal benefit at both local and international scales.

To inform stewardship and antibiotic policy there is the need to understand the prevalence and types of antibiotics used in human and animal populations. LSTM's Dr Eleanor MacPherson was part of a team that published an article in Global Health Action last year on the 'Drug Bag' method to study antibiotic use (ABU) in households and on farms, which involves using physical samples of all the antibiotics available within a given study site. This innovative Drug Bag method can produce accurate antibiotic use data as well as provide a talking point for participants to discuss antibiotic experiences and is currently being used in Malawi and Uganda for the MRC funded and LSTM led "DRUM" project.

But what of the underlying microbiology of the resistant bacteria themselves? This year has seen a plethora of data published on the microbiology, molecular biology and genomics of resistant pathogens ranging from the work of LSTM's Dr Eva Heinz on global Klebsiella pneumoniae populations and Acinetobacter baumannii isolates from Thailand to the underlying causes of bacteraemia in Tanzania by visiting researcher Dr Sabrina Moyo and the emergence of carbapenemase-producing pathogens in Malawi by Dr Rebecca Lester and Professor Nick Feasey. Closer to home pathogens isolated from the Liverpool region have been analysed. A study recently reported in the journal Nature Communications, led by Dr Alasdair Hubbard and Dr Tom Edwards, spotted a novel resistance mechanism in the bacterium Escherichia coli from a patient at a Liverpool hospital. Also, published in the journal Genes, a study led by Dr Elissavet Nikolaou reported on antimicrobial resistance genes in locally circulating strains of Streptococcus pneumoniae isolated from volunteers enrolled in the rapidly expanding experimental human pneumococcal colonisation (EHPC) research program at LSTM.

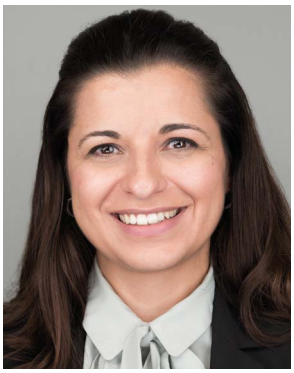
Looking forward into 2021; in addition to the multiple ongoing projects currently underway, researchers at LSTM have also been fortunate enough to win funding from various sources e.g. The Wellcome has funded Dr Eleanor MacPherson for a Public Engagement project; "Dialogues to Improve Public Engagement on AMR" and LSTM's ongoing translational work in the AMR space has been boosted recently with the awarding of two large grants from UKRI Strength in Places Fund (>£18 million) and the European Regional Development Fund (>£3 million), both led by Professor Janet Hemingway, which will catalyse the development of technology platforms and industry interactions over the next 5 years and will help bring new antimicrobials and technology to market earlier in order to counteract the emergence of AMR in the UK and internationally.

As the activity in the multiple disciplines which impact AMR increases, LSTM is well set to respond to changes in the AMR landscape, and to explore social and technological solutions and interventions on a global scale.

Agar lettering (drug resistant infection) with environmental bacteria and fungi growing on the surface

Department of Clinical Sciences

Almost a year into the COVID-19 pandemic and the effects on health, social structures and global economics are predominant in research planning and delivery. The Department is directly involved in research to both reduce the direct as well as indirect impact of the virus, and to maintain effective services despite the health system disruption. Continued excellence in the Department's global health research is complemented by an expanding portfolio of UK-based research.



Professor Daniela Ferreira
Head of Clinical Sciences

COVID-19 Response

Vaccine testing

The Oxford Phase 3 ChAd-Ox COVID vaccine study, which was the first UK Clinical Trial of and Investigational Medicinal Products (CTIMP) study at LSTM, commenced in May 2010 by the Respiratory Infection and Vaccine Group led by Professor Daniela Ferreira. In an unprecedented effort during the peak of the pandemic, a huge team led by Dr Andrea Collins, Dr Helen Hill and Sr Angie Hyder-Wright, was delighted to be the first site in the UK to recruit to time and target for this study. The team received over 3,000 applicants online and were able to screen 2,000 participants, consent 865 and vaccinate 608 participants in an extraordinary timeframe of 4 weeks. The cohort was then expanded to 900 participants including adults aged over 70s. The study was conducted efficiently and effectively due to the efforts and voluntary help of so many. The last booster vaccines occurred in November 2020. The >900 participants will be followed up for 1 year at sites across the North West – equating to over 7,000 visits in total - including 7 hospital trusts and 6 primary care sites.

Expansion of the Accelerator Research Clinic (ARC)

The research clinic located at the Liverpool Life Sciences Accelerator (LLSA) building, initially opened as a 5 bed in 2017 following a charitable donation from Unilever. It expanded to 10 beds in January following increased industry engagement for respiratory vaccine studies and has now expanded into 18 beds and it is one of the largest non-NHS research facilities in the UK.

The ARC team

Preparing for the vaccine trial

The expanded capacity, in collaboration with Liverpool University Hospital Foundation Trust (LUHFT) and Clinical Research Network North West Coast (CRN NWC), will facilitate further Phase II/III COVID vaccine trials. The clinic can also support clinical studies throughout LSTM. The Director is Dr Andrea Collins, Senior Clinical Lecturer, Respiratory Consultant LUHFT and CLRN NWC Specialty Respiratory Group co-lead and managed by Sister Angela Hyder-Wright, Senior CLRN NWC Research Nurse.

Health care workers

The SAFER Liverpool (SARS-CoV-2 Acquisition in Frontline Health Care Workers – Evaluation to Inform Response) study commenced in March 2020. Led by Dr Naomi Walker and Dr Helen Hill enrolled frontline Healthcare workers at Royal Liverpool University Hospital for 3 months during the first wave of COVID-19. Participants performed twice weekly nose/throat self-sampling, provided weekly saliva samples and attended for serological testing monthly. In collaboration with LUHFT and University College London/University College London Hospitals NHS Foundation Trust (SAFER London) the study aims to understand nosocomial risk to healthcare workers, specifically determining prevalence of asymptomatic, in addition to symptomatic infection, and association with possible hospital exposures. In addition, laboratory analyses will investigate the role of pneumococcal infection and host immune responses in infection risk (collaboration with Pfizer).

Volunteers

The Respiratory Infection and Vaccine team is hugely grateful to all participants for their encouraging feedback and continued involvement in all COVID studies in Liverpool. Thank you!

Dr Tom Fletcher was seconded to HQ WHO in January as part the COVID-19 Taskforce and led a WHO research team to South Korea in March. Since then Professor David Lalloo, Dr Fletcher and Dr Emily Adams have been an integral part of the AGILE COVID-19 clinical trial platform, which is a proof-of-confidence engine for novel therapeutics. Trials are underway in Liverpool and planned with partners in South Africa and Uganda.

Advocacy

Professor Paul Garner's personal experience of COVID-19 and the impact of protracted recovery ('Long COVID') were reported in 3 BMJ Opinion articles and was covered by multiple national and international media outlets leading to calls for improved guidelines and policies.

Maintaining functioning systems, and protecting the most vulnerable

Building and training for excellence in clinical practice and research

Adults admitted to hospital with critical illness are vulnerable and at high risk of morbidity and mortality, especially in sub-Saharan African settings where resources are limited. As life expectancy increases, patient demographics and healthcare needs are increasingly complex and requite integrated approaches. In Malawi, a multidisciplinary team of managers, patients, clinicians and nurses have established a new high dependency unit within Queen Elizabeth Central Hospital, the referral hospital for over 7 million people within the country's Southern region. This nine-bed unit will be the nidus for training, exemplary clinical practice and bespoke facility for research in acute medicine.

High dependency unit at Queen Elizabeth Central Hospital, Blantyre, Malawi

Underpinning high quality clinical trial evidence

The renaming of the Global Health Trials Unit (GHTU) reflects the expanding portfolio of global health research and a reach that extends well beyond typical clinical trial settings. The Unit has worked closely with partners to mitigate against the effects of COVID-19 disruption, especially in trials which are already underway. Quickly adapting working practices to maintain both safety and security has resulted in remote Site Initiation Visits, such as the BabyGel trial in Uganda and data management.

Additionally, seven newly funded projects include direct COVID-19 studies, including the Mologic diagnostic studies. GHTU are part of the national AGILE platform consortium, led by the University of Liverpool in collaboration with LSTM's Dr Tom Fletcher and Professor David Lalloo, and continue to support the MAL-COV Study examining the effects of COVID with malaria in Kenya and Burkina Faso.

The growing portfolio is reflected in expanding GHTU teams, including two new Data Managers, and a Trial Manager. A new leadership team of Professors Mortimer and Ter Kuile have been joined by Professor Lesosky, who will work part time, alongside her other role at the University of Cape Town.

Recognition of Excellence

Dr Kondwani Jambo and Dr Eleanor Ochodo received prestigious MRC/DFiD African Research Leader Awards. Dr Jambo will investigate the nasal immunity to pneumococcus to contribute to the development of new vaccines or vaccination strategies to maximise the health benefits of pneumococcal disease control in low-income countries, particularly HIV-infected adults.

Dr Ochodo will develop an integrative approach that optimises translation of evidence into policy through evidence synthesis and national adaptation of global guidelines using HIV, TB and malaria as examples and build capacity to conduct and use evidence synthesis in formal policy making processes.

The NIHR-funded African Research Collaboration in Sepsis (ARCS), co-led by Dr Jamie Rylance and Dr Shevin Jacob, was recognized by the Global Sepsis Alliance with a 2020 Global Sepsis Award for its contributions to sepsis research and capacity building in sub-Saharan Africa. ARCS was awarded a costed extension until March 2022 that will enable it to expand its work evaluating epidemiology of sepsis and co-morbidities, long-term outcomes, host response and an app-based quality improvement platform.

Child Health

In partnership with the Kenya Medical Research Institute (KEMRI), recruitment of newborns to the PRObiotics and SYNbiotics in infants in Kenya (PROSYNK) study in Homa Bay, Kenya, started in November 2020. Likewise, the GCRF Action Against Stunting Hub study is due to start recruitment allowing to assess the role that gut health plays in child development in Senegal, India and Indonesia.

Adolescent Health

In collaboration with the Kenya Medical Research Institute, Professor Phillips-Howard's team is completing the trial among adolescent schoolgirls in western Kenya, examining the impact of cash transfers and menstrual cups on incident HIV, HSV-2, school attrition, and sexual and reproductive health. Trial activities have resumed following COVID-19 closures. Further research on the health needs and solutions for out-of-school girls has been initiated. A study on period poverty among impoverished women in Liverpool has been completed with partners, identifying challenges in accessing supplies and facilities, and how these can be resolved. Identifying research priorities for menstrual health and hygiene and defining measures for global use are underway in collaboration with international partners.

Malaria Epidemiology Unit in Kenya

The malaria epidemiology team, led by Professor Feiko ter Kuile, continues its collaboration with the Kenya Medical Research Institute (KEMRI) and the US Centers for Disease Control and Prevention (CDC) in western Kenya, where they conduct research on malaria in pregnancy, innovative studies to track transmission intensity involving pregnant women in addition to transmission reduction studies. Four PhD students are enrolled as part of these studies.

READ-It

The READ-It consortium has gone from strength to strength moving into its second operational year. Led by Professor Paul Garner it has new partners with the TB Union in India and the British Nepal Medical Trust working on national priorities for reviews in their countries. The Cochrane Infectious Diseases Group pivoted to COVID-19 and is the editorial base for living reviews in COVID-19 diagnostics.

FEATURE ARTICLE:
Lung Health and TB

LSTM's lung health and tuberculosis (TB) research takes an holistic, person centred perspective, recognising that men, women and children experience a heavy burden of lung disease which manifests with a range of symptoms.

The causes of these problems are complex, very often rooted in poverty, and include infections such as Mycobacterium tuberculosis and Streptococcus pneumonia, and non-communicable conditions such as asthma and chronic obstructive pulmonary disease.

The solutions require multi-disciplinary collaborations aimed at both prevention and management of the full spectrum of communicable and non-communicable lung conditions.

COVID-19 and Lung Health

COVID diagnostics and the interplay between virus and pneumococcus

Within LSTM's Respiratory Infection and Vaccine Group, Sr Angie Hyder-Wright recruited over 200 patients suspected of COVID infection into The FASTER study (Facilitating A SARS CoV-2 TEst for Rapid triage). The study is validating new diagnostic tests for COVID in collaboration with LSTM's Centre for Drugs and Diagnostics. Work led by Dr Elena Mitsi is investigating the body's response to COVID-19 for identification of new markers of disease severity. In collaboration with Pfizer the study will also investigate the relationship between coronavirus and pneumococcus, the bacteria that causes pneumonia, within the noses of infected patients.

Lung biomarkers in COVID-19 infection study

Funded by CEIDR-Innovations (now part of the Infection Innovation Consortium- iiCON) and Alder Hey Children's Charity, the Respiratory Clinical Group performed bronchoalveolar lavage to wash out the lungs of 15 people after mild COVID-19 infection and 15 after a more severe infection, which required hospitalisation and oxygen, at around 8-12 weeks post infection. These samples help to understand both the duration of immunity to COVID in the lungs and why some are better protected from severe COVID pneumonia, such as children, while others are less well protected.

STREAM

TB waiting room of a hospital in Ahmedabad, India (pre-COVID)

The final results of the STREAM study's health economic analysis were published in the World Health Organization's (WHO) Bulletin in the spring of 2020.

This first stage of the STREAM study was a randomised controlled trial with seven sites in four countries to assess whether a 9 to 11 month treatment regimen for which cure rates were found to exceed 85% during a pilot programme in Bangladesh was as effective under clinical trial conditions as the longer 20 month regimen recommended by WHO. The results showed that the shorter regimen had non-inferior efficacy and comparable safety to the 20-24 month regimen.

The economic evaluation of the short treatment for multidrug-resistant tuberculosis was conducted by LSTM in Ethiopia and South Africa, in collaboration with the University of Warwick, the Medical Research Council Clinical Trials Unit at University College London (UCL) and the Institute of Tropical Medicine (ITM) in Antwerp, Belgium. It was initiated by The Union and sponsored by Vital Strategies.

Data collected from two sites in Ethiopia and South Africa showed that the shorter 9 to 11 month regimen significantly reduced the cost of treating multidrug resistant tuberculosis for patients and health systems compared to the 20-month regimen. The health system cost reduction per patient was around US$ 1,545 in Ethiopia, a 25% saving and around US$ 1,722 in South Africa, a 21% saving.

The extent to which these savings can be realised, or increased, through programmatic implementation of the 9 to 11 month regimen is dependent on the model of care adopted by national TB programmes. For example, long periods of hospitalisation will increase costs.

The shorter regimen also reduced direct costs to patients, such as transport and food, as it required fewer visits to the health facility during treatment, compared to the 20 month regimen. The reduction was 13 US$ per patient in Ethiopia and 64US$ in South Africa. In Ethiopia, patients on the shorter regimen also reported reduction in expenditure on supplementary food. The cumulative reduction in costs in Ethiopia was about US$ 225 (59%) per patient over the 132-week period of treatment and follow-up. Patients also returned to work earlier on the shorter regimen.

STREAM Stage 1 was funded by The United States Agency for International Development (USAID), with additional support from the UK Department for International Development (DFID), now FCDO.

LIGHT Consortium

Following the funding announcement by UK's Global Health Minister Wendy Morton MP in July, the LIGHT consortium was launched in September. The consortium aims to transform gendered pathways to health for those with tuberculosis in urban, HIV-prevalent settings and to stop the spread of TB.

Global Health Minister Wendy Morton MP (left) with LSTM Director Professor David Lalloo and Professor Charlotte Watts, at the time scientific adviser of DFID

LIGHT aims, ultimately, to leave no-one affected by TB in sub-Saharan Africa behind. The research programme will do this by enabling and supporting global and national policy environments and health systems to improve sustainable, equitable access to quality TB services and medical products, to reduce TB mortality and morbidity among men, women and children. Through its work, LIGHT will generate new evidence, strengthen capacity, strategically engage with key stakeholders and monitor, evaluate and share learning along the way.

There is increasing evidence that global efforts to end the TB and HIV epidemics are undermined by under-diagnosis, under-treatment and under-reporting, especially among men, who contribute to continuing disease transmission, including to women and children. It is essential that transformational ways to end TB are found, by ensuring that TB drugs, diagnostics, and, eventually, vaccines are deployed so that they can have maximum impact.

Led by LSTM, the six-year cross-disciplinary global health research programme includes leading organisations working in global health: the African Institute for Development Policy (AFIDEP), Respiratory Society of Kenya (RESOK) formerly Kenya Association for the Prevention of Tuberculosis and Lung Disease, Makerere University Lung Institute in Uganda, Zankli Research Centre in Nigeria, MLW in Malawi and the London School of Hygiene and Tropical Medicine.

IMPALA

The NIHR Global Health Research Unit on Lung Health & TB in Africa (IMPALA) hosts 8 research Projects in sub-Saharan Africa.

IMPALA is investing strategically in building capacity and capability through 5 PhD studentships for African students, adding value to the existing LSTM-led MRC funded Doctoral Training Programme in Global Health. The 5 PhD students will benefit from a structured training programme offered within supportive environments with established management and governance structures for high quality supervision and mentoring.

The PhD students are (from L to R): Martin Njoroge; Jacqueline Kagima; Irene Ayakaka; Brenda Mugai and Stephen Mulupi)

In Tanzania & Sudan, the joint Health Systems and Applied Social Sciences project team led trainings in management of chronic lung diseases (CLD) and on the use of diagnostic equipment for health workers and community volunteers during the second half of 2020 as part of the intervention implementation phase.

Training in Tanzania provided health workers with up-to-date contextual knowledge of CLDs including standard case definitions, risk factors & risk avoidance strategies, understanding of the IMPALA-developed CLD diagnostic algorithm & clinical management, patient pathways and usage of newly purchased diagnostic equipment (peak-flow meter and spirometer).

Training of community volunteers in Sudan focussed on identification and referral of presumptive CLD patients, treatment, follow-up, health education and patients' rights. The training for health workers included provision of up-to-date standard case management of CLD using locally adapted guidelines set out by The Union. Health workers were also trained on diagnostic tools such as Peak flow meters and on data capturing tools (e.g. patient card, registers, treatment outcomes forms).

Training took place in accordance with local COVID-19 guidance and was supported by the National Institute for Medical Research, Kibong'oto Infectious Diseases Hospital, Education for Health Africa, and Epidemiological Laboratory.

Elsewhere in the IMPALA Consortium, some activities were paused due to the pandemic and some researchers resumed clinical duties. Protocol revisions were made to include additional patient follow-ups to measure the effects of COVID-19 which will play a part in the long-term health of patients with existing lung conditions.

IMPACT TB

Early findings of the IMPACT TB study have been published and policy dialogue and dissemination meetings have been held to ensure evidence is translated to action, findings contextualised with the work of others and aligned with global research progress.

IMPACT TB has highlighted the severe consequences of TB for affected families in Nepal, but also shown that patient-centred care strategies such as active case finding, can dramatically reduce socioeconomic consequences for patients and their families. The findings of these studies coincide with the publication of the first ever TB prevalence survey in Nepal, which has shown that the TB burden in Nepal is 1.5 times the previous WHO estimate- something which is no surprise to those working at the frontline and witnessing the devastating impact of TB on Nepal's communities every day.

In October, the findings from different aspects of the TB REACH and IMPACT TB studies were presented at the largest international TB conference (50th Union World Conference on Lung Health) in multiple formats such as talks, seminars, posters and e-posters. These presentations included mathematical modelling studies, health economics, qualitative and operational research. Results were also presented at the 5th National Summit of Health and Population Scientists in Nepal, the European Congress on Tropical Medicine and International Health, and the TB Modelling Analysis Consortium. Three PhDs are being supported to develop national capacity for research. IMPACT TB continued to work in close integration with the National TB Centre and provide support to the National Strategic Plan for TB. The team in Eastern Nepal have made significant progress with indicators for paediatric TB, private provider engagement and active case finding scale-up through work supported by the Global Fund (principal recipient Save the Children).

The drone project in Pyuthan has been shortlisted for the prestigious AUVSIXCELLENCE Award, a recognition of the achievements of the consortium in establishing a drone transport network for health service delivery in rural Nepal.

Early career researcher and research manager from the Birat Nepal Medical Trust (BNMT), Kritika Dixit, under the supervision of LSTM's Dr Maxine Caws and Dr Tom Wingfield, presented her team's research at the European Congress on Tropical Medicine and International Health (ECTMIH, Liverpool, UK) and The 50th Union World Conference on Lung Health (Hyderabad, India).

She also received a prestigious travel scholarship from the Royal Society of Tropical Medicine and Hygiene. ECTMIH and the Union World Conference on Lung Health had research presentations across the multi-disciplinary areas of epidemiology, infectious diseases, modelling, advanced laboratory tests and digital innovations for global health priorities including social protection, and the latest studies in vaccine development.

Five of Kritika's research abstracts were accepted for oral, poster, and e-poster presentations which showcased her work at BNMT on the barriers and facilitators to TB treatment, social determinants of TB in Nepal, and the role of active case finding in reducing catastrophic costs. Furthermore, she participated in mentorship and career development sessions for early career researchers. A highlight for Kritika was meeting the young survivors of debilitating respiratory conditions at the Union World Conference on Lung Health. The young survivors raised a pledge from the global community to commit to 'Nothing about us without us' and to become more inclusive through community power consolidation to produce coordinated global advocacy.

Malawi

The past academic year saw the culmination of several years of work and two PhDs on post-TB lung disease at MLW in Blantyre, Malawi.

In 2016, Dr Jamilah Meghji set up a cohort of HIV positive and negative adults who had successfully completed TB treatment in urban Blantyre, Malawi as part of her Wellcome funded clinical PhD Fellowship. Early follow up of this cohort demonstrated a significant burden of residual post-TB lung damage in this population and highlighted the impact of this on patients' lives and livelihoods.

In 2018, Rebecca Nightingale took on the management and further follow-up of this cohort as part of her MRC DTP funded PhD Fellowship. Her work has shown that even 3-years after TB treatment completion, a substantial minority of those who successfully complete pulmonary TB treatment are left with chronic respiratory symptoms and abnormal lung function. This work was been supported by several LSTM academics including Professors Squire and Mortimer as well as Dr Jamie Rylance.

Together, these PhD projects make a strong case for health services and national TB programmes to develop strategies to prevent and address post-TB morbidity. There are several ongoing projects in this area at LSTM, including an NIHR funded programme of stakeholder engagement around strategies for post-TB care in Kenya and Malawi, which is led by Dr Meghji, and a collaborative process around guideline development for post-TB care which is led by Rebecca Nightingale and funded by The International Union Against Tuberculosis and Lung Disease.

Department of International Public Health

The Department of International Public Health (DIPH) brings together people from diverse professional backgrounds to support a range of research models from individual fellowships and project grants to large, multi-partner consortia. They focus on health systems research and its use in guiding policy and programming in order to strengthen health systems and improve care.

Professor Shabbar Jaffar
Head of International Public Health

Centre for Sexual Health and HIV AIDS Research (CeSHHAR) in Zimbabwe

Professor Frances Cowan is the Director of CeSHHAR in Zimbabwe. She leads the portfolio of implementation research including large-scale impact evaluations related to sexual and reproductive health and HIV infection. In addition, CeSHHAR runs Zimbabwe's national sex work programme 'Sisters with a Voice'. Work has been slightly delayed by the COVID pandemic. Professor Cowan is also the Zimbabwe and Key Populations lead for the Bill and Melinda Gates Foundation funded MeSH consortium (Measurement and Surveillance of HIV Epidemics). With Dr Sibanda, an awardee of the MRC African Leaders Scheme, she is conducting an evaluation of the Zimbabwe government's national elimination of mother to child transmission programme.

Research Partnership on Prevention and Management of HIV, Diabetes and Hypertension

About 2 million deaths are attributed to diabetes and hypertension in Africa each year and identifying approaches to increase access to health services for these conditions is one of the greatest public health challenges of our time.

In response a research partnership has been set up, funded by NIHR, that act as a catalyst to fund new multi-million pound research studies. Research partners are based in Europe, Tanzania and Uganda and include LSTM, Liverpool John Moores University, University of East Anglia, University of Bergen, University College Dublin, ISGlobal Barcelona, National Institutes of Medical Research Tanzania, MRC/UVRI/LSHTM Uganda Research Unit, The AIDS Support Organisation Uganda and Hindu Mandal Hospital Tanzania.

The partnership conducts rigorous high-quality research studies, designed to inform health policy in chronic diseases control in Africa and engages regularly with senior programme managers and policy makers in Africa, including the Heads of national disease control programmes for HIV-infection and non-communicable diseases. It also works actively with representatives of patients and community leaders in both Tanzania and Uganda, testing out different ways of empowering these stakeholders.

Members of the Ugandan Steering Committee – In Uganda, LSTM partners from the MRC, UVRI and the LSHTM Uganda Research Unit and the Aids Support Organisation (TASO) have been providing preliminary data on the integrated management of HIV infection, diabetes and hypertension to the Ugandan Ministry of Health.

Despite disruption by COVID-19, the partnership has set up large platforms for long-term rigorous clinical and public health research on the integrated management of chronic conditions and on strategies for the prevention of disease. This includes randomised trials with clinical and public health endpoints, the largest of their kind ever done in Africa. Other looks at the underlying burden of chronic conditions in this population, which will feed into further prevention studies.

Centre for Capacity Research (CCR)

This Centre specialises in the science of research capacity strengthening – a process of individual and institutional development leading to higher levels of skills and greater ability to perform useful research. CCR is a global leader in advancing capacity strengthening practice in low- and middle-income countries, through conducting high-quality, implementation focused capacity strengthening research, and by sharing learning and advocating for evidence-informed capacity strengthening practice. Led by Professor Imelda Bates and Dr Justin Pulford, CCR works with funders, external agencies, and in-country institutions to identify any barriers which may be preventing them from functioning effectively.

In a new project working with partners in Ghana and Uganda, CCR will develop quality improvement interventions for blood transfusions in the management of postpartum haemorrhage. This study will identify the health facilities in Ghana and Uganda that offer comprehensive emergency obstetric care and the communities within their catchment area. It will aim to understand the key problems that these health facilities and communities face when it comes to providing care for women with postpartum haemorrhage. Findings from this study will be used to design a future intervention, which will see quality improvement being applied across the health system to strengthen recognition and management of postpartum haemorrhage.

Centre for Global Health Economics

Headed by Professor Louis Niessen, the Centre has newly joined the department and comprises economists, health economists, epidemiologists, operational scientists and mathematicians, and disease modellers. They conduct academic research and training and address economic questions in relation efficiency and equity in prevention, disease control, primary and secondary care, and health systems, mainly in low-resource settings.

Its current portfolio includes HIV prevention and control studies, including primary and community care integration, diabetes and hypertension modelling, snakebite and emergency services and neglected tropical diseases, lung health and tuberculosis, prebiotics and symbiotic in infants, malaria control measures, and anti-microbial resistance and sepsis.

The group also provides postgraduate research training in Health Economics and mentors network of heath economists across sub Saharan Africa through its research programmes.

Emergency Obstetric Care and Quality of Care

Dr Charles Ameh, leads the FCDO maternal health implementation research programme in Kenya, supporting quality improvement interventions in 5 counties. The Kenya programme includes a cluster randomised trial on the effectiveness of pre-service midwifery education interventions. Interventions to support midwifery and obstetric skills retention have been designed and are been evaluated in Nigeria and Zambia with grants from the Resources Foundation and UNFPA.

Global Fund & Allied Programmes Unit

With funding from the Global Fund to Fight AIDS, Tuberculosis and Malaria, the unit works with partners and governments in host countries to deliver an implementation programme for quality improvement of integrated HIV, TB and malaria services in antenatal (ANC) and postnatal care (PNC), with an overall aim of improving maternal and newborn health outcomes. The programme is currently operating in Chad, Kenya, Nigeria, Tanzania and Togo.

Strengthening Midwifery Education and Services in Nepal

Terry Kana, leads this GIZ funded project supporting three midwifery faculties in Nepal to develop the midwifery faculties' academic, teaching and research skills. This support is contributing to the establishment of an autonomous midwifery profession in Nepal.

Members of the NIHR Group on Prevention and Management of Stillbirth in Sub-Saharan Africa

Centre for Childbirth, Women's and Newborn Health (CWNH)

A new research team, previously at the University of Manchester, bringing with them an NIHR Group on Prevention and Management of Stillbirth in Sub-Saharan Africa.

Led by Professor Dame Tina Lavender, the NIHR Group on Prevention and Management of Stillbirth in Sub-Saharan Africa, aims to promote knowledge sharing and capacity building in stillbirth prevention and management in low resource settings. This is done in collaboration with the Lugina Africa Midwives Research Network (LAMRN) a midwifery led research network operating in Kenya, Malawi, Tanzania, Uganda, Zambia, and Zimbabwe. See for more information the Feature on Maternal, Newborn and Child Health in this report.

Centre for Health Systems Strengthening (CHESS)

The department also hosts the Centre for Health Systems Strengthening (CHESS). Itis a multi-disciplinary group using research and teaching to strengthen health systems and to improve health and well-being amongst the poorest and marginalised in low and middle-income countries (LMIC) – see also Feature Article on Health Policy and Health Systems Research for more information.

Health Systems and Workforce Strengthening Unit

The FCDO-funded ReBUILD for Resilience, which started in May, continues the work of the Unit in fragile settings for the next six years. Additional project management expertise has been taken on to support the consortium. ReBUILD started with some rapid research on health systems, human resources and COVID-19 in the fragile settings of Democratic Republic of Congo, Lebanon, Myanmar, Nepal and Sierra Leone. The PERFORM2Scale management strengthening initiative continues to expand in Ghana, Malawi and Uganda and is now operating in 27 districts.

Community Health Systems Group

The group's work focuses on how best to support community health workers (CHWs) in the global push for Universal Health Care. It works with CESHHAR to deliver a community-led learning event, bringing together districts that have led their own community distribution of HIV self-test kits in areas previously hard to reach. In Kenya, the group has a close relationship with LVCT Health, a key partner for over the last 20 years. The 4byFour project has been funded by MRC to develop and pilot Quality Improvement approaches for community health workers in Migori, Kenya.

HIV self test kit

Gender and Social Determinants

COVID-19 has exacerbated inequities in global health and shone the spotlight on the importance of gender and social determinants of health. The GRCR funded ARISE consortium works in partnership with researchers, practitioners and the Federations of Slum/Shack Dwellers and communities in a participatory action research process to understand and address the gendered social determinants and promote health and well-being.

The REDRESS consortium uses action research processes to develop person-centred approaches to addressing severe stigmatising skins diseases in Liberia, with a specific focus on mental health, disability inclusion and gender transformative approaches. Rebuild for Resilience worked across the partnership to establish a Gender, equity and justice working group, strategy and associated research. The COU**NTD**OWN consortium continues to take a strong gender, equity and disability lens and has pivotal in a special issue in PLOS NTDs, which is the first to showcase work on gender, equity, disability and person centred NTDs (with 11 papers). Researchers in the DRUM consortium have used ethnographic approaches to uncover the ways in which multiple social determinants shape antibiotic use in urban and peri-urban Malawi, which are contributing towards identifying structural interventions to tackle antibiotic resistance. Trough IMPALA researchers led qualitative explorations of the gendered socio-economic impact of and health seeking behaviour for Chronic Lung Disease. These have informed the development of community-linked interventions to improve access to healthcare for chronic lung disease in Sudan and Tanzania. In partnership with CCR, a PhD student explored how intersections with other social identities shape gender inequities in scientific research career progression in sub-Saharan Africa and examples of good practices to address these through the DELTAS Learning Research Programme. LSTM also works in partnership with the Tropical Health Education Trust (THET) on the UK partnerships for Health Systems Programme, supporting the gender equality and social inclusion (GESI) components of this programme.

Tackling Deadly Diseases in Africa Project (TDDAP)

TDDAP supports the implementation of international health security procedures in six countries in Africa to reduce the impact of epidemics due to communicable diseases. The countries are Mali, Niger, Chad, Cameroon, Cote d'Ivoire and Uganda. Funded by FCDO, the consortium is led by DAI Global Health and LSTM provides technical advice and assistance to the countries to improve disease surveillance systems and to use data and evidence for decision making at each level of the health care system. At LSTM the METRe Group manages TDDAP with Dr Carmen Camino being the lead technical expert. Professor Janet Hemingway is LSTM's representative to the Consortium's Technical Leadership Group and Professor Joseph Valadez is responsible for project management. Dr Caroline Jeffery provides biostatistical support and Gillian Kyalo is responsible for operations.

Cross-Departmental Research in IMPALA Programme

IMPALA is an LSTM led collaboration of 22 institutions in 14 countries which aims to generate new knowledge and implementable solutions for Lung Health and TB in Africa. The research is being delivered through eight core projects across six thematic areas, Clinical sciences, Health Economics, Social Sciences, Health systems, Evidence uptake and Capacity strengthening. Of these, four are led from within DIPH; the remainder are led from within the Department of Clinical Sciences (DoCS).This makes IMPALA one of the largest inter-departmental collaborations at LSTM. Research design and delivery embeds capacity strengthening for ten early career researchers. Data collection in the programmes is well advanced. Outputs include recommendations for multidisciplinary global health research generated by the capacity strengthening team through the MUDI project.

FEATURE ARTICLE:
HIV

As HIV continues to cause substantial mortality and morbidity across the globe, LSTM has seen an expansion in the extent and scope of HIV-related research. The portfolio now spans studies on HIV prevention to comprehensive, integrated care for people living with HIV to management of late stage HIV infection.

HIV and Chronic Conditions

With partners in Africa and Europe and funding from NIHR, Horizon 2020, and EDCTP, Professor Jaffar and colleagues are evaluating integrated management of HIV-infection, diabetes and hypertension in both the clinic and at the community level. They are also testing biomedical approaches to prevention of diabetes in people living with HIV-infection. These studies involve phase II and III trials, which are underway. The partnership is also conducting cohort studies to understand the distribution of chronic conditions among people living with HIV-infection, which will inform further intervention studies.

Management of Advanced HIV Disease

Professor Jaffar, in partnership with colleagues at St Georges University of London and at Wits University in South Africa, have received new funding to evaluate a new strategy of preventing disease progression in cryptococcal meningitis, a serious opportunistic infection that occurs in the advanced stages of HIV. Professors Lalloo and Jaffar continue to partner colleagues at St Georges University of London, LSHTM and others in a phase 3 trial of Ambisome therapy for cryptococcal meningitis, which will conclude in 2021.

LSTM - CeSHHAR Collaboration on HIV Prevention and Sexual Health Research

The Centre for Sexual Health and HIV/AIDS Research (CeSHHAR) Zimbabwe houses research and programmatic projects on prevention, treatment and care of HIV-infection. T leads the portfolio of implementation research including large-scale impact evaluations related to sexual and reproductive health and HIV infection. LSTM's Dr Mavhu has generated key evidence for scale-up of voluntary medical male circumcision regionally. His focus is now research to inform interventions to promote positive masculinity in relation to health agency.

Professor Cowan is leading a Wellcome Trust Collaborative Award in Science which is supporting a multidisciplinary team to investigate the impact and cost effectiveness of approaches to strengthen differentiated care for sex workers in southern Africa. In addition, she is the Zimbabwe lead for the BMGF funded MeSH (Measurement and Surveillance of HIV Epidemics) Consortium, which aims to improve the measurement and surveillance of HIV in southern Africa to inform prevention and treatment monitoring and track HIV incidence decline. Dr Sibanda, an awardee of the MRC African Leaders Scheme, is evaluating HIV Self Testing models among tertiary education students in Zimbabwe.

Health Goals Malawi

'Health Goals Malawi' was a three-year project led by LSTM, using football to engage adolescent and young males in Malawi aiming to reduce the transmission of HIV and other sexually transmitted diseases.

The project used the appeal of football to attract adolescent boys and young men to events attended by HIV self-test providers. Football games helped to deliver health messages about HIV and to increase knowledge about HIV transmission, prevention, testing and treatment.

Local community leaders and coaches were supported to promote HIV self-testing and to reduce the stigma and fear of testing by normalising the discussion of HIV self-testing, through football coaching and matches. Working in partnership with Liverpool Football Club Foundation, MLW, Population Services International (PSI) and role models, such as Sadio Mané from Liverpool Football Club, the project raised awareness of support services to engage and educate young people – the least likely to access health and education services - about self-testing and treatment plans.

Young people accounted for 30% of new HIV infections in Malawi in 2016 and HIV testing rates amongst adolescents are low, with only 24% of young men and 42% of young women report having tested in the last year. HIV self-testing helps to break down the fear of HIV testing by giving users an opportunity to test themselves at home and in private. This gives users an initial insight into their status before they access services in a clinical setting.

Over 3,300 self-testing kits were distributed through the football sessions, and the percentage of participants reporting recently testing for HIV increased from 53% to 83%, likely to result in the long-term reduction of transmission of HIV and other sexually transmitted infections. In addition, the project has had a broader impact on the role of women and girls in sporting spaces in Malawi, through proactivity including women and girls in the project. This has increased the number of girls taking part in football and has helped change mindsets about the capabilities of women and girls.

Self-Testing Africa (STAR)

Professor Miriam Taegtmeyer and Professor Frances Cowan are key partners in the, UNITAID funded, STAR initiative which aims to stimulate the market for HIV self-test kits through supporting countries in Southern Africa to scale-up self-testing.

UNITAID·PSI
HIV SELF-TESTING AFRICA

LSTM developed and rigorously evaluated innovative test delivery models in Malawi and Zimbabwe that catalysed a supportive regulatory, policy and funding environment both regionally and globally. Seventy-seven countries now have HIV self-testing policies including 23 in Africa.

Availability of HIV self-testing has resulted in rapid scale-up with increased testing coverage particularly among vulnerable, underserved and key populations worldwide. STAR has provided 4,500,000 HIV self-tests across Southern Africa (>2,000,000 for STAR research) and catalysed procurement of another 8,000,000 from major funders. Four manufacturers now have WHO pre-qualified HIV self-test kits available on the world market.

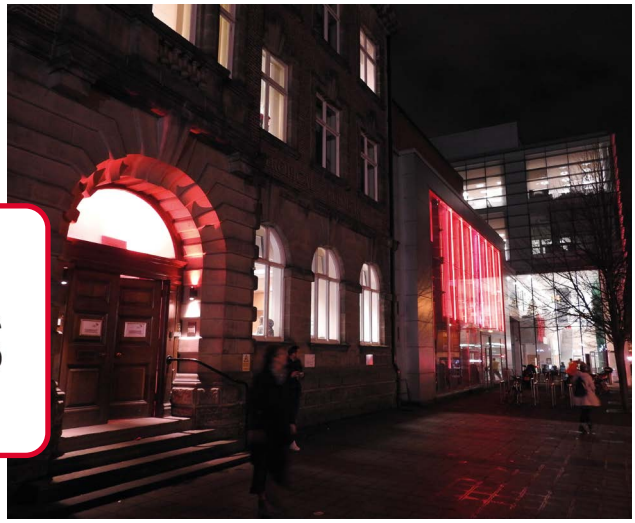
Systematic Review on HIV and Histoplasmosis

In a new systematic review, an author team from the LSTM based Cochrane Infectious Diseases Group explored the evidence regarding managing histoplasmosis in people with HIV. Their review informed the PAHO/WHO guideline development process. The review authors worked with the guideline development group to formulate key questions, including which antifungal drug to start, how long to continue, and when to start antiretroviral medication. They also looked at tuberculosis therapy when people were infected with tuberculosis, HIV, and histoplasmosis.

LSTM is one of the many well-known Liverpool landmarks that light up red around World Aids Day to raise awareness and support those who are living with HIV. It is meant to challenge and remove the stigma that still surrounds HIV and acknowledge the progress around treatment and prevention.

In Liverpool, LSTM participates in the coordination of the HIV Fast Track Cities initiative that brings together local government, civil society and health services. Its aim is to increase the uptake of HIV testing within communities living in Liverpool through a tailored HIV self-testing distribution model.

FAST-TRACK CITIES



LSTM estates light up red in the week of World Aids Day

Partnerships

Malawi Liverpool Wellcome (MLW) Clinical Research Programme

The Malawi Liverpool Wellcome Trust (MLW) celebrates 25 years of partnership in Malawi next year. The Programme has changed medicine and health in Malawi, with enormous impact on malaria, pneumonia, childhood diarrhoea, HIV and TB. MLW has been a close partner of Queen Elizabeth Central Hospital (QECH) and the College of Medicine (COM). COM has grown from 12 to 1200 students, with many of the senior leadership linked to Liverpool, MLW or both. Malawian academics working in MLW have achieved stature marked by African Research Leader awards from both the Medical Research Council and the Royal Society of the UK in 2019.

Malawi-Liverpool-Wellcome Clinical Research Programme

COVID in Malawi

Early in the pandemic WHO and IMF predicted severe COVID impact in Low Income Countries. Malawi typified the expected problems: social conditions that favour epidemic spread including crowded housing, dense population and frequent social mixing for market and other daily business. The public health sector has limited data, limited diagnostics and few interventional options.

In March 2020, the health services had almost no oxygen provision (bottle-based supply in 10 adult beds in the Queen Elizabeth Central Hospital (QECH), the main teaching hospital for southern Malawi) and the most optimistic estimates of Personal Protective Equipment (PPE) provision range were between 1 and 20% of the requirement to staff hospitals and public health responders. Staff morale was low and estimates of expected deaths ranged from 40-80,000. Very significantly, there was a real risk that the medical workforce and the College of Medicine leadership could be decimated owing to high intensity infection and low provision of PPE.

MLW partnered with Queen Elizabeth Central Hospital (QECH) and the District Health Office (DHO) to target the greatest needs – diagnostics, oxygen and Personal Protective Equipment (PPE). In response and to honour the 25 years of MLW partnership, Wellcome (UK) made a £2.1m Extraordinary Provision to support diagnostics, clinical care, oxygen provision and PPE.

MLW and COVID response

Diagnostics

MLW carried out its first COVID diagnostic tests on the 20th of March, becoming the first lab in the country to conduct the test. Since then 16 laboratory staff have been trained, a results portal and automatic reporting service have also been built, fully supportive and integrated with the DHO effort. Most recently, with reduced national need, MLW has stepped back to a support function. The State President of Malawi thanked MLW in his announcement of COVID to the nation in April.

Clinical care

MLW opened the first Respiratory High Dependency Unit in Malawi on 18th March and a cohort of nurses were assembled, trained in PPE provision and the use of oxygen in this setting. In July the ward became a COVID isolation ward and as of September 2020, had admitted 37 patients. With reducing COVID from October, the ward now admits patients with general causes of severe respiratory illness and plans future research in acute care.

From right to left, MLW Professors Henry Mwandumba, Janelisa Musaya and Stephen Gordon

Oxygen concentration plant at Queen Elizabeth Central Hospital, Blantyre, Malawi

MLW partnered with government to install an oxygen concentration plant at QECH – this project has been completed and can deliver over a million litres of oxygen per day. This project will have a legacy of benefit in pneumonia, TB, HIV related lung conditions and chronic lung disease for many years. A maintenance contract is in place for the next 5 years. In the management of emergency tent-based cases, or patients in other centres, the oxygen plant has the potential to fill many 7,000 litre (30kg) bottles per day in addition to supplying the hospital beds.

Personal protective equipment (PPE)

MLW has taken a positive role in obtaining locally sourced and internationally purchased PPE that have been donated to three hospitals (QECH, Zomba Central Hospital, and Chikwawa District Hospital) and the Blantyre District Health Office. MLW has adopted a re-usable gown strategy and have sourced and installed hot wash machines at the QECH. MLS also developed 3D printing methods for face visors using disposable acetates for screens and built patient screening booths and adopted pragmatic protocols to reduce the use of PPE.

Scientific enquiry and purposeful intervention

MLW obtained local approvals and implemented the International Severe Acute Respiratory and Emerging Infection Consortium (ISARIC) protocol for case description and sample collection. Electronic data capture tools have been developed and linked to the central government leadership data collection plans, providing MLW tools as the key instruments. A platform has been developed for determining immune responses to COVID (serology) and followed 500 health care and other workers to determine when their immune responses to COVID are sufficient. This helps to ensure MLW is a leading site in COVID vaccine trials.

Other MLW success in 2020

Construction of building

With the decline of cases of COVID, MLW began to re-adjust and re-start normal operations. This included construction of a building to house an additional research pharmacy, an expanded freezer archive and field workers offices. The new building will ease spacing issues, particularly in the laboratory and allow for smoother expansion of molecular biology and immunology projects.

DFID African research leader award

MLW's Viral Immunology group lead, Dr Kondwani Jambo, received funding for four years to pursue research which is designed to address priority health problems of people in Sub-Saharan Africa under the prestigious Medical Research Council (MRC)/DFID African Research Leader (ARL) Award.

Under this scheme, Dr Jambo aims to contribute to the development of new vaccines to maximise the health benefits of pneumococcal disease control in Low- and Medium-Income Countries, where current vaccines have not had the expected impact. Dr Jambo is the second recipient of this award, the first being Professor Henry Mwandumba.

Policy unit and translational partnership

Impact on national and international health policy and practice is key to the success MLW. As such a Policy Unit has been established through which MLW has a direct role in EVIDENT, the National Evidence Informed Decision Making Network for Health Policy and Practice in Malawi. The EVIDENT vision is to improve the health and economic status of the country by matching the "supply" of knowledge and the "demands" of policy and practice. MLW's Translational Partnership Award has now resulted in 9 awards to six research Groups and 3 external partners. The culture of translation, impact and policy change, together with the remarkable victory in COVID in Malawi, has made 2020 and outstanding year for MLW. This success was formally acknowledged on behalf of Malawi by Professor Nyovani Madise at the LSTM Board of Trustees.

KEMRI/CDC in Kenya

In Kisumu, Kenya, Professor Phillips-Howard and team continue their close collaboration with the Kenya Medical Research Institute (KEMRI) and are completing their randomised controlled trial among ~4000 schoolgirls which evaluates the effects of cash transfer or menstrual cups, or both, to reduce girls' risk of school dropout or of acquiring HIV or HSV2.

Other studies are ongoing, including one with the University of Illinois at Chicago, investigating the effect of menstrual cups on the vaginal microbiome and potential implications for acquisition of STI and HIV among 440 post-pubescent girls. LSTM, KEMRI and the LSHTM completed the evaluation of DREAMS interventions on adolescent girls and young women at risk of HIV acquisition in west Kenya.

Next stage studies planned include following up the trial population to evaluate if intervention effects are sustained into adulthood, to examine the menstrual, mental health, and sexual and reproductive health needs of out-of-school girls, and the burden of abnormal vaginal bleeding across the life-course. The team are also exploring opportunities to expand menstrual health research in the UK context, having completed a formative study on period poverty in Liverpool.

The malaria related studies, led by Professor Feiko ter Kuile, include multicentre trials of malaria chemoprevention in the post-discharge management of children with severe anaemia, which are ongoing in eight hospitals in western Kenya and Uganda and two large chemoprevention trials for the control of malaria and sexually transmitted and reproductive tract infections in pregnancy in Kenya, Malawi and Tanzania. The work was expanded to look at the interaction between COVID-19 and malaria funded by the Bill and Melinda Gates Foundation led by Professor ter Kuile.

KEMRI is also in the fourth of a five-year cooperative agreement with the US 'Centers for Disease Control and Prevention' (CDC) for joint malaria elimination and malaria vaccine studies in western Kenya. The team completed the first trial of high-dose ivermectin, a promising new tool for the control of malaria with exciting results that were published in the Lancet of Infectious Diseases in March 2018. LSTM Professors Donnelly and Torr have increased their collaboration with the entomology group in western Kenya, looking at novel methods for entomological surveillance of malaria vectors and insecticide resistance. On average 6 PhD students are enrolled in these studies.

K4D

The Knowledge, Evidence and Learning for Development Programme (K4D) supports the use of learning and evidence to improve the impact of development policy and programmes.

It is funded by UK aid and is designed to assist UK government departments and partners to be innovative and responsive to rapidly changing and complex development challenges. LSTM is a partner in this consortium led by the Institute of Development Studies (IDS) in Brighton, UK.

The Liverpool-Guangdong Drug Discovery Consortium

The Liverpool-Guangdong Drug Discovery Consortium, in collaboration with University of Liverpool and academic institutes in Guangdong, China, focussed on the development of new drug therapies for the treatment of tuberculosis, malaria, neglected tropical diseases and other infectious diseases.

The collaboration has been extended to include the South China University of Technology (SCUT) and Wuyi University. The group has developed a number of UK/China co-funded initiatives in the critical area of AMR.

MRC Confidence in Concept/Tropical Infectious Disease Consortium

LSTM's Centre for Drugs & Diagnostics (CDD) manages the Medical Research Council (MRC) Confidence in Concept (CiC), which brings together much of the UK's expertise in tropical infectious diseases into a single translational partnership, known as the Tropical Infectious Disease Consortium.

Partners are LSTM, the London School of Hygiene and Tropical Medicine (LSHTM), the Jenner Institute at Oxford University and Public Health England, Microbiology Research Services, Porton Down (PHE), and is strategically placed to deliver an portfolio of domain specific expertise in all the key research areas of interest. In 2020, the Consortium realised £45 million in follow-on funding from CiC investments.

AGILE

With a mission to shorten the time taken to identify safe, effective and affordable treatments for COVID-19, AGILE is a collaboration between the University of Liverpool, LSTM, the University of Southampton Research Unit, and other external partners.

The team includes Infectious Diseases clinicians, clinical and pre-clinical pharmacologists, clinical trials specialists and statisticians, each bringing a unique set of skills and expertise to design the best platform possible.

AGILE will be the key link in the chain of accelerated drug development, evaluating potential candidate treatments for COVID-19 and advancing only the compounds most likely to be effective into large-scale clinical trials.

CeSHHAR Zimbabwe

The Centre for Sexual Health and HIV/AIDS Research Zimbabwe, (CeSHHAR Zimbabwe), houses a number of HIV prevention and sexual health research and programmatic projects.

In addition to undertaking research and implementing programmes, CeSHHAR has a strong commitment to strengthening research capacity among Zimbabwean graduates.

Headed by LSTM's Professor Frances Cowan, CeSHHAR works closely with the Zimbabwe Ministry of Health and Child Care and National AIDS Council to provide evidence for their HIV prevention strategy – with implementation research among rural and key populations, adolescents and men funded y Wellcome Trust, MRC and others. CeSHHAR is the Zimbabwe hub for the BMGF funded MeSH consortium (Measurement and Surveillance of HIV Epidemics).

The Global Alliance to Eliminate Lymphatic Filariasis (GAELF)

LSTM has hosted the GAELF Secretariat since 2004. GAELF supports WHO's Global Programme to Eliminate Lymphatic Filariasis (GPELF) primarily by advocacy and communication.

This year, 3 further countries (Kiribati, Malawi and Yemen) have been certified as eliminating LF as a public health problem with a further 7 in post-MDA surveillance. A total of 17 countries of the 72 endemic countries are now certified as eliminated. 2020 also welcomed the launch of WHO's 2021-2030 Roadmap.

Lancaster University

In 2016, the MRC-funded Translational and Quantitative Skills Doctoral Training Partnership (DTP) in Global Health was established between LSTM and Lancaster University.

The programme seeks to train the next generation of leading "bridge" scientists working in translational research in Global Health. Attracting further support from the RCUK National Productivity Investment Fund, the LSTM-Lancaster DTP currently has funding to support over 40 PhD studentships, most projects involving co-supervision of PhD students between the two institutions for collaborative projects in all of LSTM's departments and along the entire translational research pipeline continuum. The programme received further funding in 2019 and from this, a further 7 PhD studentships will be available for 2020 start.

The partnership has been further strengthened by the successful award of MRC Skills Development Fellowships (SDF) in Translational and Quantitative Skills in Global Health. This programme which will run for 6 years, again in collaboration with Lancaster University, is focused on training of PhD graduates in translational research with an emphasis in quantitative skills.

University of Liverpool

The academic collaboration to deliver education and research projects between LSTM and the University of Liverpool continues to thrive as illustrated in initiatives such as National Institute for Health Research (NIHR) Health Protection Research Unit (HPRU) in Emerging and Zoonotic Infections; MLW; CEIDR; LHP and LIV-TB.

Centre of Excellence of Infectious Diseases Research (CEIDR)

The Centre of Excellence in Infectious Diseases Research (CEIDR) is a joint enterprise bringing together the expertise of the Liverpool School of Tropical Medicine and the University of Liverpool.

As an academic-led centre with a commitment to interdisciplinary research, education and training, and the civic agenda, CEIDR aims to reduce the impact of infectious diseases and antimicrobial resistance on human health in Liverpool, the UK and globally.

Opened by Professor Dame Sally Davies in January 2020, CEIDR's £3.5m National Institute for Health Research (NIHR) Antimicrobial Resistance Laboratories provide the infrastructure needed for Liverpool researchers to develop personalised antimicrobial therapies to prevent and treat AMR.

HCRI & MSF

Together with the Humanitarian & Conflict Response Institute (HCRI) of the University of Manchester and MSF, the Leadership Education Academic Partnership (LEAP) integrates world-class higher education into the career paths of humanitarians, with the intention of strengthening leadership within the sector.

Work is underway to extend the partnership beyond its initial 3-year phase with all 3 organisations collaborating on a joint case for support.

Liverpool Knowledge Quarter

KQ Liverpool is bringing forward new development opportunities, successfully attracting new investment, increasing the city's employment figures, improving graduate attraction and retention rates and establishing the Liverpool City Region as a key player in the Northern Powerhouse.

KQ Liverpool's strengths in life sciences, infectious diseases, sensor technology and materials chemistry attracted four new occupiers to its expansions site: Paddington Village. These include the Royal College of Physicians, Proton Partners International, who build Rutherford Cancer Centre and Kaplan, who opened Liverpool International College in January 2020.

The KQ Liverpool partners are LSTM, the University of Liverpool, Liverpool John Moores University, the Liverpool University Hospitals NHS Foundation Trust, Liverpool City Council, Bruntwood SciTech, Liverpool City Region Combined Authority, the Hope Street CIC and Liverpool Vision.

LIV-TB

LIV-TB is a collaboration between LSTM and the University of Liverpool which is co-led by Nadia Kontogianni and Tom Wingfield.

LIV-TB features monthly seminars by its members and visiting researchers, which are open to all. Membership has grown from 60 to over 120 members over the past two years with speakers and attendees from all over the globe.

The interesting seminars are relevant to healthcare professionals, advocates, people with TB, and researchers and cover a wide variety of TB topics from the laboratory to the bedside, from prevention to long-term quality of life, from low- to high-burden settings.

LIV-TB has been heavily involved with the UK Academics and Professionals to End TB group and contributed to the national and international agenda on TB.

NHS

LSTM works closely with multiple local NHS Trusts including both the Royal Liverpool and Aintree sites of the Liverpool University Hospitals NHS Foundation Trust (LUHFT) and Alder Hey Children's Hospital.

At LUHFT, eight LSTM consultant clinical academics with expertise in different aspects of infectious disease and tropical medicine work with The Tropical and Infectious Diseases Unit (TIDU) and link closely with three consultant clinical academics with expertise in respiratory medicine. Two consultant paediatric clinical academics work at Alder Hey.

All of LSTM's clinical links with the NHS enhance research that is relevant for LSTM's mission. For example, the respiratory medicine links are crucial for the Royal Liverpool University Hospital, which is staffed by a number of LSTM clinicians, all experts in different aspects of tropical medicine. The Experimental Human Challenge research which examines susceptibility to a number of respiratory pathogens and contributes to the development of interventions, including vaccines.

LFC Foundation

Following on from the Health Goals Malawi project, LSTM and LFC Foundation have maintained their partnership and are planning to upscale the project bringing it to Liverpool communities.

With the support of the Foundation and the UEFA Foundation for Children, Health Goals Liverpool will be rolled out in 2021 with training taking place in 2020. The project will use football, and the power of the FC badge, to engage young people with important messages around sexual health and relationships.

NaTHNac

The National Travel Health Network and Centre (NaTHNac), commissioned by Public Health England, has the aim of protecting the health of British travellers.

NaTHNaC seeks to improve travel health advice given by health professionals and provides reliable information to the public, health professionals, travel industry and national government. NaTHNaC works in partnership with network founders, which include LSTM.

Public Health England

LSTM clinicians provide specialist advice to Public Health England (PHE), the government body responsible for protecting the nation's health and wellbeing and reducing health inequalities.

Professor Hilary Ranson provides entomological support to the Advisory Committee on Malaria Prevention in Travellers. Dr Nick Beeching, Senior Lecturer and Honorary Consultant at the Royal Liverpool University Hospital, is part of the PHE Imported Fever Service. Professors Lalloo and Harrison sit on the PHE committee, which advises on management of exotic envenoming in the UK.

PHE also partners in several research projects run by LSTM, including work led by Dr Tom Fletcher on viral haemorrhagic fevers.

Everton FC

LSTM and Everton FC signed a 3-year partnership in November 2020. By partnering together, Everton's community reach and LSTM's scientific expertise will be used for community outreach and engagement initiatives delivered by Everton and Everton in the Community as part of its Blue Family campaign.

Activities include visits to participating primary schools highlighting how to respond to health needs, such as COVID-19 as well as the benefits pursuing a scientific career. Visits will continue across Merseyside throughout the current school year – and will act as the pre-cursor of further collaborations between Everton and LSTM, culminating in LSTM's 125th anniversary in 2023

Liverpool Health Partners (LHP)

LSTM is a founding member of Liverpool Health Partners, a strategic partnership of 10 primary care NHS organisations, LSTM and the University of Liverpool. LHP aims to improve health and deliver exemplary research, education and healthcare across the Liverpool City Region.

FEATURE ARTICLE:
Maternal, Newborn and Child Health

Maternal, neonatal and paediatric conditions continue to pose major global health risks, especially in lower- and middle-income settings. Complications around pregnancy and childbirth; infections such as with malaria, HIV and tuberculosis during pregnancy and severe acute malnutrition and undernutrition amongst children under the age of 5 still pose significant challenges despite progress made over the past years.

Centre for Childbirth, Women's and Newborn Health (CWNH)

Stillbirth is one of the most traumatic life experiences for parents and often results in psychological distress and long-term consequences for bereaved families. Despite incremental progress over the past decade, in both low and high burden settings, around 2 million babies are stillborn; around 75% of these occur in Sub-Saharan Africa and South Asia.

In response a new centre, CWNH, has been established at LSTM. A new research team, previously at the University of Manchester, brought with them an NIHR Group on Prevention and Management of Stillbirth in Sub-Saharan Africa. Lead by Professor Dame Tina Lavender, the Centre aims to promote knowledge sharing and capacity building in stillbirth prevention and management in low resource settings. This is done in collaboration with the Lugina Africa Midwives Research Network (LAMRN), a midwifery led research network in Kenya, Malawi, Tanzania, Uganda, Zambia, and Zimbabwe.

The main thematic areas include:

- *Prevention and detection of stillbirth through improved identification of women with high risk pregnancies;*
- *Promoting evidence-based intrapartum care by examining factors which influence how women seek and access care, the quality of the care received and specific causes of stillbirth in local healthcare facilities;*
- *Ensuring respectful care and support for bereaved parents through understanding the experiences of women, partners and health workers after stillbirth. Community Engagement and Involvement (CEI) has been an integral part of the Group's work.*

The NIHR Group has completed various work streams in high burden settings, to understand risk factors, social and community perceptions around stillbirth, and how the health system responds to parents' needs following stillbirth. Research findings have impacted in several ways, including a raised awareness of the needs of women following stillbirth amongst communities; tabling of

IMPROVE trial participant in Kisumu, Kenya

A Nepali midwife listens to the heartbeat of the baby

stillbirth as a priority in Ministries of Health; development of specialised antenatal services for women who have birthed a previous stillborn baby; development of a multi-component bereavement intervention to improve healthcare worker capacities and enhance support for bereaved families; and implementation of counselling services for bereaved parents. It is currently building on the results and impact of the three-year programme with an application in development to become an NIHR Global Health Research Unit.

The UK team works collaboratively with Programme Leads, Research Assistants and CEI groups in 6 partner countries and with colleagues at Kings College London, and the University of Manchester to deliver this programme.

Emergency Obstetric Care and Quality of Care

Emergency Obstetric and Care (EmOC) is an evidence-based care package designed to reduce preventable stillbirths, maternal and neonatal mortality and morbidity. Improving the availability and quality of emergency obstetric care is critical to achieving the Sustainable Development Goals' Maternal and Newborn Health (MNH) targets: reduction of global maternal mortality ratio from 300,000 per 100, 000 live births to 70 per 100,000 live births by 2030.

In 2020, skills and drills training packages to improve maternity care provider competencies to provide comprehensive EmOC, including anaesthesia were adapted for part delivery virtually. Mentoring capacity strengthening packages were also designed and will be piloted in Zambia with funding from UNFPA HQ, New York.

Also, the protocol for a cluster randomised controlled trial of a pre-service midwifery capacity strengthening programme was developed for implementation in 2021. The 4-year FCDO funded Kenya MNH programme, has four implementation research work packages:

- *In-service capacity strengthening in EmOC*
- *Pre-service capacity strengthening*
- *MNH quality improvement using Maternal Death Surveillance and Response methodology*
- *Mentoring*

The Johnson and Johnson/Resource Foundation funded 3-year implementation research MNH programme in Nigeria has 2 work packages

- *Capacity strengthening for comprehensive EmOC*
- *Designing and evaluating EmOC midwifery continuous professional development programme.*

A 2-year midwifery education strengthening programme in Nepal funded by GIZ, focuses on the art and science of midwifery, reflective writing skills and developing mini research projects. COVID-19 research in Kenya and Nigeria explored the determinants of health facility preparedness for MNH care during the COVID-19 outbreak and the effect the outbreak has had on midwifery education. In collaboration with researchers at the London School of Economics and the University of Lagos Nigeria, the cost of using childbirth in public facilities in Nigeria were analysed. Another quality of care research in collaboration with researchers from several Nigeria academic institutions developed, validated and piloted an innovative Obstetric Early Warning System (OEWS) for resource poor settings.

Improvement of Integrated HIV, TB and Malaria Services in Antenatal and Postnatal Care

LSTM's newly formed Global Fund and Allied Programmes Unit is funded by the Global Fund to Fights AIDS, Tuberculosis and Malaria. It collaborates with partners and governments in host countries to deliver programmes for quality improvement of integrated HIV, tuberculosis and malaria services in antenatal (ANC) and postnatal care (PNC), with an overall aim of improving maternal and newborn health outcomes. This includes building capacity of healthcare providers, as well as more broadly supporting health systems strengthening, with in-built monitoring and evaluation (M&E) and operational research, and more broadly evidence generation to inform planning and policy-making. The current portfolio comprises implementation programmes throughout Africa with a value of over £9.5m.

Key achievements in 2020 across the programmes:

- *84 master trainers trained to strengthen capacity of healthcare providers*
- *892 healthcare providers trained in antenatal and postnatal care using a skills and drills programme*
- *362 healthcare providers trained in quality improvement methodology and supported to implement standards-based audit for improving quality of care in their healthcare facilities*
- *Equipment and training materials distributed to 242 healthcare facilities*

Studies and M&E activities complementing the implementation programmes consisted of:

Two stepped wedge design trials:

- *15-month assessment of effectiveness of ANC-PNC capacity building and introducing standards-based audit in healthcare facilities in Togo*
  - *12-month assessment of effectiveness of antenatal and postnatal capacity building on quality of care offered in healthcare facilities in Chad*
  - *Mapping of health cadres providing antenatal and postnatal care in Togo using expert interviews with ministry of health representatives, professional bodies representatives, healthcare managers and healthcare providers*
- *Study on respectful maternity care in Togo using quantitative survey of maternal services users*
- *Study on integration of care for HIV, TB and malaria in healthcare facilities in Togo using focus group discussions and interviews with healthcare providers, managers and other key informants*
- *Healthcare facility assessments including comprehensive baseline studies and follow up review on readiness to provide care in antenatal and postnatal services, HR availability and training, availability of medications, consumables and equipment; data on maternal and newborn health outcomes and take-up of services*
- *Assessment of knowledge and skills of healthcare providers*
- *Maternal and newborn morbidity assessment initiated in Kenya, Nigeria and Tanzania*
- *Economic evaluation of the intervention programmes in Kenya, Nigeria and Tanzania being developed in collaboration with the Centre for Research on Health and Social Care Management (CERGAS) at Bocconi University in Italy.*

Paediatrics and Child Health

PROSYNK

In partnership with the Kenya Medical Research Institute (KEMRI), recruitment of newborns to the PRObiotics and SYNbiotics in infants in Kenya (PROSYNK) study in Homa Bay, western Kenya will start in November 2020. Likewise, the GCRF Action Against Stunting Hub study is due to start recruitment soon allowing us to further assess the role that gut health plays in child growth and development in Senegal, India and Indonesia including assessment of a synbiotic intervention in newborns in Senegal.

Community Health Volunteers, peer mothers and the PROSYNK research team in Homa Bay, Kenya.

Neonatal nutrition network

The Network published a systematic review of feeding practices for preterm/low birthweight infants in LMICs and the opinions of parents in Nigeria to inform the development of a core outcome set for research in these settings. A feasibility trial of a probiotic to reduce mortality and prevent sepsis and necrotising enterocolitis in preterm infants in the unit at University College Hospital Ibadan, Nigeria, led by Dr Kemi Tongo is underway.

Gastroenterology research

In the NIHR-funded gastroenterology research at Alder Hey Children's Hospital, initial promising findings regarding the measurement of faecal volatile organic compounds in the diagnosis of inflammatory bowel disease and its sub-types are being further explored in a validation set of case/control pairs. The study of "First Milk" (bovine colostrum) in gut health in children with Crohn's disease will close to recruitment at the end of the year.

Head circumference measurement of an infant in the IMPROVE cohort

Malaria in Pregnancy

Antimalarial pregnancy registry

The malaria epidemiology team, led by Professor Feiko ter Kuile, continued its research on maternal and child health with two new studies. Professor ter Kuile, Dr Jenny Hill and Dr Stephanie Dellicour, seconded to LSTM from the Medicines & Healthcare products Regulatory Agency Authority (MHRA), are leading an MMV-funded initiative to develop a global pregnancy registry on the safety of antimalarials and, ultimately, also other drugs used to treat infectious diseases.

The objective of the antimalarial pregnancy registry is to capture and analyse data on the safety of different drugs used to prevent malaria in pregnancy including the new artemisinin-based combination therapy (ACT), artesunate/pyronaridine and injectable artesunate. Particular emphasis is on collecting data during the first trimester of pregnancy which has proven extremely challenging in the past such that currently there are a variety of contradictory labels for ACT use in pregnancy.

The pregnancy registry is a multi-centre, multi-country, prospective cohort study in selected countries in sub-Saharan Africa to collect information on real-world exposures to a range of antimalarials and the data is being collated in partnership with WWARN/Oxford. LSTM is working in partnership with the MHRA to ensure that analyses are conducted and reported in accordance with regulatory requirements and with pharma. It is envisaged that the analysis of the registry data will be used to update product labels as appropriate.

Use of IPT in Indonesia

Dr Hill is leading a new MRC-funded study in Papua, Indonesia, in collaboration with the Timika Research Facility to support the Indonesian Ministry of Health to explore the best way to deliver a new preventive regimen for the control of malaria in pregnancy called intermittent preventive treatment, or IPT. It is used in most countries in Africa but not yet in Asia. With this IPT strategy, pregnant women without symptoms of malaria attending routine antenatal care in selected health facilities in Papua will receive monthly treatment with a long-acting antimalarial drug called dihydroartemisinin-piperaquine (DP) that provides four weeks of prophylaxis after each dose. Currently, in Indonesia, women are screened for malaria at their first antenatal care visit and women are treated with DP if they test positive. In the new strategy, women will receive the drug as monthly prophylaxis without prior blood testing for malaria parasites. A recent trial in Indonesia conducted by this group showed that this intervention, when taken as directed, is very effective in preventing malaria in expectant mothers. However, the concept of using drugs for prevention by women who do not have malaria symptoms is new to this region. This would be the first time that IPT with DP strategy would be used globally.

IMPROVE trials

Our multi-centre IMPROVE trials of new regimens for the chemoprevention of malaria in pregnancy in HIV-infected and -uninfected pregnant women in areas of high drug resistance in Kenya, Malawi and Tanzania are progressing well despite a temporary suspension of activities in all three sites due to the COVID-19 pandemic. The fieldwork of the trial in HIV-uninfected women was completed in April 2020 and results will be available in Q2 2021. The trial in HIV-infected women is due to complete in 2021 with results available in Q2 2022. Sub-studies are ongoing on acceptability, feasibility, and cost-effectiveness to provide evidence to inform subsequent policy adoption of either intervention should they prove efficacious, safe and well tolerated.

Public Engagement

A consequence of the restrictions put in place to reduce transmission of COVID-19, nationally, meant that the family festivals and activities planned for this academic year were postponed. However, community acceptance of LSTM's public health messages and engagement with the public with these, has never been more important.

Everton in the community

LSTM and the charity arm of Everton Football Club, Everton in the Community, signed a three year partnership in November. Initially to visit schools across Liverpool, to engage schoolchildren with science using football as a platform.

School Skills in action

Over the next three years, leading up to LSTM's 125th and Everton's 140th anniversary, the partnership will bring LSTM's work and research into classrooms to inspire learning through sports and generate fun engagement with science. The partnership began with the signing of the Memorandum of Understanding, followed by a visit to Wavertree Church of England Primary School. LSTM's PhD students Rachel Byrne and Sara Begg engaged a Year 6 class on where, how and when to wash their hands making comparisons between wash facilities in Malawi and Liverpool, and between COVID-19 guidelines and that for other infectious diseases. The schoolchildren undertook a handwashing challenge, guessing how many keepy-uppies the footballer Mason Holgate can perform within 20 seconds, the length of time recommended for washing hands during the COVID-19 pandemic.

BBC Radio Merseyside – widening of SciFri

The COVID-19 pandemic resulting in national and regional lockdowns led to an increased need in public understanding of infection control and lockdown guidelines as well as showcasing the COVID-19 work taking place within the region.

LSTM researchers have regularly spoken on BBC Radio Merseyside Breakfast show to provide reassurance and inform listeners of LSTM's COVID-19 research. Since March, 24 staff and students have spoken to presenter Tony Snell on the Breakfast show, across two or three segments per week throughout lockdown, during the easing of restrictions and beyond.

LSTM's radio slots have not gone unnoticed by listeners and presenters alike:

"Have once again just listened to you on Radio Merseyside. If only we had more people like you talking to the public. At this difficult time, we need a balance of the facts clearly and simply explained, and some reassuring hope of a good future to come. Thank you I have learnt and understood more from listening to you." Teresa Jones (a Londoner who listens to Radio Merseyside) of Bertie Squire on BBC Radio Merseyside.

Blogging and vlogging during COVID-19 lockdown

LSTM's staff and students have blogged and vlogged throughout COVID-19 lockdown. The Centre for Drugs and Diagnostics team created a series of Vlogs outlining their work in the CL3 containment laboratories at LSTM and how they were repurposed to screen and validate potential drugs and diagnostics to target COVID-19.

The team outlined their work training staff and student volunteers to CL3-standard so they can access these state-of-the art laboratories and equipment to support this work. DTM&H and MSc students also used blogs as a platform to voice their thoughts on the COVID-19 pandemic. LSTM's Dr Adam Roberts and his team prepared a post about how preparing their laboratory and research for lockdown had impacted on them in 'Don't Get Complacent AMR; we'll be back.'

FEPOW family fun day during British science week

Prior to COVID-19 lockdown, LSTM's MSc Tropical Disease Biology students took the family-friendly pop-up science exhibit, Club Tropicana, to the Victoria Gallery & Museum as part of British Science Week.

The students engaged with nearly 200 young children and adults, inspiring them about the natural world around them. The students introduced the visitors to the microscopic world, demonstrating the various parasites scientists often observe in blood samples, and LSTM's more gruesome macroscopic parasites! Through these demonstrations the young children explored the tropical science that is taking place on their doorstep.

The family fun day ran alongside LSTM's Far eastern Prisoners of War Secret Art of Survival Exhibition, containing "documentary art" illustrating many aspects of captivity from medical ingenuity to survival.

FEATURE ARTICLE:

Innovation, Discovery and Development

Innovation and translation are at the forefront of work at LSTM as it aims to discover and develop, then go forward with implementation of innovative ideas. In doing so, LSTM considers itself unique in spanning the translational pipeline from discovery to implementation.

This year has highlighted the importance of working collaboratively to prevent infectious diseases and the critical role of translational academic-industry partnerships in driving innovation in this area.

The challenges of infectious disease interventions include the COVID-19 pandemic, the global threat posed by a lack of new antibiotics, and the devastating impact of multidrug resistant bacteria parasites and viruses impacting low and middle income countries. LSTM has spearheaded several new collaborative initiatives in 2020, designed to have a major impact on these global problems.

iiCON – infection innovation Consortium

Under the leadership of LSTM Professor Janet Hemingway, iiCON brings together the North West's largest concentration of infectious diseases research in the UK in a new £120M programme. Recognising the Liverpool City Region and North West England's existing world-class expertise, iiCON, is an LSTM led consortium. It received £18.6m from UK Research and Innovation (UKRI) Strength in Places Fund (SIPF) for 5 years to accelerate the delivery of new infectious disease therapeutics for a range of human infections.

iiCON
infection
innovation
consortium

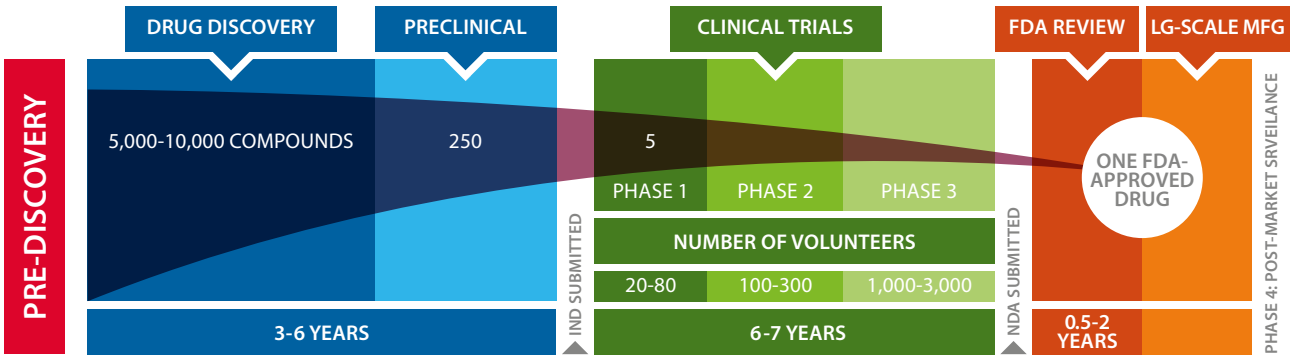
This UKRI scheme aims to boost local economic growth by building on world-class research and innovation capacity to stimulate increased R&D investment. This grant recognises the region's existing strengths in this area and has already leveraged over £100m for pilot projects eager to use the new platforms.

The project will create 8 specialist, commercially sustainable research platforms for infectious diseases therapeutics in North West England that will transform the efficiency of new product discovery, development, evaluation and impact assessment.

The consortium's first partner meeting in October, set the research agenda for the next five years. The partners: Unilever UK, Evotec, Infex Therapeutics (the former AMR Centre in Alderley Park), Liverpool University Hospitals NHS Foundation Trust, University of Liverpool and LSTM, will develop new products, working with a range of other industrial and philanthropic partners, that can directly reduce the burden of infectious diseases in the UK and around the world.

Infectious disease therapeutics (IDTs) are critical for the prevention, diagnosis and treatment of human and animal infectious diseases. While these diseases have always been major causes of morbidity and mortality, the recent COVID pandemic demonstrated that they can also cause catastrophic damage to global health and well-being and tip even the most robust economies into recession.

The need to deploy the Infectious disease therapeutics (IDTs) at scale, and the tendency for the infectious disease burden to fall disproportionately onto the world's poorest populations, over decades has led to the commoditisation of IDTs, with reduced profit margins acting as a disincentive for major Pharma to engage in new product R & D, with early stage discovery and development of new anti-infectives dominated by academia and SMEs.



Source: Pharmaceutical Research and Manufacturers of America

From right to left, Amanda Solloway MP, iiCON lead Professor Janet Hemingway and LSTM Director Professor David Lalloo

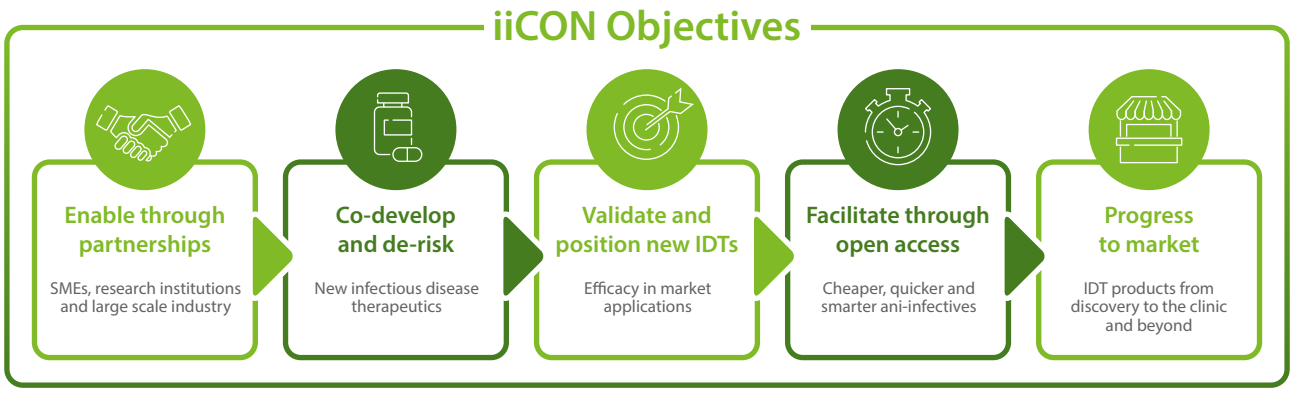
iiCON's objectives and output

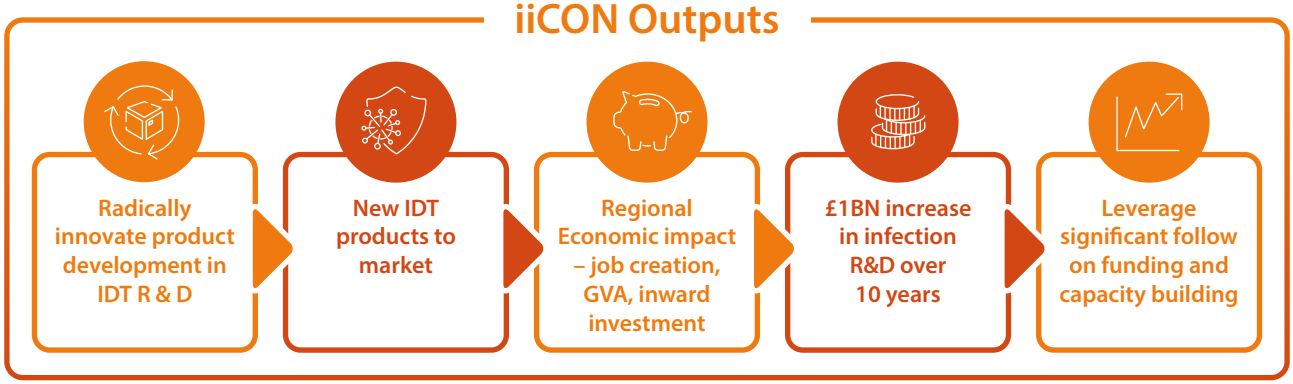
The consortium partners identified 8 points along the IDT development pathway where they collectively have ground-breaking expertise where they can develop, validate and operate commercial open access platforms with industry, to dramatically improve product development pathways. They tested the validity of their assumptions with the promise of major leveraged funding for exemplar product development projects for each of these new platforms.

In combination with the health benefits that iiCON will deliver in the medium to long term, iiCON will act as a pivotal catalyst for economic regional growth in Infection R & D in the North West, generating a world class infection R & D ecosystem that drives substantial inward investment.

In September 2020 LSTM welcomed the UK government Minister for Science, Research & Innovation, Amanda Solloway MP. In her ministerial role she represents the government's Research and Development (R&D) Roadmap, which sets out the UK's vision and ambition for science, research and innovation and as such she wanted to hear first-hand about the work, objectives and outputs of iiCON.

Building on iiCON a second formulations programme aimed at regional small and medium sized enterprises (SMEs) in the Liverpool City Region was established by LSTM, Unilever and the University of Liverpool.





ERDF formulations grant

In September LSTM received a grant of £3,3million of the European Regional Development Fund (ERDF), matched with £3.3M of leveraged grants and product donations from the Bill and Melinda Gates Foundation and Against Malaria Foundation to improve formulations of infectious diseases therapeutics.

The grant, which is part of the overall ERDF allocation to the Liverpool City Region (LCR), is in addition to the £100m guaranteed leveraged funding that iiCON managed to assemble in response to the £18,6M Strength in Places grant from UKRI, in late June.

The ERDF scheme will align SME needs with cutting edge regional science platforms and connect them to a strong and innovative ecosystem, with a broad industrial base to deliver new products, which will prevent transmission of infectious diseases agents such as viruses, bacteria and parasites.

The grant comes via the UK Ministry of Housing, Communities and Local Government, who are working closely with the Liverpool City Region Combined Authority to ensure ERDF grant applications are aligned to LCR priorities.

European Union
European Regional Development Fund

This programme will engage up to 300 SMEs and coherently network a minimum of 60 regional based SMEs with the infection-based research and development at LSTM, the University of Liverpool's Surface Chemistry group and the Unilever microbiology laboratory at the Materials Innovation Facility in a format that will help to drive productivity of the SME sector, and directly increase their potential to access global markets for the resulting products.

Both iiCON and ERDF have workstreams dedicated to new diagnostics. The Liverpool City Region, Cheshire and Warrington have the largest concentration of infectious diseases research in the UK. The critical importance of the sector is highlighted by the speed and efficiency by which the region has focused and mobilised their resources to address the COVID-19 crisis with active research programmes in diagnostics, therapeutics and vaccines.

Investment in diagnostic technologies at LSTM, initiated in response to the antimicrobial resistance (AMR) crisis, have been rapidly adapted to provide validated diagnostics to meet the needs of the COVID-19 outbreak. It has allowed Liverpool to become a test bed for new diagnostic technology development and evaluation trials for COVID-19. To this end LSTM has been central to the validation of lab based COVID-19 antibody and antigen tests and rapid diagnostic tests with multiple commercial and academic partners.

LSTM's HiVE Innovation Programme

In March 2020, guests gathered in Accra, Ghana, to celebrate the achievements of the inaugural cohort of LSTM's Health Innovation in a Virtual Environment (HiVE) programme. The event marked the end of a one-year pilot of HiVE, involving 19 Pioneers from across rural and urban Ghana.

Delivered via an online platform, the programme aimed to identify innovative, fresh-thinking and applicable ideas that address global health issues. The ideas proposed have been highly diverse, ranging from naturally-derived water treatments, waste composting and mobile technology and microfinance innovations; to stroke rehabilitation, training simulations and curriculum development.

HiVE follows the traditional idea of an accelerator, but with some twists. Pioneers are matched with a team of multidisciplinary industry experts, underpinned by a key skills curriculum. Matched with virtual mentors and advisers, participants challenge and refine their idea for real-world applications.

Future plans include growing the programme in Ghana and scaling to other regions in Africa. The digital nature of HiVE provides great flexibility, with the platforms accessible via laptops or smartphones, even with limited connectivity.

Some of the 19 HiVE pioneers

Going Virtual

Throughout the second part of the academic year LSTM researchers had to quickly adept to a new reality of online seminars, symposia, viva voces and conferences.

One of them was the GLOW Conference (Global Women's Research Society), which LSTM co-hosted in September 2020, with the University of Liverpool. The conference covered themes such as *Respectful Maternal and Newborn Care as well Decolonising Global Health, respectful care in the age of COVID-19 and promoting the Year of the Nurse and Midwife.*

Over 1,300 participants from 69 countries signed up and participated in the two days of virtual talks, panel sessions, poster and oral presentations and interactive Q&As.

Pictured: The GLOW 2020 organising committee included LSTM's Dr Charles Ameh, Dr Helen Allott, Professor Dame Tina Lavender, Dr Helen Nabwera and Terry Kana. Photo credit: David Scarlett

FEATURE ARTICLE:

Health Policy and Health Systems Research

LSTM's emphasis on product development alongside translational and policy research with special focus on health systems and capacity strengthening resonates strongly with institutions; governments and their ministries; funding bodies and partner organisations across the globe.

Health Policy and Health Systems Research at LSTM includes a strong focus on taking interventions from regulatory approval through to field implementation.

This encompasses the activities that help develop practical solutions to health needs and rights. It incorporates the spectrum of research that delivers policy-relevant evidence and includes operational, implementation, and health systems research.

Centre for Capacity Research (CCR)

The Centre for Capacity Research specialises in the science of how to strengthen the capacity of research systems and has welcomed a number of new projects to its research portfolio this year.

As part of the Developing Excellence in Leadership, Training and Science (DELTAS) Africa, the DELTAS CPE fund has been established which will strengthen capacity in the area of community and public engagement. CCR will work alongside the CPE fund grantees to develop their engagement plans and will support the monitoring and evaluation of the progress and the outcomes against these plans. In addition, CCR will monitor and evaluate the CPE programme as a whole. The DELTAS CPE fund will align with the outcomes of the existing CCR led DELTAS Learning Research Programme which is producing research-based learning about how to train and develop world-class researchers, foster their careers and collaborations, and promote research uptake.

In addition, CCR is working with DELTAS Africa grant awardees, research managers, and monitoring and evaluation officers to develop a framework to enable a comparative analysis of the partners' monitoring and evaluation approaches to their capacity strengthening efforts. CCR will collect data from across the partners about what worked, what did not work and why, concerning the monitoring and evaluation of their capacity strengthening activities. CCR will produce a report comparing the different approaches to monitoring and evaluation of capacity strengthening activities and suggestions/recommendations for future similar programmes.

The £1.5Bn GCRF fund supports collaborative, large-scale research projects between UK and developing country institutions and many of these projects directly or indirectly contribute to strengthening research capacity in partnering countries. However, much of this effort can be wasted if these capacity improvements are not adopted or sustained in the long-term. In response, CCR have been awarded a GCRF grant to identify strategies for sustaining project-initiated gains within the frame of dedicated research capacity strengthening programmes. The long-term goal of the project is for developing countries to achieve self-sufficiency in capacity to generate research and innovation to solve their own problems and accelerate socio-economic development. Findings will identify knowledge gaps and transferable lessons which will allow us to produce evidence-informed 'good practice' draft guidelines on how to embed and sustain improvements in research capacity within an institution.

Mainstreaming Disability, Mental Health, Equity and Rights within NTD Programmes and Health Systems

LSTM continues to expand its portfolio of work focused on the mainstreaming of disability, mental health, equity and rights within Neglected Tropical Disease programmes and health systems. The work spans the continuum of care from disease prevention to disease management and prioritises the needs and rights of persons affected by NTDs and their communities through the use of qualitative and participatory approaches.

Bernadette Thomas a Community Health Worker from Bonthe District of Sierra Leone poses next to a photo exhibition about the challenges she and her colleagues face in the course of their work

Through COU**NTD**OWN, REDRESS and two COR-NTD funded research projects, integrated strategies are being developed for the management of chronic morbidity, mental ill-health and disability associated with NTDs that are scalable within health systems. Key successes this year have included: the adaptation of information, education and communication

materials developed to tackle stigma associated with NTDs in Benue and Kebbi States, Nigeria, for use within COVID-19 responses; training of the first group of NTD patient advocates in Liberia to support case identification and referral of suspected NTD cases; and the successful launch of the REDRESS programme and extension of the COU**NTD**OWN programme.

As mass drug administration for NTDs re-starts across many countries within sub-Saharan Africa following COVID-19 related interruptions, with support from the ASCEND Learning and Innovation Fund, there projects are working in collaboration with partners to understand how NTD programmes can provide entry points for COVID-19 responses, with a particular focus on the provision of psycho-social support for communities and health workers. On a global scale, REDRESS and COU**NTD**OWN have contributed to the TDR toolkit focused on 'Incorporating intersectional gender analysis into research on infectious disease of poverty: a toolkit for health researchers' and supported the establishment of ICHORD (Improving Community Health Outcomes through Research and Dialogue), a social science and NTDs community of practice.

ReBUILD for Resilience

May 2020 saw the start of the ReBUILD for Resilience Research Programme Consortium (RPC). It is funded for six years by the UK government's Foreign, Commonwealth and Development Office (FCDO) for the amount of £7.68 million. Led by LSTM's Health Systems and Workforce Strengthening Unit, this programme will focus on health systems in fragile contexts experiencing violence, conflict, pandemics and other shocks.

Two billion of the world's poorest people live in fragile settings and that figure is rising, fuelled by growing inequality, violence, conflicts and other shocks, including the current COVID-19 pandemic. In these shock-prone contexts, and with growing threats from climate change, population displacement and epidemics, progress towards universal health coverage is slow. This funding will help us continue to learn how we can develop stronger and more resilient health systems which deliver both local and global health.

The research will be jointly delivered with the Institute for Global Health and Development at Queen Margaret University, UK, alongside the American University of Beirut in Lebanon, Burnet Institute in Myanmar, Herd International in Nepal, the College of Medicine and Allied Health Sciences in Sierra Leone, and associate partners at Oxford Policy Management and International Rescue Committee.

Urban Health Research with ARISE

The UKRI Global Challenges Research Fund ARISE Hub (Accountability for Informal Urban Equity) has conducted Community Based Participatory Research to explore the governance landscape, social inequities and priority health and well-being challenges facing people living and working in informal urban spaces through equitable research partnerships in Bangladesh, India, Kenya and Sierra Leone. ARISE has been at the forefront of developing safeguarding principles and practices in global health research and made major contributions towards UKCDR Guidelines for Safeguarding in International Development Research, led by the University of Liverpool.

ARISE research and partnerships have influenced both global and national strategies for preventing and managing COVID-19 in informal settlements. The Hub has produced multiple outputs across different media on the impact of COVID-19 on marginalised urban people and the importance of including their voices in policy and programme development.
It established a cohort of 7 PhD students from Bangladesh, India, Kenya and Sierra Leone, who are tackling a range of issues such as informal healthcare, youth health and well-being, including adolescent pregnancy, urban development displacement, and accountability for UHC and WASH.

Urban settlement in Sierra Leone

LSTM and ARISE partners joined the African Cities Research Consortium, funded by FCDO and led by the University of Manchester. This six-year programme will work initially in 13 cities. Through a 'city as a system' approach it aims to move beyond the sectoral silos of research and interventions by treating each city as a complex system, while integrating political and technical analysis undertaken alongside key players on the ground. An initial focus on 13 African cities will allow focused, interconnected research which delivers real insights and sustainable action for local authorities, civil society and donors.

Evidence Synthesis

The Research, Evidence and Development Initiative (READ-It) is a large evidence ecosystem developed over the last 25 years. The LSTM hub is located in the Department of Clinical Sciences, led by Professor Paul Garner, Paula Waugh and Deirdre Walsh.

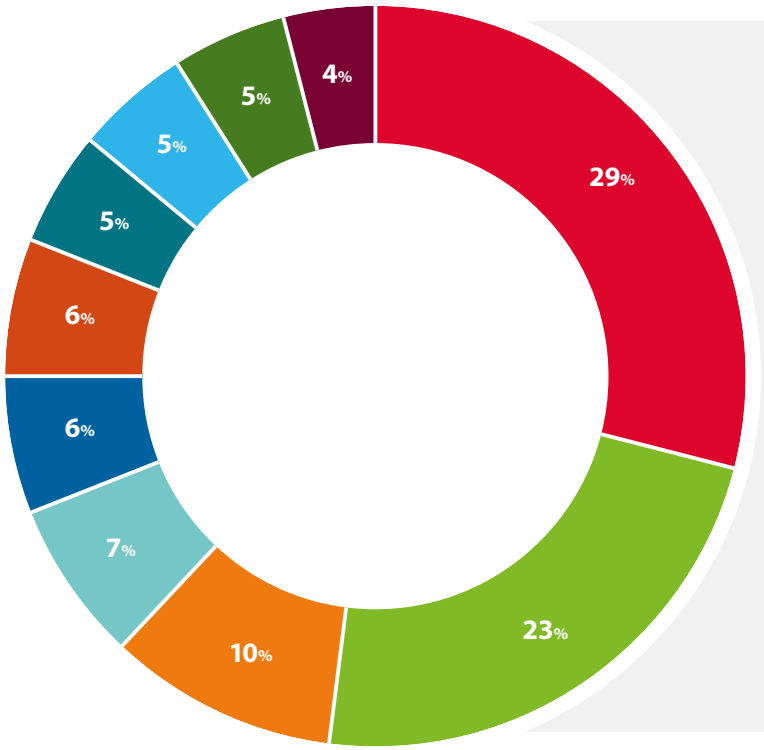
In February 2020, LSTM was awarded a new World Health Organization (WHO) Collaborating Centre in Evidence Synthesis for Global Health for 4 years. The WHO Collaborating Centres are important as they reflect the credibility of the team's work with the WHO and, through a negotiated programme of work, help ensure the research done by the READ-It global team, and the Cochrane Infectious Diseases Group (CIDG) in particular, is linked with current WHO priorities.

In the last year, the CIDG has contributed systematic reviews that inform guideline development with WHO in treating plague, for new TB diagnostic tests, and in strategies to diagnose TB in the community. The team have published 11 high-impact Cochrane reviews, including four related to COVID-19, working with the University of Birmingham and Cochrane Central Editorial Service on reviews in COVID-19 diagnostics. The READ-It Partner team in Cape Town has been working hard to inform national policy in South Africa for COVID-19, as well as completing a mammoth systematic review on interventions to improve food security.

READ-It also contributed to the new ARRIVE-2 guidelines to help improve the conduct and reporting of animal research.

LSTM's Top Research Funders

The graphics below show the top funders in terms of total contract value (by ultimate source of funding) for LSTM during financial year 2018/19 and 2019/20. ***Source: Converis***

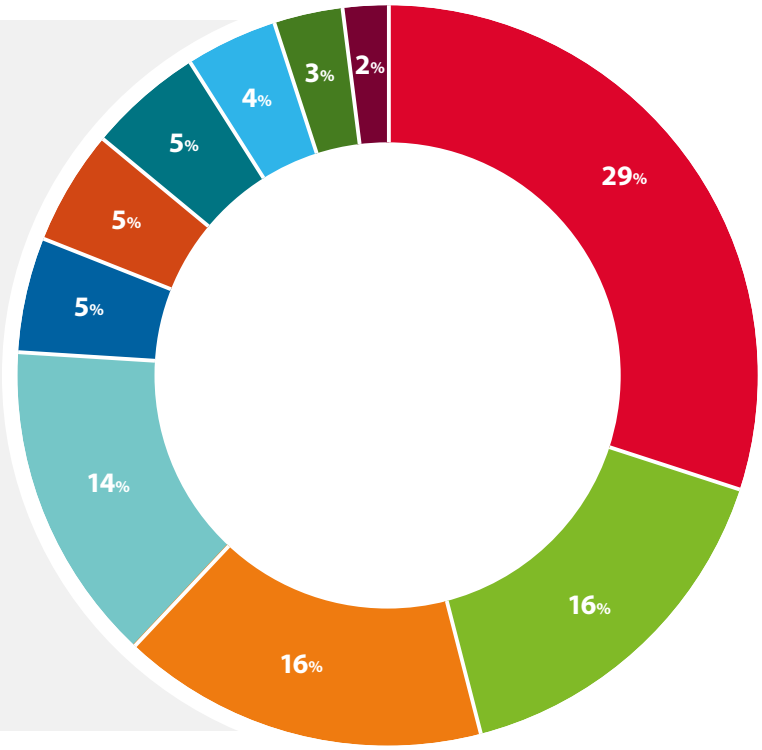


Top 10 research funders (Grant research award amount) *FY 2019/20*

- United Kingdom Research and Innovation
- Foreign, Commonwealth & Development Office (DFID)
- Wellcome Trust
- Bill & Melinda Gates Foundation
- Medicines for Malaria Venture Switzerland
- National Institute for Health Research
- Medical Research Council
- European & Developing Countries Clinical Trials Partnership
- Global Health Innovative Technology Fund
- European Structural Investment Funds

Top 10 research funders (Grant research award amount) *FY 2018/19*

- Department for International Development
- Economic and Social Research Council
- GlaxoSmithKline
- Wellcome Trust
- Bill & Melinda Gates Foundation
- Medical Research Council
- European Commission
- Pfizer Inc (USA)
- UNICEF
- Children's Investment Fund Foundation



Research Governance and Ethics

LSTM's Research Governance & Ethics Office works with researchers and programme management staff across LSTM to promote sound governance, awareness of ethical practice and adherence to research integrity principles.

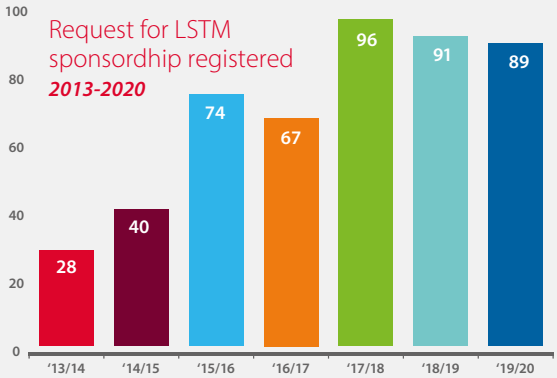
"I have recently joined LSTM as Research Governance & Integrity Manager and have been working with the Governance & Ethics team, and other teams across LSTM, to see how we can bring together all aspects of research management. My goal is to provide a holistic approach towards improving the services we provide to researchers and programme teams. I'm working on enhanced systems to manage the governance of human and non-human research in a proportionate way, accountable always to the Research Governance Oversight Committee. We are very open to work with colleagues to improve how we work, and we encourage teams to reach out to us with ideas and suggestions."

Denise Watson, Research Governance & Integrity Manager

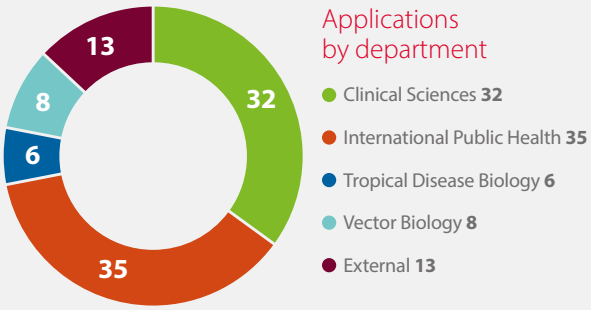
Sponsorship & ethics approval

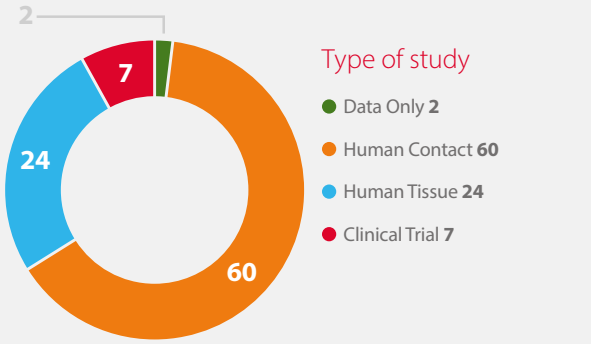
The Research Governance & Ethics Office effectively responded to the COVID-19 pandemic by establishing a rapid review mechanism, which was applied to 9 studies between March-July 2020. The pandemic did not affect the overall number of studies requiring sponsorship; this year's total was 89 new studies, compared to 91 the previous year.

The opinion of LSTM Research Ethics Committee has increasingly been sought by external research organisations over the past year.

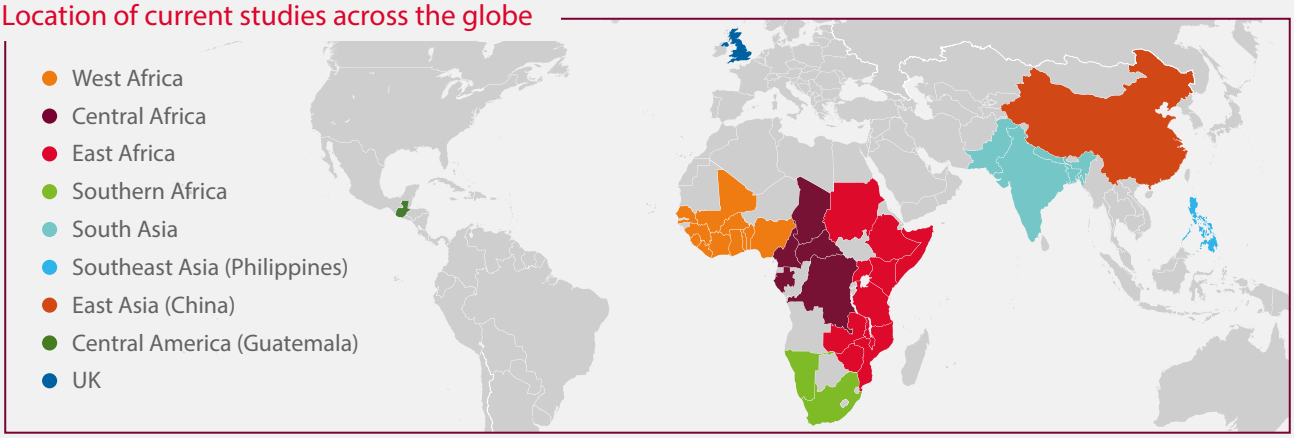


Applications reviewed by LSTM research ethics committee 2019-20





Location of current studies across the globe



Finance, Procurement and Research Services (FPRS)

FPRS has been on a radical transformation of how it communicates with the wider LSTM community. Throughout the year FPRS has come together to set and embed a l mission and set of values and analyse how FPRS members can communicate more effectively with each other and with its stakeholders. FPRS switched its planning processes so that end users are actively consulted and involved at early stages of process changes. A key part of the change transformation was a new name, one that encompasses the wide range of functions and activities that the teams provide: Finance, Procurement and Research Services (FPRS).

COVID-19

With the UK going into lockdown in March 2020, the entire FPRS team transitioned to working from home with many processes already online prior to lockdown. Finance Operations moved the entire supplier payments process online within a week and the end of year audit required additional analysis specifically relating to the COVID-19 impact.

Procurement swiftly put in place a procurement process to purchase urgently needed PPE for the MLW Centre in Malawi. Funded by Wellcome, the Procurement Team sourced 1 million gloves, 400,000 aprons, 240,000 medical masks, 200,000 N95 masks and 60,000 gowns, a huge undertaking at a critical point in the pandemic crisis. Contacting 20 suppliers worldwide, the team undertook essential due diligence of each supplier using a variety of virtual tools, translators and intermediaries.

Whilst moving to virtual working, the Finance Business Partnering team were in the middle of organisational budgeting for 2020/21. All meetings went ahead as planned with crucial budget review meetings becoming a virtual marathon. The research pre award team supported 191 applications alone in the first lockdown (50 of which were COVID related), 34 new grants were accepted and opened and 5 project audits all ran virtually.

FPRS Successes

Finance operations

Financial Operations provide financial control across the group with the coordination of the financial year end process including the first virtual external audit and production of the financial statements, a key annual activity that was completed to time. An essential legal requirement, financial statements provide detailed public information on the financial health of LSTM.

The team have been heavily involved in supporting the project management team in the construction of the Creator Building at MLW in Malawi, providing expertise in budgeting, tax, foreign exchange and cash management as they impact the project.

Procurement

The Procurement team saved LSTM over £1m through tenders, quotation exercises and negotiation, building sustainable relationships with key suppliers and better use of collaborative purchasing agreements. The LSTM eProcurement platform is used by over 230 staff members to check best pricing, view online catalogues, place orders and track deliveries for all the goods and services.

Procurement has also worked closely with our energy supplier and has now enabled LSTM to purchase 100% clean renewable energy for the future. Alongside other supplier led initiatives, this helps LSTM work towards becoming a more sustainable organisation for the future.

Finance Business Partnering (FBP)

FBP have focused on effective management information, undertaking a large project to look at data and how to get the best out of it. Working with key business stakeholders and the systems team, FBP have delivered a new set of quality management information reports tailored to individual stakeholder needs along with a comprehensive training package to really engage the users.

There was also a heavy focus this year on systems-based improvements that really impact the end user, from supporting the procurement team with the eProcurement platform, to introducing a new FPRS helpdesk, a central hub self-service.

Research Management Services (RMS)

With the RMS Post Award team supporting them throughout the preparation and the accreditation process, The Institute of Primate Research in Kenya was the first African Institution to obtain Good Financial Grant Practice (GFGP) accreditation. The Pre-Award team supported a 30% increase in applications in the year including the successful institutional applications to become host institution for AMS Springboard Awards and Knowledge Transfer Partnerships as well as supporting the successful £19m Strength in Places Fund award. The RMS Research Information team, whilst preparing for the REF2021 submission, supported and trained academics to ensure reporting requirements for outcomes and impact were correctly reported to ResearchFish (100% compliant), IATI and GFinder.

Education

The past academic year has been particularly challenging for Education due to the emergence of COVID-19 and the subsequent national lockdown implemented by the UK government. In preparation for lockdown all face-to-face teaching ceased from late March 2020 and, following a two week pause, migrated to mainly online delivery

Professor Phil Padfield - Dean of Education

This pause allowed time for students to return home where possible, to prepare for lockdown and online learning and, in some cases, to return to work for those from healthcare settings. It also provided Education with time to move face to face programmes to an online delivery model. All assessments were also conducted online. Unfortunately, due to the ongoing situation the spring running of the Diploma in Tropical Nursing and several other short continuing professional development courses had to be cancelled.

COVID-19 also provided significantly increased demand for support from LSTM's Student Advice and Wellbeing (SAW) Services and allowed the Education provision to be more agile and flexible. Supporting students with complex and unanticipated circumstances has been at the forefront throughout the academic year. This included immediate support to students who were stranded in the UK due to the national lockdown and suspension of flights. Pastoral and practical support was provided in the form of additional stipends, as well as provision of necessities and regular check-ins virtually to ensure ongoing contact with colleagues and friends. Enormous efforts were made to repatriate international students in partnership with government initiatives from various countries. Furthermore, access to LSTM's mental health support services resulted in migration to more virtual services.

Some physical teaching continued throughout the academic year whilst adhering to socially distancing and face mask rules

Other initiatives that have been offered to students included a virtual careers event and CV writing workshop. Education pro-actively developed wellbeing and mindfulness sessions for students as part of adjusting to the COVID-19 situation and reducing stress created by the unforeseen circumstances of COVID-19. During the outbreak students were provided with information related to support mechanisms in the community. In addition, SAW has also launched a Wellbeing Champions initiative.

Education continues to fund, and drive, Togetherall, which provides information and signposting for students (and staff) who require mental support 24/7 and is accessible all over the world. Education is looking to expand this provision by seeking additional external funding for innovative mental health and wellbeing provision.

Appointment of Academic Registrar

One bright spot during a difficult year was the arrival of Sarah O'Keeffe as Academic Registrar.

Academic Registrar Sarah O'Keeffe

She joined LSTM in January 2020, coming from Cardiff University where she had worked as School Manager of the School of Social Sciences for the previous five years. Prior to that she was the Chief Operating Officer of Newcastle University International Singapore, then a subsidiary company of Newcastle University running predominantly engineering courses in Singapore with students matriculating directly from the local polytechnics on to Year 2 of Newcastle undergraduate degrees. She also has seven years' experience as School Manager and Faculty Administrator at the University of Liverpool. Sarah has experience in leading multiple and diverse professional services teams, staff development, programme and student operations, governance, compliance and is a certified Change Manager.

LEAP Programme

LSTM's partnership with the international medical charity Médecins Sans Frontières (MSF) and Humanitarian & Conflict Response Institute (HCRI) of the University of Manchester, continues to grow.

LSTM hosted the LEAP student led debate on Professionalisation of Humanitarian Practice in November 2019

The LEAP (Leadership Education Academic Partnership) Programme integrates world-class higher education into the career paths of humanitarians, to strengthen leadership within the sector. COVID-19 necessitated a change in the delivery and model of the programme that would allow students to study online instead of coming partially to the UK. This model has worked effectively and enabled continuity of the programme through students being able to study whilst on work missions and supporting crucial COVID-19 and wider humanitarian activity in the field. Work is underway to extend the partnership beyond its initial 3-year phase with all three organisations collaborating on a joint case for support.

Developing the Next Generation of UK Global Health Leaders - OfS Catalyst Bid

LSTM completed the second year of reporting on its project for 'Developing the Next Generation of UK Global Health Leaders' as part of a wider 3-year initiative that has attracted £1.02M of Office for Students (OfS) funding to support this initiative.

The project strengthens LSTM as the UK's 'go-to' institution for training and development of global health professionals and leaders.

COVID-19 necessitated revised milestones and deliverables to this project whilst still upholding the key objectives and vision of this project, which are more relevant than ever given COVID-19 and attest to the relevance of the project. These include:

- *Providing a portfolio of flexible, accessible and field led global health programmes that bolster the knowledge and skill set of UK Global Health students as regional, national and international champions within a global workplace*
- *Ensuring the readiness of Public Health England (PHE) professionals for global health outbreaks*

Recruitment of Students in a Global Pandemic

Student recruitment activity for 2019/20 has been unprecedented in its unpredictability and need to adopt multiple strategies to retain existing students whilst focusing on a recruitment strategy to attract students for the September 2020 cohort.

LSTM's efforts in providing reassurance to prospective students have been predicated on a targeted communications strategy of Education's plans and readiness to welcome students onto programmes that are more relevant than ever to the Global Health agenda.

The inaugural cohort of the Global Health programme has completed its first year. This has allowed students from across the globe to access a world-leading qualification whilst not having to give up work or family commitments. Moreover, as the online delivery model has not been impacted by COVID-19, students have been able to continue to study flexibly through the pandemic.

LSTM continues to invest in a widening access and participation agenda through financial incentives such as scholarships for students both at local and international level. These include Global Health Future Leaders Scholarship Initiative, Merit Scholarships and North-West Progression Awards.

Graduation 2019

In December 2019, LSTM held its annual graduation ceremony at Liverpool's magnificent St George's Hall – its second graduation since being awarded degree awarding powers in 2017.

The ceremony accounted for the graduation of 337 students with a total of 112 present to receive certificates for their Masters, PhDs and Professional Diplomas in the Hall's Concert Room. A total of 57 students graduated from LSTM having received scholarship support for their studies.

LSTM alumna Professor Najla Al-Sonboli accepts her honorary degree via videolink from Yemen

As part of the ceremony LSTM conferred honorary Doctor of Science Degrees to LSTM's emeritus Professor Malcolm Molyneux and, in absentia, to alumna Professor Najla Al-Sonboli, who is based in Yemen.

Students & Courses

TOTAL TAUGHT STUDENTS 567
200 overseas, 367 HEU

142 RESEARCH STUDENTS 2019-20
72 overseas, 70 HEU

56 SHORT COURSES & MODULES
19 overseas, 37 HEU

24 ONLINE SHORT COURSES & MODULES
3 overseas, 21 HEU

122 MSc PROGRAMMES
41 overseas, 81 HEU

MSc Programme	Total	Overseas	HEU
MSc Humanitarian Studies (MHS)	12	1	11
MSc International Public Health (MIPH)	21	5	16
MIPH Humanitarian Assistance (MIPHHA)	3	0	3
MIPH Planning and Management (MIPHPM)	6	4	2
MIPH Sexual & Reproductive Health (SRH)	13	4	9
MSc Humanitarian Health Programme Management (HHPM)	2	2	0
MSc Tropical Disease Biology (TDB)	33	1	32
MSc Tropical and Infectious Diseases (MTID)	5	5	0
PgC Tropical And Infectious Diseases	1	0	1
MSc Tropical Paediatrics (MTP)	2	2	0
MSc Global Health (GH)	21	14	7
PgD Global Health	2	2	0
PgC Global Health	1	1	0

223 PROFESSIONAL DIPLOMAS
65 overseas, 158 HEU

Diploma	Total	Overseas	HEU
Diploma In Tropical Medicine & Hygiene (DTMH)	132	27	105
Diploma In Tropical Nursing (DTN)	48	23	25
Diploma In Humanitarian Assistance (DHA)	5	1	4
Diploma In Sexual And Reproductive Health (DSRH)	4	4	0
Diploma In Travel Health (DTH)	34	10	24

TOTAL OVERSEAS HEU (UK & EU)

Clinical Diagnostic Parasitology Laboratory (CDPL)

The CDPL offers a referral service for the identification of a wide range of human parasites from clinical specimens. The team in the CDPL examined around 3700 clinical samples throughout this year. These samples were referred to the CDPL from NHS trusts and private clinics from the UK as well as Europe. The laboratory provides diagnostic testing for a full range of human parasitic infections including some of those that LSTM specialises in such as malaria, filariasis, schistosomiasis, strongyloides and African trypanosomiasis.

Jayne Jones - Manager of CDPL

March 2020 brought major adjustments to the way we all work at LSTM. The CDPL adapted to this new way of working and has been able to offer a continued service at the same high standard that users have come to expect.

The lower rates of travel and the halting of some routine hospital clinics brought a slight reduction in the routine diagnostic parasitology work carried out at CDPL. This reduction in routine work enabled the CDPL to become heavily involved with the clinical aspects of COVID-19 research that is being carried out at LSTM. The COVID-19 research brought with it an opportunity for collaborations with teams around LSTM and outside of the organisation, showing how these teams can work together at very short notice under highly stressful circumstances.

September 2020 has seen the launch of a faecal gastro-intestinal PCR panel diagnostic test within CDPL. The introduction of this test is an exciting time for the unit as the test detects not only selected protozoa but also selected helminths within one multiplexed PCR. This test enables the CDPL to offer their users a highly sensitive and specific testing algorithm for faecal pathogens.

The launch of a new website on www.lstmed.ac.uk/cdpl significantly helped in CDPL's growing visibility. In addition, December 2019 brought continued success for the Clinical Diagnostic Parasitology Laboratory (CDPL) when UKAS accreditation to ISO15189:2012 International standard was maintained for all tests placed on scope of practice. This accreditation demonstrates the quality service provided by the CDPL to service users around the UK and globally. Service users are assured that they are receiving a quality service, provided by professional staff who are using the tests appropriate to their user demographic.

The CDPL is enrolled in four national external quality assurance schemes for faecal parasitology, blood parasitology, parasite serology and malaria rapid. A variety of samples are sent throughout the year for diagnosis. The CDPL continues to gain high marks for these four schemes.

The CDPL continues to integrate with LSTM Diagnostic research team led by Dr Emily Adams. This link provides the mechanism for validation and verification of molecular tests that will enhance the portfolio of the diagnostic testing performed within the CDPL. This link also strengthens the bonds between clinical work and research being performed within LSTM.

The CDPL continues to work with the Ministry of Defence (MOD) and is contracted to perform diagnostic work for another 3 to 5-year period within certain MOD personnel groups. This sees a very busy time for the CDPL staff when samples arrive annually in bulk.

The CDPL has been selected to be a reference laboratory for a global funded study called "Febrile Illness Evaluation in a Broad Range of Endemicities (FIEBRE) funded by the UK Government's Foreign, Commonwealth and Development Office (FCDO) . The FIEBRE study is carried out at five sites in Africa (Malawi, Mozambique, Zimbabwe) and Asia (Laos, Myanmar) and will focus on detecting infections that are treatable and/or preventable. The CDPL will receive samples from the FIEBRE study for external quality control (EQC) of microscopic diagnosis of malaria and other blood parasites from a sample of blood films prepared and read at each study site.

The team have worked tirelessly during this year and have adapted to a new way of working with each other under very difficult circumstances, I wish to pass on my thanks to the whole team for their support and hard work during this year.

Well Travelled Clinics

The travel business environment has been severely impacted by the global COVID-19 pandemic. This financial year has been a tale of two halves for Well Travelled Clinics (WTC).

Philippa Tubb - Managing Director WTC

The first six-months, August 2019 to January 2020, brought a slight increase in business with a year-end forecast of £1.115k turnover delivering a £56K net profit. The position changed significantly in the second half of the year due to the global pandemic, and our year end position was that income for the year fell short of budget by £294k at £821k (against the budget of £1,115k), with a net loss of £23K. This is a reduction of 24.8% on the sales for the last financial year.

The above year-end year position was considerably better that it could have been, due to the flexibility and hard work of the team. WTC responded quickly to the pandemic crisis, and our experienced staff have played a significant role in supporting both LSTM's and University of Liverpool's urgent public health COVID-19 research. In addition, WTC also supported the local NHS and PHE health care teams with their pandemic response. For more info on WTC's full contribution see the COVID-19 section of this annual report.

In addition to the staff redeployment measures, WTC utilised the government job retention scheme and furloughed a small number of staff during the pandemic to reduce pay costs and protect jobs. If these additional work activities had not taken place and no action had been taken to reduce the non-pay costs through the mixture of staff redeployment and furlough arrangements, the forecast would have been taken to a net loss of £203k.

Despite the global leisure travel industry downturn, specialist travel-related Occupational Health (OH) services continued to provide a significant contribution to our business performance and were essential to maintaining a level of income during the pandemic. WTC has managed to maintain all its existing corporate contracts and still carried out a significant amount of clinical activity. WTC remained open to essential workers at the Liverpool branch throughout the pandemic and carried out pre-employment vaccination and health screening for staff returning to the NHS and supported the deployment of healthcare workers, teachers and gas, oil & shipping personnel across the world.

Our Chester clinic has been temporarily closed from April-July and is likely to remain closed until the end of 2020.

The Professional Diploma in Travel Health which was set up by WTC, in conjunction with LSTM and the National Travel Health Network and Centre (NaTHNaC), has had a very successful year and a significant increase in cohort numbers, which has brought new income to both LSTM and WTC. Cohort Three of the Diploma started in May 2020 with 22 students, up on 5 for cohort one and 12 for cohort 2. The cohort is due to finish in December 2020.

WTC has provided a significant operational response to the COVID-19 pandemic. Our commercial agility and flexibility, together with the company's previous experience with vaccination and managing the healthcare needs of rapid humanitarian deployments, proved invaluable in delivering a swift and targeted response to the pandemic. It allowed us to seek other sources of income when the COVID pandemic is severely depressing the travel market.

Well Travelled Clinics continues to underpin the values of LSTM by making a difference to health and wellbeing and achieving and delivering through partnership.

2019/2020 AT A GLANCE

This year, Well Travelled Clinics:

SAW 6381 Patients

GAVE 7341 Vaccines

DISPENSED 32,872 Malaria Tablets

SOLD 1178 DEET insect repellents

and carried out:

- **49** Sickness and absence medicals
- **134** Pre deployment medical screenings for overseas workers
- **71** Oil and gas medicals
- **133** Sea farer medicals

Liverpool Insect Testing Establishment (LITE)

Liverpool Insect Testing Establishment (LITE) provides a professional testing service to commercial partners to accelerate the development of new public health insecticides and vector control tools.

Helen Williams - Head of LITE

Established by the Department of Vector Biology in 2011, and with IVCC funding, LITE employs a team of research technicians, study directors, research assistants and quality assurance specialists.

Housed in state-of-the-art and purpose-built facilities in the Liverpool Life Sciences Accelerator Building and maintains a wide range of fully characterised mosquito strains, selected to incorporate the key resistance mechanisms circulating in field populations of genera Aedes, Anopheles and Culex, for on-site laboratory testing.

In 2020 LITE has launched a new website (https://lite.lstmed.ac.uk/) and has become a provisional member of UK GLP compliance monitoring programme, with a pending implementation inspection before end of 2020 to become a full member.

LITE has also undergone an internal restructure with now offering a technical team for GLP studies and research team for non-GLP and also offering expert opinion and consultation service on any aspect or vector control processes or vector control tools.

LITE staff completing a WHO cone bioassay on cement surface with has been sprayed with an IRS vector control insecticide

IVCC

Dr Nick Hamon CEO of IVCC

IVCC's mission is to create and deliver a toolbox of disruptive vector control innovations for malaria eradication. The toolbox includes established product classes such as long-lasting insecticide treated bed nets (LLINs) and Indoor Residual Sprays (IRS), as well as new product classes such as Attractive Targeted Sugar Baits (ATSBs).

New insecticides

As part of its vector control product portfolio work, IVCC now has three new insecticide in development with novel modes of action. Broflanilide indoor residual spray (IRS), partnering with Mitsui Chemicals, is in development as VECTRON™ T500 and two additional novel active ingredients (AIs) are in development, one owned by IVCC and another by Syngenta. This has resulted in the need for new capabilities, including the establishment of a strategic partnership with Avient in China, which will support the formulation of LLIN masterbatches with 'as yet' non-registered chemistry. This capability allows IVCC to act as broker for exploring dual insecticide LLINs between manufacturers owning different AIs. At the same time, we are keeping the novel AI pipeline open, continuing to monitor all intellectual property and evaluate candidate compounds with suitable entomological, toxicological and physical profiles.

Outdoor transmission

To address outdoor transmission, the new Attractive Targeted Sugar Bait (ATSB®) station has passed the non-inferiority test and the design is being fine-tuned for durability. Entomological data looks encouraging, leading to more evaluations in 2020 and 2021 and a revised epidemiology plan aimed at triggering field studies in 2022.

Improved IRS

We are investigating the technical feasibility of long- lasting IRS through improved bioavailability on porous surfaces and improved IRS application and training efficiency, as well as exploring vector control product delivery through new business models. We have also started a major Net Design Initiative with the objective of delivering the same efficacy with less insecticide, assessing fabric and net construction with the goal of making dual active ingredient nets as cost-effective as possible.

Good Laboratory Practice (GLP) accreditation has been granted for two African testing sites, with an additional four awaiting SANAS inspections. We are also building expertise and capacity at a field-testing site in Papa New Guinea to assess new vector control tools for the Indo-Pacific region. Our own Liverpool Insect Testing Establishment (LITE) has also achieved provisional GLP certification.

The IVCC-led next generation IRS (NgenIRS) initiative closed in 2019, having achieved its goal of establishing a sustainable, growing and competitive market for longer lasting and resistance-breaking insecticides for Indoor Residual Spraying. The NgenIRS team, led by IVCC and made up of colleagues from PATH and Abt Associates, worked in partnership with 16 malaria control programmes and the US President's Malaria Initiative (PMI), and three insecticide manufacturers to increase the use of next generation IRS products. Today, there are three new insecticide products for countries to choose from and more countries are introducing or re-introducing IRS. An external evaluation reported that there has been a substantial health impact that would not have materialised in the absence of the NgenIRS project. NgenIRS has enabled malaria control programmes to protect an additional 71 million people between 2016 -2019 helping avert g an additional 4.8 million malaria cases and 14,314 deaths. It is projected that this impact will more than double over the next five years. IVCC is now working with four countries (DRC, Ghana, Nigeria and Uganda) to implement a new strategy to expand distribution through private sector partnerships based on excellent results working with mining companies, NGOs and mission hospitals under NgenIRS.

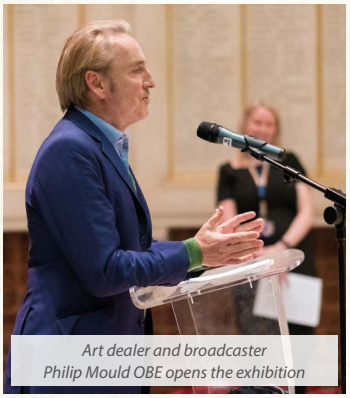
IVCC now leads a partnership on the New Nets Project (NNP) which is piloting nets treated with new insecticide combinations. This consortium of partners seeks to establish the evidence needed to support a WHO policy recommendation. Since its inception in 2018, IVCC has established partnerships with 2 net manufacturers (BASF and DCT) and 10 national malaria programs to conduct a Randomized Control Trial (RCT), evidence pilots to measure epidemiological and entomological impact and operational pilots to develop best practice guidelines for the introduction of multi-product campaigns including dual-AI nets. The RCT was launched in March 2020 and new nets have already been distributed in Burkina Faso, Mali, Mozambique and Rwanda.

We are making progress on selecting a portfolio of vector control products available for South East Asia, targeting Anopheles and Aedes with tools developed for Africa/ Malaria. The focus is on suitability for urban environment and migrating populations (outdoor protection), addressing regional access and regulatory hurdles and modelling to predict the impact of novel vector control interventions in selected areas of the Indo-Pacific region. We are also investing in rapid assessment and adoption of vector control tools in PNG (Project NATNAT) with field and semi-field-testing capabilities and effective bite prevention tools (Project BITE) in forest packs amongst forest workers.

IVCC has entered a challenging transition period between closing current grants and opening new ones, allowing us to tighten alignment with malaria needs and funder strategies. However, IVCC has demonstrated extreme resilience under pressure. What we need now is the continued long-term commitment from funders to sustain and accelerate progress.

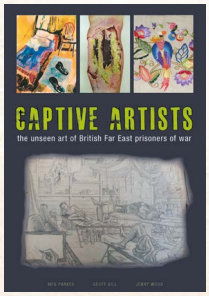
Far East Prisoners of War (FEPOW)

LSTM's involvement with ex-Far East prisoners of war and their descendants is the longest collaboration in its history. On 24 October 2019 LSTM's much-anticipated 'Secret Art of Survival' exhibition was officially opened by art historian Philip Mould at Liverpool's Victoria Gallery & Museum (VG&M).



Art dealer and broadcaster Philip Mould OBE opens the exhibition

Organised in partnership with VG&M, it was funded by a grant from the Lottery Heritage Fund, Trusts and private donors and was due to run until 20 June 2020. The culmination of a seven-year research investigation and four years in the planning, the 'Secret Art of Survival' showcased previously unseen artwork created secretly during captivity by 40 of the 69 British servicemen uncovered by the LSTM investigation. All had been Far East prisoners of war (FEPOW) held in camps throughout southeast Asia and the Far East.



In early December, *Captive Artists, the unseen art of British Far East prisoners of war,* was published by Palatine Books. Co-authored by LSTM's Meg Parkes and Geoff Gill, it is the third volume in a series based on their FEPOW research studies, for which they collaborated with Jenny Wood, former senior art curator at the Imperial War Museum. *Captive Artists* documents all 69 artists revealed by the investigation; during the exhibition another three artists were discovered, bringing the total to date to 72. In late February 2020, Philip Mould hosted a mini exhibition and book signing at his Pall Mall gallery in London.

An associated 'FEPOW Education Project' that began 2018 and ran throughout the exhibition, involved Merseyside and Cheshire schools as well as the public. Due to the pandemic the exhibition was forced to close after just four months. By then over 12,000 visitors had seen the exhibition.

One of the legacies of the exhibition was the re-development of LSTM's Captive Memories website – re-launched to mark the 75th anniversary of Victory over Japan (VJ) day on 15 August 2020. It features a virtual tour of the galleries, downloadable Resource Packs for educators and FEPOW families, information about the books and more artwork.

Another casualty of the pandemic was the seventh international Researching FEPOW History conference due to take place at LSTM in June. Co-hosted by LSTM and the Researching FEPOW History Group, this has been postponed until June 2022.

VJ Day 75

In the lead up to VJ Day, Meg Parkes worked with the BBC supplying FEPOW artwork for use in their national commemoration programmes.

Meg Parkes and Geoff Gill were also asked to advise on, and supply archive material for, a VJ Day75 Service of Remembrance and Thanksgiving at Liverpool Parish Church (Our Lady and St Nicholas). Due to the COVID-19 pandemic the service had to be held virtually. Meg Parkes gave an interview for BBC Radio Newcastle and Geoff Gill took part in an online discussion about the Burma Railway, organised by the National Army Museum. He was joined by the author and historian Julie Summers, granddaughter of Territorial Army officer Colonel Philip Toosey, a former FEPOW. A Liverpool businessman, Philip Toosey later became the first President of LSTM.

Medical History Research

Meg Parkes and Geoff Gill are linking with Imperial College London concerning an enquiry into anaesthetic practice on the Thai-Burma Railway as well as with Professor Dennis Shanks in Australia, who is investigating factors affecting malaria and cholera mortality amongst FEPOWs.

Geoff Gill is currently co-supervising a PhD student at the Department of History in the University of Liverpool who is investigating sea transport of FEPOWs by the Japanese.

Commemorating FEPOW Repatriation

To mark the 75th anniversary of the FEPOW repatriation to Britain, through Liverpool and Southampton during the autumn of 1945, Meg Parkes has been consulting with the 'FEPOW75' team on the development of a new website to highlight the occasion.

This autumn also marks the 75th anniversary of the start of LSTM's involvement with FEPOW, when the first men presented for medical help – many with relapses of malaria and amoebic dysentery. Later clinical and research work was to uncover other health problems related to captivity – notably chronic *Strongyloides* worm infections, neurological disorders related to B vitamin deficiencies, and in over one-third, post-traumatic stress disorder (PTSD). This research is documented on the Captive Memories website.

LSTM in the Media

LSTM's media output has been dominated by COVID-19, not only in terms of LSTM and cross campus research being pivoted to work on the virus, but also with LSTM's experts being asked for comment on government response, prevention advice and the research of other groups as well as its own.

Over 140 news items and press releases were published during the past academic year, resulting in over 10,000 mentions in the online, broadcast and print media with potential audiences for some stories reaching the hundreds of millions.

From the very start of 2020, LSTM's experts were called to talk to the media about the new outbreak. This included Director, Professor David Lalloo, who also took part in ITV's flagship news magazine programme, Tonight.

ITV Tonight interviewing Professor David Lalloo

It was not Tonight's only visit to LSTM, with Dr Andrea Collins also appearing in an episode looking at the use of masks and gloves in the community and the impact on respiratory infections and NHS readiness. Throughout 2020 LSTM experts appeared on local, regional and national broadcast media and in the print media, providing advice and guidance offering reassurance to the public.

LSTM has worked with the Science Media Centre throughout the pandemic. An example is Dr Tom Wingfield who has been quoted regularly in multiple national and international media outlets. He took part in an episode of Any Questions on BBC Radio 4, was named as one of the scientists who had reassured and guided the UK public through the pandemic by the Observer and took part in a number of fact checkers for the BBC.

As one of the UK's respected voices on diagnostics for COVID, LSTM's Dr Emily Adams appeared across the media on Newsnight, Channel Four News, The One Show and Sky News, as well as the Guardian, discussing LSTM's work to assessing and validating antigen and antibody tests; point of care tests that could be used overseas as well as less intrusive saliva tests.

LSTM's work in relation to vaccine development also hit the headlines when LSTM was named as a phase III site for the Oxford Vaccine trial. Dr Helen Hill and Dr Andrea Collins appeared numerous times on regional news programmes with updates at every stage of recruitment, screening and vaccination.

The head of the vaccine team, Professor Daniela Ferreira, was also featured in multiple media outlets, including in her home country of Brazil with a special edition of the programme Mulheres Fantasticas celebrating her life and career. Presented on the national TV channel TV Globo, the programme, which has aired on a Sunday evening for the last 45 years, was watched by up to 183 million Brazilians. She appeared on numerous news programmes and was interviewed by one of the country's most famous interviewers, Pedro Bial, as well as being featured in several national newspapers.

Mulheres Fantasticas celebrating the life and career of Professor Daniela Ferreira

Coping with long COVID

LSTM's Professor Paul Garner developed COVID-19 in mid-March and was badly affected with, what is now termed, long-COVID.

He has been raising awareness of the varied symptoms and is advocating for better support. Professor Garner wrote five opinion blogs for the British Medical Journal (BMJ) as well as being interviewed by local, regional, national and international media. He was also participating in a WHO webinar, chaired by its DG Dr Tedros Adhanom Ghebreyesus, in which Professor Garner was calling for better recognition and of the disease and assistance in coping "with the constantly shifting, bizarre symptoms, and their unpredictable course."

Fundraising

This has been a transformational year for the philanthropic sector as the emergence of COVID-19 prompted unprecedented levels of philanthropy across the world.

Karen Brady - Director of Fundraising

LSTM launched its COVID-19 Response and Resilience Fund to support research and colleagues involved in the frontline preparations for COVID-19 in Malawi, which, like many of the countries in which LSTM works, was under-resourced and unprepared for the pandemic.

So far, the fund has raised £197,039 from 623 donors. Some 160 LSTM staff members took part in 'Race to Malawi', a sponsored virtual event which allowed teams to log their one hour exercise during lockdown and to virtually race to Blantyre from Liverpool, in itself raising more than £15,000.

RACE TO MALAWI

Registered with FUNDRAISING REGULATOR

Focus now is on the global role LSTM will play in the future and the impact of COVID-19 on global health and the countries in which we work. A bold new fundraising campaign has been developed, supporting LSTM's growth as a global organisation and dedicated to strengthening scientific capacity in the Global South. This recognises the opportunity for philanthropy to act as a bridge, connecting our international network of partners, alumni and staff, with significant investment in Liverpool as a world-leading centre for infection R&D. The campaign will support three core aims: developing scientific leadership in the Global South; catalysing innovative new solutions for health challenges facing humanity; and training the future global health workforce.

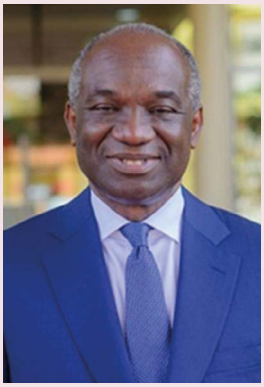
Philanthropic support has also assisted LSTM's rapid transition to online and blended teaching, providing scholarships for a number of students and vital hardship support.

LSTM also launched the FEPOW exhibition Captive Memories, funded by the Heritage Lottery Fund and LSTM's first crowdfunding appeal. The exhibition was due to run until June 2020 but because of COVID-19, a virtual 360 degree interactive tour was created, extending the life of the project.

To find out how to get involved visit www.lstmed.ac.uk/support-us

Alumni & Friends

We are incredibly proud of all our global alumni and friends who are working on the frontline to provide much needed healthcare and other essential services for their communities. Many will be facing the biggest challenges in their careers and making significant sacrifices to ensure we win in the battle against COVID-19.



LSTM alumnus Dr Asamoah Baah photo credit Kobby Blay

Among our alumni and friend's community are leading health experts, medics, midwives, innovators, humanitarians, and so much more, all of whom are playing vital roles in their communities.

Alumnus Dr Anarfi Asamoa-Baah (MSc Community Health, 1989), former Deputy Director-General of the World Health Organisation has been appointed by the Ghanaian President to lead his countries response to COVID-19.

Key Alumni Stats

TOTAL NUMBER OF CONTACTABLE ALUMNI 2273

ALUMINI FROM 93 COUNTRIES

COUNTRIES WITH HIGHEST NUMBER OF ALUMNI:

UK	CANADA	USA
KENYA	NIGERIA	

Estates

Throughout the last academic year, Estates in collaboration with research groups, education and other professional service teams has supported all manner of activities, both in the UK and overseas, ranging from travel safety and security, to multimillion-pound capital projects. Estates also provided support during the COVID-19 pandemic to ensure that LSTM's global operations continued in a safe and secure manner whilst continuing to deliver to its programme of works.

Safety and Laboratory Management

The safety and laboratory management team continued to provide effective support across all LSTM activities both on campus and abroad, identifying and minimizing potential risks and safeguarding LSTM's reputation.

In addition to providing pragmatic advice the team monitor the effectiveness of policy and process by undertaking a programme of monitoring inspections and audits. Dr David Simpkin, Head of Health and Biological Safety, undertook a safety audit of the MLW campus and filed stations in Malawi during July and continues to liaise with MLW Safety Officer and Management.

The Laboratory Management Team ensured that statutory testing was completed on time to support the safe working with pathogens within LSTM. At the beginning of the COVID pandemic a review of the Containment Laboratories was undertaken, and additional laboratories brought up the CL3 standard to be available for work on COVID related projects. Full training was given prior to allowing staff and students to work within the CL3 laboratories, and additional workers were training in response to the need for the COVID projects.

Statutory risk assessments and notifications to HSE for work with biological agents (hazardous pathogens and GMOs) is undertaken by the Safety Team and LSTM Biological Safety Committee.

The structure of the Health, Safety and Environment Committee is being reviewed to fit with the new committee structure, thus ensuring an effective risk-based approach to all LSTM activities. Work with biological agents (pathogens and GMOs) will continue to be overseen by the Biological Safety Committee. The Travel Team, working closely with the Travel Overseas Working Group Travel, and with support from specialist service providers, continues to oversee and monitor the risks associated with staff, student, consultant and volunteers travelling overseas on business.

Environmental Management

LSTM, being fully committed to operating in an environmentally friendly and sustainable manner, has introduced a new Environmental Policy.

To support the implementation of the Policy all refurbishment projects incorporate environmental and/or energy improvements whenever practicable, such as replacement windows, improved roof insulation, LED lighting, improved BMS controls etc.

LSTM now recycles at source and the following demonstrates our continuous improvement in this area.

- *Oct 17-18 LSTM were **recycling about 13% of our annual waste**.*
- *Oct 18-19 LSTM were **recycling about 22% of our annual waste** after we introduced dry mixed recycling euro bins for cardboard and paper only.*
- *Oct 19-20 LSTM were **recycling about 28% of our waste** after introducing recycling at source (bins internally), dry mixed recycling for all waste i.e. cardboard-paper-plastics-cans etc.*
- *March 20-Oct 20 LSTM **recycled 30% of the total tonnage of waste for that period.***

Energy is LSTM's second highest area of spend. Over the last 6 months Estates worked closely with LSTM's Procurement Team focusing on purchasing sustainable energy that represents best value for money via a flexible purchasing model.

This switch has allowed LSTM to move from using brown energy to using certifiable green electric energy that is audited through the Carbon Trust.

Capital Works

As a result of the COVID-19 pandemic there has been a slowdown in the delivery of capital projects.

In response to the pandemic, Estates worked closely with our clinical research teams and delivered two dedicated research centres in the Accelerator building to undertake clinical trials in relation to testing a COVID-19 vaccine. These were delivered to a very tight programme whilst ensuring that the stringent governance requirements of the trials were adhered to.

A planning application has been submitted to redevelop Pembroke House which will comprise the conversion and extension of the building to provide additional learning, meeting and lecture space to complement and enhance the current offer in other buildings within the LSTM campus.

The brief is to bring forward a high-quality development of the site which when completed will deliver:

- *An updated and more welcoming street frontage*
- *A scheme that brings back an unused building back into use and enhances its original quality*
- *Additional learning, lecture and meeting space*

Malawi

The Clinical Research Excellence and Training Open Resource (CREATOR) building project is currently at RIBA Stage 4b (Final Technical Design : Construction Packages) and the preparation of final design and construction packages for combined architecture, structural/civil engineering together with mechanical and electrical designs is being developed.

In addition to the CREATOR project the Estates team, in collaboration with the MLW team and the African project teams have designed, competitively tendered and awarded a design and build contract to a Malawian based main contractor to construct a new building to house research critical freezer archives.

This separate project was identified as a critical business requirement and is being delivered alongside the CREATOR project whilst having minimal impact on the main CREATOR programme.

COVID-19 travel restrictions have led to innovative methods in relation to delivering both projects.

Render of the CREATOR building in Blantyre, Malawi

People and Culture

COVID-19 has posed unprecedented challenges for LSTM and its staff and we will continue to feel its effects in the coming years. Overall, 50 colleagues were placed on furlough: fewer than 5 of these have left LSTM, though none as a direct consequence of this. Over 30 colleagues were seconded to support the health response in NHS or for Public Health England.

Samantha Airey - Global Director of Human Resources

The wellbeing of our colleagues has been at the heart of our organisational response, through HR support to colleagues in Liverpool and outside the UK, a wellbeing hub with information and resources, training on resilience and managing remote teams. We provided guidance and training for all staff returning to on-site working as lockdown restrictions eased and created one of the first multi-factorial COVID risk assessments in the higher education sector, developed in conjunction with LSTM clinicians and a group of GPs.

In May, we undertook a short pulse survey to determine impact of COVID-19: over 60% of colleagues who responded rated wellbeing as good or very good and 80% felt supported by their managers.

We recognise the potential long-term impact of COVID-19 on productivity and progression and we are putting steps in place to ensure this is taken account of in performance development conversations and promotion processes. We will support colleagues whose fixed term contracts are affected. An automatic 3-month extension to the length of the Career track programme was also implemented.

Culture and Engagement

Following colleague feedback, the HR team undertook a full review of all fixed-term contracts and as a result of this, over 90 people transferred to permanent contracts throughout the year.

Whilst we continue to operate within the parameters of fixed term funding in many cases, we are committed to using fixed term contracts only where necessary.

We have sought to engage with colleagues on important issues: early in the year, we held townhall meetings to discuss work-life balance and flexible working. Increased homeworking due to COVID-19 has given LSTM and our colleagues a new perspective on agile working, and as a result a working group has been set up to create a long-term framework for institutional and individual benefit.

Across LSTM, working groups were created consisting of staff volunteers tackling key issues affecting LSTM. The problems requiring solutions were based on issues that emerged at an LSTM-wide conference in March 2019. Three working groups looked at LSTM's carbon footprint; Engaging with the local community and issues affecting LGBTQ staff at LSTM.

Volunteers came forward through initial townhall meetings to kick off each discussion and working groups explored and raised the profile of their topic area and identified outcomes. The work led to an analysis of carbon footprint t by air travel, the creation of a work experience initiative and the establishment of the LGBTQ+ staff network.

Career Progression

LSTM is committed to extending opportunities for career progression and development. In the past year we have signed up to the Concordat on Researcher Development, an international agreement between funders and employers to support research careers in Higher Education. We will implement our plans widely across LSTM, not only the research cohort. We are also adapting internal processes such as recruitment and promotion to ensure they are in line with the DORA (San Francisco Declaration on Research Assessment) principles, and requirements, which are intended to improve the way in which research outputs are evaluated.

We have reviewed the criteria and process for promotion to academic roles, creating teaching only and research only routes to progression and have commenced work on a career development framework for our Programme Management roles. Our technician colleagues are implementing the Technician Commitment action plan. We will also be looking at promotion and development opportunities in professional services roles. We are working with managers to develop a more systematic approach identifying, supporting and developing our talented colleagues.

Our Career Track programme continues to challenge and support our academic leaders of the future. In 2019-20, Dr Joanna Raven successfully completed the programme and the number of candidates increased to 10. We have facilitated access to Career Track for colleagues from a non-traditional academic route.

Apprenticeship qualification have been offered to all staff and 6 colleagues have started studying to progress their careers in subjects such as Finance, HR, Health & Safety and Leadership.

Safeguarding and Freedom to Speak Up

We continue to recognise our important role in safeguarding vulnerable adults and students. Safeguarding training is included in our corporate induction and all colleagues are required to complete our online Introduction to Safeguarding course as well as sign our code of conduct.

Our Freedom to Speak Up reporting initiative continues to be used to raise issues relating to safeguarding and concerns about staff and student conduct, behaviour or wellbeing. Last year, we received 10 reports overall, all of which were investigated, with support packages in place for those affected. Further information relating to racism and racial harassment has been added to the system to raise awareness and encourage reporting of these issues.

Human Resources (HR)

2019-20 has been a year of change for the HR team with a new structure being implemented, including specialist Global Reward, Learning & Development and Inclusion, Diversity & Engagement roles.

These changes further support LSTM's commitment to be an employer of choice and an organisational culture which welcomes all, respects and values differences and ensures that everyone can fully participate in employment, research and study.

Inclusion and Diversity

The current Equality & Diversity Strategy 2017-2020 is coming to an end, giving us the opportunity to reflect on successes and areas for improvement against the themes of leadership and governance, student experience, employment and procurement.

2020-2021 will provide us with an opportunity to redefine our goals, ensuring that our action is directed towards a common aim of inclusion by design.

In May 2020, events across society again highlighted ongoing inequality both in the UK and across the globe. We have been rightfully challenged as an institution on the focus we have previously placed on race equality work internally, and we have been moved by this call to action. In close consultation with the BAME staff network and other stakeholders, we will institute a Taskforce to understand internal and external barriers to equality, make recommendations for action in order to further the overall goal of making LSTM a truly inclusive community.

Other areas of focus have been:

- *Working to reduce bias in our recruitment processes using anonymous shortlisting and gender-decoding software.*
- *Working on the 'building blocks' of inclusion – improving our Governance structures, data capture and Equality Impact Assessment processes to ensure that interventions are evidence-based.*
- *Development of a Dignity at Work policy, reinforcing a culture of fairness and mutual respect.*

LSTM's Gender Pay Gap has increased marginally between 2018 and 2019 – a reflection of the gender imbalance at senior levels. Our institutional Athena SWAN work aims to address this with a long-term action plan for career development.

Athena SWAN

LSTM currently holds two faculty level Bronze Athena SWAN awards and an institutional level Bronze award. Our submission for an institutional level Silver award in 2019 was unsuccessful.

Following the decision of the previous Chair to stand down, an open recruitment process led to the appointment of a new Chair. COVID-19 has created exceptionally challenging circumstances across Higher Education. In recognition of this, Advance HE (the Athena SWAN awarding body) has offered all institutions a 12-month extension to their current awards. LSTM has accepted this extension and will submit its institutional level bid for a Silver award in April 2022, having taken the opportunity to undertake a more thorough self-assessment. Dr Eve Worrall has been appointed as the Chair of the Athena Swan SAT, to take forward our commitment to gender equality.

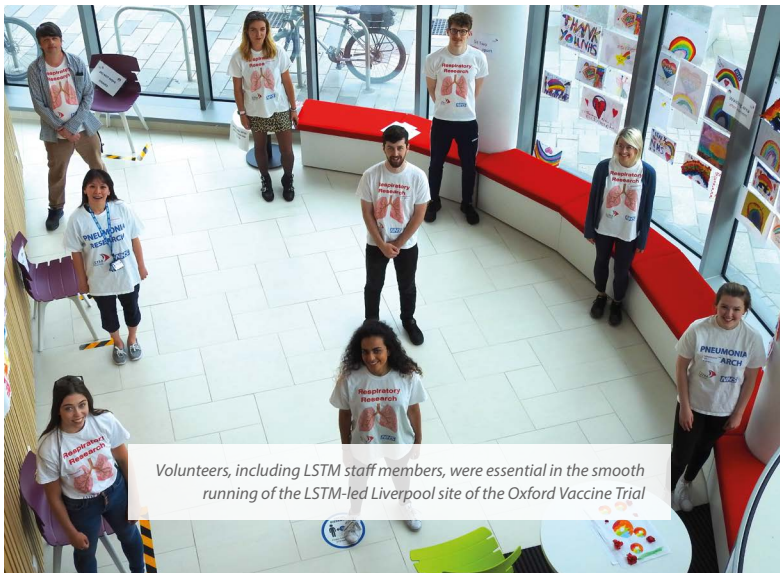
Staff Led Networks

2019-20 has also seen the creation of two staff-led networks, who we look forward to working closely with to further embed inclusivity into LSTM's culture:

LGBTQ+ Network
We are a fully inclusive staff and student network, that is grassroots-led, and aims to work with LSTM to create positive changes for LGBTQ+ staff and students. We plan a wide variety of inclusive social events, act as an informal point of contact for support or consultation and have representation on LSTM's Equality & Diversity Committee. Since establishing the network, we have improved LGBTQ+ visibility across LSTM through the creation of designated intranet/internet page and the provision of free access to rainbow lanyards.

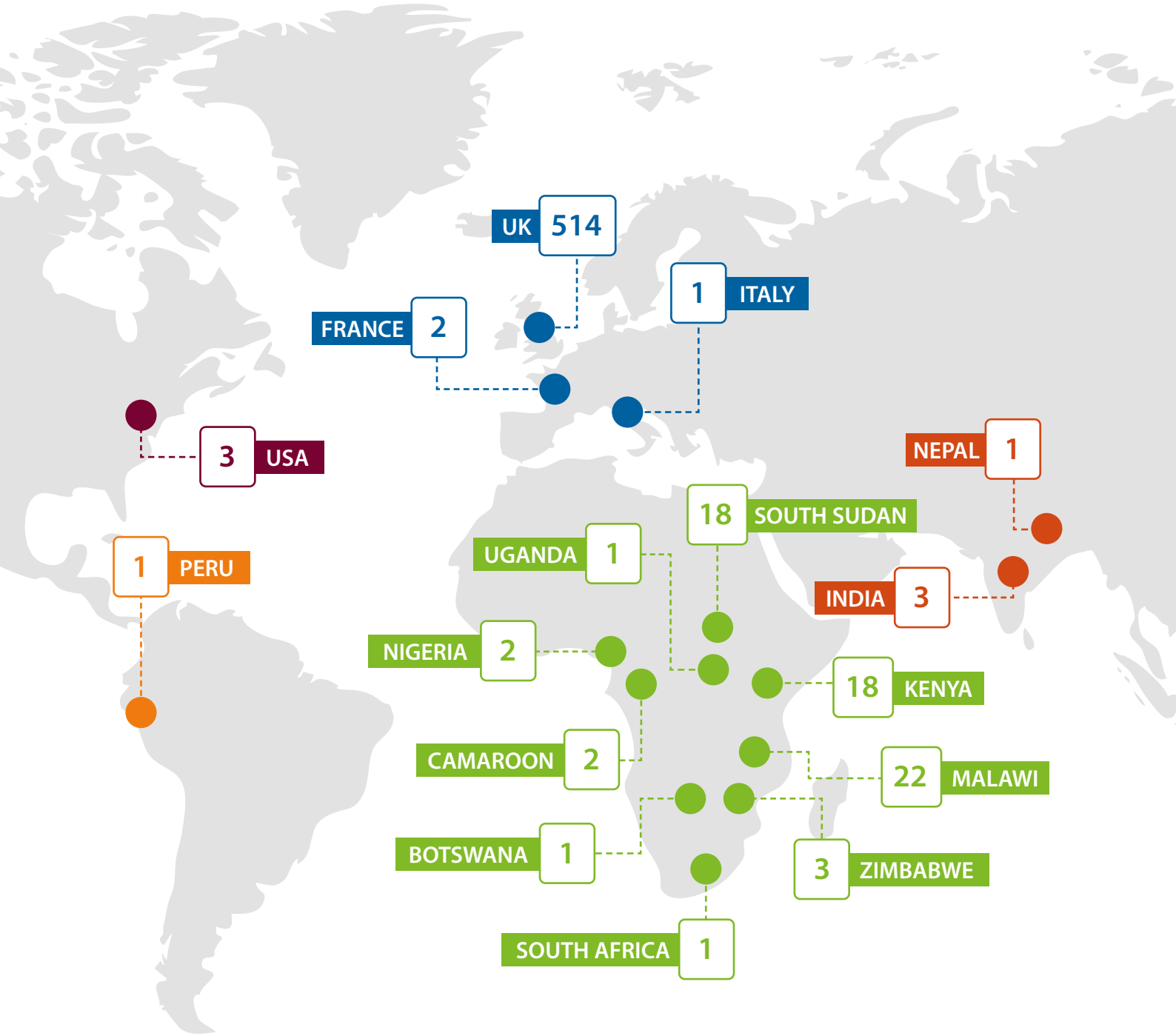
We are currently working to ensure the rights of LGBTQ+ staff and students traveling to non-inclusive countries are considered in travel policies and encouraging the use of pronouns throughout LSTM. In 2021 we look forward to celebrating LGBTQ+ history month and Liverpool Pride in the summer.

BAME Staff Network
We were founded by an active core group of staff in February 2020 and have been eager to expand our membership so that we can be representative of BAME staff voices from across LSTM. Our aim is to support all UK and International staff that identify as BAME by raising awareness of race equality across LSTM, and to promote the creation of a working and learning environment in which all staff, students, stakeholders, and visitors feel welcome, comfortable, respected and valued.



Volunteers, including LSTM staff members, were essential in the smooth running of the LSTM-led Liverpool site of the Oxford Vaccine Trial

Staff Overview



Total number of staff **593**

Numbers as per 1 September 2020 - excluding IVCC & WTC staff members

Stats include all LSTM staff on UK and respective national contracts

Governance and Business Continuity Management

Sadly, the Liverpool City Region saw a devastating impact from COVID-19 and ongoing restrictions continued to impact many lives and activities across LSTM throughout the 19/20 reporting period. Internationally, the situation was very varied with countries in Asia, such as India, being badly affected by the pandemic but Africa experiencing much lower rates of infection than anticipated. Strong governance under times of organisational challenge is vitally important to ensure that the Board of Trustees seek assurances from the appropriate areas.

This pandemic has given rise to greater innovation and resilience and it is appreciated how the entire LSTM staff team have worked to respond, protect and safeguard their beneficiaries.

Over the summer the Board of Trustees received updates from LSTM on Teaching and Research activity on-site where guidance and regulations permitted. LSTM's teaching continued, invariably with blended online and face-to-face methods, which ensured the next generation of scientists to receive a quality experience. The Board noted the exceptional level of operational response that was required by all teaching and learning staff to meet the needs of students and the continued adaptability of the Education Department to ensure constant high quality teaching delivery.

The Board of Trustees also noted the organisational expertise, adaptability and the high profile given to LSTM's research to respond so rapidly. The work with the Oxford Vaccine trial along with the diagnostic work meant that LSTM was able to demonstrate that whilst it predominantly works overseas, the work it does is equally relevant in the UK when it comes to infectious and communicable disease research. Reinforcing this message about the importance of infectious disease research and why Liverpool and LSTM specifically are the front-runners in this arena was never timelier.

Business continuity management

The Board of Trustees has continued to work closely with the Director and LSTM's senior management team during COVID-19, receiving regular updates regarding emergency response and continuity planning.

LSTM Business Continuity Management Framework (BCM)

From early March 2020, LSTM set out to monitor and implement their continuity plans to ensure that staff was able to revert to home working but also to continue to provide access to a safe COVID-secure working environment. The Board of Trustees regularly received updates and assurance from the senior team on the implementation of government COVID-19 recommendations and particular gratitude was noted for academic and professional staff and those students who continued to attend LSTM throughout stages of the pandemic.

The LSTM Emergency Management Team continued to meet at least weekly to plan and respond to relevant COVID related events and to ensure that communication with staff was prioritised. The team implemented several key procedures and published guidance for staff including the LSTM COVID-19 Exit Strategy and Action Plan; Working-Safely guidance; Return to Campus guidance; Individual Risk Assessment and an Outbreak Management and Control plan. The Board of Trustees has noted that LSTM has made good use of its strong technology infrastructure to continue to communicate with staff, either through the regular emails, Microsoft Teams "LSTM Connects" or online via the School Staff Forum.

Board of trustees membership

The impact of Coronavirus has meant that Board meetings went online from the early part of 2020 onwards. LSTM's Board of Trustees also continued to meet remotely to support ongoing business and complete the interview and appointment process for the next Chair of the Board of Trustees. LSTM is very grateful for Ms Sue Russell for stepping into the Acting Chair role during this period and for Mr Jeremy Lefroy to take on the role of Vice Chair.

Board champions continued to provide guidance and support in each area of Equality and Diversity, PREVENT duty, GDPR and Safeguarding and they are recognised for their exceptional contributions made. The Chair gave thanks to Rebecca (Becky) Nightingale, who was attending her last Board Meeting as the Student representative. Becky joined the Board in July 2017 and was an active and committed member who brought knowledge of the student perspective without losing sight of her role as a governing member. The Board was also delighted to appoint and welcome Lynn Elliot as the new Student Trustee within 19/20.

Vice presidents

The Board of Trustees at LSTM wish to thank current and former Vice Presidents for their continued support, advice, and enthusiastic representation. The Vice Presidents were joined this year by former Chair of LSTM, James Ross OBE, after a proposal to invite him was accepted. The Board of Trustees also extended their deep condolences to the family of Michael Oglesby CBE, who was the founder of Bruntwood and a philanthropist for LSTM, supporting LSTM students from low and middle-income countries through offering scholarships.

Officers 2019/20

PATRON

Her Royal Highness The Princess Royal GCVO

PRESIDENT

Sir Richard Evans CBE

CHAIR

Sue Russell – *acting*

DIRECTOR

Professor David Lalloo MB BS MD FRCP FFTM RCPS (Glasg)

VICE-PRESIDENTS

Professor The Lord Alton of Liverpool KCSG KCMCO

Nicholas Barber CBE

Nicholas Baring CBE LLD

Jennifer Borden OBE

Sir Arnold Burgen FRCP FRS

Baroness Cox of Queensbury FRCN

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Jesper Kjaedegaard

Stephen Mogford

Dame Lorna Muirhead DBE

Dame Jane Newell DBE JP

The Rt Hon Sir Stephen O'Brien PC KBE

Michael Oglesby CBE – *Passed away November 2019*

Dr John E Roberts CBE

James Ross OBE – *Joined August 2020*

Dr James Smith CBE

Sir Crispin Tickell GCMG KCVO

Sir Mark Walport FRS FMedSci

BOARD OF TRUSTEES 2019/20

CHAIR

Sue Russell – *acting from March 2020*

James Ross OBE – *stepped down March 2020*

HON TREASURER

John O'Brien Bcomm FCA

TRUSTEES

Mark Allanson

Joanne Dodd BA ACA

Lynne Elliott MPhil MBA PGCE BSc (Hons) – *Joined 1 Aug 2020*

Professor David Lalloo MB BS MD FRCP FFTM RCPS (Glasg)

Jeremy Lefroy – *Vice Chair*

Dr Julian Lob-Levyt CBE

Rebecca Nightingale MSc MRes BSc

Professor Nyovani Madise PhD DSc

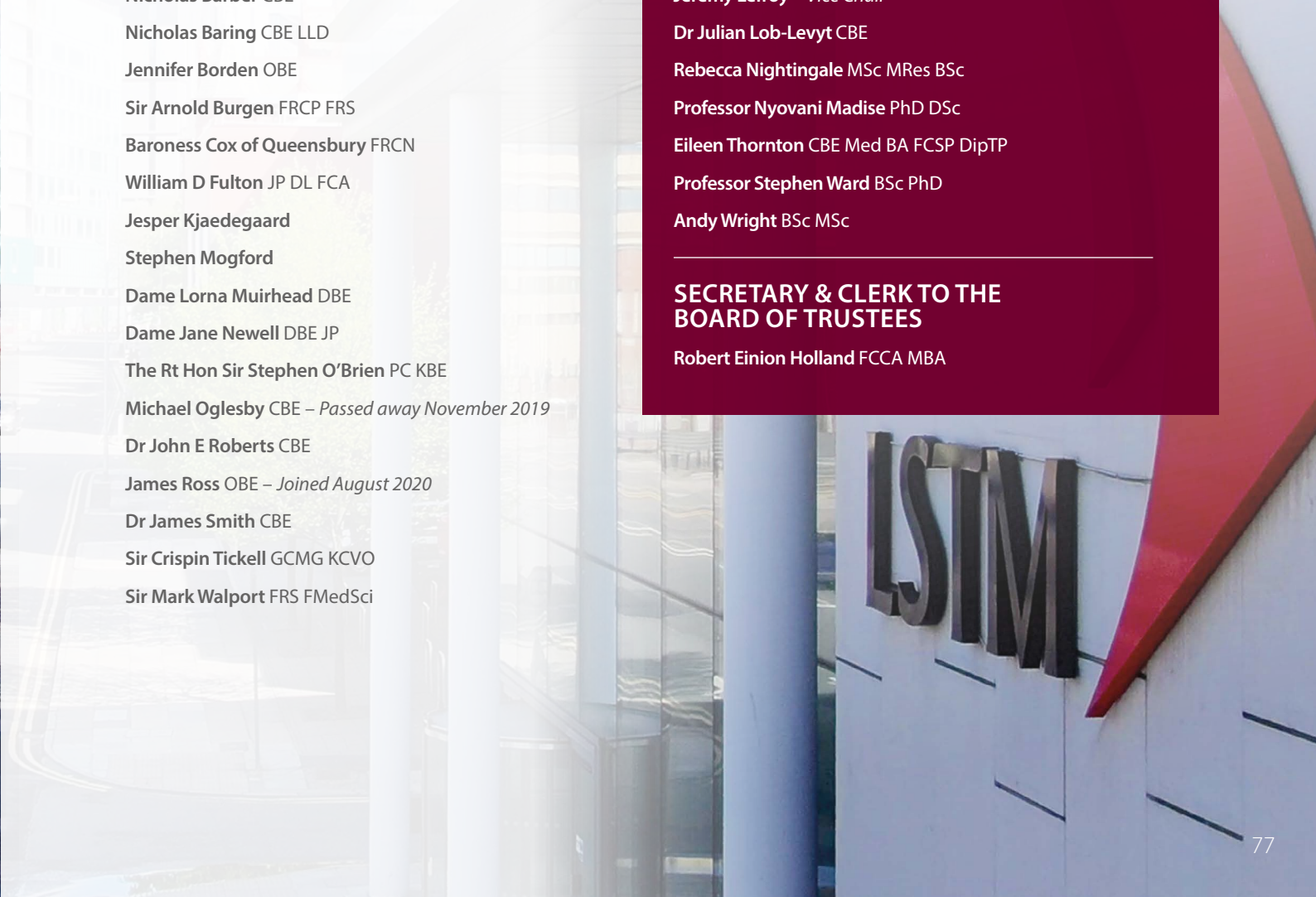
Eileen Thornton CBE Med BA FCSP DipTP

Professor Stephen Ward BSc PhD

Andy Wright BSc MSc

SECRETARY & CLERK TO THE BOARD OF TRUSTEES

Robert Einion Holland FCCA MBA



Awards and Honours

Dr Aitor Casas Sanchez receives his award

In November 2019, Dr Aitor Casas Sanchez (pictured) was awarded the 'Certificate of Scientific Excellence' by the American Committee of Molecular, Cellular, and Immunoparasitology (ACMCIP) as part of the American Society of Tropical Medicine and Hygiene (ASTMH).

LSTM's Dr Mary McCauley, Hannah McCauley and Kirsty Lowe won an award and commendations at the International Maternity Expo awards ceremony in London in November 2019. The awards were established to recognise the 'very finest examples of maternity care, research and best practice'.

LSTM's Emeritus Professor David Molyneux was appointed as Companion to the Most Distinguished Order of Saint Michael and Saint George (CMG) in the Queen's New Year's Honours list, for services to 'Controlling Neglected Tropical Diseases'.

Dr Webster Mavhu

LSTM's Senior Lecturer, Dr Webster Mavhu, has been awarded a 2020 New Voices Fellowship at the Aspen Institute (USA) – a programme which equips experts from developing countries to play a more powerful role as advocates and policymakers in the global development discussion.

In April, Dr Stuart Ainsworth from LSTM's Centre for Snakebite Research and Interventions (CSRI), was awarded a prestigious Future Leaders Fellowship from UKRI to develop an innovative and improved therapy for snakebite envenoming.

Dr Stuart Ainsworth

The 2020 LSTM's Director's Catalyst Fund awards were allocated to early career researchers pursuing independent and innovative research projects. The 6 recipients were:

Rachel Clare, who will screen and identify potential antivenom candidates which could be used rapidly in the clinic to save many thousands of lives.

Adriana Adolfi, who will investigate the link between the presence of insecticide resistance and behaviour responses in malaria-transmitting mosquitoes.

Elissavet Nikolaou, who will use home sampling for long term monitoring of family members in Liverpool households to investigate the role of the upper respiratory tract flora in respiratory disease.

Shivanand Hegde, who will rear mosquitoes devoid of a normal microbiota to study the transmission of the microbial flora between mosquito generations.

Naomi Walker, who will identify biomarkers that are associated with a TB treatment response, to predict therapeutic efficacy for the evaluation of potential treatments for HIV-TB coinfections, in UK and Malawi.

Aitor Casas-Sanchez, who will investigate the role of viral surface proteins during a coronavirus infection, and to determine whether these can be exploited as a target for treatments against COVID-19.

July saw four students, Lucy Carr-Knox, Shannon Ward, Marion Head and Megan Foster (pictured below), who attended taught modules at LSTM, win top prizes as they graduated from the University of Liverpool with BSc. degrees in Tropical Disease Biology.

Also in July, LSTM's Professor Russell Stothard was promoted to become editor-in-chief of the journal Parasitology.

The Kenyan-based Institute of Primate Research (IPR) was the first organisation in Africa to be certified under the Good Financial Grant Practice (GFGP) international standard. LSTM and PwC Kenya (GFGP certification body) supported IPR throughout the process.

LSTM's Dr Helen Nabwera received an RSTMH grant award in September for her project on developing a novel approach to improving postnatal breastfeeding support for mothers of low birth weight infants in rural Kenyan hospitals.

Dr Helen Nabwera

Following their Annual General meeting, the Royal Society of Tropical Medicine and Hygiene (RSTMH) announced that LSTM's Professor Janet Hemingway had been appointed as a Trustee and begun her term as President-Elect. She will become President in 2021.

Also in September, LSTM Professor Nick Feasey was made chair of the Wellcome AMR thinktank SEDRIC, a think tank with global representation promoting the power of high quality data to tackle Antimicrobial Resistance.

ARCS African Research Collaboration on Sepsis

The African Research Collaboration on Sepsis (ARCS), a multinational collaboration led by LSTM, has been named one of the winners of this year's Global Sepsis Awards by the Global Sepsis Alliance. ARCS was awarded the GSA Award due to their network making outstanding contributions to sepsis research and capacity building across Sub-Saharan Africa.

Lectures and Seminars

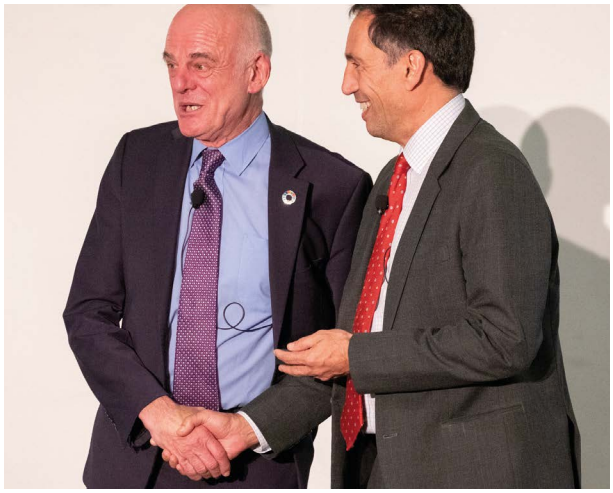
The past academic year saw high level talks, lectures, symposia and seminars being delivered both in person as well as virtually. The COVID-19 outbreak forced LSTM to move the various scheduled events to an online delivery model whilst keeping disruption to a minimum.

A planned 1 day conference in March on Global Health Research and Vaccination, co-organised with the former Department of International Development (DFID), now FCDO, and Gavi, the Vaccine Alliance, had to switch to a series of three online symposia over the spring months due to the COVID pandemic.

The symposia were in support of the UK government's hosting of Gavi's third donor pledging conference in June in London. Politicians, academics, industry leaders and global health leaders discussed the best possible ways to meet ongoing health challenges in low and middle-income countries (LMICs), especially around the development and roll out of vaccines. The various speakers confirmed their commitment to a focus on the poorest and most marginalised people in their work and to increasing access to services, medicines and technologies. They celebrated how their strengths are magnified when they work across siloes. Presenters explained how collaboration, relationships and trust are the foundation of health, and vaccine delivery, services.

Screenshot of the 3rd virtual symposium on Global Health Research & Vaccination

In the lead up to LSTM's 125th anniversary LSTM held its inaugural 'Future Focus' event in November to discuss, debate and hear from experts on a range of potential future global health and humanitarian crises. As part of this event LSTM alumnus Dr David Nabarro CBE gave LSTM's prestigious Leverhulme Lecture about his work on transforming food systems and action on climate change.



Dr David Nabarro (left) receives the Leverhulme medal from LSTM Director David Lalloo

Late 2019 saw also the inaugural TEDx LSTM event, independently conceptualised and organised by a committee of MRC DTP PhD students and held at Liverpool's historic waterfront.

Centred around the topic of 'Unknown Destinations', the purpose of the event was to share experiences and promote discussion on topics, research and ideas ranging from climate change to anti-microbial resistance to leadership in Global Health.

LSTM's weekly Seminar Series hosted 13 seminars during the reporting period, some of them highlighting LSTM's Impact Case Studies as part of the forthcoming REF submission. After an initial interruption early 2020 due to the COVID outbreak, the Series continued virtually. In October, LSTM's BAME staff network curated a series of talks on the occasion of Black History Month, focussing on LSTM's history with its roots in the profits of colonial exploitation, as well as Black Lives Matter in Health and Higher Education. It also saw the launch of a theme within the Series on 'Decolonisation of Global Health and inequalities in academia'.

Publications

The Online Archive brings together LSTM's published research outputs into one central repository, ensuring that they are made available worldwide.

The Online Archive can be accessed via:
https://archive.lstmed.ac.uk

MEDICAL HINTS FOR SHIPS' PASSENGERS PROCEEDING TO THE TROPICS

ISSUED BY
THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE
1941

PRICE 1d.

LSTM Pioneers

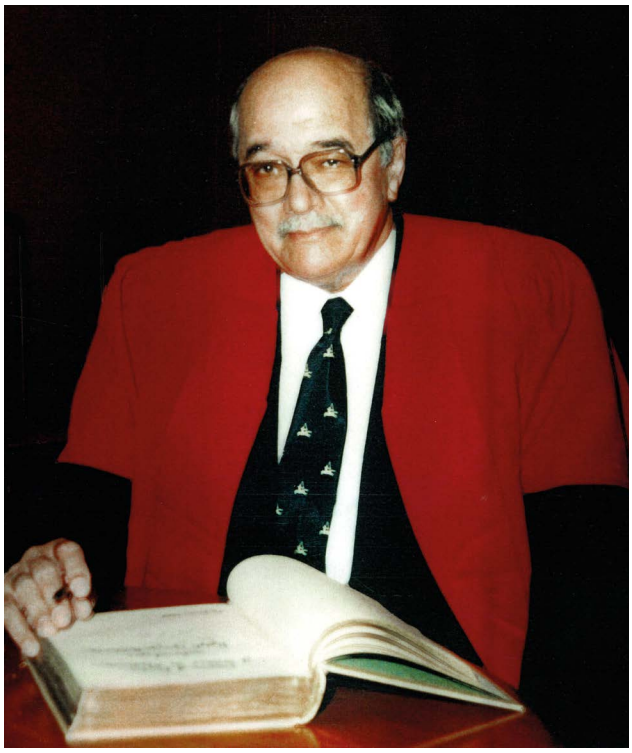
Professor Ralph George Hendrickse MD DSc FRCPE FRCPCH FMC (1926 - 2010)

Described as a 'giant of African medicine', Ralph Hendrickse was born in a mixed race community in Cape Town, South Africa. An Oppenheimer scholarship enabled him to study medicine, graduating in 1948. He was later informed that he had been the top student but was not given such recognition because of his background.

Ralph Hendrickse and his wife, Begum Abdurahman, moved to Durban, where he developed his abiding interest in paediatrics. Begum, a certified midwife, took charge of the obstetrics ward. As it was not possible then to obtain specialist qualifications in South Africa, they travelled to the UK. He took the examination in paediatrics for Membership of the Royal College of Physicians of Edinburgh.

There was no question of returning to South Africa, as state and provincial hospitals would not employ non-white doctors. A committed Africanist, Ralph, moved to newly established university hospitals in colonial West and East African countries. He was appointed as a Senior Lecturer, later Professor and Head of the Department of

Dr Ralph Hendrickse in Cambodia in the early sixties



Paediatrics in Ibadan, Nigeria, and subsequently Director of the Institute of Child Health at the University of Ibadan. He continued his research on malaria in pregnancy, protein-calorie malnutrition and kwashiorkor, and did a pioneering study on the role of aflatoxin and its damaging effects on stored grain.

In 1969 he was invited to LSTM to become Professor of the newly established Department of Tropical Paediatrics, where he developed the Diploma in Tropical Paediatric Medicine. He became Dean, an appointment he held until his retirement in 1991. He received several honours, including Senior Heinz Fellow of the British Paediatric Society; Professor with the Rockefeller Foundation, visiting and lecturing in a number of paediatric centres including Makerere University in Uganda; and a Memorial Prize of the Royal College of Physicians in 1970. After the political transformation in South Africa his Alma Mater awarded him a DSc *honoris causa*.

In 1969 he was invited to LSTM to become Professor of the newly established Department of Tropical Paediatrics, where he developed the Diploma in Tropical Paediatric Medicine

Research Consortia Hosted and Managed by LSTM

The African Snakebite Research Group

Significantly and sustainably improving health outcomes after snakebite in sub-Saharan Africa

Funded by: NIHR

Web address: www.lstmed.ac.uk/the-african-snakebite-research-group

The African Research Collaboration on Sepsis (ARCS)

Establishing centers of sepsis research excellence in Alawi, Uganda and Gabon

Funded by: NIHR

Web address: www.lstmed.ac.uk/ARCS

ARISE

Working in partnership with marginalised people in informal urban spaces towards improving accountability for their health and well-being, in Bangladesh, Kenya, India and Sierra Leone

Funded by: UKRI

Web address: www.ariseconsortium.org

COUNTDOWN

Investigating solutions to control and eliminate the seven most common NTDs by 2020

Funded by: UK Government's Foreign, Commonwealth and Development Office

Web address: www.countdownonntds.org

Drivers of Resistance in Uganda and Malawi (DRUM)

Investigating the drivers of antibiotic resistance in Uganda and Malawi

Funded by: Cross-research council AMR initiative and NIHR

Web address: www.lstmed.ac.uk/DRUM

Essentials

ESSENTIALS is developing and evaluating approaches to assess the performance of new classes of insecticide treated nets (ITNs) for malaria control.

Funded by: The Bill & Melinda Gates Foundation

Web address: www.essentials.lstmed.ac.uk/

iiCON

The infection innovation consortium (iiCON) sees academic partners working with industry and NHS partners to catalyse the transformation of infection research and development.

Funded by: UKRI; UK Government Department of Business, Energy and Industrial Strategy (BEIS)

Web address: www.lstmed.ac.uk/iicon

IMPACT

Strengthening the evidence around cardiac safety and drug-drug interactions with Arvs.

Funded by: European Union/EDCTP2

Web address: www.lstmed.ac.uk/research/collaborations/impact

IMPPACT

Translating global malaria in pregnancy policy to country-level policies and clinical guidelines.

Funded by: European Union/EDCTP2

Web address: www.lstmed.ac.uk/research/collaborations/imppact

IMPACT TB

Finding and treating TB cases in communities in Nepal and Vietnam

Funded by: European Union/Horizon2020

Web address: http://impacttbproject.org/

International Multidisciplinary Programme to Address Lung Health and TB in Africa (IMPALA)

Improving the health of children and adults in Africa through multi-disciplinary applied health research on lung health and TB

Funded by: NIHR

Web address: www.lstmed.ac.uk/impala

IMPROVE & IMPROVE-2

Conducting research into alternative drug regimens for women with malaria in pregnancy in Tanzania. Malawi and Kenya

Funded by: European Union EDCTP2

Web address: www.lstmed.ac.uk/research/collaborations/improve

LIGHT

LIGHT aims to support policy and practice in transforming gendered pathways to health for those with TB in urban, HIV-prevalent settings to improve health, socio-economic and equity outcomes and to stop the spread of TB.

Funded by: UKAID (FCDO)

Web address: www.lstmed.ac.uk/light

Malaria in Insecticide Resistance Africa (MIRA)

Quantifying the public health impact of insecticide resistance and estimate the finances required to meet malaria control targets in high burden countries where malaria is persistent

Funded by: Wellcome Trust Collaborative Award

Web address: www.mira.lstmed.ac.uk

NEAR-AMR: Network of European and African Researchers on Antimicrobial Resistance

The Network of European and African Researchers on Antimicrobial Resistance (NEAR-AMR) is analysing AMR surveillance and capacity strengthening in different national contexts

Funded by: The Joint Programming Initiative on Antimicrobial Resistance (JPIAMR) via the MRC

Web address: www.lstmed.ac.uk/near-amr

Partnership for Increasing the Impact of Vector Control

A partnership to reduce the burden of vector-borne disease through effective, locally appropriate, sustainable vector control

Funded by: Medical Research Council

Web address: www.piivec.org

Perform2Scale

Scaling up health management strengthening interventions

Funded by: European Union/Horizon2020

Web address: www.perform2scale.org

REACHOUT

Strengthening the vital work of close-to-community providers of healthcare in Africa and Asia.

Funded by: European Union

Web address: www.reachoutconsortium.org

READ-It

Focusing on evidence in malaria, TB, child health, maternal health, and health systems. Preparing and updating Cochrane Reviews. LSTM hosts the Cochrane Infectious Disease Group.

Funded by: UK government's Foreign, Commonwealth and Development Office

Web addresses: www.evidence4health.org and http://cidg.cochrane.org

ReBUILD for Resilience (R4R)

Investigating health systems in fragile contexts experiencing violence, conflict and other global health challenges.

Funded by: UK government's Foreign, Commonwealth and Development Office

Website: https://rebuildconsortium.com/rebuild-for-resilience/

REDRESS

Using a person-centred approach to health systems design REDRESS will evaluate, develop and adapt health systems interventions for the management of severe stigmatising skin diseases in Liberia.

Funded by: NIHR

Twitter: @redress_liberia

SQALE

The USAID SQALE Community Health Services Program is a partnership between LSTM, LVCT Health and the University Research Company. We work closely with the Kenyan Ministry of Health, through the Community Health and Development Unit (CHDU) to develop and test quality improvement approaches.

Funded by: USAID

Web address: http://usaidsqale.reachoutconsortium.org/

Tropical Infectious Diseases Consortium

A collaboration between LSTM, the London School of Hygiene and Tropical Medicine (LSHTM), the Jenner Institute at Oxford University and Public Health England, managing the MRC Confidence in Concept funding for individual projects that accelerate the transition from discovery science into therapeutic, diagnostic and vaccine development

Funded by: Medical Research Council

Public Benefit Statement

The charity trustees of the Liverpool School of Tropical Medicine are its Board of Trustees who have had due regard to the Charity Commission's guidance on Public Benefit, and particularly to its supplementary public benefit guidance on purpose, which primarily for LSTM, is the advancement of education and research, and advancing health/saving lives.

Although primarily concerned with teaching, learning, research, knowledge transfer, and the development of the potential of its students, both for their own sake and to serve the needs of society and the economy, LSTM also plays a major role in shaping a democratic, sustainable, and inclusive society by striving for its research to impact policies and implementing practices.

These distinct purposes inevitably impact on its governance structures and practices, including in the need to engage both staff and students in the governance of their institution and a clear recognition of the importance of public benefit.

Public benefit reporting is also an increasingly important aspect of LSTM's transparency and accountability, and this helps the staff, students, and the wider public appreciate what activities LSTM delivers in return for both public funding and tax exemptions. A representative record of those activities is published throughout this Annual Report and Financial Statements.

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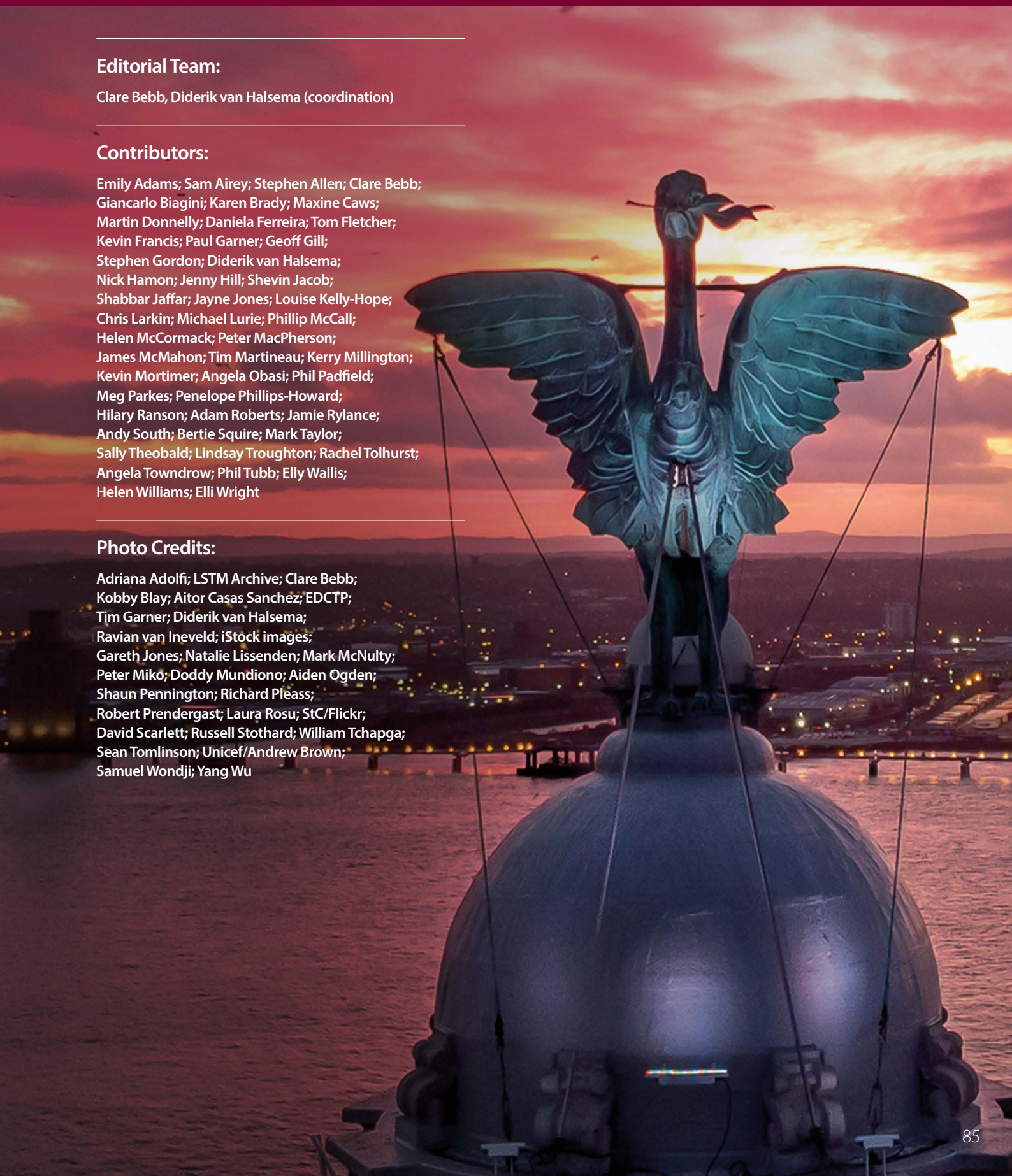
Athena SWAN Bronze Award



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Thank you to all LSTM staff, volunteers, ambassadors and contractors who helped with LSTM's COVID-19 response, and to those who kept LSTM going while working from home.

www.lstmed.ac.uk

LSTM
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Since 1898