

in association with the Health Protection Agency and Veterinary Medicines Directorate

Final Report

A Three Colleges Symposium

‘Antimicrobial Resistance in Human and Veterinary Medicine – one medicine, one problem?’

Providing an evidence base for a rational debate

Tuesday 2 October 2012

The Royal College of Physicians, London NW1 4LE

Antimicrobial resistance in human and veterinary medicine – one medicine, one problem?

Tuesday 2 October 2012, Royal College of Physicians, London

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Communiqué

The Three Colleges Symposium on Antimicrobial Resistance held on 2 October 2012

Antimicrobial Resistance in Human and Veterinary Medicine – One Medicine, One Problem?

Providing an evidence-base for a rational debate

Based on the premise of 'One Medicine, One Problem', the priorities, opportunities and challenges in tackling antimicrobial resistance (AMR) in human and veterinary medicine, were discussed by the Royal College of Veterinary Surgeons, in partnership with the Royal College of Pathologists (RCPATH) and the Royal College of Physicians (RCP), and in association with the Health Protection Agency (HPA), the Veterinary Medicines Directorate (VMD) and the British Society for Antimicrobial Chemotherapy (BSAC) at a one-day symposium in London, held at the RCP. This communiqué summarises the conclusions from the invited expert speakers' talks and the audience discussion.

1. Antimicrobial resistance (AMR) describes a state in which a bacterium is insensitive to drugs that would normally kill other bacteria. This state may be innate or acquired and the clinical consequence of this is a reduced ability to treat infections with such organisms.
2. The issue poses worldwide concern. Drug resistance presents an ever-increasing global public health threat that involves all major microbial pathogens and antimicrobial drug classes. AMR could potentially take us back to a pre-antibiotic era where treatments for common infections are absent (or extremely expensive) and procedures such as organ transplantation, cancer chemotherapy and major surgery are compromised.
3. The issue of acquisition, evolution and transmission of AMR is complex and involves human and domestic animal populations (both food animal species and non-food companion animal species), but also wildlife and the environment. It is important to understand how these factors interact, particularly with increasing international movement of people, food and animals.
4. We need to develop strategies to extend the 'shelf-life' of current antibiotics and stimulate the development of new products in the pharmaceutical market, for example, by offering extended patent life for new antimicrobial drugs. The meeting deliberately focused on debating policies for best use of the existing products and did not consider the latter in depth.
5. Four main processes are involved in the evolution of resistance: emergence, adaptation, transmission among bacteria, and transmission in the community.
6. There are some bacteria which only infect animals, and there are examples amongst them of strains where AMR has emerged, although the clinical consequences of AMR in purely veterinary infections are as yet limited. Conversely, there are bacteria confined to the human population in which AMR has evolved (by definition) from human use and which present serious clinical problems (for example, human tuberculosis). Finally, there are zoonotic bacteria, which infect or colonise humans and animals (for example, *E. coli*), in which AMR may have originated in either animals or humans, and then resistant strains have passed from animals to humans (for example, non-typhoidal *Salmonella*) or from humans to animals (for example, some MRSA in pets).

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7. Inappropriate antibiotic use is an important cause of the increased prevalence of antibiotic resistance genes. Voluntary decreases in usage at hospital level can be achieved without detriment to health, as shown by recent surveys from the Scottish NHS. Equally, Denmark has been successful in eliminating the use of fluoroquinolones in the poultry and pig industries without detriment to poultry or pig productivity. Unfortunately, this significant achievement was coincident with an increase in use of the same antibacterial for humans and an increase in AMR.
8. Resistance is usually cumulative and irreversible, ie usually there is no fitness cost associated or there has been compensation to overcome the cost. Consequently, in the absence of selection pressure, resistant strains will persist and will then be disseminated by global movement (usually by people).
9. Best practice in antimicrobial use is critical. Correct dosages for the weight of patient (human and animal) and observance of duration of treatment are critical to reduce the possibility of AMR emergence.
10. Both the veterinary and human field could profit from electronic prescribing systems, allowing the volume of usage to be accurately monitored and large amounts of data to be shared and interpreted at global level.
11. In considering restrictions in veterinary use, account should be taken of the differences that exist between companion animals and livestock. Whilst it is true that companion animals have a role to play in the transmission of antimicrobial resistance, they present a smaller threat to the safety of the foodchain when compared to livestock, and their health and welfare can be seriously jeopardised if a veterinary surgeon's antibiotic prescription rights are limited.
12. Responsible use of antibiotics will be fostered by providing GPs and veterinary surgeons with rapid bedside/penside diagnostics that can distinguish viral and bacterial infections and determine their species and antibiotic sensitivity.
13. Policies that promote the transfer of knowledge between research laboratories and clinical practice can effectively contribute to a future where molecular and microbiological data are commonly used to inform therapeutic choices, promoting best use of the available drugs.
14. Resistance can occur anywhere on the globe, but will be most likely to appear where the use and misuse of antibiotics is greatest. In an increasingly connected world, it is evident that any measures need to tackle global use. The probability that selection for resistance will occur where antimicrobial usage is highest and least controlled, coupled with unprecedented mobility of humans, means that, whether AMR originates from animal use or human use, the threats in Britain and in Europe will often emanate from outside. Strategies in the UK in human and veterinary medicine must recognise this. As well as pursuing all reasonable measures to reduce emergence and proliferation of AMR in the UK, our national strategies need to consider measures to reduce, identify (through surveillance) and deal with imported problems, be they in humans, food or animals.

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Acknowledgements

Financial support for this symposium is gratefully acknowledged from the Veterinary Medicines Directorate, the RCVS Charitable Trust, the Wellcome Trust, and the BSAC.

Authors

This communiqué is written and issued by the Scientific Advisory Committee of the symposium, comprising Professor The Lord Trees and Dr Bharat Patel (co-organisers), Professor Malcolm Bennett, Professor Peter Borriello, Professor Stephen Gillespie, Professor Peter Hawkey, Professor Duncan Maskell, Professor Laura Piddock and Professor Mike Sharland.

Links

Website: <http://www.rcvs.org.uk/news-and-events/past-events/joint-symposium-on-antimicrobial-resistance/>

Programme: <http://www.rcvs.org.uk/document-library/amr-symposium-programme/>

AMR Symposium Report: <http://www.rcvs.org.uk/document-library/amr-symposium-report/>

February 2013

LETTERS

NEW UK ANTIMICROBIAL RESISTANCE STRATEGY

UK antimicrobial resistance strategy must be set in a wider context

Peter M Hawkey *professor of clinical and public health bacteriology*¹, Bharat C Patel *consultant medical microbiologist*², Alexander J Trees *peer*³

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We welcome the editorial on the chief medical officer's intent to tackle the rise of antimicrobial resistance.¹ The remarkable success in reducing methicillin resistant *Staphylococcus aureus* bacteraemia to less than 2% exposes the rapidly growing problem of bacteraemia caused by Gram negative bacteria, particularly *Escherichia coli* (36%).² *E coli* differs from most agents that cause bacteraemia in that endogenous infections from gut carriage predominate.

The *E coli* population and resistance genes are dynamically connected to the wider environment and food animals.³ This was the subject of a recent symposium,⁴ which in addition to supporting the new intentions, strongly identified the international dimension of the problem of multidrug resistant *E coli* and *Klebsiella*. These organisms, which produce extended spectrum β lactamases (ESBLs), are resistant to third generation cephalosporins (such as cefotaxime), quinolones, and most antibiotics other than carbapenems. The ESBL rate in *E coli* isolated from intra-abdominal infections in 2008 was reported as 60% in India and China compared with 16.9% in the UK.⁵ This large difference is probably due to the heavy and relatively uncontrolled use of antibiotics in medicine, increasingly industrialised food production systems, and water and sewage systems of variable quality in India and China. Movement of resistant *E coli*, particularly through human travel, is a growing

problem, as shown by the 22.8% carriage rate of ESBL *E coli* in people in the UK of South Asian origin versus 8.1% in Europeans.⁶ Strategies to control antimicrobial resistance in human and veterinary medicine must recognise that the threat from outside Europe is potentially overwhelming.

Competing interests: None declared.

Full response at www.bmj.com/content/346/bmj.f1601/rr/642913.

- 1 Kessel AS, Sharland M. The new UK antimicrobial resistance strategy and action plan. *BMJ* 2013;346:f1601. (11 March.)
- 2 Ridge KW, Hand K, Sharland M, Abubakar I, Livermore D. Annual Report of the Chief Medical Officer. Vol 2. 2011. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/138331/CMO_Annual_Report_Volume_2_2011.pdf.
- 3 Wellington EM, Boxall AB, Cross P, Fell EJ, Gaze WH, Hawkey PM, et al. The role of the natural environment in the emergence of antibiotic resistance in gram-negative bacteria. *Lancet Infect Dis* 2013;13:155-65.
- 4 Royal College of Veterinary Surgeons. Communique from AMR symposium October 2012. www.rcvs.org.uk/document-library/communique-from-amr-symposium-october-2012/.
- 5 Hsueh PR, Badal RE, Hawser SP, Hoban DJ, Bouchillon SK, Ni Y, et al. Epidemiology and antimicrobial susceptibility profiles of aerobic and facultative Gram-negative bacilli isolated from patients with intra-abdominal infections in the Asia-Pacific region: 2008 results from SMART (Study for Monitoring Antimicrobial Resistance Trends). *Int J Antimicrob Agents* 2010;36:408-14.
- 6 Wickramasinghe NH, Xu L, Eustace A, Shabir S, Saluja T, Hawkey PM. High community faecal carriage rates of CTX-M ESBL-producing *Escherichia coli* in a specific population group in Birmingham, UK. *J Antimicrob Chemother* 2012;67:1108-13.

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Symposium Report

1. Introduction

There is much debate about the sources of antimicrobial resistance (AMR) in animals and humans, and the flow of resistance between them and the environment.

This symposium brought together medical and veterinary scientists and leading practitioners to discuss antimicrobial resistance, in the spirit of 'one medicine'.

Speakers reviewed the scientific evidence base to inform a rational debate. Apart from the origin and spread of resistance between humans and animals and the environment, they considered the rapidly-growing importance of antimicrobial use and misuse globally, the impact of travel and the historical outcomes of previous restrictions.

The project was led by Professor The Lord Trees, at the Royal College of Veterinary Surgeons, Dr Bharat Patel from the Royal College of Pathologists/Health Protection Agency (HPA), with contributions from the Royal College of Physicians, and in association with the HPA and the VMD.

2. Overview

The second half of the twentieth century has witnessed a revolution in medical care with the introduction of antibiotics. These 'wonder drugs' are now routinely used to treat both mild and life-threatening illnesses, and healthcare professionals, governments and the public have become increasingly reliant on them. Unfortunately, antimicrobial resistance, a phenomenon whereby micro-organisms which were previously sensitive to antibiotics become able to withstand attack, means these conventional treatments become ineffective. This results in prolonged illnesses and greater risk of death for human and animal patients, and threatens the return to a pre-antibiotic era without (or with very expensive) treatments for common infections, and procedures such as organ transplantation, cancer chemotherapy and major surgery are compromisedⁱ.

The issues were set out by the UK's Chief Veterinary Officer and RCVS Council member Nigel Gibbens who highlighted the need to build a strong evidence base, and not to allow speculation or opinion to overshadow the scientific research. Professor David Walker (on behalf of the Chief Medical Officer Dame Sally Davies) and Professor Heymann from the Health Protection Agency explained the interdisciplinary nature of the issue, which implies that responsibility for tackling AMR is shared between veterinary and human medicine.

Some bacteria are known to be limited to animals and some to humans, whereas others may be transmitted zoonotically from animals to humans (and vice versa). Although the clinical consequences of antimicrobial resistance in purely animal infections are still limited, the same cannot be said for resistant bacteria affecting solely humans, such as human tuberculosis. The acquisition, evolution and transmission of antimicrobially-resistant zoonotic bacteria was debated as, once resistance is acquired, resistant strains can pass from animals to humans (eg *Staphylococcus aureus*; *E. coli* O157) or vice versa (eg some MRSA in pets).

Professor Stephen Gillespie, from the University of St. Andrews, explained the four main processes involved in the evolution of resistance: acquisition, adaptation, transmission among bacteria, and

transmission in the community. Once resistance is established in a new species or strain, the resistance determinant can then be distributed into other species, following certain epidemiological and sociological patterns. Resistance is cumulative and irreversible, and consequently, in the absence of selection pressure, resistant strains will persist and will then be disseminated by global movement, usually by people. For example, the New Delhi clone of metalloβ-lactamase was also found in Birmingham (UK), where there is a large presence of population with links to India. This illustrates how the “biology of human interaction” complicates the considerations of healthcare professionals and policy experts tackling antimicrobial resistance. Any national strategy to tackle antimicrobial resistance in human and veterinary populations needs also to consider measures to reduce, identify (through surveillance) and deal with problems that are imported.

Widespread antibiotic drug use is an important cause of the increased prevalence of antibiotic resistance genes. Voluntary decreases in antibiotic usage by hospitals can be achieved without detriment to health, as shown by the recent surveys from the Scottish NHS, presented by Peter Davey from the University of Dundee. Similarly, Denmark has been successful in eliminating the use of fluoroquinolones in the poultry and pig industries without detriment to poultry or pig productivity. Unfortunately, as was shown by Frank Aarestrup, from the Technical University of Denmark, this significant achievement came simultaneously with an increase in use of the same antibacterial for humans, and an increase in AMR.

When considering restrictions in veterinary use, delegates argued there is a need to take account of the differences that exist between companion animals and livestock. Although companion animals do have a role to play in the transmission of antimicrobial resistance, the threat they present to the safety of the food chain is smaller, compared to livestock, and their health and welfare could be seriously jeopardised if limits were imposed on what veterinary surgeons may prescribe.

It was also emphasised that, to reduce the possibility of AMR emergence, it is critical that antibiotics are prescribed and used correctly, with dosages adjusted to the patients' weights (human and animal) and treatment durations observed. Electronic prescribing systems for the veterinary and human field were also discussed and their benefits highlighted, including, for example, from accurately monitoring large amounts of data which could be shared and interpreted at global level.

Discussion also included what strategies can be developed to make the most of the antibiotics we have today, and what policies can be adopted to find alternatives to the medicines we have, for example in bringing new antibiotics to market. A near future scenario was described, where the responsible use of antibiotics could be fostered by providing GPs and veterinary surgeons with rapid bedside/penside diagnostic tools that can distinguish viral and bacterial infections to determine their antibiotic sensitivity. Participants described the symposium as a “thought provoking day” with “stimulating, emotive yet considered discussions.”

Professor The Lord Trees, who co-organised the event, said it had “shed more light than heat” and that addressing the issue in such a collaborative spirit between professions should be celebrated and fostered for the future.

¹ <http://www.who.int/mediacentre/factsheets/fs194/en/>

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3. Registration

Registration was charged at £195 for industry delegates and £95 for non-industry delegates. Delegates registered online, paying by credit card only, using the EventBrite online registration system.

4. Delegates

The symposium attracted a broad audience, including veterinary and medical scientists and practitioners, postgraduate students, those from industry, opinion leaders and others with an interest in AMR.

Total delegates: 185

Breakdown:

Industry: 27%

Non-industry: 73%

A full attendance list can be seen at Appendix 1.

5. Scientific Advisory Committee

The programme and speakers were chosen by the Scientific Advisory Committee, led by Professor The Lord Trees and Dr Bharat Patel.

Members of the Scientific Advisory Committee

Name	Role	Affiliation
Professor The Lord Trees BVM&S PhD DipEVPC DVetMed(hc) MRCVS	RCVS Past President Emeritus Professor of Veterinary Parasitology, University of Liverpool	Royal College of Veterinary Surgeons
Dr Bharat Patel MBBS MSc FRCPath	Consultant Medical Microbiologist, HPA Microbiology Services Division, Division of Infection, Barts & The London NHS Trust	Royal College of Pathologists Health Protection Agency
Professor Stephen Gillespie MD DSc FRCP(Edin) FRCPath	Sir James Black Chair of Medicine & Director of Research, University of St Andrews	Royal College of Physicians Edinburgh
Professor Malcolm Bennett BVSc PhD FRCPath FHEA MRCVS	Professor of Veterinary Pathology, University of Liverpool	National Zoonoses Research Centre, Liverpool
Professor Peter Borriello PhD FRCPath	Chief Executive and Director of Veterinary Medicines, Veterinary Medicines Directorate	Veterinary Medicines Directorate
Professor Peter Hawkey BSc DSc MBBS MD FRCPath	Professor of Clinical and Public Health Bacteriology, Honorary Consultant, University of Birmingham, Health Protection Agency West Midlands Public Health Laboratory, Birmingham NHS	Professor Peter Hawkey

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Professor Duncan Maskell MA PhD FMedSci	Marks and Spencer Professor of Farm Animal Health, Food Science and Food Safety, University of Cambridge (now Head of Biological Sciences, University of Cambridge)	University of Cambridge
Professor Laura Piddock BSc PhD	Professor of Microbiology, University of Birmingham President, British Society for Antimicrobial Chemotherapy	British Society for Antimicrobial Chemotherapy
Professor Mike Sharland RCPC MD	Professor of Paediatric Infectious Diseases, Lead consultant paediatrician, Paediatric infectious diseases unit, St George's Hospital, London	Paediatric Infectious Diseases Unit, St George's Hospital, London

6. Programme and Speakers

The final programme for the day is at appendix 2.

A full list of speakers was as follows:

- Prof The Lord Trees, University of Liverpool / Royal College of Veterinary Surgeons
- Dr Bharat Patel, Royal College of Pathologists / Health Protection Agency
- Mr Nigel Gibbens, Chief Veterinary Officer
- Prof David Walker, Department of Health (on behalf of Prof Dame Sally Davies, CMO)
- Prof David Heymann, Health Protection Agency (pre-recorded)
- Dr Stephen Gillespie, Royal College of Pathologists, Royal College of Physicians(Edin)
- Prof Peter Hawkey, West Midlands HPA / University of Birmingham
- Prof Laura J V Piddock, University of Birmingham
- Mr Christopher Teale, Animal Health and Veterinary Laboratories Agency
- Prof Susan Dawson, University of Liverpool
- Prof Stuart W J Reid, Royal Veterinary College
- Prof Ross Fitzgerald, The Roslin Institute, University of Edinburgh
- Prof Elizabeth M H Wellington, University of Warwick
- Prof Marc Lipsitch, Harvard School of Public Health (pre-recorded)
- Prof Frank Aarestrup, Technical University of Denmark
- Prof Peter Davey, University of Dundee
- Prof Peter Silley, MB Consult / University of Bradford
- Prof S Peter Borriello, Veterinary Medicines Directorate

Where available, speaker biographies can be found at the following link:

<http://www.rcvs.org.uk/document-library/amr-symposium-speaker-biographies/>

Where available, presentations can be found at the following link:

<http://www.rcvs.org.uk/news-and-events/past-events/joint-symposium-on-antimicrobial-resistance/>

7. Sponsors

We are grateful to the following four organisations, for their financial support:

- Veterinary Medicines Directorate: £5,000
- RCVS Charitable Trust: £3,000
- Wellcome Trust: £2,000
- The British Society for Antimicrobial Chemotherapy: BSAC speaker expenses

All of the sponsors except the Wellcome Trust had a stand as part of a small exhibition.

Financial Report

A final budget breakdown can be found below.

Item	Cost for 185 delegates
EXPENDITURE	
Venue hire (VAT exempt)	£3,950.00
Lunch, 2 courses, from £20 + VAT	£4,263.84
Refreshments from £2.85 + VAT x 3	£644.26
Poster board and flowers	£72.00
1 x AV technician £250 + VAT	£300.00
Speakers travel and accommodation	£1,306.03
Patel/Trees/Scientific Advisory Group preparation/meetings expenses	£1,868.40
Badges/literature on the day/CPD certificates	£195.81
RCVS staff costs	£2,501.20
Event insurance	£277.72
Total expenditure	£15,379.26
INCOME	
Total income from registrations	£17,154.25
Grants	£10,000.00
Total income	£27,154.25
Surplus	£11,774.99

Surplus returned to sponsors	
VMD	£2,165
RCVS Charitable Trust	£1,300
Wellcome Trust (subsequently donated to the RCVS Charitable Trust)	£879
Balance shared by the three underwriting Colleges	
RCVS	£2,477
RCPPath	£2,477
RCP	£2,477
Total	£11,775

Evaluation

Feedback forms were included in the delegate packs, the results of which are as follows:

41 forms returned

Job description

Vet 15

(Technical advisor industry, researcher, small animal, veterinary pathologist histopathology, clinical pathologist)

Medic 22

(Medical consultant, researcher, consultant microbiologist, marketing, medical epidemiologist, clinical microbiologist, scientist, student)

Please indicate the extent to which you agree with these statements, 1 being 'I disagree', 4 being 'I agree'

	1	2	3	4
This event was worthwhile use of study leave	2	1	21	16
The facilities & catering met my requirements		3	14	22
There was ample time for discussion		4	24	7
The meeting contained new ideas and materials	2	4	18	16
I agreed with the views expressed by the speakers		4	30	2
I felt able to challenge the views expressed by the speakers and ask questions of them	1	8	18	7
I would consider implementing the ideas/concept learnt today in my workplace	1	7	19	9
The audiovisual equipment worked well, visual presentations were clear and sound was audible	4	13	19	4

- Marc Lipsitch audio link didn't work, other than that, pretty good
- Chairs of several sessions allowed speakers to overrun and then allowed time for questions which made the whole meeting overrun and shortened breaks
- Could speakers provide email addresses
- Audio problems with live link

What topics would you like to see covered in future Symposia?

- Zoonotic infections – all pathogens
- More examples of actions taken to make a difference with regards to AMR prevention
- The improvement needed in diagnostics in clinical laboratories – the gulf between research in universities and the techniques available in hospitals
- Implementing genomic sequencing in diagnostic hospital laboratories
- Links between animal and child abuse in the home ie. if animal abuse there may be domestic violence and vice versa. In the USA, social workers and animal welfare work together. This is something that could be looked at more details and maybe RCVS could look at a similar day. Bringing people from different authorities / organisations etc.
- More epidemiology showing changing trends between animals and humans
- Gram negative resistance (specific)
- Antibiotic stewardship
- Talks on the practical application of the theory
- Antimicrobial resistance as a global problem, rather than just in Europe
- Emerging zoonotic diseases
- Tuberculosis in animals and man
- Responsible use of antimicrobials in small animals
- Getting the message across
- Zoonoses in the UK and travel-associated infections
- Joint pathology sessions
- Clinical decisions
- Pharmaceutical vs clinical vs scientific
- Badgers and TB
- Perhaps a multinational working group / collaboration looking at different approaches in different countries without defensive attitudes
- New alternatives to antimicrobials
- Disease surveillance
- Risk assessment / ranking / attribution studies
- Food safety
- Emerging zoonoses
- More interaction between medical and veterinary specialists re the aspects of zoonotic infections, and environmental microbiologists

Any other comments

- Less academics and more jobbing microbiologists next time please
- Perhaps the balance of the meeting had a little too much on analysing the problem and not quite enough on what to do about it (risk assessment v risk management)
- Very good thought provoking day.

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- I think this is a great day. The organisation committee should be congratulated. It is important that the RCVS continue to host similar days to bring together professionals from medical, science, veterinary to combine work. I think the RCVS is in a good position to draw experts.
- Seating was very cramped and uncomfortable
- AV provision was very poor
- Sessions overran significantly – perhaps could have started earlier to allow more time
- Small group discussion to encourage questions and discussion
- A good day. A bit high powered for a practitioner – could have done with a simultaneous translation!
- Could you ask the photographers not to use the flash all the time. It is very distracting and irritating. Why not use a higher ISO number?
- Thank you. Really good, stimulating emotive yet controlled and considered.
- Less sophisticated molecular biology and more precise conclusions
- Don't like presentations by video link

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Appendix 1 – Delegate List

Delegate list - AMR Symposium, Tuesday 2 October 2012, Royal College of Physicians			
Prefix	Last Name	First Name	Company
Dr.	Adhami	Zoe	North Middlesex Hospital NHS Trust
Prof	Aarestrup	Frank	Technical University of Denmark
Mr.	Aggett	David	Friars Moor Veterinary Clinic
Dr.	Azadian	Berge	Imperial College Healthcare NHS Trust
Dr.	Balakrishnan	Indran	Royal Free London NHS Foundation Trust
Dr.	Banavathi	Krishna	University Hospital of North Staffordshire NHS Trust
Dr.	Barker	Caroline	Norfolk and Norwich University Hospital NHS Foundation Trust
Prof.	Barrett	David	British Cattle Veterinary Association
Dr.	Bates	Janice	Western Sussex Hospitals NHS Trust
Mr.	Battersby	Ian	Davies Veterinary Specialists
Dr.	Bax	Richard	TranScrip Partners LLP
Dr.	Bedford	Luke	Worcestershire Acute Hospitals Trust
Prof	Bennett	Malcolm	University of Liverpool
Dr.	Berry	Elizabeth	DairyCo
Dr	Bethke	Lara	Wellcome Trust
Dr	Bhumbra	Rej	BMJ
Mr	Bonner	John	Veterinary Practice
Prof	Borriello	S Peter	Veterinary Medicines Directorate
Ms.	Boville	Claire	Department of Health
Dr.	Bowen	Mark	British Equine Veterinary Association
Mr.	Brouwer	Arjen	Office of the Wales CVO, WGov
Dr.	Brown	Ian	University of Oxford
Mr.	Burch	David	Octagon Services Ltd
Dr.	Burns	William	Society for General Microbiology
Ms	Bushell	Cherry	RCVS Charitable Trust
Dr.	CAMBRAY-YOUNG	JOANNA	UNIVERSITY OF CAMBRIDGE
Mr.	Caunter	Adrian	Abbey Veterinary Group
Mrs.	Cavendish	Sue	Health Protection Agency
Dr.	Chambers	Sharon	Epsom and St Helier NHS Trust
Dr	Cichowska	Anna	HPA
Dr.	Clarke	Stephenie	Ceva Animal Health
Miss	Collins	Rachael	AHVLA Starcross
Mr.	Corbishley	Alexander	Non-practicing (PhD Student)
	Cowan	Fiona	HPA
Miss	Coyne	Lucy	University of Liverpool
Prof.	Cunliffe	Nigel	University of Liverpool
Mr	Dallow	John	Quotient Bioresearch
Prof	Davey	Peter	University of Dundee
Dr.	Davies	Robert	AHVLA Weybridge
Mrs.	Dawson	Sandra	Dechra Laboratory Services
Prof	Dawson	Susan	University of Liverpool
Mr	Day	Jamie	Animal Pharm
Mrs.	De Briyne	Nancy	FVE
Dr.	Deeny	Sarah	Health Protection Agency
Mr.	Diribe	Onyinye	AHVLA Weybridge
Dr.	Dixon	Ronald	University of Lincoln
Ms	Doorly	Ashley	RCVS Charitable Trust

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Mr.	Eames	Nick	XLVet UK Ltd
Ms.	Eckford	Suzanne	Veterinary Medicines Directorate
Dr.	Edeghere	Obaghe	Health Protection Agency
Mrs.	Edwards	Helen	Cyton Biosciences Ltd.
Ms.	Eppink	Lysan	Boehringer Ingelheim
Ms.	Esan	Seun	Health Protection Agency
Dr.	Ferguson	Edward	Pfizer Animal Health
Dr.	fifer	helen	great ormond street hospital nhs trust
Mr.	Fitzgerald	Ronan	Bayer Animal Health
Prof	Fitzgerald	Ross	The Roslin Institute, University of Edinburgh
Dr.	Foley Nolan	Clíodhna	SafeFood
Dr.	Foster	Geoffrey	Scottish Agricultural College
Ms	Foster	Debbie	BSAC / Antibiotic Action
Dr.	Garner	David	Frimley Park Hospital NHS Foundation Trust
Dr	Geoghegan	Lourda	Public Health Agency
Mr	Gibbens	Nigel	CVO
Prof	Gillespie	Stephen	RCP Edinburgh
Mrs.	Glennon	Alison	NOAH
Dr.	Gosling	Becky	Animal Health and Veterinary Laboratories Agency
	Gray	Amy	NFU
Mr.	Green	Paul	Veterinary Medicine Directorate
Dr.	Guerrero	Raul	Consultant
Mrs	Harcourt	Fiona	RCVS
Dr.	Hardy	Katie	Health Protection Agency
Mrs.	Hartley	Helen	AFBI
Prof	Hawkey	Peter	West Midlands HPA / University of Birmingham
Prof	Heymann	David	Health Protection Agency
Mrs.	Hogan	Carolyn	Pfizer AH
Dr.	Holliman	Richard	HPA London
Ms	Hubbard	Rebecca	Vet Times
Mrs.	Ingleby	Karen	MSD Animal Health
	Ironmonger	Dean	Health Protection Agency
	Ismail	Ayshe	Veterinary Record
Mr	Isted	Matthew	Veterinary Medicines Directorate
Mr.	Jaggar	Niall	Pfizer Animal Health
Dr	Jain	Sangita	NHS
Dr.	James	Stone	Gloucestershire Acute Hospitals NHS Foundation Trust
Dr.	Jepson	Annette	Imperial Healthcare NHS Trust
Mr	Jinman	Peter	RCVS Charitable Trust
Dr.	Jog	Simantini	Royal Cornwall Hospital NHS Trust
Miss	Johnson	Lesley	Veterinary Medicines Directorate
Mr.	Jones	Peter	British Veterinary Association
Dr	Jorge	Rita	RCVS
Mr.	Kainth	Bobby	Food Standards Agency
Mrs.	killner	josephine	Fitzpatrick Referrals
Mr	King	Cahir	Downe Vets
Dr.	Kubiak	Elizabeth	Aneurin Bevan Health Board
Prof.	La Ragione	Roberto	AHVLA Weybridge
Dr.	Lacey	Sandra	Queens Hospital
Mr.	Laing	Neil	XLVet UK Ltd
Mr.	Lambert	Jonathan	Pfizer Animal Health
Dr.	Latham	Sophia	University of Liverpool
Dr.	Leader	Leo	University of New South Wales
Dr.	Leonard	Finola	University College Dublin
Dr.	Littlewood	Janet	Veterinary Dermatology Referrals

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Tuesday 2 October 2012, Royal College of Physicians, London

Ms	Lockett	Lizzie	RCVS
Ms.	Lujan Benitez	Maria	Cyton Biosciences Ltd.
Dr.	Mair	Tim	Bell Equine Veterinary Clinic
Mr	Manos	John	Health Protection Report
Dr.	Martin	Mick	Royal Bournemouth Hospital
Prof	Maskell	Duncan	Department of Veterinary Medicine, University of Cambridge
Dr.	Mather	Alison	Wellcome Trust Sanger Institute
Dr.	Maxwell	Sarah	Stockport NHS Foundation Trust
Dr.	McCartney	Christine	Health Protection Agency
Dr.	MCGECHIE	DAVID	FREMANTLE HOSPITAL
Mr.	McMullin	Paul	Poultry Health Services Ltd
Dr.	Meyers	Marilyn	Southend University Hospital
Dr.	Milne	Lorna	Health Protection Agency
Ms.	Moloney	Roberta	Southport and Ormskirk Hospital NHS Trust
Mrs	Molyneux	Jacqui	RCVS
	Morris	Kathryn	RCPATH
Mrs.	Mueller	Karin	MRCVS
Dr.	Muller-Pebody	Berit	Health Protection Agency
Mr.	Murphy	Donal	NOAH
Dr.	Murray	Susan	Royal United Hospital Trust
	Nunan	Coilin	Compassion in World Farming
Mr.	Ó Scanail	Peadar	Veterinary Council of Ireland
Dr.	O' Sullivan	Margaret	Health Service Executive, Ireland
Mrs.	Oliveira	Manuela	FACULDADE MEDICINA VETERINARIA
Dr.	Pai	Sumita	Addenbrookes Hospital, Cambridge
Ms	Paice	Catherine	Freelance Editor and Journalist
Ms.	Parish	Laura	Putlands Veterinary Surgery
Mr.	Parker	Daniel	British Poultry Council
Dr	Patel	Bharat	HPA, RCPATH
Dr.	Paterson	Gavin	University of Cambridge
Dr.	Pearce	Gareth	University of Cambridge
Mr.	Pearson	Richard	The George Veterinary Group
Dr.	Peters	christine	nhs
Dr.	Petkar	Hawabibee	Barnet & Chase Farm Hospitals NHS Trust
Dr.	Philpott-Howard	John	King's College London School of Medicine
Prof	Piddock	Laura J V	University of Birmingham
Dr.	Pinchbeck	Gina	University of Liverpool
Mr.	Points	John	LGC
Dr.	Potter	Timothy	Westpoint Veterinary Group
Mr.	Powell	Roger	PTDS
Dr.	Price	Elizabeth	Barts and the London NHS Trust
Miss	Randall	Laura	Boehringer Ingelheim
Dr	Reaney	Elizabeth	DHSSPS
	Rees	Thelma	RCVS
Mrs.	Reeves	Hannah	AHVLA Weybridge
Prof	Reid	Stuart W J	Royal Veterinary College
Mrs.	Roberts	Judith	Pfizer Animal Health
Mr.	Roger	Paul	VCS Ltd
Mr.	Rogers	Mitch	Health Protection Agency
Mr.	Rowe	Will	University of Cambridge
Mr.	Rush	Ben	Finn Pathologists
Mrs.	Sayers	Ghislaine	Paignton Zoo Environmental Park
Mr.	Schmidt	Jean-Paul	Edinburgh University
Dr.	Sheahan	Anne	Health Service Executive

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Prof	Silley	Peter	MB Consult Limited / The University of Bradford
Dr.	Simjee	Shabbir	Elanco Animal Health
Mr.	Simon	Tony	Pfizer
Mr.	Sketchley	Philip	NOAH
Ms.	Skillings	Beth	Cats Protection
Mr.	Smart	David	Biomerieux - Veterinary Franchise
Dr.	Springbett	Roger	East Sussex Healthcare NHS Trust
Prof.	Staerk	Katharina	Royal Veterinary College
Mr.	Statham	Jonathan	Veterinary Surgeon
Mr	Swann	James	Royal Veterinary College
Mr.	Tasker	John	Private
Mr	Teale	Christopher	Animal Health and Veterinary Laboratories Agency
Miss	thomas	kara	Food Standards Agency
Dr.	Timofte	Dorina	University of Liverpool
Dr	Toleman	Michelle	Microbiology, NHS Bristol
Mr.	Toplis	Paul	Methodist Church
Mr.	Torren Edo	Jordi	European Medicines Agency
Prof The Lord	Trees	Sandy	University of Liverpool / RCVS
Dr.	Tucker	Dan	University of Cambridge
Dr.	Turner	Andrew	University of Nottingham
Mrs.	Valentine	Patricia	Alpha Vet
Dr.	Van Den Eede	Christel	Pfizer
Dr.	Vaughan	Lindy	Veterinary Council of Ireland
Dr.	Vicca	Anthony	Diana, Princess of Wales Hospital, Grimsby
Dr	Viner	Bradley	RCVS
Prof	Walker	David	Department of Health
Mr.	Ward	Adrian	Vetoquinol
Dr.	Watson	Penny	BSAVA Scientific committee
Prof	Wellington	Elizabeth M H Wellington	University of Warwick
Dr	Wey	Emmanuel	NHS
Miss	White	Claire	Tern Veterinary Group
Dr.	Whitehead	Martin	Chipping Norton Veterinary Hospital
Dr.	Wiggins	Robin	West Hertfordshire Hospitals NH Trust
Mr.	Williams	Matthew	Pfizer Animal Health
	Winter	Clare	RCPATH
Prof.	Woodford	Neil	Health Protection Agency
Dr.	Woznicova	Vladana	Interact Medical/MasarykUniversity
Mr.	Young	Richard	Soil Association

Appendix 2 – Programme

Antimicrobial resistance in human and veterinary medicine – one medicine, one problem?

Providing an evidence base for a rational debate

Tuesday 2 October 2012, Royal College of Physicians, London NW1 4LE

9.30-10.00 Registration and coffee

Morning session, Wolfson Lecture Theatre

10.00-10.05 Introduction

Prof The Lord Trees, University of Liverpool / Royal College of Veterinary Surgeons
Dr Bharat Patel, Royal College of Pathologists / Health Protection Agency

10.05-10.15 Opening

Mr Nigel Gibbens, Chief Veterinary Officer
Prof David Walker, Department of Health (on behalf of Prof Dame Sally Davies, CMO)
Prof David Heymann, Health Protection Agency (pre-recorded)

10.15-10.35 Antimicrobial resistance: biology and evolution

Dr Stephen Gillespie, Royal College of Pathologists, Royal College of Physicians(Edin)

10.35-11.15 Antibiotic resistance in animal and man – how big a problem?

Prof Peter Hawkey, West Midlands HPA / University of Birmingham

11.15-12.15 Origins of resistance and flow of AMR phenotype and genotypes between species and the environment

A series of shorter talks showcasing current data providing evidence of transfer of resistance, or not, between humans, other animal populations and the environment:

The worldwide dissemination of a single plasmid encoding an ESBL in bacteria isolated from people and animals

Prof Laura J V Piddock, University of Birmingham

Flow of AMR phenotypes and genotypes – food-producing animals

Mr Christopher Teale, Animal Health and Veterinary Laboratories Agency

Antibacterial resistance in companion animals and potential risk to human health

Prof Susan Dawson, University of Liverpool

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12.15-13.15 **Buffet lunch (Osler and Long Room)**

Afternoon session, Wolfson Lecture Theatre

13.15-14.15 **Previous session continued:**
The ecology of antimicrobial resistance; diversity and dogma
Prof Stuart W J Reid, Royal Veterinary College

Staphylococcus aureus host switching events and the evolution of antibiotic resistance

Prof Ross Fitzgerald, The Roslin Institute, University of Edinburgh

The environment as a reservoir of antibiotic resistance: prevalence, selection and transfer

Prof Elizabeth M H Wellington, University of Warwick

14.15-14.35 **How do we quantify the effect of animal antibiotic use on human health?**
Prof Marc Lipsitch, Harvard School of Public Health (pre-recorded)

14.35-15.15 **The history of restrictions and their effectiveness in human and veterinary usage**
Prof Frank Aarestrup, Technical University of Denmark
Prof Peter Davey, University of Dundee

15.15-15.45 **Coffee**

15.45-15.55 **AMR – the same for humans and other animals?**
Prof Peter Silley, MB Consult / University of Bradford

15.55-16.35 **Where do we go from here? Audience participation debate, including views from industry**
Prof S Peter Borriello, Veterinary Medicines Directorate

16.35-16.55 **Conclusions**
Dr Bharat Patel, Royal College of Pathologists / Health Protection Agency
Prof S Peter Borriello, Veterinary Medicines Directorate

16.55-17.00 **Closing remarks**
Prof The Lord Trees, University of Liverpool / Royal College of Veterinary Surgeons

17.00 **Finish**
