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

(revised July 2008)

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Abbreviations and Glossary

ACMSF	Advisory Committee on Microbiological Safety of Food.
AFBI	Agri-food and Biosciences Institute, Northern Ireland.
AHWEBU	Animal Health and Welfare Evidence Base Unit, formerly known as VEROD.
AMR	Antimicrobial Resistance.
Anaerobe	Organism that is able to live in the absence of free oxygen (gaseous or dissolved).
Animal Health	Animal Health is an Agency of Defra, formerly known as SVS.
Antibiotic	A substance produced by, or derived from a microorganism that selectively destroys or inhibits the growth of other microorganisms.
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. The term antimicrobial includes any substance of natural, synthetic or semi-synthetic origin which is used to kill or inhibit the growth or reproduction of microorganisms (bacteria, fungi, protozoa and viruses).
Antimicrobial Resistance	The ability of a microorganism to grow or survive in the presence of an antimicrobial that is usually sufficient to inhibit or kill microorganisms of the same species.
ARHAI	Antimicrobial Resistance and Healthcare Associated Infections Committee, an independent DH Committee formerly known as SACAR.
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	Department of Agriculture and Rural Development.
Defra	Department for Environment, Food and Rural Affairs.
DH	Department of Health.
EFSA	European Food Safety Authority.

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.
ESBL	Extended Spectrum Beta-Lactamase: a broad-spectrum enzyme capable of inactivating a wide range of penicillin and cephalosporin compounds.
Epidemiology	The study of the cause, distribution and control of a disease in a population.
EU	European Union.
EUCAST	European Committee on Antimicrobial Susceptibility Testing.
FFG	Food and Farming Group, Defra, formerly known as Surveillance, Zoonoses, Epidemiology and Risk Core, Defra.
Fluoroquinolone	A synthetic antimicrobial with a characteristic 4-quinolone ring structure and containing a fluorine moiety at the 6-position.
FSA	Food Standards Agency.
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.
MRSA	Meticillin Resistant *Staphylococcus aureus*.
Microorganism	Microscopically small organisms, including unicellular plants, animals, bacteria and fungi.
OIE	Office International des Epizooties - the animal health equivalent of the World Health Organisation.
Pathogen	Any biological agent which can cause disease.
PSD	Pesticides Safety Directorate, Defra.
RADAR	Rapid Analysis and Detection of Animal - related Risks.
Routine Surveillance	The minimum recommended surveillance requirement.
SAC	Scottish Agricultural College.
SACAR	Specialist Advisory Committee on Antimicrobial Resistance. Replaced in April 2007 to become ARHAI.
SGDIA	Defra's Surveillance Group for Infectious Diseases in Animals.
SG	Scottish Government.
SSRL	Scottish Salmonella Reference Laboratory.
SVS	State Veterinary Service, an Agency of Defra. Re-named in April 2007 to become Animal Health.

SZERC	Surveillance, Zoonoses, Epidemiology and Risk Core Function of the Food and Farming Group of Defra. Re-named in 2008 to become FFG.
VLA	Veterinary Laboratories Agency, Defra.
VMD	Veterinary Medicines Directorate, Defra.
VEROD	Veterinary Exotic Diseases, Research and Official Controls Division, Defra. Re-named in April 2007 to become AHWEBU.
VSS	Veterinary Surveillance Strategy.
Zoonoses	Diseases or infections, which are transmitted naturally between vertebrate animals and man. Zoonoses cover a broad range of diseases with different clinical and epidemiological features and control measures, because the causative organism may be viral, bacterial, fungal, protozoal, parasitic or any other communicable agent.

Chapter 1

Introduction

Surveillance for antimicrobial resistance in bacteria from 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[1]. This has reduced the effectiveness of some treatments in both humans and animals. Of particular concern is the possible transfer of antimicrobial resistance genes and resistant organisms between animals and humans and of the development of significant reservoirs of resistant bacteria in animals.

1.2 It is important therefore to develop effective mechanisms for identifying, collecting and interpreting the information that will detect relevant developments concerning antimicrobial resistance in organisms in 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[2] and Northern Ireland[3].

1.4 This strategy was first published in 2004 and has been updated following consideration by the Defra Antimicrobial Resistance Co-ordination (DARC) Group.

[1] The Path of Least Resistance. 1998. Standing Medical Advisory Committee Sub-Group on Antimicrobial Resistance, Department of Health.

[2] UK Antimicrobial Resistance Strategy and Action Plan for Scotland. 2002. Scottish Executive Steering Group on Antimicrobial Resistance.

[3] Antimicrobial Resistance Action Plan 2002-2005. 2002. Department of Health, Social Services and Public Safety, Northern Ireland.

Chapter 2

Background

2.1 In response to the recommendations in the House of Lords Science and Technology Select Committee's report on antimicrobial resistance[4], in June 2000 the Government published a cross-Government strategy and action plan[5] 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, which is necessary to inform Government action;
- promoting responsible antimicrobial use – to reduce the "pressure for resistance" by reducing unnecessary or inappropriate exposure of 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[6]. 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.

[4] 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.

[5] UK Antimicrobial Resistance Strategy and Action Plan. June 2000. Department of Health.

[6] Partnership, Priorities and Professionalism: A Strategy for Enhancing Veterinary Surveillance in the UK. 2003. Department for Environment, Food and Rural Affairs.

Chapter 3

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 Animal Health and Welfare Strategy, in step with Defra's Strategy for Enhancing Veterinary Surveillance in the UK[6]; and
- help to deliver the aims of the cross-Government strategy[5] on antimicrobial resistance.

3.2 It details the:

- aim (paragraph 3.3), objectives (paragraph 3.4), outcomes (paragraphs 3.5 - 3.7) 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 3.8 – 3.10);
- 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 animals is to collect and interpret data on resistant organisms, on disease and infection 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 adverse impacts occuring to animal health and/or public health as the result of transfer of antimicrobial resistance genes or resistant organisms between bacterial populations in animals and 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 animal keepers 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 surveillance programme will help in the assessments of risks on the transmission of zoonotic and commensal bacteria, and resistance in those bacteria, between animals and man. The importance of surveillance of this type was noted in Outline of an Animal Health and Welfare Strategy for Great Britain[7]. They will also help identify areas where further research is required to inform Government policy on antimicrobial resistance and direct future surveillance needs[(a)].

3.6 DARC and ARHAI (Antimicrobial Resistance and Healthcare Associated Infections Committee) 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 or affected by the initiatives currently in place.

[7] 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.

[(a)] Information on current Government funded research in this area is available at www2.defra.gov.uk/research/project_data/Default.asp

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.

Existing surveillance programme

3.8 There are a number of continuing 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. The table in Annex 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 2000 and 2003 Defra carried out survey's on the antimicrobial susceptibility of certain zoonotic, commensal and indicator bacteria in cattle, sheep and pigs at slaughter[(b)].

3.10 The European Food Safety Authority (EFSA) are co-ordinating surveillance for antimicrobial resistance in bacteria from food-producing animals at the European level through inclusion of surveillance for antimicrobial resistance in national control programmes for certain zoonotic bacteria, such as *Salmonella* and *Campylobacter* and in baseline studies to determine the prevalence of these organisms in certain food-producing animal species. Guidelines have also been developed for the inclusion of commensal bacteria in these European surveillance programmes. Defra is participating in these surveillance schemes and contributed to their development. Further information is available at http://www.efsa.europa.eu/EFSA/efsa_locale-1178620753812_1178697512165.htm.

Further work

3.11 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 recommended that similar surveys should be carried out on an on-going basis, with a minimum interval of 3 years, however, this commitment is in part being met by EFSA's surveillance role by organising surveillance in animals and food across the EU.

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

Standardisation of results

3.12 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 (and ideally 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. A good degree of harmonisation has been achieved through the surveillance programmes developed and co-ordinated by EFSA and described in paragraph 3.10 above. A project is also currently underway to further harmonise medical and veterinary *Campylobacter* susceptibility testing in England and Wales. Further information is available at http://www.defra.gov.uk/animalh/diseases/control/sgdia/standardisation.htm

3.13 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. The EU has appointed a Community Reference Laboratory for Veterinary Antimicrobial Resistance (situated in Denmark), who provide quality assurance for European national veterinary reference laboratories.

3.14 The UK has supported the EU and EFSA in the development of a coordinated approach to surveillance amongst EU Member States and Directive 2003/99/EC sets out that Member States shall ensure that monitoring provides comparable data on the occurrence of antimicrobial resistance. *Salmonella* and *Campylobacter* have been covered in proposals developed so far at the European level and the methods recommended by European Committee on Antimicrobial Susceptibility Testing (EUCAST) have been adopted to allow direct comparison of medical and veterinary susceptibility results between and within all participating EU Member States (Report of the Task Force of Zoonoses Data Collection, 2007)[8]. Further proposals covering commensals are under development.

[8] Report of the Task Force of Zoonoses Data Collection including a proposal for harmonized monitioring scheme of antimicrobial resistance in Salmonella in fowl (Gallus gallus), turkeys, and pigs and *Campylobacter jejuni* and *C. coii* in broilers, the EFSA Journal (2007), 96, 1-46.

Chapter 4

Scope

4.1 The proposed surveillance programme will primarily focus on food-producing animals, (i.e. cattle, pigs, poultry, sheep, fish and game). However, where there are clear public health issues to address from non food producing animals work will be directed in this area. An example of this is MRSA in companion animals and horses. Consideration will be given at a later stage to formally include other animals (including companion and wild animals) in the proposed surveillance programme; companion animals are also currently the subject of Defra-funded research projects, which include some aspects of surveillance for antimicrobial resistance; *Salmonella* isolates from companion animals are included in current surveillance on a non-statutory basis. The surveillance programme will not cover horticulture. Neither will it include food (of animal origin) as this is the responsibility of the FSA. There is at times a fine distinction between animals and food, e.g. a chicken carcase in a processing plant would be 'animal' but the same carcase at retail sale would be 'food'. Information from such food data streams will be taken into account when considering the overall situation.

4.2 To enable the proposed surveillance programme to produce data on the risks to public health linked with resistance, 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 1 identifies the bacteria that will be considered for inclusion in the surveillance programme. These are in line with the recent OIE Guidelines[9] and are also quoted in the OIE Terrestrial Animal Health Code 2006.

[9] 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 1: 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**
Pathogenic (Animals)						
Escherichia coli	√	√	√	√	√	
Staphylococus spp.		√	√	√		
Streptococcus spp.		√	√	√		
Pasteurella spp.		√	√		√	
Actinobacillus			√			
Mannheimia spp.		√			√	
Zoonotic**						
Salmonella spp.	√	√	√	√	√	√
Campylobacter coli		√	√	√	√	
Campylobacter jejuni		√	√	√	√	
Yersinia spp.		√	√	√	√	
VTEC O157*		√	√	√	√	
Other VTEC		√	√	√	√	
Commensals						
Enterococcus faecium			√	√	√	
Escherichia coli		√	√	√		

* Verocytotoxin producing *E. coli* O157

** Currently covered in surveillance under the Zoonoses Order 1989[10]

[10] The Zoonoses Order 1989 (S.I. 1989 No. 285).

Chapter 5

Antimicrobial agents

5.1 Table 2 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[8] 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 used to inform policy 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 antimicrobial resistances may therefore provide important longer-term information on trends and contribute to an understanding of the epidemiology of antimicrobial resistance. Some compounds are included as they are particularly relevant for the detection of certain important types 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 2 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.

Table 2: List of possible antimicrobials for inclusion in the proposed surveillance programme

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

[(e)] Where nalidixic acid or ceftazidime/cefotaxime resistance is detected then it is preferable that quantitative determination of the level of ciprofloxacin or ceftazidime/cefotaxime 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.

[(f)] *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.

[g] The antimicrobial cloxacillin is used in veterinary medicine for treatment of *Staphylococcus aureus* and certain other infections. Periodic surveys should be performed to ascertain whether resistance to the related antimicrobial compound meticillin has emerged in the UK in *S. aureus* in food-producing animals (none has yet been reported and surveys may be targeted to isolates of *S. aureus* showing resistance to penicillin and amoxicillin/clavulanate. (The situation in human medicine is different; resistance to the related antimicrobial compound meticillin in *S. aureus* – so-called MRSA – comprises a major problem. The situation is also different in some other European countries, where MRSA has been detected in pigs and some other food-producing animal species). 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/dalfoprisitin and vancomycin respectively. Fusidic acid is present in some antimicrobial formulations for companion animals.

[h] 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.

Chapter 6

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[11] and the Government's Response[12] also include a number of recommendations on surveillance, which are set out at Annex 2. 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.

[11] Report on Microbial Antibiotic Resistance In Relation to Food Safety. 1999. Advisory Committee on the Microbiological Safety of Food.

[12] Report on Microbial Antibiotic Resistance In Relation To Food Safety: Recommendations and Government's Response. 1999. Advisory Committee on the Microbiological Safety of Food.

Chapter 7

Implementation

7.1 This surveillance programme for England and Wales, and those already published for Scotland[2] and Northern Ireland[3], will be implemented together within the framework of the Defra Strategy for Enhanced Veterinary Surveillance in the UK[6].

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, ARHAI, FSA 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.

Chapter 8

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 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, Animal Health and FFG will develop a firm timetable for this work.

8.3 The table in Annex 1 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 FFG. Although it includes details of the surveillance programmes for Scotland[2] and Northern Ireland[3], the resources identified in the table do not include all the costs for implementing this strategy in the United Kingdom, but the groups contributing to the various surveillance programmes are identified. The funding available from Defra for AMR surveillance for 2008/09 is £529,070. Additionally, in 2007/08 Defra is funding approximately £1 million of AMR related R&D, a proportion of which will have a surveillance component. Details of the AMR R&D projects are available on the Defra and VMD websites respectively.

8.4 The priorities for surveillance shown in Annex 1 were made using expert opinion about the risks and potential impacts of different organisms and antimicrobial resistances in relation to public health, animal health and animal welfare.

8.5 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. To allow new work to be progressed new capital equipment will also be required needing additional one-off funding.

Chapter 9

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.

Chapter 10

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.

Annex 1

Current and proposed surveillance programmes in animals

Programme	Bacteria tested	Period of sampling	Animal species and sources	Coverage	Contribution to meeting AMR Surveillance Strategy objectives	Contributing organisations	Priority Rating
Monitoring of Resistance in *Salmonella* spp. and production of annual reports.	*Salmonella* spp.	Ongoing	Food producing animals, clinical samples, feed and environment. Companion animals. Samples arising from scanning surveillance case work.	UK	Information about antimicrobial resistance in bacteria isolated from animals. (Objectives[(d)]: 1, 4, 6)	Defra SG DARD	1
Monitoring of Resistance in genera other than *Salmonella* spp. and production of annual reports (Current disc diffusion testing programme) [(c)].	Pathogenic microorganisms and some commensals.	Ongoing	Food producing animals, clinical samples. Samples arising from surveillance case work.	UK	Sensitivity data accumulated from all clinical samples sent in for testing. (Objectives[(d)]: 1, 4, 6)	Defra SG DARD	1

Programme	Bacteria tested	Period of sampling	Animal species and sources	Coverage	Contribution to meeting AMR Surveillance Strategy objectives	Contributing organisations	Priority Rating
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[(d)]: 1, 4)	Fees collected from industry.	1
VMD Antimicrobial Sales Data Collection, Validation and Processing Surveillance.	N/A	January-December	All.	UK	Collection, statistical analyses and publishing of antimicrobial product sales data from pharmaceutical companies. (Objective[(d)]: 2)	Defra	1

Programme	Bacteria tested	Period of sampling	Animal species and sources	Coverage	Contribution to meeting AMR Surveillance Strategy objectives	Contributing organisations	Priority Rating
On-farm investigations following human outbreaks of food borne disease.	VTEC O157, other VTEC and *Salmonella* spp.	Ongoing	Cattle, pigs, sheep and poultry.	UK	Information on antimicrobial resistance in organisms through the food chain. (Objectives[(d)]: 1, 3, 5)	Defra SG DARD	1
On-farm investigations following the detection of newly identified or unusual patterns of resistance.	Various, as appropriate e.g. Extended Spectrum β-Lactamase (ESBL) producing *E. coli.*	Ongoing	Cattle, pigs, sheep and poultry.	UK	Information on antimicrobial resistance in organisms through the food chain. (Objectives[(d)]: 1, 3, 5)	Defra SG DARD	
Human – Veterinary medical Harmonisation ring trial.	*Campylobacter*.	2008	Cattle, pigs and poultry.	England and Wales	(Objectives[(d)]: 5)	HPA Defra	1

Programme	Bacteria tested	Period of sampling	Animal species and sources	Coverage	Contribution to meeting AMR Surveillance Strategy objectives	Contributing organisations	Priority Rating
VLA survey of the prevalence of *Campylobacter* in broilers. A further programme with similar coverage (research project FZ2025) is also descibed in the last row of this table.	*Campylobacter*.	January 2007 for three years	Poultry at slaughter (excludes eggs).	GB	Information on the prevalence of bacteria from poultry at slaughter and patterns of resistance. (Objectives[(d)]: 1)	Defra	1
Broiler samples collected under the above survey will also be examined for the presence of *E. coli* carrying ESBLs.	*E. coli.*	Ongoing	Poultry at slaughter (excludes eggs).	GB	Information on the prevalence of bacteria from poultry at slaughter and patterns of resistance (Objectives[(d)]: 1)	Defra Devolved Administrations	
MIC testing of *Salmonella* for ciprofloxacin resistance and characterisation of ceftazidime / cefotaxime resistance.	*Salmonella.* *E. coli.*	Ongoing	All food-producing species.	England and Wales	(Objectives[(d)]: 1, 2)	Defra	1
Disc diffusion susceptibility test of bacterial isolates from wildlife.	Range of clinical bacteria from infections.	Ongoing	Wildlife.	England and Wales	(Objectives[(d)]: 1, 5, 6)	Defra	4

Programme	Bacteria tested	Period of sampling	Animal species and sources	Coverage	Contribution to meeting AMR Surveillance Strategy objectives	Contributing organisations	Priority Rating
VLA-HPA-SAC liaison group meetings.	N/A	Ongoing	Food-producing animals, other species and humans.		(Objective[(d)]: 5)	VLA – HPA - SAC	2
Collection of susceptibility data for fish pathogens.			Fish.		(Objectives[(d)]: 1, 2, 3, 4)	Defra	4
Anaerobic sensitivity testing.	Brachyspira : (MIC against Tiamulin).	Ongoing	Pigs (poultry).	England and Wales	(Objectives[(d)]: 1, 2)	Defra	3
National Control Programme monitoring as required by the Community legislation on control of *Salmonella* in breeding flocks of *Gallus gallus* in the EU.	*Salmonella* spp.		Breeders.	UK	Baseline information on the prevelence of *Salmonella* from breeders. (Objectives[(d)]: 1)	Defra Devolved Administrations	1

Programme	Bacteria tested	Period of sampling	Animal species and sources	Coverage	Contribution to meeting AMR Surveillance Strategy objectives	Contributing organisations	Priority Rating
National Control Programme monitoring as required by the Community legislation on control of *Salmonella* in laying flocks of *Gallus gallus* in the EU.	*Salmonella* spp.		Layers.	UK	Baseline information on the prevelence of *Salmonella* from breeders. (Objectives[(d)]: 1)	Defra Devolved Administrations	
National Control Programme monitoring as required by the Community legislation on.the prevalence of *Salmonella* in meat producing chicken flocks of *Gallus gallus* in the EU.	*Salmonella* spp.	Ongoing sampling scheduled to commence in January 2009	Meat producing chickens.	UK	Baseline information on the prevelence of *Salmonella* from meat producing chickens (broilers). (Objectives[(d)]: 1)	Defra Devolved Administrations	1
Baseline studies and National Control Programme monitoring as required by the Community legislation on the prevalence of *Salmonella* in turkey flocks in the EU.	*Salmonella* spp.	Initial survey October 2006 to September 2007, ongoing sampling scheduled to commence in 2010	Breeding and fattening turkeys.	UK	Baseline information on the prevalance of Salmonella from meat producing turkeys. (Objectives[(d)]: 1)	Defra Devolved Administrations	1

Programme	Bacteria tested	Period of sampling	Animal species and sources	Coverage	Contribution to meeting AMR Surveillance Strategy objectives	Contributing organisations	Priority Rating
Turkey samples collected under the above survey will also be examined for the presence of *E. coli* carrying ESBLs.	*E. coli.*	Samples will be tested in 2008/09	Breeding and fattening turkeys.	UK	Information of the prevalence of bacteria from poultry at slaughter and patterns of resistance (Objectives[(d)]: 1)	Defra Devolved Administrations	
Baseline studies and National Control Programme monitoring as required by the Community legislation on the prevalence of *Salmonella* in fattening pigs in the EU.	*Salmonella* spp.	Initial survey October 2006 to September 2007, ongoing sampling scheduled to commence in 2010	Fattening pigs.	UK	Baseline information on the presence of Salmonella from meat producing pigs. (Objectives[(d)]: 1)	Defra Devolved Administrations FSA	1
Community legislation co-ordianted study on MRSA presence on breeding pig farms in the EU.	*Staphylococcus aureus.*	12 month long survey commencing in January 2008	Breeding pigs.	UK	Initial understanding of presence of MRSA in breeding pig herds across Europe.	Defra Devolved Administrations	

Programme	Bacteria tested	Period of sampling	Animal species and sources	Coverage	Contribution to meeting AMR Surveillance Strategy objectives	Contributing organisations	Priority Rating
Baseline studies and National Control Programme monitoring as required by Community legislation on the prevalence of *Campylobacter* in broilers and presence of *Salmonella* and *Campylobacter* on the carcase and enumeration of *Campylobacter* on the carcase (VLA Project FZ2025).	*Salmonella* spp. and *Campylobacter.*	12 month long survey commencing in January 2008	Broiler carcasses.	UK	Baseline information and information on trends in antimicrobial resistance in broilers. Comparative information on antimicrobial resistance in European Member States. (Objectives[(d)]: 1, 5, 6	Defra VLA SG DARD FSA	1

[(c)] Qualitative testing will be replaced by quantitative testing; the recurrent charges for the quantitative testing are the same as for the qualitative testing.

[(d)] These refer to the objectives stated in this strategy document, as noted in Section 3.4.

Annex 2

Main ACMSF report recommendations relevant to the surveillance strategy

ACMSF Recommendation	ACMSF Chapter
• Investigation of regional variations in patterns of resistance in *Salmonella* and *Campylobacter* isolates.	3, 5
• Surveillance for resistance trends and patterns and the relationships of these within sub-types of *Campylobacter* isolated from animals, humans and food.	3, 4, 5
• Surveillance of patterns of resistance in *E. coli* in healthy food animals.	3, 4
• Surveillance for patterns and trends of fluoroquinolone resistance in *Campylobacter* and *Salmonella* isolates (in particular).	5
• Surveillance of resistance to growth promoters in indicator organisms.	6, 10
• Surveillance of resistance to novel antimicrobials, post-authorisation.	7
• Surveillance of resistance to anaerobes in particular *Clostridia* sp.	3
• Surveillance of amounts of antimicrobials sold/used in the UK.	7
• Surveillance of prevalence and patterns of resistance in wild birds and animals.	12
• Assess the importance of [imported food and] animal feed as a source of antibiotic-resistant bacteria.	12
• The results from such surveillance programmes will be used to identify areas that will require funding for further research and development.	3, 4, 8, 12

Annex 3

Members of the Defra Antimicrobial Resistance Co-ordination Group*

Mr John FitzGerald	Veterinary Medicines Directorate, Chairman
Dr Kay Goodyear	Veterinary Medicines Directorate, Secretariat
Mrs Catherine Webb	Veterinary Medicines Directorate, Secretariat
Dr Nick Renn	Veterinary Medicines Directorate
Dr Jack Kay	Veterinary Medicines Directorate
Mrs Katherine Gray	Veterinary Medicines Directorate
Mr Stephen Wyllie	Food and Farming Group, Defra
Mr Andrew Frost	Food and Farming Group, Defra
Dr Francesca Culver	Food and Farming Group, Defra
Mr Chris Teale	Veterinary Laboratories Agency, Defra
Mr Jeff Jones	Veterinary Laboratories Agency, Defra
Prof John Threlfall	Health Protection Agency
Prof Peter Hawkey	University of Birmingham and Heartlands Hospital, Birmingham
Ms Sally Wellsteed	Department of Health
Dr Rowena Jecock	Department of Health
Dr Janet Gibson	Department of Health
Mrs Sheila Voas	Scottish Government
Mr Jesus Gallego	Scottish Government
Dr Paul Cook	Food Standards Agency
Ms Gael O'Neill	Food Standards Agency
Dr Stanley McDowell	Agri-Food and Biosciences Institute
Dr Dominic Mellor	Health Protection Scotland
Mr Arjen Brouwer	National Assembly for Wales, Department for Environment, Planning and the Countryside
Dr Androulla Gilliland	Chemicals and GM Policy, Defra
Dr Andrea Patterson	Animal Health and Welfare Evidence Base Unit, Defra
Dr Robin Howe	University Hospital of Wales, Cardiff
Dr David Stead	Central Science Laboratory
Dr Oliver Macdonald	Pesticides Safety Directorate, Defra
Dr Sheila Rusbridge	Scottish Agricultural College

* as at July 2008

Annex 4

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

DARC Group Terms of Reference and Remit

'To co-ordinate, advise and review Defra activities on antimicrobial usage in animals and antimicrobial resistance (AMR) in micro-organisms from feedingstuffs, animals and food'.

The Group's remit includes:

Reviewing the Defra action plan and strategy on surveillance of antimicrobial resistance in animals

This was carried out during 2007. Subsequently the strategy will be updated periodically as the need arises.

Reviewing surveillance studies on antimicrobial usage and microbial resistance.

As of the Autumn 2006 meeting, this will be carried out annually.

Promoting prudent and optimal use of antimicrobials in animals by:

- Supporting healthy food from healthy animals
- Encouraging responsible and prudent use of minimum amounts of appropriate antimicrobials
- Monitoring the development of AMR in animals
- Providing information and advice to assist in the development of antimicrobial resistance policy in animals
- Identifying the possible impact on human treatments as applications for new antimicrobial products for animal use are being assessed
- Reporting the group's activities to ARHAI.

Consider new approaches to alternatives to antimicrobials as they arise

Public awareness will continue to be promoted on the Defra and VMD web pages.

Research and development

The Group will advise Defra on research ideas as they arise. Government funded research into antimicrobial resistance will be reviewed annually at the Spring meeting.

Raising public awareness of the issue

Information is published on the Defra and VMD websites.

Annex 5

References

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

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

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

4. 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.

5. UK Antimicrobial Resistance Strategy and Action Plan. June 2000. Department of Health.

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

7. 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.

8. Report of the Task Force of Zoonoses Data Collection including a proposal for harmonized monitioring scheme of antimicrobial resistance in Salmonella in fowl (Gallus gallus), turkeys, and pigs and *Campylobacter jejuni* and *C. coli* in broilers, the EFSA Journal (2007), 96, 1-46.

9. 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.

10. The Zoonoses Order 1989 (S.I. 1989 No. 285).

11. Report on Microbial Antibiotic Resistance in Relation to Food Safety. 1999. Advisory Committee on the Microbiological Safety of Food.

12. Report on Microbial Antibiotic Resistance in Relation to Food Safety: Recommendations and Government's Response. 1999. Advisory Committee on the Microbiological Safety of Food.