LSTM
LIVERPOOL SCHOOL
OF TROPICAL MEDICINE
Since 1898

Annual Report
2020/2021

Contents

Cover image: **Larval sampling in Kasungu district, central Malawi, by field workers Kennedy Zembere, Blessings Phiri and Geoffrey Chaundwa. Photo: Michelle Stanton**

Opposite page: **Community Health Worker Gracien deploys Tiny Targets at 50 metre intervals along the river Kwa, to provide tsetse fly control in an area endemic for trypanosomiasis ('sleeping sickness') in the Democratic Republic of Congo. Photo: Sophie Dunkley.**

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

Chair's Foreword

It is a privilege to write my first foreword as Chair of the Liverpool School of Tropical Medicine. It has been a challenging time to take over as Chair and understanding this complex organisation has taken some time but I have been impressed with LSTM's achievements and all of the staff that I have met.

Whilst the COVID-19 pandemic continues to have a major impact on the way we all conduct our lives, I want to pay tribute to our staff, students and the wider LSTM family who have contributed so much over the course of the last twelve months in difficult and challenging circumstances.

I would also like to thank my fellow Trustees for their continued commitment and support. This has been especially important as I have settled into my new role; the Trustees play a critical and often unseen role in the governance of LSTM. I would like to pay special tribute to Sue Russell for the period in which she acted as interim Chair. She helped to steer the organisation through a very difficult time, has made my induction into the organisation particularly easy and continues to be a great source of strength and wise counsel.

The Board of Trustees is ultimately responsible for the governance of LSTM and last year saw the introduction of the new Higher Education Code of Governance. We therefore took the opportunity during 2021 to conduct a thorough review of our Governance arrangements supported by external consultants. The process was extremely useful in thinking through some major issues and will help us achieve our objective of continually strengthening the way that LSTM is governed and run to the benefit of all of our stakeholders.

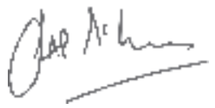
LSTM is no ordinary organisation. It has considerable experience of working in challenging environments and it has been able to draw on these skills to adapt and make a considerable contribution in response to COVID-19. This has included developing and trialling diagnostic tests, vaccines and therapeutics. Much of this has been done with partners both in the UK and overseas. Liverpool is of course only one of the centres in which we conduct our work. Our teams and partner organisations across the globe continue to make a major contribution to the health and well-being of the communities in which they work: COVID has again demonstrated how critical this contribution is.

The education portfolio is important in both achieving our mission and providing resilience to the vagaries of research funding and I have been pleased to see the entrepreneurial and imaginative way that we deliver our Teaching and Educational modules. Whilst the last year has restricted much face to face teaching, our team(s) responded quickly and delivered a range of online programmes to students across the world. It has been a joy in the last couple of months to see students return and we look forward to growing the portfolio of courses that we offer.

One of my major aims as Chair is the expansion of fundraising income. The highly successful 'Bump it Forward' campaign has raised over £250,000 in a very short period of time, supporting the purchase of much needed PPE equipment for a number of African countries. It was a wonderful example of the team and its supporters rallying to the needs of colleagues who were short of vital equipment and supplies of oxygen. It also demonstrated the considerable potential for fundraising and I am sure that the planned work on raising LSTM's external profile will help considerably with this, as will the new campaign related to the 125th anniversary. This anniversary in 2023 will provide us with an opportunity to celebrate and highlight the work that we do and to set a course for the next period of LTM's history.

As we move towards our 125th Anniversary, we remain firmly committed to improving the health and lives of disadvantaged individuals and communities across the world. The last eighteen months has demonstrated that the work that we do has never been more relevant; wherever you live, disease and viruses show little respect for geographical boundaries.

I look forward to working with my colleagues and friends to help LSTM deliver sustainable improvements to the lives of those most in need.



Jim McKenna

'I want to pay tribute to our staff, students and the wider LSTM family who have contributed so much over the course of the last twelve months in difficult and challenging circumstances.'

Director's Foreword

The COVID pandemic has continued to dominate many of LSTM's activities over the last twelve months, in common with much of the world. However, although the last year has undoubtedly been a very challenging one for LSTM staff and partners and the communities in which we work, LSTM has managed to thrive in these difficult circumstances.

There have undoubtedly been many compromises in what we have been able to do, with restrictions on project activity, funding cuts and real challenges to travel and visiting projects, but it is a tribute to all involved that LSTM's activities remain highly relevant and impactful for the populations that it works with.

Funding cuts, predominantly related to the sudden reduction in UK government Overseas Development Assistance, have been of major concern in the aid sector. Many of our programmes have been affected and I would like to thank all of the staff who worked hard alongside partners to ensure that critical research activity could continue despite substantially reduced budgets. In partnership with other universities, LSTM has undertaken a number of initiatives to try to influence the Global Health funding agenda, particularly working to try to ensure that the Government understands the UK's leading role in Global Health research and appreciates LSTM's contribution to a major area of UK strength which has considerable impact on populations overseas and the country's reputation.

Despite these restrictions in funding, the financial situation of LSTM remains healthy and the prospects for the coming year look good, particularly if some of the funding constraints ease a little. The expansion of our research activity into multiple areas of COVID research, and the consequent enhancement of LSTM's reputation nationally, will help to expand the range of future potential research funding opportunities.

One of the unexpected outcomes of the pandemic has been the closer links between LSTM and the city, through work in the communities, local clinical trials and support of the public health response. The new city-led Pandemic Institute, in which LSTM is a major partner, reflects those close relationships and we are optimistic that the alternative sources of funding through the Pandemic Institute will allow us to address important pandemic related research questions in the UK and abroad. Our overseas units have also continued to play an important role in supporting national clinical and public health responses to COVID, strengthening ties with communities and governments.

Despite the challenges of remote working and on-line teaching, our education delivery has continued to evolve. Investment in re-developing Pembroke House offers opportunities to both increase the numbers of students that we teach and to create new educational offerings aimed at developing the local, national, and international workforce. The highly successful iiCON initiative, which brings together academics and local industrial partners to work on infection problems, will help ensure that we can deliver appropriate training for local industrial trainees and encourage careers in science. The investment of £8 million in the construction of the CREATOR building at MLW in Malawi will enable a considerable increase in research capacity but will also allow opportunities for substantially enhanced postgraduate specialist medical education within Malawi itself.

All of these activities are important but as ever, success depends ultimately upon the staff of LSTM. Work continues on developing career pathways and training for colleagues to ensure that we both retain and attract the best scientists and professional services staff. We are also recommencing the initiative to expand our overseas partnerships which are so important for LSTM to be effective. It is critical for the future of LSTM that it remains flexible and responsive to the rapidly changing environment in which it works.

Looking forward to the next year, the start of our process to refresh LSTM strategy offers an opportunity to reflect on what we do currently and how we might need to change that for the future. This review will involve all parts of the organisation and will be key to enabling our continued success in the run-up to our 125th anniversary in 2023 and beyond.

Professor David Lalloo

'It is a tribute to all involved that LSTM's activities remain highly relevant and impactful for the populations that it works with.'

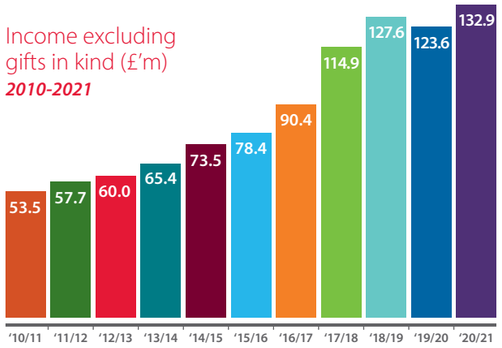
Treasurer's Report

LSTM has continued along its growth trajectory in 2021 after a COVID-effected slowdown in activity last year and into the current year. Although fieldwork delays occurred, reducing some research spend, the COVID pandemic has provided opportunities as well as challenges, and research activity has recovered in many areas in addition to the benefits of COVID related research projects this year. There was an underlying Group operating surplus of £4.4m and Group net assets of £55m at 31st July remain healthy.

John O'Brien Bcomm FCA

Group income of £210m (2020: £228m) reflects the significant reduction in 'gifts in kind' from £104m in 2020 to the current year of £77m. The gifts in kind were primarily pharmaceutical drugs relating to a FCDO mass drug administration programme in several African countries. Excluding the gifts in kind, LSTM reported total income of £133m (2020: £123m), representing an 8% increase over the previous year.

Income excluding gifts in kind (£'m)
2010-2021



Our reported surplus for the year was £6.7m (2020: surplus £9.7m). Following the negative impact of the pandemic on world markets in 2019/20, markets "bounced back" this year resulting in an unrealised gain on investments and endowments of £1.9m. Excluding these items and other non-operational accounting entries we recorded an underlying operational surplus of £4.4m, which includes £3m specialist institution funding from Research England (2020: £0.4m deficit). This is an impressive performance in the current circumstances reflecting the significant efforts of the LSTM team, international partners and the fantastic support of our research funders. LSTM has managed to adapt both its teaching and research activities, and both are proving able to continue activities despite ongoing COVID-19 restrictions and limitations.

Group net assets at the year-end totalled £55m (2020: £49m) and excluding deferred capital grants of £26m, (which are unlikely ever to be repaid), net assets totalled £81m. Group cash has increased by £6m as a result of strict cashflow monitoring and this, along with tight budgetary control were among a raft of measures brought in by the COVID-19 emergency management team. That team has now been disbanded but impact from and reaction to the ongoing pandemic remains a key organisational risk for senior management. 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. The combined LSTM and IVCC portfolio stands at £617m and the application pipeline on 31st July was £105m.

The 2021/22 budget has been built to reflect the challenges presented by the pandemic with a small surplus of <£1m.

Finally, we continue to invest in our estate to accommodate future growth plans in education and global research both in the UK and overseas. That investment in the facilities and infrastructure maintains our world class leadership in global health service, particularly global pandemics and is essential to support our excellent and dedicated teams who illustrate daily LSTM's specialist expertise.

John O'Brien *Bcomm FCA*

This is an impressive performance in the current circumstances reflecting the significant efforts of the LSTM team, international partners and the fantastic support of our research funders.

LSTM's Response to the COVID-19 Pandemic

LSTM has continued to play a unique role as the COVID-19 pandemic progressed. With research covering the whole transitional research cycle, along with patient advocacy and working closely with industry, LSTM has continued to have a significant impact on the response to the pandemic regionally, nationally and internationally.

AGILE Clinical Trial Platform

The agile clinical trial platform was a new type of study deigned for pandemic drug testing, capable of testing multiple potential treatments in parallel. Launched specifically to test new drugs for COVID-19, it represents a partnership between LSTM, University of Liverpool, The Royal Liverpool University Hospital Foundation Trust along with the University of Southampton. Over the last 12 months it has led to very strong collaboration, particularly within Liverpool, with the first drug being selected within the platform, Molnupiravir, undergoing phase I and dose escalation and being selected by the antiviral task force for later stage evaluation.

agile
Coronavirus Drug Testing Initiative

Following a successful trial in Liverpool involving healthy volunteers, LSTM is now leading AGILE's trial in South Africa, looking at the effects of treating COVID-19 with antiparasitic drug nitazoxanide. A clinically approved and affordable to manufacture antiparasitic drug, Nitazoxanide, has previously shown broad-spectrum antiviral activity against coronaviruses and was identified as a promising candidate for repurposing at a higher dose.

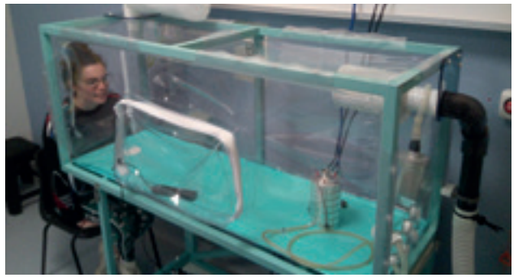
Following successful preclinical and Phase I testing in healthy participants in Liverpool AGILE has opened its first international site at the Desmond Tutu Health Foundation at the University of Cape Town in South Africa for trials in people who have tested positive for COVID-19 with mild to moderate symptoms in the community.

Air Sampling

Following on from environmental sampling conducted by PHE early in the pandemic and aiming to assess the potential increased risk in terms of transmission, particularly among health care workers, of aerosol generating procedures (AGPs), such as intubation (which could plausibly increase aerosol generation), researchers from LSTM carried out the COVID Air Study. More than 250 samples have been collected from across Aintree and the Royal Liverpool University hospitals, initial results showing that there is no lower observed frequency of detection of Ribonucleic acid (RNA) around patients on room air or using oxygen via nasal cannulae or masks than there is around AGPs. This concurs with the findings from an air sampling study within RECOVERY RS clinical trial.

IMADGENN aerosol capture box arriving at the Royal Liverpool University Hospital - photo Caitlin Thompson

The next stage of the project, COVID Space, has been using a clear aerosol capture box called IMADGENN, specially designed by Public Health England. Participants sit facing this 500L box and perform, different respiratory activities, such as singing and coughing to see how much viral RNA and viable virus is detectable.



PhD candidate Caitlin Thompson with the IMADGENN aerosol capture box - she was a study participant after having recovered from COVID herself. Photo Susan Gould

IMADGENN is set up in the Clinical Research Facility at the Royal Liverpool University Hospital, in IMADGENN the research team can use different types of samplers including one that separates particles by size. Recruited early in infection participants are also asked to use a small wearable button sampler and have a sample collected from their room at the clinic – some even sample using portable or wearable samplers at home.

Diagnostics

The diagnostics team at LSTM remains the single UK collaborating site for the Foundation for Innovative New Diagnostics (FIND) COVID-19 diagnostic evaluations. The team generated analytical and clinical evaluation data for more than 30 brands of SARS-CoV-2 Point-of-Care tests, enrolled over 1680 SARS-CoV-2 suspects in hospital and test centre settings. The team has been constantly recruiting participants and currently it is the only site in Europe open for clinical evaluations of COVID-19 point-of-care diagnostic tests for FIND.

The team also established a pipeline for COVID-19 diagnostics to support SME on the evaluation of early diagnostics prototypes and produce data to help them towards the CE marking progress.

During the past year the team has collaborated with Mologic, a UK based SME, to develop a lateral flow test for SARS-CoV-2 infection. It was able to rapidly co-develop prototypes, and progress the test through CE marking via the generation of robust evaluation data. The test is now commercially available, and importantly will be available at cost in low- and middle-income countries.

The team also carried out work looking at environmental sampling, including an LSTM led study carried out in partnership with Imperial College London and Loughborough University, looking at the transmission risk of COVID-19 from sports equipment. Funded by philanthropic donations the study found that the risk was probably low and likely to be lower than the transmission risk from player interaction before, during and after the sporting activity itself.

Product Testing

Working via the iiCON consortium, LSTM's researchers led by Dr Grant Hughes, have tested a new 'military grade' disinfectant developed by an Essex inventor alongside the British Army. The Army asked LSTM to test VIRUSEND in the Bio Security Level 3 Laboratory over a period of five weeks, with the team finding that the product was highly effective at reducing SARS-CoV-2. The product was developed in conjunction with, and partly funded by, the British Army in addition to a £180,000 Innovate UK grant from the British Government.

Some dental authorities and leading dental academics recommend mouthwashes be used to help reduce the levels of coronavirus in saliva and help control person to person transmission of the virus. As a result, LSTM collaborated with fellow iiCON partner, Unilever, one of the world's largest manufacturers of oral hygiene products, to rapidly assess the performance of mouthwashes against SARS-CoV-2. This work demonstrated the efficacy of the CPC (cetylpyridiumchloride) technology Unilever uses in its mouthwashes and provided essential data for regulatory approval and claims in key markets such as India, Italy, Indonesia, Vietnam, Russia.

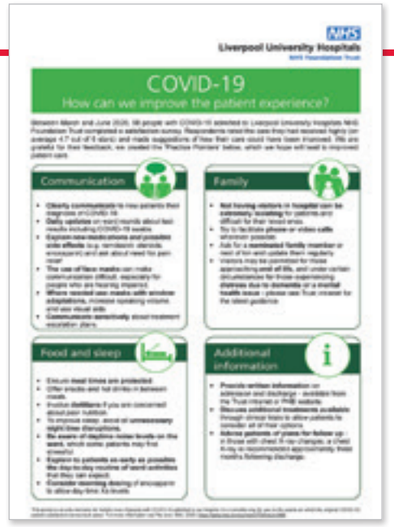
K4D

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

The pandemic underlined the importance of decision makers being able to access emerging evidence to inform their decisions. From March 2020 to May 2021, LSTM led on 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 response. These summaries covered themes such as epidemiology and modelling, social science and the indirect impact of COVID-19. They were published weekly, and at its peak daily, with 122 published in total.

COVID Patient Survey

LSTM's Dr Tom Wingfield led a team of doctors at the Liverpool University Hospitals Foundation Trust in carrying out the first peer reviewed COVID patient survey, recording the satisfaction levels of patients being treated for COVID-19. Carried out during the first wave of infections in Liverpool, the results informed an educational bundle to hep improve care and the team made the survey template available for use by other NHS Trusts. Issues highlighted included the need for improved communications around medications and the impact of mask-wearing on communication, as well as the negative effects of wearing PPE such as depersonalisation and fear and, particularly in older patients, isolation while being treated without visits from friends or relatives.



Patient Care

Like many of LSTM's clinical researchers, Professor Miriam Taegtmeyer saw the demands on her clinical work increase significantly throughout the pandemic. Arising from her clinical duties within the Liverpool University Hospitals Trust she responded to health systems challenges such as hospital acquired infection. She established "Co-flow": bringing together infectious diseases, infection control, public health and patient flow - determining safest possible patient journey through the two hospitals. In November 2020 she oversaw the introduction of lateral flow testing in emergency departments at Royal and Aintree hospitals when these were very newly available – this saw a dramatic fall off in time spent in unsafe mixed COVID areas and less nosocomial infection and became a national approach.

She has also been working together with Liverpool City Council to improve the equity of COVID vaccine uptake in four of the most deprived wards in Liverpool using approaches to improve health equity from her work in Africa and HIV testing. Professor Taegtmeyer has also been Co-PI on a study comparing experiences between health systems responses to COVID in Liverpool and Liberia, with briefs put together that outline key principles for action by health systems leaders responding to pandemics.

Nepal

In response to the COVID-19 pandemic in Nepal, LSTM and long-term collaborator Birat Nepal Medical Trust (BNMT) led on the establishment of the Epidemic Intelligence consortium project, funded by the Wellcome Trust, to conduct large scale whole-genome sequencing of SARS CoV-2, the virus which causes COVID-19.

Epidemic Intelligence

The project aims to both improve the understanding of the emergence and ongoing transmission of the virus in Nepal and to build capacity for pathogen sequencing in Nepal to enable more effective rapid pandemic response in the future. The project is collecting and sequencing 1,500 SARS CoV-2 samples from three locations spanning Nepal: Bheri Hospital in Nepalgunj (Far West), Koshi Hospital, Biratnagar (Eastern Nepal), and Sukraraj Tropical Infectious Diseases Hospital in the capital city, Kathmandu (central region). It will follow up with the participants at three and six months to understand the frequency and symptoms of long-term complications of COVID-19 illness (known as Long COVID) in the Nepali population.

In addition to LSTM and the three hospital sites, the consortium partners are: Birat Nepal Medical Trust (BNMT), Centre for Molecular Dynamics Nepal (CMDN), Oxford University Clinical Research Unit Nepal (OUCRU-Nepal), Nepal Health Research Council, and University of Cambridge.

The Cochrane Infectious Diseases Group and COVID-19

Covid Guidelines India

The explosion of research evidence in COVID-19 and the demand for answers has really tested the research evidence to policy and practice pipeline. This has been a particular challenge in low- and middle-income countries, but skilled networks linked to the Cochrane Infectious Disease Group (CIDG) kicked into action. In India, researchers and clinicians treating COVID-19 patients collaborated to develop national India guidelines, led by Professor Priscilla Rupali from the Christian Medical College in Vellore. Professor Paul Garner was the guidelines methodologist and Dr Tom Fletcher chaired the External Advisory Panel. This formal process arose out of an earlier project developing national clinical guidelines for extrapulmonary TB with the Government of India and CIDG funded by FCDO.

COVID-19 antigen testing centre Warora Maharashtra, India. Photo via CreativeCommons

The CIDG also worked hard in challenging the infodemic - the fake news about fake treatments. A Cochrane review by an international team of authors showed that hydroxychloroquine is ineffective for COVID-19, at a time when global demand was at its highest for the drug, described as a 'game changer' by the former US President Trump.

Another review looked at an antiparasitic drug, ivermectin, for COVID-19. Some advocacy groups used data from trials now shown to be fake to push for its widespread use. The Cochrane review authors showed there really was no evidence to date to back the extraordinary claims of benefit made for this drug, and the review was quoted widely worldwide in newspapers and on Twitter to counter the erroneous claims that it should be used.

The Vaccine Team

Following the success as a site for the Phase III trial of the Oxford AstraZeneca COVID vaccine trial, LSTM was once again selected as a site for further vaccine testing, this time for the world's first COVID vaccine trials looking at mixing and matching different vaccines for first, second and booster doses.

The trials, COM COV I and COM COV II, involved volunteers who had already had their first dose in the community and then, blinded and randomised, would receive one of the three widely available vaccines as their second dose. The study also looked at different intervals for the timing for the second dose and participants were followed up with regular blood tests for the next 13 months to track the immune response and understand what the potential impact that mixing vaccines might have on efficacy.

These activities were again supported by specialist nurses from the Well Travelled Clinics (WTC). Three of the WTC nurses also worked at vaccine hubs in the region to support the role out of the vaccines once they were approved for use in the population.

Estates & COVID-19 support

Estates have also provided support across its global activities during the COVID19 pandemic to ensure that LSTM's operations could continue in a safe and secure manner whilst continuing to deliver its programme of works. This included repurposing and recommissioning CL2 laboratories into CL3 laboratories to assist in the vaccine research. These repurposed facilities were fully utilised 24 hours a day and 7 days a week at the height of the pandemic.

Bump it Forward

As vaccines were being rolled out in advanced economies over the past year, the health inequalities across the world became starker. For health systems, especially those on the African continent, which were already under-resourced, having do deal with a second wave and new strains of COVID-19 became a monumental challenge. Many hospitals and clinics had to operate without the basics to protect their staff and patients. PPE and basic sanitation remained in short supply causing further shortages amongst health workers in many countries. Throughout 2021, the LSTM campaign 'Bump it Forward', asking the public to donate the equivalent cost for their free vaccine, managed to raise over £250,000, which has been distributed funds to provide PPE to protect health workers in Malawi, Kenya, Zimbabwe, Uganda, Sierra Leone, Tanzania and Liberia.

Members of the vaccine team. Photos by Phil Tubb and Mair Thomas

Introduction to the Feature Articles

Participating in sustainable and innovative partnerships both overseas and in the UK is still the key philosophy behind LSTM's research and education programmes. This focus has been maintained and further enhanced over the past year despite the major global health and financial challenges that have hit the sector. LSTM's long term commitment to delivering impact through the full translational research cycle has continued to evolve and ensured LSTM was uniquely placed to respond immediately and effectively to the rapidly shifting priorities triggered by the ongoing COVID pandemic.

This pandemic continued to put extraordinary strain on our day-to-day research and education activities requiring constant re-adjustment of work arrangements whilst ensuring that key objectives were still being met. LSTM completed its submission for the Research Excellence Framework (REF) 2021 and commenced with strategic estates expansions in both Malawi and Liverpool. Both new centres will enable the expansion of research and teaching activities to deal with the global health challenges of the future including the development of the research leaders of the future, addressing critical areas such as drug resistant and emerging infectious diseases and ensuring we have the trained workforce and skills base to address the interplay between human infection and other global priorities such as climate change. The Clinical Research Excellence and Training Open Resource (CREATOR) facility in Malawi will expand the training capacity by 30% over the next 10 years and include the only specialist postgraduate medical training centre in the country, enabling to retain the brightest talent in-country and promoting a sustainable work force leading, ultimately, to better health outcomes.

Many of our overseas partners faced huge challenges due to the COVID-19 pandemic putting already fragile health systems under considerable pressure. The lack of available vaccines for health workers and significant shortages of basic personal protective equipment (PPE) to keep them safe were particularly acute with the real potential to completely derail all efforts to manage the pandemic. Thanks to thousands of generous donors, LSTM's Bump it Forward campaign, which launched in January 2021, managed to purchase and distribute PPE, diagnostic kits and other life-saving essentials to our colleagues and partners in seven countries across the African continent.

This and other activities outlined in the following feature articles emphasise the power of effective and sustainable partnerships and collaboration in delivering solutions to anticipated and unanticipated global health emergencies.

Professor Steve Ward,
Deputy Director

Donations of PPE, diagnostic kits and other life-saving essentials to our colleagues and partners in, from top right and clockwise: Tanzania, Malawi, Kenya, Sierra Leone, Zimbabwe and Uganda. Donations were also made in Liberia

FEATURE ARTICLE:

Neglected Tropical Diseases

LSTM is working to identify critical bottlenecks in the field of Neglected Tropical Diseases (NTDs) through its research and implementation activities, whilst evaluating alternative strategies to overcome the existing barriers and to improve strategies for their control and elimination.

Centre for Neglected Tropical Diseases

As a multidisciplinary centre, CNTD has extensive expertise across all NTDs, which builds on the strengths of all our NTD research: from drug and diagnostics discovery and development to delivery, evaluation and deployment into health systems to span the translational research spectrum

The cuts to UKAID announced this year by the Foreign, Commonwealth & Development Office (FCDO) has had a major impact on our FCDO funded NTD programmes, ASCEND and COUNTDOWN. Here we review the impacts these programmes have had on NTDs over the past two decades.

Centre for Neglected Tropical Diseases – LF Elimination Programme

In 2000 the LF Support Centre was established to support endemic countries to deliver mass drug administration (MDA) through the Global Programme to Eliminate Lymphatic Filariasis (GPELF). The Centre for Neglected Tropical Diseases (CNTD) was formed in 2009 with a grant of £10.5M from the Department for International Development (DFID) to work towards the goal of elimination of Lymphatic Filariasis (LF) as a public health problem by 2020 through disease mapping followed by MDA. In 2013, DFID increased its commitment with further funding of £20M over four years to support the scale up of national programmes delivering treatments for LF across entire populations at risk in 12 countries in sub-Saharan Africa and Asia. CNTD's role was to support national NTD programmes in strengthening and increasing their capacity for NTD programme implementation; improve laboratory facilities and the provision of diagnostic services and carry out monitoring and evaluation and operational research to provide evidence of elimination.

Under the academic leadership of Professors David Molyneux (2000-2008), Moses Bockarie (2008-2014), Charles Mackenzie (2015-2016) and Mark Taylor (2016-present), LSTM's CNTD comprised of a programme management/technical team providing direct support to their counterparts in national programmes and a finance and administration team that supported activities across all project countries. CNTD also employed national technical and financial management staff in Bangladesh, DRC and Mozambique who provided direct support to the NTD programmes in country.

Included within the £20M was a commitment of funding for morbidity management and disability prevention (MMDP), which became an integrated component of the overall LF Elimination programme. In July 2017, DFID confirmed a further £8.4M commitment to the programme, extending the end date of the programme to 31st March 2019 bringing the total funding to £39.5M for the period 2009 to 2019.

The DFID funded LF Elimination programme was part of WHO's GPELF, launched in 2000. GPELF brought together national governments of endemic countries, bilateral and multilateral donors, pharmaceutical companies, academic and other technical support centres to achieve its elimination strategy which has two aims, to:

- *Stop the spread of infection: interrupt transmission of LF by MDA, and*
- *Reduce the suffering caused by the disease: morbidity management and disability prevention*

In the early stages of the LF programme (2000-2012), CNTD's activities were focussed on supporting national programmes to carry out mapping and starting drug distribution. Following DFID's increased funding commitment to LF elimination in 2013, CNTD's activities were expanded to support 12 project countries to eliminate LF as a public health problem by 2020. To achieve this, the programme supported:

- *Scale up to full geographical coverage of LF MDA across the 12 project countries*
- *Evidence gathering of the impact of LF treatment through Monitoring & Evaluation*
- *Development of context appropriate transmission surveillance strategies*
- *Training for national MOH staff in programme planning and management*
- *Burden assessments of lymphoedema and hydrocele cases*
- *Training for health care workers and patients in lymphoedema care and case management*
- *Significant contributions to the evidence base for LF elimination through operational research*
- *Use of operational research findings to adapt implementation in the field*
- *Improvement of the quality of data and its management and reporting*
- *Capacity building of staff from national NTD laboratories across 17 countries*
- *Achievement of ISO standards in 2 regional NTD laboratories*
- *Production of the necessary documentation for WHO elimination assessment (elimination dossier)*

Camera set up to take thermal images of lower legs of LF patients. Photo by Louise Kelly-Hope

Summary of Programme Achievements

- *Malawi reached its LF elimination target in 2020.*
- *The number of people treated exceeded target milestones each year since 2016 and a total of 335,742,171 treatments for LF were delivered.*
- *The cost per person treated ranged from $0.06 to $0.54.*
- *In project countries, the reduction in the proportion of people at risk of LF was 98%. The protective effect of progressive MDA's supported by this programme led to 79,462,796 people being protected and no longer at risk of LF.*
- *Collaborative and participatory approach: The programme was implemented with and through the national Ministries of Health at central, provincial and district levels in each project country and involved multiple stakeholders such as community activists, self-care groups as well as other organisations working on other NTD related projects.*
- *Reaching the poorest: LF is a disease of poverty and those suffering from LF related morbidity are particularly affected both physically and mentally from disabling acute attacks and swelling of the limbs and genitals that prevent them from being able to work and are often ostracised by their communities. Surgeries supported by this programme enabled patients and their carers living in some of the poorest communities to return to work and pursue a fuller life within their families and communities.*
- *Equal beneficiaries of change: The programme was successful in finding solutions that benefit the most vulnerable and marginalised individuals and groups. It addressed issues of inequality and gender discrimination where the delivery of treatment to females in MDA has consistently been higher than for males. Evidence from the impact of hydrocele surgeries on care givers, who are predominantly female, ensured that women and girls benefitted from MMDP interventions, even when they were not the direct recipients of treatment.*
- *Bangladesh conducted the largest scale up of Transmission Assessment Survey (TAS) surveillance reported in any of the LF endemic countries in the world with an estimated 70 million people at risk*
- *All project countries submitted data and evidence that transmission of LF is reducing and 11 out of 12 project countries qualified for TAS in at least one evaluation unit, with 123 districts progressing through TAS. Of the 6 countries still undergoing MDA, 5 have evidence that transmission of LF is reducing and they are on target to stop MDA by 2022.*
- *Integrated delivery of treatments. The integrated delivery of interventions for multiple NTD's was achieved for LF/onchocerciasis and Soil Transmitted Helminths.*
- *Partnership with pharmaceutical partners. The programme supported the administration of 1,102,736,584 tablets of albendazole, ivermectin, and DEC, leveraging a total donation value of £883,956,096 from pharmaceutical partners. GSK also contributed over £1M towards the Global Alliance for the Elimination of LF and CNTD's operational research projects between 2009 and 2021.*
- *Improved verification methods: CNTD developed LQAS (lot quality assurance sampling methodology) surveys that can provide ward level information that enable national programmes to determine which wards, if any, had very low coverage.*
- *Post MDA surveillance methods: In the absence of WHO recommended guidelines or standard protocols for post elimination surveillance, this programme supported the development of surveillance methods in Bangladesh and Malawi.*
- *The number of hydrocele surgeries completed exceeded target milestones each year since 2016. A total of 45,993 hydrocele surgeries were done since 2015, 10 countries are now implementing and scaling up their morbidity management activities.*
- *Development of mHealth tools for improved reporting: This programme developed mHealth tools (MeasureSMS) that use SMS messaging for MDA reporting and MMDP case reporting.*

- *Evidence synthesis: This programme made a significant contribution to the evidence base for LF elimination through numerous peer-reviewed publications, the provision of technical guidance and programme evaluations. Operational research activities facilitated the adaptation of treatment strategies and provided essential support and information to understand and predict the reduction in transmission and where to focus resources.*
- *Developing alternative treatment strategies: In DRC, the co-distribution of the parasite Loa loa complicated the scale-up of MDA due to the risk of severe adverse events associated with ivermectin and the national LF programme needed a practical approach to make decisions on the safest and most effective treatment strategies. CNTD developed a decision map and process for national programmes to work from that includes five practical steps to determine the most appropriate treatment strategy. Following the publication of this and review by the WHO Scientific & Technical Advisory Group, a new treatment protocol for co-endemic areas was agreed and is now the international standard and fully operational in DRC.*

LSTM and CNTD continues to work closely with MoHs and the NTD community towards the goals laid out in the WHO NTD 2021-2030 roadmap and build on the gains made over two decades of support to national programmes through continued translational, operational and implementation research across the spectrum of NTDs. We thank the dedicated teams at LSTM and in our partner endemic countries that have contributed to delivering the impact of this programme. In 2019 FCDO launched the ASCEND programme as its flagship NTD programme to continue the implementation of NTD control and elimination programmes, which was forced to end prematurely in 2021 due to the cuts to UKAID funding and is featured in the TDB department's annual report.

COUNTDOWN
Calling time on Neglected Tropical Diseases

COUNTDOWN has been an innovative seven-year FCDO funded project, which brought together a multi-disciplinary implementation research consortium focused on the scale-up of integrated interventions against NTDs. Across contexts, we have been working proactively and collaboratively with health policy makers and NTD programme implementers at country level to ensure that research evidence generated has been of maximum benefit to NTD programmes through constant dialogue and dissemination. In the last year COVID-19, plus requests from FCDO to cut back on activities, due to funding restrictions, has led to the revision of workplans, with all project teams now working on final stage evaluation and research uptake (RU). COUNTDOWN's investment in proactive RU via the use of the co-ordinated communications has enabled accessible research narratives that has led to evidence informed policy change at national and international levels.

COUNTDOWN partners meeting in Ghana

COUNTDOWN has built upon its previous research findings to develop and pilot interventions that demonstrate how NTD programme activities can reach those who are currently missed by services. Embedding female genital schistosomiasis services into the primary care system in Nigeria and Liberia shows how women and girls can be treated and supported without complex diagnostics and complicated referral systems. The creation of peer support groups for those living with NTDs in Nigeria is another way that COUNTDOWN research demonstrated the need of this type of intervention and then developed it collaboratively with local stakeholders including those affected by the diseases.

COUNTDOWN's health system focus and related research has meant that it was asked to support the restart of NTD activities after they were paused due to the COVID pandemic. COUNTDOWN teams advised on the tools for restarting and have been asked to evaluate the process to ensure that the voices of health workers and community volunteers are heard.

Health promotion in Nigeria of albendazole - a free drug to treat filarial diseases. Photo by Noela Gwani.

A key step to onward sustainability has been to build the research capacity of all of its partners. Much of this work has been through active participation through all stages of the research cycle. This year saw the implementation of a competitive junior researcher scheme aimed to provide and support early career researchers from Liberia, Nigeria, Cameroon and Ghana on how to apply for research grants, manage their research (from ethics to impact) and disseminate their findings. The combination of peer support, targeted webinars and mentoring by more senior researchers was felt by the early career researchers to be hugely beneficial.

COUNTDOWN Outcomes by More than Minutes

COUNTDOWN's research identified how health workers and community volunteers could be supported through the introduction of updated training materials and job aids. The teams have worked with stakeholders to develop these new tools that are locally designed and adapted to the local context. By developing these tools collaboratively and using a process of quality improvement (revise and repeat) has meant that the tools have been very well received by those that use them.

- *Global impact: COUNTDOWN's multidisciplinary implementation research approach is highly regarded as a best practice model of NTD research. In particular, the use of social research to coproduce adaptations to NTD programmes demonstrates how barriers to access can be overcome. The impact of these multidisciplinary approaches has strengthened MDA and supported those living with NTDs in Nigeria and Liberia.*
- *Challenge: restarting NTD activities after they were halted for a year meant that there were many competing priorities. COUNTDOWN's engagement with stakeholders as co-researchers has helped to manage the time constraints and strain that was being felt by many and ensure that activities were appropriately prioritised and supported.*
- *Results: understanding systematic noncompliance of MDA through multidisciplinary research enabled researchers to highlight the contextual challenges that exist and demonstrate that overcoming these barriers is a complex interaction of political, societal, environmental and community factors and underlines the need for acceptable alternative strategies.*
- *Impact and results: Engagement and validation of findings using visual techniques has encouraged interactions between non researchers and researchers to reach wider audiences. The research showed how images can be powerful and are recognised beyond literacy levels, culture, and language. They amplify the voices of those affected by NTDs, create ownership, and can be used for social change.*
- *Risk and challenge: a key priority for the final phase of COUNTDOWN was to reach a wider range of stakeholders internationally by presenting the findings of the research in an engaging way through regional meetings, cross country visits and collaboration with other stakeholders. These wider interactions had the potential for wide ranging impact and increased value for money.*

Sian Freer, Chief Operating Officer, CNTD/ASCEND

Dr Rachael Thomson, Director of COUNTDOWN

Professor Mark Taylor, Director of the Centre for Neglected Tropical Diseases, Principal Investigator for COUNTDOWN.

The last phase of COUNTDOWN has seen a series of national and international dissemination activities where research findings were presented to stakeholders who discussed the impact of the programme and committed to embed the learnings into policy and practice. The final webinar was held on 28th September and was attended by over 150 people from across the world. NTD implementers, researchers and policy makers from Nigeria and Liberia came together to discuss how the lessons from COUNTDOWN aligned with the NTD roadmap pillars and what this means for the future of NTDs.

Centre for Snakebite Research and Interventions

Throughout its 50-year history the Centre for Snakebite Research and Interventions (CSRI) has been focused on developing, testing, and implementing strategies aimed at mitigating the burden of tropical snakebite. The Centre and its staff are led by Director Professor Nicholas Casewell and is part of the Department of Tropical Disease Biology. Its herpetarium hosts the largest and most diverse collection of tropical venomous snakes in the UK to support its research activities.

Despite the struggles of COVID and the impact it has had on the centre's ongoing programmes, such as limiting the scope of activities due to restrictions, and funding being prematurely withdrawn due to the UKAID cuts, CSRI has continued to grow with the successful funding of three major research grants from Wellcome's Snakebite Priority Area research fund. In addition to these three major grants, the centre has successfully been awarded multiple smaller grants from Wellcome, FCDO, Bloomsbury and the RSTMH. These grants include diverse academic partners from Kenya, India, the USA, Belgium and the Netherlands.

During the last year, the centre's ongoing programmes, such as the NIHR-funded African Snakebite Research Group (ASRG) and the FCDO-funded Scientific Research Partnership for Neglected Tropical Snakebite (SRPNTS) have continued with a focus on capacity building in partnership with collaborators in India, Kenya, and Nigeria.

The ASRG is now in its final year, with research and capacity building activities including the Nigerian and Kenyan Snakebite Research and Intervention Centres (N-SRIC and K-SRIC) completing the construction of their herpetarium and pre-clinical testing facilities. These facilities will be used to house local snake species allowing for the collection of venom, testing the efficacy of antivenoms, and further enhancing their snakebite research capacities. The partners, Institute of Primate Research (IPR), Kenya and Bayero University Kano (BUK), Nigeria, with the support of NIHR funding, are being assessed for the silver accreditation for their Good Financial Grant Practices after having achieved their bronze status in 2019/2020. These were the second and third institutions globally to receive this accreditation. Both these institutions have benefitted from the GFGP accreditation with additional funding sources opening to them.

The SRPNTS programme, after initially ending prematurely in March 2021 due to cuts in UKAID funding has recently been awarded limited term project extension until the end of March 2022. This will allow us to improve the research capacity at partner institutions and complete key science activities around the proof-of-concept snakebite therapeutic research within the grant.

During the lockdowns in 2020, early career researchers (ERC) within the CSRI established International Toxin Talks (ITT) with the idea to provide a free, easily accessible platform for ECR toxinologists around the world, and in October 2021 ITT celebrated its first birthday. Over 5 days, over 100 people attended to listen to ECRs from Myanmar to Mexico, Singapore to the United States, give short research talks and participate in two discussion panels with world-leading researchers and snakebite advocates. ITT has now been invited to form the formal ECR component of the International Society of Toxinology to continue to build upon their pioneering science communication work.

Hybridisation in UroGenital Schistosomiasis (HUGS)

HUGS is a new 4-year Joint Investigator Award from the Wellcome Trust with Professor Stothard and Dr Musaya as co-PIs. The project started in April 2021 and will follow a cohort of people and livestock to assess the importance of hybrid schistosomes.

Based in Mangochi and Nsanje Districts, Malawi, pilot surveys have determined a hitherto unrealised endemicity of Schistosoma mattheei and Schistosoma bovis in cattle. The close proximity of cattle watering points to washing/water collection points of local villagers creates significant opportunities for zoonotic spill over of hybrid schistosomes into the human populace.

HUGS will track these hybrid worms as they intermingle with Schistosoma haematobium to determine if they cause heightened disease or are more resilient to praziquantel treatment in people. Recent assessments of the prevalence of urogenital and intestinal schistosomiasis in local school children demonstrate more than 50% are currently infected and desperately need preventive chemotherapy.

Post-COVID mass drug administration actions are starting up in Malawi with treatments being offered in December. The results of HUGS will help the national control programme optimise a more holistic or OneHealth approach for control of schistosomiasis in Malawi and in neighbouring countries.

School health surveys in Mangochi District, Malawi, restarting post COVID. Photo by Russell Stothard

Department of Tropical Disease Biology

Tropical Disease Biology (TDB) is a leading 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'. A key strength of the department is that we use community/field observations to inform basic laboratory experiments and in the same way aim to use findings from basic research to influence clinical treatment and community prevention initiatives.

Professor Giancarlo Biagini
Head of Tropical Disease Biology

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 and high consequence infectious diseases (e.g. Crimean-Congo haemorrhagic fever, 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 snakebite.

Within TDB there are three centres: the Centre for Drugs and Diagnostics (CDD), the Centre for Neglected Tropical Disease (CNTD) and the Centre for Snakebite Research and Interventions (CSRI). The Centres are key vehicles within the Department, moving research into developable solutions e.g. drugs, diagnostics, vaccines; enabling technologies; implementing activities and policies.

Promoting a positive research culture and investing in our future generation

TDB firmly believes that responsible innovation is key to sustainability. Shaping an inclusive environment in which diversity is valued is at the core of TDB's strategic plans. TDB promotes positive actions for the recruitment, retention and progression of underrepresented groups.

TDB adheres to the San Francisco Declaration on Researcher Assessment (DORA), committing to making assessments of research performance based primarily on the quality of the research, judged by peer review. This helps ensure a transparent and fair consideration of research quality, across a range of outputs taking into account different career stages and disciplines. TDB is aligned to the Concordat for Research Integrity and has 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.

The Department has pro-actively engaged with the implementation of The Concordat to Support the Career Development of Researchers and the Knowledge Exchange Concordat (KEC). As a result, researchers have access to a broad range of training opportunities, internal pump-priming and fellowship awards and recognition of impact outside of the traditional measures of research income and publications. In addition, there has been integration of early career researcher (ECR) participation within decision-making structures.

TDB has a vibrant ECR community and this year we are delighted to report that three of our ECRs, Dr Ana Cubas Atienzar, Dr Taline Kazandjian and Dr Laura Jeffreys, were successful in securing a Director's Catalyst Fund (DCF) award. In addition, Dr Stefanie Menzies, Dr Michael Abouyannis and Dr Becky Edge received grants from the Royal Society of Tropical Medicine and Hygiene (RSTMH) & Hamish Ogston Foundation to investigate diagnostic, pathogenesis and biological research questions in snakebite.

It is with great pleasure that the Department can also celebrate career progression and announce lectureship appointments, within the school's career track (CT) scheme, of four new investigators:

Dr Stuart Ainsworth is a UKRI Future Leader Fellow based within CSRI. Originally a microbiologist, Dr Ainsworth's fellowship is based on investigating the use of virus-like-particles, decorated with key venom components, to produce an antivenom which will possess significantly greater efficacy and geographic utility than current, crude venom derived antivenoms.

Dr Thomas Edwards' research focus is the design of innovative molecular diagnostics, using novel technologies to improve the speed, ease of use, or multiplexing ability of diagnostic tests. During the next three years he will drive early translational research in diagnostics at LSTM, in AMR and tropical fevers, working

with academic, clinical and industrial partners in the UK, Turkey and Uganda, to evaluate these tests in the field and bring them closer to market.

Dr Cassie Modahl's research expertise and interests are in the use of "omic technologies" as tools for developing neglected tropical disease treatments. Working within TDB's CSRI, Dr Modahl's current research focuses on defining the pathophysiology caused by snakebite and developing monoclonal antibodies to treat snakebite.

Dr Ghaith Aljayyoussi is a Pharmacokinetic/ Pharmacodynamic (PK/PD) modeller who is currently working on a range of projects, principally in drug discovery, within LSTM and with international academic, non-academic and industrial partners. Dr Aljayyoussi developed a software tool, MMVSola.org, that is an open source online platform, created in collaboration between LSTM and Medicines for Malaria Venture (MMV). It allows scientists in the international drug discovery community of malaria therapeutics to test their candidates, rank them and generate dosing predictions. It is predicted to lead to a dramatic decrease in the use of animals for malaria research.

Research Performance

TDB has achieved another outstanding year of research outputs, with some 200 peer-reviewed publications across the translational T1-T4 continuum, including publication of step-changing studies in leading journals. Key to its success is recognition that collaboration and partnership are essential for innovation, this is underlined by the department's formal collaborations in over 35 countries. TDB's reputation as a leading research department of international calibre is further evidenced by our ability to secure significant competitive funding – during this reporting period, TDB's active grant funding is approximately £70M split over more than 60 awards from a broad portfolio of funders.

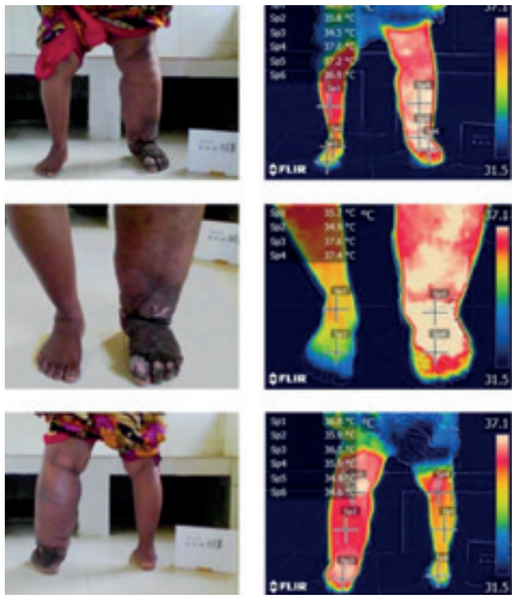
Investment in Infrastructure

TDB recognises the importance of working with pathogens of diseases and not surrogates, and has previously invested in establishing and operating multiple containment level 3 laboratories. This year, we have made a further ca. £1million investment in new state-of-the art infrastructure that includes new imaging platforms and analytical platforms. These new facilities are unique in the academic sector and will allow TDB to continue to be a word leading department in translational research for infectious diseases.

Research Highlights

The cuts to UKAID made by the Foreign, Commonwealth & Development Office (FCDO) had a major impact on our FCDO funded NTD programmes, ASCEND and COUNTDOWN. Highlights of the impacts these programmes made to NTD programmes over the past two decades is to be found in the Feature Article on Neglected Tropical Diseases.

This year saw two advances in the care and monitoring of lymphatic filariasis (LF) patients with lymphoedema. Two papers published in the Journal of Clinical Medicine reported improvements in lymphoedema status and frequency of acute attacks in patients with enhanced care packages including self-massage and breathing exercise. In the same journal Dr. Louise Kelly-Hope et al. reported on a new thermal imaging camera, which by measuring skin temperature was able to detect subclinical cases and predict the progression of lymphoedema and is now being evaluated in a multi-country prospective cohort study in Bangladesh, Ethiopia and Malawi.



Thermal imaging of lymphoedema (Kelly-Hope, LA et al (2021) Journal of Clinical Medicine 20, 2301)

The COUNTDOWN team published in BMJ Global Health the outcomes of a large-scale cross-sectional study for why onchocerciasis transmission persists after 15 years of annual ivermectin mass-drug administration. They showed a very low adherence to ivermectin treatment with many refusing any treatment at all. Interviews with community members highlighted a fear of adverse events following ivermectin, which is a risk in areas with co-endemic loiasis. The study emphasised the need for alternative strategies for onchocerciasis elimination where negative perception of ivermectin is an entrenched barrier to community participation in elimination programmes.

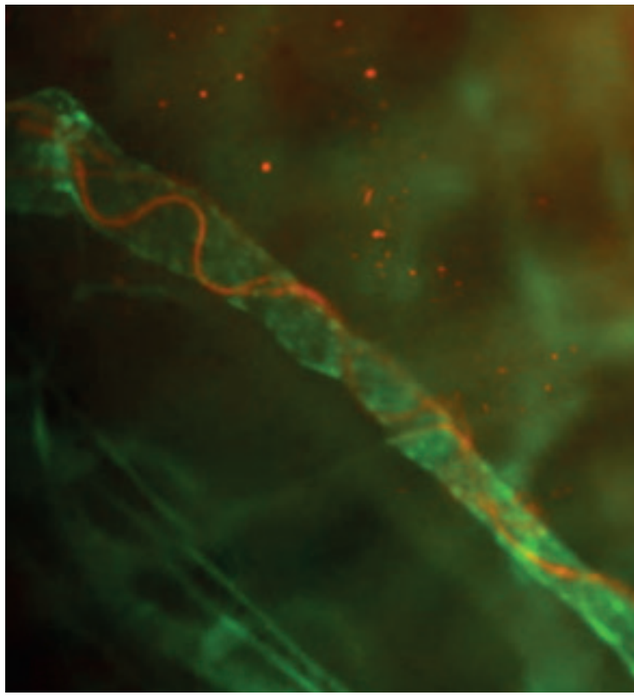
Working within CDD, several teams have made significant advances in therapeutics development and antimicrobial resistance research. Professors Steve Ward and Mark Taylor and Dr Joe Turner are leading projects for two potential alternative treatments designed to target the filarial symbiont *Wolbachia*; AWZ1066S and ABBV-4083 (TylaMac), which are currently progressing through clinical trials in DRC in partnership with DNDi and Abbvie and in Liverpool in partnership with Eisai and the Clinical Research Unit, Liverpool University Foundation Hospitals Trust, with the aim of delivering safe and effective macrofilaricides to support the elimination of onchocerciasis and LF.

CDDs discovery drug portfolio has a broad range of projects against a number of diseases including TB, malaria, SARS-COV-2, onchocerciasis and lymphatic filariasis and WHO-identified priority AMR bacterial pathogens. Work led by Dr Roberts' team funded by a recent European Regional Development Fund Award, has led to extremely productive collaborations with innovative SMEs in the Northwest of England who were looking to test, validate and improve their antimicrobial products with a view to getting them nearer to market. Projects have been completed with BioData Network Ltd, AmDel Medical and ShimyaTech.

TDB is committed to developing knowledge exchange activities to help drive regional economic, social and cultural recovery and growth. Professor Giancarlo Biagini, received a personal award from the UKRI as an "Innovation Scholar". During this role, he will take an academic lead towards the development of sustainable academic-industry partnerships that aim to generate breakthrough innovation for the treatment and management of infectious diseases. Aligned to this ambition, research teams within the CDD have worked with multiple regional companies and international agencies during the COVID-19 pandemic on developing new pre-clinical drug testing platforms, screening company drug assets against SARS-CoV-2 and testing agents for antiviral activity against SARS-CoV-2, including using a new platform for testing the efficacy of air sterilising solutions against artificially generated aerosols of SARS-CoV-2.

Significant SARS-CoV-2-related knowledge exchange activities with industry have also been conducted by the research team led by Dr Grant Hughes. The team have studies examining viral persistence, transfer of virus between skin and surfaces, and developing novel anti-viral surfaces. In addition, the team have a partnership with Unilever examining the capacity of oral care products to inactivate virus, and have looked at COVID-19 infection in cats and dogs. Catalysed via the flagship iiCON project, TDB investigators working on anti-infective research have significantly increased their engagement with regional and national SMEs and industrial partners. For example, the research team, led by Dr Adam Roberts, is continuing to assemble a substantive environmental bacteria library (currently >30,000 bacteria) so it can be available for screening by the CDD, other research institutions and companies, for new antimicrobial products. This is an extension of LSTM's citizen science project "Swab and Send" where things and places are swabbed by schools, colleges and members of the public in order to find new bacteria naturally producing novel antimicrobials.

In more fundamental studies on NTDs, Dr Joe Turner and colleagues in CNTD and CDD have unravelled the mechanism by which a common and affordable antibiotic works as a lymphatic filariasis anti-morbidity treatment. Whilst it has been over a decade since Professor Taylor first discovered that doxycycline is remarkably affective at reducing elephantiasis, the mechanism by which the drug works has remained a mystery.



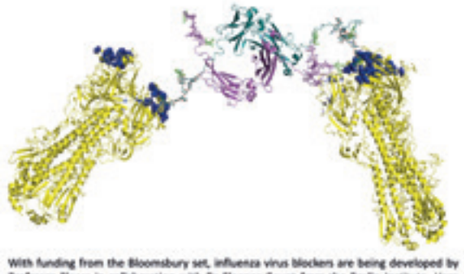
Filarial worm (red) captured immediately after invading the lymphatics (green). Image by Dr Joseph Turner

Surprisingly, the recent investigation demonstrates that doxycycline has a number of anti-inflammatory properties which culminate to prevent the pathogenic growth of malfunctioning and swollen lymphatic vessels following initial infection. The researchers now hope to embark on new studies to identify the precise nature of inflammation provoking disease and test affordable, readily available anti-inflammatory drugs as new treatments for this devastating disease of poverty. Fundamental studies on the mode of action of the antimalarial class, the 8-amino quinolines, continues within TDB following a recent award from the MRC. This award will support the team within TDB to work with partners MMV and GSK Pharmaceuticals to define the mechanism underpinning the mode of action of this important class of drugs that are currently the only therapies for the treatment of relapse malaria.

The diagnostic teams led by Drs Emily Adams, Tom Edwards and Ana Cubas Atienzar, working within TDB's CDD, completed a project with the UK Public Health Rapid Support team to develop a point of care molecular test for Crimean Congo haemorrhagic fever using the GeneDrive platform. The test was shown to be 95% accurate during studies at the UK Health Security Agency (UKHSA) and is currently being validate in trials in Turkey. The assay has now attracted further funding to progress its development into a final freeze-dried kit. The diagnostic group has also been working on a project to develop bacteriophages as biosensors for the early detection of blood stream infection and has isolated and characterised a library of novel phages with potential diagnostic applications.

CSRI focuses on developing, testing and implementing strategies aimed at mitigating the burden of tropical snakebite. CSRI researchers have described a number of important scientific outcomes over the past year, including a paper in Nature Communications revealing how combination therapies of small molecule repurposed drugs offer broad preclinical protection against viper snakebite, findings in Science detailing how toxins associated with defensive venom spitting have evolved, and public health findings in PLOS Neglected Tropical Diseases relating to the economic cost of snakebite Burkina Faso and risk factors associated with treatment adverse reactions in Nigeria.

Professor Stothard and Dr Musaya (MLW) are continuing to track the unexpected changes in epidemiology of both urogenital and intestinal schistosomiasis in Lake Malawi funded by a Wellcome Trust Joint Investigator award. In addition, Professor Stothard's team will be leading research themes in schistosomiasis in the recently awarded NHIR funded Shire Valley Vector Control Project (ShiVec).



With funding from the Bloomsbury set, influenza virus blockers are being developed by Professor Pleass in collaboration with Dr Eleanor Gaunt from the Roslin Institute. Here one molecule of the engineered Fc is seen binding two influenza haemagglutinin molecules in yellow. Haemagglutinin is the major target of protective immune responses and is located on the virus surface. The sialic acid (green) receptor binding pocket is shown in dark blue spheres. The work is described in the MAbs. 2021 Jan-Dec;13(1):1953220. doi: 10.1080/19420862.2021.1953220.

TDB continues with the expansion and innovation of novel antibody platforms. Professor Pleass, in collaboration with Dr Eleanor Gaunt from the Roslin Institute, has recently obtained funding for proof-of-concept studies to demonstrate the therapeutic potential of sialylated Fc domains of human IgG as both for therapeutic discovery of new disease immune modulators and antiviral drugs.

Dr Hastings and colleagues continued their work on optimizing methods to estimate malaria drug effectiveness, and published the fourth in a series of papers showing the current WHO-approved methods most likely miss around half of all drug failures and that deep-sequencing 3 to 5 carefully selected genes is accurate and should become the new "gold standard" in surveillance for drug resistance. They also continued to work on how insecticides can be deployed to control disease vectors while minimizing selection for resistance.

Special Thanks to Professor Robert Harrison

Professor Robert Harrison and the late Mr Kofi Annan. Photo by Kofi Annan Foundation

This year marked the retirement of Professor Robert Harrison, former Director of CSRI. Professor Harrison joined LSTM in 1994 and made major research contributions to the field, including applying some of the first transcriptomic approaches to define snake venom composition and pioneering the use of rationally selected toxin epitopes as novel ways to generate venom-specific therapeutic antibodies. Simultaneous, Professor Harrison became a globally recognised advocate for snakebite, and was a key player in successfully lobbying the WHO, Wellcome and the Kofi Annan Foundation to formally recognise snakebite as a priority neglected tropical disease. At LSTM, Professor Harrison's legacy is best exemplified by the growth of a small snakebite research group into the 25-person strong CSRI that exists today. We wish Professor Harrison a very successful retirement and thank him for his outstanding contributions to the field of neglected tropical diseases.

FEATURE ARTICLE:

Malaria and other Vector Borne Diseases

LSTM hosts a diverse research portfolio in vector borne diseases (VBDs), from mosquito genomics to health economics, spanning the whole 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 in prevention and treatment are urgently needed. The technical expertise, strong collaborations with research and implementation partners in disease endemic countries and ongoing expansion with the next generation of VBD scientists, puts LSTM in a prime position to tackle the ongoing challenges in this field.

CEASE

The LSTM led CEASE project – Controlling Emergent *Anopheles stephansi* in Ethiopia and Sudan – began in 2020, looking at the reasons that the invasive mosquito species has been found in the horn of Africa, far from its traditional home in the Middle East and South Asia. Between 2000 and 2010, the mosquito hitchhiked its way to the Arabian Peninsula via freight traffic and eventually reached the Horn of Africa. A mainly urban dwelling insect, the *Anopheles stephansi* has been linked to an increase in cases of malaria in cities, including an unusual outbreak in Djibouti City.

anopheles stephensi. Photo by RadboudUMC

With the UN estimating that 56% of the population of Africa will live in urban areas by 2050, an urban-adapted malaria mosquito could be a real problem in a country where the disease is already endemic. A £3.5 million award from the Wellcome Trust will enable the collaboration to understand the spread and offer targets to control this invasive species.

The interdisciplinary CEASE team is divided into entomological, epidemiological, mathematical and geostatistical modelling and social sciences work packages in order to map the spread and the route of the mosquito.

The collaboration brings together experts from Jimma University and Armauer Hansen Research Institute, both in Ethiopia; University of Khartoum, Sudan; Institute of Tropical Medicine (ITM), Belgium; Imperial College London, Lancaster University and LSTM.

PIIVeC

The Partnership for Increasing the Impact of Vector Control (PIIVeC) was established with funding from the Global Challenges Research Fund. Bringing together leading research institutes and national disease control programmes in Burkina Faso, Cameroon and Malawi, the partnership is generating new evidence to develop effective, locally appropriate strategies for the control of vector borne diseases and strengthening research capacity in this area.

Generating new knowledge and tools to support vector control

Through a network of researchers in partner countries, PIIVeC co-created a multidisciplinary research programme to address some of the most pressing challenges and evidence gaps. It supported 12 African research fellows to establish their own independent research groups by providing research funding, access to a multidisciplinary network or advisors at LSTM and partner organisations, and by supporting a further 20 junior scientists who are mentored by PIIVeC's research fellows. Over half of the research fellows have already secured follow on funding and/or permanent research positions in African research organisations and several have received invitations to join key advisory boards at WHO. Through ongoing dialogue with Ministries of Health, PIIVeC commissioned over 15 small, demand-led

operational research projects, on topics ranging from quality control of insecticide treated bednets to opportunities for strengthening community engagement in dengue control.

Building local research capacity in vector control

In addition to supporting our African Research Fellows transition to independence, the partnership has invested in institutional capacity strengthening. Following capacity assessments in the four partner research organisations, action plans were developed to fill capacity gaps. Actions supported by PIIVeC included physical improvements to laboratories and experimental field stations, training in quality and data management systems and support for Good Financial Grant Practices accreditation.

Reinforcing links between researchers and policymakers

Throughout the project we have provided training and support to all researchers in the communication of their research findings to diverse audiences; this aspect of the programme was highly valued by all participants in a recent evaluation. To strengthen the utilization of evidence, technical vector control advisory groups (TVCAGs) were established in each country. These serve as knowledge translation platforms that enable a two-way dialogue between researchers and policymakers with each multi-sectoral TVCAG comprised of members from government, research, and industry. Together, they have defined the vector control research agenda in each country and, as testament to their success, all three countries have identified pathways to maintaining the TVCAGs after the current cycle of funding ends next year.

Examples of Research Supported by PIIVeC

- *Alert on high levels of dengue in patients with acute febrile illness in Cameroon*
- *Data on performance of new classes of insecticide for malaria control in Malawi*
- *Identification of threats to sleeping sickness control in Southern Cameroon and piloting of vector control tools.*
- *Identification of a new method to rapidly detect exposure to pyriproxyfen, and insect growth regulator being incorporated into new classes of insecticide treated nets.*
- *Quantification of the impact of malaria on productivity of cotton farmers in Burkina Faso*
- *Development and evaluation of improved traps for blackflies and tsetse*
- *Characterisation of ectoparasites of cattle in Cameroon*
- *Profiling of insecticide resistance, and underpinning mechanisms, in Aedes and Anophelesmosquitoes.*

MALCOV

MALCOV, a study designed to determine the interaction between malaria and COVID-19 on disease progression and severity, led by Professor Feiko ter Kuile of the Malaria Epidemiology Group. It is funded by the Bill & Melinda Gates Foundation, has been ongoing in western Kenya since January 2021. It is conducted in collaboration with the London School of Hygiene and Tropical Medicine and the GRASS institute in Burkina Faso.

ATSB

In addition, a large new vector control trial co-led by Professors Ter Kuile and Donnelly is scheduled to start in early2022, looking at the impact of attractive targeted sugar bait (ATSB) to reduce malaria transmission in about 70 rural villages in western Kenya. The trial is funded by the Innovative Vector Control Consortium (IVCC) and is part of a larger international network of partners conducting similar large trials in Mali and Zambia. ATSBs are bait stations hung on the exterior walls of houses to target the population of outdoor biting *Anopheles* mosquitoes responsible for the continued transmission of malaria in areas where insecticide-treated bednets, targeting indoor biting mosquitoes, are widely used. The baseline ATSB studies started in 2021.

Innovation to Impact (i2i)

A continuation award of $2million USD from the Bill & Melinda Gates Foundation to the Innovation to Impact (i2i) team at LSTM will help to reduce the impact of vector-borne diseases by improving the product development landscape for vector control tools. Supporting enhanced evaluation processes for new products the team will work with the World Health Organization Pre-Qualification Vector Control Team in Geneva as well as stakeholders from global and country level policy makers, product developers, donors, regulators and implementing partners to streamline data generation, while working to address regulatory bottlenecks at country level.

The need for new vector control tools is now more urgent than ever. This is particularly true in Africa, where the challenges have been exacerbated by the development of insecticide resistance amongst vector populations. New tools are required to urgently address this threat and allow countries to expand their effective portfolio of tools to combat vector borne diseases in a wider range of settings.

The i2i leadership team has now transitioned to LSTM's Vector Biology Department and will be supported by a Steering Committee comprising global experts in product development, regulatory affairs, trial design and public health.

House Modification

In a study led by Penn State University, researchers from LSTM looked at a new type of housing modification which reduces malaria incidence among children by between 40 and 50%.

The intervention uses window screening, together with PVC tubes fitted with insecticide-laced screens and installed under the eaves of homes, as a novel method of killing malaria mosquitoes as they attempt to enter the house. By combining a physical barrier plus an insecticide, the housing modification both blocks and kills mosquitoes, thereby protecting not only the people living inside, but also the community at-large. The study has been published in The Lancet.

Nitisinone in the Control of Tsetse Fly Populations

A study led by LSTM's Dr Alvaro Acosta-Serrano has found that nitisinone, a drug used to treat a number of human genetic diseases can be repurposed to kill blood feeding insects including the tsetse fly.

Tsetse fly. Photo by Dhruv Patel

Tsetse flies transmit the parasitic disease, African trypanosomiasis, which is fatal to both humans and animals if left untreated. Without a vaccine, the most effective way of controlling the disease is to control the tsetse flies that carry it. The FDA-approved drug nitisinone acts by blocking the insect from breaking down the amino acid tyrosine, which is found in abundance in animal blood. The catabolism of tyrosine is crucial for blood-feeding insects such as mosquitoes, ticks and kissing bugs as accumulating amounts of tyrosine becomes toxic to these species if it is not degraded and eliminated. This international team demonstrated that nitisinone was lethal to tsetse flies when administered either orally in the bloodmeal or topically to the insect cuticle. The resulting accumulation of tyrosine led to rapid fly paralysis, tissue disintegration and death.

The drug does not have the same impact on insects that do not feed on blood, making it safe for insects that are beneficial to the environment, such as bumble bees, which is different to widespread use of insecticides. This means that there is potential for an insecticide-free control tool and could compliment insect control strategies to block the transmission of malaria, African trypanosomiasis and other vector borne diseases in Africa.

Bed Nets

Researchers from LSTM confirmed that in areas with high pyrethroid resistance in mosquitoes, fewer people were infected with malaria parasites when piperonyl butoxide (PBO) + pyrethroid-treated bed nets were used. An updated Cochrane Review shows these benefits were sustained over two years.

Bed nets treated with pyrethroid insecticides are an effective way to reduce malaria transmission and have widely been deployed across Africa. However, the spread of insecticide resistance in mosquitoes threatens their impact. One way to control insecticide-resistant mosquito populations is by using insecticide synergists, such as PBO, alongside the insecticide in the bed net. PBO is not an insecticide, but it blocks the substance (an enzyme) inside the mosquito that stops pyrethroids from working.

A recently updated Cochrane review, led by LSTM's Katherine Gleave, assessed the available data to help better understand whether pyrethroid-PBO bed nets were more effective at reducing the burden of malaria compared to standard pyrethroid nets.

The World Health Organization (WHO) requires two randomized trials, in different malaria-endemic settings, demonstrating the public health benefit of an intervention before they can make a policy recommendation to support its use. This update of Gleave incorporates data from a second clinical trial conducted by researchers working with the Government in Uganda in partnership with LSTM scientists.

The review update included 16 trials, conducted between 2010 and 2020, that compared standard pyrethroid nets to pyrethroid-PBO nets. These consisted of 10 experimental hut trials and four village trials that measured the effect of

pyrethroid-PBO nets on wild mosquito populations, as well as two randomized controlled trials (RCTs) which measured the impact of the nets on malaria infection in humans.

The analysis demonstrates that when mosquitoes had high levels of resistance to pyrethroids, pyrethroid-PBO nets performed better than standard pyrethroid-only nets, increasing mosquito mortality and reducing blood feeding rates. In addition, the two RCTs involving 10,603 participants in areas where mosquitoes are very resistant to pyrethroids, found that fewer people were infected with malaria when the population used pyrethroid-PBO nets.

Collating the evidence from the different trials in this systematic review greatly assists WHO in updating Global Policy recommendations on the use of pyrethroid-PBO bednets.

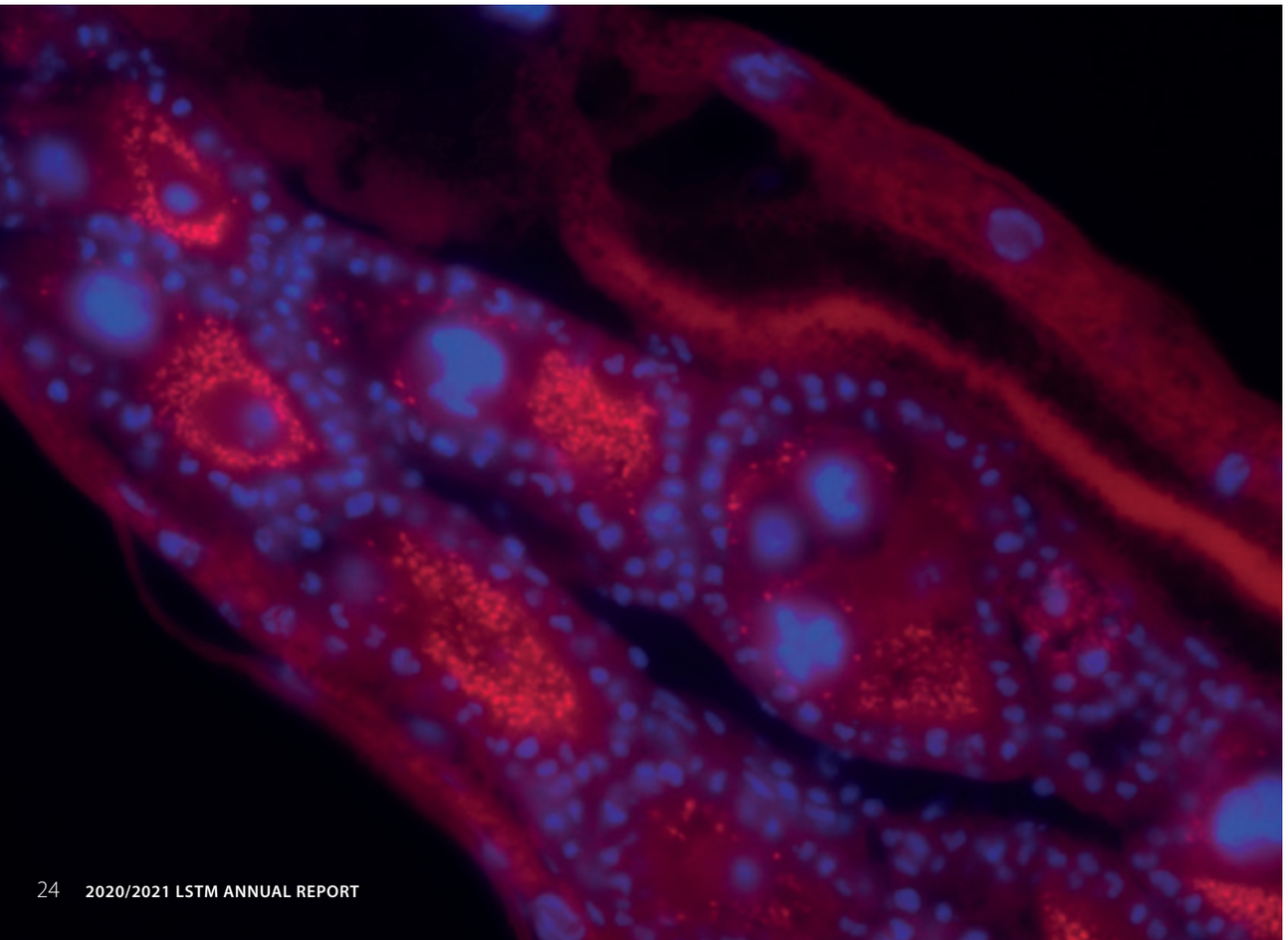
Wolbachia in Malaria Control

A study carried out by researchers from LSTM along with colleagues at the London school of Hygiene and Tropical Medicine (LSHTM) amongst others, and published in Current Biology, provided evidence of high-density natural *Wolbachia* infections in *Anopheles* mosquito populations. The study showed that not only was the bacterial symbiont found in the some of these populations that act as a vector for malaria, but that these strains of *Wolbachia* are transmitted maternally to following generations. Already used in control strategies for arboviruses, this study has provided evidence that raises to possibility that the same could be possible for malaria control.

Genome sequencing of these *Wolbachia* strains obtained genome depths and coverages comparable to other insects known be infected by *Wolbachia*, providing further evidence for the infection. These sequencing data also showed these strains possessed genes which are known to enable the bacteria to spread through host populations, which is critical if *Wolbachia* is to be used for control approaches.

The researchers determined the prevalence, density and genetic diversity of *Wolbachia* strains in geographically diverse mosquito populations of Cameroon, Kenya and the Democratic Republic of Congo (DRC).

Fluorescent in situ hybridization of Wolbachia infections in Anopheles moucheti ovaries (Wolbachia – red, mosquito nuclei stained by DAPI - blue). Image taken by Shivanand Hegde.



Department of Vector Biology

Professor Martin Donnelly
Head of Vector Biology

The Department of Vector Biology has a research portfolio spanning from studies on the functional genomics, behaviour and ecology of disease vectors, to clinical trials, implementation research and the development of tools for monitoring and evaluation of disease transmission. Its aim is to contribute to the control or elimination of vector borne diseases afflicting the world's poorest populations.

Dr Anne Wilson and a team of collaborators from the Gambia National Malaria Control Programme, Durham University, MRC Gambia at LSHTM, LSHTM and the Royal Danish Academy, have conducted experiments evaluating the impact of window screening on indoor climate and entry of malaria mosquitoes into houses in The Gambia. Experimental houses with window screening had lower indoor temperatures and fewer malaria mosquitoes than un-screened houses. Computational fluid dynamic modelling showed that screening works by weakening plumes of carbon dioxide released by humans when sleeping. The house is the most common location of malaria transmission in Africa and by making simple modifications to the house structure we can reduce mosquito entry and make the house cooler, encouraging use of insecticide-treated bednets.

Experimental houses at Walikunda field station, MRC Gambia at LSHTM. Photo by Anne Wilson

Based in the Chikwawa region of southern Malawi, the newly awarded NIHR Shire Valley Vector Control Project (Shire-Vec) led by Dr Chris Jones, Dr Themba Mzilahowa and team, will focus its research on a 40,000-hectare irrigation scheme in the Shire valley exploring its effect on endemic vector borne diseases, such as malaria and schistosomiasis. Working with local farmers and agricultural stakeholders, Shire-Vec will investigate how the irrigation scheme influences smallholder farming practices and disease burden in the area, and will offer practical solutions to manage the impact of the scheme across both public health and agriculture. The project aims to reduce the transmission and burden of vector-borne diseases for smallholder farmers in the lower Shire Valley, while maintaining the socio-economic benefits of expanding agricultural development in southern Malawi.

Dr Tony Nolan and team have been researching methods of genetically manipulating the *Anopheles funestus* mosquito. This year, with Prof Charles Wondji, they showed for the first ever time that it is possible to introduce specific DNA changes of choice into this mosquito. This is important because *Anopheles funestus* is the major vector of human malaria in several regions of Africa. The emergence of resistance to insecticides in these mosquitoes is a big problem in controlling vector populations, and thereby malaria. The study findings allow us to study the genetic basis of resistance to insecticides and open up the possibility of developing new tools to control these mosquitoes.

This year Dr Grant Hughes and his team confirmed that the mosquitoes Anopheles *moucheti* and Anopheles *demeilloni* harbour natural *Wolbachia* infections. Using genome sequencing, PCR, and fluorescent microscopy they showed that these mosquitoes possess high density *Wolbachia* strains that are transferred from mother to progeny. This research provides that first robust evidence that *Wolbachia* naturally resides in Anopheles mosquitoes and these strains are ideal candidates to transfer into other medically relevant Anopheles species for novel vector control approaches.

Dr Acosta-Serrano and colleagues have discovered that interrupting the metabolism of tyrosine (an amino acid taken from the blood meal) using repurposed herbicides, kills tsetse flies and other blood feeding insects, but not sugar feeders like insect pollinators. With financial support from Bill & Melinda Gates Foundation, they have now demonstrated that the same compounds kill Anopheles mosquitoes when administered in sugar or blood meals. Pending on new funding, they plan to start conducting field tests next year, mainly using attractive targeted sugar baits. If the strategy works, it could be used to complement other malaria control strategies and as an integrated approach for the control of several vector-borne diseases.

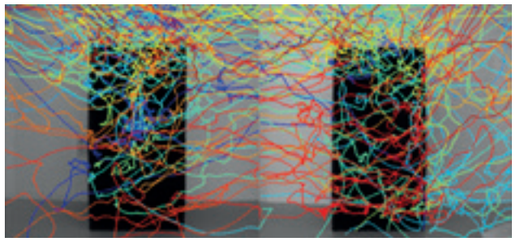
Along with colleagues at MLW, Dr Michelle Stanton has been quantifying the influence of small dams and their resulting reservoirs on Anopheles mosquito abundance in Kasungu, Malawi. They conducted monthly indoor mosquito catches in 90 homes across three communities from May-August 2021, alongside drone mapping to identify mosquito larval habitat and subsequent larval habitat sampling. The results of this study will help identify which communities are at a higher risk of malaria during the dry season, allowing malaria control programmes to target their interventions accordingly.

Indoor spraying of residual insecticides is one of our main malaria vector control tools and this year Dr David Weetman and colleagues conducted research to understand the genetic basis of the resistance to pirimiphos methyl, an insecticide used for this purpose. The work used a combination of in silico analysis of data from the 1000 genomes project and laboratory work on West African samples gathered by project partners. The research found that duplicate copies of the resistance gene are needed for demonstration of the resistance phenotype. This could provide a new technique by which to monitor resistance in the field which can inform malaria control programmes on when to change insecticides.

Dr Jennifer Lord has reached the interview stage for the MRC Career Development Award with a project investigating the transmission dynamics of Japanese encephalitis virus in Bangladesh. The proposed research would involve an iterative process of mathematical modelling and empirical data collection in Bangladesh. Part of the research will assess the ability to predict Japanese encephalitis virus risk based on livestock census survey data which may be used to target vaccination strategies.

In DRC, Professor Steve Torr and colleagues have been scaling up the deployment of Tiny Targets in the former province of Bandundu aiming to control tsetse vectors of Gambian sleeping sickness (Gambian human African trypanosomiasis, gHAT). Tiny Targets were deployed over an area of ~12000 km2 where >50% of cases of gHAT cases had occurred in the last five years; the deployment was carried out by the national programme (PNLTHA) and local communities with technical support provided remotely by LSTM. DRC has the highest burden of gHAT in Africa and strengthening the ability of PNLTHA to implement large-scale tsetse control will enable the country to achieve the WHO goal of eliminating the transmission of gHAT by 2030.

Martin Donnelly and collaborators from LSHTM, IDRC Uganda, UCSF, Makerere University and the National Malaria Control Programme in Uganda have conducted a large clinical trial of a new type of long-lasting insecticidal net. The trial investigated whether the new type of net containing both pyrethroids and piperonyl butoxide (PBO), a synergist that can partially restore pyrethroid susceptibility in mosquito vectors, was more effective than a standard pyrethroid net. The team presented the data from this trial showing that the pyrethroid-PBO net was associated with lower malaria prevalence to WHO in April of this year and they are now moving forward with a new recommendation for how and where Ministries of Health should procure and deploy the new net type



Flight paths of Aedes aegypti mosquitoes as they navigate two bookcases during a tracking experiment in Recife, Brazil. Photo by Luca Facchinelli

Philip McCall's research team uses infra-red 3D video tracking and a range of bioassay methods to investigate the behaviour of mosquitoes during host location and in response to insecticides. Recent work has led to patented improved designs for insecticide-treated bednets in Africa, currently under evaluation in a clinical trial in central Africa, while in collaboration with Instituto Oswaldo Cruz in Recife, Brazil are building 'Indoor Maps' of the movements during flight and resting behaviour of the arbovirus vector *Aedes aegypti*. The research aims to inform the design of novel vector control methods that overcome resistance to existing insecticides or obviate the need for insecticides in disease endemic communities.

Combined rice-duck farming in Bangladesh, which provides suitable larval habitat for potential Japanese encephalitis virus vectors and hosts of both virus and vector. Photo by Jennifer Lord

FEATURE ARTICLE:

Resistance Research and Management

Antimicrobial resistance (AMR) continues to represent a serious, global public health threat and may well have been exacerbated in certain sectors by the COVID-19 pandemic. COVID has changed health-seeking behaviour in different countries in different ways, and the effects of these changes are reflected in antimicrobial use.

It is possible, and in some cases likely, that this will impact the resistance seen in bacteria circulating in healthcare and in the environment at large. The effects might remain unknown for years to come but researchers at LSTM are focused on pandemic preparedness, international awareness, surveillance and capacity building to cope with any changes in AMR that may manifest over the next few years.

Agar letters with environmental bacteria and fungi growing spelling out LSTM and TB ahead of World TB Day 2021. Made by LSTM's Ellie Allman and Claudia McKeown using agar letters instead of plates provides additional public engagement opportunities to inform audiences on AMR.

International Collaborations

Dr Adam Roberts

To this end, LSTM's Dr Adam Roberts was part of an international team of 23 researchers who earlier this year published a landmark paper on 'Key considerations on the potential impacts of the COVID-19 pandemic on antimicrobial resistance research and surveillance'. In the paper the authors call for continued, internationally coordinated and targeted research on AMR so that healthcare systems can be proactive in their response to new disease outbreaks, rather than reactive as we have been with COVID-19.

Despite the serious funding cuts to overseas work experienced in 2021 and the continued disruption to international travel and face-to-face meetings, LSTM has been able to continue to lead on its AMR-facing international projects and collaborative efforts with overseas partners.

One of our key AMR projects, funded by the Medical Research Council, is drawing to a close. The 'Drivers of Resistance in Uganda and Malawi' (DRUM) project, led by Professor Nick Feasey, is in its final year and has generated a wealth of data that is currently being analysed. This ranges from the DNA sequence data and data on human behaviour, to results of policy implementation research. Policy implementation is key to turning the findings of the study into action which can translate into benefits for society. Understanding the barriers to this process are key if policy is to be implemented successfully.

Influencing Policy

The policy work strand of DRUM, led by Russell Dacombe from LSTM's Centre for Capacity Research (CCR), has two main research objectives: to explore key actors' perceptions of barriers to and enablers of the collaborative development and implementation of AMR control policy in Malawi and Uganda, and to explore the collaborative processes and actions of AMR policy development and implementation in those countries.

Data has been collected from in-depth interviews with stakeholders with supporting policy document reviews over the last few years. Most stakeholders in these countries framed the causes of AMR as a development issue, focusing on antibiotic use in the human and animal sectors. Some structural differences in policy formation and implementation were also found, with Uganda operating through an existing One Health structure. Barriers to the development and implementation of AMR policy included competing and conflicting policy priorities and a lack of evidence to push for more prioritisation. The challenges between sectors included AMR being viewed as a human health issue and structural issues negatively impacting on efforts to establish cross-sectoral budgets for joint activities.

Capacity Development

Once policy is in place it is important that capacity and capability exist to effectively carry out that policy and to provide reliable data packages which will further guide development of healthcare infrastructure.

LSTM has been particularly active within The Fleming Fund Country Grants which are designed to provide technical

assistance to strengthen laboratory capacity and surveillance systems to improve the monitoring of AMR. The CCR is part of a consortium led by international development agency DAI that has been awarded Fleming Fund Country Grants for Nigeria, Bangladesh, Pakistan, and Indonesia.

The team supported the renovation of 17 laboratories in Nigeria, as well as two national reference laboratories in Pakistan. The renovated laboratories have received new equipment to improve their AMR diagnostic capabilities. Biorepositories have been formed in the main reference laboratories, which will be used to collect samples from across the country's laboratory network and will form important collections to monitor individual country's AMR trends. Work is progressing between LSTM, DAI and the Indonesian Ministry of Health to undertake a large-scale sequencing-based AMR surveillance project, and a further 20 laboratories from the human and animal health sectors across Pakistan, Indonesia and Bangladesh are in various stages of design and renovation, with work expected to be completed next year.

Quality assurance

CCR also supported the National Institute of Health in Pakistan to update its external quality assurance system for bacteriology in line with international ISO standards; samples for the updated system were distributed to 26 laboratories across Pakistan. As well as helping to improve diagnostic and surveillance-based laboratory quality, the system will also help to form national support networks. The Pakistan model is now being adapted to help update comparable systems for human and animal health in Bangladesh.

Other international collaborations

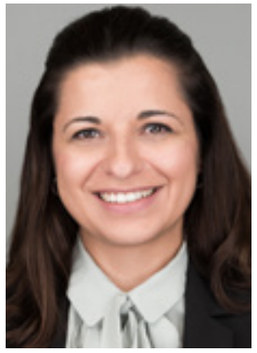
Another international project, 'AMR Responsive Dialogues', is being led by Dr Eleanor MacPherson at MLW in Malawi. This Wellcome Trust-funded team is using participatory methods to co-create solutions and policy asks to address AMR. The project brings together experts, policy makers and different groups (farmers, community prescribers and dispensers, and care givers) as part of the research process. We are also working with the Wellcome Trust Public Engagement team at the Mahidol Oxford Tropical Medicine Research Unit (MORU) to share the project learning across Malawi and Thailand.

In September, LSTM entered a new partnership with the Faculty of Public Health (UK) and the Ghana Public Health Association (GPHA). Supported by a small grant from the Commonwealth Partnerships for Antimicrobial Stewardship (CwPAMS), this partnership positions the consortium well for future collaborative efforts and funding for antimicrobial stewardship work in Ghana. Both GPHA and CwPAMS are influential in the activities of the Ghana National Platform Antimicrobial Resistance, the body mandated by the government to drive the national agenda on antimicrobial resistance in policy.

Policy also features heavily in the NIHR Global Health Professorship recently awarded to Professor Nick Feasey. This award is aimed at answering the question of how the WHO Infection Prevention and Control (IPC) guidelines can be adapted to the African context, and iteratively improved by using causal inference to investigate their efficacy and economic modelling to evaluate their cost-effectiveness. It will provide five years of funding to enable Professor Feasey and his team to describe the effectiveness, efficacy and cost effectiveness of an IPC programme in Africa. Success in Malawi will entail the development of a cadre of IPC professionals that will establish a learning health system capable of sustaining an effective IPC programme, which will be able to respond to future threats such as pandemics.

Department of Clinical Sciences

As has been the case across LSTM, the past academic year has been a challenging one for the Department of Clinical Sciences (DoCS). Lockdowns and reduced funding have had their impacts but there are also reasons for optimism. The department's researchers and clinical workers have continued to deliver a diverse translational impact as well as making significant 'bench to bedside' contributions to the COVID-19 response.



Professor Daniela Ferreira
Head of Clinical Sciences

Human Challenge

The need for the rapid development of safe medicines has impacted on our established controlled human infection models (CHIM). Professor Daniela Ferreira and her team are moving from single infection models and are instead establishing co-infection models which better mimic the real-world environment in which viruses and bacteria circulate and frequently interact in their human host.

2021 also marked the completion of an important step in consolidating the CHIM facility in Blantyre, Malawi. The team will now start a randomised controlled trial to investigate how vaccines against common causes of pneumonia behave differently in Malawi compared with in the high-income countries in which they were designed. The results will directly benefit the populations most at risk from these diseases.

COVID-19

This year saw the publication of the first immunological description of severe COVID-19 in Africa. The evidence was produced by an international team of scientists which included DoCS staff and demonstrates the strength of this approach in delivering the best science, and quickly.

As outlined in the COVID overview at the beginning of this report, the Cochrane Infectious Diseases Group (CIDG) published a review of ivermectin in COVID-19. This has been widely cited in major newspapers and is #160 out of 190 million research outputs tracked by Altmetrics.

As the review showed, ivermectin does not work in the treatment of COVID-19, but the delivery of high-quality care and careful research at the individual level do. Staff in Kenya, Malawi, Uganda and elsewhere have continued important capacity building through clinical provision, training and supporting the availability of PPE through LSTM's #BumpItForward campaign. Key to this success has been the long-term partnerships between LSTM collaborators and ministries of health, hospitals, and NGOs. We are living through difficult times but continue to celebrate these important connections and friendships.

Respiratory Research

IMPALA (International Multidisciplinary Programme to Address Lung Health and TB in Africa) is a four-year collaboration

The IMPALA team in Durban, South Africa

funded by the National Institute of Health Research (NIHR). The programme was completed in September 2021 and has been highly successful. It has seen five PhD students from the Global South drive relevant research agendas in acute and chronic respiratory care. Larger scale projects have included a birth cohort examining early life impact of the environment on lung health, and the integration of health systems for chronic respiratory disease. This trans-disciplinary group has woven policy, clinical and health systems aspects into 39 publications, 30 media events, 36 conference presentations, broad training in science and project administration, and more.

Tupumue community team creating a mural in the Mukuru informal settlement, Nairobi. Photo by Hellen Meme

Respiratory care themes continue within the Tupumue (a Kiswahili word meaning 'let's breathe') study of childhood non-communicable lung disease in Nairobi, Kenya through creative arts (theatre, street art, puppetry, storytelling), novel testing for asthma using a running test, and the measurement of personal air pollution exposure.

There was also considerable tuberculosis-related activity including the provision of multiple systematic reviews to WHO by Dr Peter MacPherson and colleagues, and policy-changing primary research demonstrating the efficacy of automated chest X-ray-based screening.

Equitable North-South Partnerships

The department's commitment to equity within its international partnerships is clear. This year members of DoCS took this further by leading the production of consensus guidance to promote equitable partnerships in manuscript submissions.

(More than Minutes)

LSTM researchers were part of a multi-disciplinary team of researchers and journal editors from South Africa, Kenya, Tanzania, Nigeria, Malawi and the UK who reviewed relevant literature and existing guidelines and developed the proposed guidance. The team sought to address the problem of parachute research, i.e. research that is conducted in low- or middle-income countries (LMICs) by researchers from institutions in high-income countries without adequate recognition of the contribution of the LMIC research teams. The proposed guidelines provide guidance to journal editors about how they should assess these statements when decisions to accept or reject submitted manuscripts are made. The authors urge journal editors to adopt these recommendations to ensure the practice of parachute research stops and current authorship inequities in their journals is being addressed.

North-South learning in Antimicrobial Resistance

Antimicrobial resistance (AMR) is a globally important issue which is increasingly compromising human health. It occurs when microorganisms (bacteria, fungi and protozoans) develop the ability to grow in the presence of the antibiotics, antiseptics and antimicrobials that are supposed to either kill them or prevent their growth. DoCS is involved in this vital research. This year Professor Nick Feasey was awarded an NIHR Global Health Professorship which ties his work in AMR in Malawi to the drug resistance group within the LSTM led infection innovation consortium, iiCON. Also, Dr Patrick Musicha will join DoCS from the Sanger Institute to continue AMR work in Malawi as part of his Wellcome Africa International Fellowship.

The Global Health Trials Unit (GHTU)

The GHTU is a specialist unit with an international outlook and focus. It designs, conducts, analyses, and publishes global health trials in low and middle-income countries (LMICs). The expert statistical, epidemiological, and other methodological advice supports many successful trials whilst benefitting from LSTM's experience in wide-ranging research.

The team remained very active during the COVID pandemic and supported a number of related trials including MALCOV, designed to look at the interaction of Malaria and COVID; a COVID diagnostic study with Mologic, manufacturers of rapid antigen tests, and led on the AGILE drug trial in South Africa, as part of the larger AGILE platform testing the efficacy of drugs for use following early diagnosis of COVID-19.

To date, GHTU supported more than 20 studies with many still active and more scheduled to start.

Acute Medical Care in LMICs

Sepsis remains a key driver of global mortality and an important focus for DoCS. This year key publications from Dr Joe Lewis and colleagues have identified tuberculosis as an important contributor to the sepsis problem in Malawi, and further epidemiological work by Dr Peter MacPherson's and colleagues suggests that targeted HIV inpatient care might reduce mortality.

However, identifying and treating human disease can be very complex, even for 'simple drugs' for 'simple conditions'. The rise of multimorbidity (the presence of two or more long-term health conditions) which has resulted from global trends in non-communicable diseases and the persistence of infections as major health risks, demands that we deliver more horizontally-integrated care. Dr Felix Limbani at MLW and Dr Jamie Rylance have been awarded £5m by NIHR to address the issue and its health system considerations in hospitals in Malawi and Tanzania (the Multilink project).

Menstrual, Sexual and Reproductive Health in Adolescents

Adolescence is a sensitive time for girls' sexual and reproductive health. Biological changes occur alongside heightening pressures for sexual activity which unfortunately can result in sexually-transmitted infections. A team led by Professor Penelope Phillips-Howard has completed the follow-up to a trial for menstrual and health solutions for out-of-school adolescent girls in Kenya. The study has revealed the factors associated with sexual activity and sexually-transmitted infections and highlighted the vulnerability of this group of young women, particularly among those experiencing early menarche. The team's baseline data will be followed-up with the results of a randomised controlled trial of the impact of menstrual cups and cash transfers in reducing infections and school dropout rates.

Paediatric Nutrition

Bacteria that occur naturally in breast-fed infants may help to prevent gut infections and improve gut health, which can have profound health implications for those children. Professor Stephen Allen is leading a study in western Kenya which will test whether dietary supplements given to children over 0-6 months can improve their gut health and prevent malnutrition. LSTM is also leading the Neonatal Nutritional Network and the Gut Health Workstream of the GCRF Action Against Stunting Hub (AASH) which is active in Nigeria, Senegal, India and Indonesia.

FEATURE ARTICLE:

Lung Health and TB

LSTM's lung health and tuberculosis (TB) research takes a holistic, person centred and gender sensitive 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 cause by viral and bacterial pathogens as well as non-communicable conditions such as asthma and chronic obstructive pulmonary disease.

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

IMPALAA PhD students (from l to r): Martin Njoroge; Jacqueline Kagima; Irene Ayakaka; Brenda Mugai and Stephen Mulupi)

IMPALA

This year saw the successful completion of the International Multidisciplinary Programme to Address Lung Health and TB in Africa (IMPALA). This has been a four your collaborative Lung health research and capacity strengthening programme led by Professors Mortimer and Chakaya and Dr Obasi at LSTM, working with scientists from 22 institutions from 14 countries, including 10 in Africa, which has been the focus of IMPALA activities.

Key studies have been completed by PhD students in five disciplinary areas: clinical, social science, health systems, health economics and policy as follows:

- *A mixed-methods prospective evaluation of the diagnostic utility of point of care ultrasound study of 213 adults with acute respiratory symptoms in Kenya (Kagima)*
- *Exploration of patient and health worker needs & experiences around communication for Chronic Respiratory Diseases (CRDs) management in public health facilities in Kampala, Uganda (Ayakaka)*
- *Health system readiness evaluations of responses to patients with chronic respiratory diseases and an evaluation of the health system impact of COVID-19 (Mulupi)*
- *Model-based analyses of data on 1282 adults to measure the health burden of airflow obstruction and the relationship of health-related quality of life to lung function (Njoroge)*
- *Evaluation of the use of CXR in TB screening for the large-scale identification of non-TB lung disease and the assessment of the feasibility assessment of operational modelling in the use of TB policy in Kenya (Mungai).*

Other larger studies completed this year include a mixed-methods, cross-country (Sudan & Tanzania) evaluation of a health systems strengthening intervention and prospective cohort study of the association of maternal diet, food insecurity, air pollution, household energy use on lung function of 564 pregnant women & their babies in Uganda.

Our key findings have contributed new knowledge in four thematic areas:

Lung health diagnostics include confirmation that use of clinician-performed point of care ultrasound (PoCUS) can promote accurate & early diagnosis & treatment to acutely breathlessness patients. This is particularly relevant in LMICs where access to advanced diagnostics can be limited.

The examination of **lung health systems** challenges in chronic respiratory disease has found that non-TB lung diseases are neglected. The majority of symptomatic patients who do not have TB receive no diagnosis. Asthma-related stigma undermines diagnosis & management. Low-cost lung function tests are feasible but not accepted by community due to stigma associated with being seen with peak flow meters or inhalers. For those receiving treatment asthma care was unaffordable to most & not covered by existing social protection. IMPALA's co-designed health system strengthening approach is an acceptable and feasible way to address some of these challenges.

Research into **lung health across the life course** has shown that the nutritional intake of a high proportion of pregnant women in the study communities in Uganda were insufficient for healthy lung development in their infants; that exposure to high levels air pollutants & low socioeconomic status suggest population at high risk of CRDs later in life; and that previous TB and declining lung function significantly impacts health related quality of life.

Lung health policy research identified the urgent need for strengthened prioritisation of non-TB lung disease and that operational modelling may be an acceptable and feasible way to strengthen lung health policy making.

IMPALA has also led important global initiatives to strengthen lung health research in LMIC. For example, the publication in *The Lancet* (Meghji et al) of an already highly cited review of strategies to improve lung health in LMIC which synthesised recommendations from a number of global and regional lung health organisations. This includes the Global Asthma Network, The International Union Against TB and Lung Diseases, The Pan African Thoracic Society and the WHO. To further facilitate uptake of research findings have been presented at a number of key international policy forums including two presentations to the Network of African Parliamentary Committees of Health.

In addition to the training of ten early career researchers IMPALA has this year trained and certified 18 clinicians in Kenya in bedside sonography and 201 spirometry practitioners in eight countries on how to train others, contributing to a sustainable legacy of enhanced lung capacity.

LIGHT Consortium

Men have twice the burden of undiagnosed TB compared to women and face substantial barriers in achieving timely diagnosis and treatment. LIGHT (Leaving no-one behind: transforming gendered pathways to health for TB) research programme, a UK aid-funded six-year cross-disciplinary global health research programme, is a consortium of partners based in Kenya, Malawi, Nigeria, Uganda and the UK. It aims to provide new evidence on the effectiveness of gender-sensitive pathways and approaches to health for those with TB in urban, HIV-prevalent settings.

Following the kick-off meeting in September 2020, the team has been busy establishing themselves, despite the challenges faced due to the ongoing COVID-19 pandemic. LIGHT contributed to a systematic review in Emerging Infectious Diseases looking at pooling samples (sputum) as a potentially efficient approach in testing for tuberculosis (TB) during the COVID-19 pandemic.

The team has taken to social media, writing blogs to highlight the importance of a gender-sensitive response in order to end TB; calling for a paradigm shift in addressing the social determinants of TB; and looking at gender equitable access to healthcare as an essential element of a resilient TB response in Nigeria.

They have employed three African Early career researchers to look at areas of study such as health economics, epidemiology and clinical practice. LIGHT was well represented at this year's Union World Conference on Lung Disease, with several presentations disseminating research findings.

IMPACT TB

Three publications from the IMPACT TB programme, PI Dr Maxine Caws, have shown that its community based Active Case Finding interventions for tuberculosis (TB) in Vietnam and Nepal are successfully reaching the poorest, most vulnerable members of the community, who often lack access to conventional health services. Patients often incur substantial costs through having TB. These costs are termed 'catastrophic' due to their long-term impact on the wellbeing of the patient and the household. The programme's health economic evaluation has shown its interventions also reduce the prevalence of 'catastrophic costs' among TB patients and their families in both Vietnam (a middle-income country) and Nepal (a low-income country). Six further publications explored the ways in which evidence contributes to active case finding policy in national TB Programmes of high burden countries, and the critical evidence gaps hindering policy translation and implementation.

A BNMT drone operator flying a banner for World TB Day - Photo by Hem Tamang

Dr Caws' programme of work in collaboration with the Birat Nepal Medical Trust (BNMT) in Nepal continues to grow and now incorporates projects investigating nutritional support for people affected by TB (TB Recovery), the first large scale whole genome sequencing of Mycobacterium tuberculosis in Nepal (TARGET TB), piloting of socioeconomic support models for TB patients (ASCOT), the impact of COVID-19 pandemic on TB service delivery (TB READY) and medical cargo drone transport in remote rural areas. Together these projects take a holistic, multidisciplinary approach to addressing the multiple aspects of the complex challenges facing tuberculosis patients, their families and the healthcare workers supporting patients to access and complete

treatment. The COVID-19 pandemic has underlined our need for strong, patient-centric and accessible health services everywhere to ensure early diagnosis and effective treatment of infectious diseases. Sadly, the strain on fragile health services caused by the pandemic has had a devastating effect on people affected by TB, with many patients unable to access care, delaying diagnosis or dropping out of treatment early. The travel restrictions and diversion of healthcare staff to pandemic response exacerbated the barriers already faced by people suffering from TB in LMIC.

The community based active case finding at the core of this Nepal programme of work is focused on developing optimised, resilient models of patient-centric care for people affected by tuberculosis. The pandemic also highlighted the need to strengthen infectious disease research capacity in LMIC, which has been a focus of LSTM's global programme since its inception. LSTM's collaboration in Nepal is building a team of early career researchers at BNMT who work with a network of international collaborators. This capacity building will support the future development of Nepali science and public health implementation to find locally appropriate and locally driven solutions to the health and development challenges facing the country.

Tupumue

The Tupumue (Kiswahili for 'let us breathe') study is quantifying the burden of childhood non-communicable lung diseases in two communities in Nairobi, Kenya. In addition, it explores children's experiences of lung problems and whether the adult lung disease in Africa starts early in life.

Children aged 5-18 years are being recruited in the informal settlement of Mukuru and adjacent Buruburu. Unusual aspects of Tupumue include the training of local lung health champions to raise the profile of lung disease, the use of creative arts (theatre, street art, puppetry, story telling), the testing of children for asthma using a running test, the measurement of personal air pollution exposure and the use of Child Health Card records of birth weight, serial weights and chest infections.

Tupumue is aiming to recruit 2000 children, which started in late January 202o and halted in March 2020 by COVID-19. Recruitment restarted in May 2021 and to date 2413 parents have allowed us to approach their children and we have measured the lung function of 1117 children.

Tupumue is led by researchers from the Kenyan Medical Research Institute (KEMRI) supported by researchers from 13 UK institutions, led by LSTM.

Malawi

Dr Peter MacPherson and colleagues from MLW undertook four systematic reviews and meta-analyses to inform the new 2021 WHO TB Screening Guidelines. Their review of the impact of active case finding on the community epidemiology of tuberculosis changed WHO recommendations, which now recommend that "Systematic screening for TB disease may be conducted among the general population in areas with an estimated TB prevalence of 0.5% or higher.

Dr MacPherson undertook the first randomised controlled trial to evaluate an artificial intelligence intervention for health. In the PROSPECT Study, adults with symptoms of TB who received computer-aided chest x-ray screening for TB were significantly more likely to be diagnosed with TB and had a much shorter time to initiation of TB treatment than individuals in the routine care system. These trial findings have already contributed to TB Screening Guidelines, with WHO recommending that computer-aided TB screening can be used for TB diagnosis and triage testing.

Researchers from LSTM and MLW, Drs Ben Morton and Dr Kondwani Jambo, led a study exploring the diagnosis and treatment of COVID-19 in Sub-Saharan Africa, the results of which were published in the journal Nature Communications.

The researchers recruited patients who had been admitted to hospital in Malawi with severe acute respiratory infection and suspected COVID-19 disease. The team found that for patients suspected of COVID-19 who tested negative

Tupumue mural

A trial participant in Blantyre, Malawi. Photo Neema Toto


nature COMMUNICATIONS

ARTICLE

Distinct clinical and immunological profiles of patients with evidence of SARS-CoV-2 infection in sub-Saharan Africa

for SARS-CoV-2 (via a nasal swab PCR) but who had a positive serum antibody test, demonstrated very similar immunological profiles to patients who had laboratory-confirmed SARS-CoV-2 infection. These clinically suspected patients were not given specialised COVID-19 clinical care, including dexamethasone treatment, and were more likely to die than laboratory-confirmed COVID-19 patients. Specialised COVID-19 clinical care in this hospital setting was restricted to laboratory-confirmed COVID-19 patients.

The team also looked the transfer of the unique human carriage model from its birthplace in Liverpool to Malawi. The team tested the feasibility of using a human pneumococcal challenge model in Malawi to understand immune correlates of protection against carriage and to trial alternative vaccine candidates, concluding that it was in fact feasible and can be used to test vaccine efficacy in this population in Malawi.

Liverpool

The Accelerator Research Clinic (ARC) commenced a clinical trial this year that is academically sponsored and commercially funded by Pfizer. In this trial it will be using its extensive experience in the Experimental Human Pneumococcal Challenge model to test the current pneumococcal vaccines available in the UK. The team aims to determine which vaccine offers more protection against colonisation of pneumococcal bacteria in the nose. Two commonly found serotypes of the bacteria will be used to determine short-term (spn 3 at 1 month) and long-term protection (6B at 6 months) post vaccination.

ARC ACCELERATOR RESEARCH CLINIC

Healthy volunteers aged 18-50 years will be screened to determine their eligibility prior to enrolment. They will be randomly allocated to receive a Pneumococcal vaccine (PCV-13 routinely given to children or PPV-23 routinely given to adults over 60yrs old) or placebo (saline injection). Participants will be experimentally challenged with pneumococcal bacteria and attend clinic appointments to monitor colonisation.

The trial is running through the Accelerator Research Clinic with the assistance from the Well-Travelled Clinic nursing staff. It will help to understand why serotype 3 is still causing disease in the community (vaccine escape) despite being included in both pneumococcal vaccines.

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. Department members particularly focus on health systems implementation research and intervention studies combatting high-burden diseases, all in partnership with researchers, policy makers and other stakeholders in low-resource settings.

Professor Shabbar Jaffar
Head of International Public Health

This year members of the department have been shortlisted for national awards in recognition of their collaborative working and their supervision and mentoring of research students. In the 2021 Research Excellence Framework, academic staff submitted 86 research papers that were considered internationally excellent or world leading and two impact case studies on HIV control. Our research income in the last year was around £100m.

DIPH also includes the Health Systems and Workforce Strengthening Unit, the Community Health Systems Group and the Gender, Health and Social Determinants Group. Their activities are featured in the Feature Article: Health Policy and Health Systems Research.

Centre for Health Systems Strengthening (CHESS)

CHESS is a multi-disciplinary group using research and teaching to strengthen health systems and to improve health and wellbeing amongst the poorest and marginalised in low- and middle-income countries (LMICs). CHESS brings together researchers from DIPH's Health Systems and Workforce Strengthening Unit, the METRe Group (Monitoring and Evaluation Technical assistance and Research), the Centre for Capacity Strengthening (CCR), the Community Health Systems Group, and the Gender, Health and Social Determinants Group. Staff from the team are involved in numerous projects which you will find outlined in the Health Policy and Health Systems Research Feature Article. They include health and wellbeing for marginalised people in cities (ARISE and the African Cities Research Consortium), health system strengthening in fragile contexts (ReBUILD for Resilience), health workforce strengthening (PERFORM2Scale), and addressing severe stigmatising skin diseases (REDRESS and sister projects). DIPH researchers were also involved in COUNTDOWN as highlighted in the Feature Article: Neglected Tropical Diseases.

Cross-cutting Social Science and Anthropology Research

This research agenda is led by Dr Nicola Desmond and is delivered by centres in both DIPH and with the Department of Clinical Sciences. The work explores the processes and impacts of global public health practice to promote engagement with gendered health seeking and improved health behaviours within communities and the wider health system. It includes work on acceptability, bioethics, social capital, behaviour change, community engagement, trust and risk, as well as the intended and unintended impacts of health technologies, such as vaccines and diagnostics, on health behaviours. The team has a number of long-term collaborations with partners in Africa and elsewhere including the Global Health Bioethics Network, a Wellcome Strategic Award, work with PATH and WHO on vaccine acceptability, and strong collaborations with University of Oxford, University of Liverpool and London School of Hygiene and Tropical Medicine. Funding has also supported a long-term programme for capacity strengthening and career development in mixed-methods social science research at MLW (Malawi Liverpool Wellcome) in Malawi.

Monitoring, Evaluation, Technical assistance and Research (METRe)

METRe works in low resource countries to provide technical assistance and build capacity on how to effectively collect, analyse and use robust data. It does this to assess the coverage of communities with essential health services, to monitor the quality of clinical care in communities and to improve evidence-based decision making for health programmes and policies. The team, led by Professor Joseph Valadez, is active since 2010, working to support ministries of health, civil society and donors throughout Africa, Latin America and Asia.

METRe's implementation research is conducted in diverse locations facing diverse challenges. In South Sudan, METRe supports the Ministry of Health, World Bank, UNICEF, Foreign, Commonwealth and Development Office and USAID in strengthening the health system in all 10 states. In Uganda, METRe works to strengthen health systems in refugee settlements, while in Laos the team collaborates with UNICEF to aid the Ministry of Health in planning and implementing its first major health system assessments in districts and sub-districts. In each setting METRe develops innovative biostatistical methods to improve information quality and to gain insight about the population health. Now working with other departments, METRe is developing new approaches to rapidly assess anti-microbial resistance.

Centre for Global Health Economics

Economic questions around disease control and health systems in global health are addressed by the Centre for Global Health Economics. The team quantifies the health and economic burden of diseases and assesses the costs and cost-effectiveness of new health delivery approaches. This work is complemented by research on healthcare financing and financial protection, and on the efficiency and equity of health systems.

The team works across departments and its current portfolio includes studies on HIV prevention and control studies, diabetes and hypertension modelling, snakebite and neglected tropical diseases, lung health and tuberculosis, prebiotics and synbiotics in infants, malaria control, and anti-microbial resistance and sepsis. Almost all its work is in low-resource settings, including Ivory Coast, Burkina Faso, Ethiopia, India, Moldova, Kenya, Nigeria, Liberia, Cameroon, Ghana, Malawi, Uganda, Tanzania and Zimbabwe.

Centre for Sexual Health and HIV AIDS Research (CeSSHAR), Zimbabwe

HIV continues to be a massive burden in sub-Saharan Africa, with more than 25 million people living with the disease and more than 900,000 new infections each year. The Centre for Sexual Health and HIV AIDS Research Zimbabwe conducts a large portfolio of research on HIV prevention and sexual and reproductive health, with a particular focus on key populations.

The Centre, based in Zimbabwe and led by Professor Frances Cowan, is supported by a Wellcome Trust Collaborative Award in Science and a multi-disciplinary team which investigates the impact and cost effectiveness of approaches to strengthen differentiated care for sex workers in southern Africa. CeSHHAR is part of a large consortium evaluating the expansion of self-testing for COVID-19, which builds on its considerable experience in HIV self-testing in Africa.

Deputy Director at CESHHAR, Dr Webster Mavhu, has recently been awarded a five-year intermediatory fellowship on research to promote positive masculinity and sexual health among younger adolescents in Zimbabwe.

Research Partnership for the Control of Chronic Diseases in Africa (RESPOND-AFRICA)

RESPOND-AFRICA's research focus is on the prevention and management of HIV, diabetes and hypertension. The programme, which began with NIHR funding in 2017, is still in the early stages of its development but it is hoped that it will guide policy and practice and build research capacity in this area for years to come. More details are in the Feature Article on HIV.

RESPOND-AFRICA is a group of European institutes (LSTM, Liverpool John Moores University, University of East Anglia, University of Bergen, University College Dublin and ISGlobal Barcelona) and African research partners (National Institute for Medical Research at Muhimbili University of Health and Allied Sciences and Shree Hindu Mandal Hospital, both in Tanzania, and MRC/UVRI/LSHTM Uganda Research Unit and The AIDS Support Organisation, Makerere University both in Uganda). The team has strong links with the ministries of health in Tanzania and Uganda, and with patient and community leaders, civil society organisations and other stakeholders.

The group was short-listed in the International Collaboration of the Year category at the 2021 Times Higher Education Awards.

Centre for Capacity Research (CCR)

CCR specialises in 'research on research systems' and the science of research capacity strengthening. This is a process of individual and institutional development leading to higher levels of skills and a greater ability to perform high-quality research. CCR is a global leader in generating evidence on research systems and in advancing capacity strengthening practice in LMICs. It does this through conducting high-quality, implementation-focused research, and by sharing learning and advocating for evidence-informed improvements to research systems and capacity strengthening practice.

Laboratory technicians' workshop, Lusaka, Zambia. Photo Royal Society

CWNH training of Bereavement Champions in Nairobi, Kenya. Photo CWNH

CCR is by Professor Imelda Bates and Dr Justin Pulford and works with funders, external agencies and in-country institutions to identify barriers which may be preventing their research systems and those working in them from functioning effectively. Over the past 12 months, CCR has produced 49 knowledge products and led or supported a portfolio of 17 projects. They include:

- *Funding from the Wellcome Trust Institutional Translational Partnership Award allowed CCR members to develop training workshops aimed at removing barriers between research disciplines and to promote 'team science'. The team facilitated a series of training seminars on identified bottle necks to foster confidence and increase knowledge, and to allow individuals to move their research along the translational research pathway. All of the 452 individuals who attended the workshops reported an increased understanding in the subject area which included designing research capacity strengthening components within proposals, how to create and use a 'Pathway to Impact' and how to manage research consortia.*
- *The CCR-led MUDI project was hosted within the International Multidisciplinary Programme to Address Lung Health and TB in Africa programme, studying the working strategies of its cross-disciplinary research teams, approaches and actions. MUDI generated robust evidence about what works for fostering cross-disciplinary global health research which has since been widely disseminated, eg the team was invited by Vitae - the global leader in supporting professional development of researchers - to lead an interactive workshop on cross-disciplinary research and the development of cross-disciplinary researchers.*

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

The Centre for Childbirth, Women's and Newborn Health is a multidisciplinary group of applied health researchers with a shared vision that all women and newborns can access high quality and respectful healthcare, wherever they live. The team is led by Professor Dame Tina Lavender and works across global settings and a WHO Collaborating Centre.

CWNH focuses on applied maternal and newborn health research, including the prevention of stillbirth and newborn deaths, improving support for bereaved parents and families, and enhancing access and uptake of quality, respectful maternal and childbirth care in LMICs.

Capacity strengthening, particularly for front-line midwives and nurses in LMICs, is a unifying thread in the centre's activities. Working in partnership with the Lugina Africa Midwife Research Network, the CWNH recently completed a four-year programme of research and capacity development in six African countries, funded by the National Institute of Health Research.

Emergency Obstetric Care and Quality of Care Unit

The Emergency Obstetric Care and Quality of Care Unit conducts research on ways to reduce maternal mortality/morbidity through improved quality of care. The team, which is led by Dr Charles Ameh, combines rigorous research with capacity strengthening and technical support to optimise its impact, working in partnership with policy makers and local researchers to ensure its research is locally relevant and informs policy. Specific areas of research include antenatal care, emergency obstetric care, quality of care and obstetric clinical care monitoring tools.

More information on the work of the Unit as well as CWNH can be found in the Feature Article on Maternal, Newborn and Child Health.

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 as well as research into other chronic conditions that often cause complications and sit as co-infections to HIV. The portfolio spans UK based work as well as global work on prevention, diagnosis and care.

HIV in the UK

In Liverpool, LSTM participates in the coordination of the HIV Fast Track Cities initiative that brings together local government, civil society and health services. Liverpool aims to reduce the proportion of residents living with undiagnosed HIV and extend the UNAIDS 90-90-90 target to 95-95-95 through accessible high-quality service delivery, support, information and choices to people living with HIV in our city. We want to make our care pathways stronger, more integrated and eliminate stigma. One way we are aiming to achieve this is through a LSTM funded project which listens and works with local HIV community champions to increase the uptake of HIV testing within communities living in Liverpool using a tailored HIV self-testing distribution model.

An LSTM Directors Catalyst Award study, led by Dr Victoria Watson, was conducted to understand the current barriers to accessing HIV testing services within Liverpool. The aim of the study was to increase uptake of HIV testing in order to reduce the number of undiagnosed infections and the high rate of late diagnosis present within Liverpool.

Working in collaboration with Fast Track Cities, Public Health Liverpool, Axess Sexual Health (NHS), and Sahir House, the pilot launched in six Liverpool community pharmacies on June 1st and for two months members of the local community were able to access free HIV self-test kits.

Pilot results showed that 53% of tests accessed were by individuals testing for HIV for the first time, with an additional 25% having last tested over a year ago. The pilot successfully showed that HIV self-testing is an innovative accepted way to increase HIV testing uptake within previously untested groups in Liverpool.

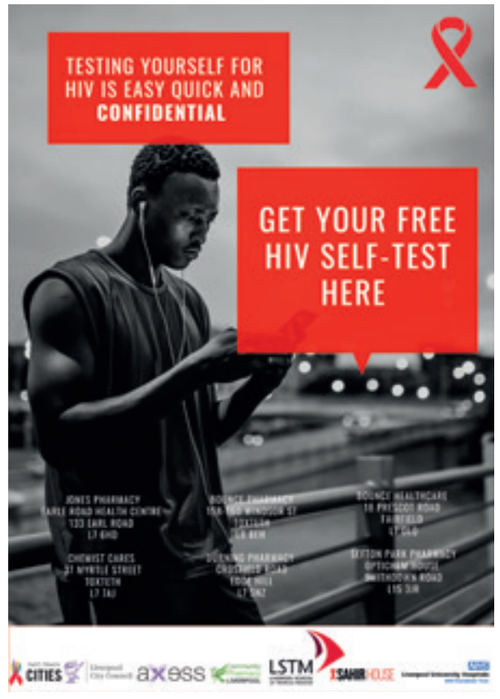
World AIDS Day

WORLD AIDS DAY MERSEYSIDE

Every year a part of LSTM estates lights up red to mark World AIDS Day. LSTM is one of the many well-known landmarks throughout Liverpool's city region that does so to raise awareness and support those who are living with HIV.

The initiative is led by Sahir House and is meant to challenge and remove the stigma that still surrounds HIV and acknowledge the progress around treatment and prevention.

HIV Programmes



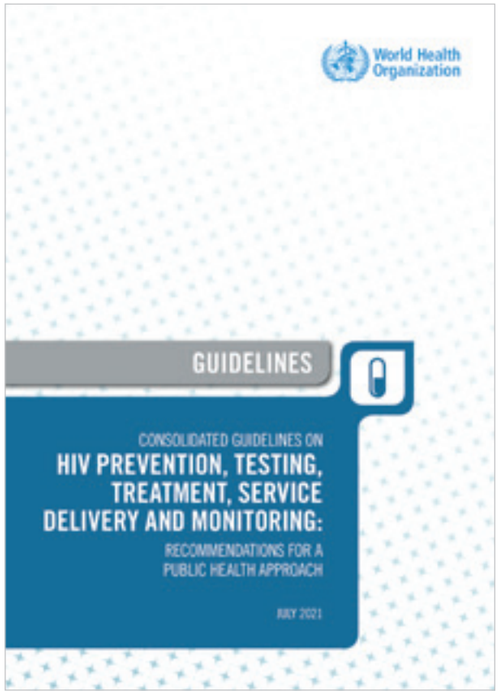
Globally, LSTM's HIV work involves the Zimbabwe based Centre for Sexual Health and HIV AIDS Research (CeSHHAR). It conducts rigorous implementation research in HIV and sexual and reproductive health, generating policy relevant evidence on scale up of HIV self-testing. It now also looks into SARS COV -19 Antigen self-testing as well as voluntary male circumcision, programmes for HIV positive adolescents and prevention of mother to child transmission. LSTM works in partnership with Unitaid, PSI, WHO and colleagues from LSHTM, UCL and the University of York, bringing together a collaboration of epidemiologists, social scientists, modelers and economists,

conducting a wide range of HIV research projects with sex workers in Zimbabwe, exploring how to minimise their risks of acquiring HIV and optimising HIV treatment if they need it.

LSTM's community health systems group has been conducting research on stigma reduction, and on increasing access to HIV self-testing in different low-resource settings including Kenya and Zimbabwe and here in Liverpool. The group is also involved in research on (HIV) treatment adherence and retention in HIV-care.

LSTM continues to work on late-stage HIV-infection with partners at LSHTM, St Georges University of London, National Institute of Medical Research Tanzania (NIMR).

WHO 2021 HIV Guidelines



Dr Peter MacPherson and colleagues from MLW undertook two systematic reviews and meta-analyses to inform the 2021 WHO Consolidated guidelines on HIV prevention, testing, treatment, service delivery and monitoring. These reviews provided evidence on the harms and benefits of starting antiretroviral therapy in people with symptoms of tuberculosis and defined the optimal periods for starting antiretroviral therapy in people with confirmed tuberculosis (TB) disease. In a new recommendation, for the first time, WHO recommends that people with symptoms of TB can start HIV treatment on the same day that they are diagnosed with HIV, removing substantial barriers to patients initiating antiretroviral therapy.

Research into Other Chronic Conditions

Sign for the Diabetes Centre in Wakiso, Uganda

Rates of diabetes and hypertension have risen sharply in sub-Saharan Africa. About 2 million people every year are now dying prematurely from the complications of these conditions. Both diabetes and hypertension can be controlled through diet and lifestyle advice and through low-cost drugs available widely in generic form. However, only about 10% of people living with these conditions are in regular care and even among this small proportion, less than 50% have good control of hypertension and glycaemia.

The international research partnership on the control of chronic conditions – RESPOND-AFRICA - has been conducting research to identify novel approaches of preventing and managing HIV, diabetes and hypertension in sub-Saharan Africa settings.

Research is being undertaken in partnership with researchers in Tanzania, Uganda and the UK, and involves working closely with patient leaders, civil society groups, senior disease control managers and policy makers.

Management of Chronic Conditions in Africa (MOCCA) was the initial pilot of the group, testing integrating care for HIV, diabetes and hypertension. It showed that the approach was feasible, generally popular with patients and health care providers as well as being potentially cost-effective. This was followed by the INTE-AFRICA trial, a large cluster-randomised trial, which will finish in 2022, comparing integrated care with standard vertical care for HIV, diabetes and hypertension in Tanzania and Uganda.

The META trials are evaluating whether metformin, a drug that has been commonly used to treat people with diabetes since the 1950s, can now be used to prevent progression to diabetes when given to people with HIV who are at high risk of developing diabetes.

Qualitative research has also been undertaken with the foundation for innovative new diagnostics (FIND) into the feasibility and useability of self-testing for Hepatitis C. This formed part of a large, multi-country trial into the use of self-testing for Hepatitis C.

COVID-19 has had a major impact on RESPOND-AFRICA's research studies but due to the strength of the partnership and the trust that has been built, the team has been able to continue to collaborate. The network of partners in Uganda and Tanzania were able to procure and deliver £49k worth of PPE to health facilities as part of LSTM's Bump It Forward campaign.

Partnerships

Malawi Liverpool Wellcome (MLW) Clinical Research Programme

Since its inception in 1995, the Malawi Liverpool Wellcome Clinical Research Programme (MLW) has transformed medicine and health in Malawi, with enormous impact on malaria, pneumonia, childhood diarrhoea, HIV, TB and capacity strengthening.

In addition, COVID presented MLW with a unique opportunity to leverage its close partnership with institutions within Malawi such as the Queen Elizabeth Central Hospital, Kamuzu University of Health Sciences (formerly College of Medicine and Kamuzu College of Medicine) and the Ministry of Health as well as outside of Malawi with the Liverpool School of Tropical Medicine, University of Liverpool and Wellcome, to deliver an exemplary COVID response in a limited-resource setting.

MLW and COVID Response

MLW's contribution to the COVID response in Malawi has been acknowledged and appreciated widely. Early in the pandemic, MLW partnered with Queen Elizabeth Central Hospital (QECH) and the District Health Office to target the greatest needs – diagnostics, oxygen, and Personal Protective Equipment (PPE).

Communication

MLW has played a key role in promoting positive and responsible COVID messages. When COVID vaccines became available in Malawi, MLW mobilized its Communications and Public Engagement team and scientists to partner with the Ministry of Health, the World Health Organization, and media houses to communicate important COVID vaccine messages to the public with authority and based on scientific facts.

Diagnostics

Most recently, in June 2021, MLW was the first laboratory in Malawi to sequence the SARS-CoV-2 virus and generated critical data about the variants responsible for the second and third waves of COVID in the country. These data enabled public health officials to understand the origin and transmission dynamics of the variants of concern circulating in Malawi. The State President of Malawi thanked MLW for this development in his address to the nation.

Clinical Care

In August 2021, MLW donated three Continuous Positive Airway Pressure (CPAP) breathing machines to Queen Elizabeth Central Hospital to assist patients with severe breathing problems, including those suffering from severe COVID. The machines were bought with support from the #BumpItForward campaign organised by MLW partners in the UK. With reducing COVID, from September 2021, the equipment is now used predominantly by patients with general causes of severe respiratory illness admitted to the hospital's Respiratory High Dependency Unit.

Oxygen Provision

In May 2021, MLW donated 100 oxygen cylinders (each with a capacity of 7000 litre, 30kg) and 100 flow meters to Queen Elizabeth Central Hospital to assist in the management of emergency tent-based COVID patients, or patients in other hospitals surrounding Blantyre. The cylinders are filled from the hospital's oxygen plant and will benefit patients with pneumonia, TB, HIV related lung conditions and chronic lung disease for many years. The cylinders and flow meters were bought with support from the #BumpItForward campaign and other well-wishers in the UK.

Scientific Enquiry and Purposeful Intervention

MLW is a leader in hospital- and community-based COVID research in Malawi including molecular characterisation of the viral variants circulating in the country and determining immune responses to SARS-CoV-2 (serology) among healthcare workers, blood donors and COVID patients with different degrees of disease severity. Additionally, MLW researchers have conducted qualitative studies to explore the public's understanding of, and response to the COVID pandemic. Findings from the research have informed Malawi's public health response and have been published in peer-reviewed scientific journals such as Nature Communications.

Other MLW Success in 2021

Despite the many challenges presented by the COVID pandemic in the last 12 months, MLW has not wavered in its quest for excellence.

Construction of Kafukufuku Building

Construction of a building to house an additional research pharmacy, an expanded freezer archive and field workers offices was completed in August 2021 and is now fully functional. The new building has eased spacing issues, particularly in the laboratory and allowed for smoother expansion of molecular biology and immunology projects at MLW.

Construction of CREATOR Building

We are excited to report the start of the construction of the Clinical Research Excellence And Training Open Resource (CREATOR) building. CREATOR will be a purpose-built centre of excellence, which will enable MLW to increase research capacity by 30% over the next ten years and will provide the first specialist postgraduate clinical

training facility in the country. This will enable Malawi to train and retain more specialist doctors and attract the best research minds to the region to work together to save and improve lives. It will also enable us to centralise the health research agenda issues, not just at MLW but across the country and the wider regions.

Ultimately, CREATOR will nurture a step-change in the scale of clinical research and a reversal of the accepted norm of trainees leaving Malawi, through enabling us to train and retain the brightest talent in-country. It will promote clinical and research excellence and collaboration, focussed on catalysing new ideas, better health outcomes and improved clinical care for the people of Malawi and the wider sub-Saharan African region.

ISO15189 Accreditation of MLW laboratory

MLW laboratory was one of six Malawi laboratories congratulated by the Minister of Health for attaining the Southern African Development Community Accreditation Services (SADCAS) ISO15189:2012 accreditation at a ceremony held in Lilongwe in July 2021. As a community, we are extremely proud of this achievement which will enhance the quality of our work.

Clinical Trials

MLW was one of six sites in five countries that participated in the AMBITION trial. The trial explored a simplified treatment for HIV-associated cryptococcal meningitis and released its findings at the International AIDS Society scientific conference in July 2021. The trial findings have been hailed as ground-breaking and lifesaving by healthcare personnel, people living with HIV and policymakers. The AMBITION trial findings have led to a change in the Malawi guidelines for the treatment of HIV-associated cryptococcal meningitis. MLW Policy Unit spearheaded the dissemination of the trial results to national policymakers and stakeholders at an event held in Lilongwe on 20th August 2021.

MLW also conducted the TyVAC trial to assess the efficacy of a single dose of typhoid conjugate vaccine (TCV). This mammoth trial recruited 28,000 children in less than a year and recently published its findings in the New England Journal of Medicine. The results prove that TCV vaccines are safe for infants (from 9 months old) and young children in the preventing Typhoid disease.

The Malawi Government has embraced the trial findings and will introduce mass campaign and roll out of the vaccine in late 2022. This is a milestone for MLW.

MLW TyVAC study team member with a study participant.Photo by MLW

Diversity and Inclusion

Two events to promote and enhance diversity and inclusion at MLW have taken place in 2021. First, Strategic Workshop 2 (SW2) took place in May 2021. SW2 reviewed the progress we have made in addressing key recommendations from the first workshop (SW1) and tackled key scientific and operational issues in preparation for the next Core grant renewal.

Second, a review of the culture and values (Culture Review) at MLW, conducted in conjunction with our partners, is near completion. The goal of the review is to ensure that MLW remains an organisation in which all staff and students thrive and work together to achieve our institutional vision. Recommendations from SW2 and the Review will enhance the working environment at MLW.

MLW staff members at the MLW 2021 Strategic workshop. Photo by MLW

Personal training fellowships awards

MLW has maintained its focus on training the next generation of researchers, even in the era of the COVID pandemic. In the last 12 months, MLW trainees excelled in open international competition and were awarded prestigious fellow- and scholarships.

Our congratulations go to:

Dr Donnie Mategula who received a MRC-DTP Case PhD Fellowship;
Dr Cliford Banda for being awarded a Wellcome Trust and NIHR International Training Fellowship;
Dr Richard Kamwezi for his GSK MSc Scholarship for Future Health Leaders;
Dr Patrick Musicha who received a Wellcome Trust and NIHR Training Fellowship;
Mr Clinton Nkolokosa for his a Wellcome International Trust Masters Fellowship;
Dr Innocent Sulani for being awarded a Beit Trust-University of Glasgow MSc Fellowship;
Ms Dalitso Kalua for her LSHTM MSc Merit and HNTI Scholarship and
Ms Letitia Suwedi-Kapesa for her Commonwealth PhD Fellowship.

KEMRI/CDC in Kenya

In Kisumu, Kenya, Professor Phillips-Howard and team continue their close collaboration with the Kenya Medical Research Institute (KEMRI) and have successfully completed field work for 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 a study with the University of Illinois at Chicago, KEMRI, and Nyanza Reproductive Health Society, Kisumu, investigating the effect of menstrual cups on the vaginal microbiome and potential implications for acquisition of STI and HIV among 440 post-pubescent girls. A study in the same area is also underway to investigate the menstrual, mental health, and sexual and reproductive health needs of out-of-school girls.

Next stage studies planned include following up the trial population to evaluate if intervention effects are sustained into adulthood, including the effects of the COVID pandemic environment on the sexual and reproductive health, education, and employment of adolescent girls and young women.

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 has been expanded to look at the interaction between COVID-19 and malaria funded by the Bill & Melinda Gates Foundation led by Professor ter Kuile.

Two new Cooperative agreements (CoAG) with CDC were signed to support KEMRI in conducting medical research at its Centre for Global Health Research. One CoAG with CDC is for malaria research (2020-2025) and is a continuation of three previous 5-year collaborative agreements with CDC that focuses on research to improve malaria surveillance. In addition, a new 5-year CoAg (2021-2026) for HIV and TB and laboratory-based research was approved in May 2021, which significantly expands the research collaboration with CDC and KEMRI beyond malaria. These new CoAGs allow several Kenyan students to enrol for PhDs studies at LSTM while conducting their research on-site in Kenya.

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.

Since the beginning of the COVID-19 Pandemic the team the team produced 122 K4D COVID-19 Health Evidence Summaries in total arranged to cover themes such as Epidemiology and modelling, Social Science and the Indirect impact of COVID-19 among many others. During the height of the pandemic these summaries were published daily, reducing to a weekly, before ceasing in May 2021.

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), International Healthcare Innovation Institute (Jiangmen) 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), who are strategically placed to deliver a portfolio of domain specific expertise in all the key research areas of interest.

To date, the TIDC has received ~ £4million in funding from the MRC CiC. These funds have supported 95 projects, ~50% of which involved collaborations within the consortium, 50% included academic partners external to the Consortium, and >70% involved industrial partners.

The funded themes have so far included: vaccine development projects (for emerging/outbreak pathogens and established tropical infectious diseases), drug/biologics discovery projects, diagnostic discovery/development projects (including AMR), new insecticide resistance focussed products, surveillance and control tools, translational enabling technologies, anti-venom therapies, adjunct therapy projects and other interventions (e.g. bed net innovation).

MRC CiC project funding has directly contributed to 1 spin-out, 15 patent applications (4 granted to date), and 1 trademark. Completed projects have gone on to attract approximately £59million in additional external follow-on funding (national and international funders) from 49 out of the 95 funded projects – an almost 15-fold return in investment.

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 Southampton Clinical Trials Unit, and other external partners.

The team includes infectious diseases clinicians, clinical and pre-clinical pharmacologists, clinical trials specialists and statisticians, bringing 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. The platform have successfully launched 3 clinical trials, one of which is in South Africa, with 2 more to initiate in the coming months.

CeSHHAR Zimbabwe

The Centre for Sexual Health and HIV/AIDS Research Zimbabwe (CeSHHAR Zimbabwe) was founded in 2012 in response to the need to expand implementation research to accelerate and optimise public health policy and impact in Southern Africa. Over the past decade, CeSHHAR has expanded its research, programmatic footprint and research capacity strengthening activities, employing 260 people to work across Zimbabwe. Preparations for the 10th anniversary are underway!

CeSHHAR aims to conduct research which influences the global HIV an Sexual Health policy environment and strengthens the quality of provision of evidence-based HIV prevention, treatment and sexual health care. Headed by LSTM's Professor Frances Cowan, CeSHHAR works closely with the Zimbabwe Ministry of Health and Child Care and National AIDS. CeSSHAR is supported by a range of international donors addressing four thematic areas: Key Populations, Integration of HIVH Prevention with Sexual and Reproductive Health, Masculinity Studies and Children and Adolescents. CeSHHAR's research has facilitated important innovations in implementation of HIV prevention and has contributed to national policy and guideline development. Most recently CeSHHAR is also conducting research to support the regional COVID response.

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.

2020 welcomed the launch of WHO's 2021-2030 roadmap and also marked the 20th anniversary of the Global Programme to Eliminate Lymphatic Filariasis. A total of 17 countries of the 72 endemic countries are now certified as eliminated. Only 3 countries remain to commence MDA.

Lancaster University

The MRC funded Translational and Quantitative Skills Doctoral Training Partnership (DTP) in Global Health was established in 2016 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 some 50 PhD studentships. Most projects involve 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.

In 2021, there was a national competition for new DTP programmes and the DTP was again successful in securing a further 3 years of support, with a further 2 years if the programme continues to be successful.

The partnership has been strengthened by the successful award of MRC Skills Development Fellowships (SDF) in Translational and Quantitative Skill in Global Health. This programme, which has been running for 5 years, is focused on training of PhD graduates in translational research with an emphasis on quantitative skills. The programme is already bearing fruit with recent awardees Dr Ghaith Aljayyoussi and Dr Victoria Ingham securing lecturer roles at LSTM and Heidelberg University, Germany, respectively.

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 MLW, LHP, Pandemic Institute and LIV-TB.

HCRI & MSF

Together with the Humanitarian & Conflict Response Institute (HCRI) of the University of Manchester and the international medical NGO Médecins Sans Frontières (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.

Over the past year, all 3 partner organisations have collaborated on the development of an extended 4-year term of LEAP with an agreed case for support now in place from all 3 organisations. The extension of this partnership is testament to the ongoing impact the programme has had on MSF and the wider humanitarian workforce during a period of unprecedented change.

Liverpool Knowledge Quarter

Knowledge Quarter Liverpool (KQ Liverpool) is a 450-acre innovation district which spans more than half of Liverpool City Centre. Since coming into being KQ Liverpool has overseen £1bn of new developments, with a further £1bn in the pipeline.

Paddington Village is the flagship KQ Liverpool expansion site which is home to the Spine – the new northern home of the Royal College of Physicians – Kaplan and Rutherford Cancer Centre. Sciontec, the KQ Liverpool spin-out development company, will undertake the next development on Paddington Village, HEMISPHERE.

In July 2020, KQ Liverpool launched their 2025 Vision setting out a roadmap for ambitious yet sustainable, inclusive growth for the innovation district and beyond.

LSTM is one of KQ Liverpool's partners, in addition to the University of Liverpool, Liverpool John Moores University, Liverpool University Hospitals NHS Foundation Trust, Liverpool City Council and Bruntwood Sci-Tech.

LIV-TB

LIV-TB is a collaboration between LSTM and the University of Liverpool and co-led by Nadia Kontogianni and Dr 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 160 members over the past three years with speakers and attendees from all over the globe.

The 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 NHS trusts, including the Royal Liverpool and Aintree sites of the Liverpool University Hospitals NHS Foundation Trust (LUHFT) and Alder Hey Children's Hospital.

At LUHFT, LSTM clinical academics work in a number of relevant clinical specialties including Infectious Diseases, Clinical Microbiology & Parasitology, Respiratory Medicine, Critical Care, Haematology, and Genito-Urinary 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 Experimental Human Challenge research, which examines susceptibility to a number of respiratory pathogens and contributes to the development of interventions, including vaccines is closely linked with LSTM's respiratory and infectious diseases clinicians.

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.

An initial study of the sex and relationship education needs of adolescent participants engaged in the LFC Foundation's "Kicks" programme has been conducted. This will inform implementation of a programme of life-skills development and sexual health promotion activities linked to football sessions and tournaments in the city, with delivery starting in Spring 2021, funded by the UEFA Children's Foundation and the LFC Foundation.

NaTHNac

The National Travel Health Network and Centre (NaTHNac), commissioned by the UK Health Security Agency (formally 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, heath professionals, travel industry and national government.

NaTHNac works in partnerships with network founders which include LSTM.

UK Health and Security Agency

LSTM clinicians continued to provide specialist advice to the government body responsible for protecting the nation's health and wellbeing and reducing health inequalities. It is currently in transition to become the UK Health and Security Agency, UKHSA.

Professor Hilary Ranson provides entomological support to the Advisory Committee on Malaria Prevention in Travellers. Dr Nick Beeching, Emeritus Professor at LSTM 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.

Everton in the Community

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 2021/22 school year – and will act as the pre-cursor of major collaborations, culminating in LSTM's 125th anniversary in 2023

Liverpool Health Partners

LSTM is a founding member of Liverpool Health Partners (LHP), the academic health science system for Cheshire and Merseyside. LHP is a network of four HEIs and eight NHS Trusts, working together to develop ground breaking research strategically developed to address the diverse and complex needs found across Cheshire & Merseyside.

Pandemic Institute

LSTM is a founding partner of the Pandemic Institute, a partnership of academic & health organisations plus local/regional government in the Liverpool area, all focused on preparing the world for future pandemics. These partners have proven capability for pandemic research innovation and impact.

With headquarters in Liverpool, the Institute has a unique local and global ecosystem, unifying on the ground intelligence to generate scientific excellence with societal impact for all. The Institute will provide comprehensive end-to-end capability across the pandemic lifecycle, a game changer that will allow the world to respond at pace in the race to prepare for the next pandemic.

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)

Professor Dame Tina Lavender

Led by Professor Dame Tina Lavender, CWNH is a dynamic, multidisciplinary group of applied health researchers working across global settings. In partnership with the Lugina Africa Midwife Research Network (LAMRN), the Centre recently successfully completed a 4-year programme of research and capacity development in six countries in Africa funded by the National Institute of Health Research.

The NIHR Global Health Research Group on Stillbirth Prevention and Management in Sub-Saharan Africa was a unique partnership between Kenya, Malawi, Tanzania, Uganda, Zambia, Zimbabwe and UK aimed at reducing stillbirth, supporting bereaved families and strengthening capacity in stillbirth research in Africa and UK.

Exploratory work in Tanzania and Zambia around women's experiences of care revealed how physical distance and lack of "connectedness" characterised dysfunctional intrapartum referral systems and pathways. Crucially, women's and family's willingness to access maternity services was also diminished by experiences and perceptions of disrespect and abuse in health facilities. Relational care was not prioritised and communication between staff was often suboptimal. Antenatal care preferences were investigated further in a discreet choice experience (DCE) in Tanzania. Proximity to the clinic, perception of a friendly welcome and respectful care were identified as priorities. A new antenatal care bundle co developed with community engagement and stakeholder groups is planned to address gaps in existing services, aiming to improve engagement and reduce adverse outcomes.

Respectful maternity and newborn care are a particular area of interest, the group has developed a context-specific educational film to address unconscious bias amongst health workers in Tanzania. Previous successes with game-based learning informed the development and testing of new educational game – Dignity – promoting understanding and practice of Respectful Maternal and Newborn Care. Testing in Malawi and Zambia with students and midwives confirmed this was an enjoyable experience, enhanced reflection on practice and motivated to behaviour change. A respectful care bundle, including the game, the video and other components will be co-created and tested in Malawi and Tanzania in the next phase of the work.

Improving the availability and quality of bereavement support for parents after the death of a baby in LMICs, including Kenya and Uganda, has also been an important focus. Building on previous exploratory work, the team have co-developed and tested the feasibility of a multicomponent interventions to improve facility and community support following stillbirth. A bereavement champion network was created in two facilities to support health workers to develop and sustain care and postnatal telephone peer support offered to women after discharge. Despite COVID-19 interruption 100 women were willing to take part and most completed the research. The team are now planning a large-scale evaluation. The NIHR Group also developed a novel training package "Advancing Bereavement Care in Africa" to improve health workers' understanding of the impact of baby death on parents. Piloting in Malawi, Uganda, Zambia and Zimbabwe was recently completed.

The programme also targeted women experiencing the double tragedy of obstetric fistula, a debilitating and stigmatising birth complication, and stillbirth. Following work to identify the psychological, social and economic challenges, engagement with stakeholders and communities helped define a package of interventions to be tested in a feasibility study.

Emergency Obstetric Care and Quality of Care Unit

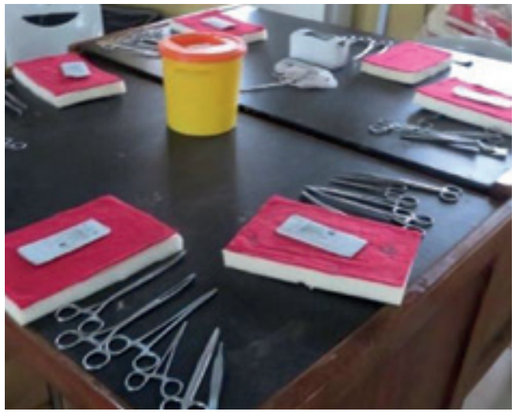
Dr Charles Ameh

Dr Charles Ameh leads the Emergency Obstetric Care and Quality of Care unit which conducts research on ways to reduce maternal mortality/morbidity through improving quality of care, combines rigorous research with capacity strengthening and technical support to optimise impact, whilst working in partnership with policy makers and local researchers to ensure research is locally relevant and informs policy.

Antenatal and Postnatal Care (ANC&PNC)

In line with the Global Fund Strategy 2017-2022 to invest in building sustainable and resilient systems for health (or "RSSH"), the Global Fund team of the EmOC &QoC Unit is working with partners and governments in five African countries is conducting implementation research under three grants: 2020-2023, $5.1M for Nigeria, Tanzania and Kenya, 2020 for Chad Euros 633, 129, 2020 for Togo $570, 578. The purpose of these grants is to implement, document and disseminate innovative approaches to improving the screening, testing and treatment of HIV, TB and malaria and improve integrated service delivery at facility and community levels.

The programmes phased implementation research approach to support sustainable improvements in the quality of antenatal and postnatal care in these countries includes 3 areas 1) Identification of the 'bottle necks' to providing Quality of Care (QoC), 2) Design and introduce a Quality Improvement process at health facility level and 3) Evaluate effectiveness and efficiency. These are achieved through partnerships with Ministries of Health, sub national health authorities and local research institutions.



Training material for the Nigeria expanded EmOC programme

Implementation and research have started in Nigeria, Kenya, Togo and Chad. Implementation in Tanzania will start in 2022.

Ongoing implementation research studies:

- *Baseline assessment on antenatal and postnatal care services, with focus on HIV, TB and Malaria in selected healthcare facilities in Togo*
- *Where is the 'C' in ANC and PNC: a multi-country survey of availability of Antenatal and Postnatal Care*
- *Development of a Risk Scoring System for Maternal and Child Health in Chad*
- *Randomised stepped wedge trial to assess the effectiveness of healthcare provider training on the availability and quality of Antenatal (ANC) and Postnatal Care (PNC) in Chad*
- *Crossed randomised stepped wedge trial to assess the effectiveness of standards-based audit and healthcare provider training on the availability and quality of Antenatal (ANC) and Postnatal Care (PNC) in Togo*
- *Economic assessment of a capacity-building intervention to improve the quality of integrated HIV, Tuberculosis, and Malaria services within antenatal and postnatal care in Kenya*
- *What are the essential components of Antenatal Care? A systematic review of the literature and development of signal functions to guide monitoring and evaluation" in all countries*
- *What are the essential components of Postnatal care? A systematic review of the literature and development of signal functions to guide monitoring and evaluation" in all countries*
- *Understanding women's experiences of respectful maternity care during antenatal and postnatal care in Lomé, Togo. A cross sectional descriptive study.*
- *Change in knowledge and skills after antenatal and postnatal training in Togo*
- *What are the enablers and barriers for healthcare providers providing integrated ANC and PNC including HIV, TB and malaria care in Togo?*
- *COVID-19: How has the global pandemic impacted maternity care provision in Lomé, Togo? A qualitative study*

Skills training at the Kenyan Medical Training College in Nairobi

Emergency Obstetric Care and Midwifery Education

In Kenya, LSTM, with the UK FCDO funding, is delivering a £13M Reducing Maternal and Newborn Deaths programme (2019-2023). This programme is designed to:

- *support the implementation of methods to improve Quality of Maternal and Newborn Care*
- *strengthen the capacity of the workforce through in-service Emergency Obstetric and Newborn Care training interventions*
- *Strengthen the capacity of pre-service training institutions*
- *Support the development, implementation and evaluation of a mentorship and supportive supervision package*
- *Disseminate findings and lessons learned to improve implementation.*

Current studies include an RCT evaluating the Implementation of the Updated Midwifery Syllabi for Pre-Service Training in Kenya and mixed methods study to evaluate the barriers to the practice of assisted vaginal births in Kenya.

Also in Kenya, with $1.3M from the Johnson and Johnson Foundation (2020-2023), LSTM is designing and evaluating a midwifery educator continuous professional development programme (CPD). All nurses and midwives are required to attain CPD points to renew their annual licence. However, accredited programmes specific for midwifery educators are limited. Working with Kenya's Ministry of Health, LSTM is designing a 20 credit (20 hour), Nursing Council of Kenya approved, module to upskill midwifery educators' teaching skills. The mandatory self-directed component of midwifery educator package will be hosted on a web e-learning platform, accessible to most nursing and midwifery councils in Africa.

With $117, 787 from UNFPA (2021), LSTM continues its work to strengthen global midwifery curricula by developing a standardized package of evidence-based modules aligned with the International Confederation of Midwives competencies. These are accompanied by standardized assessment and accreditation tools, training packages for midwifery education facilities, midwifery educators, and new graduates. The outputs of this work are feed into the Global pre-service midwifery education technical working group.

In Nigeria, through Johnson and Johnson Foundation funding (2020-2022), LSTM in partnership with the Nursing and Midwifery Council of Nigeria and the Kwara State Ministry of Health, is establishing a Centre of Excellence for Emergency Obstetric and Newborn Care training. The centre is equipped for competency based EmONC training and serves as a Mandatory Continuous Professional Development centre for nurses and midwives, and a centre for doctors to update their knowledge and EmONC skills, with nurses and midwives being able to earn CPD credits towards their practice licence renewal.

Health System Strengthening

With $109, 882 from Johnson and Johnson Foundation, LSTM conducted a COVID-19 health system preparedness study published in the American Journal of Public Health and through LSTM's Nigeria programmes, supported the Nigeria COVID-19 response by procuring and providing PPE, hygiene and sanitary materials to national and state governments and key stakeholders. LSTM also supported the COVID-19 response in Kenya through funds mobilised from British Citizens through the Bump it Forward campaign. These funds were used to procure PPE to the value of £65, 548, which has protected health care workers in Uasin Gishu, Vihiga, Kilifi, Taita Taveta and Garissa counties.

Malaria in Pregnancy

MIMBA Antimalarial Pregnancy Registry

The malaria epidemiology team, led by Professor Feiko ter Kuile has continued to expand the MMV-funded global pregnancy registry on the safety of antimalarials. This is a multi-centre, multi-country, prospective cohort study in sub-Saharan Africa to collect information on inadvertent real-world exposures to a range of antimalarials during the first trimester of pregnancy. Despite complications due to COVID-19, the project has now been rolled out across 35 sites in western Kenya, involving over 17,000 women of childbearing age. A PhD student is undertaking a nested study, while a second is being recruited and capacity development and study preparations to expand the registry to Burkina Faso are underway.

Malaria Vaccine Utilisation in Western Kenya

This has been a landmark year for malaria control in children with the recent announcement in October by the WHO of a broad recommendation for "the RTS,S/AS01 malaria vaccine to be used for the prevention of P. falciparum malaria in children living in regions with moderate to high transmission". The decision was reached after a careful review by WHO's joint meeting of the Malaria Policy Advisory Group (MPAG) and the Strategic Advisory Group of Experts on Immunization (SAGE) members of data on the safety, impact, feasibility, acceptability and equity provided by the malaria vaccine evaluation partners. This included findings from the healthcare utilisation study (HUS) led by Dr Jenny Hill in western Kenya.

New Malaria Preventive Therapy in Indonesia

Dr Hafidz Firdaus joined the malaria epi team to work with Dr Jenny Hill on the MRC-funded implementation study of intermittent preventive treatment in pregnancy (IPTp) with dihydroartemisinin-piperaquine in Papua, Indonesia. Dr Firdaus will be based in Papua for the duration of the study working closely with our local research partners at the Timika Research Facility. Preparations are ongoing in collaboration with the Indonesian Ministry of Health for its implementation in high-malaria transmission areas in southern Papua in 2022.

Integration of Malaria Prevention in Pregnancy and Children

Dr Hill is leading a process evaluation of a new EDCTP-funded implementation trial led by the Malaria Research and Training Centre (MRTC) in Bamako, Mali, in collaboration with the Institut De Recherche En Sciences De La Santé (IRSS), Burkina Faso. The INTEGRATION study aims to evaluate whether the delivery of intermittent preventive treatment to pregnant women (IPTp), can be improved by integrating its delivery through the seasonal malaria chemoprevention (SMC) community-based channel in Mali and Burkina Faso. SMC is a control strategy targeting young children that successfully reaches up to 90% of children. The aim is to use the SMC channel to increase access to pregnant women during the rainy season when malaria transmission peaks and access to health facilities is reduced and mobilise pregnant women to attend the eight antenatal care contacts as recommended by WHO. The pilot will be implemented by the Malian and Burkinoise Ministries of Health in Q2 2022.

IMPROVE

The multi-centre IMPROVE trial in Tanzania, Malawi and Kenya, led by Professor ter Kuile, concluded in 2021. The trial assessed alternative regimens for the chemoprevention of malaria in pregnancy in 4,680 HIV-uninfected pregnant women in areas of high drug resistance. Results were unexpected and showed that intermittent preventive treatment in pregnancy (IPTp) with the new antimalarial dihydroartemisinin-piperaquine was much more effective than the standard of care with sulfadoxine-pyrimethamine, against which parasites have developed high levels of resistance. However, this did not translate into better pregnancy outcomes. Even though sulfadoxine-pyrimethamine failed as an antimalarial, it was found to have potent non-malarial effects that improved foetal growth and resulted in better birth outcomes. This is likely to have important policy implications.

Sub-studies on the acceptability and feasibility of IPTp with dihydroartemisinin-piperaquine, led by Jenny Hill, provided additional evidence on the health systems effectiveness to deliver these 3-day regimens through antenatal care and pregnant women's adherence to a multiday regimen in a real-life setting.

PMC

Professor ter Kuile's team in western Kenya also completed the post-discharge malaria chemoprevention (PMC) trial conducted in nine hospitals in western Kenya and Uganda. Dr Titus Kwambai from the Kenyan Ministry of Health led the trial in East Africa as part of his PhD studies. Three months of post-discharge malaria chemoprevention reduced the number of re-admissions and death in children admitted with severe anaemia by 70%. The study was published in the New England Journal of Medicine. Because of the unexpected large beneficial impact, it caught the attention of policy-makers in Uganda, Kenya and Malawi and the WHO. PMC Implementation research, led by Dr Jenny Hill, is scheduled to start in 2022.

Paediatrics and Child Health

PROSYNK

In partnership with the Kenya Medical Research Institute (KEMRI), the PRObiotics and SYNbiotics in infants in Kenya (PROSYNK) study in Homa Bay, western Kenya, is comparing the effects of 3 different pro/synbiotic supplements on gut health and growth in the first 0-2 years. Recruitment of 600 newborns is expected to be completed early in 2022. To date, compliance with the supplements and research procedures has been excellent with very few withdrawals. Linked MSc projects with LSTM co-supervisors have confirmed that pro/synbiotic supplements are acceptable to mothers, families and health staff and that this intervention may be affordable and able to be scaled-up should it prove to be beneficial.

GCRF Action Against Stunting Hub

LSTM leads the Gut Health work stream of the GCRF Action Against Stunting Hub (AASH). The role is to assess how poor gut health interacts with epigenetics, nutrition, the home and food environment and education and child development to develop a new typology of stunting. In cohorts of children 0-2 years in Senegal, India and Indonesia and working with the in-county teams and UK collaborators, the team is assessing biomarkers of environmental enteric dysfunction in stool and blood, bacterial and parasitic pathogen colonisation and the gut microbiota. In the Senegal Synbiotic (SENGSYN) study, the team is comparing linear growth at one year and the other outcomes being assessed in the AASH in infants who receive one of the synbiotic supplements being evaluated in the PROSYNK study. This will allow the team to compare the effects of the same intervention in two different settings.

Neonatal Nutritional Network

The Neonatal Nutritional Network in sub-Saharan Africa continues to grow and generate research outputs. These have included the effects of COVID-19 lockdown on institutional delivery, neonatal admissions and prematurity and the perceptions of parents regarding core outcomes for neonatal research in Nigeria and an overview of systematic reviews on the evidence that informs feeding practices in very low birthweight and very preterm infants in sub-Saharan Africa.

In collaborative research with colleagues in Sri Lanka, UK and Canada the Network reported very high levels of oxidant stress alongside marked anti-oxidant deficiencies in the different β-thalassemia syndromes paving the way for intervention studies and completed a cost-of-Illness analysis of β-Thalassaemia major in children. The Network also contributed to the analysis of long-term outcomes and survival in Haemoglobin E Thalassaemia patients followed-up prospectively for over 20 years.

Related Activities

Supported by the LSTM Cochrane Infectious Diseases Group, the systematic review of probiotics for the treatment of acute diarrhoea was updated, highlighting the lack of evidence for efficacy despite numerous clinical trials conducted over many years.

At Alder Hey Children's Hospital, studies on loneliness, isolation and relationships in children and young people with inflammatory bowel disease and of ferric maltol, a novel iron supplement, in iron deficiency, were completed.

Members of the Neonatal Nutrition Network

Field supervisor Auxilia Omwanda records an IMPROVE participant's weight measurements on the case report forms, in Rabuor Sub County Hospital, Kisumu, Kenya.

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

Public Engagement

LSTM is committed to engaging the public about its world-class research, both nationally and internationally, to promote awareness of global health issues and enhance the significance and impact of LSTM's research with target audiences and to inspire the next generation of scientists.

Knowledge Exchange Framework Agenda

LSTM's current public engagement strategy is being reviewed and revised as part of the Knowledge Exchange Framework (KEF) agenda. The aim of the Knowledge Exchange Framework is to increase efficiency and effectiveness of the use of public funding for knowledge exchange and to further a culture of improvement within academia. It will allow institutes like LSTM to better understand and improve their own performance, as well as provide businesses and other users with more information to help them access the world-class knowledge and expertise embedded within LSTM. An important aspect of KEF is community and public engagement.

LSTM's Public Engagement Manager is working alongside colleagues to consult with staff and students on Community and Public Engagement, which will feed into the revision of the current strategy contributing to LSTM's submission to the KEF. In addition, the team will identify barriers and challenges to improving LSTM's KEF score regarding community and public engagement, including developing an adequate definition of community and public engagement for LSTM and issues of reporting engagement.

Summer Science Day

Summer Science Day at Liverpool's VG&M. Photo by Amy McLeman

A team from LSTM engaged with children and adults at a Summer Science Day at Liverpool's Victoria Gallery & Museum. LSTM's Amy McLeman and team set up hand stamps on agar, for the children to culture their hand bacteria to feed into the citizen science Swab and Send project. The team also took games and puzzles to play with the visitors which included puzzles to show bacteria and antibiotic interactions and top trumps bacteria battles. In addition, LSTM's Natasha Neitham explored the unseen world of Liverpool's parks with the families visiting the Summer Science Day, showcasing videos and art of Sefton and Princess Park microbes. The teams received excellent feedback from the families attending the Summer Science Day.

> ***"It was slightly nerve-racking but exciting returning to face-to-face engagement after so long but the support from you all has made it easier. I cannot emphasise enough how much our families get out of events and how much they appreciate meeting LSTM staff working in so many interesting areas",***
>
> *Kirsty Hall, Education Officer VG&M.*

Swab and Send

The citizen science project 'Swab and Send', led by Dr Adam Roberts, aims to identify the next new antibiotic in the homes and schools of participants. The identification of new antibiotics is of vital importance as the rise of infections caused by antibiotic-resistant bacteria continues. Most of the antibiotics we use today come from bacteria and fungi that inhabit the soil. The next antibiotic might come from microbes that live in the back of people's cupboards, bins, or other unusual environments.

Dr Roberts asks school children, families and adults to pledge to buy swabs and join in the hunt for the next antibiotic, the participants are sent swabs which are used to swab areas collecting some potentially interesting microbes. Returned swabs are tested to see if any bacteria are present and if they are making antibiotics. The past year has seen the team collect bacteria from an ornamental ship within a fish tank which showed activity against *Candida* spp. Whilst a chicken feeder, a bathroom overflow and the inside of a hose pipe all harboured isolates that showed activity against *E. coli*. Highlighting the reach of the Swab and Send project, the team were thrilled to receive swabs of stockfish resin from a very small fishing island in Norway called Røst; one isolate from Norway showed antimicrobial activity against *E. coli*, MRSA and M. *luteus*. Other samples received by the team included swabs of some mouldy blueberry yoghurt, a leaky tap in a greenhouse and a Shih Tzu dog mouth.

Virtual Pint of Science Festival in Liverpool

For the fourth year running Liverpool hosted Pint of Science, this annual festival brings engaging science and latest research findings to pubs and bars across the world. Dr Laura Dean, Lecturer at LSTM spoke to 40 viewers during 'Medicine, children, and skin disease: a moral journey.'

In her talk entitled 'The stigma and burden of skin diseases,' Laura discussed the stigma, social exclusion and poverty caused by severe stigmatising skin diseases in Liberia and how her team has used participatory methods, such as photovoice, to work with faith healers and community members to break down barriers in accessing treatment and support.

Everton in the Community

LSTM continues to work with Everton in the Community providing opportunities for staff and students to visit primary and secondary schools within the Blue Mile to engage the pupils on LSTM's research and history. Everton in the Community is the official charity of Everton Football Club and delivers a range of programmes to promote health, education, social inclusion and equality to over 30,000 participants every year across Merseyside and North Wales using the power of sport.

Everton in the Community provide training to the staff and students visiting schools, and the PE Manager and Communications Team provide support in the form of images and videos, and helping researchers make their science jargon-free and engaging.

Social Mobility Foundation

LSTM continues to provide mentorship to secondary school pupils as part of its relationship with the Social Mobility Foundation.

BBC Radio Merseyside

LSTM guests, including Professor Nick Beeching and Dr Tom Wingfield, have regularly spoken on BBC Radio Merseyside Breakfast show providing reassurance and information to listeners as the Liverpool City Region moved out of COVID-19 lockdowns and saw the further easing of pandemic restrictions. BBC Radio Merseyside continues to offer radio slots enabling LSTM to present new research and its outcomes.

DTMH Audio Blogs

DTMH student, Dr Lia Lopez, worked with Professor Nick Beeching and Dr Tom Wingfield to create two audio blogs on the topics of, respectively, working overseas and teaching tropical medicine, and burnout and work-related stress during the COVID-19 pandemic. These were the first audio blogs created, following on from the success of the regular DTMH blog series.

LSTM Podcasts

LSTM's PE Manager and the Technology Enhanced Learning (TEL) Team are supporting Dr Kim Ozano and PhD student Beatrice Egid in producing podcasts highlighting the role of participatory methods in health science research. Topics discussed by the team include social mapping and photovoice approaches with guests and interviewees coming from across LSTM and Sightsavers.

Public Engagement Training

The Public Engagement Manager continues to provide training for LSTM staff and postgraduate researchers on public engagement. Most notably, the Public Engagement Manager and Senior Media Officer gave a virtual training session to staff based in Kenya. Sessions focused on the history of public engagement, the relationship between one-way dissemination and two-way methods of communication and science and society controversies.

Decolonising Agenda

The Public Engagement Manager is currently working with the staff involved in the decolonising agenda of the LSTM's research and education, and the BAME network to reach communities within Liverpool LSTM does not currently target. In the first instance, ethics approval is being sought to conduct a mapping exercise to identify where communities can be found within Liverpool and how best to target them.

125 YEARS 1898 - 2023 | LSTM LIVERPOOL SCHOOL OF TROPICAL MEDICINE

125th Anniversary

LSTM's Public Engagement Manager is also participating in LSTM's 125th Anniversary (in 2023) preparations and activities, preparing grant applications and working alongside LSTM's Fundraising Office, National Museums Liverpool and DW Consulting.

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 its innovative ideas. In doing so, LSTM considers itself unique in spanning the translational pipeline from discovery to implementation. Decades of under-investment in new drugs and diagnostics means the world is ill-equipped to respond to the burgeoning challenge posed by infectious diseases, antibiotic resistance, and emerging pandemics.

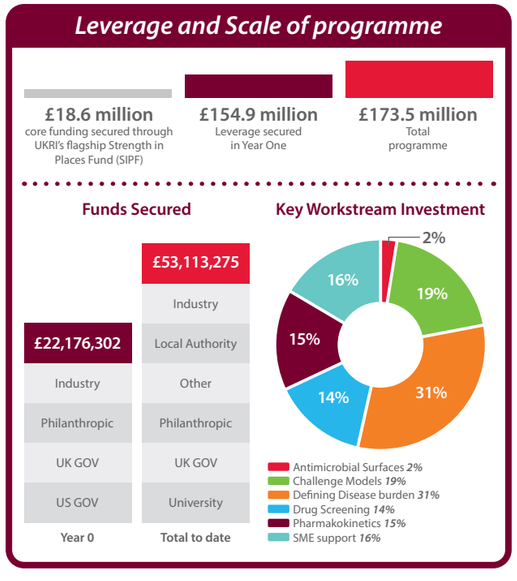
In response to this challenge, the LSTM led Infection Innovation Consortium (iiCON) bridges the gap in the infection innovation ecosystem. The consortium brings together industry, academia, and the NHS in a collaborative effort with a clear aim: to save lives globally by accelerating the discovery and development of innovative new treatments, diagnostics, and preventative products for infectious diseases.

Success in the First Year

Since launching in September 2020, iiCON has established itself as a global centre for infectious disease R&D. Founded with an £18.6 million government grant provided through UK Research and Innovation's flagship Strength in Places Fund, iiCON has raised an additional £154.9 million in public and private investment in its first year – creating a £173.5 million programme.

iiCON
infection innovation consortium

Leverage and Scale of programme



Source: iiCON Annual Report

The collaborative R&D programme is based in the North West of England. Operating across ten open-access, commercially-sustainable specialist research platforms able to pivot to handle any infectious disease, the consortium is designed to drive innovation and provide pandemic resilience.

Bringing together industry, research and the NHS in a collaborative effort, iiCON's other partner members are Unilever, Evotec, Liverpool University Hospitals Foundation Trust, University of Liverpool, and Infex Therapeutics.

> "Since our launch in 2020, the consortium's model of partnership-led co-innovation has enabled a remarkable impact both in terms of driving forward innovation and bringing new products to market, and is starting to shape health policy at a regional, national, and global level - saving and improving millions of lives."
>
> *iiCON's founding Director, Professor Janet Hemingway CBE*

Global Health Impact

The consortium is already having an impact on global health, saving and improving lives by enabling and supporting innovative collaborations that are fast-tracking new treatments and products to communities across the globe.

Over the last 12 months, iiCON has launched collaborative partnerships with over 186 UK SMEs and start-ups alongside key projects with global industry giants including Pfizer and Unilever. The programme has also attracted significant support from organisations including The Bill and Melinda Gates Foundation, The Wellcome Trust, and the Medical Research Council.

The last year has seen iiCON accelerate the development of new treatments and preventions for COVID-19 and a number of other important infectious diseases.

iiCON validated the first COVID-19 lateral flow test for asymptomatic, pre-symptomatic and symptomatic people. It also worked with the Ministry of Defence to develop a surface spray that deactivates COVID-19 in 60 seconds, which was used in UK COVID testing sites. Under an iiCON-brokered programme, LSTM collaborated with Unilever, one of the world's largest manufacturers of oral hygiene products, to rapidly assess the performance of mouthwashes against SARS-CoV-2. This work demonstrated that the technology Unilever uses in its mouthwashes inactivated COVID and provided essential data for regulatory approval and claims in key global markets.

Other contributions to the global COVID effort include co-developing a new model organoid that replicates the impact of COVID-19 on the lungs more accurately than traditional plate bioassays, with the UK SME Newcells BioTech. This innovation will be used to screen more targeted treatments for COVID-19 and other respiratory infections.

Discovering and developing new treatments for deadly resistant infections is a key priority for iiCON's platforms. Partner Infex Therapeutics is expecting to progress two novel therapeutics to tackle dangerous multi-drug resistant microbial infections into clinical trials over the next 12 months – helping to address the major global health threat of Anti-Microbial Resistance.

iiCON's work is influencing international health policy, supporting communities across the globe, including Africa. iiCON is building on the trial that found that piperonyl butoxide long-lasting insecticide treated nets (PBO LLINs) offered more protection against malaria than conventional non-PBO LLINs over a period of up to 25 months in Uganda. It is supporting two new trials in DRC, to look at simpler ways of large-scale testing and evaluate a novel new bednet shape. Data from the Uganda trial was scrutinised by the WHO Vector Control Advisory Group, resulting in a recommendation for WHO Prequalification to change policy advice for PBO-nets. Following this important work, 33% of the millions of treated mosquito nets distributed in Africa in 2021 were PBO nets – helping to protect communities and save lives. An iiCON follow on study in DRC is now comparing the biological and chemical efficacy of different PBO nets from four manufacturers.

Source: iiCON Annual Report

Key partners include:

298 *MAJOR COMMERCIAL / INDUSTRY STAKEHOLDERS*

40 *CONTRACT RESEARCH ORGANISATIONS*

54 *LABORATORIES*

> "iiCON has had an incredible first year. As lead partner, we are delighted with the programme's impact in enabling collaboration and driving forward world-changing innovation in infection research and development that will ultimately help to save and improve the lives of millions of people."
>
> *Professor David Lalloo, Director LSTM*

A rapid COVID-19 antigen test, validated by researchers at LSTM through iiCON is being used to deliver large-scale testing in key areas of need across Africa as part of a major FIND and UNITAID programme. The consortium is also working with the Malawian Government and the Wellcome Trust to provide data that is shaping the country's COVID-19 policy response.

Strengthening Capacity and Creating Jobs of the Future

Strengthening Infection R&D capacity and capability within the North West is an important part of iiCON's purpose. Since launching, the consortium has created 176 new high-value jobs across the North West and invested £9.4 million in local capacity and workforce development.

Future Proofing

INVESTMENT & JOB CREATION

91 Secured contracts valued at ***£48M***

176 ***high value jobs*** created in the North West

44 Industry projects totalling ***£11.2M***

387 ***total jobs*** created to date

It is investing in developing the next generation of global health leaders and supporting the interface between industry and academia to bolster collaboration and innovation in the infection space. A £2.5 million investment secured by iiCON from the Liverpool City Region Combined Authority, has provided anchor funding to establish a pioneering new capacity development centre for co-innovation and training at Pembroke House.

Building on the region's world-leading capability in infectious disease research and innovation, the new centre will provide a bespoke centre for world-class collaborative and interactive online learning, industry collaboration, and community engagement and training.

Pembroke House will drive impactful partnerships between industry, research, and the NHS to support pioneering infection innovation R&D, contributing to the Liverpool City Region target of R&D increasing to five per cent of GDP.

Through iiCON companies will be able to access high-quality professional and industrial training, alongside opportunities for high-quality networking and partnering. This will be critical in facilitating the research/industry interface and will act to rapidly connect iiCON's innovative research with industry.

The centre will also be used to support ongoing collaboration with regional partners, including Everton in the Community, to engage with young people and those living in the local community around the career opportunities available in health and life sciences and infection innovation.

iiCON Director Prof Janet Hemingway and Liverpool Metro Mayor Steve Rotheram. Photo by Ruth Cobban.

FEATURE ARTICLE:

Health Policy and Health Systems Research

LSTM's Health Policy and Health Systems Research is broad in its scope, ranging from individual-level capacity building and disease treatment through to national-level research and policy change. However, the uniting factor is a drive to translate research into policy and practice and improved health and wellbeing for some of the world's most vulnerable people.

COVID-19 has inevitably featured heavily in LSTM's health systems work this year, in all cases disrupting work and in several providing new avenues for research.

REDRESS

The REDRESS consortium works to address severe stigmatising skins diseases (SSSDs) such as destructive skin ulcers and elephantiasis in Liberia. The consortium uses action research processes to develop person-centred approaches, with a specific focus on mental health, disability inclusion and gender-transformative approaches. For many people with SSSDs, a lack of access to health and social services results in significant physical and psycho-social consequences, complex treatment journeys and catastrophic socio-economic impacts. REDRESS is using integrated health system approaches to reduce the associated illness, stigma, social exclusion and poverty.

REDRESS is funded by NIHR as part of its Research Innovation for Global Health Transformation (RIGHT) programme, and has been co-developed by researchers, patients and programme implementers at the request of the Liberian Neglected Tropical Diseases (NTD) programme. The programme directly responds to the needs addressed in the country's 'Investment Plan for Building a Resilient Health System'.

Key successes for REDRESS this year include:

- *Formative research successfully conducted across four themes and intervention development underway.*
- *Working closely with the Ministry of Health technical advisory board as key programme partners to support the revision of the national NTD master plan, feeding REDRESS findings into policy adjustments. Also the successful recruitment and engagement of people affected in the key data collection and analysis phases of the research.*
- *Community engagement which has included a presentation on 'engaging community minds to challenge stigma and support mental wellbeing' at the Pint of Science festival, and running workshops for RIGHT sister projects on photovoice and approaches to stakeholder engagement for WHO.*
- *A series of virtual skills building sessions have been conducted with Liberian Fellows and external partners. They have included protocol development, data analysis, paper writing, research methods, safeguarding, ethics and implementation research.*
- *A series of photovoice booklets has been produced that explores experiences of community health assistants and volunteers, faith healers and traditional healers in providing care for people affected by SSSDs.*
- *A Memorandum of Understanding has been established with the Carter Center to jointly develop tools to improve the psychosocial support and mental health service provision for people affected by SSSDs/NTDs in Liberia.*
- *REDRESS colleagues co-produced two policy briefs which focused on principles for promoting resilient health systems in the context of the COVID-19 response, with learnings from Liberia and Merseyside.*

REDRESS aims to instigate social change for people affected by SSSDs and to tackle marginalisation and discrimination through the development of innovative interventions that reflect the needs and values of those affected. For example, the collaboration with Effect Hope, based in Canada, led to the creation of a counterpart project in Tshikapa Health Zone, Democratic Republic of Congo (DRC), which seeks to develop and pilot a community mental health intervention package for NTD-affected communities; less is known about mental health impacts in countries that have experienced conflict and fragility, such as DRC and Liberia. This study aims to understand the existing mental health burden (depression and anxiety) in the general population and the NTD-affected population in Kasai region in DRC, while also working with communities and health workers to understand the best way to support affected people.

Strengthening Health Systems and the Health Workforce

LSTM's work on workforce and health systems strengthening has continued this year with substantial progress made across a number of programmes.

The ReBUILD for Resilience Research Programme Consortium focuses on health systems in fragile contexts experiencing violence, conflict, pandemics and other shocks. Two billion of the world's poorest people live in

such 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. Working in Lebanon, Myanmar, Nepal and Sierra Leone, ReBUILD for Resilience seeks to understand how to develop stronger and more resilient health systems which deliver both local and global health.

The programme, funded by the UK government's Foreign, Commonwealth and Development Office (£7.68 million), has achieved many successes since launching in May 2020:

- *Completed a highly successful inception year which exceeded set targets and outputs.*
- *Conducted research on health systems and COVID-19:*
  - Health system, health worker and community resilience in addressing COVID-19: a case study from Myanmar.
  - Understanding health system resilience to respond to COVID-19 in a federalised context: a case study of health workforce management at sub-national level in Nepal.
  - The gendered experience of close-to-community providers in fragile and shock-prone settings: implications for policy and practice during and post COVID-19. This work was conducted in Lebanon, Sierra Leone, Nepal and Myanmar.
  - Health system resilience amid outbreaks: understanding the politics of sexual and reproductive health service adaptation in eastern DRC.
  - Delivered webinars on health systems strengthening; close-to-community providers, gender and COVID-19; and disability-inclusive health systems in fragile & shock-prone settings.
  - Developed numerous products including papers, policy briefs and blog posts.

The PERFORM2Scale management development programme has now been running for more than three years, during which it has gradually scaled-up its activities to 27 districts across three countries in Africa.

PERFORM2Scale focuses on improving health workforce performance in Ghana, Malawi and Uganda, and as the programme enters its final year country partners have been negotiating with their respective governments about how to continue the scale-up. The team has completed the end line evaluation and is now teasing out the important lessons about management development and the scale-up of complex interventions.

Also on the governance of the health workforce, but at a different level, the team is working with WHO. They have completed case studies on the coordination of health workforce stakeholders and strategic human resource management in Malawi, Sudan and Nepal, which will feed into background documents for the World Health Assembly in May 2022.

Urban Health and Wellbeing

LSTM's work on urban health and wellbeing has continued through the GCRF Accountability for Informal Urban Equity ARISE Hub and contributions to the newly-launched African Cities Research Consortium.

ARISE's participatory research with informal settlement communities works to support the most marginalised people in protecting their health and wellbeing during the COVID-19 pandemic. It has also informed the pandemic responses of municipal and national governmental and non-governmental bodies. The team is building on what it has learnt to promote equitable access to COVID-19 vaccines for people living and working in informal settlements, as well as fostering inclusive pandemic preparedness and climate crisis adaptation processes.

ARISE has also built the capacities of people living in informal settlements to conduct research with professional researchers, and to use these skills to plan community actions to promote health and wellbeing. For example, with support from ARISE researchers, young co-researchers in the Kollyanpur informal settlement in Dhaka, Bangladesh won a prize in an Urban Health Innovations Challenge and presented their plans to the Mayor of Dhaka South City Corporation.

The Perform2Scale team

Community and professional researchers discuss Intimate Partner Violence and HIVAIDS linkages in Korogocho settlement in Nairobi. Photo by Beate Ringwald

ARISE has also communicated its learning through Stories of Change, blogs, papers, presentations, photo stories, videos and webinars, and to FCDO advisors through a Learning Journey on Leaving No-one Behind in Universal Health Coverage. Its findings also informed the UK International Development Select Committee report on Secondary Impacts of the COVID-19 pandemic.

As joint lead on the Health, Wellbeing and Nutrition and cross-cutting Gender 'domains' of the African Cities Research Consortium, the LSTM team has developed conceptual notes on key areas of focus for cross-sectoral, political settlements and 'city systems' research. Nairobi, Freetown and Lilongwe are the first cities where research on health, wellbeing and nutrition will take place, with further locations to follow in a second wave.

Centre for Capacity Research (CCR)

This year CCR has again been involved in the African Capacity Building Initiative. Funded by the Royal Society and FCDO, the initiative aims to strengthen the research capacities of universities and research institutions in sub-Saharan Africa. After a successful CCR-led workshop in 2019 on quality management systems for laboratories

Youth Associate members acting as community researchers in Kollyanpur informal settlement in Dhaka, Bangladesh

and educational skills for laboratory technicians, a series of virtual workshops took place in March and October 2021. Laboratory technicians who had attended the 2019 workshop were invited to present progress on their quality improvement projects, highlighting successes and identifying the barriers faced. Their experiences have since been developed into a Royal Society case study featuring recommendations and lessons learned.

CCR is also supporting the Shire Valley Vector Control Project (Shire-Vec). Along with robust work packages to monitor disease burden and the perceptions and behaviours of local farming communities, this multi-disciplinary project will strengthen the research capacity of individuals and institutions. Led by Dr Chris Jones (LSTM Vector Biology) and Themba Mzilahowa (Malaria Alert Centre), Shire-Vec will establish a network of experts in vector biology, agriculture and veterinary science from academic and governmental partners to share knowledge, skills and on-the-ground knowledge to support the training and development needs of future vector scientists in Malawi. Research capacity will be strengthened through training materials and courses in vector and One Health methods, as well as training in research skills such as grant and paper writing, geographic information systems, epidemiology, social science, vector biology and statistics. The first cohort of trainees who will benefit from the network will include two post-doctoral research assistants, three PhD candidates and three MSc students who will be funded by Shire-Vec.

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

It has been a year of progress for LSTM's work to mainstream disability, mental health, equity and rights within its NTD programmes and health systems research. As already highlighted, REDRESS, ReBUILD for Resilience and ARISE have delivered work to address these issues, spanning disability- and gender-inclusive health systems research, disease management to challenge stigma and support mental wellbeing, and equitable access to COVID-19 vaccines.

Despite entering its final year, the COUNTDOWN project has continued to champion this area as well. The last phase has seen a series of national and international dissemination activities where research findings – including those which focus on chronic morbidity, mental ill-health and disability associated with NTDs - were presented to stakeholders who discussed the impact of the programme and committed to embed the learning into policy and practice. The final webinar was held on 28 September and was attended by more than 150 people from across the world. NTD implementers, researchers and policy makers from Nigeria and Liberia came together to discuss how the lessons from COUNTDOWN aligned with the NTD roadmap pillars and what this means for the future of NTDs. For more information on COUNTDOWN see the Feature Article on Neglected Tropical Diseases

Research, Evidence, and Development Initiative (READ-It)

READ-It
Research, Evidence & Development Initiative

In 2021, READ-It has continued to strive for healthcare decisions based on unbiased, reliable, critical summaries of research evidence. This initiative, within the Department of Clinical Sciences, is led by Professor Paul Garner and Paula Waugh and includes the Cochrane Infectious Diseases Group (CIDG) managed by Dr Deirdre Walshe.

The team has had some terrific reviews this year, especially following the lead role CIDG took in countering the 'infodemic' around ivermectin. Fake trials and badly -conducted systematic reviews fuelled a global demand for this antiparasitic drug, and politicians in countries that had not organised COVID-19 vaccines promoted it as an alternative to other treatments. The Cochrane review, 'Ivermectin for preventing and treating COVID-19', did not show evidence of any COVID-19-related benefit to this drug. These findings were quoted in newspapers worldwide, and there were more than 10,000 tweets about the review. Dr Walshe also worked closely with the Central Cochrane Editorial Team and the University of Birmingham, UK, on widely cited reviews of COVID-19 diagnostic tests.

The 2020 Impact Factor for the Cochrane Library is 9.3 and for the Cochrane Infectious Diseases Group 7.5.

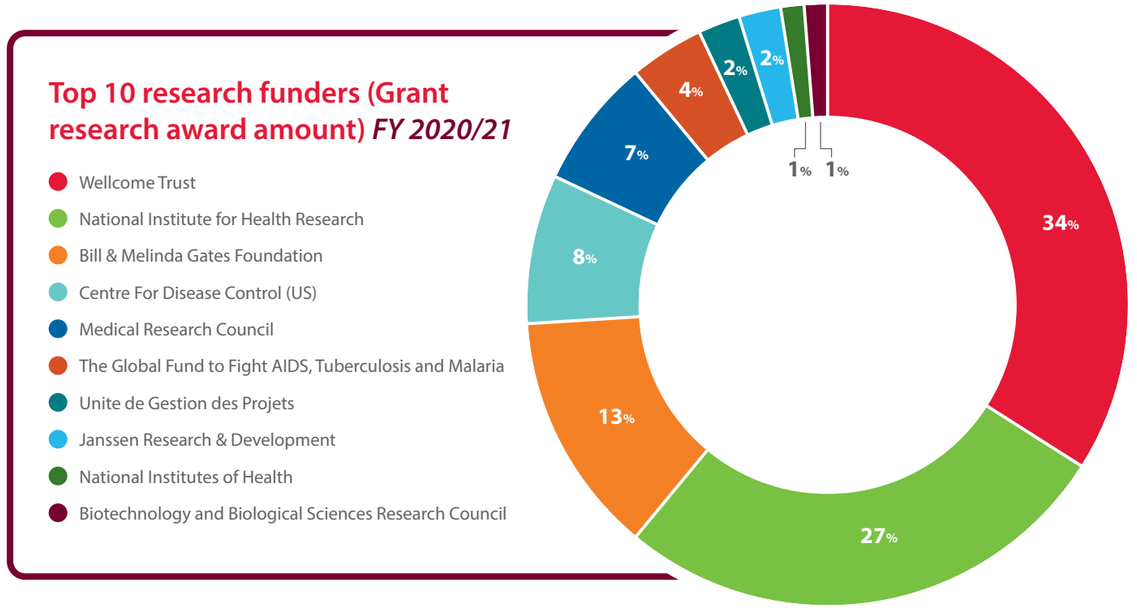
Guideline development is part of the READ-It brief, and this year the team was the technical and methods resource for WHO plague guidelines and TB diagnostic guidelines. They were also part of India's evidence-based COVID-19 treatment guidelines for clinicians.

LSTM's Top Research Funders

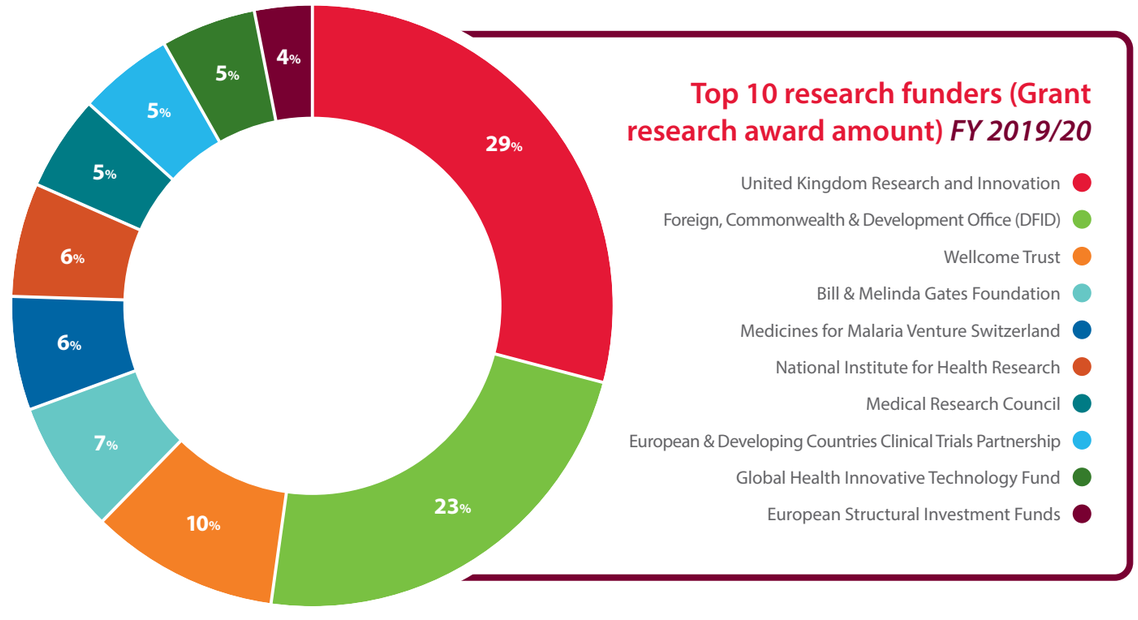
The graphics below show the top funders in terms of total contract value (by ultimate funding source) for LSTM during financial year 2019/20 and 2020/21.

Source: Converis

Top 10 research funders (Grant research award amount) *FY 2020/21*



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



Finance, Procurement and Research Services (FPRS)

External communication with the wider organisation was FPRS' focus in 2021, a key objective in the delivery of the transformation strategy. This included introducing new internal intranet site, self-service information desk and virtual sessions to share information and best practice. The department has undertaken customer services training during 2021, all held virtually and are now working to implement the skills and strategies obtained from these sessions.

FPRS Online

FPRS launched its new intranet site in 2020/21, which gives news articles of recent events and a monthly newsletter. It contains frequently asked questions with directions of where to find information, and a key section "You said, we did", explaining how FPRS is consulting and listening to the LSTM community to make changes that help make processes better. The site also details upcoming events of training and "BiteSize" sessions, and deadlines such as month end close off dates.

Top Desk is a self-service portal that many LSTM professional service teams use to provide a single point of entry for enquiries and information. The FPRS Top Desk contains information about all four FPRS sections (Finance Operations, Procurement, Business Partners and Research Management Services) with "how to" guides and video tutorials across a wide spectrum of business activities. Help and guidance is also available such as how to complete bank transfer forms, how to use FPRS systems, tax advice, budgeting and financial planning, how to prepare a grant proposal and support on running projects. The Top Desk facility has helped bring together all the information that FPRS holds into one central place, making it easier for staff to quickly find the help and information they need.

FPRS BiteSize

In April 2021, FPRS launched "BiteSize". These are mini virtual sessions, 25 minutes in length, and run every 6-8 weeks with a hot topic and Q&A. Hot topics are selected to be relevant for each session and have so far covered getting the best out of company credit cards, a demo on information on Top Desk and a demo on accessing and interrogating Power BI statements. Each session is recorded and is made available to all LSTM staff from the dedicated BiteSize area and link on the FPRS site. BiteSize aims to make FPRS staff more accessible and the aim is that these sessions will become a "one stop shop" info session. This has been a success during the pandemic as virtual sessions were more widely attended than in the past when they were held face to face.

FPRS in Action

There is a lot of day to day work undertaken within the FPRS department, but we are also given some great opportunities to use our talents and skills to achieve great value for

The FPRS team at an away day

LSTM. This year, with a grant of £1.1m, LSTM were able to upgrade the equipment used for research, with the FPRS team working together to ensure the speedy purchase and delivery of 34 pieces of equipment. Through our supply chain and procurement networks FPRS was able to make budget savings of around 20%, allowing for extra items to be purchased to get the most out of this funding stream. The FPRS team also worked closely with the IT department to replace outdated hardware with equipment suitable for virtual and hybrid meetings.

Management Information

FPRS has been working hard to improve the support to business activities and during 2020/21 continued to target management information as key for improvement. Considerable work was done on the configuration and development to our reporting software, Power BI for budget/expenditure statements, delegated authority and grant cost recovery.

Budget/expenditure statements are self-service, accessed via Top Desk, giving an up to date position on account expenditure and where relevant redesigned in consultation with user groups. These reports give month-end access to all types of accounts: research, core, profit centre and discretionary with meaningful analysis, greater interrogation and a more user-friendly visual presentation. A series of training events were held at the launch and regular refresher trainings are held. Similar user group consultation and training was undertaken for reports on delegated authority access to accounts.

Managing the finances of over 400 projects and with many activities overseas, the Research Management Services (RMS) team has been working to report on grant cost recovery, giving key management information to senior management on the health and strength of the research portfolio.

Research Governance, Ethics and Integrity

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

Processes

For the past year the team has worked through systems and processes whilst adapting to off site working through the pandemic. This has enabled us to look at different and more streamlined ways of working. An example of this is remote monitoring where we have been developing a hybrid model to monitor studies to provide assurance. With this model we are improving our carbon footprint and reducing to costs to study budgets in challenging times.

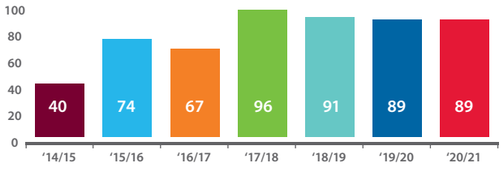
The new research management system EDGE is now up and running and we are starting to roll it out to sites to enable live information to be captured for recruitment figures. The reporting tool within the system has been invaluable for oversight of LSTM sponsored activity and track approvals of studies to identify any barriers we can help tackle to get the study open.

Overview of Activity

Reviewing all live studies, the map below shows where LSTM is currently operating. Of these, 78% of non-UK study countries are hosted in Africa and 10% of study countries are located across Asia.

89 studies were approved for LSTM sponsorship in 2020/2021. 67 studies were open to recruitment to participants.

Request for LSTM sponsorship registered ***2014-2021***



First Phase I Sponsored

Over the past year LSTM has been working to open its first sponsored phase I clinical trial of an investigational medicinal product in the UK. Recruitment is planned in November 2021.

COVID-19

COVID-19 has led to the team following agile working, the team have managed to maintain a supportive service to researchers. Studies affected by COVID-19:

- *One study's follow up on hold*
- *Three studies recruitment on hold*
- *One study closed due to COVID-19*

Research Integrity Working Group

To support the on-going work LSTM undertakes to improve the culture within LSTM, the team have set up a Research Integrity Working Group. It is created to represent all groups within LSTM so the group can identify issues that need work, give feedback from their peers and to have a platform to share best practice. There are sub-groups which lead on certain streams.

The Year Ahead

The team will continue to develop their processes and training opportunities in 2021/2022. Drop-in sessions are planned to support researchers which will ensure the support available is visible to researchers. Research Integrity is a theme for the year ahead with a new Dean for Research, Culture and Integrity, the work to bring a more holistic approach across LSTM for research activities, through collaboration of different teams, will be a key focus.

Location of LSTM Studies as per October 2021

UK
Brazil
Sierra Leone
Liberia
Ghana
Cote d'Ivoire
Nigeria
Cameroon
Sudan
Uganda
Tanzania
Zimbabwe
Ethiopia
Kenya
Malawi
South Africa
India
Nepal
Bangladesh
Myanmar
Cambodia
Indonesia

Education

The past year has been particularly challenging again for Education as a result of the impact of COVID and the need to navigate a pathway to deliver courses under highly unpredictable and fast-changing circumstances. Ahead of the start of academic year 2020-21 we had informed students of our intention to run with a blended format, in line with much of the sector.

Dr Martyn Stewart - interim Head of Education

Adapting Teaching for COVID

Having learnt from the previous year, retaining face-to-face teaching was important for student well-being to reduce withdrawal. For safety we planned for socially distanced on-campus learning, working with the safety advisors and Estates teams. This reduced the capacity of large teaching spaces from a capacity of up to 90 to 40 and meant many smaller teaching rooms could not be used practically. This caused us to review capacity levels for each programme. To prevent too many students being on campus at once to preserve social distance, and to reduce pressure on the larger teaching rooms, the timetable was replanned to a model of alternating online and on-site days. This required substantial planning and a series of guidance documents were produced by staff in education to guide appropriate pedagogic design to sequence online and campus-based activity appropriately. Adding to this complexity was the growing number of self-isolating students, requiring creative use of technology to maintain a sense of togetherness with students on-site and joining online.

Students in LSTM's Dagnall teaching lab, masked and social distancing meaning smaller groups and repeat sessions. Photo by James LaCourse

Due to the winter surge in cases, all MSc courses reverted to fully online for the first two blocks of Semester 2 (January to March). Whilst the students were disappointed with this move, they were pleased with LSTM's swift decision making which was taken before the government's advice changed. Education staff worked closely with programme directors and module leads to ensure teaching was engaging and to support effective teaching strategies. However, student well-being, along with everyone else, was impacted by the prolonged lockdown and the Student Wellbeing team were managing large numbers of cases. As restrictions reduced Government guidance allowed students on practical courses to return to campus after Easter 2021, we decided to run those modules with computer or laboratory work back on site, to relieve pressures on students. It was also agreed to allow students back on site over the summer to work in the research laboratories and access library services.

Student wellbeing info on display in student break-out room

Despite the challenges in planning and adapting technology-use very rapidly, there were many innovations in teaching and new skills acquired by academic and Education staff and students alike that are being incorporated into our future course designs.

New Education Strategy

LSTM's Education Strategy 2021-26 sets out the vision for a high quality sustainable education portfolio. At the heart of the strategy is the development of a learning environment that enables students to fulfil their potential, developing attributes in critical thinking and problem solving, as well as being culturally and ethically aware in preparation for working and under-taking research in resource-poor environments. At the institutional level the strategy outlines the vision for establishing an operationally sustainable and financially viable education portfolio, and the recognition of teaching and education alongside research.

Restructure of MSc programmes and academic framework

Alongside the planning and delivery challenges caused by COVID, the Department and academic teams continued with the process of restructuring the programmes and module structures for the existing MSc courses ahead of their relaunch in September 2022, with the new Masters in Public Health, MSc in Tropical Disease Biology, MSc in Humanitarian Studies and MSc in Tropical Medicine undergoing approval, along with a new Masters in Research programme. Whilst changing so many courses simultaneously has caused problems in terms of workload, the whole restructure process allowed us to address long-standing structural issues and redesign the underlying curricular architecture for a more efficient course model that is simpler to operate and expand.

Retirement of the Dean of Education

Professor Phil Padfield decided to retire from his position as Dean of Education in August 2021. He was Dean at LSTM for three and a half years during which time he has led the development of both our teaching plan and the education department. Dr Martyn Stewart has been appointed as Interim Head of Education from September 2021 whilst a new Dean of Education is recruited. We pass on our great thanks to Phil for his considerable contribution to LSTM and his passionate advocacy for education and teaching.

Pembroke House

The year saw a great deal of planning for the refurbishment of Pembroke Place as LSTM expands its footprint in Liverpool. Pembroke House is a new Capacity Development building shared between the Education Department and iiCON Consortium to evolve the education and workforce capacity at all career stages. Building work commenced in October with the opening scheduled for autumn 2022 to align with the relaunched MSc courses.

Plans for the building include new education and training spaces designed around flexible use and to enhance collaborative and interactive online learning. Spaces include a pop-up immersive suite that can project onto walls a range of simulated settings such as hospital wards or outdoor field environments to create a more authentic and engaging context to apply learning. Other rooms are designed with blended learning in mind, for individuals off-site also to be able to participate with those on-site, which will be essential for building future educational collaborations.

Staff and Student Achievements

Over the past year we had 21 staff and postgraduate research students completing LIGHT: LSTM's Leading in Global Health Teaching programme. Achieving Fellowship demonstrates recognition of teaching experiences and practices and this is achieved through submission of a comprehensive reflective piece against a set of criteria which are linked to the UK Professional Standards Framework (UKPSF). LSTM's LIGHT programme is accredited by Advance-HE and we award Fellowships that meet the criteria.

The distribution of Fellowship achievements this year is:

- *8 Associate Fellows (PhD students, Postdocs, technical staff and/or staff on learning support roles)*
- *10 Fellows (mostly teaching staff and technical staff and staff on learning support roles with significant teaching experiences)*
- *3 Senior Fellows (staff who are coordinating education processes and lead on teaching programmes)*

The distribution by department of this year's Fellowships is:

- *Vector Biology: 5*
- *International Public Health: 5*
- *Clinical Sciences: 3*
- *Tropical Disease Biology: 3*
- *MLW Programme in Malawi: 2*
- *Education: 3*

The next round of LIGHT will start in December 2021 and end in June 2022, managed by Christos Petichakis.

For students, we award prizes to the top performing student in each MSc programme. This year's winners were:

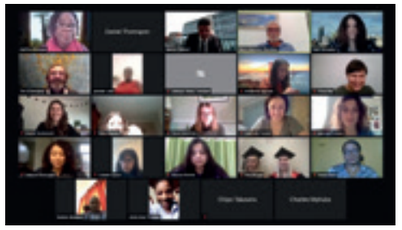
Rachel McCormick: Debbie Quinney Prize (MSc International Public Health – Humanitarian Assistance)

Thomas Arme & Jessica Dagley: Joint winners of the Jervis Prize (MSc Tropical Disease Biology)

Claire Turnbull & Laura Williams: Humanitarian Prize (MSc in Humanitarian Studies & Humanitarian Health and Programme Management).

Graduation 2020

LSTM held its annual graduation ceremony in January 2021, virtually and delayed from its usual December slot because of COVID-19.



Screenshot of some of the graduates and LSTM staff during the virtual ceremony

A total of 235 students graduated, with around 130 joining the ceremony from all over the world.

The ceremony was opened with a welcome from LSTM's Director Professor David Lalloo, congratulating the Class of 2020 for all of their hard work in the face of unique and difficult circumstances.

Dr Mwelecele Ntuli Malecela

Dr Anarfi Asamoa Baah

The two recipients of the honorary degree Doctor of Science were WHO Director of the Department of Control of Neglected Tropical Diseases, Dr Mwelecele Ntuli Malecela, and LSTM alumnus and former WHO assistant Director-General, Dr Anarfi Asamoa Baah.

Students and Courses

LSTM's Education revenue is directly linked to the number of postgraduate taught and postgraduate research students recruited each academic year.

In 2020/1, we saw a 10% increase in student numbers from the previous year on our campus-based MSc programmes. This was due to increased demand from the intercalating 'Home' market as well as heightened interest by students to study LSTM's topical programmes amidst a global pandemic.

LSTM also teaches 3 professional diplomas: the Diploma in Tropical Medicine and Hygiene (DTMH), Diploma in Tropical Nursing (DTN) and Diploma in Travel Health (DTH). Over the past year we saw a 28% decrease in numbers compared to the year before. The decrease is directly attributable to COVID-19 as we had to cap student numbers due to social distancing restrictions. Furthermore, many of the intended participants of these clinical programmes were directly involved in the COVID-19 response and needed to defer their studies due to professional commitments.

Despite these challenges, we have managed to run successful cohorts of students, albeit with reduced capacity. Students have expressed appreciation to LSTM for running these programmes and adapting the delivery model to accommodate COVID-19 challenges.

TOTAL TAUGHT STUDENTS **296**
177 38 81

137 MSc PROGRAMMES
86 12 39

MSc Humanitarian Studies	MSc Humanitarian Health Programme Management	MSc International Public Health (MIPH)
10	3	28
9 1 0	2 0 1	18 3 7
MIPH Humanitarian Assistance (MIPHA)	**MIPH Planning and Management (MIPHPM)**	**MIPH Sexual and Reproductive Health (SRH)**
17	6	13
14 1 2	2 1 3	8 2 3
MSc Tropical Disease Biology (TDB)	**MSc Global Health (GH) *Part time***	**MSc Global Health (GH) *Full time***
32	23	5
28 2 2	4 0 19	1 2 2

TOTAL **RESEARCH** STUDENTS **154**
69 16 69

4 SHORT COURSES & MODULES
4

7 SHORT COURSES ONLINE
69
16

125 PROFESSIONAL DIPLOMAS
85 25 15

Diploma in Tropical Medicine & Hygiene (DTMH)	Diploma in Tropical Nursing (DTN)	Diploma in Travel Health (DTH)
70	27	28
53 15 2	19 5 3	13 5 10

23 LEAP PROGRAMME (Leadership Education Academic Partnership)
23
Offered jointly with Médecins Sans Frontières & HCRI of the University of Manchester

TOTAL HOME EU OVERSEAS

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 3,700 clinical samples throughout this year. These samples were referred to the CDPL from NHS trusts and private clinics throughout the UK as well as those throughout 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

January 2021 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 inspection saw the start of a new UKAS four-year cycle and therefore took the form of a main visit which examined adherence to all aspects of the ISO15189:2012 International standard. The inspection was carried out virtually and demonstrates the quality service provided by the CDPL 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 five national external quality assurance schemes for faecal parasitology, blood parasitology, parasite serology, malaria rapid and faecal molecular panel. The unit also participates in Interlaboratory comparison schemes with peers for tests that are not covered by the national schemes.

The CDPL continues to integrate with the LSTM diagnostics research team. 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. We are currently evaluating additions to the faecal PCR panel that was launched in September 2020, this is being evaluated for *Enterobius vermicularis* detection plus detection of *Schistosoma haematobium* from urine samples. The next phase of molecular validation and verification will be a review of the unit's Leishmania diagnosis algorithm.

CDPL team members Jayne Jones, Paula Wright, Jessica Mason and Iain Slack. Photo by Gill Wareing.

The CDPL staff also supports the teaching team at LSTM by providing demonstrator and examiner roles for the practical sessions of the DTM&H courses. This gives the staff a chance to meet the students and interact with the LSTM teaching team enhancing links and sharing knowledge external to the unit.

The CDPL continues to work with the Ministry of Defence (MOD) and is contracted to perform diagnostic work within certain MOD personnel groups. This sees a very busy time for the CDPL staff when samples arrive annually in bulk. However, the team all work together to ensure the samples are processed in a timely manner.

The CDPL is performing an External Quality Assurance role 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 focuses on detecting infections that are treatable and/or preventable. The CDPL is currently working through the samples and the data generated will feed into the study outcomes.

I am supported in the CDPL by Biomedical Scientists Iain Slack, Jessica Mason and Simone McLaughlin, Medical laboratory assistant Paula Wright and administration assistant Angela Hargreaves. The team continue to work in a committed professional manner, and I wish to pass my thanks on to them for their support and hard work during this year.

Well Travelled Clinics

The travel business environment continued to be severely impacted by the global COVID-19 pandemic and because of this, the company ended the financial year at a net loss.

Philippa Tubb - Managing Director WTC

All Well Travelled Clinics (WTC) sales were behind budget, except occupational health income and revenue related to our NHS work and educational courses. We were able to reduce our losses through controlling staff costs, utilising the government furlough scheme where possible, and receiving a small business grant for our Chester clinic.

We continued to contribute to COVID-19 research during this financial year, with our nursing and administrative staff working on research at both LSTM and the University of Liverpool. In addition, a member of our medical team supported clinical work at the Liverpool University Hospitals NHS Foundation Trust. Three of our nursing team were deployed to support the local vaccination hubs during the COVID-19 vaccine roll-out.

WTC also designed and delivered a number of training courses on vaccination in research for pharmacists and research nurses who were going to be involved in vaccine trials, on behalf of the Northwest Coast Clinical Research Network.

Our Liverpool clinic has remained open to all essential workers throughout the pandemic and continued to carry out pre-employment vaccination and health screening for UK healthcare staff, international humanitarians, research staff, gas, oil, and shipping personnel across the world. We also continued to provide occupational health services to our UK-based clients.

Our Chester clinic, closed for most of the year, finally reopened for 2 days per week in May 2021. We plan to increase the opening hours leading up to Christmas 2021 and into the New Year.

The Occupational Team was involved in supporting LSTM's response to the pandemic in relation to reviewing COVID risk assessments, staff and student testing and providing advice and support in relation to COVID-19 to the HR team and the COVID Emergency Management Team when required.

WTC implemented new COVID swab services to enable us to offer pre-travel "Fit to Fly" swabs to our clients.

This required the company to register with the Department of Health and Social Care (DHSC) and apply for accreditation for this clinical service through the UK accreditation service (UKAS). We were awarded full accreditation by UKAS for COVID-19 swab sampling under ISO-15189 in August 2021. In addition to fit to fly testing, we have subsequently registered with DHSC to carry out "Test to Release" day 5 swabs, and day 2 and 8 swabs, and can now offer these services to our customers.

WTC continues to work in partnership with LSTM and the National Travel Health Network and Centre (NaTHNaC) in the delivery of the Professional Diploma in Travel Health. It has been another successful year, with two more student cohorts starting this course, 15 in cohort 4 and 13 in cohort 5.

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

2020/2021 AT A GLANCE

This year, Well Travelled Clinics:

HAD 4796 PATIENT VISITS

ADMINISTERED 2195 VACCINES

DISPENSED 592 PACKETS OF MALARIA TABLETS

and carried out:

- **48** *Sickness and absence medicals*
- **339** *Pre deployment medical screenings for overseas workers*
- **84** *Oil and gas medicals*
- **49** *Sea farer medicals*
- **96** *pre-employment screens for LSTM staff*

Liverpool Insect Testing Establishment (LITE)

LITE was formed 11 years ago in response to demand from agrochemical companies for a service to evaluate alternative chemistries against an array of mosquito vectors.

Professor Hilary Ranson - Interim Head of LITE

From an initial staff of 3 LITE has grown to a team of 16 and has expanded the range of mosquito populations, and bioassay and analytical platforms, to meet the growing demand for our services.

LITE is housed in purpose built facilities on the top floor of the LLSA building, also known as the 'Accelerator'. As member of the Good Laboratory Practice compliance monitoring programme LITE is able to support manufacturers in assembling data packages for regulatory authorities, including the World Health Organization's vector control prequalification process, but also works with clients to develop bespoke assays for use earlier in the discovery phase of the pipeline.

This year has seen some key staff changes with the departure of our previous Head of LITE, Helen Williams, and the arrival of Noureen Shahid, who is acting as interim Test Facility Manager, supported by Professor Hilary Ranson and Study Directors Louise Ford and Amy Guy and the rest of the team. The technical team has been restructured to provide more opportunities for training and career progression.

In July LITE was awarded a competitive tender from IVCC to support their insecticide development pipeline for a further 3 years. This funding provides an excellent platform to embark on LITE's next phase of expansion: in January 2022 LITE will be transitioning to a spin out company, in partnership with iiCON. This transition will enable LITE to expand its client base, and offer a wider range of services, including assays on other nuisance pests, whilst maintaining strong links with the technical expertise in vector control at LSTM.

Images clockwise from the left: Maintaining our multiple lines of insecticide resistant mosquito populations; Aspirating mosquitoes in preparation for insecticide testing; Testing the durability of insecticides on alternative mud surfaces. All photos by Robert Prendergast

IVCC

Dr Nick Hamon, CEO of IVCC

IVCC is the only product development partnership (PDP) working in vector control. Our goal is to support the development of a toolbox of new and enhanced vector control interventions to address the growing threat of pyrethroid resistance, the mostly commonly used public health insecticide in vector control.

Our strategy since inception has been focussed on three distinct areas of product development; to increase the availability of new indoor residual sprays (IRS) to support their annual rotation and therefore the longevity of the insecticide; secondly, to reduce reliance on pyrethroid only bed nets which malaria carrying mosquitoes are increasingly showing resistance to and thirdly to look for new tools that can help address the challenge of outdoor biting mosquitoes. Our progress to date has been both successful and rewarding.

A Suite of New Indoor Residuals Sprays Delivered

With Sylando® (BASF) and VECTRON™ T500 (Mitsui Chemicals Agro) awaiting WHO PQ listing, along with K-Othrine® Polyzone (Bayer), Actellic® 300CS (Syngenta), Fludora® Fusion (Bayer) and SumiShield®50WG (Sumitomo Chemical), the toolbox of IRS products that will allow for best practice insecticide resistance management through rotation has been delivered. Through the Unitaid-funded NgenIRS initiative, we have learned a great deal about the strong performance of IRS as well as created competition to lower intervention costs and increase coverage with effective products.

Focus on New Generation Bed Nets

The introduction of Interceptor® G2 (BASF) is paving the way for a new generation of dual active ingredient bed nets. Starting in 2010 with an archive of over 4.5 million compounds, IVCC has studied and optimised 27 chemical classes with activity against mosquitoes and narrowed the field down to a handful of lead candidates. Three novel insecticides new to public health are in full development. Our focus over the next five years is converting the chemistry pipeline into 2 repurposed and 2 novel public health insecticides. This relies on strong partnerships with a fast-consolidating R&D based agrochemical industry and with companies having expertise in net development, manufacturing, and distribution. IVCC is contributing funding, scientific support, know-how and technical evaluation capacity in malaria endemic countries across Africa and, more recently, the Indo-Pacific region.

Outdoor Transmission Prevention, the Next Frontier

Protecting people against mosquitos biting when they are outdoors is the next technical challenge to be tackled to enable malaria eradication. IVCC's strategy is driven by two key projects: establishing Attractive Targeted Sugar Bait (ATSB®) public health value in sub-Saharan Africa and the evaluation of last mile outdoor protection tools in the Greater Mekong Subregion.

Although the concept of ATSB®s was not new, it was an IVCC 'Call for Proposals' in 2015 that brought the potential of ATSB®-type technologies to the forefront. A first generation ATSB®s (from Westham) is in an advanced stage of development and about to be deployed in large scale epidemiology studies in Kenya, Mali and Zambia, with an expectation to open a new vector control product class by 2025. There is also strong interest in evaluating the use of ATSB®s against urban malaria (*Anopheles stephensi*), their potential for indoor use and their performance against vectors of dengue, Zika virus and Chikungunya.

Nothing can be done without Highly Effective Partnerships

IVCC is a product development partnership (PDP), with the emphasis on partnership. None of the progress made in the past year could have been achieved without the collaboration with donors, industry, the academic community, national malaria control programmes (NMCPs) and non-government organisations. It is the quality of these partnerships which will allow for insecticide resistance management (IRM) and integrated vector management (IVM) strategies to preserve new tools from resistance.

There is a critical need to have IRM and IVM strategies and agreements in place with industry partners and NMCPs to preserve new interventions and optimise their performance. The scale-up of new tools, which is almost always more costly at launch than the products they replace, calls for the implementation of sustainable catalytic market shaping initiatives in key endemic countries. From an operational perspective, IVCC recognises a need to increase its footprint in endemic countries to inform strategy and support on the ground activities.

Public Health Revolutions

The development of a COVID-19 vaccine in little more than 12 months with no compromise on safety or efficacy demonstrates what can be achieved when the right resources, scientific expertise and political will are focused on a public health challenge. The same recipe can be applied to malaria, so NMCPs can have access to effective new vector control tools and deploy them at scale.

The WHO endorsed malaria vaccine, RTS,S/AS01 (trade name: Mosquirix) is a major breakthrough in the elimination of malaria. Modelling and experience tells us it is essential that this long-awaited new tool is complemented by antimalarial drugs, diagnostics and highly effective vector control to maximize its efficacy. It is the right combination of tools in the right geography, aided by effective surveillance-informed decision-making that will allow the world to finally be free of malaria. As Yacine Djibo, the founder and executive director of 'Speak Up Africa' wrote in a letter to the New York Times back in October, 'With more investments and effective tools, we can be the generation that will end the disease for good'.

LSTM in the Media

Yet again LSTM media output has been dominated by the COVID-19 pandemic. The year has seen more than 120 press and news releases published, alongside numerous requests for comment and reassurance from LSTM's experts, resulting in thousands of mentions in the online, broadcast and print media with a potential reach of hundreds of millions.

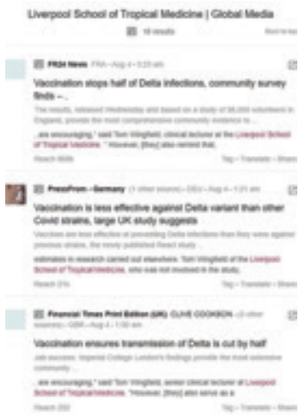
COVID-19 remained the biggest story of the last 12 months, with LSTM's experts being called on to talk about all aspects of the pandemic, from testing to vaccination roll-out and the post-Christmas lockdown. Professors Bertie Squire and Kevin Mortimer alongside Emeritus Professor Nick Beeching and Drs Tom Wingfield, Tom Fletcher and Angela Obasi became familiar faces and voices to local and regional audiences throughout. News of the approval of the Oxford AstraZeneca over Christmas, and the fact that LSTM had been a site for Phase III of the trial, meant that Dr Andrea Collins and Dr Helen Hill gave comment on the possible rollout. The success of LSTM's part in the trial meant that the team were called on again to take part in the ComCov trial which saw different vaccines as primary and booster jabs to test the efficacy of doing so. Utilising the local media, participants were recruited in record time, regardless of the narrow criteria and meant strong coverage for the start of the trial with regional broadcast media as well as ITN and Channel 5 News visiting LSTM.

BBC North West Tonight reporter Andy Gill at LSTM during the ComCov vaccine trial - photo Clare Bebb

Other aspects of LSTM's research also hit the headlines with Dr Emily Adams and her team, who had become familiar faces in the media in relation to the search for effective diagnostics for COVID-19, being interviewed about their study into the transmission risks posed by sports equipment. Dr Adams and Dr Thomas Edwards were interviewed by BBC Sport as well as earning a front page on the national tabloid paper, The Daily Star, when they found that the risk of transmission from sports equipment was likely to be relatively low, opening discussions at a national level in regard to reintroducing amateur sport again as the UK started to ease some restrictions. The work was part of wider research by the team, looking at how the virus was transmitted, which also included surface swabbing and air sampling within medical and testing settings.

The relationship that has been built between LSTM's clinicians and scientists and the media has been of benefit to LSTM with a few notable examples: The reporting on International Day of Women and Girls in Science, when ITV Granada came and filmed some of the women who had been involved in the pandemic research and clinical trials, which was featured on the news regionally and prominent on ITV's national news website. The second example of the importance of a good relationship with the media was LSTM's Bump it Forward Campaign, launched to encourage people to donate the equivalent value to their COVID vaccine in order to provide quality PPE to our colleagues working on the frontline in Africa until they received their vaccinations. BBC North West Tonight covered the campaign, interviewing Drs in Malawi and Professor Kevin Mortimer at LSTM and donations of over £25,000 were received in a few hours after the programme's transmission.

LSTM has continued to work with the Science Media Centre again this year, carrying our exerts voices far and wide. LSTM's Dr Tom Wingfield remains in close contact with the team in London, which has seen him regularly quoted by nearly 400 outlets throughout the UK media as well as across the world, with audience figures in the millions. He has also written, with his colleague Professor Miriam Taegtmeyer, several pieces for the online platform The Conversation about the impact of the pandemic on frontline health care, which have also been picked up by national newspapers, including the Independent.



Partial capture of LSTM's daily media monitoring report - 4 August 2021

Early September saw the launch of the Pandemic Institute, which is a partnership across Liverpool institutions including LSTM, which will look at pandemic preparedness. LSTM featured heavily in the launch publicity with Good Morning Britain going live from the lab on the morning of the launch and local BBC and ITV, Sky news and Al Jazeera interviewing Professor Daniela Ferreira and Dr Carla Solórzano Gonzalez about the importance of development of platforms that would make delivering vaccines and therapeutics for future pandemics much quicker. LSTM and

Dr Carla Solorzano Gonzalez with ITV Granada News for their report on Women and Girls in Science 2021 - photo Clare Bebb

MLW's Professor Henry Mwandumba was also interviewed by Al Jazeera and featured in an article in the Observer, alongside Professor Ferreira, about the importance of pandemic preparedness for international partners.

Also, from March 2021 onwards, LSTM advocated on behalf of science and global health in the face of the UK Government's decision to reduce the amount of GDP spent on the Official Development Aid budget as a means of economic recovery in the face of the pandemic. Director Professor David Lalloo spoke publicly not only about the lives that could be potentially lost due to the cuts, but also the damage to the UK's world standing as a health and science superpower and to international partnerships in Lower-and Middle Income Countries (LMICs), because programmes would be cut short or budgets significantly reduced.

As well as giving comment to the Financial Times and the Lancet, he jointly authored an Editorial in the Daily Telegraph about the cuts, alongside the then Director of the London School of Hygiene and Tropical Medicine, Professor Peter Piot, and the Director of the Institute of Development Studies, Professor Melissa Leach. Alongside these editorials, Professor Hilary Ranson spoke to the Daily Telegraph about the cuts to the vector control programme PIIVeC, which saw the programme's funding stopped just months before its completion, at the vital results gathering stage. This was also featured on Channel 4 News, including an interview with PIIVeC fellow Dr Tresor Melachio in Cameroon.

DT opinion


The Telegraph News Business Sport Opinion Politics World Money Life Style Travel Culture

UK news Coronavirus Royals Health Defence Science Education Environment Investigations Global Health Security

COMMENT

The government's aid funding cuts are a wrecking ball to global health security

UK research has led to major health gains around the world - that is now in jeopardy

PETER PIOT | DAVID LALLOO | MELISSA LEACH

1 April 2021 • 3:29pm

Fundraising

LSTM's 125 anniversary campaign received a boost from the Lord Leverhulme's Charitable Trust who pledged £125,000 to mark this significant milestone for LSTM in 2023. The funding will support the new Pembroke House development (see Estates elsewhere in this report), creating a flagship centre for training and capacity development at the heart of the campus in Liverpool.

Karen Brady - Director of Fundraising

Registered with FUNDRAISING REGULATOR

The first donations towards the 125 Anniversary Scholarships programme were also received, supporting students on online and campus programmes. LSTM aims to secure 125 new scholarships as part of the Anniversary campaign.

The ambitious fundraising campaign focuses on supporting LSTM's growth as a global organisation; breaking the cycle of poor health and poverty, and bridging the gap in health inequalities. The campaign supports four key aims: Building Connections (via partnerships and a connected global infrastructure; Creating Opportunities (through scholarships, PhDs and our virtual incubator, HiVE); Generating Knowledge (through catalyst seed funding for exciting new research and the establishment of a flagship Institute for Resilient Health Systems); and Developing Capacity (by investing in global scientific talent and associated training and development).

More information can be found here:
www.lstmed.ac.uk/support-us

A significant focus for the Fundraising team throughout 2021 has been the Bump It Forward (BIF) campaign, which was launched in January 2021 in response to reports of high COVID-19 rates in Malawi and inadequate levels of PPE. The campaign was created and launched in three days and was run via JustGiving, asking donors to 'bump forward' the equivalent of their vaccine (c£25) in order to protect health workers in African countries until the vaccine reached them. The response has been phenomenal, with the campaign raising £268,249 in online and offline donations from 4,863 donors.

This funding has enabled LSTM to support partners in seven countries to purchase 1.3million items of PPE to date, which have been distributed to over 160 healthcare facilities. The impact of this has been profound, genuinely helping to keep health workers safe at a time when they are most needed as health systems became overwhelmed. Bump It Forward was featured in regional, national and international media.

We are truly grateful to the individuals, foundations and businesses who supported our work over the last year.

All gifts, regardless of size or designation, help us to tackle the global health challenges facing humanity.
www.justgiving.com/campaign/bumpitforward

Dr Fumbani Limani, Dr Chanizya Mulambia, Dr Dingase Dula and Dr Melita Gordon on the ward in Blantyre, Malawi wearing PPE provided by BIF. Photo by Melita Gordon

Key Alumni Stats

TOTAL NUMBER OF CONTACTABLE ALUMNI 2378
increase of 4% with 2020

ALUMNI FROM 93 COUNTRIES

COUNTRIES WITH HIGHEST NUMBER OF ALUMNI:

UK	***CANADA***	***USA***
KENYA	***NIGERIA***	

ALUMNI NEWSLETTER AVERAGE 40% OPEN RATE
29% industry average: Source Mailchimp

Environment and Sustainability

LSTM is a centre of research excellence on global health challenges that affect some of the most disadvantaged communities in the world, and given our mission, we have an obligation to advocate for change and be a leading force in the fight against climate change.

Sustainability and Environment Committee (SEC)

LSTM set-up the Sustainability and Environment Committee (SEC) in January 2021. SEC has broad representation across LSTM's departments and career stages and is responsible for the development and implementation of environmental sustainability across LSTM ensuring an integrated, proactive approach that is informed by best practice, and aligns with our values, objectives and strategy.

SEC works in close partnership with other parts of LSTM governance structures and reports to LSTM's management committee.

The SEC and its Environmental Working Group (and sub groups) have developed an Action Plan, which includes measures and targets across corporate governance, operational management, procurement and travel.

PROGRESS TO DATE:

2019

LSTM introduces dry mixed recycling bins around all LSTM buildings, in communal, and open office areas.

2020

Jul: the Carbon/Travel subgroup carries out a schoolwide survey and focus group discussions to investigate staff international travel throughout 2019, and gauge opinions on how LSTM could best reduce its carbon footprint. A Report is submitted to Management Committee, and published on LSTM website.

Oct: LSTM switches from brown electricity – containing fossil fuels – to 100% certifiable renewable energy

2021

Jan: Sustainability & Environmental Committee is established (SEC).

Feb: LSTM decides to divest from fossil fuel companies.

Aug: LSTM Estates in collaboration with an external consultant carries out a short Travel Attitude Survey to better understand how staff are feeling about travelling to work or study (locally).

Sept: The Data subgroup reviews the People and Planets guidelines and assessment categories and submits LSTM's data. For the first time ever, SEC launches external webpages dedicated to sustainability and environment at LSTM ***https://www.lstmed.ac.uk/about/sustainability-environment-at-lstm***

Oct: The Green Working subgroup launches The Green Laboratory Guide, inclusive of a green pledge for LSTM lab users to show their commitment to ensuring green laboratory practices at LSTM.

Nov: COP26 (31st October – 12th November). Estates lights up the main building in green. The Comms subgroup books speakers & arranges for a board in the social space for people to share their thoughts.

2022

Developing Biodiversity & Sustainable Construction statements and make them publicly available

Reducing air travel emissions and sustain this reduction

Enhancing awareness of carbon costs in collaboration with new travel provider

Investigating offsetting options

Awareness raising

Developing local travel plan aimed at decreasing the environmental impact of transport to and from LSTM

Appointing an Environmental Officer

Promoting responsible procurement practices throughout our Supply Chain

People and Culture

'Our aim is to ensure that LSTM is a place where colleagues can thrive and flourish, where they feel valued and recognised whilst developing their career prospects and where managers are supported to lead their teams successfully'

Management Committee response to staff survey 2020.

Pandemic

The pandemic continued to dominate our work throughout 2020-2021, as we supported colleagues to work remotely and onsite. Working closely with health professionals, we developed a health risk assessment, which helped us to understand the risk of COVID exposure, based on a range of individual health factors. We also facilitated early access to the vaccination programme. Over 70 colleagues were supported through the furlough scheme, which helped individuals and teams who were unable to deliver projects or normal work because of the pandemic. We extended our Career Track programme by 12 months, giving participants longer to achieve targets required for successful completion. We provided means by which colleagues could share how the pandemic had impacted them, through annual performance review conversations.

Maintaining mental health and resilience have been important throughout this period: thanks to our wellbeing champions - a team of dedicated volunteers who organised a series of wellbeing activities and events to support colleagues throughout the year.

In September 2021, we introduced a new agile working programme which enables people to work to a more flexible working pattern, including a combination of onsite and remote working, to support better work life balance, whilst still meeting organisational needs. This was the culmination of a review undertaken by a working group, who canvassed views across the organisation and took account of our experience of remote working during the pandemic.

Career Progression

Support for career progression and development continues to be a cornerstone of our work. This year we have launched a learning and development programme and hosted targeted career development events across all professional disciplines: to support promotion and development for researchers, technicians, programme managers and professional services colleagues; we have successfully promoted opportunities through apprenticeships with over 30 colleagues participating.

Our aim is for everyone at LSTM to have their own active growth and development plan and we will continue to evolve our Learning and Development programme.

Our successful Career Track Programme welcomed a further 8 future academic leaders in 2020-21. We would like to recognise the achievements of Dr Eva Heinz, Dr Kondwani Jambo and Dr Anne Wilson (pictured from left to right) who successfully completed this challenging programme this year.



We have reviewed our academic promotions scheme to include a more systematic approach to identifying and supporting potential future candidates and opportunities for those from non-traditional routes to apply and be considered. Congratulations to the following who were promoted in the last academic year:

Senior Lecturer: Dr Eva Heinz and Dr Kondwani Jambo
Principal Research Associate: Dr Jenny Hill
Reader: Dr Emily Adams, Dr Charles Ameh, Dr Grant Hughes, Dr Tim Martineau, Dr Lisa Reimer and Dr David Weetman.

We successfully piloted a regrading process to enable colleagues across LSTM to have their role reviewed and appropriately recognised.

Engagement and Culture

We undertook an LSTM wide staff survey last year. The feedback illustrated the strong sense of pride that people have, working for LSTM and the commitment to our mission and success. It also highlighted the opportunity for strong leadership and further action to improve opportunities for progression and develop and to improve equity and inclusion. The outcomes have been shared and incorporated into our plan of work.

Equity and Inclusion remains a major focus of work. As part of our longer-term plans for race equality work, we have established a Race Equality Advisory Panel which will provide evidence-based advice and recommendations for the development of race equity strategy and actions and has commissioned an external review, which will report back later in the year. In 2021, we published our first ethnicity pay gap report, using 2020 data and have also achieved earlier publication of our 2021 pay gap reports. We have seen the gender pay gap reduce, but the picture for ethnicity pay gap is not so clear: overall, this is a result of the lower numbers of minoritised ethnic colleagues. We have set actions to close the gaps over coming years.

2020-2021 saw the relaunch of the Athena SWAN charter and we are continuing our self-assessment process in preparation for our application for a silver award in 2022, focusing on trends in our staff profile, opportunities for progression and diversity across committees and governance structure

In 2020-2021, we will publish our revised inclusion strategy, which will bring together our Athena SWAN plans and race equity actions alongside other priorities.

Our staff networks play an important role in the development of equity and inclusion at LSTM. In the last year, both the BAME Network and the LGBTQ+ network have organised activities, acknowledged and celebrated events such as Black History Month, Pride, International Women's Day and National Pronouns Day and contributed to the development of our strategy. We are currently exploring further networks and resource groups including a disability network.

HR and Wellbeing

Within HR, we have appointed a Global HR Manager, based in Malawi, who will support the development of international HR practices in the coming years. Following Brexit, we have supported our staff from European countries, to navigate the Settlement Scheme, enabling them to continue to work and live in the UK. Changes to the visa and immigration system have seen an increase in roles being offered internationally.

We have developed a range of wellbeing resources and activities including a central hub of resources and information, health and wellbeing support and advice, accessible via mobile and app for colleagues globally; we have trained mental health champions and menopause champions who can provide specific support to colleagues. We will develop a wellbeing strategy in the months ahead.

Research Culture

The culture of a research institute affects who does research, what research is done, how it is done and the reach and impact of that research. In the last few years there has been increased awareness across the sector of the negative impacts of a hyper competitive research environment, both on the individual and the institution. At LSTM we strive to create a healthy research culture that recognises and rewards the contributions of all across the organisation for their varied contributions to research, encourages all to support the career development of others and enables all to generate and disseminate excellent, impactful research that meets the highest standards of research integrity.

Over the last 12 months we have revised our academic promotions documentation to take a more holistic view of the varied contributions to research, avoiding the use of misleading metrics, and developed an action plan to support the development and career pathways of researchers, utilising learnings from early career researchers that have recently left LSTM to identify areas for improvement.

We have also been improving our guidance, training and policies on research integrity and data management to improve the reproducibility of research. Building on ongoing reflective learning on equitable partnerships, we seek to create a research environment where all staff are encouraged to speak up if they witness questionable research practices in any aspect of our work, and any such activities are promptly addressed, with lessons learnt embedded across the organisation. Much remains to be done but by working together across the organisation, great progress can be made.

Safeguarding at LSTM

LSTM recognises its role in safeguarding and protecting our staff, students, volunteers and other representatives as well as research participants, patients and communities with whom we have direct and indirect contact through our work.

A Strategic Safeguarding Oversight Committee (SSOC) is in place to monitor the organisation's progress against our safeguarding action plan which identifies four work streams:

Reporting; People & Training; Policy & Practice and Risk Identification.

Reporting

- *LSTM encourages reporting of concerns through our "Freedom to Speak Up" (FTSU) system which is available to all staff and students. The system aims to instil a culture of "speaking up" about any concerns in order to improve the safety and security of our research participants, patients and other people who come into contact with us, as well as that of our staff, students and other representatives.*
- *We also have a paper-based reporting form on our external website which any member of the public or our collaborative partners can access to raise concerns. Any concerns raised during the year have been managed in accordance with the relevant LSTM policies and procedures.*

People & Training

- *A safeguarding training needs matrix has been developed outlining the type and level of training available for different levels of staff and safeguarding focal points. Induction training and mandatory 3 yearly safeguarding training is in place for all staff and students.*
- *Role descriptions have been developed and approved for the Safeguarding Lead, Safeguarding Focal Points and the Lead Trustee for Safeguarding.*
- *During 2020/21 nine face to face workshops on Safeguarding in Research and five online Introduction to Safeguarding workshops have been delivered for research teams and an online Safeguarding Information Point has been developed on the LSTM website.*

Policy and Practice

- *The Strategic Safeguarding Policy and The Protecting Children and Vulnerable Adults' Procedure have been reviewed and updated.*
- *The safeguarding lead has continued to work closely with a number of LSTM departments, to support the development of their safeguarding systems and processes and improve practice.*

Risk Identification

- *LSTM has identified key organisational safeguarding risks, and these are regularly reviewed. The SSOC continually re-assess these risks to identify further controls and monitor progress against our action plan.*
- *LSTM has developed a safeguarding risk mapping tool to allow teams to consider safeguarding risks related to the delivery of research activities and identify actions to mitigate and identify appropriate referral mechanisms. There is still ongoing work required in this area to ensure that safeguarding risk assessments are reviewed regularly.*

Priorities for the Year Ahead

- *To promote continued use of the FTSU system and advertise the safeguarding focal points.*
- *Ongoing training, development and capacity building of safeguarding processes across LSTM and in conjunction with our collaborative partners.*
- *Continue to promote roll out and adoption of safeguarding risk assessment.*

Staff Overview

Total number of staff **620**

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

Stats include all LSTM staff on UK and respective national contracts

Information and Knowledge Exchange

The Information Services Team faced many challenges this year. Whilst the Library was closed, our work to support LSTM continued. Information services has supported LSTM's commitment to REF, Open Access and DORA (the San Francisco Declaration on Research Assessment).

Publishing

Throughout the year we provided support through access to transformative publishing arrangements and publisher deals to allow increased access to publication funding, alongside providing greater access to our research in line with LSTM's mission, values and DORA commitments. We worked with a cross organisational team to ensure compliance through our Institutional Repository to not only support our REF submission but to guarantee funder requirements were met.

Library

Our ongoing support to teaching and learning allowed us the opportunity to expedite our planned expansion of services the library has to offer to support the immediate shift to online and remote working. This was welcomed by staff and students alike, from the click and collect offer for physical resources when the staff were back on site, to more complex inter library loans and document supply that proved extremely challenging whilst so many libraries were closed, to the vastly increased access to electronic resources including large upgrades to eBooks, providing access whilst teaching and learning was operating remotely but will ensure our expanded offering will continue. Whilst we are proud to say that during the last year our service never stopped, we are delighted that we have been able to open our doors physically once again and are welcoming library users to study and browse our shelves once more.

Knowledge Exchange (KE)

KE is defined as "Research information and expertise that is exchanged with businesses, society and/or the economy to enhance the contribution higher education (HE) makes to the economy and society". At LSTM, KE activities include, but are not limited to, engaging stakeholders beyond the academic community in order to increase impact of research, commercialisation, technology transfer, public engagement and engagement with policy and professional practice.

KE activity is now being assessed via the Knowledge Exchange Framework (KEF). This is a national exercise currently in the infancy stages. Universities are scored and ranked on the following criteria:

- *Research Partnerships*
- *Working with business*
- *Working with the public and third sector*
- *Skills, enterprise and entrepreneurship*
- *Local growth and regeneration*
- *IP and Commercialisation*
- *Public and community engagement*

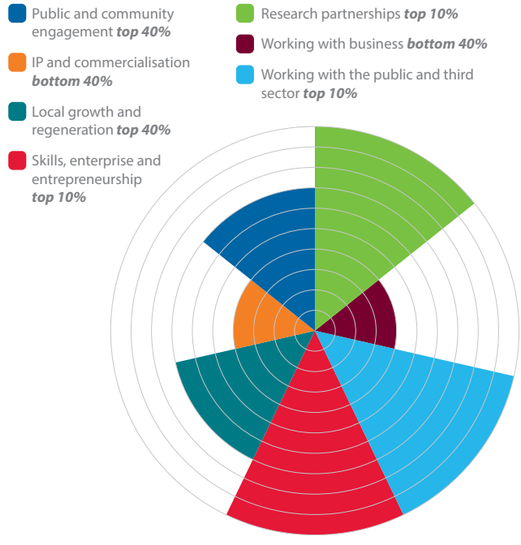
LSTM is in a cluster with other research-intensive organisations and our performance is scored relative to others in the cluster.

To support our KE activity aligned with the KEF metrics LSTM are signatories to the Knowledge Exchange Concordat (KEC) and have committed to developing our knowledge exchange activity to help drive economic, social, and cultural recovery and growth.

The KE concordat will facilitate the development, enhancement and transparency of the wide range of knowledge exchange activities performed by LSTM and support partnerships integral to our success.

KE at LSTM is a fundamental part of our mission and a KE Steering Group has been established to share, develop and coordinate opportunities, based on the KEF metrics and eight principles of the KEC (Mission, Policies and processes, Engagement, Working transparently and ethically, Capacity building, Recognition and rewards, Continuous improvement, Evaluating success).

Through the Wellcome Trust Institutional Translational Partnership Award we have made good progress in staff and student capacity building. Following a gap analysis conducted with staff to identify barriers in translational research 30 workshops have been made available to 963 registered staff/ students/overseas partners. Evaluation surveys conducted post workshops have shown a 100% increase in knowledge/ confidence in the workshop topic.



Governance and Assurance

As a specialist institution focusing on research and teaching, LSTM occupies a unique space in the global Higher Education landscape. As predominantly a post-graduate institution, the teaching/research interconnection at LSTM is extremely important as is the student proximity to cutting edge research. This is a fundamental part of the learning experience here and creates the unique identity of LSTM.

The determination and resilience that our students have demonstrated throughout the pandemic is congratulated by the Board of Trustees. Their ability to adjust to restrictions and adapt to new models of teaching and learning have been exemplary.

The Board of Trustees also acknowledged the work of the Management Team and all staff for their commitment and rapid response during these unprecedented times. Creating a stable and sustainable working environment, whilst managing financial risks has been well managed and well executed. These are the challenges faced as a specialist research intensive provider, and it is crucial to be agile and responsive when considering the implications to the organisation when operating under continued restrictive measures.

Board of Trustees

For the majority of 20-21, the Board of Trustees continued to meet virtually and received detailed updates throughout the pandemic response from the Director of LSTM and Chairs of Finance and Investment, Audit Committees and the LSTM executive. This provided the Board with significant assurance during a continued turbulent period. It was clear that LSTM's response and action were always transparent and well communicated across the institution.

The challenges faced by our communities both in Liverpool and overseas, as situations deteriorated late in 2020, were worrying for all concerned. The visit from the Minister of Science to Liverpool to launch the £18M Strength in Places grant reinforced the message about the importance of infectious disease research and why Liverpool and LSTM specifically are the front-runners in this arena. The Trustees congratulated Professor Janet Hemingway on the success of this significant grant from UKRI to work on the infection innovation consortium (iiCON).

In its September 2020 virtual away day, The Board formerly welcomed Lynne Elliott in her capacity as Student Representative. For almost 20 years, Lynne has worked in global health, having extensive experience as a senior consultant and Director leading and reviewing large-scale health and development programmes in over 25 countries across Africa, Asia and Latin America. The Board always asks the Student Representative to engage the student body in communication so that the diversity of views of the entire student body, can be articulated back to the Board of Trustees.

At the November 2020 Board of Trustees meeting, LSTM's acting Chair, Sue Russell reported back on the work of the Selection Committee for the recruitment of a new Chair to the Board of Trustees. After a rigorous selection and interview process, the committee endorsed the appointment of Jim McKenna, formally as a Trustee and as Chair elect. Jim, who is the former COO of Logica, an international IT service firm, is an experienced Chair and Non-Executive Director and has worked extensively in the commercial, charity and higher education sectors. The Board of Trustees and staff were delighted to have him appointed as LSTM moves towards its 125th anniversary.

At her final Board meeting as Acting Chair, the Board of Trustees unanimously thanked and congratulated Sue Russell for her role in supporting the Chair position since March 2020. LSTM is extremely grateful to Sue and all Trustees who provide their time and commitment to LSTM's work.

LSTM held its 121st AGM on the 26th November 2020, which was the first in our history to be held virtually. A COVID-19 related amendment to the Corporate Insolvency and Governance Act 2020 allowed Charitable companies and Charitable Incorporated Organisations to hold their AGMs online up until 30 December 2020. Jim McKenna was formally appointed as a Trustee at the AGM and Sue Russell announced Jim McKenna as the new Chair elect to its Board of Trustees. Reporting on LSTM's financial situation, Treasurer John O'Brien talked about the impact of the pandemic and the UK lockdown on LSTM's finances and the challenges it posed, but that the institution had responded well. He concluded that overall, the financial condition of LSTM, with the support of our research funders, remains healthy despite the pandemic. During the AGM the Annual Report and Financial Statements were formally adopted.

Jim McKenna formally took over as Chair on the 1st February 2021 and one of the first tasks to oversee was an independent review of governance arrangements. How LSTM adapts to the emerging challenges presented by the pandemic, addressing greater awareness of significant structural inequalities, and a need to address our organisational sustainability all require robust leadership from the Board of Trustees and so it was crucial to identify ways in which LSTM's Board and the executive team can collectively address these challenges.

Board Governance Effectiveness Review

The Board of Trustees commissioned an external support to review and enhance its governance effectiveness. Using the Governance Maturity Framework, Advance HE engaged with Board members over a series of meetings and presented its report back to Trustees. Advance HE's main findings were delivered over the summer '21 and are structured across four main priorities:

- *Academic Governance Oversight – This area will undergo a further review to enhance good governance oversight arrangements, building upon the good work already implemented by the Education team.*
- *Strategy Oversight – As LSTM moves into the 2023-2028 strategic development and implementation period, the Board of Trustees have already started to engage further and deeper across LSTM through more regular, formative strategic discussions and strategy oversight on a more holistic basis.*
- *Performance – LSTM's executive are also prioritising their model of LSTM performance monitoring and how this is reported back in summary to the Trustees.*
- *Board composition – Ensuring diversity and succession planning of members is critical to the future stability and succeeds of LSTM's Board of Trustees.*

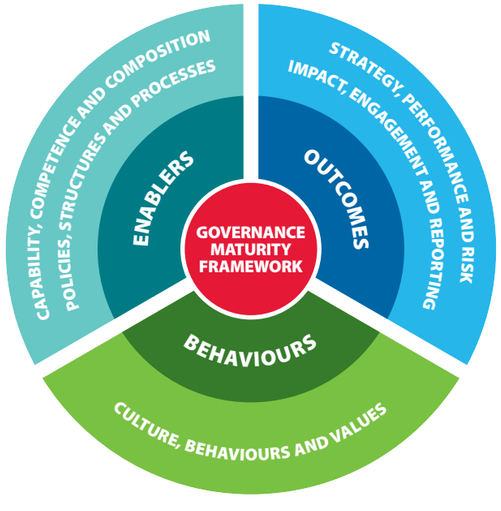
The report summarised that governance arrangements at the Liverpool School of Tropical Medicine are effective. Being enabled by good practices, policies and processes and realised through a Board and wider governance structure that is generally fit for purpose and clearly committed to the institution's long-term success.

The Board welcomed Advance HE's assessment and will discuss the action plan related to the activity as part of their ongoing commitment to developing governance effectiveness over the next 12 months.

GOVERNANCE MATURITY FRAMEWORK REVIEW

The assessment framework is designed to reflect the fact that every provider's Board of Trustees effectiveness review will be different to that of their peers. The brief of this review was aimed to:

+ Be forward looking, developmental and support LSTM in the realisation of its strategic ambitions, and be contextualised within its own vision, mission, and values.
+ Be informed by best practice in the HE sector, with demonstration of knowledge and evidence of relevant examples across HE and other sectors in the UK and internationally.
+ Examine LSTM's governance culture and ethos and the role of the Board in helping to determine the LSTM's strategy.
+ Evaluate LSTM's commitment to and understanding of embedding equality and diversity
+ Consider the scope, remit, and scheme of delegations of the four Committees of the Board (Audit; Finance & Investment; Nominations & Governance; and Remuneration).
+ Explore and evaluate the relationships between the Board and its committees and the Board of Trustees and the Management Team.
+ Be fully contextualised: examining the relevant reference points and benchmarks, including the *Regulatory Framework for Higher Education in England and other publications issued by the Office for Students (OfS), the Committee of University Chairs' HE Governance Code and the HE Remuneration Code.*
+ Stimulate an informed deliberation of existing practice, structures, processes, behaviours, and opportunities for improvement.



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.

Safety and Laboratory Management

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

LSTM laboratories were maintained to support COVID research projects and those staff and students working on site:

- *Statutory notifications to HSE were undertaken to allow work on COVID-19 specific projects.*
- *The containment laboratories were routinely monitored & maintained at CL3 standard.*
- *Full training for new staff and students wanting to work within the containment laboratories was provided or reviewed and approved.*
- *The Laboratory Management Team ensure that statutory testing is completed on time to support the safe working with pathogens within the school.*

On campus the team were involved in reviewing and updating the COVID risk assessment and measures to ensure the safe working of staff and students around LSTM campus.

The structure of the Health, Safety Oversight Committee is the Health & Safety (H&S) risk register and the management of H&S within LSTM, ensuring an effective risk-based approach to all LSTM activities.

The Travel Team, working closely with the Travel & Overseas Working Group and Procurement are implementing a new Travel Management Process with an integrated risk assessment solution for staff, students, consultant and volunteers travelling overseas on business. This will provide a more streamlined travel booking and monitoring process whilst ensuring LSTM meets in duty of care to all travellers.

Facilities Management

The long-standing cleaning service contract ended in May 2021 and tenders via the

CPC Framework for Cleaning Services were dispatched. The aim of the exercise was to obtain optimal value for money for cleaning services for all current LSTM buildings and put in place a framework of costs for future buildings as they come online.

The contract was awarded to Churchill Contract Services and the Living Wage was included as part of the contractual arrangements. There are numerous social value benefits to moving to the Living Wage and the evaluation team felt this was in line with LSTM's values as an organisation.

Environmental Management

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

To support the implementation of the policy all refurbishment projects incorporate environmental and/or energy improvements whenever practicable. This will include the aspiration to achieve a BREEAM Very Good rating on significant projects.

LSTM now recycles at source:

- *Oct 17-18 about 13% of waste.*
- *Oct 18-19 about 22% of waste.*
- *Oct 19-20 about 28% of waste.*
- *Oct 20-21 about 33.2% of waste.*

Energy is LSTM's second highest area of spend. During the reporting period, the switch to purchasing sustainable energy that represents best value for money via a flexible purchasing model has realized significant savings of around £139k to £189k for gas and electricity.

Pembroke House at the LSTM campus in Liverpool. Render by MCAU architects

Capital Works

Capital works are now picking back up following the mass roll out of the COVID-19 vaccination programme. The redevelopment of Pembroke House will extend and refurbish this existing teaching facility. The works involve the strip-out of internal fabric, forming of new windows and lift openings, and category B fit-out to provide state of the art teaching facilities. The existing 1-storey block will be extended to 2-storeys with feature wraparound glazing elements.

The project secured with funding from the Liverpool City Region Combined Authority (LCR), the Infection Innovation Consortium (iiCON) a collaborative industry: NHS: academic partnership and LSTM Education are the key users.

The project has planning approval and construction works started in October 2021.

The Clinical Research Excellence and Training Open Resource (CREATOR) building project in Blantyre, Malawi, is currently at RIBA Stage 5 (construction) and site preparation has already commenced on site.

Site clearance for the CREATOR building, Blantyre, Malawi. Photo by Daniel Chafulumira

In addition to the CREATOR project a new building to house research critical freezer archives was completed in 2020.

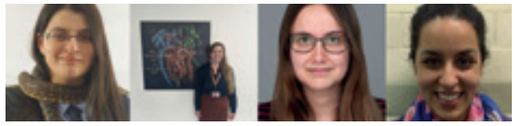
Awards and Honours

In June, **Dr Fiona Marston** was awarded the honour of OBE in the Queen's Birthday Honours List 2021.

Professor Kevin Mortimer

Professor Kevin Mortimer and his team received the Medical Research Foundation's Changing Policy and Practice Award for their work to evaluate an enhanced asthma care package for children in Malawi.

The 2021 LSTM's Director's Catalyst Fund awards were allocated to early career researchers pursuing independent and innovative research projects. The 4 recipients (pictured from left to right) were:



LSTM Director's Catalyst Fund Award winners 2021

- **Taline Kazandjian** *for evaluating novel snake venom gland organoid technology as a platform to accelerate antivenom research and development.*
- **Laura Jeffreys** *for elucidating the mechanisms of action of new chemical entities and repurposed drugs against SARS-CoV-2*
- **Ana Cubas Atienzar** *for accelerating diagnosis of Crimean Congo Haemorrhagic Fever through simultaneous detection of viral antigens and IgM.*
- **Jamilah Meghji** *for redeveloping models of care for symptomatic former TB patients in urban Blantyre, Malawi*

July saw four students **Josephine Shepherd**, **Jemima Hair**, **Jack Singleton** and **Abraham Gilbody**, who all attended taught modules at LSTM, win top prizes as they graduated from the University of Liverpool with BSc. degrees in Tropical Disease Biology (TDB).

Every year LSTM welcomes intercalating medical students and veterinary students. As part of supporting these students, LSTM awards competitive Intercalating Medic Prizes to support the cost of their MSc research project. This year's winners were **Celina Mitala** (MSc International Public Health – Sexual & Reproductive Health), **Beth McCallum** and **Rachel McCormick** (both MSc International Public Health – Humanitarian Assistance).

Also in July, **Dr Lucas Cunningham** has been awarded a substantial grant from the Caudwell LymeCo Charity, which raises money specifically for diagnostics and treatments into Lyme disease

In September, **Dr Carla Solórzano-Gonzalez** received a £50K catalyst pump-priming award from the University of Birmingham for her work in bacterial vaccinology to explore new approaches and strategies to advance vaccines in partnership with Lower-and Middle Income Countries and industry.

PGR student **Stephen Woolley** was awarded the Membership of the Order of St John for his COVID-19 work for the Royal Navy.

President Janet Hemingway wearing the RSTMH presidential chain. Photo RSTMH

In October, LSTM **Professor Janet Hemingway FRS**, director of the iiCON Consortium, became President of the Royal Society of Hygiene and Tropical Medicine (RSTMH), during their Annual General Meeting in Liverpool.

At the same meeting LSTM's **Professor Charles Wondji** was named as recipient of the RSTMH Chalmers Medal. The award recognises his work in tropical medicine and global health mentoring and professional development of junior investigators and other forms of capacity building.

Professor Charles Wondji

Emeritus Professor Nick Beeching was elected to Fellowship of the International Society of Travel Medicine in May and was awarded the Guthrie Medal of the Royal Army Medical Corps as outstanding Honorary Civilian Consultant Adviser to the Army in October.

Dr Emily Adams and Dr Fiona Marston OBE

Dr Emily Adams and **Dr Fiona Marston OBE** were both listed as 'Movers and Shakers' in BioBusiness 2021, an annual report published in November, which features the profiles of 30 talented individuals who are tackling the current biggest health challenges, creating new opportunities for growth by combining a human understanding of technology and data with the drive to make healthcare improvements more accessible.

Also in November, Senior Lecturer in Global Health and Social science, **Dr Webster Mavhu**, has been awarded a five-year NIHR-Wellcome Trust Global Health Partnership International Intermediate Fellowship.

Dr Webster Mavhu

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

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Lynne Elliott MPhil MBA PGCE BSc (Hons) – *retired November 2021*

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

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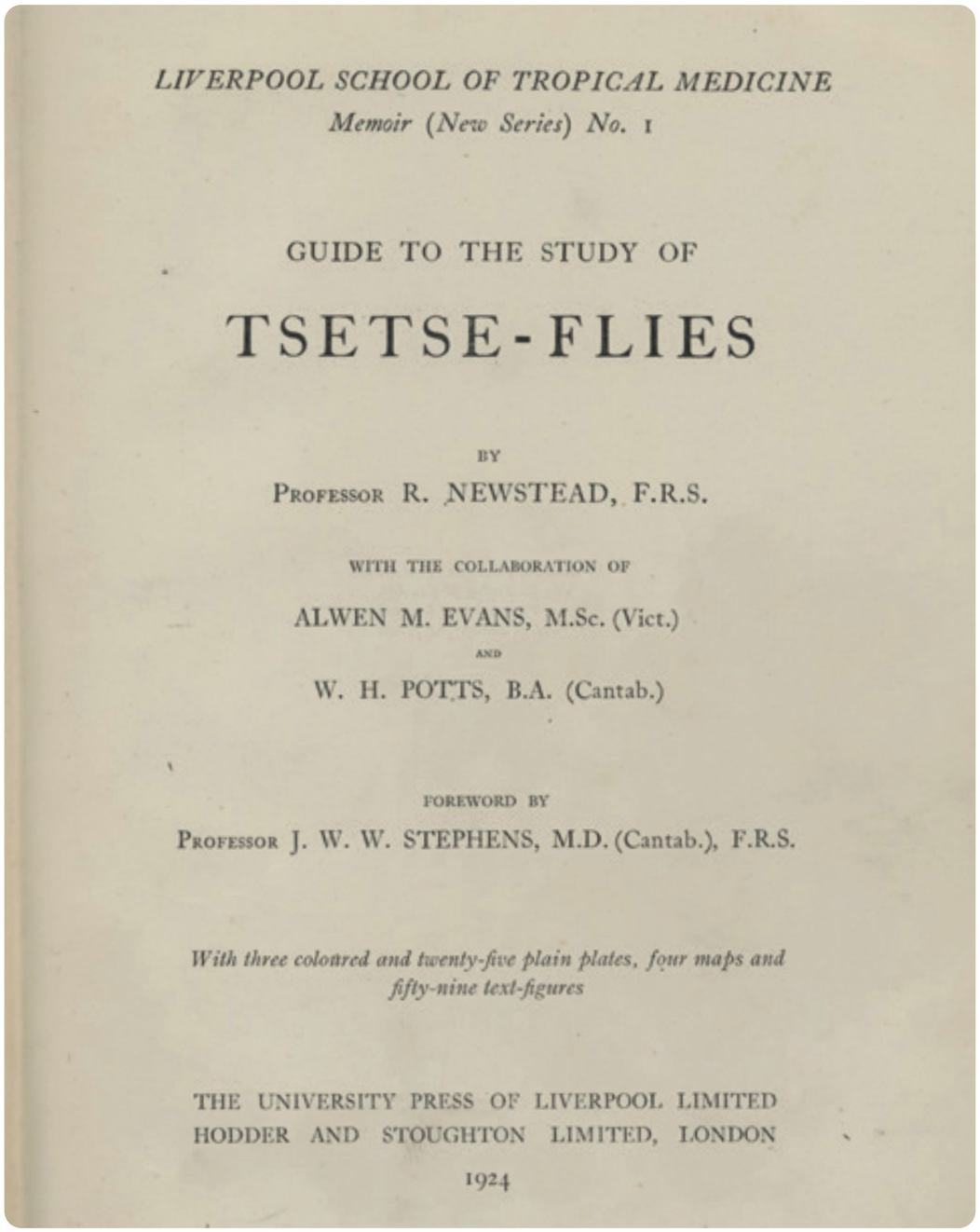
SECRETARY & CLERK

Robert Einion Holland FCCA MBA

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:
http://archive.lstmed.ac.uk



LIVERPOOL SCHOOL OF TROPICAL MEDICINE

Memoir (New Series) No. 1

GUIDE TO THE STUDY OF

TSETSE-FLIES

BY

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With three coloured and twenty-five plain plates, four maps and fifty-nine text-figures

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1924

LSTM Pioneers

Professor Herbert Michael Gilles
CMG UOM KCSJ MSc DSc MD FRCP FFPH DMedSc (1921 – 2015)

LSTM's longest serving vice-president and former Dean. First 'lecturer-at-large' for LSTM and seconded to the University of Ibadan, Nigeria, in 1960. Professor Gilles later established Ghana's first tropical medicine institute. Deeply respected for his expertise in Tropical Medicine throughout the world and one of LSTM's greatest ambassadors.

In Nigeria, Maltese-British Professor Gilles became the mentor of Professor Adetokunbo Lucas, who later became WHO Director for Tropical Disease Research.

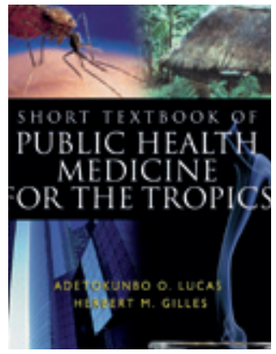
Returning to LSTM in 1965, he was offered a Senior Lecturer position by LSTM Director Professor Maegraith, before taking the Warrington Yorke Chair in Tropical Medicine.

Professor Gilles retired in 1986, having spent the previous five years as Dean of LSTM. He received LSTM's highest award, the Mary Kingsley Medal, in 1994 and the WHO awarded him the Darling foundation medal in 1990.

Prof. Gilles receiving the insignia of Companion of the Order of St Michael and St George from Queen Elizabeth II, 2005.

After his retirement, he continued to teach in Ireland, Italy and Malta and helping postgraduates who are seeking further training overseas. He was awarded the CMG for his outstanding work overseas and was appointed Companion of the Most Exalted Order of the White Elephant by the King of Thailand for his involvement with the faculty of Tropical Medicine at Mahidol University in Bangkok.

Professor Herbert Gilles published over 150 papers in scientific journals and several books, including *'A Short Textbook of Public Health Medicine for the Tropics'*, co-written with Professor Lucas and first published in 1973.



A Short Textbook of Public Health Medicine for the Tropics

Returning to LSTM in 1965, Professor Gilles was offered a Senior Lecturer position by LSTM Director Professor Maegraith, before taking the Warrington Yorke Chair in Tropical 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 centres of sepsis research excellence in Malawi, 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***

CEASE

The CEASE project aims to investigate the origins, epidemiological importance and control of the invasive malaria mosquito *Anopheles stephensi* in the Horn of Africa

Funded by: ***Wellcome Trust/NIHR***

COUNTDOWN

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

Funded by: ***UK Government Foreign, Commonwealth and Development Office (FCDO)***

Web address: ***https://countdown.lstmed.ac.uk/***

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

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: ***https://essentials.lstmed.ac.uk/***

The Infection Innovation Consortium (iiCON)

A global infectious disease R&D programme bringing together industry, academia and the NHS in a collaborative effort to save lives by accelerating the discovery, development and deployment of new antimicrobial treatments and products

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

Web address: ***www.infectioninnovation.com***

Innovation to Impact (i2i)

I2I works to address barriers to the introduction of new vector control tools. It works with stakeholders across the product development spectrum to address issues pertaining to efficient and effective testing, quality assurance and regulatory affairs to better streamline the product development value chain

Funded by: ***The Bill & Melinda Gates Foundation***

Web address: ***www.innovation2impact.org***

IMPACT

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

Funded by: ***European Union/EDCTP2***

Web address: ***https://www.lstmed.ac.uk/research/collaborations/impact-improving-the-impact-of-existing-malaria-products-%E2%80%93-acts***

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: ***https://www.lstmed.ac.uk/light***

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***

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 (FCDO)***

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: ***FCDO***

Website: ***https://www.rebuildconsortium.com/***

REDRESS

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

Funded by: ***NIHR***

Twitter: ***@redress_liberia***

RESPOND AFRICA

Established in 2017, the Partnership for the Control of Chronic Diseases in Africa (RESPOND-AFRICA) is a multi-disciplinary group from Tanzania, Uganda, Europe and the UK. Our vision is to improve the health outcomes of people with chronic life-long conditions in Africa through research, conducted in partnership with researchers from different disciplines, policy-makers, patient and community leaders and other stakeholders

Funded by: ***NIHR, EDCTP and Horizon 2020***

Twitter: ***www.lstmed.ac.uk/RespondAfrica***

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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