

# Strategy for developing and implementing a programme of surveillance for antimicrobial resistance in animals in England and Wales



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# Abbreviations and glossary

ACMSF	Advisory Committee on Microbiological Safety of Food.
AHWDG	Animal Health and Welfare Directorate General, Defra.
Anaerobe	Organism that is able to live in the absence of free oxygen (gaseous or dissolved).
Antibiotic	A substance produced by, or derived from a microorganism that selectively destroys or inhibits the growth of other microorganisms.
Antibiotic Resistance	The ability of a microorganism to withstand an antibiotic.
Animal husbandry	The practice of breeding and rearing livestock.
Antimicrobial	A compound that, at low concentrations, exerts an action against microorganisms and exhibits selective toxicity towards them.
Antimicrobial Resistance	The ability of a microorganism to withstand an antimicrobial.
CEFAS	Centre for Environment, Fisheries and Aquaculture Sciences, Defra.
Commensal	An organism that derives benefit from living in close physical association with another organism that derives neither benefit nor harm from its relationship with the commensal.
Cross-resistance	The tolerance to a usually toxic substance as a result of exposure to a similar acting substance.
CSL	Central Science Laboratory.
DARC	Defra Antimicrobial Resistance Coordination Group.
DARD NI	Department of Agriculture and Rural Development, Northern Ireland.
Defra	Department for Environment, Food and Rural Affairs.
DH	Department of Health.
Enhanced Surveillance	Surveillance that provides significant additional information to routine surveillance in current areas of interest or concern and that can be targeted at a subset of organisms identified in the preliminary routine surveillance screening.
Epidemiology	The study of the cause, distribution and control of a disease in a population.
EU	European Union.
FEFANA	European Association of Feed Additives Manufacturers.
Fluoroquinolone	A synthetic antimicrobial with a characteristic 4-quinolone ring structure and containing a fluorine moiety at the 6-position.
FSA	Food Standards Agency.

## Abbreviations and glossary

Growth Promoter	Antimicrobials used at low concentrations to stimulate an animal's growth, resulting in increased daily live weight gain and feed conversion efficiency.
HPA	Health Protection Agency (including the PHLS [Public Health Laboratory Service]).
Microorganism	Microscopically small organisms, including unicellular plants, animals, bacteria and fungi.
OIE	Office International des Epizooties.
Pathogen	Any biological agent which can cause disease.
PSD	Pesticides Safety Directorate, Defra.
RADAR	Rapid Analysis and Detection of Animal-related Risks.
Resistance	The spread within a population of genes, via selection, for their ability to destroy or otherwise reduce the effect of some artificial chemical, e.g. an antimicrobial.
Routine Surveillance	The minimum recommended surveillance requirement.
SAC	Scottish Agricultural College.
SACAR	Specialist Advisory Committee on Antimicrobial Resistance.
SEERAD	Scottish Executive Environment and Rural Affairs Department.
SGDIA	Defra's Surveillance Group for Infectious Diseases in Animals.
SSRL	Scottish Salmonella Reference Laboratory.
SVS	State Veterinary Service, Defra.
VLA	Veterinary Laboratories Agency, Defra.
VMD	Veterinary Medicines Directorate, Defra.
VRD	Veterinary Research Division.
VSS	Veterinary Surveillance Strategy.
Zoonoses	An infectious disease that can be contracted by humans where the pathogen is normally maintained within the animal population.

# Introduction

## Surveillance for antimicrobial resistance in animals in England and Wales

**1.1** Antimicrobial products, including antibiotics, play a key role in maintaining and improving human and animal health. Over recent years there has been an increasing prevalence of microorganisms resistant to treatment with antimicrobial products<sup>1</sup>. This has reduced the effectiveness of some treatments in both humans and animals. Of particular concern is the possible transfer of antimicrobial resistant organisms from animals to humans and of resistance genes between microorganisms.

**1.2** It is important therefore to develop effective mechanisms for identifying, collecting and interpreting the information that will provide early warning of antimicrobial resistance developing in food producing animals.

**1.3** This document sets out the Department for Environment, Food and Rural Affairs (Defra's) strategy for developing and maintaining such mechanisms. It also identifies the actions that Defra has taken, and will take, to implement it in England and Wales. It is along very similar lines to, but separate from, the action plans developed for Scotland<sup>2</sup> and Northern Ireland<sup>3</sup>.

<sup>1</sup> The Path of Least Resistance. 1998. Standing Medical Advisory Committee Sub-Group on Antimicrobial Resistance, Department of Health.

<sup>2</sup> UK Antimicrobial Resistance Strategy and Action Plan for Scotland. 2002. Scottish Executive Steering Group on Antimicrobial Resistance.

<sup>3</sup> Antimicrobial Resistance Action Plan 2002-2005. 2002. Department of Health, Social Services and Public Safety, Northern Ireland.

# Background

**2.1** In response to the recommendations in the House of Lords Science and Technology Select Committee's report on antimicrobial resistance<sup>4</sup>, in June 2000 the Government published a cross-Government strategy and action plan<sup>5</sup> on antimicrobial resistance.

**2.2** Its aims were to:

- minimise morbidity and mortality due to antimicrobial resistant infection; and
- maintain the effectiveness of antimicrobial agents in the treatment and prevention of microbial infections in man and animals.

**2.3** It encompassed three key elements:

- surveillance – to monitor “how we are doing” and to provide the data on resistant organisms, illness due to them and antimicrobial use, necessary to inform Government action;
- promoting responsible antimicrobial use – to reduce the “pressure for resistance” by reducing unnecessary and inappropriate exposure for microorganisms to antimicrobial agents in clinical and veterinary practice, animal husbandry, agriculture and horticulture; and
- infection control – to reduce the spread of infection in general (and thus some of the need for antimicrobial agents), and of antimicrobial resistant microorganisms in particular.

**2.4** Defra has also published its own Strategy for Enhancing Veterinary Surveillance in the UK<sup>6</sup>. A key element of this will be to establish a surveillance programme for identifying, collecting and interpreting data on antimicrobial resistance in animals. This document sets out the strategy for developing and implementing such a programme.

<sup>4</sup> House of Lords Select Committee on Science and Technology. Session 1997-98, 7th Report. Resistance to Antibiotics and Other Antimicrobial Agents. Chairman Lord Soulsby. London: The Stationery Office.

<sup>5</sup> UK Antimicrobial Resistance Strategy and Action Plan. June 2000. Department of Health.

<sup>6</sup> Partnership, Priorities and Professionalism: A Strategy for Enhancing Veterinary Surveillance in the UK. 2003. Department for Environment, Food and Rural Affairs.

# Strategy for developing and implementing a surveillance programme for antimicrobial resistance in animals

**3.1** The following paragraphs set out the steps necessary for developing and implementing a surveillance programme for antimicrobial resistance in animals that will:

- contribute effectively to Defra’s Strategy for Enhancing Veterinary Surveillance in the UK<sup>6</sup>; and
- help to deliver the aims of the cross-Government strategy<sup>5</sup> on antimicrobial resistance.

**3.2** It details the:

- aim (paragraph 3.3), objectives (paragraph 3.4), outcomes (paragraph 3.5) and scope (paragraphs 4.1 – 4.2) necessary for such a programme;
- existing surveillance for antimicrobial resistance in animals and identifies where this needs to be extended or supplemented (paragraphs 3.6 – 3.11);
- key microorganisms to be included in the proposed surveillance programme (section 5);
- recommendations from the ACMSF Report, and how the proposed programme will address them (section 6); and
- methods for implementing the proposed surveillance programme (section 7), the resources necessary (section 8), criteria for evaluating its success (section 9) and the arrangements for reviewing it (section 10).

## Aim

**3.3** The aim of Defra’s proposed surveillance programme for antimicrobial resistance in food producing animals is to collect and interpret data on resistant organisms, on illness due to them and on antimicrobial usage, so as to:

- reduce the risk of development of antimicrobial resistance in animals; and
- reduce the risk of transfer of antimicrobial resistance genes from animals to man.

### Objectives

**3.4** Its objectives are to:

Objective 1: provide information on the prevalence, patterns and trends of antimicrobial resistant microorganisms in animals and their environment and their spread;

Objective 2: produce this information so that it can be related to patterns detected in similar microorganisms in foodstuffs and humans;

Objective 3: investigate any relationship that might exist between the prevalence of resistance to antimicrobials in animals, the pattern of use and the amounts of antimicrobials sold for use in animals;

Objective 4: investigate any relationship that might exist between the prevalence of resistance to antimicrobials in animals and husbandry methods, non-antimicrobial constituents of animal feed, vaccination or hygiene procedures;

Objective 5: use the data generated to guide and encourage the responsible, prudent and judicious use of antimicrobials by the veterinary profession and producers and thus prolong the efficacy of these valuable drugs;

Objective 6: address the issue of cross correlation with parallel human antimicrobial resistance surveillance schemes; and

Objective 7: use the data generated to identify areas for further research and investigation.

### Outcomes

**3.5** The data collected through this proposed surveillance programme will help in the assessments of risks on the transmission of zoonotic and commensal bacteria, and resistance in those bacteria, from animals to man. The importance of surveillance of this type was noted in Outline of an Animal Health and Welfare Strategy for Great Britain<sup>7</sup>. They will also help identify areas where further research is required to inform Government policy on antimicrobial resistance and direct future surveillance needs<sup>(a)</sup>.

**3.6** DARC and SACAR will also use the results from the proposed surveillance programme to monitor trends of changes in the prevalence of antimicrobial resistance in animals and feeding stuffs over time to evaluate how the occurrence of resistance is being limited by the initiatives currently in place.

**3.7** These data will also be made available to assist in detecting new or emerging resistance mechanisms as well as monitoring the emergence and spread of resistant clones (e.g. *S. Typhimurium* DT104), the development of new resistance phenotypes and genotypes and the spread of resistant organisms to the UK by international trade of animals and other routes. An archive of isolates will be used in the monitoring of development and spread of (multi-) resistant organisms.

<sup>7</sup> Outline of an Animal Health and Welfare Strategy for Great Britain. 2003. Department for Environment Food and Rural Affairs, Scottish Executive and Welsh Assembly Government.

<sup>(a)</sup> Information on current Government funded research in this area is available at [www2.defra.gov.uk/research/project\\_data/Default.asp](http://www2.defra.gov.uk/research/project_data/Default.asp)

## Existing surveillance programmes

**3.8** There are a number of existing ongoing surveillance programmes for antimicrobial resistance in food producing animals in the UK. Since 1970 there has been regular monitoring of the patterns and levels of antimicrobial resistance in *Salmonella* isolates recovered from animals and their environment. Additionally since 1998 the results of susceptibility testing of clinical isolates of veterinary pathogens and some commensal organisms (including *Escherichia coli*) have been collected. Table 1 details all of the surveillance programmes for antimicrobial resistance in food producing animals currently carried out in the UK.

**3.9** In addition, in 2002 Defra also carried out a survey on the antimicrobial susceptibility of certain zoonotic, commensal and indicator bacteria in cattle, sheep and pigs at slaughter<sup>(b)</sup>. A further survey of this nature began in January 2003, with results expected in 2004.

## Further work

**3.10** To provide statistically robust information on these issues, particularly for certain zoonotic bacteria and the so-called "indicator" bacteria (see paragraphs 4.2 and 4.3), DARC recommends that similar surveys should be carried out on an on-going basis, for a minimum of 3 years. An additional slaughterhouse survey for poultry should also be undertaken to fill a gap in existing surveillance.

## Standardisation of results

**3.11** To maximise their value the results from these surveys, and others undertaken within the surveillance programme, should be comparable across the UK and with data from other EU countries (or even globally). To this end the Veterinary and Public Health Standardisation Group, the sub-group of SGDIA, should aim to harmonise and where possible standardise the sampling and testing criteria across the UK and the EU. Their objective (in the short term) should be to harmonise veterinary and medicinal susceptibility testing procedures in the UK.

**3.12** As part of harmonising the testing criteria it will be necessary to establish levels of quality assurance that guarantee that all the elements of the surveillance are working to appropriate standards for sampling, testing and electronic gathering and reporting of data. These will need to be developed in such a way as to ensure that the data generated are comparable to data generated from similar schemes looking at human isolates.

**3.13** The UK will seek to gain EU support for this work through a coordinated approach to other Member States. The UK should start work on this area once there is a clear picture of the UK's likely obligations on antimicrobial resistance surveillance at EU level.

<sup>(b)</sup> Further information on this survey can be accessed at [www.defra.gov.uk/animalh/diseases/zoonoses/conference/amrdsstrat.htm](http://www.defra.gov.uk/animalh/diseases/zoonoses/conference/amrdsstrat.htm)

## Chapter 3

**Table 1: Current surveillance programmes in food animals**

Programme	Bacteria tested	Animal species and sources	Possible contribution to strategy (and which objective these address)	Current/ Proposed and Frequency	Funded By
VLA, AHWDG, SAC, SSRL and DARD NI. Monitoring of Resistance in <i>Salmonella</i> spp. (Current disc diffusion testing programme) <sup>(c)</sup> .	<i>Salmonella</i> spp.	Food producing animals, clinical samples, feed and environment. Samples arising from scanning surveillance case work.	Information about antimicrobial resistance in bacteria isolated from animals. (Objectives <sup>(d)</sup> : 1, 2, 5, 7)	Current annual.	Defra, SEERAD and DARD NI
VLA and SAC Monitoring of Resistance in genera other than <i>Salmonella</i> spp. (Current disc diffusion testing programme) <sup>(c)</sup> .	Pathogenic microorganisms and some commensals.	Food producing animals, clinical samples. Samples arising from surveillance case work.	Sensitivity data accumulated from all clinical samples sent in for testing. (Objectives <sup>(d)</sup> : 1, 2, 5, 7)	Current annual.	Defra and SEERAD
Defra annual survey of the prevalence of food borne pathogens and antimicrobial resistance.	<i>E. coli</i> including O157, other VTEC as appropriate, <i>Salmonella</i> spp. <i>Campylobacter</i> spp. <i>Enterococci</i> .	Finished cattle and sheep at slaughter. Pigs at slaughter.	Base line information on the prevalence of <i>E. coli</i> (O157), <i>Campylobacter</i> and <i>Salmonella</i> from healthy animals at slaughter and patterns of resistance. (Objectives <sup>(d)</sup> : 1, 2, 6, 7)	Current every 3 years. Proposed annual.	Defra
Veterinary Medicine Pharmacovigilance Scheme.	Various.	All species Suspect Adverse Reaction Reports are used to identify trends in the possible development of lack of efficacy due to resistance. This will provide information for possible further surveillance.	Antimicrobial resistance 'in the field'. (Objectives <sup>(d)</sup> : 2, 5)	Current annual.	Fees collected from industry

<sup>(c)</sup> Qualitative testing will be replaced by quantitative testing; the recurrent charges for the quantitative testing are the same as for the qualitative testing. This change will require a one-off charge for capital equipment as noted in Section 8.6.

<sup>(d)</sup> These refer to the objectives stated in this strategy document, as noted in Section 3.4.

## Strategy for developing and implementing a surveillance programme for antimicrobial resistance in animals

**Table 1: Current surveillance programmes in food animals**

Programme	Bacteria tested	Animal species and sources	Possible contribution to strategy (and which objective these address)	Current/ Proposed and Frequency	Funded By
FEFANA Antimicrobial Resistance Surveillance Scheme.	<i>E. faecium</i> . <i>Campylobacter</i> spp., <i>Salmonella</i> spp. and <i>E. coli</i> are now under consideration for testing.	Pigs and poultry at slaughter (the UK are sampling poultry only).	Base line information on antimicrobial resistance in most EU countries to tylosin, avoparcin, avilamycin, bacitracin zinc, flavophospholipol, spiramycin, and virginiamycin. (Objectives <sup>(d)</sup> : 1, 2)	Testing started in the summer of 1998 after development of a protocol in 1997.	FEFANA
VMD Antimicrobial Sales Data Collection, Validation and Processing Surveillance.	N/A	All.	Collection, statistical analyses and publishing of antimicrobial product sales data from pharmaceutical companies. (Objective <sup>(d)</sup> : 3)	Current annual.	Defra and VMD
VLA and SAC on-farm investigations following human outbreaks of food borne disease.	VTEC O157, other O157 and <i>Salmonella</i> spp.	Cattle, pigs, sheep and poultry.	Information on antimicrobial resistance in organisms through the food chain. (Objectives <sup>(d)</sup> : 2, 4, 6)	Current, as necessary.	Defra and SEERAD

# Scope

**4.1** The proposed surveillance programme will initially focus on food producing animals, (i.e. cattle, pigs, poultry, sheep, fish and game). However, where there are opportunities to use samples from non-food producing animals collected for other purposes these will be included. Consideration will be given at a later stage to formally include other animals (including companion and wild animals) in the proposed surveillance programme. It will not cover horticulture, as it does not involve animals, nor food, as this is an FSA responsibility.

**4.2** To enable the proposed surveillance programme to produce data on risks to public health linked with resistance as well as patterns of disease in animals and emerging problems of lack of efficacy of antimicrobials, used to treat disease in animals, it will include bacteria chosen from the following categories:

- bacteria pathogenic to animals;
- zoonotic organisms; and
- commensal bacteria where these are considered especially likely to provide a reservoir of resistance genes or to provide a useful indication of the exposure of the normal flora to a selective pressure.

**4.3** Table 2 identifies the bacteria that will be considered for inclusion in the surveillance programme. These are in line with the recent OIE Guidelines<sup>8</sup>.

<sup>8</sup> Franklin, A. *et al.* Antimicrobial Resistance: Harmonisation of national antimicrobial resistance monitoring and surveillance programmes in animals and in animal derived food. 2001. In: Antimicrobial Resistance: Reports Prepared by the OIE Ad Hoc Group of Experts in Antimicrobial Resistance. OIE Scientific and Technical Review, Vol. 20, Pp 859-870.

**Table 2: Testing to be carried out for antimicrobial resistance in food producing animals and other products**

Bacteria	Investigated in Animal Species/Product					
	All species	Cattle	Pigs	Poultry	Sheep	Feed
<b>Pathogenic (Animals)</b>						
<i>Escherichia coli</i>		✓	✓	✓	✓	
<i>Staphylococcus</i> spp.		✓	✓	✓		
<i>Streptococcus</i> spp.		✓	✓	✓		
<i>Pasteurella</i> spp./ <i>Actinobacillus</i>		✓	✓		✓	
<i>Mannheimia</i> spp.		✓	✓		✓	
<b>Zoonotic**</b>						
<i>Salmonella</i> spp.	✓	✓	✓	✓	✓	✓
<i>Campylobacter coli</i>		✓	✓	✓	✓	
<i>Campylobacter jejuni</i>		✓	✓	✓	✓	
<i>Yersinia</i> spp.		✓	✓	✓	✓	
VTEC O157*		✓	✓	✓	✓	
Other VTEC spp.		✓	✓	✓	✓	
<b>Commensals</b>						
<i>Enterococcus faecium</i>			✓	✓		
<i>Escherichia coli</i>		✓	✓	✓	✓	

\* Verocytotoxin producing *E. coli* O157

\*\* Currently covered in surveillance under the Zoonoses Order 1989<sup>9</sup>

<sup>9</sup> The Zoonoses Order 1989 (S.I. 1989 No. 285).

# Antimicrobial agents

**5.1** Table 3 lists antimicrobials that may be included in the proposed surveillance programme. This list is in general accordance with the list of antimicrobials suggested by the OIE in their Scientific and Technical review<sup>8</sup> but not in any order of priority. It includes key microorganisms, including pathogens, zoonoses and commensals, and the main antimicrobials that may be available to control them. The proposed surveillance programme will be designed to maintain the effectiveness of antimicrobial agents used in the treatment and prevention of microbial infections in man and animals. The listed antimicrobials therefore include those that are of therapeutic importance to both man and animals. Although some may no longer be used or available, resistance can persist in microorganisms long after use of a particular antimicrobial has ceased. Continued surveillance of such antimicrobials may therefore provide important longer-term information on trends and contribute to an understanding of the epidemiology of antimicrobial resistance.

**5.2** To carry out detailed surveillance for all of the listed microorganisms would require significant resources and would yield a large body of data. Therefore it will be important to ensure that the proposed surveillance programme is flexible enough to respond appropriately to changing circumstances, such as antimicrobial availability and prescribing practices.

**5.3** DARC will advise on which of the antimicrobials listed in Table 3 should be given priority. In providing this advice, DARC will take into consideration the following factors:

- which antimicrobials are authorised at that time for use in veterinary medicines;
- developments in the medical field;
- emergence of resistance in the bacterial populations under test; and
- the availability of equivalent related antimicrobials where existing listed antimicrobials are withdrawn from commercial production.

**5.4** DARC will also advise on the sources from which samples should be collected, which might include sick animals, healthy animals on farm, their feed and environment and healthy animals at slaughter. Environmental sampling where appropriate should be driven by the results of sampling from food producing animals. Where samples are collected from companion animals such as cats, dogs, and horses, the bacteria targeted for these species will need to be addressed separately because of the different sources of infection and medicines available.

**5.5** Even though the proposed surveillance programme will cover England and Wales, Defra will also consider information produced in Scotland by SAC, and in Northern Ireland by DARD NI.

**Table 3: List of possible antimicrobials for inclusion in the proposed surveillance programme**

Organism	Antimicrobial
<i>E. coli</i> (incl. VTEC O157) <i>Salmonella</i> spp. <i>Yersinia</i> spp.	<b>Routine surveillance<sup>(e)</sup>:</b> Ampicillin, amoxicillin/clavulanate, apramycin, gentamicin, chloramphenicol, neomycin or kanamycin, streptomycin, amikacin, tetracyclines, sulphonamides, nalidixic acid, trimethoprim/sulphonamide, ceftazidime, cefotaxime. <b>Enhanced surveillance<sup>(e)</sup>:</b> Ciprofloxacin, ceftriaxone.
<i>Campylobacter</i> spp.	<b>Routine surveillance:</b> Ampicillin, erythromycin, chloramphenicol, tetracyclines, ciprofloxacin <sup>(f)</sup> , nalidixic acid, kanamycin.
<i>Staphylococcus</i> spp.	<b>Routine surveillance:</b> Penicillin, amoxicillin/clavulanate, erythromycin or tylosin, tetracyclines, neomycin, novobiocin, trimethoprim/sulphonamide. <b>Enhanced surveillance<sup>(g)</sup>:</b> Methicillin/cloxacillin, vancomycin, fusidic acid, linezolid, virginiamycin, quinupristin/dalfopristin, possibly in some circumstances a fluoroquinolone with an expanded Gram-positive spectrum and certain of the cephalosporin compounds. Chloramphenicol.
<i>Streptococcus</i> spp.	<b>Routine surveillance:</b> Penicillin, erythromycin or tylosin, tetracyclines, neomycin, amoxicillin/clavulanate, trimethoprim/sulphonamide. <b>Enhanced surveillance:</b> Fusidic acid, virginiamycin, possibly in some circumstances a fluoroquinolone with an expanded Gram-positive spectrum and certain of the cephalosporin compounds. Chloramphenicol.
<i>Enterococcus</i> spp.	<b>Routine surveillance<sup>(h)</sup>:</b> Ampicillin, gentamicin, streptomycin, vancomycin, teicoplanin, virginiamycin, quinupristin/dalfopristin, erythromycin, tetracyclines, flavomycin, bacitracin, salinomycin.
<i>Pasturella</i> spp. <i>Mannheimia</i> spp. <i>Haemophilus</i> spp. <i>Actinobacillus</i>	<b>Routine surveillance:</b> Penicillin, ampicillin, tetracyclines, erythromycin or tylosin, sulphonamide/trimethoprim, florphenicol, enrofloxacin.
<i>Brachyspira</i> spp.	<b>Enhanced surveillance:</b> Tiamulin.

<sup>(e)</sup> Where nalidixic acid or ceftazidime resistance is detected then it is preferable that quantitative determination of the level of ciprofloxacin or ceftriaxone resistance is performed. Ciprofloxacin is included rather than the veterinary fluoroquinolones to allow direct comparison with results in the medical field. Fluoroquinolones such as ciprofloxacin or enrofloxacin should be included in routine surveillance if organisms resistant to nalidixic acid will not be screened further for fluoroquinolone resistance in follow-up enhanced surveillance.

<sup>(f)</sup> *Campylobacter* infections in food producing animals (with the possible exception of *C.fetus fetus* abortion storms in sheep) are rarely treated. The medical fluoroquinolone Ciprofloxacin, has been chosen because of its importance in the public, rather than the animal, health field.

## Chapter 5

- <sup>(g)</sup> The antimicrobial cloxacillin is used in veterinary medicine for treatment of *Staphylococcus aureus* infections, though resistance has only rarely been detected in European veterinary isolates of this bacterium. Periodic surveys should be performed to ascertain whether resistance has emerged in the UK (none has yet been reported) and surveys may be targeted to organisms showing resistance to penicillin and amoxicillin/clavulanate. (The situation in human medicine is different. Staphylococci that are resistant to the related compound methicillin – so-called MRSA – are a major problem, linked to the use of such penicillin compounds in man. It is therefore important to monitor any similar emergent resistance in animals). Vancomycin, quinupristin/dalfopristin and linezolid are all compounds that are used in human medicine though not in veterinary medicine, although in some cases related compounds such as virginiamycin and avoparcin were formerly used as growth promoters in animals. Cross-resistance can occur between the former veterinary growth promoters virginiamycin and avoparcin and the compounds quinupristin/dalfopristin and vancomycin respectively. Fusidic acid is present in some antimicrobial formulations for companion animals.
- <sup>(h)</sup> Enterococci (in particular *Enterococcus faecium*) are naturally carried as commensals by certain domestic animals but rarely cause clinical disease in those species. Organisms of this type also occur in the human intestinal tract and can cause infections in some people, particularly those who are immunosuppressed or have long-term intra-venous catheters. Exchange of resistance genes between the types of enterococci affecting man and animals is considered a potential problem and also the possibility that some strains may be able to naturally colonise animals and man. The antimicrobials selected reflect those that are used to treat human enterococcal infections and certain antimicrobials that have been used in animals.

# Recommendations from the Advisory Committee on the Microbiological Safety of Food (ACMSF)

**6.1** The ACMSF's Report on Microbial Antibiotic Resistance In Relation To Food Safety<sup>10</sup> and the Government's Response<sup>11</sup> also include a number of recommendations on surveillance. (These are set out at Annex 1.) These will need to be properly reflected in the proposed surveillance programme.

**6.2** To achieve this Defra will ensure that the proposed surveillance programme will provide the data necessary to:

- identify total number or percentage of sensitive/resistant microorganisms detected within the population sampled;
- identify % resistance for the most frequently isolated strains from both sick and healthy animals;
- identify % resistance based on other characteristics, such as type of animal husbandry or previous treatment history, (although current systems need some development before this could be achieved);
- identify the occurrence of co-resistance in the bacterial strain;
- identify the most frequently observed resistance patterns;
- identify % of multiple resistance (to four or more unrelated antimicrobials);
- identify % of important pathogens (e.g. *Salmonella*) resistant to antimicrobials of interest (i.e. those used in veterinary and human medicine);
- allow comparison with data produced in other EU countries; and
- allow joint reporting from human and animal AMR surveillance.

<sup>10</sup> Report on Microbial Antibiotic Resistance in Relation to Food Safety. 1999. Advisory Committee on the Microbiological Safety of Food.

<sup>11</sup> Report on Microbial Antibiotic Resistance In Relation To Food Safety: Recommendations and Government's Response. 1999. Advisory Committee on the Microbiological Safety of Food.

# Implementation

**7.1** This proposed surveillance programme for England and Wales, and those already published for Scotland<sup>2</sup> and Northern Ireland<sup>3</sup>, will be implemented together within the framework of the Defra Strategy for Enhanced Veterinary Surveillance in the UK.

**7.2** Defra will develop effective systems to ensure that data are disseminated to all who need it in a timely fashion, and in a way that allows trend analysis. This will allow more effective targeting of future surveillance and action to address trends that may be of concern. As part of this process Defra will consolidate the links between the UK Zoonoses Group, ACMSF, DARC, SACAR and other working groups and advisory committees to improve overall communication.

**7.3** The proposed surveillance programme will help the UK to meet its obligations under the Zoonoses Directive 2003/99/EC, which sets out requirements for the surveillance of zoonoses, including antimicrobial resistant strains.

**7.4** This strategy will also be used as the basis for discussions in the EU to ensure compatibility between data submitted to the European Commission by different Member States. It will also be used to direct UK input into discussions on the standardisation or harmonisation of detection and surveillance protocols.

## Resources required and timetable

**8.1** The actions detailed in this document have to be prioritised, costed and have resources allocated to them. Some of the surveillance work recommended in this proposed surveillance strategy is already in progress. Defra will review these current programmes in terms of the scope, the objectives, priorities and current resources to establish whether they might be adapted so that they better meet the requirements of the proposed surveillance strategy. The additional requirement for active surveillance of healthy food producing animals recommended in this document would have significant additional resource implications.

**8.2** Once it is clear what resources are likely to be available, the VLA, the HPA and other groups including the FSA, SVS and AHWDG will develop a firm timetable for this work.

**8.3** Table 4 details the surveillance, both current and proposed, and probable resources required to implement this strategy. The surveillance has been prioritised within the Table and this will be used for funding decisions by Defra's AHWDG. Although it includes details of the surveillance programmes for Scotland<sup>2</sup> and Northern Ireland<sup>3</sup>, the resources identified cover only the costs for implementing this strategy in England and Wales.

**Table 4: Surveillance and resources necessary to implement this strategy**

Programme	Bacteria tested	Animal species and sources	Contribution to meet Strategy objectives	Current/ Proposed and Frequency	Funded By	Costs to meet the strategy	Priority Rating
VLA, AHWDG, (SAC and DARD NI). Monitoring of Resistance in <i>Salmonella</i> spp. (Current disc diffusion testing programme) <sup>(c)</sup>	<i>Salmonella</i> spp.	Food producing animals, clinical samples, feed and environment. Samples arising from scanning surveillance work.	Information about antimicrobial resistance in bacteria isolated from animals. (Objectives <sup>(d)</sup> : 1, 2, 5, 7)	Current annual.	Defra	England + Wales = £40,000	1
VLA (and SAC). Monitoring of Resistance in genera other than <i>Salmonella</i> spp. (Current disc diffusion testing programme) <sup>(c)</sup>	Pathogenic microorganisms and some commensals.	Food producing animals, clinical samples. Samples arising from surveillance work.	Sensitivity data accumulated from all clinical samples sent in for testing. (Objectives <sup>(d)</sup> : 1, 2, 5, 7)	Current annual.	Defra	England + Wales = £110,000	1

<sup>(c)</sup> Qualitative testing will be replaced by quantitative testing; the recurrent charges for the quantitative testing are the same as for the qualitative testing. This change will require a one-off charge for capital equipment as noted in Section 8.6.

<sup>(d)</sup> These refer to the objectives stated in this strategy document, as noted in Section 3.4.

## Chapter 8

**Table 4: Surveillance and resources necessary to implement this strategy (continued)**

Programme	Bacteria tested	Animal species and sources	Contribution to meet Strategy objectives	Current/ Proposed and Frequency	Funded By	Costs to meet the strategy	Priority Rating
Veterinary Medicine Pharmacovigilance Scheme.	Various.	All species Suspect Adverse Reaction Reports will identify trends in the possible development to lack of efficacy due to resistance. This will provide information for further surveillance.	Antimicrobial resistance 'in the field'. (Objectives <sup>(d)</sup> : 2, 5)	Current annual.			1
Provisions of annual reports based on antimicrobial resistance in livestock.				Current annual. Ongoing.	Defra	England + Wales = £140,000	1
VLA (and SAC) on-farm investigations following human outbreaks of food borne disease.	VTEC O157 and other O157, <i>Salmonella</i> spp.	Cattle, pigs, sheep and poultry.	Information on antimicrobial resistance in organisms through the food chain. (Objectives <sup>(d)</sup> : 2, 4, 6)	Current, as necessary. Ongoing.	Defra		1
VMD Antimicrobial Sales Data Collection, Validation and Processing Surveillance.	N/A	All.	Collection, statistical analyses and publishing of antimicrobial product sales data from pharmaceutical companies. (Objective <sup>(d)</sup> : 3)	Current annual.	Defra, VMD	UK = £40,000	1
VLA:HPA, (SAC and DARD NI) Harmonisation ring trial.			(Objectives <sup>(d)</sup> : 6)	Current, as necessary.	Defra		1

## Resources required and timetable

**Table 4: Surveillance and resources necessary to implement this strategy (continued)**

Programme	Bacteria tested	Animal species and sources	Contribution to meet Strategy objectives	Current/ Proposed and Frequency	Funded By	Costs to meet the strategy	Priority Rating
EU concerted action programme.				Current annual.	EU		2
VLA-HPA-SAC liaison group meetings.			(Objective <sup>(d)</sup> : 6)	Current Ongoing.		Unknown	2
Defra annual survey of the prevalence of food borne pathogens and antimicrobial resistance.	<i>E. coli</i> including O157, other VTEC as appropriate, <i>Salmonella</i> spp., <i>Campylobacter</i> spp. and <i>Enterococci</i> .	Finished cattle and sheep at slaughter.  Pigs at slaughter.	Base line information on the prevalence of <i>E. coli</i> (O157) <i>Campylobacter</i> spp. and <i>Salmonella</i> spp. from healthy animals at slaughter and patterns of resistance. (Objectives <sup>(d)</sup> : 1, 2, 6, 7)	Current every 3 years.  Proposed annual.	Defra	GB = £70,000 for cattle and sheep GB = £180,000 for pigs	1
Epidemiological analyses, support and provision of denominator data, linkage to husbandry methods, vaccines, etc.			(Objectives <sup>(d)</sup> : 1, 4)	Proposed as required. Ongoing over 10 years as part of RADAR under VSS.	Defra	England Wales = £110,000	3

## Chapter 8

**Table 4: Surveillance and resources necessary to implement this strategy (continued)**

Programme	Bacteria tested	Animal species and sources	Contribution to meet Strategy objectives	Current/ Proposed and Frequency	Funded By	Costs to meet the strategy	Priority Rating
Defra survey of the prevalence of food borne pathogens and antimicrobial resistance.		Poultry at slaughter. Excludes eggs.	Base line information on the prevalence of bacteria from poultry at slaughter and patterns of resistance. (Objectives <sup>(d)</sup> : 1, 2)	Proposed annual. (Unlikely to start before 2006).	Defra	GB = £135,000	1
MIC testing of <i>Salmonella</i> for ciprofloxacin and ceftriaxone resistance.			(Objectives <sup>(d)</sup> : 2, 3)	Proposed annual.	Defra	England + Wales = £4,000	1
Relate patterns in animal data with those in humans and foodstuffs.			(Objectives <sup>(d)</sup> : 2, 6, 7)	Proposed annual.	Defra	Unknown	1
<i>Brachyspira</i> MIC against Tiamulin, anaerobic sensitivity testing.			(Objectives <sup>(d)</sup> : 2, 3)	Proposed annual.	Defra	England + Wales = £2,000	3
Disc diffusion test on isolates from wildlife.			(Objectives <sup>(d)</sup> : 1, 2, 6, 7)	Proposed annual.	Defra	England + Wales = £2,000	4
Collection of susceptibility data for fish pathogens.			(Objectives <sup>(d)</sup> : 1, 2, 3, 4, 5)	Proposed annual.	Defra CEFAS	Unknown	4

## Resources required and timetable

**8.4** The annual cost of carrying out the surveillance programme proposed in Table 4 are estimated to be £400,000\* for continuation of existing annual surveillance and £430,000\* to undertake the proposed new work (including the one-off cost for epidemiological analyses). Funding allocated for the current work is expected to continue to be available from current sources. The proposed new surveillance work will require additional funding.

**8.5** To allow the new work listed in Table 4 to be progressed, the following additional capital equipment will also be required (Table 5). Costs for this equipment will be one off, rather than annual.

**Table 5: Capital equipment required to undertake the additional surveillance proposed in this strategy**

<b>Equipment Item</b>	<b>England and Wales Cost</b>
Automated zone readers	£256,000**
IT infra-structure development	£40,000**
<b>Total Cost</b>	<b>£296,000**</b>

\* 2002 costings.

\*\* Costs as in 2002.

# Evaluating the success of this strategy

**9.1** Defra will monitor the success of this strategy and will publish regular reports on achievement of its objectives, as recommended by the ACMSF. DARC will develop and review criteria for success as the programme evolves. These will include the strategy's effectiveness in obtaining and collating relevant data through all possible routes and exploiting existing initiatives as effectively as possible.

# Review

**10.1** DARC will keep this document under review, and will amend it to reflect new information and scientific developments. It will be republished when necessary. When required DARC will also provide guidance on best practice to those undertaking surveillance.

**10.2** This document also reflects the views of stakeholders, who were consulted in its preparation. Their comments will continue to be welcomed as the scientific knowledge on antimicrobial resistance develops.

## Main ACMSF report recommendations relevant to the surveillance strategy

ACMSF Recommendation	ACMSF Chapter
<ul style="list-style-type: none"> <li>Investigation of regional variations in patterns of resistance in <i>Salmonella</i> and <i>Campylobacter</i> isolates.</li> </ul>	3, 5
<ul style="list-style-type: none"> <li>Surveillance for resistance trends and patterns and the relationships of these within sub-types of <i>Campylobacter</i> isolated from animals, humans and food.</li> </ul>	3, 4, 5
<ul style="list-style-type: none"> <li>Surveillance of patterns of resistance in <i>E. coli</i> in healthy food animals.</li> </ul>	3, 4
<ul style="list-style-type: none"> <li>Surveillance for patterns and trends of fluoroquinolone resistance in <i>Campylobacter</i> and <i>Salmonella</i> isolates (in particular).</li> </ul>	5, 6
<ul style="list-style-type: none"> <li>Surveillance of resistance to growth promoters in indicator organisms.</li> </ul>	6, 10
<ul style="list-style-type: none"> <li>Surveillance of resistance to novel antimicrobials, post-authorisation.</li> </ul>	7
<ul style="list-style-type: none"> <li>Surveillance of resistance to anaerobes in particular <i>Clostridia</i> sp.</li> </ul>	3
<ul style="list-style-type: none"> <li>Surveillance of amounts of antimicrobials sold/used in the UK.</li> </ul>	7
<ul style="list-style-type: none"> <li>Surveillance of prevalence and patterns of resistance in wild birds and animals.</li> </ul>	12
<ul style="list-style-type: none"> <li>Assess the importance of [imported food and] animal feed as a source of antibiotic-resistant bacteria.</li> </ul>	12
<ul style="list-style-type: none"> <li>The results from such surveillance programmes will be used to identify areas that will require funding for further research and development.</li> </ul>	3, 4, 8, 12

## Members of the Defra Antimicrobial Resistance Co-ordination Group\*

Mr John FitzGerald	VMD Chairman
Dr Kay Goodyear	VMD Secretariat
Dr Jack Kay	VMD
Mr Phil Davies	VMD
Prof John Threlfall	HPA
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Dr Oliver Macdonald	PSD
Dr David Steed	CSL
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\* as at 31 March 2004

# Terms of reference and remit of the Defra Antimicrobial Resistance Coordination (DARC) Group

## Terms of reference

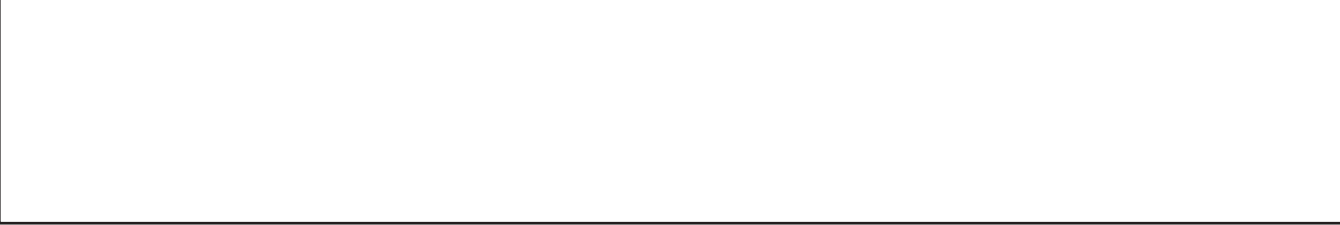
*“To co-ordinate and direct Defra activities on antimicrobial usage in animals and microbial antibiotic resistance in feedingstuffs, animals and food.”*

## REMIT

- To provide a Defra response to the ACMSF report.
- To develop a Defra Action Plan and Strategy on antimicrobial resistance in animals.
- To monitor surveillance studies on antimicrobial usage and microbial resistance.
- To promote prudent and optimal use of antimicrobials in animals.
- To investigate alternatives to the use of antimicrobial products in animals.
- To monitor research and development regarding antimicrobial resistance.
- To raise public awareness of the issue of antimicrobial resistance.

## References

1. The Path of Least Resistance. 1998. Standing Medical Advisory Committee Sub-Group on Antimicrobial Resistance, Department of Health.
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10. Report on Microbial Antibiotic Resistance in Relation to Food Safety. 1999. Advisory Committee on the Microbiological Safety of Food.
11. Report on Microbial Antibiotic Resistance in Relation to Food Safety: Recommendations and Government's Response. 1999. Advisory Committee on the Microbiological Safety of Food.



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