

## Recommendations for National health authorities

### Surveillance of antimicrobial resistance

- Establish/consolidate quality assurance programmes.
- Type alert organisms using molecular techniques.
- Establish/consolidate a network of reference laboratories.
- Network national programmes for surveillance and control of communicable diseases across countries to allow comparability.

### Antibiotic policy and surveillance of antimicrobial consumption

- Create national bodies and programmes to coordinate antibiotic stewardship, policy and practice. Integrate these activities with programmes for monitoring antibiotic resistance and consumption.
- Establish a list of nationally marketed antimicrobial products, linked to ATC classification.
- Implement a national surveillance system for collation, feedback and benchmarking of antibiotic consumption data in hospitals.
- Provide resources – including computer support, software and personnel – for collation/retrieval and analysis of antibiotic usage data.
- Frame national antibiotic guidelines for clinical pharmacy services.

### Infection control policy

- Require (and provide support for) acute care hospitals to implement infection control staff levels meeting at least those recommended based on the SENIC study (1 infection control physician /hospital and 1 infection control nurse / 250 acute care beds).
- Offer specialised training and competence certification to infection control staff (physicians and nurses), according to national standards.
- Support the development of educational material, e.g. on hand hygiene (alcohol-based hand rubs), adapted to the relevant professional groups.

## Recommendations for European health authorities

### Surveillance of antimicrobial resistance and antimicrobial consumption

- Ensure the sustainability of surveillance efforts, including external quality assurance checks.
- Promote the harmonisation of approaches to the measures described here.
- Encourage and extend the activities of ESCMID's EUCAST.

### Antibiotic policy

- Form a Europe-wide body to coordinate multi-centre evaluations of control measures, overseeing harmonisation of antibiotic stewardship, policy and practice.

### Infection control policy

- Harmonise national surveillance of alert organisms, using European standard definitions and denominators.
- Standardise typing methods for key alert organisms at the European level; support and coordinate typing databases.

### Education

- Determine the public health impact of infections caused by antimicrobial-resistant bacterial pathogens. Use findings on the human and financial costs to inform patient organisations, policy-makers and the media on the consequences relative to other disease burdens.

## Glossary

**Alert organisms:** Antibiotic resistant bacterial pathogens of clinical and infection control importance

**Antimicrobial susceptibility testing:** Laboratory methods for establishing which antibiotics are suitable to treat specific bacteria causing infection

**Antibiotic audit:** Analysis of the appropriateness of individual antibiotic prescription (surveillance of volume of antibiotic consumption is not audit)

**Antibiotic formulary:** List of antibiotics routinely stocked in the hospital

**Antibiotic policy:** Provision of guidelines for antibiotic prescribing

**Antibiotic stewardship:** Overall strategic management of antibiotic prescribing

**ATC system:** Anatomical Therapeutic Chemical system for drug classification (<http://www.whocc.no/atcddd>)

**DDD:** Defined Daily Dose (assumed average maintenance dose per day for a drug used for its main indication in adults) (<http://www.whocc.no/atcddd/indexdatabase/>)

**DTC:** Drugs and therapeutic committee

**EUCAST:** European Committee on Antimicrobial Susceptibility Testing (EUCAST) is a standing ESCMID committee which was set up to standardise susceptibility testing in Europe so that comparable results and interpretations are produced

**MRSA:** Methicillin-resistant *Staphylococcus aureus* – bacteria that cause conditions such as furunculosis, septicaemia, osteomyelitis, suppuration of wounds, and food poisoning

**SENIC:** Study on the Efficacy of Nosocomial Infection Control (SENIC) (Reference: Haley RW, Culver DH, White JW, Morgan WM, Emori TG, Munn VP, Hooton TM, The efficacy of infection surveillance and control programs in preventing nosocomial infections in US hospitals. *American Journal of Epidemiology* 1985; 121:182-205.)

**WHO:** World Health Organization

## Links to related internet sites

[www.escmid.org](http://www.escmid.org)  
[www.eucast.org](http://www.eucast.org)  
[www.earss.rivm.nl](http://www.earss.rivm.nl)  
[www.esac.ua.ac.be](http://www.esac.ua.ac.be)  
[helics.univ-lyon1.fr](http://helics.univ-lyon1.fr)  
[www.whocc.no](http://www.whocc.no)



For a copy of this leaflet in other languages, consult the European Commission's Research DG website:

<http://www.cordis.lu/lifescihealth/major/drugs.htm>

or the ARPAC website:

<http://www.abdn.ac.uk/arpac/>

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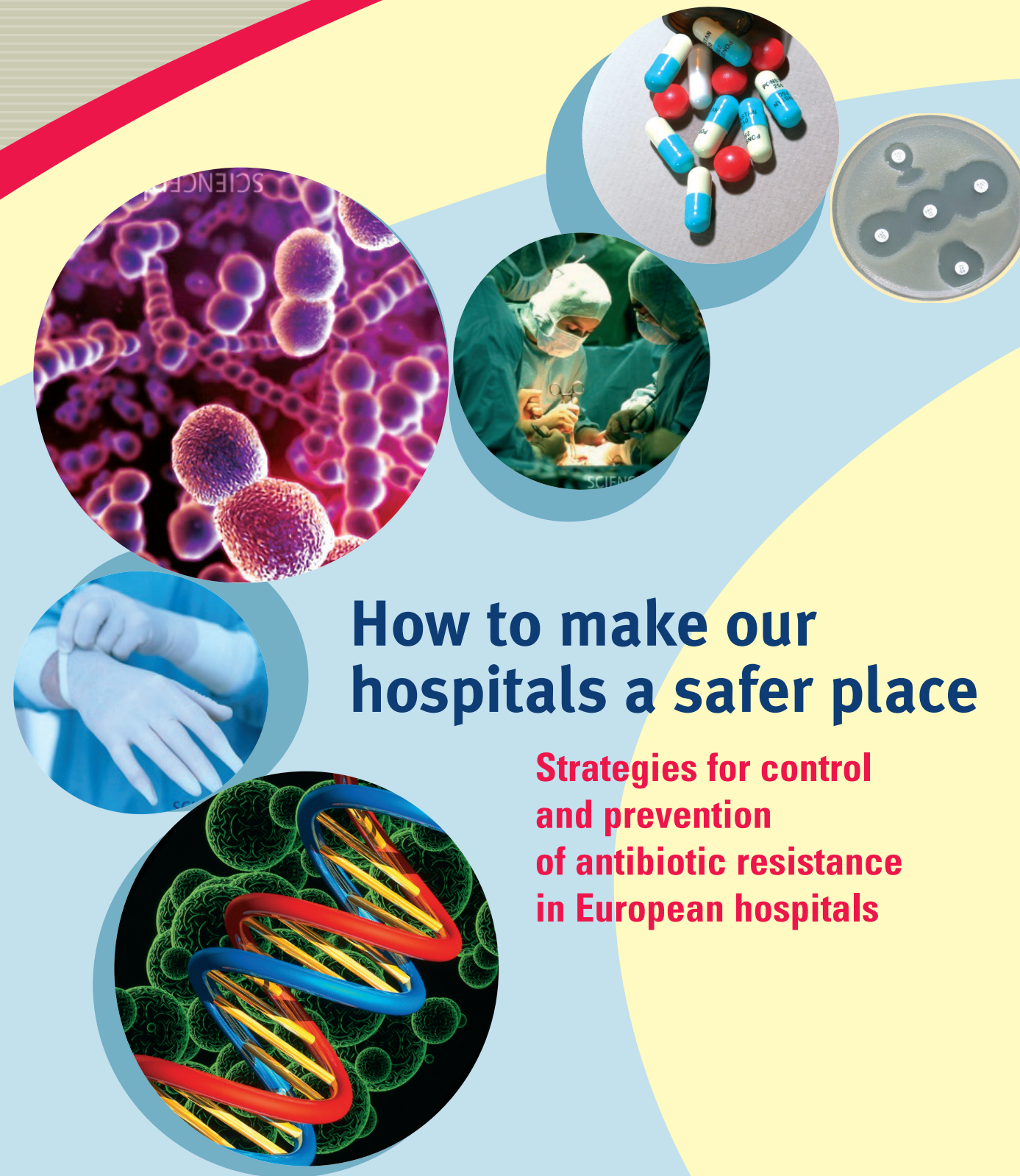


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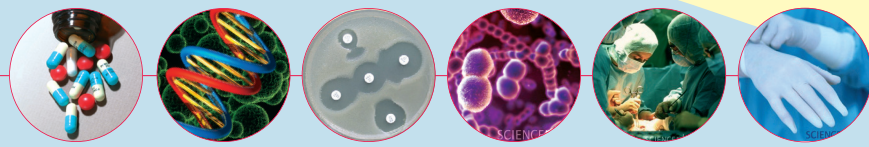
## How to make our hospitals a safer place

Strategies for control and prevention of antibiotic resistance in European hospitals

Conclusions of the ARPAC project, a European Commission DG Research-funded Concerted Action, contract number QLK2-CT-2001-00915. ARPAC is a collaborative effort undertaken by four ESCMID Study Groups.



SIXTH FRAMEWORK PROGRAMME



## The challenge of antibiotic resistance

Antibiotics are rapidly losing their effectiveness and no longer warrant the description 'miracle drugs'. Due largely to the overuse and misuse of antibiotics, bacteria have become increasingly resistant to many of the compounds we rely on to treat serious infections in our hospitals.

Although many antibiotic-resistant bacteria exist, there are specific strains which frequently cause infection and cannot be treated with standard antibiotics, requiring alterations to routine therapeutic regimes. These bacteria are often particularly virulent, causing serious infections. Such bacteria are called 'alert organisms'. The atypical resistance phenotypes can only be detected by performing antibiotic susceptibility tests. Often, the alternative choice of antibiotic is less effective or toxic to the patient and clinical outcome is worse.

**The ARPAC project identified the following alert organisms of concern in Europe:**

*Staphylococcus aureus* resistant to methicillin/oxacillin

*Enterococcus* species resistant to vancomycin

*Acinetobacter baumannii* to the carbapenems

*Escherichia coli* resistant to the quinolones

*Klebsiella pneumoniae* resistant to the third-generation cephalosporins

*Pseudomonas aeruginosa* resistant to the carbapenems or aminoglycosides or quinolones or ceftazidime/cefepime

**In addition, the following are alert organisms of worldwide concern. As yet, they are rare in Europe but would have major implications for treatment and control should they become more prevalent:**

*Staphylococcus aureus* resistant to the glycopeptides

Beta-haemolytic streptococci resistant to penicillin

### Comprehensive study

Four study groups of the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) sought to investigate the practices being employed at a pan-European level in a bid to control antimicrobial resistance. This was the first large effort to quantify the problems of antibiotic-resistant bacteria in the context of parallel infection control and antibiotic policy measures in European hospitals. It was also the first large attempt to quantify actual antibiotic use at a hospital level.

Almost 300 hospitals from 34 European countries took part in this work. At the end of the project, nearly 200 participants attended the ARPAC Consensus Conference (22-24 November 2004, Amsterdam, The Netherlands) to review the project's findings in the context of the worldwide situation, and to recommend strategies for prevention and control of antibiotic-resistant pathogens in European hospitals.

### Minimum requirements

This brochure summarises the highest priority recommendations emerging from the Conference, which can be regarded as the minimum requirements to begin tackling the problem.

The findings are presented at three levels: for hospitals, national health authorities, and European health authorities respectively. For hospital managers especially, checking the boxes in the tables shown in the following pages provides a useful means of evaluating how well individual institutions are performing. This exercise will also highlight further measures that can be taken to control the threat from resistant bacteria.

## Recommendations for hospitals

*Checking the boxes in the following tables will provide a useful means of evaluating how well individual institutions are performing.*

### Surveillance of antimicrobial resistance

Antimicrobial susceptibility testing methodology varies considerably between European hospitals, hampering institutional comparison of resistance rates. For example, 88% of hospitals participating in the ARPAC project used a disc diffusion method, 70% determined minimum inhibitory concentrations for selected organisms, and 87% interpreted their results using breakpoints.

RECOMMENDATION	Done	To do
Standardise methods for antimicrobial susceptibility testing.		
Maintain a local list of alert organisms.		
Conduct continuous local surveillance of antimicrobial resistance.		
Return summaries of resistance surveillance data to antimicrobial prescribers, at least once a year.		

### Surveillance of antimicrobial consumption

Of 263 European hospitals, 140 provided antimicrobial use data for the whole hospital to the ARPAC project and 110 provided data for their intensive care units. This reflected the fact that many hospitals were collating these data for the first time. Having done so, participants were keen to benchmark their figures against those of other hospitals.

Amongst hospitals which participated in the ARPAC project, clinical microbiologists and infectious diseases physicians play a much more active role than pharmacists in advising clinicians on prescribing antimicrobial agents. Indeed, 41% of clinical microbiologists/infectious disease physicians, compared with 15% of pharmacists, carry out daily ward rounds – while 70% of clinical microbiologists/infectious disease physicians, against 39% of pharmacists, are available to give prescribing advice outside normal working hours.

RECOMMENDATION	Done	To do
Carry out regular local surveillance of hospital antimicrobial use data. (The WHO-defined unit of DDD/100 patient-days and the Anatomical Therapeutic Chemical (ATC) classification system should be used and the data fed back to individual prescribers.)		
Investigate and document reasons for fluctuations in antimicrobial agent consumption, in conjunction with changes in antimicrobial resistance patterns.		
Employ clinical pharmacy services to support the prescribing of antimicrobial agents.		

### Education

Education was seen as the key to the success of many of the interventions and strategies implemented in European hospitals to control the problem of antibiotic resistance. Although educational interventions have historically been poorly carried out, the ARPAC project did provide evidence that they are associated with better outcomes. Active education programmes on antibiotic prescribing in participating hospitals were consistently linked to lower consumption of some of the key antibiotic classes.

RECOMMENDATION	Done	To do
Implement education programmes on antimicrobial prescribing and infection control.		
Aim education programmes at all healthcare workers, from undergraduate to experienced staff (continuous education).		
Make education programmes multimodal and evidence-based, with feedback on compliance with local recommendations.		

## Infection control policy

On average, ARPAC participating hospitals had 2.8 infection control nurses per 1000 beds and 1.5 infection control doctors per 1000 beds. The project provides evidence that MRSA prevalence in hospitals can be reduced by up to 13% by promoting the use of alcohol-based hand disinfection, placing MRSA patients in single rooms, and by the use of gowns and gloves. Only 14% of hospitals typed MRSA isolates in-house; a further 12% sent their isolates to a reference laboratory.

RECOMMENDATION	Done	To do
Ensure that the infection control programme is implemented by an adequate staff resource, meeting at least the levels recommended in the SENIC study (1 infection control physician/hospital and 1 infection control nurse/250 acute care beds).		
Provide sufficient isolation facilities (single patient rooms and staff reinforcement).		
Implement standard precautions (such as hand disinfection) and audit healthcare workers' compliance with these precautions.		
Validate and implement rapid microbiological methods for screening and detection of alert organism carriers among high-risk patients admitted to acute care hospitals, in particular in ICUs.		
Develop and evaluate local surveillance, outbreak detection and ad hoc control measures for containment of emerging/importable alert organisms.		
Provide direct access to rapid molecular typing of alert organisms.		

## Antibiotic stewardship

The ARPAC project found that the existence of an antibiotic formulary, a multi-disciplinary drugs and therapeutic committee (DTC) and an active education programme on antibiotic use and resistance were associated with lower antibiotic consumption. Some 77% of ARPAC hospitals had a written formulary, 86% had a DTC (multi-disciplinary in only 30%) and 80% had educational programmes.

RECOMMENDATION	Done	To do
Establish an antibiotic stewardship programme with strategic goals.		
Create a multi-disciplinary drugs and therapeutic committee (DTC), with members who have expertise and authority in prescribing antimicrobial agents.		
Make the DTC responsible for providing the hospital with an easily accessible and up-to-date antibiotic formulary.		
Require the DTC to: <ol style="list-style-type: none"> <li>manage antimicrobial policy in response to national guidelines, local requirements and susceptibility data</li> <li>develop and implement guidelines for prudent antimicrobial prescribing.</li> </ol>		
Audit and react to poor performance, as indicated by antimicrobial resistance and antimicrobial consumption data.		
Reserve key antibiotics – e.g. carbapenems, glycopeptides, fourth-generation cephalosporins, and oxazolidinones – for the most severely ill patients.		

