



Tackling AMR – A Cross Council Initiative

Theme 4: Behaviour within and beyond the health care setting

AMR Theme 4 Large Collaborative Awards (announced in 2017) x7

The focus of the call was to drive forward innovative high quality multi-disciplinary collaborative research to address the broad challenges presented in AMR initiative - theme 4.

AMR Theme 4 Pump Priming Awards (announced in 2017) x12

This call was for small, novel, high risk proposals to address the broad challenges presented in AMR initiative - theme 4. The focus of this call was on research that is potentially transformative, stimulating creative thinking across disciplines.

Links:

<http://www.mrc.ac.uk/research/initiatives/antimicrobial-resistance/tackling-amr-a-cross-council-initiative/>

<http://www.esrc.ac.uk/funding/funding-opportunities/tackling-antimicrobial-resistance-behaviour-within-and-beyond-the-healthcare-setting/>



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**National Institute for
Health Research**

Theme 4 Large Collaborative Grant

Grant Holder	Institution	Title of Award
Dr Clare Chandler	London School of Hygiene and Tropical Medicine	Anti-Microbials In Society (AMIS): a Global Interdisciplinary Research Hub
Co-Investigators	Summary	
<p>London School of Hygiene and Tropical Medicine:</p> <p>Dr Sarah Staedke Dr Coll Hutchinson</p> <p>Infectious Diseases Res Collaboration:</p> <p>Ms Susan Nayiga</p> <p>Ministry of Public Health, Thailand:</p> <p>Dr Komatra Chuengsatiansup</p> <p>Mahidol University:</p> <p>Dr Luechai Sringernyuang</p>	<p>Our use of antibiotics has escalated. We are often most aware of antibiotic use when we treat infections - for people, and animals. However, their use is more widespread. We use them routinely to reduce risks of infection amongst people with vulnerable immune systems, in farming livestock, to manage infection and to promote growth and even in crop farming. This widespread use is linked to a rise in antibiotic resistance (AMR). The amount of antibiotic chemicals in circulation is held responsible for driving selection pressure amongst bacteria such that some infections become untreatable with previously effective drugs. This can have dramatic consequences for both health and economics. And yet, scientists have emphasised the lack of evidence for using antibiotics in many scenarios. For example, it is estimated that at least 50% of human antibiotic usage has no clinical benefit.</p> <p>Policy makers are agreed that we must reduce our reliance on these medicines. But how? Efforts to change end user behaviour are often called for but thus far have not had the widespread impacts required to curb the emergence and spread of resistance. In this research, we propose that antibiotics are embedded within our socioeconomic infrastructure in such a deep way that attempts simply to change behaviour of patients, physicians or farmers are peripheral to our underlying dependency on their use. We suggest that by understanding the ways in which antibiotics are intertwined with our lives, institutions and infrastructures today we may identify ways to replace their use while minimising unintended consequences. For example, attempts to reduce use of one antibiotic often increases the use of another. Removing antibiotics all together may require a more systemic intervention such as the promotion of recovery time. In so-doing, however, other consequences could occur for the workforce and for economies tied up with pharmaceutical production and sales. We need to look closely at measures that have already been taken to reduce antibiotic use and understand what their consequences have been, as well as play out potential new interventions in different settings. If we are able to identify effective measures to reduce reliance on antibiotics in different scenarios, this will be more cost effective and timely than one-size-fits-all efforts to change end user behaviour.</p> <p>The issue of AMR is global, and is expected to have most severe consequences for low and middle income countries (LMICs). The need to reduce use of antibiotics in these settings presents a particular challenge, where markets fill the gaps of fractured health systems. An access-excess balance is described whereby many in need of antimicrobials remain untreated while these medicines are commonly used unnecessarily. This scenario persists despite decades of research and programmes into the rational use of medicines in LMICs. New approaches are needed to uncover the significance of antibiotics in our societies, to understand why the imperative to target their use so difficult to enact.</p> <p>This project presents a fresh approach beyond the traditionally delineated domains of social, biological or clinical sciences. The project aims to launch the AMIS Hub, an internationally recognised centre of excellence for developing, implementing and disseminating high quality research on antimicrobials in society, and two initial studies in Thailand and Uganda with the following objectives:</p> <ol style="list-style-type: none"> 1. To understand the roles of antibiotics in every-day life and infrastructure 2. To evaluate the impact on care of imperatives to restrict antibiotics 3. To identify and rehearse counterfactuals to antibiotic use 	

This project will generate a critical mass of researchers undertaking high quality research into AMR, high quality comparative evidence indicating the nature of our reliance on antibiotics and recommendations for alternatives to antibiotics that will minimise unintended consequences.

Theme 4 Large Collaborative Grant

Grant Holder	Institution	Title of Award
Professor Andrew Hayward	University College London	Preserving Antibiotics through Safe Stewardship: PASS

Co-Investigators	Summary
<p>University College London:</p> <p>Dr Spiros Denaxas Professor Nick Freemantle Professor Rob Horne Professor James Thomas Dr Louise Atkins Professor Susan Michie Dr Laura Shallcross Mrs Ellen Fragaszy Dr Jennifer Mindell Dr Patty Kostkova</p>	<p>Since the discovery of Penicillin in the 1940s, antibiotics have transformed our ability to treat bacterial infections allowing us to live healthier, longer lives. However, we have been overusing antibiotics for decades to treat mild infections that would usually get better on their own. This overuse makes bacteria evolve so that they can survive the effect of an antibiotic making infections much harder to treat. If we are to preserve antibiotics for the future, we need to make sure that they are used carefully and not wasted. This careful use of antibiotics, making sure that those who need them can benefit but that they are not over-used is known as "antibiotic stewardship". This proposal will provide the information necessary to design approaches that can support safe antibiotic stewardship.</p>
<p>University Hospitals Birmingham:</p> <p>Dr Elaine Hardy</p>	<p>In the first set of studies, we will measure how the public and healthcare professionals use antibiotics in the United Kingdom. We will invite people to take part in a survey called "Bug Watch." This survey will allow us to measure what different people usually do when they get common infections, for example, whether or not they visit their GP, take an antibiotic or take some other treatment. We will also use electronic patient records from a range of health settings to understand how healthcare staff are using antibiotics in general practice, hospitals and nursing homes for the elderly. Whenever we analyse medical records, they will be anonymous such that we cannot tell whose records they are. In addition to measuring how healthcare staff use antibiotics, the analyses will allow us to understand better which patients most need antibiotics to prevent complications of infection and which patients can safely not use antibiotics. Scientists who are experts in the use of electronic health records will lead this work.</p>
<p>University of Leicester:</p> <p>Dr Carolyn Tarrant</p>	<p>In the next set of studies, we will interview members of the public, patients, parents, doctors and other healthcare staff to provide a deeper understanding of what influences decisions about antibiotic use. The interviews will focus on the aspects of prescribing identified as needing improvement in the earlier work. We will also visit GP practices, nursing homes and hospital wards to observe how healthcare staff use antibiotics. The science of behaviour change allows us to understand human behaviour and how best to change this. Scientists who are experts in studying health behaviour will lead this work.</p>
<p>Royal College of Art:</p> <p>Mr Jonathan West</p>	<p>A large number of studies have already tested different approaches to reducing unnecessary antibiotic use. We will summarise these studies to show what has worked in the past. We will use behavioural science theory to explain why some attempts to reduce prescribing have been successful while others failed.</p>
<p>London Scholl of Hygiene and Tropical Medicine:</p> <p>Professor Liam Smeeth</p>	<p>Our detailed analyses of how and why we use antibiotics in different settings and of what has worked in the past will help us design new combinations of approaches that can be used to improve antibiotic use across the community and health service. We will develop these new approaches to antibiotic stewardship in partnership with patients, members of the public and healthcare staff. We will also design studies to find out how well these new strategies work.</p>
<p>Queen Mary, University of London:</p> <p>Dr John Robson</p>	<p>We will work with designers to develop a website to explain the results of our work and to act as a practical tool to help the public, health care staff and health service planners improve antibiotic use.</p>
<p>National Centre for Social Research:</p> <p>Ms Anne Conolly</p>	<p>The work, which involves scientists from many different backgrounds, will provide excellent opportunities for training young researchers. These scientists will increase our future ability to tackle the growing problem of antibiotic resistance.</p>

Theme 4 Large Collaborative Grant

Grant Holder	Institution	Title of Award
Professor Henry Buller	University of Exeter	Diagnostic innovation and livestock (DIAL): towards more effective and sustainable applications of antibiotics in livestock farming

<p>Co-Investigators</p> <p>University of Exeter: Professor Steve Hinchliffe</p> <p>University of Bristol: Dr Kristen Reyher Professor David Barrett</p> <p>University of Edinburgh: Professor Joyce Tait Dr Ann Bruce</p>	<p>Summary</p> <p>The widespread use of antibiotics in livestock farming, in many circumstances, increasingly serves as alternative to the diagnosis, targeted treatment and prevention of disease in individual animals, flocks and herds. Relationships and practices between diagnosis, prescription, treatment and prevention have become stretched to the point of rupture, a rupture thrown into sharp focus by the issue of AMR. Better, smarter, more rapid and more accessible diagnoses, driven by a shift in the behaviours and conditions associated with diagnostic decision making (whether performed in the laboratory or at the point-of-care by veterinarians or farmers) represents a critical step to delivering a more effective and sensible use of antibiotic medicines in animal health. Improvements in diagnostic development and practice, however, and in their relationship to prescription and treatment, require social, governance and technical innovations, understanding the parameters and conditions of which demands urgent research. In this proposed research, we ask: "What needs to be in place to develop better conditions for a diagnostic-led approach to animal care and treatment?"</p> <p>This interdisciplinary research team will work with and draw from original, empirically driven information, understanding and analysis from diagnostic tool developers and regulators, veterinary practices and professional bodies, farmers and treatment, decision makers, veterinary laboratories, the food industry and government regulatory authorities to develop durable and innovative strategies for facilitating and advancing smarter approaches to the use of antibiotics in agriculture.</p> <p>We aim to collaboratively generate, evaluate and analyse behaviours and strategies in the practice and governance of animal disease diagnosis, and to show how innovation in the development of diagnostic tools and methods in diagnostic practice along with diagnostic regulation and governance can lead to more sensible use and prescription of antibiotics in animal farming. To do this, we will assess current diagnostic and treatment decision practices in the UK. We will generate understanding of the current development of, market for, and regulation of new and innovative diagnostic tools and technologies. Working with veterinarians, diagnostic developers, farmer and regulators, we will identify pathways and possibilities for improved diagnostic practice and, with partner veterinary practices, will trial new diagnostic tools on a series of farms. We will conduct pilot and capacity-building research in Tanzania, where the relative absence of robust national-level institutions and governance structures for the management of animal disease creates a different context for the coherent stewardship of antibiotic practice and diagnostic use.</p> <p>We will assess the adaptability and responsiveness of the different production sectors (poultry, pigs and cattle), along with a variety of veterinary structures, to the trialled innovations in diagnosis and diagnostics, and will determine the likely benefits of these innovations for prescription practice, for animal health and for livestock production. We will evaluate the implications these innovations will have for the organisation, cost-effectiveness and efficiency of veterinary practice, as well as for veterinary training. We will identify the changes in behaviour, practice and knowledge necessary to accompany the more widespread adoption of novel and innovative practices that are deemed effective. We will assess the regulatory and governance support necessary to see the adoption and use of innovative diagnostic practices. With our project partners, we will develop detailed strategies for the improved use of diagnostic tools and practices to enable more effective and sensible use of antibiotics in livestock agriculture.</p>
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Theme 4 Large Collaborative Grant

Grant Holder	Institution	Title of Award
Dr Charis Marwick	University of Dundee	Understanding and improving antimicrobial prescribing in care homes: a multidisciplinary approach
<p>Co-Investigators</p> <p>University of Dundee:</p> <p>Professor Peter Donnan Professor Bruce Guthrie Dr Suzanne Grant</p> <p>Queen's University of Belfast:</p> <p>Professor Carmel Hughes</p> <p>City, University of London:</p> <p>Professor Jillian Francis Dr Fabiana Lorencatto</p>	<p>Summary</p> <p>Bacteria that cause common infections are becoming increasingly resistant to currently available antibiotics. Antibiotics are essential in modern healthcare but their use drives the development of resistance as bacteria develop ways of surviving their effects. Previous research has found that antibiotics are often used when they are not needed, which increases the development of resistance in bacteria. Older people living in care homes are prescribed many more antibiotics than average and as a result often get antibiotic resistant infections later, which are then harder to treat. The amount of antibiotics used in different care homes varies a lot but we don't really know why. Most research on finding ways to safely reduce antibiotic use has been carried out in hospitals or GP surgeries rather than care homes. There is general agreement that antibiotic use in care homes could and should be safely reduced. However, to design effective approaches to reducing antibiotic prescribing for care home residents we need to understand more about how, when and why they get prescribed, from the perspectives of nurses, carers, GPs, and residents and their relatives. Researchers with different areas of expertise will work together in a four-stage project:</p> <ol style="list-style-type: none"> 1. Measuring patterns of antibiotic use (epidemiology): We will analyse information on antibiotic prescribing and antibiotic resistance for all care home residents in two Scottish health board regions. As well as examining the link between antibiotic prescribing and later antibiotic resistance, this will help us better understand how common antibiotic use is, which residents are prescribed, and variation in prescribing between care homes. This information will also be used to invite care homes with different patterns of antibiotic use to participate in the next stages of the project. 2. Understanding how and why antibiotic prescribing happens in different care homes (sociology and social anthropology): We will work with staff, GPs, residents and relatives in eight care homes. We will observe how staff and GPs work together and react to residents being unwell, and how this leads to antibiotic prescribing. We will also interview staff, GPs, residents and relatives to understand how the way the care home and general practices are organised influences the care different residents receive. This will help us identify new approaches to improving antibiotic prescribing decisions. 3. Identifying staff behaviours that could be changed to reduce antibiotic prescribing (health psychology): We will also carry out more focussed interviews and questionnaires to find out specific reasons why carers, nurses and GPs perform certain actions, and investigate what might encourage or discourage these actions. For example, what causes a nurse to phone a GP to request a prescription for a resident? Why might the GP sometimes write a prescription without reviewing the patient first? This will help us identify specific changes in behaviour which could improve antibiotic prescribing decisions. 4. Creating and testing new approaches to changing antibiotic prescribing (intervention development and testing): We will use all the information from the first three phases, and evidence from other situations (e.g. hospital or GP antibiotic studies) to create an intervention that we will try out in a small number of care homes to see if it is acceptable to staff and residents, and whether it is feasible to do alongside normal work. The intervention will include different elements, such as education for care home staff and GPs, and feedback about how many antibiotics are being used in each care home. At the end of the study, we will have created new and useful knowledge about antibiotic prescribing and its consequences in care homes, but we will also have pilot-tested a new intervention. The next stage of our research programme will be testing it in a large-scale trial to see if it 'works'. 	

Theme 4 Large Collaborative Grant

Grant Holder	Institution	Title of Award
Professor Alison Grant	London School of Hygiene and Tropical Medicine	Infection prevention and control for drug-resistant tuberculosis in South Africa in the era of decentralised care: a whole systems approach
Co-Investigators	Summary	
<p>London School of Hygiene and Tropical Medicine:</p> <p>Professor Janet Seeley Dr Richard Lessells Dr Anna Vassall Dr Richard White Dr Rein Houben Dr Nicky McCreesh</p> <p>Queen Margaret University Edinburgh:</p> <p>Dr Karina Kielmann</p> <p>University of Cape Town:</p> <p>Dr Christopher Colvin</p> <p>Institute of Development Studies:</p> <p>Dr Hayley MacGregor</p> <p>University of KwaZulu-Natal:</p> <p>Dr Anna Voce Dr Alexander Pym</p> <p>University College London:</p> <p>Dr Tom Yates</p>	<p>Drug-resistant tuberculosis (DR-TB) is a major threat to global public health, causing one in four estimated worldwide deaths attributable to antimicrobial resistance. In South Africa, DR-TB transmission within clinics, particularly to HIV-positive people, is well-documented. Most TB transmission happens before people start TB treatment, but DR-TB transmission may continue after treatment is started, raising concern as DR-TB services in South Africa are decentralised from hospitals to primary care clinics. The extent to which exposure in clinics, as compared to other community settings, drives ongoing transmission of DR-TB requires better definition, to mobilise necessary resources to address this problem. Guidelines for clinics concerning infection prevention and control (IPC) measures to reduce DR-TB transmission are widely available. There is ample evidence that recommended measures are not put into practice, but limited understanding of the reasons. A comprehensive approach to understanding barriers to implementation is required to design effective IPC interventions for DR-TB.</p> <p>Failure of IPC measures for DR-TB is often attributed to health care workers (HCW) failure to adhere to guidelines. Cognisant that HCW are part of a health system with specific organizational features, we examine how the health system as a whole supports IPC measures. We investigate the biological, environmental, infrastructural, and social dynamics of DR-TB transmission in clinics in two provinces in South Africa (KwaZulu-Natal and Western Cape). Our aim is to provide evidence for effective ways to improve IPC for DR-TB, addressing not only behavioural factors, but also the ways in which clinic space, infrastructure, work and patient flows are managed, and a rights-based occupational health ethos might be cultivated.</p> <p>Our innovative approach brings together a team from several scientific disciplines. Taking a 'whole systems' approach, we will use methods from epidemiology, anthropology, and health systems research to understand the context, practice, and the potential for effective implementation of IPC for DR-TB. We will examine how South African policies on IPC for TB have evolved and been implemented. The epidemiological context will be defined by estimating how much DR-TB transmission happens in clinics compared to other community locations. We will estimate the risk of contact between people with infectious DR-TB and other clients within clinics, and separately estimate, among community members, the frequency of social contacts in clinics as compared to other settings where people meet.</p> <p>We will use structured and in-depth qualitative methods to document IPC practice in health clinics: the role of clinic design, organisation of care, work practices, as well as HCW, manager, and patient ideas about risk and responsibility in IPC. In collaboration with key stakeholders, we will use health systems mapping and model-building exercises to visually document the environmental and organizational barriers and enablers to implementing optimal DR-TB IPC.</p> <p>Synthesis of all these data will lead to development of a package of health systems interventions to reduce DR-TB transmission in clinics, adapted to the constraints and opportunities of the South African health system. We will use mathematical and economic modelling to project the potential impact of interrupting clinic-based transmission on community-wide TB incidence, and the consequent economic benefits for health systems and households.</p> <p>In addition to significant academic, policy and programme-relevant outputs, the project will create an interdisciplinary platform for future</p>	

implementation and evaluation of health systems strategies to improve IPC. It will stimulate discussion between researchers working on DR-TB and other drug-resistant infections, and foster greater public awareness of the importance of systems that minimize the risk of airborne infections in health facilities.

Theme 4 Large Collaborative Grant

Grant Holder	Institution	Title of Award
Professor Ann Walker	University of Oxford	Improving the uptake and sustainability of Effective interventions to promote Prudent antibiotic Use in Primary care (STEP-UP)

Co-Investigators	Summary
<p>University of Oxford:</p> <p>Professor Christopher Butler Dr Sarah Tonkin-Crine Dr Sarah Wordsworth Dr Laurence Roope</p> <p>Imperial College London:</p> <p>Professor Alison Holmes Dr Ceire Costelloe Dr Monsey McLeod Dr Benedict William John Hayhoe Professor Azeem Majeed</p> <p>Public Health England:</p> <p>Dr Julie Robotham Dr Susan Hopkins</p> <p>University of Southampton:</p> <p>Professor Michael Moore</p>	<p>Bacteria are increasingly resistant to the antibiotics we use to kill them. This is a major problem for us all. The more we use antibiotics, the more resistant the bacteria become. In England, GPs prescribe about 3/4 of antibiotics used. Most of these prescriptions (about 80%) will not actually benefit the patient but all will help to increase antibiotic resistance.</p> <p>Many ways to help GPs prescribe fewer antibiotics to patients who are unlikely to benefit have been tested. These have included training and strategies like 'back-up' prescriptions for patients to use if symptoms get worse. Many have worked well and GPs using them have prescribed fewer antibiotics. The problem is that GPs not taking part in the research have not started using them, so very little has changed overall.</p> <p>Government policies have also been introduced to give general practices more money if doctors prescribe fewer antibiotics to patients who are unlikely to benefit. This cost millions of pounds, and reduced antibiotic use, but it is not clear how promising extra money actually makes changes happen.</p> <p>When researchers test a new diagnostic tool or training package, they don't just ask whether it works, but how much it would cost the NHS to use widely. Working out 'value for money' balances costs now against benefits and risks in the future. Antibiotics are so cheap (usually under £1 for a course) that most analyses suggest everyone should always get antibiotics. The problem is that we don't have good ways to include the threat that resistance poses in the future in these cost-benefit calculations.</p> <p>This means that we spend time and money looking for new 'magic bullets' to reduce antibiotic prescribing, without getting the most from what we already know can work, but is not used. We need to know why effective strategies aren't used and improve them so they are used regularly in every-day care.</p> <p>This project aims first to understand in more detail how the strategies that previous studies have shown reduce antibiotic prescribing worked. We need to do this because 'common sense' ideas are often wrong: different people react in different ways to the same situation and what researchers think is going on is often not the case. This will help us come up with ways to make existing strategies more attractive and easier to use every day. These will increase their uptake across England, meaning we can continue to reduce unnecessary antibiotic use and the threat of antibiotic resistance.</p> <p>We will investigate 4 different, carefully chosen, areas.</p> <ul style="list-style-type: none"> - Incentivising general practices: evaluating an England-wide policy to pay general practices to reduce unnecessary antibiotic use - Changes to the system: exploring 'delayed prescribing' where GPs give a prescription that patients can 'cash-in' if their symptoms get worse - Improving GPs communication skills: investigating ways to help GPs explain to patients when antibiotics are not needed - Better-informing decision-makers: assessing how we balance the health and cost impact of antibiotic use now vs resistance in the future, and how we determine cost-effectiveness of changes in antibiotic use <p>In each area, we will run detailed studies to find out what the barriers are to using effective strategies, and work out ways to overcome them. These will include studies with clinical commissioning groups, with GPs, nurse prescribers, practice managers and patients. We will then develop ways to improve strategies, in partnership with different types</p>

of healthcare professionals and patients. We will test these enhancements in an implementation study. We will also develop and apply new economic evaluation research methods to assess value for money.

Our team covers expertise in health psychology, health economics, biostatistics, primary care, pharmacy and clinical epidemiology. It also provides the opportunity for younger researchers to take leadership roles whilst being supported by more experienced colleagues.

Theme 4 Large Collaborative Grant

Grant Holder	Institution	Title of Award
Professor Alison Holmes	Imperial College London	Optimising antibiotic use along surgical pathways: addressing antimicrobial resistance and improving clinical outcomes.
Co-Investigators	Summary	
Imperial College London: Dr Raheelah Ahmed Professor Franco Sassi King's College London: Dr Nick Sevedalis Mr Andy Leather Professor Ewan Ferlie University of Leicester: Dr Carolyn Tarrant University of Cape Town: Professor Marc Mendelson Dr Mark Ian Hampton Amrita Institute of Medical Sciences: Dr Sanjeev Singh University College London: Dr Suneetha Ramani Moonesinghe University of Hertfordshire: Dr Mohamed Lebcir University of Rwanda: Dr Jules Ndoli Minega	<p>Antibiotics in the right manner is a sure way of preventing infections after surgery. For example Antibiotics are important to prevent infections after several types of surgery. The growing number of infections that cannot be treated with antibiotics may mean that many basic types of surgeries cannot continue. Around the world a large amount of all antibiotics are used during the surgical process. Antibiotics in surgery are used to prevent infections from happening after surgery (it is called 'prophylaxis') and for the treatment of infections after surgery. Infection after surgery is a growing concern in many countries. 23 million infections after surgery (or 'surgical site infections', SSIs) lead to 2 million deaths every year. Using, if the right antibiotics are given at the right time before surgery, then up to seven times less antibiotics are needed after surgery because less people get infections.</p> <p>Aims and objectives:</p> <p>The care before, during and after surgery (inside and outside of hospital) must include using the right antibiotics at the right time for the correct amount of time, making sure that there are no missed or late doses. The wellbeing of patients including nutrition and ability to move about can also affect how quickly they recover if they do get an infection. To get this care right at each stage, a lot of coordination and communication is needed between all the different health professionals (nurses, surgeons, anaesthetists, pharmacists), patients and carers involved. Because so many key parties are involved in this process, it is an ideal place to do research to understand ways of thinking about the correct use of antibiotics and behaviours such as hand hygiene which can prevent infections from happening in the first place. This study will use social science research to find out what helps individuals, teams and patients to practice safely and use antibiotics in the right way as described above.</p> <p>The study will research these issues in England and Scotland as they each have different ways of organising and managing surgery. We will also carry out research in countries where there are less resources but they still manage surgery in the same way (India, South Africa and learning from Rwanda). The studies in countries outside of the UK will also tell us how behaviours can be changed when different health professionals are involved, and when antibiotics are less available within hospitals but also available from other sources.</p> <p>Methods: The study will last four years and will start with an analysis of all factors within and outside of healthcare organisations which may influence how antibiotics are used. The methods we use at the moment to change behaviours of professionals and patients will be evaluated. New methods will also be designed, developed and also evaluated, and may include using new technologies such as computers or smartphones. We may also change the roles and expectations of different professionals within teams or changing the incentives or penalties associated with proper use of antibiotics. Some of these may involve patients and carers taking a more active role.</p> <p>Potential applications and benefits:</p> <p>By understanding the full context where surgery occurs, we will cover aspects of care within and beyond healthcare settings. As we will understand factors such as availability of antibiotics, financial pressures, regulation as well as what patients expect of their healthcare system and professionals, the solutions we will propose will be tailored for each setting. As we will be looking at how professionals, patients and carers behave and use antibiotics, it is likely that the new solutions that we propose would become part of routine practice,</p>	

helping us to keep antibiotics working for much longer.

Theme 4 Pump Priming Award		
Grant Holder	Institution	Title of Award
Professor Steve Hinchliffe	University of Exeter	Production without medicalisation: a pilot intervention in global protein production
Co-Investigators	Summary	
<p>University of Exeter: Professor Charles Tyler</p> <p>University of Edinburgh: Dr Krithika Srinivasan</p> <p>WorldFish Center: Dr Muhammad Meezanur Rahman</p> <p>ARBAN: Mr Arifuzzaman Syed</p>	<p>Global stewardship of existing antibiotics within livestock systems is a key component of any attempt to manage the incidence and transmission of emergent and resistant bacteria, resistance conferring genes and mobile elements. Yet, global demand for animal derived protein is fuelling investment in and intensification of livestock systems with resulting increases in use of veterinary medicines. These systems have until now relied on medicinal and other inputs as infrastructure that permits increased stocking densities and livestock throughput, while reducing morbidity and mortality. In this sense, antibiotics have become a key component of livestock agriculture. Decoupling agriculture from the risks of generating greater antimicrobial resistance is a key challenge addressed in this project.</p> <p>This project focuses on the growing and under-regulated aquaculture (fish and shell fish production) sector within Asia, which is intensifying to meet domestic demand for animal derived protein and worldwide export markets. We aim to assess the growing use of antibiotics within this important sector of global food production, and experiment with farm based medicine stewardship strategies that promote sustainable and appropriate use. The project has implications for food security, food safety, human and environmental (aquatic) health as well as the livelihoods of millions of people.</p> <p>The rapidly growing and intensifying global aquaculture industry (the so-called blue revolution) is known to be a major user of antimicrobials and a key gateway for antimicrobial resistance. Reducing or preventing the escalation of non-therapeutic and unnecessary uses of antibiotics requires social innovations that address path dependencies and the socio-economics of livestock production.</p> <p>Detailed knowledge on the uses and socio-economic drivers of antimicrobial inputs in aquaculture is required in order to</p> <ol style="list-style-type: none"> 1. Minimise the potential risks of aquaculture expansion for human and environmental health. 2. Develop strategies that allow for the prudent use of compounds, particularly where they increase risks of the emergence and transmission of antimicrobial resistance. <p>In this pump-priming project we seek to investigate variability in use of antibiotics and AMR-related inputs within aquaculture, and devise a strategy that encourages appropriate and alternative animal health treatments. We focus on the effective stewardship of antibiotics within the rapidly growing, poorly regulated and heterogeneous shrimp and prawn sectors in Bangladesh.</p> <p>The project involves development of a partnership between UK and Bangladeshi expertise, and involves social scientists, biologists, aquaculture and rural development experts in order to understand the drivers of antibiotic uses and to cooperatively develop with farmers interventions for developing more appropriate treatments and disease abatement strategies. The project will survey shrimp and prawn farmers and hatcheries to develop clear understanding of the relationship between farm inputs, farm sizes and value chain characteristics. This information will be augmented with more detailed interview data with farmers, farm suppliers (those who sell antibiotics and other inputs), market intermediaries, depots and other key actors. The resulting knowledge on the disease as well as socio-economic pressures that farmers face will be used to develop a series of workshops in which farmers will work together to devise a social and technical specification for a farm-based intervention that allows for more sustainable and appropriate development of aquaculture. Once co-developed in the form</p>	

of an in-principle design, the step-wise approach to design as well as the design itself will be used to seed further funding and impact across the fish and livestock sectors.

Theme 4 Pump Priming Award

Grant Holder	Institution	Title of Award
Dr Rebecca King	University of Leeds	Community dialogues for preventing and controlling antibiotic resistance in Bangladesh

Co-Investigators	Summary
<p>University of Leeds:</p> <p>Professor James Newell Dr Helen Elsey</p> <p>Malaria Consortium (UK):</p> <p>Mr Christian Rassi Dr Prudence Hamade Mr Muhammad Shafique</p> <p>ARK Foundation:</p> <p>Dr Rumana Huque</p>	<p>We plan to develop and test the "community dialogue" approach for preventing and controlling antibiotic resistance in Bangladesh. The emergence and spread of antibiotic resistance is especially problematic in settings where antibiotics can be bought without a prescription and where they are over-prescribed by health workers and over-used by the public. The World Health Organisation recommends that the general public can help combat antibiotic resistance by preventing infections, using antibiotics only when prescribed by a health professional, completing the full prescription, never using leftover antibiotics and never sharing antibiotics.</p> <p>The Ministry of Health and Family Welfare has established the Revitalization of Community Health Care Initiative in Bangladesh. They have done so in order to improve access, utilisation and equity of healthcare. This initiative aims to enable community clinics in rural areas to deliver an essential service package to the approximately 6000 people in their catchments areas. So far, around 13,300 community clinics have been built across the country. Members of this research team have already collaborated with MOHFW on developing and evaluating an intervention to improve the quality of essential services provided within the community clinics in Comilla district. A key part of this package was training community health care providers to prescribe antibiotics correctly and this was very successful. Improving provider capacity to prescribe antibiotics correctly is one important component within a range of behavioural issues that impact on the ways in which antibiotics are used. We intend to build on our existing partnership and develop an intervention that improves knowledge and behaviour in relation preventing and controlling antibiotic resistance within communities in Bangladesh, where antibiotics are available not only from community clinics but also from drug stores.</p> <p>Objectives</p> <p>The project has five objectives: to conduct research to inform the content of and processes for delivering community dialogues; to adapt the community dialogues approach to the setting; to pilot-test the approach in the catchment areas of five community clinics; to evaluate the feasibility of the pilot intervention in terms of the number of people it reaches, the extent to which it is delivered as intended, and whether or not is it acceptable to a range of stakeholders; and to engage with key stakeholders, such as policy makers, district health officials, community clinic staff and communities to ensure that the intervention is appropriate.</p> <p>Applications and benefits</p> <p>We will ensure that the community dialogues are "embedded" within the infrastructure of the community support groups of the community clinics. This means that they will be delivered through existing mechanisms and will, therefore, be replicable across Bangladesh. This intervention has the potential to a. contribute to a body of urgent action recommended by WHO to prevent a post-antibiotic era, in which common infections and minor injuries will kill; b. build health system capacity in Bangladesh to deliver community-based interventions; and c. empower communities in Bangladesh to build cohesion and social capital, thus enabling them to contribute further to the economic and social welfare of the country. Furthermore, it has the potential to be adapted for implementation in other national health systems that support similar infrastructures, and to be adapted to address other areas of ARM, including behaviours that contribute to resistance to drugs to treat infections caused by parasites (e.g. malaria) and viruses (e.g. HIV).</p>

Theme 4 Pump Priming Award		
Grant Holder	Institution	Title of Award
Dr Mylene Lagarde	London School of Economics & Political Science	Determinants of antibiotic prescribing in primary care in South Africa: studying patient-provider interactions in the private and public sectors
Co-Investigators	Summary	
University of the Witwatersrand: Dr Duane Blaauw	<p>Because it increases the morbidity and mortality of bacterial infection, as well as the duration and cost of antibacterial treatment, antibiotic resistance constitutes a significant threat to global public health. The problem is even more critical in low- and middle-income countries which have higher infectious disease burdens, often higher rates of antibiotic resistance, less access to diagnostic tools, and fewer financial resources to purchase newer more effective antibiotics. In South Africa, antibiotic resistance is particularly high, despite an effective drug regulatory system and various initiatives to tackle the problem. Antibiotic resistance is accelerated by the overuse and over-prescription of antibiotics, which is the product of complex interactions between providers' decisions and knowledge, and patients' expectations. Yet research on the determinants of prescribing behaviours from LMICs in general, and South Africa in particular, is limited, and has been criticised for being too descriptive and superficial, with limited insight into the relative importance of different behavioural determinants to be able to prioritise interventions. In South Africa, most research efforts have focused on hospitals rather than primary care, despite the fact the majority of antibiotics are prescribed in primary care, mostly for respiratory infections.</p> <p>This study aims to explore how the interactions between providers and patients influence inappropriate antibiotic prescribing for URTIs in public and private primary care in South Africa.</p> <p>The study will include three components. First, drawing on medical anthropology, we will explore qualitatively providers' and patients' perceptions and experiences of antibiotic prescribing. This will be done through observations of consultations, interviews with providers and focus group discussions with patients. Second, building on the first part and drawing on methods from marketing research, we will design a survey consisting of a series of hypothetical clinical cases where clinical and patient characteristics will be systematically varied; for each case, the providers taking part will be asked indicate what drugs they would prescribe in a list of proposed drugs. The results will allow us to quantify the relative importance of the factors influencing antibiotic prescribing, with a view to inform policy-makers design future interventions. Finally, drawing on recent economics and medical education research, we will move beyond observational research and design a small randomised field study to test the impact of patients' knowledge and financial incentives on the prescribing practices of public and private primary care providers. This will be achieved with the use of standardised patients, who are healthy subjects trained to portray specific symptoms and disclose a rehearsed medical history. These patients will be sent to visit providers who agreed to take part in the research, at a time and under an identity unknown to them. The standardised patients will only differ in their expectations of antibiotics and the insurance status they will disclose. This will allow us to test the impact of these different characteristics on the likelihood of antibiotic prescription.</p> <p>We anticipate that the results will provide invaluable insights into our understanding of prescribing decisions in the public and private</p>	

sector in South Africa, thereby informing the stewardship programmes for antimicrobial resistance in this country. Beyond this setting, these findings will be useful to other middle-income countries with a similar mix of public and private providers. More generally, we aim to produce high-quality research and develop innovative methods that could be replicated in other low-income settings to study antibiotic prescribing.

Theme 4 Pump Priming Award

Grant Holder	Institution	Title of Award
Professor Claire Heffernan	University of Bristol	Supporting Evidence-Based Policy: a longitudinal study of AMR risk behaviours among livestock keeping communities in India and Kenya

Summary

Anti-microbial resistance (AMR) is set to rival climate change as one of the largest barriers to health and wellbeing in the 21st century (Aarestrup, 2015; O'Neil, 2015; Woolhouse et al., 2015). And like climate change, AMR is likely to have a preferential impact on communities of the poor (Heffernan, 2017). Yet, to date, the inter-relationship between poverty and AMR has not been well explicated. This is particularly true with regard to animal agriculture. Indeed, while 2/3rds of the global poor are livestock keepers (Lin and Heffernan, 2009a, 2010) very little is known about the factors facilitating AMR among this population. We do know however, that AMR emerges out of the social, cultural and behavioural milieu in which disease and healing is situated. And in this case the environment in which livestock are produced. Therefore, the aim of the project is to explore three inter-related drivers: social, behavioural and environmental to the emergence of AMR among two communities of the livestock dependent poor: Maasai pastoralists in Kenya and subsistence dairy producers in Orissa, India. Both of these communities had participated in a large-scale study on animal healthcare service delivery funded by DFID in 1999 (Heffernan and Misturelli, 2000; Heffernan, 2001). In this manner, the research will draw on a historical dataset to compare a variety of parameters important to the emergence of AMR. Ranging from animal healthcare seeking behaviours/preferences to livestock-based livelihoods to access to service providers to farmer of understanding disease etiologies and access to livestock pharmaceuticals and antibiotic use, including dosages and timing over a 17-year period. Thus the study offers a unique opportunity to explore behavioural change over time. Such an historical assessment is beneficial on two levels: first, the strength and directionality of these forces on AMR emergence can be measured and thereby, better understood and second, the analysis offers a unique opportunity to support evidence-based decision-making.

The risk of the rapid ascendancy of AMR as a global threat is that the development community will formulate policies on a weak evidential base. Equally problematic, much of the current research exploring AMR focuses on bio-prospecting in one-off exercises. Therefore, it is likely that this approach will create an evidence base biased towards single outcomes. And in this manner, related decision-support tools will be limited in their ability to predict change by the singular, deterministic nature of the underpinning data (Heffernan and Yu, 2010; 2007; Yu and Heffernan, 2009). To address this issue, the project will create and deliver the 'AMR forecaster' an easy to use ranking and weighting framework based on the longitudinal dataset. The aim is to enable policy makers, researchers and practitioners to use the simple on-line tool to assess the relative risk of AMR emergence among the communities involved.

Finally, however, we know that changing behaviour regarding the use of antibiotics is imperative both in the global North and South (O'Neil, 2015; Woolhouse et al., 2013; 2015). Previous studies have shown that children can be effective entry points for livestock-related knowledge at the community level (LDG, 2011). Therefore, the project team will produce and disseminate learning material on AMR to local school children, and measure the transfer of key messages or 'memes' on wider households members.

Theme 4 Pump Priming Award

Grant Holder	Institution	Title of Award
Professor David Demeritt	King's College London	Animal Husbandry, Prescribing Practices and the Control of Veterinary Medicines and AMR in Colombia's 'Livestock Revolution'

Summary

In common with many low- and middle-income countries, Colombia has seen sharp rises in livestock production in response to rapidly growing domestic demand for food of animal origins. While this 'livestock revolution' promises to enhance food security, reduce poverty, and improve rural livelihoods, there are also questions about its sustainability and wider implications for human and environmental health. Expanding livestock production is associated with a host of negative impacts on biodiversity, carbon emissions, water availability and quality. As livestock numbers have risen globally, so too has the use of antibiotics and other veterinary medicines (VM) in animal husbandry. VM has been instrumental in reducing the global burden of livestock disease and delivering the productivity increases necessary to meet the rising demand for food globally, but the World Health Organization (2012) warns that the scale and nature of antibiotic usage in livestock production poses major risks to both human and animal health. As well as undermining food safety and environmental quality through residue contamination, the pervasive use of antibiotics in agriculture creates strong selective pressures favouring the emergence of bacteria that are resistant to antibiotic drugs used for treating disease. Such anti-microbial resistance (AMR) threatens to cast us back into the dark ages of medicine without effective antibiotic treatments.

The aim of this proposal is to support international efforts to address the AMR crisis and support poverty alleviation in low- and middle-income countries like Colombia by improving understanding of the behavioural factors influencing the control and use of VM, which is a major contributing factor in the emergence of AMR. To that end it will combine interview, observational, survey, and documentary analysis methods to achieve these more specific research objectives (ROs):

RO1. Explore animal husbandry practices and their implications for animal health, farm incomes, use of VM, and AMR risk across two different milk production systems (extensive, dual-purpose, i.e. meat and milk, and intensive & specialised, i.e. milk only)

RO2. Analyse prescribing practices and the formal and informal networks through which VMs are sourced, circulate, administered and then accounted by veterinary professionals and by food and pharmaceutical markets

RO3. Evaluate the regulatory systems in Colombia for ensuring animal health, food safety, and appropriate prescription and use of VM

RO4. Build a wider network to support behavioural change interventions in Colombia and across Latin America for improving the control and use of VM

Theme 4 Pump Priming Award

Grant Holder	Institution	Title of Award
Professor Mike English	University of Oxford	Infection Prevention and Control and Antibiotic Stewardship to Avert Antibiotic Resistance in High-Risk Populations from Resource-Poor Settings

Co-Investigators	Summary
<p>University of Oxford: Professor Charles Vincent Dr Olga Tosas Auguet Dr Eleanor Murray</p> <p>WHO TDR: Dr Margaret Montgomery</p> <p>Ministry of Health – Kenya: Dr Isabella Maina</p> <p>KEMRI Wellcome Trust Research Programme: Dr David Gathara</p>	<p>Global under-5 deaths have halved in the last 20 years(1). However, reduction in the neonatal mortality rate has lagged greatly behind other advances, and now contributes over 40% of all child mortality in many countries (1). Yet, prior research in low and middle income countries (LMICs) suggests sick newborns often do not receive the interventions they need to ensure their disability free survival. Infections are estimated to cause 40% of all neonatal deaths in LMICs (2), where the burden health care-associated infections (HCAIs) is also up to 20 times higher than in industrialised countries (3) and where antibiotic resistant HCAIs are rapidly increasing (4) due to increases in antibiotic use, rising rates of hospitalisation, and high prevalence HCAIs (5) not matched with increases in hospital resources and measures to prevent these. Resistant infections often lead to longer hospitalizations (6), thus increasing opportunity for transmission to other inpatients in care, and subsequent transmission into the community following hospital discharge. The potential societal impact of bacterial antibiotic resistance (BAR) infections in sick newborns in LMICs, is reflected in the 58,000 deaths attributable to antibiotic resistant neonatal sepsis in India alone (5) compared to the 23,000 deaths each year across all population age groups in the United States (7). The much-needed attention to improve newborn health, has triggered multiple stakeholders to propose the 'Every Newborn: an action plan to end preventable deaths' (8), which seeks to improve the quality of care to ultimately end preventable newborn deaths. HCAIs, reflect breakdown in infection prevention and control (IPC) measures, which combined with injudicious use of antibiotics contribute to emergence of resistant HCAIs in neonatal units (9), and are the most frequent preventable adverse event in healthcare delivery worldwide (3). Intervention bundles comprising behavioural, environmental and antibiotic stewardship components (10), could prevent many HCAIs (11-13), and improved provision of high-quality, basic care in resource-limited hospitals could deliver up to a 71% reduction in neonatal mortality (14,15).</p> <p>Initiatives to improve quality and safety in healthcare, however, too often result in limited changes for the better and are often hard to replicate in new contexts (16). In this pump-priming grant, we seek to address key formative stages of the MRC framework for complex interventions (17,18) by generating contextual knowledge of the health system traits and behaviours that need to be understood prior to formulation and implementation of behavioural/integrated interventions to attain best IPC and antibiotic stewardship (IPC-ABS) practice required to reduce HCAIs and BAR in resource-limited healthcare facilities delivering care to sick newborns. In our approach, we draw from elements of the theory of change (ToC) (19,20), by first identifying the desired long-term goals and then working back from these to identify all the conditions that must be in place for the goals to occur. This proposed pump-priming grant includes research that aims to:</p> <ol style="list-style-type: none"> Facilitate the development of appropriate, evidence based interventions based on a critical analysis of the policy, organisational and practice environments and current management, team and individual behaviours relevant to IPC-ABS, aimed at limiting BAR in high-risk populations in Kenyan facilities; Help identify context-appropriate clinical and performance indicators for use in monitoring and evaluation of IPC-ABS interventions; Highlight challenges in the uptake of policy into effective IPC-ABS practice; Increase capability and motivation to limit BAR and improve safety

in hospitals;

e. Initiate a process of building research capacity around IPC-ABS in Kenya.

We expect proposed interventions to be generalizable to other inpatient settings in East African hospitals that share similar challenges.

Theme 4 Pump Priming Award

Grant Holder	Institution	Title of Award
Dr Patty Kostkova	University College London	GADSA: gamified Antimicrobial Stewardship (AMS) decision support app for prescribing behaviour change

Co-Investigators	Summary
<p>University College London:</p> <p>Professor Andrew Hayward Dr Laura Shallcross Dr Carmen Lefevre</p> <p>University of Lagos:</p> <p>Professor Folasade Ogunsola</p>	<p>Antimicrobial resistance is a global problem. Implementing appropriate antimicrobial prescribing policies and stewardship in clinical and community healthcare settings is one of the powerful ways to reduce antibiotics overuse. This is of great importance in Nigeria and other Low and Middle Income countries (LMIC) where clinical practice is less regulated. In these countries, due to resource constraints, a widespread over the counter availability of antibiotics and counterfeits create a very challenging environment for implementing antimicrobial stewardship. The Infection Control Africa Network (ICAN), with 28 African member states, has launched the Antimicrobial Stewardship Education Initiative in July 2016 to tackle this issue across the continent.</p> <p>The aim of this interdisciplinary project is to investigate the use of gamified apps on mobile phones and tablets for changing prescription rates through improving compliance with prudent antimicrobial prescription policies, supporting professionals in prescription decision making around three key conditions (urinary tract infections, single dose surgical prophylaxis and upper respiratory track infections). Based on previous study with ICAN and the international Infection Control Resource (iNRIC, www.nric.org.uk) delivering policies and guidance to infection professionals at the point of care, it was identified that African experts preferred accessing policies in a graphical gamified format over their mobile devices compared to text-based guidelines.</p> <p>The app will be co-authored and developed jointly with healthcare professionals from two settings (national teaching hospital in Lagos and a community hospital) and evaluated to assess usability and prescribing behaviour change over a period of 3 months. The cutting edge game-based training technology will enable a customisation support to localize the gamified app to new settings by healthcare professionals themselves. This pilot will demonstrate a new innovation approach with a potential to be cost-effectively scaled up and expanded to cover other AMS policies and settings to support professionals across ICAN member states across the African continent.</p> <p>Our multi-disciplinary team, consisting of computer scientists, epidemiologist, infection control experts, and a behavioural scientist is ideally placed to develop an app based AMS intervention. We have expertise in app development, AMS guideline translation, and behaviour change, ideally placing us to deliver the proposed programme of work. Moreover, we will co-design our app with users in Nigeria, utilising our existing partnership with ICAN and The College of Medicine of the University of Lagos - affiliated to the national Lagos University Teaching Hospital (LUTH) and regional Obafemi Awolowo University hospital.</p>

Theme 4 Pump Priming Award

Grant Holder	Institution	Title of Award
Dr Emily Rousham	Loughborough University	Who gets what and when? Pathways of antibiotic use among people and animals in Bangladesh

Co-Investigators	Summary
<p>ICDDR,B: Dr Mohammad Islam</p> <p>University of Bristol: Dr Patricia Lucas</p> <p>Durham University: Dr Papreen Nahar</p>	<p>Bangladesh is a low-income country with an estimated 40% of the population living in extreme poverty. Against this background of poverty, Bangladesh is internationally recognised for achieving 'good health at low cost' through community-based interventions to improve the health of the most disadvantaged. However, antibiotic resistant bacteria are known to be present in drinking water, wastewater and in patient samples, and the availability of over-the-counter, inexpensive antibiotics means that there is a high risk of a rapid and uncontrolled spread of antibiotic resistance throughout the population. Studies in Bangladesh suggest that 63% of prescriptions for antibiotics are from practitioners with no qualifications, and antibiotics are prescribed in nearly half (44%) of all consultations in primary health care. Tackling antibiotic resistance is essential for the long term economic development and welfare of the country.</p> <p>In order to slow the spread of antibiotic resistance, there are complexities around balancing the need for access to health for the disadvantaged, at the same time as introducing greater regulation around the prescribing and ready availability of antibiotics. Research is required to better understand the needs of households and individuals for antibiotic treatment for their family and livestock, as well as understanding the prescribing behaviours of qualified and unqualified practitioners.</p> <p>We will study the pathways of antibiotic use 1) from the perspective of lay people who buy or consume antibiotics either for themselves, family members or for livestock and 2) from the perspective of the healthcare practitioners, including qualified and unqualified providers (market sellers, unqualified drug shop owners and untrained 'doctors'). Through in-depth interviews in urban and rural Bangladesh, we will gain a better understanding of behaviours around antibiotic prescribing and consumption as well as establishing whether there is an awareness of antibiotic resistance among healthcare practitioners, or their patients and clients. By interviewing practitioners across the whole range of formal and informal outlets we will assess the potential for practitioners to change prescribing practices or act as agents of change. The third aim of the study is to work with government and non-government agencies to inform the development of interventions to reduce antibiotic use. We will use the formative research from interviews to work with a professional communication team to develop culturally appropriate messages and materials for awareness-raising and communication campaigns on antibiotic resistance. These materials will be pre-tested with lay people, healthcare providers and drug shop owners to establish the acceptability of messages, who should be targeted, and what potential there is for the users and stakeholders in antimicrobial resistance to develop national awareness-raising or behaviour change interventions.</p> <p>The benefits of this research are to shed light on the behaviours around antibiotic treatment seeking behaviour and prescribing, the relationships between lay people and their local healthcare practitioner, motivations for seeking or selling antibiotics for people and animals; who and what the antibiotic treatment is sought for; what happens to antibiotics after prescription or purchase, and on the perceived effects of antibiotics on the resolution of symptoms. The findings will provide formative data on which to identify pathways for behaviour change. Our international partner, the International Centre for Diarrhoeal Disease Research Bangladesh (ICDDR, B), is internationally recognised for the development and delivery of low-cost, scalable solutions to major health problems. Capacity-building in Bangladesh and establishing a leading centre for research on antimicrobial resistance are integral parts of this pump-priming initiative.</p>

Theme 4 Pump Priming Award

Grant Holder	Institution	Title of Award
Dr Marco Haenssgan	University of Oxford	Antibiotics and Activity Spaces: An Exploratory Study of Behaviour, Marginalisation, and Knowledge Diffusion

Co-Investigators	Summary
<p>University of Oxford:</p> <p>Dr Proochista Ariana Dr Paul Newton Dr Yoel Lubell Professor Heiman Wertheim Dr Caroline Jones Dr Mayfong Mayxay Dr Felix Reed-Tsochas</p> <p>University of Reading:</p> <p>Dr Giacomo Zanello</p> <p>Mahidol University:</p> <p>Dr Phaik Cheah</p>	<p>Antimicrobial resistance (AMR) is a global health threat that endangers the achievement of the Sustainable Development Goals, especially Goal 3 on "Good Health and Well-Being." Leading UK and global strategy papers aiming at improving people's antibiotic usage to fight and prevent AMR thereby focus exclusively on awareness-raising campaigns, but this narrow approach suffers from conceptual, methodological, and empirical weaknesses. In response, our study intends to improve the understanding of patients' antibiotic-related health behaviour to inspire more targeted and unconventional interventions in low- and middle-income countries (LMICs). Speaking to the themes of "awareness and engagement" and "informal markets and access to antibiotics," we will investigate three research questions:</p> <p>RQ1. What are the manifestations and determinants of problematic antibiotic use in patients' healthcare-seeking pathways?</p> <p>RQ2. Will people's exposure to a behavioural health systems intervention diffuse or dissipate within a network of competing healthcare practices?</p> <p>RQ3. Which proxy indicators facilitate the detection of problematic antibiotic behaviours across and within communities?</p> <p>Our interdisciplinary approach frames behaviour within a shared activity space. By drawing on theories and tools from public health, medical anthropology, sociology, and development economics, and by focusing on vulnerable rural dwellers in the DAC countries Thailand and Laos, we will be able to generate innovative and unprecedentedly detailed open-access survey data on antibiotic-related behaviour and its social, economic, and spatial determinants. We aim to maximise complementarities with other ongoing projects in the region that (1) implement biomarker testing and education campaigns in clinical settings, (2) generate mixed-method evidence on cross-cultural patterns of antibiotic use, and (3) engage with the general public to improve global health awareness.</p> <p>We will apply a rigorous three-stage stratified cluster random sampling design to produce district-level representative survey data of the antibiotic use of 2,400 villagers; and we will carry out social network censuses in four communities with a total of 2,400 villagers. Using satellite imagery and digital data collection tools, we can realise these sample sizes at 75% of the cost of conventional survey approaches. Pursuant to our research questions, we will generate novel insights into the nature and variability of Thai and Lao antibiotic usage and health behaviours using the following methods: We will (1) use event sequence analysis and multilevel regression to investigate the impact of technology and digital media as well as economic, social, and spatial characteristics of patients on adverse antibiotic usage, (2) apply social network analysis to understand how knowledge and practice diffuse from clinical interventions into village communities, and (3) use latent class analysis to detect problematic conditions for antibiotic use through easy-to-collect proxy indicators.</p> <p>Under the umbrella of the Oxford Tropical Network-an inspiring and enabling research environment-this project will be made possible through collaboration across world-leading researchers and groups in health behaviour research (KEMRI Wellcome Trust Research Programme; Kenya), health economics and public engagement (Mahidol Oxford Tropical Medicine Research Unit in Thailand; LOMWRU in Laos), evidence-based antibiotic policy (Oxford University Clinical Research Unit; Viet Nam), social network analysis (CABDyN Complexity Centre; Oxford), development economics (Technology and Management Centre for Development; Oxford), and global health</p>

training (Centre for Tropical Medicine and Global Health; Oxford). ODA relevance follows from our partnerships, capacity building activities, and research interest in vulnerable groups in LMICs. We apply for £249,804 from 1 January 2017 - 31 October 2018 for this pump-priming research.

Theme 4 Pump Priming Award

Grant Holder	Institution	Title of Award
Dr Carolyn Tarrant	University of Leicester	Antimicrobial resistance as a social dilemma: Approaches to reducing broad-spectrum antibiotic use in acute medical patients internationally

Co-Investigators	Summary
<p>University of Leicester:</p> <p>Professor Andrew Colman Dr Edmund Chattoe-Brown</p> <p>University Hospitals of Leicester NHS Trust:</p> <p>Dr David Richard Jenkins Dr Nelun Perera</p> <p>Stellenbosch University:</p> <p>Professor Shaheen Mehtar</p>	<p>Antimicrobial resistance is one of the largest and most widely-acknowledged problems in 21st century medicine. Attempts to change the ways antibiotics are prescribed, in order to tackle the problem of antimicrobial resistance, have met with variable success. This is partly because the prescription of antibiotics is influenced by many social, cultural and organisational factors, and those prescribing antibiotics have to balance competing interests, values and short and long term benefits when making decisions. Healthcare providers have a responsibility both to individual patients and to "society at large", and since there is often not a "technical" solution to problems with prescribing, decisions are usually based on moral values and the customs of the healthcare community. Therefore attempts to change the ways antibiotics are prescribed will be more effective if they take these social factors into account.</p> <p>These social factors, and thus decisions made by individuals about prescribing antibiotics, are strongly influenced by the local and national context. By comparing attitudes to prescribing antibiotics in England, Sri Lanka, and South Africa this study will consider and predict the influence of different contextual factors on various attempts to change the ways antibiotics are prescribed. This will make it easier to assess which attempts will be successful and could be repeated in different international contexts. Models, which take these factors into account, can be used to predict how changes in individual behaviour, social, cultural, or economic factors will impact on decisions about prescribing antibiotics, and the broader problem of antimicrobial resistance. The project has three main aims:</p> <ol style="list-style-type: none"> 1. To develop an international group of academics and clinicians who will work together to use social science theory and methods to look at the use of antibiotics in treating seriously ill patients. Close collaboration will make sure that the work of the project will be relevant to many contexts in which people are trying to improve antimicrobial resistance, particularly in non-high income countries. 2. To use theory to build a model that describes the use of broad spectrum antibiotics in treating seriously ill patients. The model will identify the risks, tensions, and elements of social and cultural context that effect the way antibiotics are prescribed. To find ways to improve antibiotic prescribing, and to consider the potential of various actions to address problems with the use of antibiotics in treating seriously ill patients in different parts of the world. 3. To begin work on a future proposal which would use two types of mathematical models to predict the effect of various attempts to try and improve the use of antibiotics in different contexts. The model or models developed within the grant could be used to improve the success of attempts to influence antibiotic prescription, by making it clearer which actions have the best chance of success in different contexts, particularly in non-high income countries. This would reduce the risk of investing finances, time, and energy in unsuccessful projects. <p>The work will lay the ground work for future international collaborations, and for the development of larger projects to research and test attempts to improve the way antibiotics are prescribed. This might involve a study which interviews patients to explore their role in the prescription of antibiotics. The study will also involve training local researchers in Sri Lanka and South Africa in interviewing skills.</p>

Theme 4 Pump Priming Award

Grant Holder	Institution	Title of Award
Dr Alex Hughes	Newcastle University	Corporate food retailers, meat supply chains and the global responsibilities of tackling antimicrobial resistance (AMR)

Co-Investigators	Summary
<p>University of Southampton:</p> <p>Professor Charles William Keevil Dr Emma Roe Professor Michelle Lowe</p>	<p>This project makes a path-breaking contribution to the agenda for tackling antimicrobial resistance (AMR) by focusing scoping research and significant networking events on a link that has so far been missing from academic and policy debate - the pivotal role of corporate food retailers. The aim of the project is to address the responsibility of retailers in tackling the AMR challenge in the context of their chicken and pork supply chains, and to investigate this evolving role and how it might be shaped in the future, in the UK and at a global scale. Against a backdrop of decades of intensive farming of animals involving the use of antibiotics, it is becoming clearer that while antimicrobials are a necessary tool to maintain health and welfare on the farm, the key issue is their inappropriate and disproportionate use in animals thereby reducing availability for humans. There is food industry-wide concern that this is leading to growing resistance amongst certain bacteria such as Salmonella, Campylobacter and E-coli, placing pressure on the sector to develop and implement standards for more responsible use.</p> <p>Supermarket chains are a key set of actors strategically positioned to address the global challenge of reducing antibiotic use in food supply chains and raising consumer awareness as part of tackling AMR. The project will address the role of retailers in navigating the AMR challenge through their overseas as well as their national store networks, and through supply chains that flow through spaces of the global South as well as the North. Specifically, the project addresses this role by proposing scoping research and dissemination events in the UK, where policy leadership is acknowledged and where corporate retail power is well-established. Driving the momentum of the project's policy engagement will be the support of the UK government's Food Standards Agency (FSA) as a Project Partner facilitating both a pre-project scoping workshop and a dissemination workshop at the end of the research. This reflects close alignment between the project's objectives and the emerging priorities of the FSA.</p> <p>The objectives of the project are: (i) to map and model the current AMR challenge involving corporate food retailers through their chicken and pork supply chains; (ii) to evaluate current and evolving corporate retail strategies and standards in the UK for reducing antibiotic use in chicken and pork supply chains; (iii) to consider the role of consumer engagement in raising standards for responsible use of antibiotics in farming; and (iv) to facilitate increased dialogue between corporate food retailers and wider institutional policy and scientific networks in the UK, in order to shape future strategy for tackling AMR. These objectives will be met through four project phases conducted over eighteen months and involving both quantitative and qualitative methods that include: the mapping and modelling with trade data of the AMR problem facing UK corporate food retailers in their supply chains; interviews with retailers' food technologists and food standards policy-makers in the UK; and interviews with a sample of UK meat producers.</p> <p>A project website, a stakeholder report and an end-of-project workshop in London will complement academic publications, in order to communicate the findings of the scoping research to non-academic beneficiaries and to shape evolving strategy regarding corporate food retailers' roles and responsibilities in tackling AMR.</p>

Theme 4 Pump Priming Award

Grant Holder	Institution	Title of Award
Dr Johanna Hanefeld	London School of Hygiene and Trop Medicine	How do policymaker perceptions of antimicrobial resistance drive behaviour and policies for appropriate antimicrobial use? A case study of Pakistan

Co-Investigators	Summary
<p>London School of Hygiene and Trop Medicine:</p> <p>Dr Mishal Khan Dr Helena Legido-Quigley</p> <p>The Aga Khan University, Pakistan:</p> <p>Professor Rumina Hasan</p> <p>Royal Veterinary College:</p> <p>Dr Ana Luisa Pereira Mateus</p>	<p>The research proposed here is for a pump prime award to determine how policymakers' perceptions of Antimicrobial Resistance (AMR) drive their behaviour and selection of policy options aimed at appropriate use of antimicrobials, focusing on one lower middle income country: Pakistan. Applying qualitative methods and engaging a multidisciplinary team with human and animal health expertise, it will map policy actors and their networks, drawing on the Social Construction Framework, to identify how motivation, social constructions, power relations and contextual factors shape policy maker behaviour. Research findings will be essential to achieving the ESRC's underlying objective to identify the specific economic factors, cultural norms, experiences and practices relating to antibiotics that enable the best strategies for action, by providing concrete knowledge and tools for working with policymakers in low- and middle-income countries (LMICs) as they adapt and adopt national policies for appropriate use of antimicrobials.</p> <p>Key questions this research will address include:</p> <ol style="list-style-type: none"> Who are the key policy actors to engage for effective implementation of interventions and policies concerning appropriate antimicrobial use? How are these actors currently, and potentially, connected? How are the selected policy options socially constructed and how do social constructions reinforce or weaken support or opposition for the selected policies? What other motivations, power relations and contextual factors drive the selection of specific policies? How do these differ among different groups of policymakers identified under objective 1 (e.g. animal health versus human health or political affiliation)? Based on analysis of the questions above, how do policies for appropriate use need to be presented and framed to ensure that essential groups of policy actors engage with and respond to these effectively? <p>This project focuses on the drivers of policy actor behaviour in one high risk AMR country in South Asia - Pakistan. With a population of 185 million, it is possibly the largest country without a national policy or guideline on AMR (Horton 2013). A key consideration for appropriate use interventions is care provision through the for-profit and informal health sector. This issue is particularly critical in South Asia where 80% of patients seek care within the poorly regulated private or informal sector (Private Sector for Health, 2016), and Pakistan provides an ideal case study to investigate this as 78% of the population pay out-of-pocket and the private sector provides 75% of health services (Nishtar 2013). The project will then follow a step wise approach to triangulate findings at national level, at regional level in South Asia and with global policymakers. Research outputs include guides for policymakers working on AMR, a research methodology, as well as scientific outputs and papers.</p> <p>Research will be begin by comprehensively mapping the range of policy actors involved in policy processes relating to appropriate use of AMs, across the One Health spectrum including private and public sector actors. Using the list of policy actors generated by the mapping exercise, we will purposively select policy actors for in-depth interviews (IDI). As part of the IDI process, actors will be asked questions to explore their perceptions about AMR and AM use and to then rank the</p>

five policy options while talking through their rationale using a 'thinking aloud' methodological approach.

Research will be conducted by an interdisciplinary team of social and animal scientists from the London School of Hygiene and Tropical Medicine, the Aga Khan University in Pakistan, the National University of Singapore and the Royal Veterinary College in London. Research will in addition benefit from advice and oversight of an academic and an impact advisory panel to ensure maximum impact on policy and future research on AMR.