



Tackling AMR – A Cross Council Initiative AMR in a Global Context: Development Awards

AMR in a Global Context: Development Awards (announced in 2017) x10

The call ultimately aims to support three to four interdisciplinary research consortia taking a whole systems approach to identify the burden and primary drivers of AMR and specifically antibacterial resistance (ABR) in Low and Middle Income Countries (LMICs).

Links:

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

<https://www.mrc.ac.uk/funding/browse/antimicrobial-resistance-in-a-global-context1/antimicrobial-resistance-in-a-global-context-a-cross-council-call-in-partnership-with-the-department-of-health/>



Department
of Health

AMR in a Global Context – Development Award

Grant Holder	Institution	Title of Award
Dr Christopher Quince	University of Warwick	Novel inter-disciplinary approaches for identifying and tackling the spread of AntiMicrobial Resistance through Environmental pathways in Pakistan
Co-I Investigators	Summary	
<p>University of Warwick:</p> <p>Professor Elizabeth Wellington Professor Matthew Keeling</p> <p>London School of Hygiene and Tropical Medicine:</p> <p>Dr Johanna Hanefeld Dr Mishal Khan</p> <p>Royal Veterinary College:</p> <p>Dr Ana Luisa Pereira Mateus</p> <p>University of Glasgow:</p> <p>Dr Huabing Yin</p> <p>The Aga Khan University:</p> <p>Dr Sadia Shakoor Professor Rumina Hasan Professor Zahra Hasan</p>	<p>Medicine has been transformed by the development of antibiotics, medicines that kill bacteria. These have made deadly bacterial diseases that once killed millions such as tetanus, syphilis, and leprosy, easily treatable. They are given as a preventative measure prior to surgery to prevent infection and they relieve suffering from less dangerous diseases such as strep throat. There is, however, a problem. Bacteria are becoming resistant to antibiotics. This is a result of evolution. The use of antibiotics inevitably selects for bacteria that carry genes that can protect them against these compounds. We call these antibiotic or antibacterial resistance genes (ARGs). Genes are pieces of DNA that make up part of the bacteria's genome or smaller DNA molecules such as plasmids. ARGs provide bacteria with the ability to degrade or excrete antibiotics. They can be exchanged between different species of bacteria allowing these abilities to spread through communities.</p> <p>The use and misuse of antibiotics is accelerating the rate at which ARGs evolve and spread. Using antibiotics to treat nonbacterial infections or to improve the growth rate of livestock results in large amounts of antibiotics entering the environment, this creates a strong selective pressure leading to many resistant bacteria. This resistance can develop in free-living bacteria that perform important functions in ecosystems, e.g. soils or rivers, but then spread to bacteria that cause disease within humans, pathogens. There are pathogens beginning to appear that are resistant to multiple antibiotics, e.g. multidrug-resistant tuberculosis. If this multi-drug resistance spreads further then diseases that are now treatable will become increasingly deadly. This is a potential global public health disaster.</p> <p>The problems caused by antibiotic resistance (ABR) will particularly badly impact Low and Middle Income Countries (LMICs), such as Pakistan, that depend upon cheap antibiotics to treat many infectious diseases. Tragically, it is just these countries, which are likely to have the most problems. This is because antibiotics are easily available without prescription over the counter. People take antibiotics to treat non-bacterial diseases or do not take them for long enough, this allows the resistant bacteria to spread and proliferate. This is compounded by manufacturers of antibiotics releasing wastewater contaminated with antibiotics into the environment, farmers using large quantities of antibiotics in intensive livestock rearing, and the fact that human and animal waste is dumped untreated into water sources. All this pollution results in more resistant bacteria evolving. It is unclear, however, which of these factors are most important to address, in order to prevent the spread of ABR.</p> <p>We have assembled a team of biologists, engineers, social scientists and mathematicians, to better understand ABR in Pakistan and how to combat it. We will conduct a survey of resistance genes across multiple areas within Pakistan, chosen in order to determine what causes them to proliferate and spread, ultimately leading to drug-resistant infections in humans. We will do this by sequencing DNA direct from environmental samples to resolve the genes that are present in the bacteria. We will sample from the environment and from a range of health facilities to reveal how genes are being transmitted from environmental bacteria into pathogens. We will also study the behaviour of people and institutions in Pakistan and determine how that contributes to the scale of the problem. This will allow us to propose ways in which they can reduce the spread of antibiotic resistant genes. These might be changes to how antibiotics are used in health facilities or improved approaches to waste disposal. This will be of great benefit to Pakistan but also - because these genes</p>	

are capable of spreading between individuals across the world - to other LMICs and us in the UK too.

AMR in a Global Context – Development Award		
Grant Holder	Institution	Title of Award
Professor Alistair Boxall	University of York	Drivers of human exposure to antibacterial resistance in the Sri Lankan environment
<p>Co-Investigators</p> <p>University of York:</p> <p>Professor Nik Brown Professor Jane Thomas-Oates Dr Ville-Petri Friman Professor Karen Bloor Professor Sanjoy Bhattacharya</p> <p>International Water Management Institute:</p> <p>Dr Priyanie Amerasinghe</p>	<p>Summary</p> <p>There is a growing evidence-base that the presence of antibacterials, other environmental pollutants and antibacterial resistance genes in the natural environment (i.e. wastewater systems, soils, surface waters and groundwaters) is indirectly affecting human and animal health and contributing to the global antibacterial resistance problem. The release of antibacterials, other selection pressures and resistance genes to the environment will occur from a number of sources including antibacterial manufacturing sites, hospitals and clinics, livestock facilities and from households. Once in the environment these contaminants may persist or dissipate and will be distributed around the different environmental compartments. Humans and animals can then be exposed to the antibacterial compounds and resistant organisms through: the breathing of dust; consumption of contaminated drinking water, plants, meat, fish and shellfish; through recreational and bathing activities; and via contact with wildlife. The level of exposure will be driven by a range of cultural, socio-economic, health and environmental drivers. In areas of Europe and N. America with highly regulated, centralised wastewater treatment and good quality water, the environmental exposure and occurrence of antibacterial compounds and resistance genes is likely to be controlled to some degree. However, the issue of antibacterial and antibiotic resistance pollution is likely to be much more acute in rapidly developing economies and areas with lower wastewater treatment connectivity. Given the increasing evidence-base for the occurrence of antibacterials and resistance genes in the natural environment on overall resistance levels, there is an urgent need to understand the contribution of the natural environment to the problem, and the drivers behind this, in low to middle income countries (LMICs).</p> <p>In this project, we will bring together health practitioners, environmental scientists, microbiologists, modellers and social scientists to develop, parameterise and validate a spatial framework for modelling the occurrence of antibacterial substances and antibiotic resistance genes in the environment of Sri-Lanka and the subsequent exposure of the human populations to these. The framework will characterise the impacts of a range of drivers of occurrence and exposure including antibacterial manufacturing and use, land-use and the characteristics of the natural environment. By bringing this information together, we will be able to identify 'hotspots' of occurrence and exposure across the country which will allow future interventions to be targeted at scenarios and practices resulting in the highest risk of exposure. While in the project we will focus on the Sri Lankan situation, the knowledge, tools and processes developed in the project will be relevant to other LMICs.</p> <p>The 8-month development phase project will combine data and literature review activities, workshops and stakeholder events to develop a conceptual model for AMR exposure in the environment of Sri Lanka and to establish the availability of data sets to parameterise the model. This phase of the project will therefore better define the work programme of the full project phase and identify the needs of key stakeholders with an interest in the problem of antibacterial resistance in Sri Lanka. A key component of the development phase will be the establishment of an</p>	

interdisciplinary and intersectoral partnership comprising leading organisations from Sri Lanka, the UK and elsewhere.

AMR in a Global Context – Development Award		
Grant Holder	Institution	Title of Award
Professor Richard Sullivan	King's College London	"Iraqibacter": Exploring the Links between War and Antimicrobial Resistance
Co-Investigators	Summary	
<p>American University of Beirut:</p> <p>Dr Omar Dewachi Dr Ghassan Abu Sittah</p> <p>Graduate Institute for Int & Dev Studies:</p> <p>Dr Vinh-Kim Nguyen</p>	<p>WHO and the G20 have identified the growing threats of Anti-Microbial resistance (AMR) as a major concern that will define the future of global health. Despite these urgent calls, the emergence of AMR in settings of war and distress migration has not been systematically explored. Case reports from Syria, Iraq, Libya, Yemen, and Afghanistan have shown the proliferation of AMR in combatants and civilians injured in these protracted conflicts. With regional conflicts spreading across state borders as well as one of the largest global refugee crises in decades, AMR in the context of conflict has come to pose a serious threat both regionally and internationally. So began penicillin in the Second World War: antibiotics arose in war. Today, in the context of long-running military conflicts we see harbingers of the end of antibiotics. The core question underpinning this proposal is how war, particularly weapons and the industrialised, urbanised context of contemporary conflicts, drives antibiotic resistance by contaminating the environment and the human and non-human organisms that live there. So far, there has been no systematic or holistic consideration of the environmental health impacts of contemporary conflicts conducted in cities.</p> <p>Our program draws together scholars working in the fields of medicine, anthropology, history of science, ethics, epidemiology, microbiology, molecular biology, and environmental sciences to examine the specific intersection of antibiotic resistance and war. Rather than focus on antibiotic resistance as a universal problem afflicting modern societies in general, we focus first on the impact of global conflict on antibiotic resistance more holistically, and second on the case of multi-drug resistant <i>Acinetobacter baumannii</i> (MDRAB), initially reported by American military surgeons under the moniker Iraqibacter, and that has been identified recently by the WHO as a "critical pathogen" for research and the development of new antibiotics. We will focus on a number of specific countries - Iraq, Syria, Palestine, Yemen, and Lebanon-places with history of protracted conflicts and with different, yet overlapping, ecologies of war.</p> <p>The potential global health significance of conflict-related heavy metal mediated antimicrobial resistance is enormous and warrants further study. It will contribute to the field of environmental pathways for antimicrobial resistance more broadly as well as informing the specific intersection of war and antibiotic resistance.</p>	

AMR in a Global Context – Development Award

Grant Holder	Institution	Title of Award
Dr Matthew Avison	University of Bristol	One Health Drivers of Antibacterial Resistance in Thailand
Co-Investigators	Summary	
<p>University of Bristol:</p> <p>Dr Kristen Reyher Dr Helen Lambert Professor Adrian Mulholland Dr Annela Seddon Dr James Spencer Dr Katherine Turner</p> <p>Chulabhorn Research Institute:</p> <p>Professor Skorn Mongkolsuk</p> <p>North Bristol NHS Trust:</p> <p>Professor Alasdair MacGowan</p> <p>Mahidol University:</p> <p>Professor Visanu Thamlikitkul Dr Luechai Sringernyuang Dr Aronrag Meeyai Dr Dakrong Pissuwan Dr Parntep Ratanakorn</p> <p>University of Exeter:</p> <p>Professor Henry Buller</p> <p>NERC Centre for Ecology and Hydrology:</p> <p>Dr Andrew Singer</p> <p>University of Bath:</p> <p>Professor Edward Feil</p> <p>RAND Europe Community Interest Company:</p> <p>Dr Emma Pitchforth</p>	<p>Like many Overseas Development Assistance (ODA) countries, and particularly those in South and South East Asia, Health and well-being in Thailand is significantly undermined by the high prevalence of antibacterial drug resistance (ABR) in disease-causing bacteria found in humans, animals and the environment. ABR reduces the ability of doctors to treat infections with antibiotics and other antibacterial drugs, with an estimated impact on Thailand in 2010 of 38,000 deaths and an economic loss of 1.2 billion US\$. ABR rates continue to rise and its impact is rising in parallel.</p> <p>Because of the threat of ABR, the Thai National Strategic Plan on Antimicrobial Resistance (2017-2022) has been instigated. This will involve improved national surveillance for ABR bacteria to quantify the problem, initiatives to reduce the rates of infections and those to reduce the usage of antibiotics and other antibacterial drugs, which are known to select for ABR bacteria. However, even when this strategic plan starts to pay dividends, there will be much still to learn about ABR in Thailand, and in other ODA countries, as is also true for developed countries where ABR reduction strategies have been in place for some time.</p> <p>In this development project, we will build on partnerships we have already initiated between UK and Thai clinicians and academics. We will develop a consortium grant application to address knowledge gaps about ABR in Thailand, which we have identified through discussions between UK and Thai partners. The consortium will consider whether chemicals in the environment - present naturally or as a result of agricultural pollution (e.g. herbicide use) - can select for ABR bacteria. This would render strategies to reduce antibiotic use less effective in reducing ABR in a community where chemical pollution of the environment is common. We will also consider whether ABR bacteria circulate within local environments in rural Thailand, and will measure how this changes over time as the Thai National Strategic Plan on Antimicrobial Resistance progresses. We will perform research aimed at understanding key behaviours around antibiotic use by farmers, farm management practices, and how people make decisions around healthcare. We will use the information that we generate from the microbiology, genomic and chemical screens and the anthropological research to produce mathematical models that can be used to predict useful changes that can be made to reduce ABR in Thailand and other ODA countries. We will also help Thai policymakers evaluate the effectiveness of changes initiated through the Thai National Strategic Plan. Finally, we will develop technologies that will be used to streamline our research; technologies that may also be useful to help local communities tackle the problem of ABR.</p> <p>During the development project we will run a series of workshops in Thailand, which will be used to develop the details of our proposed research project and to identify the study sites we will use. These workshops will also give us the opportunity to share knowledge amongst Thai and UK ABR experts, and bring together a group of early career academics, to raise the knowledge base around ABR in Thailand. We will also discuss postgraduate education strategies, and public engagement events in Thailand. The development phase will also involve a comprehensive investigation of policymaking around ABR in Thailand, enabling us to tailor our consortium research project to the needs and knowledge gaps of these groups and individuals.</p>	

AMR in a Global Context – Development Award

Grant Holder	Institution	Title of Award
Professor Mathew Holden	University of St Andrews	Holistic Approach Towards Unravelling Antibiotic Resistance in East Africa
Co-Investigators	Summary	
<p>University of St Andrews:</p> <p>Dr Wilber Sabiiti Dr Mike Kesby Dr Len Thomas Dr Andy Lynch Professor Stephen Gillespie Dr Derek James Sloan</p> <p>Makerere University:</p> <p>Dr Benon Asimwe</p> <p>KEMRI (Kenya Medical Research Institute):</p> <p>Dr John Kiiru</p> <p>Makerere University:</p> <p>Dr Stella Neema</p> <p>Kilimanjaro Clinical Research Institute KCRI:</p> <p>Professor Gibson Kibiki</p> <p>Catholic University of Health and Allied:</p> <p>Professor Stephen Mshana</p> <p>MRC/UVRI Uganda Research Unit on AIDS:</p> <p>Professor Alison Elliott</p> <p>Wellcome Trust Sanger Institute:</p> <p>Dr David Aanensen</p>	<p>The potential harm that increasing levels of antibacterial resistance (ABR) will have on human health is vast, as a consequence the effects of this will be felt across society and at the economic level. It is predicted that by 2050, 10 million lives per year and a cumulative 100 trillion US Dollars of economic output may be lost worldwide. In order to address this looming problem a co-ordinated global response is required to try and halt the rise of ABR. Efforts are underway to tackle the rise in resistance, however agenda-setting is dominated by High Income Countries (HICs) and may not reflect priorities or needs of Low and Middle Income Countries (LMICs), where the levels of resistance and also the types of disease caused by bacteria may be different.</p> <p>One of the most vulnerable regions to the increase in antibiotic resistance is Africa where, in comparison to other regions of the world, the burden of infectious diseases is highest. The economic, cultural and ethnic diversity of Africa mean that the problems surrounding ABR across African countries are likely to be distinct from other regions of the world, and therefore require regional solutions and approaches. For example, the availability of antibiotics can be patchy, and the routes of access to antibiotics are variable (including traditional healers, public and private medical practitioners and over-the-counter antibiotic access). Social, cultural and lifestyle drivers of ABR in Africa also have specific features – closer communal living in cities with variable water/sanitation, and closer animal husbandry in rural communities.</p> <p>This project aims to address ABR in Africa and fill the gaps in knowledge. The research will target three main areas that comprise the problem: the bacteria that are antibiotic resistance and cause disease; the amount of antibiotics that are used to treat disease; and the behaviour of humans that governs how antibiotics are used and supplied. The three elements incorporate epidemiological, economic, cultural and societal factors that interact and contribute to the problem.</p> <p>Bringing together research covering these 3 elements will provide a holistic view of ABR in East Africa. The project will establish a surveillance network across Uganda, Kenya and Tanzania that is comprised of sentinel sites that monitor and characterize the ABR bacteria that cause disease at that location, map the use of antibiotics in the sentinel hospitals and the surrounding communities, and capture the behaviour and attitudes of humans that is responsible for their use in these settings. The project also recognises antibiotics are not exclusively used for human medicine, therefore our surveillance will also cover the use of antibiotics in veterinary medicine in the linked communities to provide a 'One Health' view. Using a multidisciplinary approach, encompassing, microbiology, genomics, epidemiology, statistics, social sciences and geography, we will seek to explore and describe the relationships between the elements, and identify the drivers of ABR.</p> <p>Using this knowledge, we will identify interventions, such as public health and infection control measures and legislative changes, that can be made to control ABR at national and regional level. At the global level, the output of this project will add to the worldwide picture of ABR. This information will also be of value to global development agencies such as the WHO and FAO, to direct funding into effective interventions critical to the region.</p>	

AMR in a Global Context – Development Award

Grant Holder	Institution	Title of Award
Professor Ruth Zadoks	University of Glasgow	Supporting the National Action Plan on AMR in Tanzania (SNAP-AMR)
Co-Investigators	Summary	
<p>University of Glasgow:</p> <p>Dr Louise Matthews Dr Emma Whyte Laurie Dr Katarina Oravcova Dr Alicia Davis Dr Shona Hilton Dr Tiziana Lembo</p> <p>Kilimanjaro Christian Medical College:</p> <p>Dr Blandina Mmbaga</p> <p>Nelson Mandela African Institute NMAI ST:</p> <p>Dr Gabriel Shirima</p> <p>University of St Andrews:</p> <p>Professor Nick Hanley</p> <p>Glasgow School of Art:</p> <p>Ms Gemma Teal Dr Tara French</p> <p>Ministry of Health & SW Tanzania:</p> <p>Mrs Siana Mapunjo</p> <p>Catholic University of Health and Allied:</p> <p>Professor Stephen Mshana</p>	<p>Antimicrobial resistance (AMR) is recognised as a global threat to human and animal health, productivity and prosperity. AMR is widespread in both resource-rich nations such as the UK and in low and middle income countries (LMICs). The United Republic of Tanzania is one such LMIC, and in response to a call to action from the World Health Organisation, it has created a National Action Plan (NAP) to combat AMR.</p> <p>The NAP is an ambitious plan outlining five strategic routes for tackling AMR: i) improved awareness and understanding; ii) enhanced surveillance and research; iii) better sanitation, hygiene and infection prevention; iv) optimized use of antibiotics; and v) sustainable investment in alternatives. In common with many LMICs, the challenge posed by AMR is exacerbated by widespread or unregulated use in both humans and livestock, whilst successful implementation of the NAP is threatened by lack of human and financial resources. Prioritisation of activities and targeting of interventions is therefore an essential component of an effective and efficient campaign to control AMR.</p> <p>Our research will provide new evidence to support this prioritisation and targeting, taking an approach that recognises that behavioural change is a complex phenomenon depending not just on policy, regulation or knowledge provision but also on cultural background and social norms. Our team of UK and Tanzania-based researchers and policy experts will take an interdisciplinary approach to provide novel insights into the biological, social and cultural drivers influencing antibiotic use in the community and health care system; the spread of AMR between the humans and animals in the community and health care settings; knowledge about AMR; and how to change behaviours to reduce antibiotic use and the spread AMR.</p> <p>We will contrast doctor prescribing practices in different health care settings (referral hospitals, district hospitals, health centres, dispensaries), as well as investigating community access and attitudes to antibiotics among householders, community 'drug' shops and unregulated sources such as roadside traders. We will use focus groups to examine factors that influence prescribing and usage, e.g. availability of antibiotic drugs, diagnostic facilities, patient demands, medical training and knowledge, coupled with choice-based experiments to establish how best to create change in prescribing behaviour or use. We will also use choice-based experiments to examine use in livestock by individuals with different levels of knowledge about AMR, e.g. district vets, community livestock officers and livestock holders. In parallel, bacterial isolates from people or livestock in hospital and community settings will be DNA-sequenced and examined using genomic tools to establish whether resistant commensal bacteria found in faecal samples in the community are those responsible for illness (respiratory infections, diarrhoea, sepsis and urinary tract infections) in hospitalised children.</p> <p>The final component will be to assess the knowledge and sources of knowledge held by the public, health care and veterinary workers, policy makers and educators; to design interlinked targeted media campaigns that reflect educational, professional and cultural differences; and to assess the uptake of these materials and their impact on attitudes and approaches to antibiotic drugs and resistance.</p> <p>The outcomes of our research will help priority setting and targeting in the NAP by identifying the settings (health care system or</p>	

community) where most effective change can be achieved; showing how to create change in antibiotic usage (e.g. via improved training or education, diagnostic facilities or a social-norm based 'nudge') and identifying the individuals to target to create the most effective change; and by designing and delivering a mass media campaign to create awareness and behavioural change that will help Tanzania to combat the threat posed to its future by AMR.

AMR in a Global Context – Development Award		
Grant Holder	Institution	Title of Award
Dr Nicholas Feasey	Liverpool School of Tropical Medicine	How do human and bacterial behaviour interact in urban and rural African environments to facilitate the stable acquisition of antimicrobial resistance
Co-Investigators	Summary	
<p>Liverpool School of Tropical Medicine:</p> <p>Dr Adam Roberts Dr Rachel Tolhurst Mrs Eleanor MacPherson Mr Russell Dacombe Dr Shevin Jacob Professor David Lalloo</p> <p>Lancaster University:</p> <p>Dr Christopher Jewell</p> <p>University of Warwick:</p> <p>Dr Hendramoorthy Maheswaran</p> <p>Malawi Liverpool Wellcome Trust:</p> <p>Dr Pui-Ying Iroh Tam</p> <p>Makerere University:</p> <p>Professor Moses Joloba</p>	<p>The development of antibacterials has saved millions of lives; however, the massive global usage of these agents has created huge pressure for bacteria to become resistant to these drugs and to cause infections that are difficult or impossible to treat. This, combined with the flow of drugs slowing profoundly, has made antibiotic resistance a threat to health of global importance. New approaches are necessary to reduce illness caused by resistant bacteria. In Low and Middle Income countries (LMIC), there is a huge burden of severe illness caused by bacteria, a critical lack of clinics and hospitals to diagnose and appropriately treat bacterial infections and widespread availability of antibiotics without prescription. This situation is responsible for a huge amount of illness and is increasing the pressure on bacteria to become drug resistant. LMIC settings will be the last to benefit from new types of antibiotics and it is therefore of urgent importance to undertake research addressing antibiotic resistance in LMICs that aims to identify which are the most important causes or drivers of the development of drug resistance. This requires scientists from a variety of fields and with a variety skills, from the laboratory to policy implementation to work together.</p> <p>We will therefore describe both where bacteria live when not causing infections, whether in humans, animals or the environment, and how antimicrobials are used and misused in humans, animals and the environment to:</p> <ol style="list-style-type: none"> 1. Determine ways of using antibiotics make resistance come at a cost rather than as a benefit to bacteria 2. Develop ways of using antibiotics across all sectors that both improves access for people that really need them, but protects medicines of last resort in a manner acceptable to governments, communities and doctors to minimise the local emergence of resistance; 3. Identify ways in which different parts of government, the health and research sectors can more effectively work together to reduce antibiotic resistance at national and district level, both within and between human and animal health and the environment. 	

AMR in a Global Context – Development Award

Grant Holder	Institution	Title of Award
Professor Eric Fevre	University of Liverpool	Partnership for a cross-disciplinary approach to the ecology of antimicrobial drug resistance in Kenya

Co-Investigators	Summary
<p>University of Liverpool: Professor Nicola Williams Professor Jonathan Rushton</p> <p>KEMRI (Kenya Medical Research Institute): Professor Samuel Kariuki</p> <p>University of Edinburgh: Professor Mark Woolhouse Dr Till Bachmann Dr Alice Street</p> <p>Wellcome Trust Sanger Institute: Professor Gordon Dougan</p> <p>University of Nairobi: Dr Salome Bukachi Dr Florence Mutua</p> <p>Int Livestock Research Institute: Dr Josephine Birungi</p> <p>CDDEP (Disease Dynamics Econ & Policy): Professor Ramanan Laxminarayan</p> <p>The Aga Khan University, East Africa: Professor Revathi Gunturu</p>	<p>Antibacterial resistance (ABR) is a significant threat to the future of effective healthcare and veterinary care. Globally, we are dependent on antibiotics for treating common as well as severe infections, but we abuse the value of these compounds by using them irrationally. In Kenya, as in many other countries, antibiotics are prescribed unnecessarily and without properly identifying the micro-organisms being targeted, a fact that often leads to treatment failures. In agriculture, antibiotics are often used directly by farmers, as they are readily available on the market without prescription. Kenya is a country undergoing a demographic transition towards urbanisation, with over half the population expected to be in urban zones by the middle of this century. Many of these people are likely to live in low income settlements (eg 60% of residents of Nairobi, the capital, live in low income settlements = slums). Provision of high quality health care is lacking in such sites. Further, with more people living in towns and cities, the pressure will be on farmers to produce more food more efficiently, and a key part of this - as has been the case in more developed economies - will be to use antibiotic drugs. These factors combine to produce a great deal of risk for highly drug resistant micro-organisms to emerge. Essential in preventing this will be to collect high quality data in hospitals and on farms, to understand what levels of resistance are present now, and how the organisms share their genes, a process that can result in rapid spread of resistant traits. A key aspect of this is also to understand how antibacterial drugs are used in practice, how they are procured and what drives individual and collective decision making about their use. Our programme will investigate these different aspects and work with partners in Kenya and internationally who make policy, in order to develop long term surveillance tools, plans to limit the spread of resistance and advice to the public to conserve these important drugs.</p> <p>In Kenya and elsewhere, the antibiotic landscape for healthcare and livestock production is shaped by poor regulation and irrational drug use. There is a need for related evidence-based policy and the implementation plans for such policy. We will conduct in depth research in clinical and community settings to understand patterns of resistance, transmission of bacteria and their resistance determinants and genome based studies of resistance evolution. This will be combined with social and economic approaches to quantify the burden of antibacterial infection, the behavioural aspects of drug prescribing and use and the risks of mixing of bacterial populations between clinical settings, the community and the food systems that link them. Our approach is to build a strong network of antibacterial surveillance to monitor microbial ecology, and identify hotspots of selective pressure.</p> <p>Our objectives are:</p> <ol style="list-style-type: none"> 1) Surveillance in health care settings. We will establish longitudinal and cross sectional surveillance in clinical settings and explore changes in the diversity of bacterial flora with differing care pathways and drug exposure. 2) Community based longitudinal monitoring of ABR in livestock producers. We will recruit commercial farmers in to a series of longitudinal cohorts and monitor their bacterial ecology over time. 3) Microbiological dynamics within the household. We will explore the longitudinal dynamics of bacterial populations in humans, their animals and the immediate farm environment, as well as the products leaving the farms for market.

4) Microbiology and sequencing. We will develop robust microbiological and sequence-based approaches to quantifying bacterial diversity and drug sensitivity

5) Human behaviour and decision-making. We will emphasise the study of the social and economic environment in which antibiotic use takes place, both in domestic animals and humans and develop policy frameworks to limit irrational use.

AMR in a Global Context – Development Award		
Grant Holder	Institution	Title of Award
Professor Javier Guitian	Royal Veterinary College	Towards controlling antimicrobial resistance in global aquatic animal food systems by enhancing collective resilience (AMFORA)
Co-Investigators	Summary	
<p>Royal Veterinary College:</p> <p>Professor Katharina Stark Dr Barbara Nicole Haesler Dr Lucy Brunton Dr Ana Luisa Pereira Mateus</p> <p>International Livestock Research Institute:</p> <p>Dr Barbara Wieland Dr Silvia Alonso</p> <p>University of Stirling:</p> <p>Professor Sandra Adams</p> <p>London School of Hygiene and Tropical Medicine:</p> <p>Dr Erling Hoeg</p> <p>WorldFish Center:</p> <p>Dr Mohan Chadag</p>	<p>Aquatic animals such as fish and shellfish are an increasingly important source of protein for the growing world population. In 2014 the contribution of aquaculture to supply food for human consumption overtook that for wild-caught fish for the first time. Fish diseases are still considered to be a major constraint to aquaculture globally and it has been estimated that 10% of all farmed aquatic animals are lost because of infectious diseases alone, amounting to >10 billion USD in losses annually on a global scale. Farmed fish are often kept in intensive systems where antibiotics are heavily used. Effective vaccines exist for use in Atlantic salmon aquaculture and the use of antibiotics has been reduced by over 99%. In comparison, although many other species (e.g. carp and tilapia) are well established cultured species, there are few vaccines available, and antibiotics are still heavily used. Aquatic animals are increasingly traded worldwide, partly due to growing awareness for balanced diets and healthy eating in high-income countries and as a vital source of quality animal protein in low and middle income countries (LMIC). This creates opportunities and supports livelihoods in countries such as Bangladesh, Egypt and Vietnam, that together contribute to 9% of the global aquaculture production.</p> <p>Despite the importance of antibiotic use in aquaculture and the size of the global trade, the contribution of aquaculture to the burden of consumer exposure to antibiotic resistance genes is currently not being addressed. Reasons why this issue is currently not being tackled include; i) the complexity of global food systems that involve different actors (producers, suppliers, intermediaries) spanning different countries across the world, ii) the lack of knowledge of the so called "drivers" of resistance in aquatic systems (i.e. the influences, e.g. through animal husbandry and farm management, that result in the emergence of resistance in bacteria) and, iii) the fragmented responsibilities in global food systems. However, it is important that antibiotic resistance in aquaculture is addressed as a global issue, because hazards emerging in producer countries will have public impact on consumers elsewhere through global trade and travel. Also, opportunities to learn from progress made in European fish farming remain underexploited. To address this complex challenge we need innovative research strategies that combine different disciplines and approach the system as a whole rather than its individual components in isolation. Our plan for the full proposal stage is to apply research methods that allow us to integrate societal, legal, governance and economic drivers in addition to biological risk, creating new approaches to better describe, analyse and assess the resilience of a global food system. In the first phase of the project, two workshops will be conducted to develop the model framework and plan the activities for the second phase. These workshops together with a review of published studies, reports and interviews with key stakeholders will allow us to map the different components of the system, the drivers, responsibilities and governance and to identify knowledge gaps for the main project. Our focus will be on selected fish species farmed in Bangladesh, Vietnam and Egypt, all of which are traded internationally. In the full-stage proposal, intervention strategies to reduce antibiotic use will be developed and implemented and their impact assessed using novel approaches. Our aspiration is that this project increases risk awareness for consumers, enhances surveillance and develops a novel set of indicators of system resilience in the context of antibiotic resistance.</p>	

AMR in a Global Context – Development Award		
Grant Holder	Institution	Title of Award
Professor John Walley	University of Leeds	Containing antimicrobial resistance in rural Cambodia: a one-health multi-disciplinary intervention to improve village healthcare and farming practice
Co-Investigators	Summary	
<p>University of Leeds:</p> <p>Ms Laura Ann Bates</p> <p>China Global Health Research & Dev:</p> <p>Professor Xiaolin Wei</p> <p>Karolinska Institute:</p> <p>Dr Ashok J Tamhankar Professor Cecilia Stålsby Lundborg</p> <p>Malaria Consortium (UK):</p> <p>Dr prudence hamade</p>	<p>Antibiotic resistance has been termed the greatest menace of the current century by the World Health Organization. If appropriate measures to mitigate antibiotic resistance are not taken immediately, it is estimated that millions of people will die, in the near future due to complications arising out of inability to treat resistant infections and most of this burden will fall on the poor, underdeveloped part of the world.</p> <p>The main drivers of antibiotic resistance are antibiotic use and antibiotic residues in the environment. Both generate resistant bacteria. Appropriate monitoring and mitigation of both is neglected in poorer countries due to inadequacy of awareness, infrastructure, economics, political will, socio-cultural dimensions and a myriad of other factors. Resistance knows no geographical or political boundaries; it spreads quickly all over the world. So, not only the poorer human beings from underdeveloped countries suffer, these countries also become 'hot spots' of resistance generation and spread.</p> <p>Cambodia is the poorest country in the Greater Mekong Sub-Region and continues to recover from a prolonged civil war which saw its institutions and infrastructure destroyed, which resulted in the loss of most of its educated personnel. With support of international partners, Cambodia is rapidly developing; Cambodia was one of the countries, which achieved the millennium development goals in reducing infant and child mortality. The proposed provinces for the antibiotic resistance study and intervention are among the most remote and underserved both within the formal health and agricultural systems and rely for care on personnel who have minimal training for both care of patients and animals. When a person or animal becomes ill, medicines including antibiotics, often of dubious quality are bought from local pharmacies or market stalls and administered by the persons themselves. Human antibiotics are often given to animals and vice versa. Due to the deficit of trained health personnel, Cambodia has developed a cadre of village level healthcare workers, who have minimal training and little supervision to treat villagers or their sick animals. Little care is taken in disposing of antibiotics, which must be resulting in huge amount of residues in Cambodian environment.</p> <p>The proposed project will investigate and map the current status of antibiotic use, antibiotic resistance and antibiotic residues in the target area and would examine the drivers for these in these remote areas, involving various stakeholders including human and animal healthcare providers and policy makers. We would involve the newly instituted laboratory and personnel in the Royal University of Agriculture and Veterinary Medicine as well as our partners, the Ministry of Health and the Ministry of Fisheries and Agriculture. We would also seek to evaluate the efficacy of a community dialogue intervention in improving the knowledge and understanding of use, handling and disposal of antibiotics to achieve appropriate antibiotic resistance management.</p>	