

Institution: London School of Hygiene and Tropical Medicine
Unit of Assessment: 2

1. Unit context and structure, research and impact strategy

The London School of Hygiene & Tropical Medicine (LSHTM) is a specialist postgraduate institution. Our mission is to improve health and health equity worldwide, working in partnership to achieve excellence in public and global health research, education and the translation of knowledge into policy and practice.

LSHTM performs strongly on the world stage. In the 2020 Shanghai World Rankings it was placed third globally and first in the UK for public health. In the 2020 CWTS Leiden Ranking the School was:

- fifth in the UK for research impact in all sciences, based on proportion of publications in the top 10% most frequently cited publications
- first in the UK in all sciences for proportion of female authorships, reflecting our commitment to equality and diversity
- ninth in the world, fifth in Europe and first in the UK in all sciences for inter-institutional collaborative publications
- sixth in the world and first in Europe for long-distance collaborative publications

In May 2020, as the COVID-19 crisis deepened, Edurank named @LSHTM the most influential university Twitter feed in the UK and Ireland.

1.1. How research is structured across the unit

Our UOA2 submission (381.74 FTE, 454 staff) includes 100% of Category A eligible staff in the four departments in the Faculty of Epidemiology and Population Health (EPH) and the three departments in the Faculty of Public Health and Policy (PHP), together with most staff in the Department of Disease Control and the Department of Clinical Research in the Faculty of Infectious and Tropical Diseases (ITD). This represents significant expansion, a 48.4% increase in FTE, when compared with our REF 2014 submission.

Home to one of the largest groups of epidemiologists in Europe, EPH aims to inform and advance understanding of social and biomedical causes of disease and to provide methodologically rigorous and innovative approaches to generating evidence for decision-making in public health. PHP focuses on improving health in the UK and worldwide through research on policy, interventions, systems and services and individual, social and environmental influences on health. The two ITD departments included in this submission specialise in developing, designing, implementing and evaluating interventions for preventing, controlling and treating infectious diseases.

The Medical Research Council (MRC) Unit The Gambia (MRCG) and the MRC/UVRI Uganda Unit (MRCU) joined LSHTM in February 2018, with status equivalent to Faculties. Before then, there was already significant joint research activity between LSHTM and the two MRC Units – a key rationale for the Units joining LSHTM – and our research activities now extend across the three campuses.

MRCG aims to deliver innovative, world-leading research to reduce the burden of illness and death in low-and-middle-income countries (LMICs). MRCU focuses on research to improve the control of infectious and non-communicable diseases in Uganda, Africa and globally. MRC Unit research cross-cuts our Faculties, so staff are allocated across our two UOAs.

Departments within Faculties, along with the Units, constitute academic staff's 'homes', where technical and administrative support is provided for research, doctoral training and career development. Faculties are supported by Central Service departments; the MRC Units draw on these but have their own local support structures as well.

Research activity across LSHTM takes place through flexible and dynamic teams, which often span Departments, Faculties and, increasingly, the MRC Units – evolving over time in response to research priorities and opportunities. LSHTM's 14 School Centres, cross-institution networks of academics, actively draw together School-wide expertise in specific priority areas to support interdisciplinary interactions; these are listed in full in REF5a.

1.2. Research objectives during the assessment period and over the next five years, including review of unit's research plans in REF 2014

Since 85% of staff submitted are in UOA2, our School-level strategies provide the relevant research objectives during the assessment period. Our REF 2014 plans were stated at the disease or programme level, and achievements against these are included in section 1.3. The assessment period encompasses two School strategy periods: 2012-2017 and 2017-2022.

1.2.1. Strategy – 2012-2017

Six cross-institutional areas critical to LSHTM's mission were prioritised for strengthening during the first strategy period:

- a. Emerging infectious diseases (including animal and human interactions)
- b. Evaluation of large public health programmes
- c. Globalisation, trade and health
- d. Maternal, reproductive and child health
- e. Non-communicable diseases
- f. Vaccine research

We demonstrate here how we have successfully strengthened these priority areas. We summarise key findings and impacts across all our UOA2 research in section 1.3.

a. Emerging infectious diseases

From 2014 onwards, there was huge, demand-led expansion of our work on emerging infectious diseases. This was supported by key recruitments, including Parker (social anthropology), Medley (modelling), Bausch (tropical health) and Checchi (humanitarian crises).

The West African Ebola outbreak in 2014 catalysed responses across LSHTM. Our enhanced ability to react rapidly was demonstrated in 2016, when our response to the Zika epidemic drew on our existing partnerships in Brazil and our expertise in epidemiology, entomology and disability. In December 2016 a £20m award to Public Health England (PHE) and LSHTM for the UK Public Health Rapid Response Team (UK-PHRST) created a standing capacity to mobilise research and outbreak management as epidemics occurred. Other developments in this area included the realisation of projects funded by the Foreign, Commonwealth & Development Office (FCDO) and UK Research Council Zoonoses and Emerging Livestock Systems initiative, which strengthened our collaboration with the Royal Veterinary College (RVC).

b. Evaluation of large public health programmes

Established in 2012, our Centre for Evaluation brought together researchers specialising in cluster-randomised trials, programme evaluation and quantitative, qualitative and mixed methods. Since 2014 the Centre has enhanced both internal collaboration/learning and external engagement. Methodological workshops have included approaches to randomisation in cluster-randomised trials; commonalities and differences in epidemiologists' and economists' approaches to impact

evaluation; and approaches to assessing transferability of findings across settings. Key recruitments have included Bonell (evaluation of social interventions) and Persson (public health evaluation).

In 2017 the Centre made a successful bid to become lead partner of the Centre of Excellence for Development Impact and Learning. Funded by the UK's FCDO, the Centre is developing innovative methods for evaluation and evidence synthesis in international development.

c. Globalisation, trade and health

With initial research on the health consequences of trade identifying agriculture as a key issue, the award in 2011 of a major Leverhulme Trust grant to 'embed emerging disciplines' provided a platform to move into novel challenge areas. Linking LSHTM, SOAS University of London and the RVC, the Leverhulme Centre for Integrative Research on Agriculture and Health (LCIRAH) has successfully expanded intersectoral research to address complex problems at the nexus of food systems, the environment and health.

Attracting close to £30m from funders including Wellcome, LCIRAH has advanced knowledge in areas including the links between environmental change, food systems and health; the pathways (from household to global scale) through which markets and trade affect health and nutrition, particularly among vulnerable groups; and the development of new methods and metrics for research in agriculture, nutrition and health.

d. Maternal, reproductive and child health

The Centre for Maternal, Adolescent, Reproductive and Child Health (MARCH) was relaunched with a new Director (Lawn), who joined LSHTM in 2013. The recruitment of Graham strengthened expertise in obstetric epidemiology. Three research themes were prioritised: adolescents and young people achieving healthy transitions; births that are wanted and pregnancies that are safe; and children with a healthy start, optimal growth and development.

Growth in grants and researcher numbers has resulted in MARCH becoming the world's largest group of researchers addressing the life course of women and children. The Centre has more than 200 researchers spanning disciplines including epidemiology, clinical care (paediatrics, neonatology and obstetrics), economics, health systems and the social sciences. A key growth area has been adolescent health, reflecting its inclusion in the targets enshrined in the United Nations Sustainable Development Goals (SDGs) and in national priorities, with awards from MRC, FCDO, the Bill & Melinda Gates Foundation (BMGF) and the National Institute for Health Research (NIHR).

e. Non-communicable diseases

Our multidisciplinary research on non-communicable diseases (NCDs) has been expanded and strengthened during the assessment period. Grant successes have included a three-year project, funded by £1.8m from Wellcome, to develop and evaluate a mobile health application to assist in chronic disease management in South Asia; and Txt2Heart, an MRC-funded initiative to develop text messaging to tackle local causes of poor adherence to cardiovascular medications. Joint appointments to strengthen global partnerships have included Prabhakaran (epidemiology).

The Centre for Non-Communicable Diseases was relaunched in 2017 as the Centre for Global Chronic Conditions. Moving beyond its initial focus on LMICs, it tackles chronic conditions in an integrated way by examining common determinants and responses across a range of contexts. Research encompasses transitional settings and vulnerable populations, such as humanitarian crises and migrant communities, and takes into account interaction between chronic conditions, in particular mental health, and infectious diseases such as TB and HIV/AIDS.

f. Vaccine research

The Vaccine Centre was founded in 2013 as a key vehicle for implementing LSHTM's strategic ambitions. It brought together expertise in developing new vaccines and evaluating their biological potential; testing new vaccines for safety, immunogenicity and efficacy; and assessing and optimising vaccine programmes and policies.

The Centre's engagement in UK policy expanded significantly in 2014 with the award of the NIHR Health Protection Research Unit in Immunisation (£4.2m, 2014-2020; renewed in 2020). Further key awards to UOA2 Principal Investigators (PI) have included EBODAC (€20.3m, 2014-2020) funded by the Innovative Medicines Initiative 2, for Ebola vaccine deployment acceptance and compliance in Africa; and the Pneumococcal Conjugate Vaccine Impact Study in Kenya (£3.9m, 2016-2018; subsequently extended), funded by Gavi.

1.2.2. Strategy – 2017-2022

The first strategy period, described above, enhanced our strengths in infectious diseases, vaccine research and NCDs; built a strong research community around maternal, neonatal, child and adolescent health; and highlighted the cross-cutting importance of our multidisciplinary expertise in health systems, services and policy research. Flourishing School Centres provided platforms for further expansion of priority research areas. Analysis of the external environment identified new issues and trends we needed to prioritise, notably antimicrobial resistance (AMR), mental health, data science and the health implications of climate change. As a result, our 2017-2022 priorities have included both ongoing and new themes:

- a. Infectious diseases (especially vaccines, AMR and emerging infectious diseases/epidemics)
- b. Chronic conditions (especially use of large-scale data and closing the mental health treatment gap)
- c. Life course and vulnerable populations
- d. Health services and systems (including health economics)
- e. Environment, climate change and health

Progress in delivering on these priorities is addressed below.

a. Infectious diseases

The integration of the MRC Units in 2018 added to our infectious diseases research on malaria, vaccines and HIV. It brought in leading scientists, including d'Alessandro (infectious diseases) and others submitted in UOA1. UOA2 vaccine research funding grew from £33m in 2014-2015 to £49m in 2019-2020.

In 2018, along with the University of Oxford and Imperial College London, LSHTM was a founding partner in the UK's first dedicated Vaccines Manufacturing Innovation Centre, enabled by a £66m UK Research and Innovation (UKRI) investment. This partnership has boosted our vaccine translational research pipeline from bench and epidemiological research to patient impact in the UK and worldwide.

To respond to COVID-19, UOA2 researchers rapidly built and deployed capacity in key areas:

- The Centre for the Mathematical Modelling of Infectious Diseases led LSHTM's modelling input in the UK and around the globe.
- The Electronic Health Record Group, with the University of Oxford, set up the OpenSAFELY platform to link hospital, primary care and mortality data initially for 24 million people in England. Outputs, including on vulnerable groups, have directly informed policy in the UK and globally.

- Larson, funded by Johnson & Johnson, led a global study exploring public sentiment around measures to contain and treat COVID-19, including potential vaccines.
- The Water, Sanitation and Hygiene Group was appointed technical lead of a £100m UK Government/Unilever programme to improve practices around handwashing for up to a billion people worldwide.

A multidisciplinary Antimicrobial Resistance (AMR) Centre was launched in 2016 to capitalise both on UK domestic policy interest in AMR and on the global AMR agenda driven by the then Chief Medical Officer for England. The Centre has developed strong relationships with many global agencies, and is known as the voice on AMR science. Key research awards have included the Economic and Social Research Council (ESRC) Global Interdisciplinary Research Hub on Anti-Microbials in Society (£1.8m, 2017-2021) and an MRC grant on operationalising antibiotic stewardship in India's pluralistic rural health system (£0.8m, 2019-2022).

b. Chronic conditions

Research on chronic conditions has expanded in areas including disease aetiology, safety and effectiveness of medications, environmental influences and health services.

Expertise in applying data science to chronic conditions contributed to a successful bid by University College London (UCL), Imperial College, King's College London (KCL), Queen Mary University of London (QMUL) and LSHTM for the London platform of Health Data Research UK (HDR UK). This led to three HDR UK early- and mid-career fellowship awards from the UKRI Rutherford Fund, as well as the development of a new MSc programme to train a new generation of world-leading health data scientists. Other key research awards have included multiple fellowships from Wellcome and other funders for exploring electronic health records and large datasets to improve understanding of chronic disease determinants and treatments.

Research on global mental health has expanded via new recruitments of staff based overseas (Chibanda, Zimbabwe; Nadkarni, India) and internal appointments (Kinyanda, MRCU). Major new awards have included an FCDO Research Programme Consortium on supporting people with psychosocial disabilities in sub-Saharan Africa (£6.9m, 2020-2026; awarded to Shakespeare, who joined in 2019 as Professor of Disability Research); an MRC/DFID African Research Leader award on mental health among HIV-positive children and adolescents in Uganda (£0.7m, 2014-2017); and a Wellcome Collaborative award on alcohol use in humanitarian settings in Uganda and Ukraine (£3.7m, 2020-2025).

c. Life course and vulnerable populations

New recruits building capacity in this area included Heffernan (international development) and Bundy (child development). Major new awards have included an LSHTM-led UKRI Global Challenges Research Fund (GCRF) Action Against Stunting Hub (£18.3m, 2019-2021); the multi-institutional £50m NEST360 partnership, which aims to halve neonatal mortality in sub-Saharan Africa through increased use of effective and affordable devices; and the MRC-funded MENISCUS trial of a menstrual health intervention in Ugandan secondary schools (£3.2m, 2020-2023).

LSHTM's research expertise in gender violence and health has contributed to two UKRI GCRF Hub awards. The first, led by the University of Oxford, supports work on Africa's adolescents (£18.5m, 2019-2024). The second, led by Coventry University, supports work on South-South migration, inequality and development (£18.8m, 2019-2024). In addition, in partnership with the University of Bristol, LSHTM was awarded an NIHR Global Health Research Group on health system responses to violence against women (£2.3m, 2018-2021).

d. Health services and systems

Health services and systems research has benefited from three new Professorial appointments: May (medical sociology), Nolte (health systems) and Briggs (health economics). In 2018 the

Centre for Health Economics in London was launched, bringing together world-leading expertise and comprising more than 50 LSHTM academics. Trial-based economic evaluation has been complemented by BMGF funding to develop research for priority-setting at the health sector level and support global agencies with evidence to inform resource allocation within TB and HIV programmes. In collaboration with our LMIC partners, we were the most successful university with the FCDO, MRC, ESRC and Wellcome Health Systems Research Initiative, receiving 25 (27%) of the 92 awards.

In 2019 our NIHR Policy Research Units in Innovation and Evaluation Research, Health and Social Care Systems and Commissioning, and Public Health were re-funded, and a fourth added, Quality, Safety and Outcomes, in collaboration with the Universities of Oxford and Kent. Other key grant successes have included the GCRF-funded RECAP, a £7.8m multi-partner project to strengthen research capacity and knowledge to respond to humanitarian crises; GOAL, which supports government and partners in strengthening health systems to improve the mental wellbeing of Syrian refugees and host communities in Lebanon (£1.7m, 2020-2023); and a portfolio of research as part of the £6m DFID-funded Anti-Corruption Evidence consortium.

e. Environment, climate change and health

Capacity in the field of climate change and health was developed throughout the previous strategy period. With the imperative created by the continuing climate emergency, this led to the launch in 2019 of the Centre on Climate Change and Planetary Health, and the recruitment of Murray to MRCCG.

The Centre is committed to taking a 'planetary health' perspective in its work, identifying interventions that benefit both health and the environment and support the SDGs. Key grants have included Wellcome programmes on complex urban systems for sustainability and health (with UCL; £5.2m, 2018-2023) and on sustainable and healthy food systems (£4m, 2017-2022), and renewal of the NIHR Health Protection Research Unit on Environmental Change and Health (£4m, 2020-2025).

1.3. Research findings and impacts in the REF period

We list below our major findings and related impacts, including delivery on intentions outlined in REF 2014. This list is broadly structured according to the four themes we used in our REF 2014 statement and includes priorities for the next five years in each area. Staff leading our research teams are noted.

All our research overseas is in collaboration with local partners, but space does not permit full details here. Our shared research resources are described in section 3.7 and our collaborations in section 4.1, with complete partnership details provided in our impact case studies.

1.3.1. High-burden health problems

Malaria (M Cairns, Chandramohan, Clarke, d'Alessandro, Greenwood, Fornace, Kleinschmidt, Lines, Logan, Milligan, Protopopoff, Pitt, Rowland, Staedke, Tusting, Yeung)

- We demonstrated the effectiveness of the RTS,S/AS01 malaria vaccination in preventing cases of clinical malaria in young infants and children when administered with or without a booster dose.
- We showed seasonal malaria control, an approach developed by LSHTM researchers and partners, reduced outpatient malaria cases by 25%-59% in seven Sahel countries during 2015 and 2016, and that this approach was cost-effective.
- We found combined prevention education, insecticide-treated nets and antimalarial treatment in regions with seasonal malaria could reduce the risk of schoolchildren developing anaemia and improve cognitive performance.

- We demonstrated that a 'resistance-breaking' bed net treated with piperonyl butoxide, which neutralises mosquitoes' ability to resist pyrethroid insecticide, provided children with greater protection than standard long-lasting pyrethroid nets. The World Health Organisation (WHO) recommended this as a new class of nets in 2017.
- Future research will address the effectiveness and efficiency of investments in vector control, including trials of novel malaria vector-control tools, and will continue on seasonal malaria control.

HIV and sexually transmitted infections (Bond, Crampin, Fielding, Floyd, Francis, Grosskurth, Hargreaves, Hayes, Hickson, Kapiga, Neuman, Seeley, Terris-Prestholt, Todd, Weatherburn, Weiss, Wellings)

- We showed through our PopART trial that a universal testing and treatment (UTT) strategy was able to achieve the UNAIDS 90-90-90 targets and reduce HIV incidence by around 20%. We also showed UTT could be delivered at scale in urban South African communities.
- We estimated 500,000 men who have sex with men in European and Central Asian countries could not access pre-exposure prophylaxis, even though they would be likely to use it.
- We discovered a high prevalence of bacterial vaginosis increased susceptibility to STIs and HIV in a study of schoolgirls in Tanzania, and that this was strongly associated with having two or more sexual partners and prevalent human papillomavirus infection.
- Future research will aim to measure the impact of UTT on other diseases and evaluate an STI screening intervention in adolescents and young people in Zimbabwe using innovative STI diagnostic methods.

TB (Crampin, Fielding, Godfrey-Faussett, Hayes, Houben, Mangtani, Vassall, White)

- We showed in a large trial of South African gold miners that mass testing and treatment were inadequate to interrupt TB transmission and that six months' isoniazid preventive therapy may be inadequate to cure latent TB among those heavily exposed to infection.
- We found a national roll-out of Xpert MTB/RIF diagnostic testing in South Africa did not reduce mortality at six months among people testing for TB.
- We identified a strong association between mortality and lipoarabinomannan-positivity (LAM-positivity), a glycolipid virulence factor associated with TB, among HIV-infected patients. We also produced evidence on using urine TB-LAM testing to reduce TB mortality in adults with HIV.
- Future research priorities include evaluating new diagnostic and prognostic tests, using improved understanding of transmission to design control strategies and evaluating integration of TB screening and diagnosis into maternal and child health programmes.

Emerging infectious diseases (Bausch, Brickley, Edmunds, Eggo, Flasche, Funk, Jit, Kucharski, Kuper, Larson, Lees, Logan, Medley, Parker, Wilder-Smith)

- We made the first estimates of the COVID-19 case fatality rate in Wuhan and showed transmission declined with the introduction of travel restrictions and control measures.
- We modelled the effects of different scenarios to support evidence-based decisions on critical care capacity and large-scale interventions to reduce COVID-19 transmission in the UK and elsewhere.
- We provided evidence on crucial sociocultural and political dimensions of the 2014-2015 West African Ebola epidemic and supported locally appropriate interventions through our Ebola Response Anthropology platform.
- We co-led collaborative research on the 2015-2016 Zika virus outbreak in Brazil which confirmed the link between Zika and microcephaly; described the adverse outcomes in pregnancy; developed the definition of congenital Zika syndrome; assessed the impact of Zika on families and health services; developed and validated tools for diagnosis; and showed permethrin-treated long-sleeved clothing provided the best *Aedes* mosquito protection.

- Future research priorities include further mathematical modelling of emerging infectious diseases and the establishment of a Centre for Epidemic Preparedness and Response to bring together multidisciplinary epidemic expertise.

Neglected tropical diseases (including eye health) (Bailey, Bastawrous, Cameron, Marks, Peeling, Pullen, P Smith, Yacob)

- We showed biennial mass treatment with azithromycin reduced all-cause under-five mortality in a large-scale cluster randomised trial in Niger, Malawi and Tanzania.
- We carried out global trachoma-mapping programmes that informed mass distribution of azithromycin in 29 countries.
- We conducted the largest-ever study on mass drug administration to control scabies, contributing to the evidence that led WHO to formally adopt scabies as a neglected tropical disease in 2017.
- Future research will address diagnostics for yaws, the impact of severe stigmatising skin diseases in Africa and the determinants, prevention and treatment of ocular chlamydia trachomatis transmission.

AMR (Chandler, Goodman, Graham, Heffernan, Khan, Knight)

- We produced economic modelling of the potential impact of antimicrobial drug resistance, contributing to estimates presented in the UK Review on AMR chaired by Jim O'Neill and informing the Department for Health & Social Care (DHSC).
- We carried out ethnographic research that showed how antimicrobials are used in Uganda and Tanzania as a 'quick fix' for weak healthcare systems and poor sanitation and hygiene.
- We evaluated the UK's AMR Strategy 2013-2018, finding that electronic prescribing systems supported AMR targets and that local champions played an important role. This work was carried out by our Policy Innovation and Evaluation Research Unit in collaboration with the RVC.
- Future research will focus on integration of diagnostics and revised algorithms into case management of fevers, AMR as a global environmental health issue and the impact of mass drug administration.

Maternal, neonatal, child and adolescent health (Blencowe, Bonell, Campbell, Cousens, Devries, Filippi, Graham, Kerac, Kirkwood, Lawn, Marchant, C Marston, Mayhew, Penn-Kekana, Pitt, Ronsmans, Roca, J Schellenberg, Stoeckl, Tann, Weiss, Shakur-Still, Wellings)

- We estimated the global burden of Group B Streptococcus (GBS) on stillbirths and showed a maternal GBS vaccine could prevent 231,000 infant and maternal GBS cases annually.
- We improved measurement of life-saving programmes for maternal and newborn health through research in Ethiopia, Nigeria and India, including the development of population-level measures of quality of care and effective coverage.
- We found tranexamic acid reduced deaths from post-partum haemorrhage by a third if given within three hours. This finding, which emerged from our WOMAN trial, was rapidly reflected in WHO guidelines on tranexamic acid use.
- We showed that an intervention in UK secondary schools reduced bullying, smoking, alcohol use, drug use and police contact.
- Future research will be aligned with streams of work on vaccines, nutrition and infections. A key aim will be to support comprehensive strategy development and evaluation within primary, hospital, and school-based care.

Chronic conditions (Allemani, Bhaskaran, Chibanda, Coleman, Crampin, Kinra, Kinyanda, Langan, Leon, Murthy, Nadkarni, Nitsch, Nyirenda, Pearce, Perel, Rachel, B Roberts, I Roberts, Smeeth, Tomlinson, Shakespeare, Warren-Gash, Weiss)

- We identified increased risk of cardiovascular disease in cancer survivors through analysing more than 630,000 UK medical records, and recommended improved awareness, preventive measures and earlier interventions to reduce treatment impact.
- We found a major burden of mental health and substance use among conflict-affected populations, including PTSD symptoms in a fifth of Syrian refugees in Turkey, and depression in a quarter.
- We developed and evaluated the Friendship Bench intervention in Zimbabwe, where 'grandmother health providers' deliver cognitive behavioural therapy to those struggling with poor mental health. Dramatic improvements in the symptoms of patients with common mental health disorders were observed.
- Future research will include integrated approaches to prevention, treatment and management of multiple chronic conditions, and a focus on vulnerable groups such as migrants and those affected by humanitarian crises and large-scale social change.

1.3.2. Development of new tools and methods

Vaccines (A Clarke, Edmunds, Greenwood, Jit, Larson, Langan, Mangtani, Mounier-Jack, Mulholland, Parker, Roca, Sanderson, A Scott)

- We used epidemiological modelling to predict the impact of different vaccination strategies during the West Africa Ebola epidemic. A trial of the rVSV-ZEBOV vaccine using the 'ring vaccination' approach was highly protective in Guinea.
- We found giving the flu vaccine to children was a cost-effective way to reduce the burden of the disease in the general population. This finding informed changes to UK flu vaccination policy.
- We showed that herpes zoster vaccination in the UK was effective and gave very good protection against post-herpetic neuralgia. This finding informed the UK zoster vaccination programme.
- We produced evidence on global vaccine hesitancy and interventions, helping governments and agencies respond to this evolving health threat. Our Vaccine Confidence Index showed European populations had the least confidence in vaccines globally.
- Future research will include the use of novel vaccines in pregnant women and implementing the WHO Roadmap for Elimination of Meningitis by 2030. It will also aim to enhance the public-facing aspects of vaccine research and development to increase vaccine confidence.

Data science (Aggarwal, Bhaskaran, Cromwell, Diaz-Ordaz, Douglas, Langan, Minassian, Nitsch, Smeeth, Tomlinson, Warren-Gash, Williamson)

- We explored how to use machine learning estimation within causal analyses using high-dimensional data. This research helped clarify the conditions under which machine learning can be used, as well as shedding new light on how to handle missing data in research that depends on the use of electronic health records.
- We analysed electronic health records to address concerns that certain widely used drugs, including some for high blood pressure and erectile dysfunction, might increase cancer risk. We showed this was not the case.
- We developed a new pregnancy identification algorithm to establish a pregnancy register in the Clinical Practice Research Datalink. We found no evidence of an increased risk of major congenital malformations following flu vaccination during pregnancy.
- Future research plans include a portfolio of work extending causal machine learning techniques to longitudinal studies, with a focus on optimal treatment recommendations using electronic health records in diseases such as diabetes, heart disease, cancer, eczema and chronic kidney disease.

Modelling and statistics (E Allen, Atkins, Baguelin, Bottomley, Carpenter, Clayton, Collier, Diaz-Ordaz, Edmunds, Eggo, Elbourne, Flasche, Frost, Funk, Gasparrini, Grieve, Jewell, Jit, Keogh, Kucharski, Lewin, Lowe, Medley, S Pocock, Pearce, Sharples, Vansteelandt, Weiss, White, Williamson)

- We developed simple strategies to calculate confidence intervals for high-dimensional, generalised linear models and Cox models, accounting for bias and uncertainty due to variable selection.
- We established new approaches for longitudinal mediation analysis, allowing for time-varying confounding. We also extended methods for dynamic prediction of survival using longitudinal data.
- We developed innovative study designs and statistical techniques for environmental health research, including distributed lag non-linear models and extended meta-analytical models.
- We developed a novel methodology to provide statistically robust estimates of COVID-19 cases and infections. Using a Gaussian process, we showed substantial under-ascertainment of symptomatic cases in many countries – particularly at the peak of the first wave of the pandemic.
- Future research plans include the further development of machine learning methods – to address confounding and for causal prediction and mapping environmental exposure to related health risks, and further innovations in trial design and analysis.

1.3.3. Performance of health services and systems

Economics of health and health systems (Borghi, Briggs, J Cairns, Cornelsen, Goodman, Grieve, Hanson, Keogh-Brown, Legood, Mills, Miners, Pitt, Powell-Jackson, Terris-Prestholt, Vassall, Wiseman)

- We found a ‘snack tax’ was potentially more effective than the UK’s sugared drink tax in tackling obesity, based on economic modelling of UK households.
- We developed new approaches to reduce bias and enhance precision in cost-effectiveness analyses, including in the context of pre-exposure prophylaxis of HIV, blood collection services, surgical techniques and bullying in schools.
- We developed ways of measuring and using preference heterogeneity to design HIV prevention interventions in order to optimise uptake across populations.
- We found performance-related payment to health facilities in LMICs could improve drug availability, patient interactions and staff supervision and reduce out-of-pocket payments. However, we also found such a strategy to be costly and likely to reduce coverage of non-incentivised services.
- Future research will advance methods that use machine learning, expand our portfolio of rigorous cost-effectiveness analyses and develop a programme around assessment of and payment for high-cost oncology drugs.

Health services research (Aggarwal, P Allen, Black, Cohn, Cromwell, Egan, Erens, Free, Hogan, May, van der Meulen, Nolte, Peckham, Rachet, Sanderson, Walker)

- We analysed hospital admissions data in England for patients diagnosed with bowel cancer and found those in the most deprived areas had up to a 13% higher proportion of emergency hospital admissions before diagnosis than those in the least deprived areas. This finding helped target campaigns and policies towards the most vulnerable groups.
- We investigated the impact of NHS patient choice and hospital competition policies on prostate cancer care by using electronic health data. We found up to one in three prostate cancer patients bypassed their nearest surgical or radiotherapy centre, emphasising the need for guidance in choice policies to ensure equitable and affordable cancer care.
- We carried out the largest retrospective case record review of hospital deaths ever undertaken in England, providing definitive evidence of a lack of association between hospital-wide standardised mortality ratios and avoidable deaths.

- Future research plans include expanding work on the impact of policies on patient safety, quality of life and cancer survival rates.

Health policy and systems research (Balabanova, Gilson, Khan, Liverani, Martinez-Alvarez, Mays, Mayhew, McKee, Spicer)

- We showed that the reorganisation of public health in the UK under the 2012 Health and Social Care Act caused serious disruption to vital public health functions, but that local actors eventually developed 'workarounds' to maintain services.
- We demonstrated how systems thinking could be brought into public health evaluation, informing MRC and NIHR guidance on complex intervention development and evaluation.
- We generated new insights into health system resilience through studies of district health system governance in Kenya and South Africa, highlighting the importance of mid-level managerial leadership and space for reflective practice among frontline staff.
- We showed social franchising of maternal health services does not improve quality of care and fails to reach the poor in India and Uganda, and argued that governments and donors should be more sceptical of such initiatives and demand rigorous evidence of effectiveness.
- Future research plans include further evaluation of government reforms and policy development in the UK and LMICs, as well as expansion of research on quality of care and anti-corruption approaches in LMICs.

1.3.4. Social and environmental determinants of health and nutrition

Social determinants (Bacchus, Beattie, Bonell, Cislighi, Cornelsen, Cummins, Curtis, Egan, Hargreaves, Harris, Hickson, Knai, Lock, Petticrew, Platt, Rhodes, Stoeckl, Walls, Weatherburn, Wellings, Zimmerman)

- We conducted research on adolescent health to show how improving school environments can reduce bullying, smoking, alcohol use, drug use and police contact in the UK and India.
- We theorised the unintended and possibly harmful consequences of public health interventions via 'dark logic' models, explaining why an intervention with youth workers increased rather than reduced teenage pregnancy rates.
- We found local public health professionals can and do play an important and valued role in the alcohol licensing process, shaping alcohol availability and reducing alcohol-related harms.
- We analysed data from the UK National Surveys of Sexual Attitudes and Lifestyles (NATSAL), revealing increased acceptance of same-sex partnerships and expansion of heterosexual repertoires.
- Future research will evaluate the impact of modifying school social environments on sexual and mental health; explore the epidemiology and prevention of COVID-19 transmission in schools; and complete the fourth wave of NATSAL.

Environmental determinants and climate change (Belesova, Cairncross, Cummins, Dangour, Green, Gasparrini, Haines, Hajat, Kadiyala, Kovats, Lowe, Murray, Scheelbeek, Walls, Wilkinson)

- We identified the health risks associated with non-optimal temperature and projected future impacts under various climate-change scenarios for 749 locations in 43 countries, and estimated the effect of projected temperature increases on physiological capacity to work outdoors.
- We estimated the effect of climate and environmental changes on global crop yields, estimated the impact of lower crop yields on child survival in sub-Saharan African subsistence farming populations and quantified the health and environmental benefits of meeting dietary recommendations in the UK and India.
- We quantified the combined impact of hydrometeorological hazards and urbanization on dengue risk in Brazil, and developed an operational dengue early warning system for Vietnam that provided probabilistic dengue forecasts up to six months in advance. We confirmed links

between exposure to urban pollution and mortality risk in the largest international epidemiological assessment of its kind to date.

- Future research will quantify the health effects of projected rises in temperature and air pollution; identify interventions with the greatest benefits for human health across different sectors; understand how complex hazards impact the timing and intensity of infectious diseases; and explore how transformations in food systems will affect environmental and population health.

1.4. Enabling impact

1.4.1. Strategies for enabling impact and their relationship to case studies

Maximising synergies between research, education, knowledge translation and innovation is a major feature of the LSHTM environment. Our 2019 staff survey revealed 95% of staff felt proud to work for LSHTM and 97% felt our work improved health and health equity worldwide. Our impact case studies reflect our far-reaching and beneficial impact on health outcomes around the world.

Our approach to impact has been built on four main elements: generic activities to support staff in achieving impact; mechanisms to help build long-term relationships with research users; activities relating to specific research projects; and influencing future decision-makers through teaching and training. These are outlined below, with illustrations from our impact case studies (*italicised in brackets*). We summarise the organisational infrastructure that supports impact in section 3.

Generic activities to support staff in achieving impact

The teams within our Communications and Engagement Department have played a key role in generic activities to support impact. LSHTM's media activity has been vital in increasing public understanding of science and public health, shaping public debate and influencing health policy, practice and behaviours.

LSHTM has been a prominent voice on vaccine confidence, with Larson, Director of the Vaccine Confidence Project, quoted in the media on more than a thousand occasions in 2019 alone (*Shaping public health strategies by monitoring and building public trust in vaccines*). In 2020 our modellers made near-daily UK media appearances to explain the latest COVID-19 developments and the importance of complying with restrictions (*Informing the UK response to COVID-19*). LSHTM had more than 133,500 pieces of print, online and broadcast coverage during the year compared with 23,400 in 2019, reflecting the scope and volume of our response to the crisis.

Our events team supported many major dissemination events. For example, with *The Lancet*, we co-hosted regular Global Health Lab public debates. We were key contributors to *Lancet* Special Commissions, and produced 42 papers for 15 *Lancet* Special Series between 2014 and 2020. One *Lancet* Special Series in which we were closely involved fed directly into the UN's Every Newborn Action Plan, led by UNICEF and WHO, for preventing newborn deaths (*Generating data and solutions to save newborn lives*).

Our 14 Centres have played an important part in achieving impact, and our case studies benefited from sharing of expertise and external networks. For example, MARCH linked with our disability researchers to respond to the Zika epidemic (*The Zika virus emergency: informing the international response*). Centres also supported communication of research findings, enhanced links with research users and the general public and interacted with relevant stakeholders, including parliamentary select committees and all-party parliamentary groups.

We took the following steps towards strengthening our systems for encouraging and assisting staff to achieve impact:

- Research dissemination activities and seeking policy and practice impact were explicit expectations in our new promotion criteria, developed in 2015.

- Our Human Resources (HR) policies have supported recruitment and retention of staff based overseas, where they can interact closely with local research users. 79 staff submitted to UOA2 have been based overseas.
- Our talent and educational development programme has provided communication skills training to researchers.

Mechanisms to help build long-term relationships with research users

Translating findings into impact depends on long-term, trusted relationships between research producers and users. We have encouraged our academic staff to play an active role in global, regional, national and local organisations that shape health policy and practice, and we report on these in more detail in section 4. Long-term, trusted relationships with research users have played a key role in the pathway to impact in many of our case studies. Examples of relationships include:

- More than 15 of our academics have served on the UK Government Scientific Advisory Group for Emergencies and its subgroups (*Informing the UK response to COVID-19*). We have also regularly presented evidence on vaccines to the UK Joint Committee on Vaccinations and Immunisations (*Using mathematical modelling to inform policy decisions on vaccination*).
- Our close relationships with WHO, including WHO Advisory Committee membership, have supported WHO policy and guidance, leading to country implementation and health improvements. For example, WHO used our research and expertise in its recommendation on seasonal malaria chemoprevention (*Developing a new seasonal approach to malaria prevention in children*) and in the prequalification of different nets for controlling malaria (*Methods for malaria control: evaluation of vector control products to improve personal and community protection from malaria*).
- Engaging with industry has facilitated huge campaigns to encourage healthy behaviours. For example, our partnership with Unilever enabled our research on handwashing to benefit billions around the world.
- Our staff based overseas have worked directly with local research users. In Zimbabwe, for example, they facilitated national scale-up of the Friendship Bench (*Lay health worker interventions to treat mental health disorders*).

Activities relating to specific research projects

Our teams have actively engaged research users from an early stage through to dissemination of findings. We regard this as standard, accepted practice and encourage such an approach in our training on achieving impact.

For example, we first identified the benefits of HIV self-testing and then led implementation research to inform government scale-up strategies (*Making HIV self-testing available to millions as a diagnostic strategy for low and middle income countries*). Similarly, Zimmerman worked with the International Organisation for Migration to translate her research into a handbook, as well as providing the UK Government with evidence to improve provision for victims of human trafficking (*Prioritising and addressing the health effects of human trafficking survivors*).

The creation at the end of 2016 of UK-PHRST, in collaboration with PHE, further increased our capacity to have impact. In light of its Ebola response, LSHTM was chosen to jointly run this £20m initiative and expand the range of scientific expertise available for outbreak control (*Controlling Ebola in West Africa: innovative and pragmatic solutions to a major epidemic*). UK-PHRST has since been deployed to a number of countries to assist in tackling various outbreaks, including meningitis, Lassa fever, Ebola, pneumonic plague, diphtheria and COVID-19.

Influencing future decision-makers through education

Delivering research-led masters, doctoral and short-course programmes for future health leaders is core to our mission. There is a deliberately close match between our research expertise and the portfolio of educational programmes we offer.

We provide a wide range of MSc modules that make available the latest knowledge in particular fields. For example, our Infectious Disease Modelling module has featured our COVID-19 models in its real-time modelling lecture, its study module assessment and several practicals; the models have also been used in our Health Decision Science module.

In 2015, to reach an even wider audience, we introduced Massive Open Online Courses via the online platform FutureLearn. These are led by eminent researchers who translate their expertise into learning materials relevant for healthcare workers, public health practitioners and those interested in public health issues. The following examples link to our impact case studies:

- *Controlling Ebola in West Africa: innovative and pragmatic solutions to a major epidemic* explored how the Ebola outbreak became a humanitarian emergency (>24,000 enrolments).
- *The Zika Virus Emergency: Informing the International Response* focused on the *Aedes* mosquito and its lifecycle, behaviour, distribution and role in transmitting vector-borne diseases (>18,000 enrolments).
- *Informing the UK response to COVID-19* covered the emergence and identification of COVID-19, the public health measures worldwide and what might be required to address the pandemic in the future (> 236,000 enrolments).

Finally, some research programmes have featured educational materials as a specific output. Examples have included the following:

- Outputs from Indian trials on lay-counsellor interventions for alcohol dependence and depression/anxiety disorders were adapted into competency-based, open-access digital courses. These were aimed at laypeople providing peer counselling and at community health workers (*Lay health worker interventions to treat mental health disorders*).
- A film, *Chiedza's Song*, was developed in Zimbabwe to facilitate discussions in communities and schools through a partnership between HIV researchers and the Ministry of Education (*Uncovering and addressing gaps in care for adolescents with HIV*).
- COVID-19 researchers worked with authors and communications experts on educational materials. Examples included *Coronavirus: a book for children*, a collaboration with illustrator Axel Scheffler (*The Gruffalo*), which won a FutureBook award; and an education programme on COVID-19 for families – now recommended by the UK's Department for Education as a resource for schools (*Informing the UK response to COVID-19*).

1.4.2. Shaping and adapting plans to ensure they continue to support the vitality and sustainability of the unit's impact in the future

We have found our multi-pronged approach to achieving impact, as outlined above, an effective strategy. We will maintain such an approach in the future, reshaping it in light of experience and new opportunities – including digital developments.

We will continue to work with policy and practice communities in the UK and globally to shape health systems and services through strategic research programmes. This will involve continued engagement with DHSC, WHO Advisory Committees, local Technical Working Groups to support Ministries of Health, UK advisory bodies and our WHO Collaborating Centres – among others.

In addition, we have committed to launching a Policy and Leadership Institute to further increase the profile and impact of our research among policymakers and leaders globally and optimise how we respond to opportunities to shape health policy. Our goal is to create an interface organisation

to bridge policymaking, leadership and research. The Institute will house our educational programmes including the professional Doctorate in Public Health and Executive Programme for Global Health Leadership.

1.5. Unit's approach to supporting interdisciplinary research in the context of unit's research strategy

Our focus on improving the health of populations requires us to address many interdisciplinary questions, demanding, for example, an understanding of aetiology, treatment, social determinants of health, cultural influences, economics and other topics. An acknowledged strength of LSHTM is that we support research to be truly interdisciplinary.

Our Centres, listed in full in REF5a, have been key mechanisms through which interdisciplinary research has developed in strategic priority areas, along with the methodological and disciplinary rigour required to achieve excellence. All the Centres are interdisciplinary – focused on a disease, a programme or development challenge, or a methodological approach applicable across subject areas – and explicitly engaging with and integrating the various relevant disciplines. Retreats, proposal development workshops, newsletters, and showcasing research findings have all helped create vibrant interdisciplinary research communities around key strategic priority areas.

For example, the AMR Centre's structure is based on five disciplinary pillars: biological and pharmacological sciences; clinical and veterinary sciences; humanities and environmental sciences; epidemiology and modelling; and economic, social and political sciences. These are mobilised collectively to address research questions that demand an interdisciplinary response.

In 2019, reflecting acknowledgement of the effectiveness of its interdisciplinary approach, the AMR Centre was chosen as a host institution for cohorts of Fleming Fund Fellows. DHSC introduced the Fleming Fund Fellowship programme to develop the skills that national institutions require to help combat AMR. Our current Fleming Fund Fellows are from Ghana, Kenya and Zimbabwe.

In the area of TB, the ESRC-funded 'Umoya Omuhle' project used a whole systems approach to identify interventions to reduce TB transmission within primary health care clinics in South Africa. Rather than presenting parallel, disciplinary-specific findings on the barriers to infection control at the clinic level, evidence-informed group modelling by researchers (anthropologists, social scientists, clinical scientists, epidemiologists, mathematical modellers and economists), practitioners and policymakers was used to build common understanding and identify feasible solutions to improve infection control.

The 'What Works' project piloted and evaluated different approaches to preventing gender-based violence in LMICs. Evaluation teams including experts in gender-based violence, epidemiology, clinical trials, social science and economics worked together to develop robust evaluations that captured the diverse economic and social consequences of gender-based violence in a rigorous way.

1.6. Open research environment

Principles of open research are instilled in researchers at all levels, supported by our Library and Archives Service. Our 2017 Open Access Policy mandated open access for all research outputs, regardless of REF and funder policies.

Our research data management service has offered in-depth advice about plans, reproducibility, ethics and legal issues and has maintained our Data Compass repository, where data are discoverable, accessible and re-usable. The repository held more than a thousand datasets by 2020. In addition, since 2014, as an early adopter of an e-thesis policy, we have mandated that all PhD theses are openly available.

In the 2020 CWTS Leiden Ranking indicators for all sciences, 90.7% of our publications were open-access, ranking us second in the UK and third in the world for this indicator. This achievement underlines our successful commitment to and support for an open research environment, as does the fact that our modellers and statisticians routinely post online their statistical packages, R codes and models – as has been the case for LSHTM's COVID-19 and climate change modelling.

In 2019/20, we rewrote our internal policies and guidelines to ensure staff career progression and hiring processes were in line with recommendations on open research. We also ensured they reflected the San Francisco Declaration of Research Assessment (DORA), which we signed in 2018.

Our Academic Expectations and Promotions Guidance are now explicit in stating that all types of research output – including datasets and software – are valued. They also explain that we expect authors of research papers, monographs and book chapters to make their results freely available and to ensure underpinning data can also be openly accessed at the earliest opportunity.

1.7. Research integrity

A Research Governance Committee was established in 2013. Acting as a subcommittee of Senate and superseding previous arrangements, it strengthens oversight of our responsibilities and obligations – including as a sponsor of health-related research. The Committee oversees our ethics committees and our policies and procedures on research governance; promotes best practice; ensures effective monitoring and reporting arrangements are in place for investigating allegations of research misconduct; receives reports of research governance audits or inspections by external bodies; and monitors the School's response to the findings of external audits or inspections.

The Research Governance and Integrity Office (RGIO) provides the secretariat to the Committee and ensures research is conducted in accordance with standards of good practice, professional frameworks and relevant legislation in all countries where we work. These commitments are underpinned by a Good Research Practice (GRP) policy, which follows guidance from UKRI and the UK Research Integrity Office and conforms with the Concordat to Support Research Integrity.

GRP has been introduced to all staff and students during staff induction and student orientation days. In addition, RGIO has provided an in-depth training course on GRP for doctoral students and staff which runs three times a year. Procedures and templates have been made available to help researchers develop high-quality protocols that comply with the current regulatory framework. Clinical trials, projects involving human tissue and tissue storage facilities have been regularly audited by RGIO to ensure compliance with study protocols, regulations and other LSHTM policies and procedures.

International projects must receive approval from the relevant partner country's ethics committee; clinical trials of investigational medicinal products or medical devices must also receive approval from the relevant regulatory authority. The MRC Units have their own ethics review processes, with projects fast-tracked through LSHTM's overarching committees to assure timely review and effective oversight.

RGIO staffing numbers have been increased during the assessment period in order to meet regulatory requirements where LSHTM is the named legal sponsor. Ethics committees have also been reviewed and updated to meet increased demands (submissions rose by 76% between 2014 and 2019). A new Commercialisation and Rapid Response Committee was set up to review research projects in emerging epidemics and commercial projects with quick turnaround times. LSHTM's own ethics training course was made available to our staff online in October 2019.

2. People

2.1. Staffing strategy and staff development

2.1.1. Staff development strategy

Demonstrating our institutional commitment to the European Charter for Researchers and Code of Conduct for their Recruitment, LSHTM is a signatory to the Concordat to Support the Career Development of Researchers. In 2019, following a gap analysis of policies and practices against the principles of the Concordat and the development of an action plan, we were awarded the EU HR Excellence in Research Award.

We have also established a Research Staff Forum. This is part of our HR Excellence in Research Award and works alongside the Concordat Monitoring Group, which reports annually to the Senior Leadership Team and our People Committee.

The Talent and Educational Development (TED) team and the Strategic Research Office (SRO) support researchers' career development. TED is responsible for professional development and opportunities to improve skills and capabilities at work, including high-quality transferrable skills training for all staff and doctoral students. SRO provides comprehensive support assisting early- and mid-career researchers with fellowship applications (see section 3.2 for further details).

LSHTM ran 311 in-house training workshops, with 3,098 training places filled, in 2019-2020. With online training provision increased, 43% of sessions were offered virtually. Since 2015, when the SRO was established, fellowship and personal award applications have notably increased, with an average success rate of 40%.

In 2017 LSHTM launched an annual Pathway to Academic Leadership Programme. More than 80% of participants have reported this has developed their leadership confidence, with feedback describing the initiative as 'excellent' and 'the best training I've been on in over a decade'. Senior staff are encouraged to take advantage of external training opportunities provided by funders, with several participating in Wellcome, NIHR and Academy of Medical Sciences leadership programmes.

In 2015 we drew on the Vitae Researcher Development Framework and Advance HE's UK Professional Standards Framework to create new Expectations for Academic Staff. We retained LSHTM's traditional structure of areas of academic work – knowledge generation, education, internal contributions and external contributions – but set criteria for performance at each grade and in each category, with examples of activities that could be evidenced.

This approach enables academics to develop their portfolio of work in line with their own preferences and abilities and the School's requirements. A level of contribution is required in all categories – ensuring that, although we are a research-intensive institution, we acknowledge the value of all areas of academic work. This initiative saw us adopt the terminology of Assistant Professor and Associate Professor, introduce Professorial bands to ensure fair pay and expectations at each career stage and explicitly describe how adjustments would be made for personal circumstances such as clinical practice, overseas location and those characteristics protected in law.

Processes and outcomes of our promotion cycle are subject to annual review. This includes collecting and publishing statistics on applications and outcomes by gender and ethnicity. We continue to update and improve our approach as necessary – as illustrated in 2019/20, when we added clearer guidance on adhering to our DORA commitment and the importance we place on team-working and ensuring a supportive academic environment.

Our annual online Performance and Development Review (PDR) process assesses whether objectives have been met in the context of our Expectations for Academic Staff, and agrees goals and development activities for the coming year. TED provides training for reviewers and reviewees. In 2018 the PDR process was streamlined and communications around its importance enhanced, resulting in completion rates increasing from 63% in 2018 to 78% in 2019.

The School runs an in-house Mentoring Programme, open to all staff. It was evaluated, revised and relaunched in 2017-2018 and is complemented by mentoring arrangements in research groups and Departments.

2.1.2. Clinical academics

Clinical academics form an important component of our research workforce in both London and the MRC Units. 49 clinical academics in UOA2 hold honorary consultant contracts (e.g. in infectious diseases, paediatrics, public health) or joint academic NHS appointments. Our Academic Expectations and Promotions Guidance explicitly state how we allow for time spent on clinical duties.

We support the career development of clinical researchers through NIHR awards. Since 2014 there have been five public health Academic Clinical Fellowships (ACFs) and three clinical epidemiology/urology ACFs, plus (across both of our UOAs) nine infectious diseases ACFs and seven infectious diseases Academic Clinical Lecturers.

Our health services researchers collaborate closely with the NHS, including with clinical staff at University College Hospital and through our research partnerships with the Royal Colleges of Surgeons and Obstetricians and Gynaecologists. We joined the board of UCLPartners in 2013 and are part of its NIHR Applied Research Collaborations and Academic Health Science Centre (reaccredited in 2020).

2.1.3. Staffing and recruitment policy

A key aim of our 2017-2022 strategy has been 'to recruit, develop and retain outstanding and diverse researchers and educators who produce excellent science and can influence the public and global health agenda, providing equal opportunity for progression'. We listed major strategic recruitments during the assessment period in section 1.

LSHTM's Recruitment and Selection Procedures ensure new staff are selected via a fair and transparent process. To encourage internal redeployment and retain researchers, all jobs are advertised for redeployment for one week before being advertised externally, and staff can be placed on the redeployment register three months before a contract is due to end. To match our Expectations for Academic Staff and provide a standard framework, job description templates have been created for all academic roles.

As a research-intensive institution, LSHTM continually recruits to junior researcher roles. Our promotion processes ensure these recruits' achievements and growing maturity as researchers are recognised.

Our REF submission includes all staff at Assistant (196), Associate (119) and Professor (139) grades who have significant responsibility for research. Our staff profile has remained fairly stable during the REF period.

On average, 7% of each grade pool are promoted each year.

Grade	Academic staff by grade		% of pool promoted to next grade; average 2017-2020
	2014	2020	
Research Assistant	13%	9%	8%
Research Fellow	36%	36%	7%

Assistant Professor	22%	23%	7%
Associate Professor	11%	15%	7%
Professor	17%	17%	4% (band movement)

LSHTM maintains a large network of national and international partnerships (see sections 3.7 and 4.1). Joint appointments have been used to cement these and to build work in areas of common interest. Such appointments have involved the University of Glasgow in the UK, and overseas, the Public Health Foundation of India, Nagasaki University in Japan, and National University of Singapore.

A 'big splash' recruitment drive was launched in 2017 reflecting our new strategy, identification of priority areas and the need to retain expertise in fields fundamental to our mission. As a result, we made new Professor and Associate Professor appointments in data science, global mental health, health systems research and medical sociology, as well as junior supporting appointments.

2.1.4. Fixed-term contracts

In 2014 LSHTM reviewed fixed-term contracts for Professors. This resulted in a transformation of contracts – for example, a reduction from 53% to 0% for female fixed-term Professors. In 2016 our Fixed-Term Contracts Policy was revised and updated in line with current legislation, ensuring such contracts' use only 'for transparent and objective reasons, where there is genuine fixed-term need'. All staff at Associate Professor level and above were reviewed in 2016 for transfer to permanent contracts, leading in 2017 to a sharp fall in the use of fixed-term contracts for Associate Professors.

53.5% of UOA2 staff are on fixed-term contracts, mostly linked to time-limited grant funding. Fixed-term contract levels by gender are monitored in fulfilment of commitments to Athena SWAN awards at School and Faculty level, and ethnicity monitoring was added in 2020.

2.1.5. Support to early-career researchers

Early-career researchers (ECRs) and postdoctoral research staff are the lifeblood of LSHTM. Supporting them to become innovative and accomplished scientists is fundamental to our mission. Both EPH and PHP appointed Associate Deans for Research in the assessment period, with a remit to especially support ECRs.

We nurture early-career development through individually tailored activities. These include reviewing grant proposals; holding mock interviews for fellowship and grant applicants; structuring projects so that ECRs can lead on components; supporting and facilitating external research and policy links; advising on journal selection strategies; journal clubs; work-in-progress seminars; and practice sessions for conference presentations. Two of our major funders – MRC and Wellcome – have established career frameworks, and our SRO uses these as points of reference. SRO, TED and the Careers Service also support staff exploring career options outside academic research.

Our early-career researchers, making full use of our in-house support, have enjoyed great success, with 94 fellowships and personal awards won by UOA2 staff and their team members during the assessment period. Of these, 29 have subsequently been promoted internally (included in this submission are Beattie, Bhaskaran, M Cairns, Cornelsen, Diaz-Ordaz, Eggo, Greco, Harris, Keogh, Knight, Kucharski, Flasche, Funk, Langan, Lowe, Stoeckl) or appointed to a more senior role externally (Daniel).

We have also won a number of training awards. These have included an MRC Skills Development Fellowship block grant to recruit four fellows over two years in biostatistics, epidemiology, mathematical modelling and health economics; three Doctoral Training Partnerships (MRC, ESRC, Biotechnology and Biological Sciences Research Council (BBSRC)); a Wellcome Clinical PhD Programme in Global Health; and three HDR UK UKRI Rutherford Fellowships.

We support ECRs at partner institutions with fellowship applications. The School was awarded a Universities UK Rutherford Fund Strategic Partner Grant to support six-month placements for five postdoctoral researchers from Nagasaki University to develop their research collaborations with LSHTM staff.

Research Assistants and Research Fellows without a PhD but with a suitable project can register for an LSHTM doctorate at highly reduced fees. In 2019-2020 71 such staff working with UOA2 researchers were registered, benefiting from the creation of our Doctoral College in 2018 (see section 2.2). All ECRs and postdoctoral research staff can freely access all 117 intensive and 85 distance learning modules taught in LSHTM's MSc programmes; they can also access our in-house TED programme, which allows the creation of more tailored personal development pathways. LSHTM supports eight women each year on the Advance HE Aurora Programme. Formal teaching qualifications include the Postgraduate Certificate in Learning & Teaching, which all early-career staff are required to follow. 244 UOA2-associated staff attended at least one staff development course in 2019-2020.

In 2018, using our Wellcome-funded Institutional Strategic Support Fund, we initiated a biennial internal fellowship scheme to support the career progression of researchers at the crucial mid-career transition point. So far eight fellows have been given up to 18 months' support to develop applications for external fellowship or major grant funding and to complete the Pathway to Academic Leadership Programme. SRO meets with fellows on a regular basis to provide guidance. One member of the first cohort was awarded a fellowship, and all three were promoted to Associate Professor (with one promoted to Professor).

The final six months' funding for the second cohort was conditional on submitting a mid-career fellowship application. All four fellows did so, and three were successful. Two of these fellows are included in our UOA2 submission: Diaz-Ordaz (Wellcome Royal Society Sir Henry Dale Fellowship) and Price (Wellcome Clinical Research Career Development Award). In addition, 35 awards have been made during the REF period through a pump-priming scheme, again backed by the Institutional Strategic Support Fund, to enable Research Fellows and Assistant Professors to undertake small research projects of up to £10,000.

In 2019 we set up an Early-Career Researcher Network. With a dedicated intranet site and a termly newsletter, this assists researchers – from PhD students to Assistant Professors – with their professional and career development and provides networking, training and funding opportunities.

Individual research teams, Departments and Faculties regularly run research-related events. Advertised in weekly e-bulletins, these are open to all staff. Centres also run events aimed at ECRs – for example, the annual Centre for Statistical Methodology's Early-Career Researcher Showcase.

The MRC Units share in the initiatives described above. They also have their own longstanding systems of support for ECRs.

MRCG is a regional training hub for West Africa. Its strategy was redefined in 2016 with the creation of a new department that builds the human resources required for world-class research in sub-Saharan Africa, with a particular focus on nurturing and developing young talent from The Gambia and West Africa for internships and technical positions. A researcher leadership and development programme provides PhDs and postdoctoral fellows with skills development and resources, guidance on initiating early mentorship and support for personal development plans. By 2019 10 out of 17 ECRs and postdoctoral scientists at the Unit had attracted grants for either the consolidation phase or pathway to independence phase, with some creating and developing their own research groups. The Unit hosts the African Research Excellence Fund, established by UK MRC to invest in talented emerging researchers.

MRCU has similarly strong capacity-strengthening programmes. For example, through Seeley's leadership, it has built a considerable social science presence in Uganda and the region, becoming

the 'go-to' centre for related research and providing relevant training for other disciplines and organisations. It has also run regional epidemiology and statistics courses drawing on LSHTM material.

2.1.6. Research, impact and sabbatical leave

Assistant Professors and above who complete five years' continuous service with the School can apply for study leave of three to eight months. For example, to explore strengthening social science research in the region, Mayhew visited MRCG and partners at Senegal's Institute for Health Research, Epidemiological Surveillance and Training and Université Cheikh Anta Diop de Dakar – leading to the establishment of an interest group at MRCG and enhanced opportunities for collaborative research visits.

Take-up of such leave is relatively low because most LSHTM academics spend the bulk of their time on research, with their teaching deliberately restricted to specific blocks of time to facilitate research and overseas work. Study leave is not as critical to research excellence as it might be at institutions with higher teaching loads.

2.1.7. Exchanges between academia and business, industry, public or third-sector bodies

Requests for exchanges and secondments are accommodated whenever possible. Staff who have been seconded to policy and implementing agencies include Whitty (Department for International Development (DFID), Chief Scientist, 2009-2015; DHSC, Chief Scientific Adviser, 2017-2018; HM Government, Chief Medical Officer for England, 2019-present) and Watts (DFID, now FCDO, Chief Scientist, 2015-present). Other examples include Godfrey-Fausset (UNAIDS, Senior Science Adviser), D Schellenberg (WHO Global Malaria Programme, Scientific Adviser) and Dangour and Lawn (DFID, Senior Research Fellows).

Industry links have been strengthened during the REF period. We have built cross-sector partnerships to enhance capacity in data science, infectious disease control and preparedness. A Research England Connecting Capabilities Fund award, Bloomsbury SET: Connecting Capability to Combat the Threat from Infectious Disease and Antimicrobial Resistance (led by RVC; £4.9m, 2018-2021), has enhanced our knowledge-exchange capabilities with regard to infectious diseases and AMR through seed and project funding, cross-sector symposia and industry mentorship.

Dedicated seed funding, training and translational facilitation for staff have also been provided by Higher Education Innovation Funding from Research England and a Wellcome Institutional Translation Partnership Award. A new Intellectual Property Manager was recruited in 2019 to support consultancy and technology-transfer activities.

2.1.8. Rewarding research and impact

We recognise and reward research and impact in the following ways:

- Our Academic Expectations and Promotions Guidance clearly state how research and impact are valued and how achievements can be evidenced to support career progression.
- Our weekly internal staff newsletter, *Chariot*, includes regular research stories, particularly highlighting staff successes such as prestigious fellowships. *Chariot* also includes Centre of the Month and Publication of the Month features.
- LSHTM's website showcases newsworthy and impactful research publications, press releases and opinion pieces demonstrating our thought leadership. Major awards and honours are also highlighted.
- Our annual LSHTM Week showcases the research, innovation and impact of our academics. First introduced in 2013, this is now a highlight of the academic year. All staff – including those based overseas – are invited to participate.

- Faculties, Departments, Units and Centres regularly celebrate success via their own newsletters, as well as through annual research days.

In 2018 the Director's Awards were launched as an additional means of recognition, conferred in a ceremony in LSHTM Week. They are open to all academic and professional services staff across every Department, discipline and grade, whether based in the UK or overseas. The academic categories cover individual and team performance, ECRs, education contributions and public engagement.

2.2. Research students

2.2.1. Doctoral study environment

LSHTM is an exclusively postgraduate institution with a vibrant, research-active community. As such, it provides a fertile environment for doctoral study. We do not currently offer MRes programmes, though research methods and summer projects intended to develop students' research skills are important elements of our MSc programmes. Four MScs qualify as year 1 in 1+3 arrangements for our ESRC Doctoral Training Programme.

A Doctoral College was launched in September 2018, encompassing both our PhD programme and our professional Doctorate in Public Health (DrPH). In 2017, as part of a broader research partnership, we launched a joint doctoral training programme with Nagasaki University. Historically, MRCG has awarded PhDs as an Affiliated Research Centre of the Open University, and this arrangement has continued. We also support the development of doctoral training overseas – especially in Africa and Asia – and the School is a partner in seven capacity-strengthening consortia supported by Wellcome's Developing Excellence in Leadership, Training and Science Africa programme, led by or including 16 different African partners.

Doctoral students at LSHTM are very diverse. In 2019-2020 48% were over 36 years old (sector average: 22%), 67% were part-time (sector average: 24%), 40% were from a black and minority ethnic (BME) background (sector average: 18%) and 8.4% declared a disability. We have doctoral students from 70 countries, with the five largest representations after the UK (39.5%) being the US (11.7%), Canada (5.6%), France (3.0%), Uganda (2.2%), and Italy (2.0%).

Staff undertaking PhDs made up 24% of the total doctoral student body in 2019-2020. This has been an important means for aspiring researchers to get the formal training needed to progress their careers. In 2019 a PhD-by-publication route was introduced to enable researchers with significant research experience to prepare and submit a PhD within six to 18 months, based on work already completed, plus an analytic commentary.

Our 2020 Postgraduate Research Experience Survey results showed improvements in almost all areas. We particularly improved on research culture, and this area scored particularly well compared to other institutions. There was 90% satisfaction with supervision, while other especially strong areas included understanding of research integrity, transferable skills training and submitting papers for publication.

2.2.2. Recruitment into Doctoral Training Programmes

To ensure fair recruitment, all funded studentships are advertised. These include both major Doctoral Training Programmes and individual opportunities. All potential students are interviewed by an academic Departmental Research Degree Coordinator who is outside the supervisory team. To widen access, our Capacity-Strengthening Research Degree Scheme has provided highly subsidised fees for low-income country students employed by 15 of our major overseas partners.

We were members of the following Doctoral Training Programmes during the REF period (LSHTM studentship numbers noted in brackets):

- The MRC London Intercollegiate Doctoral Training Partnership (run jointly with St George's, University of London) supported research across three main themes: global infectious diseases, quantitative skills for analysis of large datasets and evaluation of complex interventions (5 p.a.).
- The Wellcome Bloomsbury Centre for Global Health Research Clinical PhD programme (led by LSHTM, with UCL; KCL; QMUL; St George's; Brighton and Sussex Medical School) supported clinicians to train in research relevant to global health (2-3 p.a.).
- The ESRC UCL, Bloomsbury and East London Doctoral Training Programme (with UCL; SOAS University of London; Birkbeck, University of London; University of East London) supported research across the social sciences and economics, with a particular focus on interdisciplinary research (2-15 p.a.).
- The BBSRC London Interdisciplinary Doctoral Programme (with UCL; RVC; QMUL; Birkbeck, University of London; KCL) supported projects in basic biology (2-4 p.a.).
- The Medical Research Foundation National PhD Training Programme in Antimicrobial Resistance Research (consortium led by the University of Bristol) trained new researchers to tackle antimicrobial resistance (1-3 p.a.).
- The Bloomsbury Colleges PhD Studentships (with Birkbeck, University of London; RVC; SOAS, University of London; Institute of Education, UCL) offered interdisciplinary research opportunities with joint supervision across two institutions (2 p.a.).

Other sources of funding included individual scholarships awarded by NIHR, national governments (e.g. Thailand) and charities (e.g. Cancer Research UK). Some research grants and programmes, including from Leverhulme and NIHR, budgeted for doctoral scholarships or were awarded linked scholarships.

Annually, via a competitive selection process and international advertisement, MRCG has recruited three to four PhD students funded by the MRCG Doctoral Training Programme budget. At MRCU, where funding was available, opportunities have been awarded on a competitive basis; staff have also supported students registered at Makerere University. Staff at both MRC Units have accessed LSHTM doctoral degrees at significantly discounted fee rates since 2018.

2.2.3. Support, monitoring and progression

A number of changes were made during the REF period to increase support to doctoral students and improve progression. These included:

- Formalising the composition of supervisory teams
- Mandatory training and retraining of supervisors, including mentorship
- Clarifying expectations of supervision frequency
- Using electronic supervision records
- Introducing a compulsory deadline of four years full-time, eight years part-time, with flexibility for personal circumstances

In addition, regular progress monitoring by an academic Department Research Degree Coordinator, approachable at any time, has provided opportunities to identify progression-related issues. The positive impact of these changes has been evidenced in HESA statistics and in the fact that the new deadlines have not led to any increase in failed upgrades from MPhil to PhD or in 18-month thesis corrections (rates of which are very low).

2.2.4. Skills development and preparation for future career

The Doctoral College has coordinated our extensive programme of training in transferable skills and our more specific courses. This has included in-house training and shared courses in the Bloomsbury Postgraduate Skills Network, enabling doctoral students to acquire skills listed in Vitae's Researcher Development Framework. One-to-one support for statistical skills has also been made available.

Many doctoral students have contributed to our Masters teaching after appropriate training. Most doctoral students have already taken part in our Masters programmes, with many benefiting from access to further MSc modules during their studies (see section 2.1.5).

DrPH students study two specific modules during their first term and then complete an organisational and/or policy analysis. The latter usually involves three to six months' fieldwork based on observing and analysing policy and/or operations at a host organisation.

2.2.5. Integration into research culture

Doctoral students are considered full members of our academic Departments. They are invited to meetings, seminars and social events, and are encouraged to join our Centres, most of which have student representatives. Many doctoral students already have a wealth of experience, which enhances the two-way process of integration into Departments and Centres.

Involving staff and students alike, work-in-progress seminars were run at various levels – research team, Department and Faculty – during the REF period. These augmented the more formal upgrading and pre-viva seminars and the annual doctoral student poster day. Students were strongly encouraged to submit work to external conferences and seminars, and funding was made available to support attendance at such events. Doctoral students were also represented on the Research Culture Working Group.

2.3. Equality and diversity

2.3.1. LSHTM's commitment

LSHTM is committed to providing an inclusive working environment for research and ensuring all staff and students are treated with respect, consideration, courtesy and dignity. Our Equality, Diversity and Inclusion (EDI) Strategy 2016-2019 detailed our vision 'to embrace and value the diversity of the staff and student population and to embed equality and diversity activities as an essential element in enhancing our contribution to the improvement of health worldwide'.

Reflecting this ethos, we explored EDI issues in staff surveys conducted in 2015, 2017 and 2019. Following evidence in the 2019 survey that some staff did not feel valued, an LSHTM Professor led a more detailed study involving focus group discussions and interviews. The 2019 survey and our subsequent *Feeling Valued* report have since been used to develop a framework for enhancing LSHTM leadership, values, culture and staff wellbeing. In 2020, in parallel with this process, staff's growing engagement with Decolonising Global Health (DGH) and Black Lives Matter (BLM) networks underlined the importance of keeping EDI at the heart of everything we do.

In 2019 we reformed our EDI Committee to ensure it has oversight on all matters relating to equality, diversity and inclusion, and is connected into decision-making structures via its chair, the Deputy Director and Provost. We have been updating our action plan around EDI issues, taking into account the impact of COVID-19 and seeking to inform the planning of support structures and processes for the whole LSHTM community. In developing the EDI action plan we have drawn on an evidence base that includes progress against our previous strategy, the 2019 survey and follow-up activities, DGH and BLM testimony, Athena SWAN submissions, external focus groups, ongoing discussions and data analysis. We are committed to continued, positive change.

2.3.2. Arrangements for supporting flexible and/or remote working

Our policies and practices support flexible working arrangements to help staff combine the demands of employment with those of family or other personal commitments. Options include part-time work, flexible working hours, job-sharing initiatives, term-time contracts and working from home.

The requirement to work from home during the COVID-19 outbreak led to significant changes in how we managed flexible working. We provided extensive support and guidance on remote software, GDPR regulations, health and safety, stress and mental health. Equipment required for ergonomic working was paid for by LSHTM or project funds. We supported efforts to balance work with caring responsibilities and managers were encouraged to establish ongoing dialogue with staff to ensure manageable workloads. It was not necessary to request carer's leave, annual leave or other types of leave to manage non-work commitments, and staff directly or indirectly affected by the outbreak were not required to 'make up' missed hours or log time away from work. We facilitated staff and students with volunteering to support COVID-19 control efforts.

We put special emphasis on supporting mental health and wellbeing, further detailed in section 2.3.5. To engage staff and maintain our sense of community, all LSHTM communications and events were placed online. We prioritised delivering an interactive virtual events programme, including lectures, seminars and panel discussions, and also held regular webinars with all staff, with up to 600 participants.

A June 2020 survey on working from home assessed the effectiveness of our support, as well as how staff might prefer to work after COVID-19. It reported 90% satisfaction with support from line management, as well as increased trust and collegiality.

The survey also highlighted areas for improvement, including burnout issues, isolation and deterioration in mental health. New initiatives have since been implemented to address such areas. 66% of academic staff wanted to mix home and office working in the future, and a pilot scheme reflecting this preference is now being tested.

2.3.3. Career pathways for part-time and fixed-term staff

Our UOA2 submission includes 158 part-time staff (35% of the submission). We have a structured, single career path for academic staff, progressing from Research Assistant to Professor. The academic promotions process runs annually, and anyone – regardless of FTE and length of contract – can apply. Heads of Department are tasked with ensuring all academic staff can access the process, with no-one unfairly disadvantaged, and a Department-managed annual CV review provides constructive feedback.

Our Academic Expectations and Promotions Guidance include clear statements on how we allow for personal circumstances, including part-time working. In 2018 an external consultant reviewed the fairness of promotion decisions with respect to part-time working, and found no evidence of disadvantage. We acted on recommendations to improve our processes, including formalising a small committee to assess personal circumstances statements.

2.3.4. Taking equality and diversity into account in structures and processes

EDI principles are embedded throughout LSHTM's training provision. We have also run EDI-specific workshops on Respectful Working Cultures, Mental Health Awareness and Disability Awareness. An online Report & Support tool was launched in 2020, enabling staff and students to report any incidents of bullying and harassment.

We monitor the diversity of our research workforce as part of an annual, publicly available report. This presents staff and student data across protected characteristics, highlights activities supporting EDI during the year, and identifies areas for further investigation and action.

Recruitment panels and staff promotion committees are required to have diverse membership. EDI and HR colleagues analyse promotion data after each round, and these analyses are made available to all staff via *Chariot* and included on all staff promotion committees' agendas.

LSHTM has introduced several career re-entry fellowships, complementing existing schemes, for those returning to work after a period of absence. The Centre for Maternal, Adolescent,

Reproductive and Child Health runs a competitively awarded £30,000 career re-entry fellowship scheme to support one member of staff each year. ITD awards up to two £15,000 Athena SWAN Career Restart Fellowships for Carers annually. LSHTM also encourages applications for external fellowships to support those who have caring responsibilities or who wish to return to academia after a career break; we currently host a Royal Society Dorothy Hodgkin Fellow (Lowe).

Gender

Our UOA2 submission is 56% female and 44% male.

LSHTM's institutional Athena SWAN bronze award was renewed in 2018. PHP's silver award was renewed in the same year, and EPH's and ITD's bronze awards were renewed in 2019 and 2018 respectively.

LSHTM's academic staff is majority female, except at the most senior level. At the start of the assessment period, women became equally represented at the associate professor grade, and achieved this in 2017/18 for the entry band for professors (Band C). In Bands B and A, the share of women increased from 31% in 2014/15, to 35% in 2019/20. We seek further improvement through targeted support to women nearing the point of promotion to professor and progressing through the professorial bands. Recruitment data show women were more likely to be appointed than men overall, but relatively fewer women applied to advertisements for higher academic grades.

School-wide promotion data for 2017 to 2020, including both proportion successful from the grade pool and proportion successful from those who applied, show women had higher application success rates for promotion to grades where they were less dominant (Associate Professor and Professor). Similarly, men had higher application success rates for promotion to grades where they were less dominant (Research Fellow and Assistant Professor).

Promotions by gender (2017-2020) from grade of:	% pool applied		% pool promoted		% applications successful	
	Women	Men	Women	Men	Women	Men
Research Assistant	14	6	9	6	69	100
Research Fellow	12	9	7	7	64	78
Assistant Professor	10	16	6	8	60	53
Associate Professor	12	10	9	5	75	50

MRC, one of our largest funders, reports gender-specific data on our applications annually. The number and share of applications, and successful applications, from female LSHTM staff have increased dramatically over time. Our gender balance is superior to all other universities applying to MRC. In addition, the 2020 CWTS Leiden Ranking named LSHTM the UK's top university in all sciences for the proportion of academic research with women listed as authors (48.1%).

These improvements can be attributed to various activities to support female progression, including:

- Active Athena SWAN committees, with membership on School promotion committees
- Improved job security from awarding permanent contracts to most Associate Professors (a lower percentage of women than men reported concern about job security in our 2019 staff survey)
- Extensive career and leadership development programmes for women
- SRO investment to support academic career progression
- A deliberate increase in female committee membership
- Drawing on the large cadre of senior LSHTM female academics to provide career advice to junior colleagues

- Supporting leadership development for mid-career female staff through eight places each year on the Advance HE Aurora Programme

Ethnicity

Our UOA2 submission is 76% white, 19% BME, and 5% not declared.

LSHTM has acknowledged its colonial origins and in 2018 funded archival research to explore its colonial legacies. This historical study is already informing discussions about research, teaching and working practices. All staff are required to undergo mandatory EDI training, and progressing race equality has been a key focus in developing our new EDI action plan.

In 2020 29% of Research Assistants identified as BME, but this decreased to 15% at Professorial level. There was an increase in the proportion of BME staff at all grades between 2015 and 2020, though to a lesser degree for higher grades. Recruitment data show white applicants were more likely to be appointed than BME applicants, and analysis by grade shows fewer BME applicants for higher academic grades.

School-wide promotion data for 2017 to 2020 reveal similar application success rates for BME and white staff for promotion to Research Fellow and Professor, with lower application success rates for BME staff at Research Fellow and, in particular, Assistant Professor level.

Promotions by ethnicity (2017-2020) from grade of:	% pool applied		% pool promoted		% applications successful	
	BME	White	BME	White	BME	White
Research Assistant	11	12	8	8	73	73
Research Fellow	10	10	6	8	59	73
Assistant Professor	15	11	5	7	32	65
Associate Professor	17	10	11	7	64	64

In 2020, to enhance transparency in the promotions process, around 3 non-committee members were invited to observe each Faculty and School staff review committee. Their judgement was that all applicants received a fair hearing and were given constructive and supportive feedback. Their recommendation that EDI contributions be more strongly embedded in reward and recognition criteria is now being taken forward, along with strengthened positive actions to support BME staff career development. We are also ensuring that recruitment material – including job descriptions and person specifications - and selection processes support the recruitment of a diverse population of academic staff, in line with our mission as a global health institution.

The killing of George Floyd and subsequent events in 2020 shed renewed light on social inequalities and racism, leading LSHTM to reaffirm its commitment to ending racial injustice and racial disparities in public health. Members of the DGH and BLM movements were invited to speak to LSHTM's Council about their experiences, and a new Council Committee on Diversity and Inclusion was set up to scrutinise progress and monitor structural and cultural change. The School also signed up to Race Equality Charter self-assessment. Other actions and activities included:

- A working group to produce guidance on how to eliminate racist and colonial perspectives in curriculum content
- A White Privilege Discussion Group to self-reflect on improving as colleagues and people
- A safe space for People of Colour staff and students in Microsoft Teams, offering a forum for reflection and support while working remotely
- Supporting leadership development for mid-career BME staff through four places each year on the Advance HE Diversifying Leadership Programme

Other protected characteristics

LSHTM offers a range of support and cover for parental and adoption leave. Staff and their line managers are encouraged to use Keeping in Touch days to stay informed about what is happening in their teams and to benefit from training and development opportunities. The maternity return rate of 92% for academics is comparable with a sector benchmark of 88% for academic and research staff. Our Menopause-LSHTM network shares experiences, offers support and seeks to demystify and destigmatise all stages of menopause.

We are a Stonewall diversity champion, committed to supporting lesbian, gay, bisexual and transgender staff. LSHTM's Director, a former Director of UNAIDS, has been a prominent champion of the Lesbian, Gay, Bisexual and Trans (LGBT) community. An LGBT and Friends Network is open to all staff and students and hosts an LGBT+ welcome event and LGBT History Month Celebrations. Trans identity is explicitly mentioned in our Anti-Bullying and Harassment Policy, updated in 2017, and in recent training on creating respectful working cultures.

4% of UOA2 staff declared a disability. The School is a Disability Confident Employer and is working to become a Level 3 Disability Confident Leader. It is also a certified user of the Two Ticks Disability Scheme. Our International Centre for Research on Disability works with people with disabilities at every stage in its activities and has a work experience scheme for students with disability, one of whom commented: 'It has been a truly amazing experience – more than I ever imagined it could be. I have been able to make a real contribution whilst learning many new skills.'

LSHTM accommodates reasonable time for staff and students to pray. The School has a multi-faith room for prayer or quiet contemplation.

2.3.5. Supporting the wellbeing of staff and research students

In 2017 LSHTM achieved the London Healthy Workplace Charter Award and signed the Time to Change Pledge, which recognised our action plan to end mental health discrimination in the workplace. In the same year the School set up a Mental Health Network, made up of staff volunteer Mental Health Champions. We also launched a network of trained Mental Health First Aiders.

Other wellbeing initiatives have included an annual Wellbeing Week, our staff summer picnic, walking and running groups, staff and student yoga, the School's choir and a range of healthy eating schemes. LSHTM's Wellbeing Committee has coordinated efforts in collaboration with the EDI Committee.

LSHTM provides free and confidential counselling to all members of staff through the University of Westminster's Only Connect counselling service. Via Skype or phone, this is also available to staff overseas. In addition, occupational health support has been increased in response to growing demand. LSHTM's Student Support Services offers confidential support and advice for students on non-academic issues, including counselling, disability and dyslexia support, and a financial hardship fund.

During the COVID-19 outbreak the LSHTM community developed a number of wellbeing resources. These included a Microsoft Teams site for parents and carers; regular staff emails on changes in government guidelines; disability resources relating to the implications of COVID-19; virtual coffee mornings and meditation; workstation support; and processes and infrastructure for staff struggling to work from home.

2.3.6. REF Code of Practice

Our Code of Practice was drafted to ensure an inclusive REF process. This has enabled us to identify all independent researchers and the outputs produced by Category A eligible staff across

all protected groups and with individual circumstances that may have constrained their ability to undertake research during the REF period.

A mock REF scoring exercise for outputs was conducted, with the scoring profile and number of outputs allocated to all submitted staff compared with the equality profile of all submitted staff at those grades. This was done to determine whether the outputs from any groups in relation to their protected characteristics were underrepresented in the final submission. Analysis of the submitted outputs by gender, ethnicity and disability demonstrated that no groups were underrepresented. Equality Impact Assessments of the outcome of the exercise and the preparation for final REF submissions were also undertaken.

3. Income, infrastructure and facilities

3.1. Research funding

LSHTM's grant portfolio continued to grow during the assessment period, with research income in UOA2 of £46.3m in 2013-2014 and £85.8m in 2019-2020. The total value of the 198 new grants awarded to UOA2 staff in 2019-2020 was £84.3m.

Research income to UOA2 increased overall by 86%:

- UKRI income increased by 208%, reflecting our success with GCRF and the incorporation of the MRC Units
- EU funding increased by 61%
- DHSC and FCDO income increased by 39%

We frequently receive awards as the lead institution and transfer funds to partners, often in LMICs. The average research income per FTE submitted staff member in 2019-2020 was £224,884.

We have seen an increase in the size of research grants awarded to staff in UOA2 during the REF period, with 28 over £5m and 162 over £1m. The high quality and relevance of our research expertise have been shown most recently in our success in the UKRI COVID-19 research calls, in which we were third in the UK for total value of awards (£11.3m), fourth in average value (£753k) and fifth in number (15).

The nature of our research funding is critical to ensuring high-quality outputs and impact. We have especially attracted substantial awards to evaluate major innovations – including new vaccines, therapeutics and ways of using existing products – and have ensured the inclusion of funds in grants for dissemination and policy change.

For example, Peek Vision is a social enterprise born out of LSHTM research. Bastawrous developed prototype apps to enable the use of smartphones in mobile eye clinics, created a support platform, led trials to demonstrate feasibility and then evaluated the impact on health programmes. Peek includes tools and software for measuring visual acuity, undertaking population-based eye surveys, and reporting data and analysis, and has since been implemented, with Bastawrous' support, into school and community eye health programmes in Botswana, Kenya, India, Pakistan and Zimbabwe.

In addition, we have used allocations from Research England's QR GCRF, Higher Education Innovation Fund and the QR Strategic Priorities Fund to amplify the impact achievable from grant funding. Internal funding calls using the Strategic Priorities Fund have awarded small grants to staff with innovative ideas to engage with policymakers and translate research into benefits beyond academia. We also dedicated a proportion of QR GCRF funding in 2020 to support four innovative projects on COVID-19 in LMICs.

3.2. Organisational infrastructure supporting research and impact

Established as a central resource in 2015 and now with five staff, our Strategic Research Office (SRO) supports academics in identifying research funding opportunities, developing high-quality grant applications and coordinating institutional-level strategic applications. It also runs regular Funder Showcases and an annual Fellows' Showcase, where fellowship holders talk about their experiences.

SRO is further responsible for knowledge exchange, international partnerships and implementing QR GCRF and Higher Education Innovation Fund strategies. It manages institutional grants, including the Wellcome Institutional Strategic Support Fund and Wellcome Institutional Translational Partnership Award, MRC Skills Development Fellowships, HDR UK Fellowships, the

Rutherford Fund Strategic Partner Grant and the GCRF Impact Accelerator Award. A position was added in 2018 to work across the School to facilitate impact, including supporting the development of REF impact case studies.

During the assessment period there was substantial investment in the Research Operations Office, which manages LSHTM's portfolio of external research funding. A 12-week development programme in 2018 saw process review and new technology improve response times, contract turnaround times, project set-up times and finance reporting. Additional resources were created to support Faculty staff, including a 'project lifecycle' document detailing roles and responsibilities. The team increased from 20 to 34 between 2017 and 2019 and managed 1,000 applications and a UOA2 portfolio of 833 active grants with a total value of £482m in 2019/20.

We also significantly enhanced our support to staff in communicating research to specialist and public audiences. Our Communications & Engagement Department grew to include 30 members of staff in London. We launched a new website in 2017, and many research projects that had their own standalone websites have migrated their sites to lshtm.ac.uk – more than doubling their traffic. Our social profile grew significantly, with more than 150,000 followers across Twitter, Facebook, Instagram and LinkedIn. Our monthly external e-newsletter now has more than 15,000 subscribers from audiences including funders, policymakers, NGOs and the public, with open (36.4%) and click-through (21.3%) rates far above the sector averages (17.4% and 2.6% respectively).

In 2015 we introduced a Research in Action feature series to reflect our impact and policy influence. It was highly commended in two categories at the Medical Journalists' Association Awards in 2017. We have provided dedicated support for staff to write op-eds that demonstrate their thought leadership via external news media and influencer channels, including the *Guardian*, *Devex* and Thomson Reuters Foundation. More than 20,000 pieces of LSHTM coverage were generated each year across print, online and broadcast media globally.

LSHTM has developed an inclusive strategy to embed and facilitate public engagement. In 2017 a UKRI SEE-PER (Strategic Support to Expedite Embedding Public Engagement with Research) grant supported a School-wide survey of attitudes and needs around this goal. A new action plan for 2018-2022 has supported a strong culture of public engagement through developing new training, networks and champions.

School Centre administrative, communications and events support was fragmented and largely self-funded by the Centres prior to 2014, at which point a budget for a shared team of administrators was allocated. A Centres Forum began to meet termly to coordinate activities and ensure centralised support in line with Centres' needs, with a light-touch annual review and an in-depth triennial review evaluating performance and guiding further development. A Centres' representative sits on LSHTM's Senate.

The incorporation of the MRC Units in 2018 introduced a major change in the organisational infrastructure supporting research and impact. While MRCG and MRCU have continued to function as autonomous research units on the basis of their quinquennial review awards, synergies between the Units and other LSHTM research groups have been encouraged. Unit scientists can apply for the award of an academic title bringing attachment to a Department and Faculty; School funding has been used to support two-way visits and seed funding for joint projects; and Unit staff have enriched the activities of School Centres.

For example, in 2020 MRCG and the Centre on Climate Change and Planetary Health, in partnership with the government of The Gambia and the University of The Gambia, co-hosted a conference, Improving Health and Wellbeing in West Africa under Environmental Change. As well as feeding into plans for the next MRCG quinquennial review, the event showcased local evidence, supported an emerging research community, engaged with local policymakers and other stakeholders and highlighted the urgent actions required in West Africa to safeguard the health of people and the planet.

3.3. Operational and scholarly infrastructure

Research within UOA2 is housed across the LSHTM estate. It encompasses London-based staff at our historic Keppel Street (EPH and ITD) and Tavistock Place (PHP) sites; MRCG staff at the Unit's three campuses in Fajara, Basse and Keneba, with state-of-the-art facilities and 10,000m² of laboratory and office space; and MRCU staff at the campus of the Ministry of Health's Uganda Virus Research Institute (UVRI) in Entebbe, which includes research clinics, laboratories and technical and infrastructural support services.

In 2017, the School's Council agreed a major capital programme to increase space and renovate old buildings. £23.6m was spent between 2017 and 2020, with a total of £38.6m committed to further phases. The programme includes a new building at Tavistock Place, refurbishment of laboratories at Keppel Street, longer-term improvement to offices at Keppel Street and completion of inherited building projects at both MRC Units.

Key work completed during the REF period included new insectaries to enhance facilities for our entomologists; a new entomology laboratory at MRCG to conduct clinical trials of novel interventions against vector-borne diseases; and a new teaching and training facility in our London Bedford Square building to support executive leadership programmes. Ongoing projects include refurbishment of internal space and essential infrastructure upgrades at Keppel Street.

Work on a new 2,500m² state-of-the-art facility at Tavistock Place is also under way. The intention is to provide greatly improved research facilities, enhance capacity for new appointments and bring together infectious disease researchers. This project is supported by philanthropic donations and a £7.5m grant from HEFCE's Catalyst Fund.

Reflecting our commitment to achieve carbon neutrality by 2030, environmental sustainability is a key objective both in the capital programme and throughout LSHTM's operations. In 2019, as highlighted by the Gambian government at COP25, a solar power generation system – the biggest of its kind in the country – was completed at MRCG, reducing energy bills by 25% and cutting 1,250 tons of annual carbon emissions. LSHTM has invested in new virtual conferencing facilities and rolled out new video-conferencing software to all staff as a sustainable alternative to business travel. The School's catering service was redesigned to provide healthy meals with lower environmental footprint.

These and other changes resulted in the following:

- A 42% reduction in Scope 1 and Scope 2 carbon emissions between 2012-2013 and 2018-2019
- Increased recycling rates – from 54% in 2016-2017 to 66% in 2018-2019
- An 18% reduction in water consumption between 2016-2017 and 2018-2019
- A 66-place rise in the People & Planet University League between 2016 and 2019

Other elements of our operational and scholarly infrastructure include our technical and support staff, datasets, advanced equipment, IT resources, publication and data repositories and our Library and Archives collections.

Chariot Innovations Ltd was established in 2013 to manage knowledge exchange and commercial innovation activities resulting from LSHTM research. It is a wholly owned subsidiary of the School and provides an incubator for spin-out companies established by LSHTM academics. During the assessment period we enhanced our support for translational research and innovation through the recruitment of a new Intellectual Property Manager and an SRO member of staff dedicated to supporting funding applications for translational research.

Our School Library has extensive collections of print and electronic material, including the archives of leading health researchers and professionals and rare book collections. A collection evaluation

project ensures subscribed-to resources are mapped on to researchers' subject interests, and ongoing acquisition policies ensure resources are relevant. Resources are provided by subscriptions and by promoting discovery resources such as Unpaywall and Open Access Button and providing an easy-to-use interlibrary loan service. The Library and Archives Service also offers tailored one-to-one advice on literature searching and systematic reviews.

The Library and Archives Service is responsible for the School's open-access repository of our research (LSHTM Research Online) and a digital repository of our research data (LSHTM Data Compass). Staff provide support and advice on open-access publishing and research data management. In 2015 we enhanced our data management and fulfilled expectations to comply with the Engineering and Physical Sciences Research Council Policy Framework on Research Data.

Our use of large routine datasets has increased during the assessment period, and we have established secure facilities to support this. Datasets include UK Clinical Practice Research Datalink, Hospital Episode Statistics, drug and disease registries and numerous international data sources.

Researchers embarking on a study store original datasets on the School's secure server, which is accessible only by members of the relevant research group. All anonymised statistical analysis files and datasets are stored on LSHTM network drives or School-owned encrypted laptops or hard drives during a study. Data are then archived on the School's secure server once a study is completed. Physical media and any physical copies of the data are held in a safe. Data are stored in accordance with licence agreements with data controllers and processors.

3.4. Equality and diversity considerations in infrastructure

Our new buildings provide opportunities to ensure accessibility solutions not available to us in our old, Grade II listed premises. Enhancements include more wheelchair-accessible toilets, asymmetrical door sets and coloured plug sockets to aid those with visual impairments.

Our flexible working policy, as detailed in section 2.3.2, enables researchers to work from home to help manage caring and related responsibilities. Coupled with the global reach of our activities, this means enabling digital communications has become increasingly vital.

A standardised audio-video calling/conferencing platform was rolled out across LSHTM in 2019. This put us in a strong position when COVID-19 required home working. All our work moved online with little apparent difficulty. The high quality of our digital communications has enabled staff to work effectively from home and avoid travelling to LSHTM to do essential work – except when dependent on accessing laboratories or the Library's physical holdings.

Our TED and Technology-Enhanced Learning teams have developed various materials to support staff in maximising digital accessibility. These include training in best practice when designing resources and the use of SensusAccess, which allows staff and students to automatically convert documents into a range of alternate media.

3.5. Use of infrastructure, facilities and expertise in impact activities

Before COVID-19 we made extensive use of our facilities and central London location to host our own events and those of others. Especially notable examples during the assessment period included:

- The launch of the AMR (2016) and Climate Change and Planetary Health (2019) Centres. The former featured the Chief Medical Officer and the latter the UK House of Commons Chair of the Environmental Audit Committee.

- High-profile talks in our annual Women in Science series, including a lecture by then WHO Director General Margaret Chan and an ‘on the sofa’ conversation with the Deputy Director and Provost on career choices and influences.
- The John Snow Annual Pumphandle Lectures, which have featured Joanne Liu, International President of Médecins Sans Frontières; Richard Horton, Editor in Chief of *The Lancet*; and Paul Spiegel, former Chief of Public Health at the UN High Commissioner for Refugees.

Although participant numbers prevented the event being held at our own facilities, in 2018 LSHTM hosted the second Women Leaders in Global Health conference – convened to help redress the imbalance of women occupying less than 25% of influential leadership positions despite making up 75% of the global healthcare workforce. More than 900 participants, representing 80+ nationalities from 70+ countries of residence, attended. Speakers included Soumya Swaminathan, Deputy Director General for Programmes, WHO; Agnes Binagwaho, Vice Chancellor, University of Global Health Equity, and former Rwandan Minister of Health; and Sally Davies, then Chief Medical Officer for England.

3.6. Specialist research infrastructure and facilities

A number of our research areas rely on computation, including mathematical modelling, machine learning and research on electronic health records. LSHTM runs three high-performance computing clusters – one in London and one at each of the MRC Units – and is also a partner in the eMedLab data centre and secure computer cluster. LSHTM reviewed its high-performance computing faculties in 2019 and agreed on additional staffing.

The inclusion of MRCG in 2018 brought further specialist infrastructure and facilities. The Unit’s investigator-led research is underpinned by excellent laboratory facilities, close proximity to field sites, outstanding clinical services, rigorous ethical procedures and GCP-compliant delivery of clinical trials. Research platforms and clinical cohorts include the health demographic surveillance systems in West Kiang (from 2005), Farafenni (from 1981) and Basse (from 2007), covering a population of 240,000; the Clinical Research platform; the Sukara Health Centre and the paediatric ward of the Edward Francis Small Teaching Hospital in Banjul; and the TB Case Contact platform.

Similarly, additional specialist infrastructure and facilities came with MRCU’s inclusion. The Unit’s main operational base on UVRI’s Entebbe campus includes research clinics, laboratories and other support services. Field stations at Kyamulibwa, Masaka and Mengo host various studies and staff members. Established in 1989, MRCU’s General Population Cohort in rural south-western Uganda monitors trends in prevalence and incidence of HIV infection and their determinants. The Entebbe Mother and Baby Study, established in 2005, studies how experiences early in life affect health outcomes. The MRC/UVRI Medical Informatics Centre supports the integration of epidemiological methods with genomic and computational technologies to study the biology of a broad range of diseases. MRCU also has a key role in strengthening capacity to ensure sub-Saharan African researchers are fully engaged in medical informatics developments.

LSHTM’s Clinical Trials Unit (CTU) has an international reputation, especially in the areas of trauma and emergency care, cardiovascular disease, cluster randomised trials, and maternal health. During the assessment period CTU led prominent international trials such as CRASH3, WOMAN, HALT-IT, StatinWISE and ARREST, and expanded to include school-based intervention trials such as INCLUSIVE and Positive Choices.

3.7. Cross-HEI shared/collaborative research infrastructure and major research facilities

3.7.1. Overseas

One of the five priorities in LSHTM’s 2017-2022 strategy is to create and consolidate strong national and global partnerships. The Deputy Director and Provost has overall strategic responsibility for these, supported by a Partnerships Officer. Senior oversight of African partnerships is provided by a Special Adviser on Overseas Programmes in Africa.

Below we address major cross-HEI shared use of research infrastructure overseas and in the UK. We deal with our research collaborations in more detail in section 4.1. Since our philosophy has been to develop capacity overseas through strengthening – or supporting the creation of – local research entities, these partnerships are all with locally owned institutions.

Africa

LSHTM's shared research facilities in Africa have their origins in agreed capacity-strengthening programmes. Over time these have developed into significant shared programmes of research, with each partner bringing its own expertise. In 2019, we reviewed our African partnerships to consolidate key relationships and enhance regional connections. We dedicated funding from Wellcome's Institutional Strategic Support Fund to an African partnership grants scheme.

- *Ethiopia*: The Ethiopian Public Health Institute and the Armauer Hansen Research Institute are autonomous institutions under the Federal Ministry of Health, a key partner for a number of LSHTM research projects in the field of maternal, newborn and child nutrition and health, vaccination and infectious diseases (including TB and leprosy).
- *Malawi*: The Malawi Epidemiology and Intervention Research Unit (MEIRU) is a partnership with the Malawi College of Medicine and the Malawi Ministry of Health. Initially focused on mycobacterial disease, HIV and other infectious diseases in Karonga District, MEIRU now has an additional base in Lilongwe and a major programme of work on cardiovascular disease and diabetes. Another major collaboration with the College of Medicine is via the Malawi-Liverpool-Wellcome Unit in Blantyre.
- *South Africa*: The Africa Health Research Institute is an independent scientific research institute based in KwaZulu-Natal and a key partner in research on TB and adolescent health.
- *Tanzania*: The Mwanza Intervention Trials Unit is a formal, long-standing partnership with the Tanzania National Institute for Medical Research Mwanza Centre. The collaboration has expanded to include research on reproductive health, HPV vaccination, chronic non-communicable diseases and the health of adolescents and young people, with shared clinical trials expertise and strengthened laboratory infrastructure.
- *Zambia*: Zambart is a research organisation that grew out of a 20-year collaboration between the University of Zambia's School of Medicine and LSHTM. It is now aligned with the University of Zambia's School of Public Health. Shared research now covers epidemiology, clinical research, social science, health policy analysis, health economics and other areas of public health importance.
- *Zimbabwe*: The Biomedical Research and Training Institute (BRTI), a Zimbabwean NGO, is a key partner for the Zimbabwe LSHTM Research Partnership. LSHTM researchers based at BRTI have worked on community interventions for TB diagnosis and on the health of children and adolescents who survive with often undiagnosed HIV infection.

Asia

- *Japan*: A major development during the assessment period has been the creation of shared research resource between LSHTM and Nagasaki University. Founded in 2013 with two staff members (currently Cox and C Smith) based full-time to Nagasaki, the partnership has supported the new Nagasaki School of Tropical Medicine and Global Health and provided LSHTM researchers with access to Nagasaki's resources and partnerships within the region (e.g. the Vietnam Research Station and its collaboration with San Lazaro Hospital, the National Infectious Diseases Referral Hospital for the Philippines). Our joint PhD programme received scholarship funding from the Japanese Government's Doctoral Programme for World-Leading Innovative and Smart Education.
- *Singapore*: Our partnership with the National University of Singapore (NUS) encompasses three NUS faculties in health sciences managed through the National University Health System. It centres on infectious disease, comparative health systems and non-communicable diseases and supports research with a South East Asian focus. Five joint appointments – three

in the School of Public Health and two in the School of Medicine – develop research programmes and projects based on the research infrastructure of NUS.

- *India*: LSHTM has a longstanding institutional partnership with the Public Health Foundation of India (PHFI), including collaboration on two joint LSHTM-PHFI centres: the South Asia Centre for Disability Inclusive Research, based at the Indian Institute of Public Health, Hyderabad, and the Centre for Control of Chronic Conditions, based at PHFI Delhi. Building institutional capacity for research and training has been a top priority and was one of the aims of the Wellcome-funded PHFI-UK consortium, based at LSHTM from 2008 to 2017.

3.7.2. UK

LSHTM is a member of the London International Development Centre (LIDC), a consortium of seven institutions. LSHTM, RVC, SOAS and the Institute of Education, UCL, are the other core members. City University of London, QMUL and the Department of Geography, Birkbeck, University of London, are associate members.

LIDC facilitates interdisciplinary research and training to tackle complex problems in international development. Member colleges collectively fund a core team – including a Director (Heffernan) – and associated infrastructure. LIDC has had a major influence on college collaboration in international development, as evidenced by success with the UKRI GCRF Action Against Stunting Hub.

Also in London, LSHTM is a member of UCLPartners, and of its Academic Health Science Centre and Applied Research Collaboration. LSHTM is also a member of Health Data Research London. This platform enables access to large-scale data and develops advanced analytics to provide transformative health benefits.

4. Collaboration and contribution to the research base, economy and society

Note that collaboration in doctoral training is addressed in section 2.2.2.

4.1. Research collaborations, networks and partnerships

LSHTM's research collaborations span the world. We are a member of global networks including the M8 Alliance of Academic Health Centers, Universities and National Academies and the US-based Consortium of Universities for Global Health. The 2020 CWTS Leiden Ranking for all sciences placed us first in the UK and ninth in the world for proportion of papers published in collaboration with researchers from other institutions (95%), as well as first in the UK and seventh in the world for proportion of papers published with researchers from outside the UK (78.3%). Data from InCites show that between 2014 and 2020 we collaborated on more than 10 publications each with close to 1,500 institutions:

- Africa: 118 institutions
- Middle East: 74 institutions
- Asia Pacific: 295 institutions
- Latin America: 66 institutions
- North America: 319 institutions
- EU-27: 420 institutions
- UK: 167 institutions

Our major collaborations are in Africa, Asia, Latin America, Europe and the UK, considered in turn below.

4.1.1. Africa

In 2020 LSHTM had more than a hundred researchers based in Africa outside the MRC Units, embedded within local institutions. Our principal collaborating institutions are shown below, and many country research projects include further collaborators to bring in additional expertise or strengthen research capacity outside the main urban centres. These collaborations were fundamental to much of the research and related achievements described in section 1.

<i>Benin</i> : Centre de Recherche Entomologique de Cotonou
<i>Democratic Republic of Congo</i> : Institut National de Recherche Biomédicale
<i>Ethiopia</i> : Ministry of Health; Ethiopian Public Health Institute; Armauer Hansen Research Institute; Haramaya University
<i>Ghana</i> : Kintampo Health Research Centre; Kwame Nkrumah University of Science & Technology; Noguchi Memorial Research Institute, University of Ghana
<i>Kenya</i> : Kenya Medical Research Institute – Wellcome Trust Research Programme
<i>Malawi</i> : Malawi Epidemiology and Intervention Research Unit; College of Medicine, University of Malawi
<i>Senegal</i> : Université Cheikh Anta Diop; Institut de Recherche en Santé, de Surveillance Epidémiologique et de Formation
<i>Sierra Leone</i> : College of Medicine and Allied Health Sciences, University of Sierra Leone

<i>South Africa:</i> Africa Health Research Institute, University of KwaZulu Natal; Universities of Cape Town, Stellenbosch and Witwatersrand
<i>Tanzania:</i> Mwanza Intervention Trials Unit; National Institute for Medical Research; Muhimbili University of Health & Allied Sciences; Ifakara Health Institute; Kilimanjaro Christian Medical University College; Sokoine University
<i>Uganda:</i> Uganda Virus Research Institute; Infectious Diseases Research Collaboration; Makerere University
<i>Zambia:</i> Zambart
<i>Zimbabwe:</i> Biomedical Research Training Institute

LSHTM has supported the development of regional networks to share expertise and strengthen capacity – as illustrated, for example, by MRCG initiating the development of a West Africa network. This has built on existing connections with Senegal through the West Africa Global Health Alliance and, more widely, the West African Network of Excellence for TB, AIDS and Malaria. Links have also been developed with LSHTM projects and staff in Sierra Leone, and are being explored in Nigeria. MRCU has been developing links with key LSHTM partners in East and Southern Africa – including the Mwanza Intervention Trials Unit in Tanzania and as part of the Lake Victoria Consortium for Health Research – while partnership grants have been awarded to collaborations linking the Unit with the Africa Health Research Institute (South Africa) and Zambart (Zambia).

4.1.2. Asia

In section 3.7.1 we covered partnerships in which we share research resources in Japan and Singapore. Other strong links are with Fudan, Peking and Sichuan Universities in mainland China and the University of Hong Kong, and the Chinese Center for Disease Control and Prevention. We have around 25 researchers based elsewhere in Asia, with significant clusters in India (especially PHFI) and Thailand (Mahidol University). Collaborations between London-based researchers and universities in Cambodia, China, India, Indonesia, Laos, the Philippines, Thailand and Vietnam have strengthened research and capacity in infectious diseases and health systems. Research collaborations in India and South Asia have strengthened research and capacity in nutrition, leishmaniasis, eye health, maternal/child health, mental health and NCDs.

4.1.3. Latin America

We have particularly strong historical links with Brazil, reinforced by our work on the Zika epidemic. The Fundação Oswaldo Cruz (Fiocruz) has emerged as a major partner, and reciprocal leadership visits have explored ways to deepen links. Our Fiocruz partnership has had a strong focus on the ‘triple epidemic’ of dengue, chikungunya and Zika and has also expanded into projects on disability and health systems. We co-led the establishment of the 100 Million Brazilians Cohort hosted by Fiocruz Bahia.

4.1.4. Europe

LSHTM works with many European institutions and collaborators and leads and/or contributes to a large number of EU and EDCTP research consortia. We have been working to consolidate an academic partnership with the Charité – Universitätsmedizin Berlin, and the LSHTM-Charité Global Health Lecture Series, initiated in 2020, brings together leading scientists from the UK, Germany and further afield to present cutting-edge research. In 2020 we joined the new European Global Health Research Institutes Network, and we are also a member of the Association of Schools of Public Health in the European Region.

4.1.5. UK

LSHTM collaborates with numerous leading research and teaching institutions in the UK, including UCL, Imperial College, the London School of Economics, the Universities of Cambridge and Oxford, the Francis Crick Institute, the Wellcome Sanger Institute and PHE. Many of these collaborations include partners in Africa, Asia and elsewhere. Our DHSC research programmes also feature strong partnerships with many UK universities – for example, with the Universities of Oxford and Kent on the Quality, Safety and Outcomes Policy Research Unit, and with the eight universities in the National School of Public Health Research.

4.1.6. Evaluation of collaborations

Our indicators of success for our research collaborations around the world include awards, discoveries, citations, strengthened capacity and impact on policy and practice. Examples include:

- Major programme grants such as the ESRC GCRF programme to build research capacity and generate knowledge to support preparedness for and response to humanitarian crises and epidemics. Sierra Leone's College of Medicine and Allied Health Sciences and Lebanon's American University of Beirut are partners in this programme. We have also been involved in six of the 12 UKRI GCRF Interdisciplinary Research Hubs.
- Significant discoveries, especially in the control of infectious diseases such as malaria, TB, trachoma and vaccines (see section 1.3)
- High citation rates for our published outputs with partners, as illustrated by the Category Normalized Citation Impact (CNCI) for our top five partnerships in South Africa during the 2014-2020 period:
 - University of Witwatersrand: 682 publications, CNCI of 6, 10% of papers in top 1%
 - University of Cape Town: 642 publications, CNCI of 8, 13% of papers in top 1%
 - University of KwaZulu Natal: 309 publications, CNCI of 15, 18% of papers in top 1%
 - Stellenbosch University: 294 publications, CNCI of 14, 19% of papers in top 1%
 - South African Medical Research Council: 247 publications, CNCI of 18, 22% of papers in top 1%
- Strengthening of research capacity in key locations – as illustrated, for example, by how decades of collaborative research in Zambia have resulted in a well-established non-governmental local research institution, Zambart, which undertakes high-quality science with local and global impact. In 2017 Zambart began a restructuring process with an explicit commitment to decolonisation and developing Zambian leadership, with Bond moving to a mentoring and technical support role. It now has a new mission statement and organisational structure, a new board of directors, an executive leadership team, a seven-pillar strategic research plan and improved support and communication for all staff.
- Impact on policy and practice: 85% of our UOA2 case studies draw on research produced through our overseas partnerships.

4.2. Collaboration with external organisations, including health services, industry and government bodies

We have developed productive and valuable links with partners in government and its executive agencies, the NHS, PHE and local authorities, industry and charities. For example:

- The government-funded UK Public Health Rapid Support Team and NIHR Health Protection Research Units are jointly run with PHE.
- LSHTM is a member of UCLPartners, providing valuable links into the local NHS.
- MRCCG works closely with the Gambian Ministry of Health, providing medical care to the general public in Fajara and Keneba and contributing to policy development. This collaboration contributes to the local population's wellbeing while also supporting the Unit's research studies.

- MRCU has worked closely with the Ugandan Ministry of Health and the country's AIDS control programme since 1988. Its clinics provide health services both locally and to study participants, as well as HIV voluntary counselling and testing services for the general public.
- We contribute expertise to the Coalition for Epidemic Preparedness Innovations, which brings together government, industry, philanthropy and universities to finance and coordinate vaccine development.
- LSHTM is a founding partner in the Vaccines Manufacturing Innovation Centre (see section 1.2.2). Commercial partners including Janssen Vaccines & Prevention BV, Merck Sharp & Dohme and GE Healthcare provide additional funding and support.
- LSHTM's Arthropod Control Product Test Centre (ARCTEC) is a partner to multiple research and development programmes, including testing and evaluating commercial vector-control products in Brazil and Cambodia in 2019.
- LSHTM's collaborations with charities are extensive. For example, we have provided technical support in hygiene and disease prevention in disaster zones, working with NGOs such as Médecins Sans Frontières, Action Against Hunger, See Change and Beyond Conflict. Domestically we have worked on evaluating school-based relationships and sexual health interventions with NSPCC and the National Children's Bureau, and on developing HIV health promotion strategies with the Terrence Higgins Trust and National AIDS Trust.

4.3. Relationships with key research users

The table below summarises our key research users and the areas in which they have enriched our research environment. We provide specific evidence on our advisory roles in section 4.8.

Main global users/beneficiaries	Key research areas
Governments in LMICs; regional agencies (e.g. Africa Centres for Disease Control and Prevention)	Disease control; maternal, adolescent, newborn and child health; nutrition; mental health; health policy; health systems; climate change and health
International agencies (e.g. WHO; UNICEF; UNAIDS; UNDP; Global Fund to Fight AIDS, TB and Malaria; PEPFAR; UNITAID; Gavi Alliance; International Organization for Migration)	Vaccines; maternal, newborn and child health; sexual health; global mental health; HIV, TB, malaria and other infectious diseases; violence against women; universal health coverage; health needs of trafficked women
World Bank and regional development banks	Hygiene promotion; universal health coverage; evaluation methods
European agencies (e.g. EU; European Centre for Disease Prevention and Control)	Cancer policy; financing and organisation of health services and systems; impact of patient mobility for healthcare; vaccine confidence; infectious diseases surveillance and control
Bilateral aid agencies	Infectious diseases; maternal, newborn and child health; nutrition; mental health
Industry (e.g. pharmaceuticals; pesticides; clothing)	Clinical trials; insecticide development and testing; malaria prevention
Major NGOs (e.g. Médecins Sans Frontières; Sightsavers; Action Against Hunger)	Eye health; disability; health provision in humanitarian crises; mental health; COVID-19

Main UK users/beneficiaries	Key research areas
DHSC; NHS England; PHE; NICE; Royal Colleges of Surgeons, Obstetricians and Gynaecologists, Faculty of Public Health; the Intensive Care National Audit and Research Centre; No.10, Cabinet Office, Department for Education	Vaccines; pandemic influenza; COVID-19; cancer; smoking cessation; sexual health; alcohol and drugs; obesity; quality of care; NHS reforms; healthcare commissioning; climate change; heatwave and cold weather plans; cost-effectiveness of new drugs and technologies; pharmacoepidemiology; national surgical audits; evaluation of service innovations
FCDO	Malaria; newborn health; neglected tropical diseases; nutrition; agriculture and food systems; family planning; disability; health systems; trafficking and modern slavery
Other government departments (e.g. Home Office; Education; Energy and Climate Change; Environment, Food and Rural Affairs; Transport; Food Standards Agency, House of Commons; Scientific Advisory Group for Emergencies)	Crime and mental health; health needs of trafficked women; urban regeneration and health; transport and wellbeing; housing, insulation and health; food supplements and organic foods; COVID-19; humanitarian crises; children and young people's mental health
London Mayor's Office; Transport for London; specific London boroughs	Transport and wellbeing; obesity; evaluation methodology; promoting health in schools
UK industry	Vaccines; handwashing with soap; insecticide development and testing; phone app for eye testing
Health management and policy think-tanks: Nuffield Trust; King's Fund	Healthcare commissioning; primary care organisations; performance of NHS across UK; rating hospitals
Charities (including development and human rights charities)	HIV prevention; sexual health; maternal, newborn and child health; alcohol abuse; health needs of victims of trafficking and modern slavery; healthcare financing

4.4. Wider contributions to economy and society

We provide here two examples of contributions to the economy and society. While they do not readily lend themselves to impact case studies, they exemplify how LSHTM makes a critical contribution to issues beyond the health sector.

Climate change and planetary health

Climate change and planetary health represent a major priority for LSHTM in terms of both research and operational sustainability (see section 3.3). Launched in 2019, the Centre on Climate Change and Planetary Health built on more than 25 years of our work in the areas of healthy and sustainable cities, infectious diseases and food systems. Our research has explored and publicised climate change mitigation and its health benefits.

For example, Haines chaired the Rockefeller Foundation/*Lancet* Commission on Planetary Health, published in 2015, and co-chaired the development group for the Health Knowledge Action Network of Future Earth in 2014-2015. Green advised Parliament on the UK's first nationwide citizens' assembly on climate change in 2019.

The Centre co-hosted an event with WHO at COP25 in 2019, and in the same year Dangour served as Specialist Adviser to the UK Government's Environmental Audit Committee for its inquiry on planetary health. Released by the House of Commons, the resulting *Our Planet, Our Health* report – to which Haines, Watts and Heffernan also contributed – highlighted the extent to which climate change could affect health and wellbeing in the UK and warned that high dependency on imported fresh food, coupled with failure to act on climate breakdown, could risk national food security.

Gender violence

LSHTM has made significant contributions to knowledge on violence against women. Watts played a central role in designing and implementing the WHO Multi-Country Study on Women's Health and Domestic Violence, which involved population-based studies in 10 countries and was the first research to provide comparable data on the prevalence of violence against women and intimate partner violence.

The data have since been widely used to advocate urgent steps to address this issue as part of the global health agenda. The worldwide estimate of 'one in three' has mobilised millions of pounds' worth of resources to combat the problem, and domestic violence is now regarded as one of the top 10 risk factors for poor health in women. The methods and ethical/safety recommendations for research in this field have been used in national surveys in more than 37 countries, and evidence on effective prevention interventions has led to an increased focus on such initiatives globally. As Chief Scientific Adviser and Head of Research at DFID, and now at FCDO, Watts has continued to demonstrate strong leadership in shaping policy on gender and supporting the UK Government's work on safeguarding.

WHO guidelines and implementation tools for studying violence against women, based on LSHTM's research, have been taken up and adapted in many LMICs and have influenced policies and programmes across countries and organisations. For example, PEPFAR and UNAIDS have begun considering violence against women as an important driver of HIV among young girls.

4.5. Engagement with diverse communities and publics

LSHTM engages with diverse, hard-to-reach communities all over the world to address inequalities in health. Examples include:

- The International Centre for Disability at LSHTM was awarded £7m of FCDO funding to identify which interventions should be implemented to improve the wellbeing of people with disabilities in LMICs and support policymakers to make evidence-based decisions on issues including poverty, health, education, stigma and discrimination. The project works closely with people with disabilities and organisations that support them and has established an International Disabled People Advisory Committee – comprised primarily of persons with disabilities from LMICs – to advise the research team.
- LSHTM's Sigma project specialises in social research into lesbian, gay, bisexual, trans, queer and intersex communities' sexual health and wellbeing. Specific programmes of research have focused on HIV and STI prevention in men who have sex with men (MSM), including practices relating to chemsex in South London and multi-method studies investigating HIV self-testing strategies for MSM. This research has informed the national MSM HIV health promotion strategy.
- The East London Project engaged with sex workers to determine how removing law enforcement practices against sex work could affect safety, health and access to services in

Hackney, Newham and Tower Hamlets. Current and former sex workers, members of sex worker organisations and sex work projects were involved in designing and conducting the study.

- Harris's NIHR Career Development Fellowship was the first study in the UK to investigate the barriers and facilitators to skin and soft tissue infection care for people who inject drugs. Community engagement with people who inject drugs and the charities supporting this group was crucial to the project's success. This work has led to the promotion of skin and soft tissue care and guidance on safer injecting practices.

4.6. Contribution to sustainability of discipline, support for interdisciplinary research, responsiveness to national and international priorities

LSHTM makes an essential contribution to sustaining disciplines critical to global health. A case in point is the expertise contained within the MRC International Statistics and Epidemiology Group (ISEG), which initiates epidemiological research and provides statistical expertise for projects in resource-poor settings.

ISEG has a specific focus on strengthening capacity in epidemiology and medical statistics. This includes its long-running flagship Fellowship Programme for African students to undertake LSHTM's MSc in Medical Statistics, followed by a year's work as a statistician at a collaborating institution in Africa, plus ongoing mentorship.

LSHTM has also been the locus of developments in the interdisciplinary field of health systems and policy research. Originating in Mills' work to build our own capacity and support international initiatives, this is now a well-established field of research across LMICs.

In 2016, reflecting her contributions, Mills received the inaugural lifetime service award from the Alliance for Health Policy and Systems Research. In 2019 she was appointed Chair of the NIHR Global Health Policy and Systems Research funding committee. Along with Gilson and Balabanova, she has also served as a board member of Health Systems Global, founded in 2012 to promote health policy and systems research. LSHTM researchers and LMIC partners have made major contributions to the success of the joint FCDO, MRC, ESRC and Wellcome Health Systems Research Initiative funding stream.

As shown in section 1, LSHTM has been agile in responding to national and international priorities such as Ebola, Zika and COVID-19. Our modellers have mobilised in response to the last of these, with Medley (Professor of Infectious Disease Modelling), for example, chairing the Scientific Pandemic Influenza Group on Modelling (SPI-M). The MRC Units were at the forefront of stepping up the COVID-19 response locally, offering their labs and expertise to boost national testing capacities and thereby proving critical to contact-tracing and quarantining efforts; they continue to monitor the outbreak in population samples from across Africa, using machine learning to provide real-time analyses of its evolving biology.

The SDGs provide another example of LSHTM's responsiveness to international priorities. On average, according to bibliometric analysis, LSHTM researchers have contributed around 600 papers a year with content relevant to the SDGs. Many of our academics helped develop SDG targets, including Curtis (water and sanitation), Haines (climate change), Lawn (neonatal, child and adolescent health) and Mills (universal health coverage).

For example, MARCH contributed to the first newborn target and multi-country case studies with Countdown to 2030, a collaboration to improve the scale and scope of measurement, evaluation and programming strategies for the SDG 2030 targets. In the first five years of the SDG era, to 2020, MARCH produced new systematic literature reviews and epidemiological estimates, many with the UN. The Centre also provided innovative methods for tracking donor funding.

4.7. Encouraging reproducibility

LSHTM hosts 3ie, the International Initiative for Impact Evaluation, which produces, synthesises and quality-assures rigorous evidence on development effectiveness. In 2012 3ie initiated a replication stream of work, in which LSHTM researchers have participated during the assessment period.

For example, in 2015 Hargreaves and colleagues carried out a replication analysis of Nobel laureate economist Kremer's influential study on the impacts of school-based deworming. The analysis identified important differences in some areas of interpretation. This led to high-profile debate about issues such as the importance of replication studies, differences in evidence appraisal between disciplines and the evidence-base for mass school-based deworming.

4.8. Wider influence, contributions and recognition of UOA2 staff in the assessment period

4.8.1. Honours, awards and prizes

Honours, awards and prizes received by LSHTM staff during the assessment period included the following:

- *UK honours*: DCMG – Mills; CMG – Watts; Knight Bachelor – Black; OBE – Edmunds; Honorary OBE – Checchi
- *Election to Learned Societies*: FRS – Peto; Academy of Medical Sciences – Watts, Smeeth, Lawn, Edmunds, Weiss; Fellow of the Academy of Social Sciences – Wellings; National Academy of Medicine, USA – Watts, Jewell, Lawn
- *Awards and prizes*: MRC Millennium Medal – Greenwood; Galen Medal – Mills; WHO Europe Regional Director's Award for Health – McKee; Faculty of Public Health's Bazalgette Professorship Champion of Evidence Award – I Roberts; Alliance for Health Policy and Systems Research Award for Lifetime Service in Health Policy and Systems Research – Mills; Royal National Institute of Blind People Lifetime Achievement Award – Gilbert; George Macdonald Medal by the Trustees of the Royal Society of Tropical Medicine and Hygiene – Kirkwood; Peter Wills Medal by Research Australia – Mullholland; Jules Francois Golden Award by International Council of Ophthalmology – Gilbert; inaugural UK Faculty of Public Health Global Public Health Award – Allemani; World Congress of Optometry Paul Berman Young Leader Award – Morjaria; Rolex Award for Enterprise – Bastawrous; Order of Australia Medal – S White; L'OCCITANE Sight Award – Gilbert; George Macdonald Medal, awarded jointly by LSHTM and the Royal Society of Tropical Medicine and Hygiene – Hayes and Peeling; Edwin Chadwick Medal – Cairncross; Faculty of Public Health Alwyn Smith Prize – McKee; ESRC Outstanding International Impact Prize – Parker, Chandler and Martineau; Queen's Anniversary Prize for Higher and Further Education – LSHTM

4.8.2. Fellowships

There were 94 competitive fellowships and personal awards to UOA2 staff during the assessment period, including the following:

- *MRC*: Clinical Research Training Fellowship – Telisinghe, Candler; Skills Development Fellowship – Diaz-Ordaz, Cornelsen, Greco, Lepine, Kreif, Flint, Lopez-Bernal, Smith, Root, Keogh, Davey, Lewis, McCreesh, Morgan, Knight, Page, Cowling, Fearon, Courtin, Leyrat; Career Development Award – Cornelsen; African Research Leader (with DIFD) – Kinyanda
- *ESRC*: UBEL Postdoctoral Fellowship – Calvert, Miller, Hartwell; Policy Engagement Fellowship – Oliver
- *UKRI*: Rutherford Fellowship – Eggo, Forbes, Minassian; Future Research Leader – Keogh, Afolabi
- *British Academy*: Mid-Career Fellowship – Beattie

- *Royal Society*: Dorothy Hodgkin Fellowship – Lowe; Future Leaders African Independent Research Fellowship – Tientcheu
- *British Heart Foundation*: Immediate Fellowship – Wong
- *NIHR*: Doctoral Research Fellowship – Aggarwal, Johnson, Leurent, Wallace, Pettigrew, Parry, Bhate, van Schalkwyk; Clinical Doctoral Research Fellowship – Hartwell; Postdoctoral Research Fellowship – Herrett; NIHR Career Development Award – Harris; Advanced Fellowship – Aggarwal
- *Wellcome*: Sir Henry Wellcome Fellowship – Harron, Sinnott, Mathur, Brady, Harris-Fry, Thomas, Cruz, Lohmann; Sir Henry Dale Fellowship (with Royal Society) – Bhaskaran, Daniel, Kucharski, Flasche, Diaz-Ordaz, M Cairns; Senior Research Fellowship – Langan, Kinyanda, Funk, A Scott, Bhaskaran; Principal Research Fellowship – Patel; Clinical Research Training Fellowship – Bhopal, Brotherton, Smith, Wedderburn; Postdoctoral Research Training Fellowship for Clinicians – Price; Clinical Research Career Development Fellowship – Seale; Intermediate Clinical Fellowship – Warren-Gash; Wellcome Society and Ethics Research Fellowship – Boccia, Walters, Murphy, Thompson, Bonnington, Wardle, Weston, Elizabeth, Kovacs; International Training Fellowship – Jobe; International Intermediate Fellowship – Fatumo; Investigator Award in Medical Humanities – Gorsky, Mold
- *ERC*: Starting Grant – Stoeckl, Atkins, Houben; Consolidator Grant – Allemani; Advanced Grant – Pearce

4.8.3. Research grant committees

There were at least 67 instances of service on research grant committees during the assessment period, including the following:

- *MRC*: Applied Global Health Research Board – Mills, Chibanda; Infections & Immunity Board – Weiss, Hayes; Population & Systems Medicine Board – Pearce, Leon (Chair); Methodology Research Programme Panel – Sharples, Carpenter; Public Health Intervention Development Panel – Hayes (Deputy Chair), Seeley; Health Systems Research Initiative Funding Panel – Mills; Joint Global Health Trials Funding Committee – Graham (Deputy Chair), P Smith; Skills Development Fellowship Funding Panel – Cummins; Clinical Training & Career Development Panel – Diaz-Ordaz; GCRF Foundations Award Panel – Mills; African Research Leader Panel – d'Alessandro; Cross-Board Cohort Advisory Group – Hayes; Population Health Sciences Group – Hayes; Expert Steering Group for Prevention Research – Smeeth.
- *NIHR*: Global Health Funding Panel – P Smith, Nyirenda; Public Health Research Board – Bonell, Cummins, Egan; Global Health Policy and Systems Research Commissioning Funding Committee – Mills (Chair); Senior Investigators Competition Panel – Mills; Policy Research Programme – Egan (Deputy Chair); Health Technology Assessment Panel – Free; Programme Grants for Applied Research Panel – Khan; Research for Patient Benefit London Regional Advisory Committee – Warren-Gash; Doctoral Research Fellowship Funding Panel – Cummins; Health Services & Delivery Research Programme Funding Board – Mays; Policy Research Programme Expert Commissioning Group for COVID-19 System Recovery – Mays, Petticrew, Nolte
- *UKRI*: Future Leader Fellowship Panel – Weiss; Steering Group for AMR Funding Strategy – Chandler; Joint COVID-19 Rapid Response Call Expert Panel (with DHSC) – C Roberts, Mays
- *ESRC*: Centres Competition Panel – Sear; Innovations in Social Care – May; Social Care Research Centre Panel – May
- *Wellcome*: Biomedical Resources Committee – Smeeth; Longitudinal Population Studies Committee – Smeeth; Science Strategy Advisory Group – Mills; Early Career Medical Humanities Expert Review Group – Mold; Humanities and Social Sciences Selection Panel – Hanson; Sir Henry Dale Fellowship Interview Committee – Medley; International Interview Committee – Nyirenda; DELTAS Review Committee – Chandler; Wellcome Governor – P Smith (Trustee); India Alliance Grants Committee – Hanson, Whitworth; Population and Public Health Expert Review Group – Weiss

- *Royal Society*: Resilient Futures Challenge-Led Grants Panel – Mills (Chair); FLAIR Future Leaders African Independent Research Fellowships Panel – Greenwood (Co-Chair), Mills, Lawn, Prentice, Whitworth; Rosalind Franklin Award Committee – Lowe
- *EDCTP*: Career Development Fellowship Panel – Weiss, Whitworth, P Smith, Webb; Scientific Review Committee – Adetifa

4.8.4. Advisory roles

There were many examples of UOA2 staff acting as advisers for UK, international and other national agencies during the assessment period; over one hundred are listed below:

UK agencies

- *HM Government*: Scientific Advisory Group for Emergencies – Bonell, Edmunds, Medley, Watts; SPI-M – Medley (Chair), Baguelin, Edmunds, Eggo, Funk, Jit, Jombart, Klepac, Kucharski, Mathur, Fearon, Knight; SPI-B – Curtis, Bonell; other subcommittees and groups – Baguelin, Bonell, Curtis, Edmunds, Eggo, Klepac, Medley, Mathur
- *Care Quality Commission*: Advisory Groups – Black
- *FCDO*: Science Advisory Group – Mills (Co-Chair)
- *DHSC*: Advisory Groups – Sanderson, Nolte; Joint Committee on Vaccination and Immunisation and related sub-committees – A Scott, Edmunds, Smeeth, Flasche, Mangtani
- *House of Commons*: Environmental Audit Committee Specialist Adviser – Dangour; Health and Social Care Select Committee Specialist Adviser – P Allen
- *Medicines and Healthcare Products Regulatory Agency*: Working Groups – Douglas, A Scott, Sharples, Smeeth
- *NHS England*: National Advisory Group on Clinical Audit and Enquiries – Cromwell; Patient Reported Outcome Measures Advisory Group – Black; NHS England New Care Models Evaluation Strategy Working Group – Mays
- *British Heart Foundation*: Smeeth (Trustee); Care Quality Commission Impact and Value for Money Academic Advisory Group – Mays

International, regional and other nations' agencies

- *WHO*: Advisory Groups – Adetifa, Bonell, Cameron, Campbell, Flasche, Free, Goodman, Greenwood, Hanson, Harding-Esch, Mangtani, Mounier-Jack, O'Reilly, Wellings, White, Leon, Rudge, Mills, Filippi, Afolabi, M Cairns, Chandler, Day, Eaton, Edwards, Foster, Hargreaves, Kirkwood, Marchant, Ngufor, P Smith, Houben, Abbas, d'Alessandro, Floyd, Gilbert, Graham, Jit, Larson, Ohuma, Parker, Rice, A Scott, Sweeney, Whitworth, Nolte, Manton; Access to COVID-19 Tools Accelerator COVAX – P Smith
- *UN*: UNICEF Advisory Groups – Tann, Marchant, Cousens; UNAIDS Advisory Groups – Hayes, Rice; World Food Programme School Health Programme Evaluation Steering Committee – Bundy
- *Africa Centres for Disease Control and Prevention*: Working Groups – Brickley, Bower
- *Europe*: Food Safety Authority Working Group on Epidemiological Studies – Pearce
- *Ireland*: Irish Research Council COVID-19 Pandemic international review panel – Mays
- *Canada*: National Advisory Committee on Immunization – Jit

4.8.5. Journal editorships and editorial boards

LSHTM journals include two that lead their fields: *Journal of Health Services Research and Policy* (Editor – Nolte; Associate Editor – Cromwell; Editorial Advisory Board – Mays, Black) and *Health Policy and Planning* (Editors-in-Chief – Mounier-Jack, Wiseman; Section Editors – Spicer, Hargreaves, J Schellenberg, Khan, Goodman; Executive Board Chair – Mayhew).

During the assessment period at least 95 UOA2 staff held Editor, Editor-in-Chief and Section Editor roles, including:

- *BMC: Health Services Research* – Mayhew (Associate Editor), Balabanova (Section Editor); *Infectious Diseases* – Marks (Associate Editor), Tully (Editorial Board); *Medicine* – Jit (Editor); *Women's Health* – Kyegombe (Associate Editor)
- *British Journal of General Practice* – Smeeth (Editorial Board)
- *British Medical Journal Sexual & Reproductive Health* – Free (Associate Editor)
- *Bulletin of the World Health Organization* – P Smith (Editorial Board)
- *Clinical Epidemiology* – Smeeth (Editorial Board)
- *Cochrane Heart Group* – Free (Editor)
- *Health Economics* – Pitt (Associate Editor)
- *Health Policy* – Nolte (Associate Editor)
- *Implementation Science* – May (Editorial Board)
- *International Journal of Drug Policy* – Rhodes (Editor-In-Chief), Harris and McGowan (Associate Editors)
- *International Journal of Epidemiology* – Leon (Editor), Price and Pearce (Editorial Board)
- *Journal of Adolescent Health* – Weiss (Editorial Board)
- *Journal of the Royal Statistical Society* – Sharples (Series A Joint Editor), van Steelandt (Series B Associate Editor), Lewin (Series C Associate Editor)
- *PLOS: Medicine* – Zimmerman (Editorial Board); *Neglected Tropical Diseases* – Marks (Deputy Editor)
- *Philosophical Transactions of the Royal Society* – Sear (Series B Editorial Board)
- *Science* – Sear (Board of Reviewing Editors)
- *Social Science and Medicine* – Courtin (Editorial Board)
- *Social Theory and Health* – Mays (Editorial Board)
- *Transactions of the Royal Society of Tropical Medicine and Hygiene* – Greenwood (Editor-in-Chief)