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EARSS Annual Report 2005

The European Antimicrobial Resistance Surveillance System (EARSS), funded by DG SANCO of the European Commission, is an international network of national surveillance systems which collect comparable and validated antimicrobial susceptibility data for public health action.

EARSS performs continuous surveillance of antimicrobial susceptibility for seven major bacterial pathogens *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Enterococcus faecalis*, *Enterococcus faecium*, *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* causing invasive infections and monitors variations of antimicrobial resistance over time and place.

In December 2005, over 900 microbiological laboratories serving some 1400 hospitals from 32 countries had provided susceptibility data of almost 400,000 invasive isolates. An interactive website is available at www.rivm.nl/earss, where up-to-date details can be found on country-specific resistance levels for important groups of antibiotics.

Period of data collection: January 1999 – December 2005

This document was prepared by the EARSS Management Team, members of the Advisory Board, and national representatives of EARSS, Bilthoven, The Netherlands, October 2006.

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A word of thanks

The successful introduction of sulpha drugs and penicillin in the 1940's heralded an era of drug discovery reminiscent only of a freshly unearthed gold field. Numerous derivatives from over twenty distinct antibiotic classes had been licensed in the 15 years between 1945 and 1960 alone. And in the decades that followed, demographic and economic improvements in Europe and Northern America lead to a decline in infectious diseases as one of the major health threats in this part of the world. But many of these achievements are increasingly threatened.

Since the 1990's, only a single class of antibacterial compounds have become available for therapeutic use in humans (oxazolidinones). At the same time antimicrobial resistance clearly became an emerging problem, threatening the previous advances of modern medicine. The consequences of this disquieting development have still not been appreciated to its full extent at a time when international, national and non-governmental agencies trust that market forces and worldwide demand will redirect the flow of investment and scientific initiative. It is therefore critical to realise that antimicrobial effectiveness, widely accepted as a common good, cannot be taken for granted and that antimicrobial substances are increasingly attaining the status of non-renewable resources. What is even more surprising is that the scientific community lacks a precise understanding of the impact of this problem on public health in terms of mortality, morbidity and economic loss.

Before being able to estimate what effect antimicrobial resistance has on healthy life expectancy, it is necessary to have comparable resistance surveillance data for wide geographical regions. We are therefore deeply indebted to all the national representatives and national data managers from 32 European countries, and the 900 participating laboratories willing to keep up their enthusiasm to share antimicrobial susceptibility data throughout the European region and to the European Commission and Dutch Ministry of Welfare and Sports who, during the last seven years, have maintained the financial support that made EARSS the largest publicly funded surveillance network on antimicrobial resistance worldwide.

I would also like to thank all members of the EARSS Advisory Board and the EARSS Management Team for sharing their expertise, for their contribution to this report and also for making the activities organised within EARSS again successful during the past year. Furthermore I would like to thank John Stelling for his ever altruistic contribution and the many visits to participating countries to give support on WHONET for EARSS and Bennie Bloemberg for his technical support in developing the country summary sheets that are a substantial part of this report.

Finally, I would like to thank the European Centre for Disease Prevention and Control (ECDC) for their success in earmarking the funding, which will allow us to continue our collaborative effort of this well-functioning network for yet another year.

With confidence I look forward to the important future work with all of you....



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Summary

The European Antimicrobial Resistance Surveillance System (EARSS) is an international initiative funded by the Director General for Health and Consumer Protection (DG SANCO) of the European Commission and the Dutch Ministry of Health, Welfare and Sports. It maintains a comprehensive surveillance and information system that links national networks by providing comparable and validated data on the prevalence and spread of major invasive bacteria with clinically and epidemiologically relevant antimicrobial resistance in Europe.

EARSS collects routinely generated antimicrobial susceptibility (AST) data, provides spatial trend analyses and makes timely feedback available via an interactive website at www.rivm.nl/earss. Routine data for major indicator pathogens (*Streptococcus pneumoniae*, *Staphylococcus aureus*, *Enterococcus faecalis*, *Enterococcus faecium*, *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*) are regularly submitted by over 900 laboratories serving around 1400 hospitals in 32 European countries. By the end of 2005 two new countries joined the EARSS initiative, Lithuania and Turkey. Based on a previous laboratory/hospital questionnaire, the overall hospital catchment population of the EARSS network is estimated to include over 100 million inhabitants in the European region, with national coverage rates that ranged between 20-100% for individual countries. In 2005, information on the laboratory demands for external quality assessment (EQA) was collected by questionnaire. Several countries do not have formal agreements on national or international quality assessment schemes in place. Among the international providers of EQA the British UK-NEQAS scheme was most frequently named by countries. Alternatively, different national schemes are in place, either alone or in combination with one of the international programs. Importantly, the majority of laboratories that participate in EARSS utilise some type of EQA, demonstrating their commitment to diagnostic accuracy.

In Europe the proportion of antibiotic resistant *S. pneumoniae* keeps changing with decreasing penicillin-resistance in some highly endemic countries and with continuous loss of susceptibility against penicillin and erythromycin in others. The main resistance phenotypes in pneumococci are confined to few serogroups, all of which are included in the currently promoted conjugate vaccines. This suggests that vaccination, especially in young children, may represent an effective additional means of controlling antibiotic resistance in pneumococcal disease in Europe. The increase of MRSA is consistent throughout Europe and includes countries with high, medium and low baseline MRSA endemicity. At the same time it appears that the MRSA pandemic is not an irreversible secular trend as two European countries (Slovenia and France) succeeded in constantly reducing the proportion of MRSA among *S. aureus* blood stream infections over the past five or six years.

The speed with which fluoroquinolones lose their activity against *E. coli* is next to no other compound pathogen combination in the EARSS database. Combined resistance is a frequent occurrence, with co-resistance to three antimicrobial classes including third generation cephalosporins already among the four most common resistance patterns encountered in invasive *E. coli* in Europe, and undeniably these resistance traits are on the increase as well. In *K. pneumoniae* a high prevalence of resistant strains to third generation cephalosporins, fluoroquinolones and aminoglycosides becomes evident in Eastern and Southeastern Europe. Combined resistance is the dominant threat imposed by invasive *P. aeruginosa*. Our data suggest that the same geographical gradient exists for all gram-negative pathogens and shows that lower resistance prevails in the Northwest with increasing resistance towards the Southeast of Europe.

It appears that the overall threat imposed on European communities by the increasing loss of antimicrobial effectiveness continues unabated with the same speed as has been previously described by our network. This is shown most convincingly among the pathogens that are frequently transmitted in health care settings (MRSA and VRE) and for antimicrobial compounds that are available for oral administration and hence preferred in ambulatory care (aminopenicillins, macrolides, and fluoroquinolones). The growing availability of third-line antimicrobial drugs as oral formulations is in this context a matter of concern and underscores the need of locally or nationally advised prescribing practices for both ambulatory and hospital-based care.

List of abbreviations and acronyms

AMR	Antimicrobial resistance
ARMed	Antibiotic resistance surveillance and control in the Mediterranean region
AST	Antimicrobial susceptibility testing
CC	Clonal complex
CSF	Cerebrospinal fluid
DCFP	Data Check and Feedback Programme
DEFS	Data Entry & Feedback Software
DG-SANCO	Directorate General for Health and Consumer Protection
DNA	Deoxyribonucleic Acid
EARSS	European Antimicrobial Resistance Surveillance System
EARSS-ibis	EARSS internet based information system
EARSS-MT	EARSS Management Team
EARSS-NR	EARSS National Representatives
ENSP	Erythromycin non-susceptible <i>Streptococcus pneumoniae</i>
EU	European Union
EQA	External quality assurance
ESAC	European Surveillance of Antimicrobial Consumption
ESBL	Extended-spectrum beta-lactamase
ESCMID	European Society of Clinical Microbiology and Infectious Diseases
ESGARS	ESCMID Study Group for Antimicrobial Resistance Surveillance
EUCAST	European Committee on Antimicrobial Susceptibility Testing
GISA	Glycopeptide intermediate resistant <i>Staphylococcus aureus</i>
HLAR	High level aminoglycoside resistance
ICU	Intensive care unit
IPSE	Improving Patient Safety in Europe
MIC	Minimal inhibitory concentration
MLS	Macrolide-Lincosamide-Streptogramin
MLST	Multi Locus Sequence Typing
MRSA	Methicillin-resistant <i>Staphylococcus aureus</i>
NRL	National reference laboratories
OXA	Oxacillinase gene
PBP	Penicillin binding protein
PCV	Pneumococcal conjugate vaccine
PFGE	Pulsed Field Gel Electrophoresis
PNSP	Penicillin nonsusceptible <i>Streptococcus pneumoniae</i>
RIVM	Rijksinstituut voor Volksgezondheid en Milieu (National Institute for Public Health and the Environment)
RNA	Ribonucleic Acid
SeqNet.org	European Network of Laboratories for Sequence Based Typing of Microbial Pathogens
Spa-typing	<i>S. aureus</i> protein A sequence typing
SHV	Sulfhydryl Variable gene
UK-NEQAS	United Kingdom National External Quality Assessment Scheme for Microbiology
VISA	Vancomycin intermediate resistant <i>Staphylococcus aureus</i>
VRE	Vancomycin resistant enterococci
VREF	Vancomycin resistant <i>Enterococcus faecalis</i>
VRSA	Vancomycin resistant <i>Staphylococcus aureus</i>
WHO	World Health Organization
WHONET	WHO microbiology laboratory database software

The EARSS network from January 2005 till August 2006

I. Countries participating in EARSS

Austria	AT	Italy	IT
Belgium	BE	Latvia	LV
Bulgaria	BG	Lithuania*	LT
Croatia	HR	Luxembourg	LU
Cyprus	CY	Malta	MT
Czech Republic	CZ	Netherlands	NL
Denmark	DK	Norway	NO
Estonia	EE	Poland	PL
Finland	FI	Portugal	PT
France	FR	Romania	RO
Germany	DE	Slovakia	SK
Greece	GR	Slovenia	SI
Hungary	HU	Spain	ES
Iceland	IS	Sweden	SE
Ireland	IE	Turkey*	TR
Israel	IL	United Kingdom	UK

* regular reporting commences in 2006

II. EARSS national representatives per country

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A. Nissinen (FiRe)			Finnish Study Group for Antimicrobial Resistance (FiRe)	www.ktl.fi/extras/fire/index.html
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P. Grzesiowski	National Institute of Public Health	Poland	OPTY	
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M. Lillie J. Shah	Health Protection Agency Communicable Disease Surveillance network	United Kingdom	UK EARSS Collaborating Group	www.hpa.org.uk

IV. EARSS advisory board members in 2005

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Dr. J. Kolman	all countries	University Medical Centre Ljubljana, Slovenia
Prof. A. Vatopoulos	all countries	National School of Public Health, Athens, Greece

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VII. EARSS related publications

Scientific papers in peer reviewed journals

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- Bronzwaer SL, Cars O, Buchholz U, Molstad S, Goettsch W, Veldhuijzen IK, Kool JL, Sprenger MJ, Degener JE. European Antimicrobial Resistance Surveillance System. A European study on the relationship between antimicrobial use and antimicrobial resistance. *Emerg Infect Dis* **2002**; 8: 278-82.
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Belgium

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Czech Republic

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Estonia

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Chapter 1. Introduction

Antimicrobial resistance (AMR) threatens the effectiveness of successful treatment of infections and is a public health issue with local, national, and global dimensions. Antimicrobial resistance thus can result in increased morbidity, disease burden, and mortality. Surveillance of antimicrobial resistance proportions provides data that are needed to raise the awareness to the problem and instigate necessary interventions.

At the 'Microbial Threat Conference', held in September 1998 in Denmark, it was concluded that an 'Effective European surveillance should be in place and must have the agreement and active involvement of all participants' ('the Copenhagen Recommendations' [1]). This conference led to the foundation of the European Antimicrobial Resistance Surveillance System (EARSS), funded by the Directorate General for Health and Consumer Protection (DG SANCO) of the European Commission and the Dutch Ministry of Health, Welfare and Sports. Since 1999, it has been the remit of EARSS to maintain a comprehensive surveillance and information system that links national networks by providing comparable and validated data about the prevalence and spread of major invasive bacteria with clinical and epidemiologically relevant AMR in Europe. In 2001, at a follow-up EU conference in Visby, Sweden, it was concluded that all Member States of the European Union (EU) shall join the EARSS initiative as a minimum requirement of national surveillance programmes ('the Visby recommendations' [2]) and during the Rome conference convened by the EU Commission Directorate for Research and Development in November 2003, it was made clear that linking antimicrobial resistance with microbial ecology and improving the knowledge about its costs to European societies is essential for the development of effective control strategies [3].

EARSS is co-ordinated by the Dutch National Institute of Public Health and the Environment (RIVM). Ever since the start of EARSS, the number of participants has increased. By the beginning of 2006, EARSS covers an estimated population of more than a 100 million inhabitants served by about 1400 hospitals in 32 countries. The EARSS database contains AMR data on approximately 400,000 invasive isolates of *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Enterococcus faecalis*, *Enterococcus faecium*, *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. It is thus the most comprehensive public health effort that describes and analyses geographic and secular trends in AMR worldwide.

EARSS operates in close collaboration with other EU-financed projects: European Surveillance of Antimicrobial Consumption (ESAC), and Antibiotic Resistance Surveillance and Control in the Mediterranean region (ARMed). There is a close partnership between the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) and two of the society's sub committees, namely, the European Committee on Antimicrobial Susceptibility Testing (EUCAST) and the ESCMID Study Group for Antimicrobial Resistance Surveillance (ESGARS).

This report presents an overview of activities, innovations and results of the EARSS network from January 2005 till August 2006. Chapter 2 summarises the objectives and operational strategy. Chapter 3 describes the situation on External Quality Assessment of Antimicrobial Susceptibility Testing in Europe. Chapter 4 provides a descriptive analysis of the situation of AMR in the European region. Chapter 5 presents the overall conclusions and recommendations based on these results. The annexes contain a technical section (Annex 1), detailed country summary sheets (Annex 2) and overview

tables of antibiotic resistance in Europe in 2005 (Annex 3). Results are based on data recorded from January 1999 - December 2005, if not otherwise indicated.

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Chapter 2. EARSS objectives and operational strategy

2.1. Objectives

It is the remit of EARSS to maintain a comprehensive surveillance and information system that links national networks by providing comparable and validated data on the prevalence and spread of major invasive bacteria with clinically and epidemiologically relevant antimicrobial resistance in Europe.

Thus, EARSS aims to:

- Collect comparable and validated AMR data;
- Analyse trends in time and place
- Provide timely AMR data that constitute a basis for policy decisions
- Provide feedback to ‘those who need to know’
- Encourage the implementation, maintenance and improvement of national AMR surveillance programmes
- Supports national systems in their efforts to improve diagnostic accuracy at every level of the surveillance chain
- Link AMR data to factors influencing the emergence and spread of AMR, such as antibiotic use data
- Initiate, foster and complement scientific research in Europe in the field of AMR.

EARSS collects routine antimicrobial susceptibility test (AST) results of invasive (blood culture and CSF) isolates of *Streptococcus pneumoniae*, *Staphylococcus aureus*, (both since 1999), *Enterococcus faecalis* and *E. faecium*, *Escherichia coli* (since 2001), and *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* (since 2005). These pathogens were selected because they have different epidemiological and ecological backgrounds and serve as markers for clinically and epidemiologically meaningful developments in antibiotic resistance. The decision to collect routine data, preferably according to the internet-accessible EARSS protocols, means that no changes to the regular diagnostic process are needed. In this way, the participation of many laboratories in many countries has become feasible.

2.2. The EARSS network and operational strategy

2.2.1. Organisation of the EARSS network

Each participating country has appointed one or two national representatives. They are medical microbiologists and/or infectious diseases epidemiologists (see Table II, page 13). Moreover, each country has a national data manager (see Table III, pages 14-15). The main task of the national representatives is to coordinate the EARSS-specific activities of the participating laboratories (data collection, reporting, questionnaire completion and EQA strain and results distribution) and to communicate with the EARSS Management Team (EARSS-MT). The national representatives also encourage the laboratories to generate their AST data according to the EARSS protocols, as published in the EARSS Manual 2005 (downloadable from the official EARSS website at www.rivm.nl/earss). The main tasks of the national data manager are to collect, approve and forward resistance data each quarter to the international data manager maintaining the EARSS central database and to assist the national representative. Protocols for standardising the data collection have been developed with professional help from the European Society of Clinical Microbiology and Infectious Diseases (ESCMID), the European Committee on Antimicrobial Susceptibility Testing (EUCAST) and WHO microbiology laboratory database software (WHONET). To assess the quality and comparability

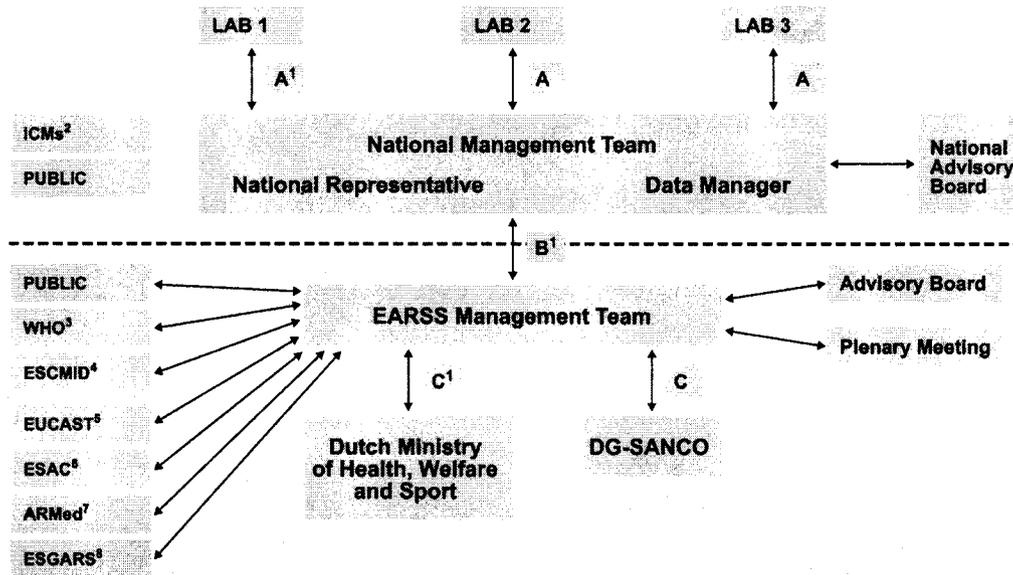


Figure 2.1. Structure of the EARSS network.

¹ Reporting lines are indicated with arrows. The most important reporting lines are further clarified with letters (A-C):

A. Participating laboratories collect data and report the data to the national data manager, who checks the data. Messages from the national level and from EARSS-MT, including new protocols, questionnaires and reports, are forwarded by the national representative to the participating laboratories. B. Once checked, the national data manager forwards the data to EARSS-MT, where the data is again checked and a feedback report is produced which is sent to the national representative. EARSS-MT awaits approval of the data by the national representative before the results are added to the EARSS database and thus become visible at the interactive website and published in the annual report. Messages from EARSS-MT, including new protocols, questionnaires and reports, are always directed to the national representatives who shall forward the information to the relevant parties in their own country. (NB: the annual plenary meeting brings together EARSS-MT and all national representatives). C. Official reports are forwarded for final approval to DG Sanco and the Dutch Ministry of Welfare and Sports (considering a 45 days term) before they become official reports of the EARSS network.

² ICMs: Intersectoral Co-operating Mechanisms

³ WHO: World Health Organisation

⁴ ESCMID: European Society on Clinical Microbiology and Infectious Diseases

⁵ EUCAST: European Committee on Antimicrobial Susceptibility Testing

⁶ ESAC: European Surveillance on Antimicrobial Consumption

⁷ ARMed: Antibiotic Resistance Surveillance and Control in the Mediterranean Region

⁸ ESGARS: ESCMID Study Group for Antimicrobial Resistance

⁹ European Centre for Disease Prevention and Control

of AST data, regular EQA exercises are carried out in collaboration with UK-NEQAS. In 2005, no EQA exercise was organized because of budgetary constraints, but the next EQA exercise is now being prepared for February 2007.

2.2.2. The national networks

It is the task of the national representatives to select participating laboratories/hospitals that cover at least 20% of the total population and serve various types of institutions (university or tertiary care hospitals, general or district hospitals, rehabilitation centres or nursing homes, and others). Different geographic regions (urban/rural), and the socio-economic strata should be included in a demographically representative manner.

2.2.3. Collecting and processing antimicrobial susceptibility testing (AST) results

EARSS collects susceptibility test results of invasive isolates and background information about patients. Laboratories are asked to report the first isolate per patient from blood or CSF per reporting quarter, including specific information on the bacterial isolate, host, institution and laboratory that submits the results. Data shall be reported according to the specifications of the EARSS exchange format. AST results are generated and reported as specified by standard EARSS protocols. Furthermore, optional data are collected such as clinical diagnosis, other conditions, and facultative susceptibility data for additional antibiotics. More information about data collection and protocols can be found in the EARSS Manual 2005, which can be downloaded from the official EARSS website at www.rivm.nl/earss.

Laboratories

Participating laboratories can opt for one of two ways of submitting data: electronically or by sending in conventional isolate record forms (on paper). EARSS provides various free software tools for electronic data handling, downloadable from the website at www.rivm.nl/earss: (1) WHONET, the microbiology laboratory software, adapted for EARSS by John Stelling, and (2) Data Entry & Feedback Software (DEFS), which was developed as an exclusive EARSS tool. Laboratories are asked to collect AST data on a routine basis and to forward them to the national representative or data manager quarterly.

Before submission, laboratories are asked to check their data for:

- Adherence to the EARSS protocol
- Microbiological consistency/plausibility
- Consistency with clinical breakpoints, sensitive (S), intermediate (I) and resistant (R) breakpoints as defined by the specific guideline used.

National representative and national data manager

At the national level, the national data manager, in consultation with the national representative, processes the data.

This is done in a stepwise fashion:

- Recording data from all participating laboratories and manual data entry if isolate record forms are used.
- Merging data from all participating laboratories into *one* single file.
- Converting data to EARSS exchange format (EARSS Manual 2005).
- Revising data with the Data Check and Feedback Programme (DCFP).
- Approval of data by the national representative (adherence to EARSS protocol).
- Data transfer to EARSS-MT at the end of each quarter (March, June, September and December).

International data manager at EARSS-MT

After receiving the data from the national data manager, the files are examined by the international data manager of EARSS-MT.

This process involves the following steps:

- Checking the data format
- Inspection of the contents of the files
- Removing duplicate reports
- Determining resistance proportions
- Identification of unusual or rare results
- Compilation of a feedback report summarizing the results
- After approval by the national representative, data are added to the database, and the results are made public on the EARSS website at www.rivm.nl/earss.

Feedback from EARSS-MT

Once data become available to EARSS-MT, they are processed and returned in a standard feedback report to the national representative in order to obtain confirmation and final approval of validity and completeness of the data. This feedback step also informs the national representatives of the occurrence of resistance patterns with particular public health importance (MRSA, PNSP, VRE, GISA and ESBLs). Subsequently, the national coordinator is asked to confirm the correctness of the results. With his/her approval, the data will be added to the EARSS database and will become immediately available on the interactive EARSS website at www.rivm.nl/earss, where they can be displayed in various downloadable formats, such as tables, figures, and maps. The data from the EARSS database are used to prepare annual reports, newsletters and publications that are disseminated to the participants, the scientific community, policy makers and a broader public.

2.2.4. EARSS meetings

EARSS organizes annual meetings for all national representatives to inform them on the progress of EARSS and discuss future initiatives. The annual plenary meeting was held from 23-25 November 2005 in cooperation with EUCAST in Rome, Italy, and in collaboration with our Italian representative Dr. Annalisa Pantosti. An update was given on the situation of antimicrobial resistance in Europe. The results of laboratory/hospital questionnaire 2005, including factors potentially influencing resistance proportions were discussed. The latest results on *S. pneumoniae* serotyping were shown and delegates were updated on the EARSS - internet based information system (EARSS-*ibis*). Besides the plenary meeting, EARSS organizes training sessions for data managers and reference laboratory staff. Data managers workshops are organized bi-annually. In June 2006, the 4th data managers workshop was organized in Bilthoven, the Netherlands, in which theoretical and practical aspects of data management were discussed, focussing on data analysis and feedback at national level. A workshop for reference laboratory personnel on molecular typing of *S. aureus* using the spa method was organized in October 2005 in Muenster, Germany, in cooperation with SeqNet.org.

2.2.5 Linkage with other networks

Laboratory protocols on the identification of fluoroquinolone resistance in *Streptococcus pneumoniae* as well as the clinically and epidemiologically relevant resistance patterns for the two new species (*Klebsiella pneumoniae* and *Pseudomonas aeruginosa*) were devised in cooperation with EUCAST. EARSS and ESAC exchanged their surveillance data for the linking of resistance with the prescription of antimicrobial compound in Europe (manuscript in preparation). Collaboration with IPSE resulted in the integration of a new web-accessible communication platform for hospital infection control practitioners (NEWS site) with the EARSS-*ibis* tool. A new initiative on 'Identifying the dominant strains of *Staphylococcus aureus* causing invasive infection in the European region' was based on a formal agreement (see 2.3.4 Typing initiatives) for collaboration with the previously established SeqNet.org group.

2.3. EARSS in 2006 and beyond

2.3.1. Collection of antimicrobial susceptibility data

Data for 2006 will be presented in the EARSS annual report 2006, to be published in autumn 2007. The most recent version of the database includes data reported in 2006 and can be accessed interactively at the EARSS website (see www.rivm.nl/earss). Results up to and including 2005 are described in Chapter 4 and are the focus of his report.

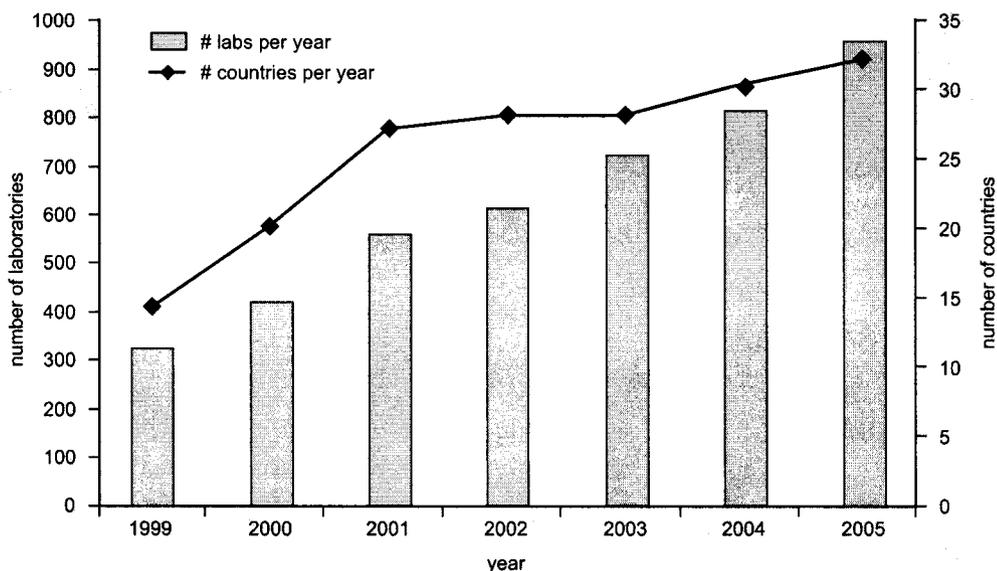


Figure 2.2. Number of laboratories (left axis) and countries (right axis) participating in EARSS by year.

2.3.2. The EARSS network

Two new countries (Lithuania and Turkey) joined the EARSS initiative in 2005. Both countries started reporting in 2006 on a regular basis. The number of laboratories continued to increase in 2005.

2.3.3. Upcoming EARSS meetings

The next plenary meeting will be organized on the 10th and 11th of May, 2007. The meeting will focus on exploitation of interventions based on EARSS data and the future of EARSS with ECDC.

2.3.4. New initiatives

Early warning and response systems (EARSS-*ibis*)

The EARSS-*ibis* system is accessible on the internet (see www.rivm.nl/earss) since 2005. The EARSS-*ibis* system enables users (mainly microbiologists) to report on bacterial pathogens with unexpected antimicrobial resistance, virulence or transmissibility. The EARSS-*ibis* system can be used within a country as well as internationally. To facilitate the use of EARSS-*ibis* as a national tool, it is possible to use the national languages. Eleven languages have been made already available with the help of the EARSS National Representatives.

Typing initiatives

Through its grant agreement for action (no. 2003212) the European Antimicrobial Resistance Surveillance System (EARSS) is committed to improve the understanding of the spread of antimicrobial resistance by identifying the expansion of clones of particular public health importance (i.e. with special resistance, transmissibility or virulence) through common typing approaches. Since 2004, EARSS has collected *S. pneumoniae* serotype data next to the AST results. By now, 10 countries have made serotype data available for this species. An analysis of the serotype data available is presented in chapter 4 of this report (page 38).

For *S. aureus*, EARSS undertook a European-wide consultation of scientific experts in the field of molecular typing and stakeholders including the National Reference Laboratories (NRL) and the EARSS National Representatives (EARSS-NR) in 2004. As a result of this consultation, sequence-based typing approaches were identified as the most reliable method, since DNA sequencing utilises the genetic code, a common and biological meaningful language. Sequence-based typing allows for unambiguous clone designation, unequivocal comparisons, and real time quality control. A comparison of the different sequence-based approaches (MLST, spa-typing) with the most frequently used typing technique (PFGE) identified spa-sequence typing of *S. aureus* as the most promising technique in terms of ease, costs, discriminatory ability and excellent concordance with the other two (29).

With the wide availability of sequencing capacity at NRLs and user-friendly software that allows for automatic strain identification and on-line quality control, the means for easy communication and international comparison of typing information are available for spa-sequence typing. A central database at <http://www.ridom.de/spaserver/> has been established where information of spa-types, like their frequencies, their relation to MLST sequence types and epidemiological information is freely available. This is established and maintained by the SeqNet.org initiative on behalf of all users (<http://www.seqnet.org>).

During two workshops in Muenster, Germany in fall 2004 and fall 2005 (the 2005 workshop was funded by EARSS) laboratory experts from 28 European countries were trained in all aspects of spa-sequence typing (DNA purification, amplification, sequencing, editing and submitting). At the EARSS Annual Plenary Meeting that took place in November 2005 in Rome, a decision was supported by all EARSS-NRs to pilot an initiative of "Identifying the dominant *Staphylococcus aureus* strains causing invasive infections in the European region" using the spa-sequence typing approach for isolates submitted by the EARSS participating hospitals. Thereby, each EARSS participating laboratory shall submit the first 5 successive MSSA isolates and the first 5 successive MRSA isolates from individual patients with invasive infection per hospital they serve. Collection of isolates started on the 1st of September 2006. The duration of the sampling shall be six months ending on the 28th of February 2007. More information about this joint EARSS/Seqnet.org initiative can be found in the protocol manual at www.rivm.nl/earss.

Data collection on two new pathogens

Since November 2004, EARSS participants are encouraged to report antimicrobial susceptibility data for *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. In 2005 about 5000 isolates of *K. pneumoniae* and 4000 isolates of *P. aeruginosa* from 24 and 23 countries respectively, were already reported to the EARSS database during this first year of data collection. This reflects not only the availability of AST data for these two important pathogens but also the enthusiasm of the participating laboratories to expand the EARSS information base for public health purposes. Standard protocols were devised together with EUCAST and the EARSS Advisory Board. The first results of 2005 are published in chapter 4 of this report (pages 62 and 66, respectively).

Chapter 3. The status of Quality Assessment in Antimicrobial susceptibility testing in Europe

3.1. Introduction

External Quality Assessment (EQA) plays a crucial role in the evaluation of diagnostic accuracy, reflecting the validity of reporting and thus directly influences the quality i.e. effectiveness of treatment and patient care. EQA is also an educational tool that allows laboratories to monitor, evaluate and improve their own performance, which ultimately improves local, national and international standards. At the same time EQA is a requirement for surveillance networks as it reflects the quality and thus the comparability of test results from different laboratories. With this in mind, EARSS has carried out EQA once yearly by sending out six strains belonging to five bacterial species for antimicrobial susceptibility testing. The results were convincing and demonstrated that for the bacteria and antimicrobials addressed by the EARSS program, the comparability of routine AST data from the different countries participating in EARSS was satisfactory for surveillance purposes.

However, it is important to remember that the EARSS EQA is not in a strict sense an EQA, since the EQA strains are given special attention by the participating laboratories. The results do not necessarily reflect routine diagnostic procedures in many of the laboratories for bacteria and antimicrobials not part of the program. We advocate that laboratories should routinely subscribe to one of the national and or international EQA schemes. By signing up for one of the international programs, the laboratory is given the opportunity to compare its proficiency on a grander scale. By means of a questionnaire we explored, at country level, what kind of EQA schemes are already in place in the European countries, and how EARSS National Representatives envisage the implementation or improvements of EQA in their country.

3.2. Methods

All National Representatives of the countries currently participating in EARSS (n=32) were sent a questionnaire with questions on national opportunities for EQA in bacteriology in general and AST in particular and on their opinion on how EQA should be organised in the future. EQA was defined as; the regular documentation and assessment of and feedback on performance of a sizable number of laboratories by an independent external institution designed to evaluate quality of diagnostic performance and to demonstrate a continuous commitment to quality. All completed questionnaires were collected at the RIVM and processed by EARSS-MT.

3.3. Results

Current EQA situation in Europe. Twenty-seven of 32 countries returned a completed questionnaire. Four countries reported that they did not have a formal, mandatory EQA scheme (Austria, Cyprus, Portugal and Turkey). In Cyprus and Portugal this was attributed to the absence of financial support. Austria and Turkey indicated that there was a need for organisational support. Italy has mandatory EQA, but there is no national scheme since the organization of EQA has been devolved to the regions. Six countries reported that they had national schemes, 9 that they used international schemes

Table 3.1. Information on the current EQA schemes in the EARSS countries that returned the EQA questionnaire (n=26)

Question/Country	Austria	Cyprus	Portugal	Turkey	Belgium	Bulgaria	France	Germany	Italy	Spain	United Kingdom	Estonia	Iceland	Ireland	Israel	Latvia	Lithuania	Luxembourg	Slovenia	Sweden	Croatia	Czech Republic	Denmark	Finland	Hungary	Norway	Poland
National EQA scheme					X	X	X	X	#	X	X										X	X	X	X	X	X	X
International EQA scheme												X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
No EQA scheme	X	X	X	X																							
Reason why no EQA																											
No financial support		X	X																								
No scientific support																											
No organizational support	X			X														X									
Other reason									X						X												
Who pays for EQA																											
Government/ministry					X		X																X		X	X	X
Nat. Microbiological Society										X																	
International body																					*	*			*		*
Local laboratory	X					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

*WHO/CDC EQA scheme

Italy has no national EQA scheme, but a mandatory EQA at the regional level.

and 7 participated in both national and an international schemes (Table 3.1). Table 3.2 shows the different EQA schemes in the various countries. In general all EARSS laboratories participate in their respective national EQA schemes. In ten countries, laboratories subscribed to the UK-NEQAS scheme, 4 participated in WHO/CDC EQAS and another 4 participated in the Labquality scheme provided by a Finish institute. The costs of EQA were fully covered by the respective governments in Belgium, Norway and France, (Table 3.1), but were entirely borne by the participating laboratories in 12 of 22 responding countries. Four countries participated in the WHO-CDC scheme. Only laboratories in Spain were supported financially by a national professional organisation.

EQA in the future. All agreed that EQA should be part of a regular scheme and of the every-day workflow in diagnostic laboratories. Moreover, organisation and logistics should be in the hands of an independent agency. The majority of countries also agreed that EQA should be mandatory and reflect an agreed national diagnostic standard (Table 3.3).

Although bacteriological identification and antimicrobial susceptibility testing were given priority, typing, serology, and nucleic acid-based tests were also regarded as important components of future EQA schemes (Table 3.3). There were further suggestions that mentioned microscopic examination of micro organisms, antigen testing of difficult organisms, and critical resistance to be added to the EQA programme. But there were also replies arguing that “no single EQA can cover all areas of diagnostic microbiology” and advocated an a la carte content of EQA depending on the diagnostic activities the individual laboratory needs to assess.

Table 3.2. Different EQA schemes executed by country

Country	National EQA scheme	Distribution frequency	ID pathogen	Participation EARSS labs?	International EQA scheme	Distribution frequency	ID pathogen	Participation EARSS labs?
Belgium	EQA Microbiology	4 strains every 4 months	Y	ALL	-	-	-	-
Bulgaria	BULSTAR-EQA	5 strains every 6 months	Y	ALL	-	-	-	-
Croatia	WHO/CDC EQAS	2-4 strains every 6 months	Y	ALL	UK NEQAS	2 strains every month: + 3 only ID	Y	3/29
Czech Republic	EHK-Externí hodnocení kvality	2 strains every 3 months	N	ALL	WHO/CDC EQAS	2 strains every 6 months	Y	32/50
Denmark	DANRES-M	10 strains every 12 months	Y	14/15	UK NEQAS	NEQAS scheme	-	ALL
Estonia	-	-	-	-	Labquality (Finland)	1-3 strains every 1-3 months	Y	7/10
Finland	UK NEQAS	-	-	ALL	Labquality: Blood culture	2 strains every 3 months	Y	ALL
France	Afssaps-CQN	1-3 strains every 6 months	Varies	ALL	-	-	-	-
Germany	INSTANDe.V ¹	5 strains every 6 months	Y	ALL	-	-	-	-
Hungary	QualiCont	3 strains every 4 months	Y	20/25	WHO/CDC EQAS	3 strains every 6-8 months	Y	1/25
Iceland	-	-	-	-	UK NEQAS and EQUALIS (Sweden)	depends on scheme	The whole NEQAS scheme	ALL
Ireland	-	-	-	-	UK NEQAS	2 stains every month	-	ALL
Israel	-	-	-	-	UK NEQAS General Bacteriology + Antimicrobial susceptibility	2 strains every month: + 3 only ID	Y	1/5
Latvia	-	-	-	-	Labquality (Finland)	depends on financial possibilities of hospital	Gram stain, ID, susceptibility testing	ALL
Lithuania	-	-	-	-	Labquality (Finland)	5-7 strains every month	Y	1/13
Luxembourg	-	-	-	-	EEQA (ISP B-1050 Bruxelles)	4 strains every 4 months	All microorganisms	ALL
Norway	Bacteriological EQAS (NIPH ²)	4 specimen ³ every 3 months	Y	ALL	UK NEQAS	-	-	? of 10
Poland	POLMICRO	4-5 strains every 3-4 months	Y	ALL	CDC/WHO EQAS Labquality (Finland)	2-3 strains every 6 months	Y	1 of ?
Slovenia	-	-	-	-	UK NEQAS	2 strains every month: + 3 only ID	Y	ALL
Spain	Control Calidad SEIMC	4 strains every year	Y	ALL	-	-	-	-
Sweden	-	-	-	-	UK NEQAS	2 strains every month	Y	ALL
United Kingdom	UK NEQAS	1-2 strains every month	Y	ALL	-	-	-	-

¹ Gesellschaft zur Förderung der Qualitätssicherung in medizinischen Laboratorien² Norwegian Institute of Public Health³ Simulated clinical material

Table 3.3. Answers to the questionnaire (n=27) regarding the needs of a future EQA

Question	Number that agreed	First priority
Should EQA be part of regular scheme/routine workflow	27	-
Should an Independent agency carry out the EQA?	26	-
Should EQA be mandatory and reflect nat. diag. standards	25	-
EQA shall include;		
Identification of organisms	26	25
Susceptibility testing	27	25
Typing	26	5
Serology	24	12
Nucleic acid-based tests	24	11
Other	3	-
Information with strains;		
Clinical info on the case	27	24
Source of the isolate	27	25
Sampling procedure	25	13
Epidemiological info	26	7
Other	3	-
Different levels of EQA	20	-

There was broad agreement on the accompanying information of the EQA strains. Clinical information and the isolate source were regarded crucial. Information on the sampling procedure and information on the epidemiology were by some regarded as important (Table 3.3). Several asked that the information provided should be realistic and commented that under normal circumstances it is unlikely that very much epidemiological information will be provided. Others asked that basic demographic data such as age and gender of source patients be given.

Opinions on the frequency of EQA and the number of isolates per shipment, varied widely between countries. Eight countries indicated that they prefer to receive samples every month, but the requested number of isolates per shipment varied between 1 and 5. Most of these countries participate in the UK-NEQAS scheme, where a monthly schedule is today standard. Seventeen countries preferred quarterly, half year or yearly distributions; the number of preferred strains per shipment ranged between 2 and 6.

Most countries (n=20) agreed that there should be different EQA schemes for routine diagnostic laboratories and reference laboratories. Five preferred no difference in levels. Again the issue of a la carte designed EQA appeared in some responses. Since general bacteriology and AST distributions probably apply to all laboratories, these abilities should be principally assessed in EQA. However, it should be possible for labs to indicate which specific tests they do not perform routinely (as in the UK-NEQAS scheme).

3.4. Conclusions

The EARSS questionnaire on EQA provided us with a better understanding of the availability and practices of EQA in Europe. It became evident that a few countries do not have any formal arrangements for mandatory EQA. This was mainly due to lack of financial or organisational support. Laboratories in twenty-two countries participate in regular EQA for diagnostic bacteriology. Almost half of them (n=10) participate in the UK-NEQAS scheme, 4 participated in WHO/CDC EQAS and another 4 participated in the Labquality scheme provided from Finland. Alternatively, national schemes were used, either alone or in combination with one of the international schemes. The major-

rity of laboratories participating in EARSS also participated in the EQA scheme available in that country. The information provides a useful insight into the existing structures and may facilitate the next steps towards a sustainable and comparable EQA structure in Europe.

3.5. Acknowledgements

We would like to thank Gunnar Kahlmeter and Derek Brown from EUCAST and Christine Walton and Vivienne James from UK-NEQAS and the EARSS Advisory Board for their expertise in putting together the questionnaire. Furthermore we would like to explicitly thank the EARSS National Representatives for completing this questionnaire.

Chapter 4. Antimicrobial resistance in Europe

4.1 Introduction

This chapter provides an overview of the EARSS data 2005 and the trends of antimicrobial resistance in Europe. For seven years EARSS has been collecting antimicrobial susceptibility data of invasive isolates with clinical and epidemiological importance. For each pathogen the clinical and epidemiological relevance, major resistance mechanisms, the data and trends of antimicrobial resistance until 2005 will be described. Information on the statistical methods and the inclusion criteria for the different analyses and figures can be found in Annex 1.

4.2. *Streptococcus pneumoniae*

4.2.1. Clinical and epidemiological importance

Streptococcus pneumoniae is a common cause of disease, especially among young children, elderly people and patients with immunodeficiencies. The clinical spectrum ranges from upper airway infections such as sinusitis, and otitis media to pneumonia and invasive disease meningitis, and sepsis (1). Since *S. pneumoniae* is the most common cause of pneumonia worldwide, morbidity and mortality are high and annually approximately 3 million people die of pneumococcal infections (50). These casualties are frequently associated with economic inequalities and about one third of these are children under the age of five.

Pneumococci carry a wide variety of virulence factors that facilitate adherence and invasiveness of host tissues. The cell wall of pneumococcal cells is coated with a viscous slime layer termed the polysaccharide capsule. This is the most important virulence factor, because it protects the bacteria from destruction by leucocytes (45). Capsular polysaccharides are highly diverse and play an important role in immune evasion. Around 80 different serotypes have been described. The serotype distribution varies with age, disease and geographical region (17-19). Interestingly, serotypes most frequently involved in pneumococcal disease in infants are also most frequently associated with antimicrobial resistance (42;48).

Resistance mechanisms. Beta-lactam antibiotics bind to cell wall synthesizing enzymes, penicillin-binding proteins (PBPs) and interfere with the biosynthesis and remodelling of the bacterial cell wall during cell growth and division. The mechanism of penicillin resistance in *S. pneumoniae* consists of alterations in PBPs, which results in reduced affinity to this class of antibiotics. Alterations in PBPs develop in a stepwise fashion which causes different degrees of resistance proceeding from low-level resistance – conventionally termed intermediate* (I) to full clinical resistance (R). Although intermediately resistant strains are clearly less susceptible than sensitive strains, in absence of meningitis, infections with these strains are often successfully treated with high doses of penicillin or alternative beta-lactam compounds (11, 15).

Macrolide, Lincosamide and Streptogramin (MLS) antibiotics are chemically distinct, but all bind to the ribosomal 50S subunit. In *S. pneumoniae* two resistance mechanisms against MLS antibiotics have been reported: i) The acquisition of an erythromycin ribosomal methylation gene (*erm*) results

* Microorganisms are defined as intermediate by a level of antimicrobial activity with uncertain clinical effect. Occasionally, this can be overcome if antibiotics can be administered at a higher dose and/or are concentrated at the infected body site (From unpublished discussions between CEN and ISO for a new MIC dilution method 2005).

in a posttranscriptional modification of the 23S ribosomal RNA, which blocks the binding of the macrolide to the ribosome. Once expression of the gene is induced, this often results in high-level resistance (MIC>128 mg/L) to macrolide, lincosamides and streptogramin B, termed MLS_B resistance (46;49). ii) The acquisition of a macrolide efflux system gene (*mefE*) results in pumping of the antimicrobial out of the cell via an efflux system, and is effective against erythromycin, azithromycin and clarithromycin (25). In contrast to beta-lactam resistance, macrolide resistance via these mechanisms is absolute, and cannot be overcome by increasing the dosages of antibiotics (24).

Since *S. pneumoniae* is the most frequent cause of community-acquired pneumonia and can clinically not easily be distinguished from airway infections caused by other pathogens, empirical treatment of community-acquired lower respiratory infections needs to be active against pneumococci and should take the local prevalence of antimicrobial resistance into account. Reports on widespread beta-lactam resistance therefore engender the habitual prescription of non-beta-lactam compounds in countries where penicillin resistance has been frequently reported. Such reactive prescribing increases the selection pressure for alternative antibiotics such as macrolides and novel fluoroquinolones. It is therefore no surprise to see a dynamic antimicrobial resistance picture emerge in different European countries.

4.2.2. *Streptococcus pneumoniae* resistance trends: 1999-2005

Penicillin

In 2005, 29 countries reported AST results of invasive *S. pneumoniae* isolates to EARSS (n=10,741). Large differences in PNSP were reported between the countries, varying between 1% in the Netherlands (n=802), 36% in France (n=632) and 39% in Romania (n=18) (Figure 4.1, Annex 3.1). No consistent trends were observed over time. Several countries reported a significant increase like Sweden (from 1.5% in 1999 to 3.6% in 2005), Iceland (from 2.1% in 1999 to 8.11% in 2005) and Bulgaria (from 8% in 2002 to 32.6% in 2005) whereas Spain (from 32.5% in 1999 to 25.6% in 2005), Ireland (from 19.5% in 2000 to 11.1% in 2005), Belgium (from 13.5% in 1999 to 11.8% in 2005), and the UK (from 7.4% in 1999 to 3.9% in 2005) reported a decrease in the proportion of PNSP. In Belgium and the UK this decrease is mainly caused by a significant drop in full penicillin resistance (Figure 4.4).

Erythromycin

In 2005, the majority of countries reported between 10% and 25% of erythromycin resistance. Only Estonia, Czech Republic, Sweden, Denmark and Bulgaria still reported resistance levels below 10% (Figure 4.2, Annex 3.1). Until 2000, The Netherlands, Austria, Norway, Germany, Finland also reported levels below 10%, but in these countries proportions have increased significantly in the last five years (NL 11%, AT 15%, NO 16%, DE 17% and FI 20%, Figure 4.5). Only in the UK erythromycin resistance seems to decrease.

Dual resistance to penicillin and erythromycin

Dual resistance still remained below 5% for most of the countries, but has reached high levels in France (32%, n=632) and Romania (31%, n=31%) (Figure 4.3). On the positive side, the UK reported a significant drop from 3.3% in 1999 to 1.2% in 2005. Finland where erythromycin resistance had steadily increased over the entire EARSS surveillance period, dual resistance also went up from 1.4% in 1999 to 4.9% in 2005 (Figure 4.6). For most of the remaining countries no significant changes in dual resistance were observed.

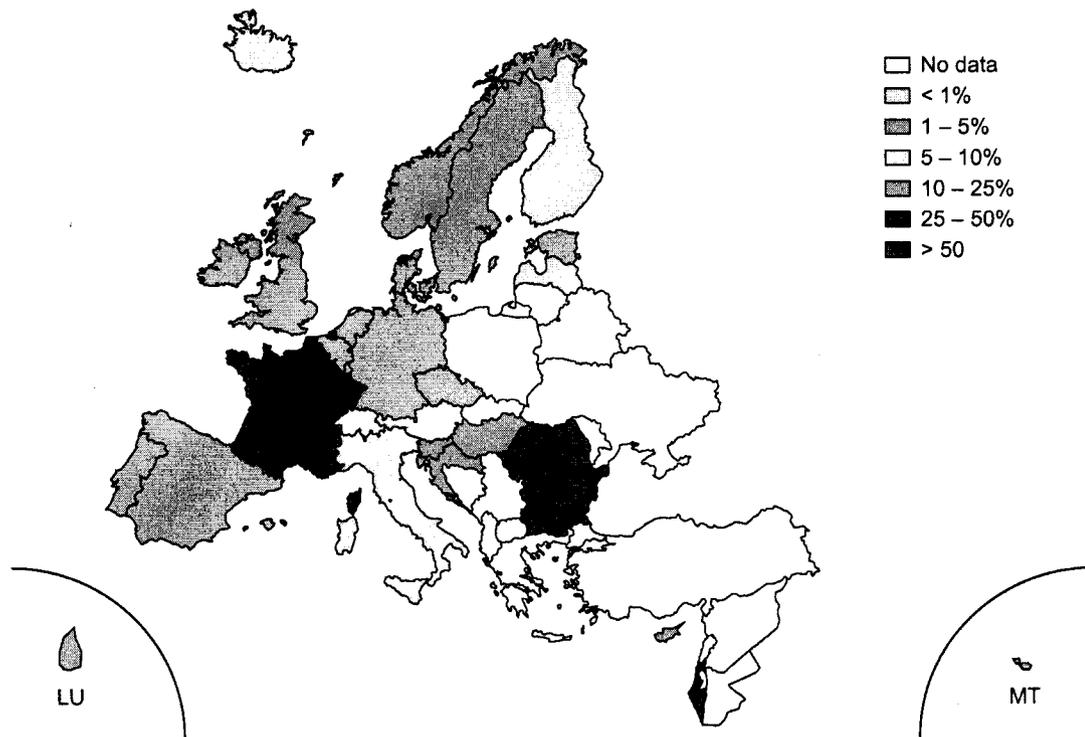


Figure 4.1. *Streptococcus pneumoniae*: proportion of invasive isolates non-susceptible to penicillin (PNSP) in 2005.

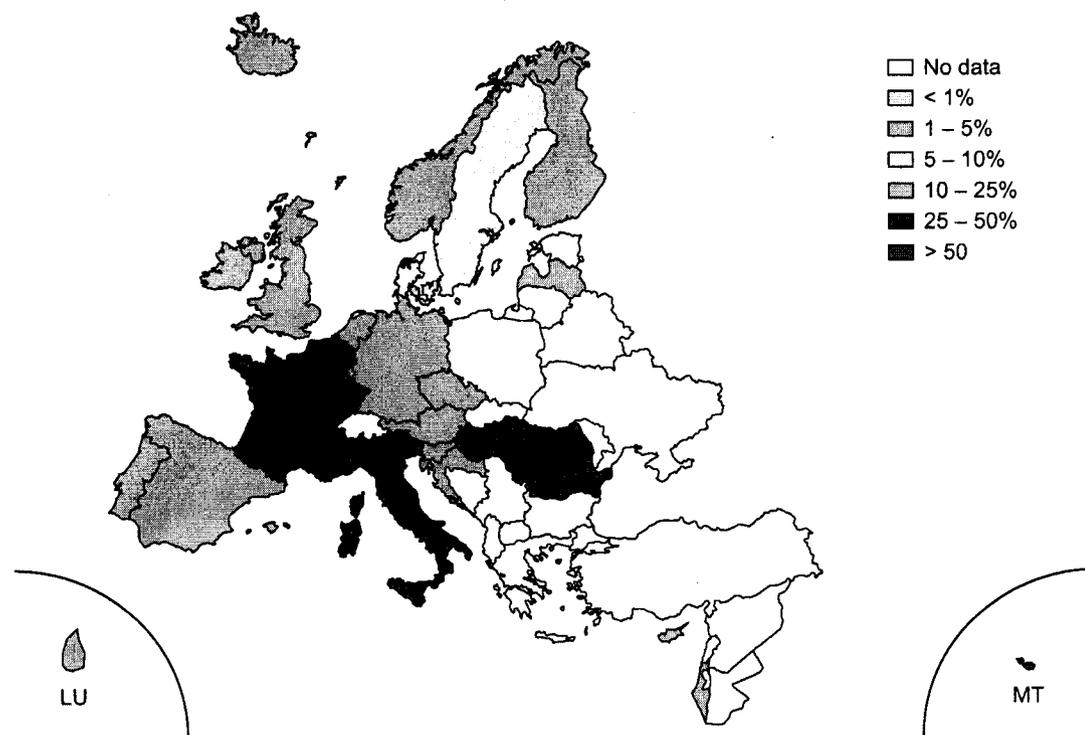


Figure 4.2. *Streptococcus pneumoniae*: proportion of invasive isolates resistant to erythromycin (ENSP) in 2005.

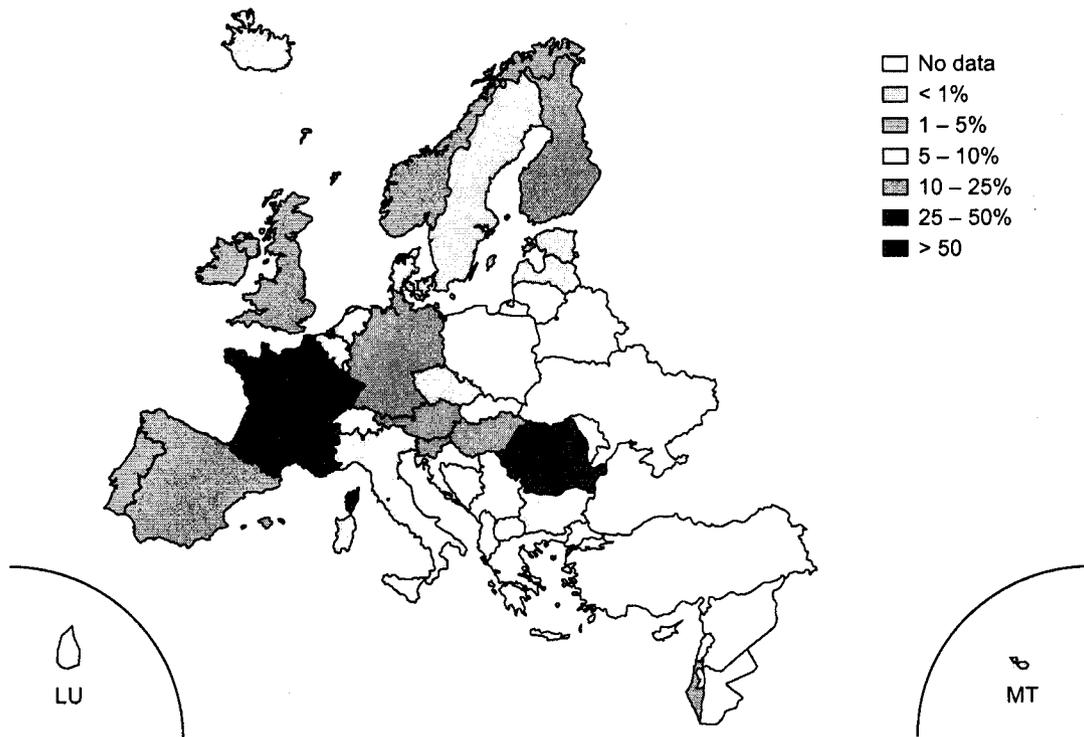


Figure 4.3. *Streptococcus pneumoniae*: proportion of invasive isolates with dual resistance to erythromycin and penicillin in 2005.

4.2.3. Serotypes

Since 2004 serogroup/serotype information is collected by EARSS. In 2005, serotype information was provided by 8 countries (Austria, Belgium, Bulgaria, Czech republic, Denmark, Iceland, Slovenia and the United Kingdom). The data are presented in table 4.1. Austria and Bulgaria could only provide serotype information for a small number of isolates and are therefore not presented in the table. The distribution of serotypes as well as the resistance within serogroups varies between countries. The relative high proportion of erythromycin resistance in serogroup 1 in Belgium (21%) was not seen in any other country and may indicate the dissemination of a single clone.

Figure 4.6a illustrates the distribution of serogroups for all isolates reported in 2005. The illustration may, however, not reflect the true serogroup distribution in Europe as a whole, as Belgium, Denmark and the UK reported more than 1000 isolates and may cause some distortion due to over-representation. However, some salient features become visible; penicillin resistance is confined to only five serogroups (14, 9, 19, 6 and 23) and entirely absent from the most frequent serogroup, serogroup 1. Erythromycin resistance is especially high in serogroup 14, and moderately high in 9, 19, 6 and 33. Importantly, all serogroups that comprise resistant isolates are included in the 7-valent conjugate vaccine, with as exception the relatively rare serotype 33. It can be therefore expected that the introduction of this vaccine into the officially recommended childhood vaccination programs in many European countries will have a sizeable impact on the control of antimicrobial resistance in *S. pneumoniae*.

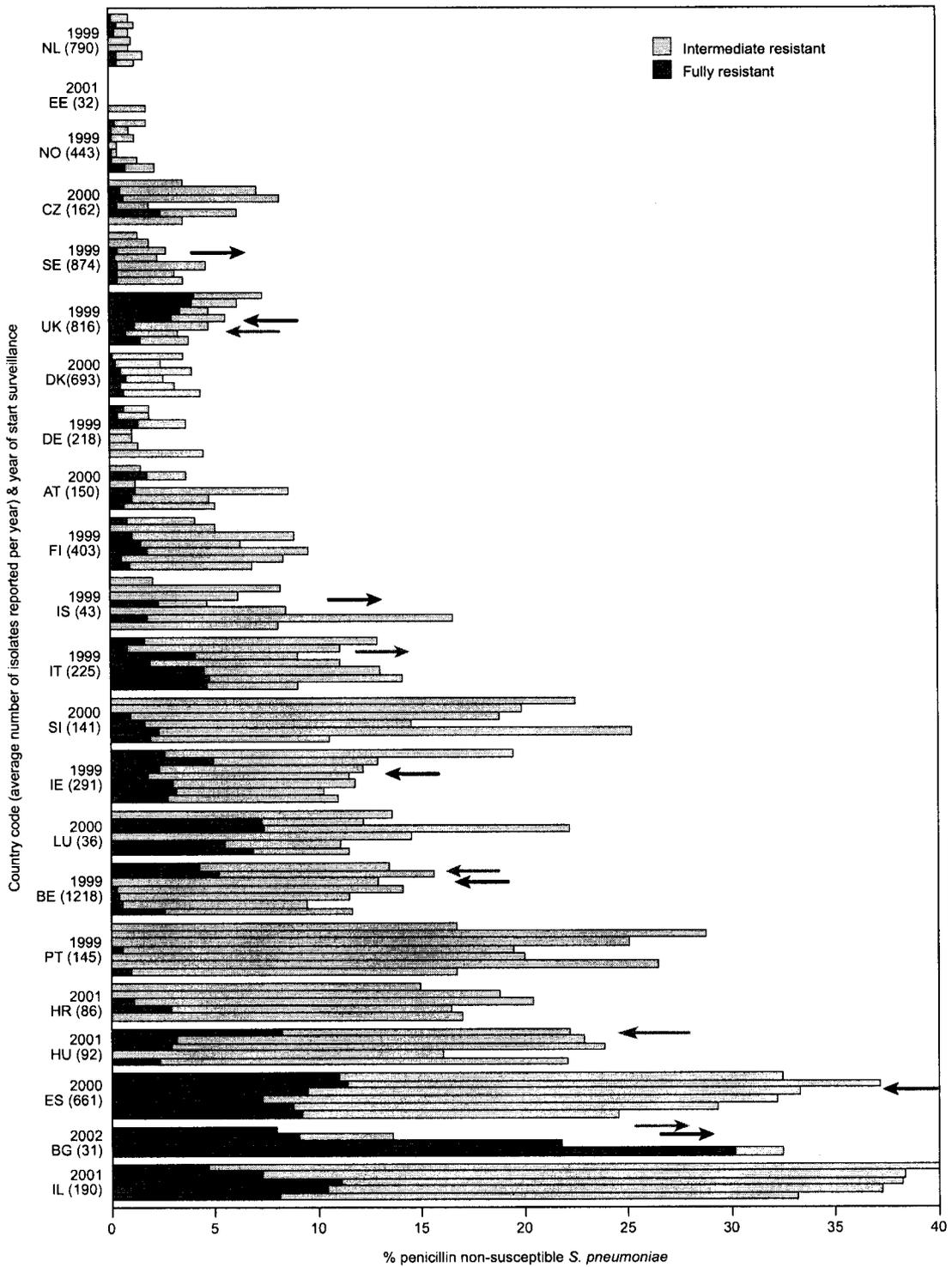


Figure 4.4. *Streptococcus pneumoniae*: trends of penicillin non-susceptibility by country, 1999-2005. Only the countries that reported 20 or more isolates per year for at least 3 years were included. The arrows indicate the significant trends observed for the proportion of PNSP (black arrows) or only full penicillin resistance (red arrows).

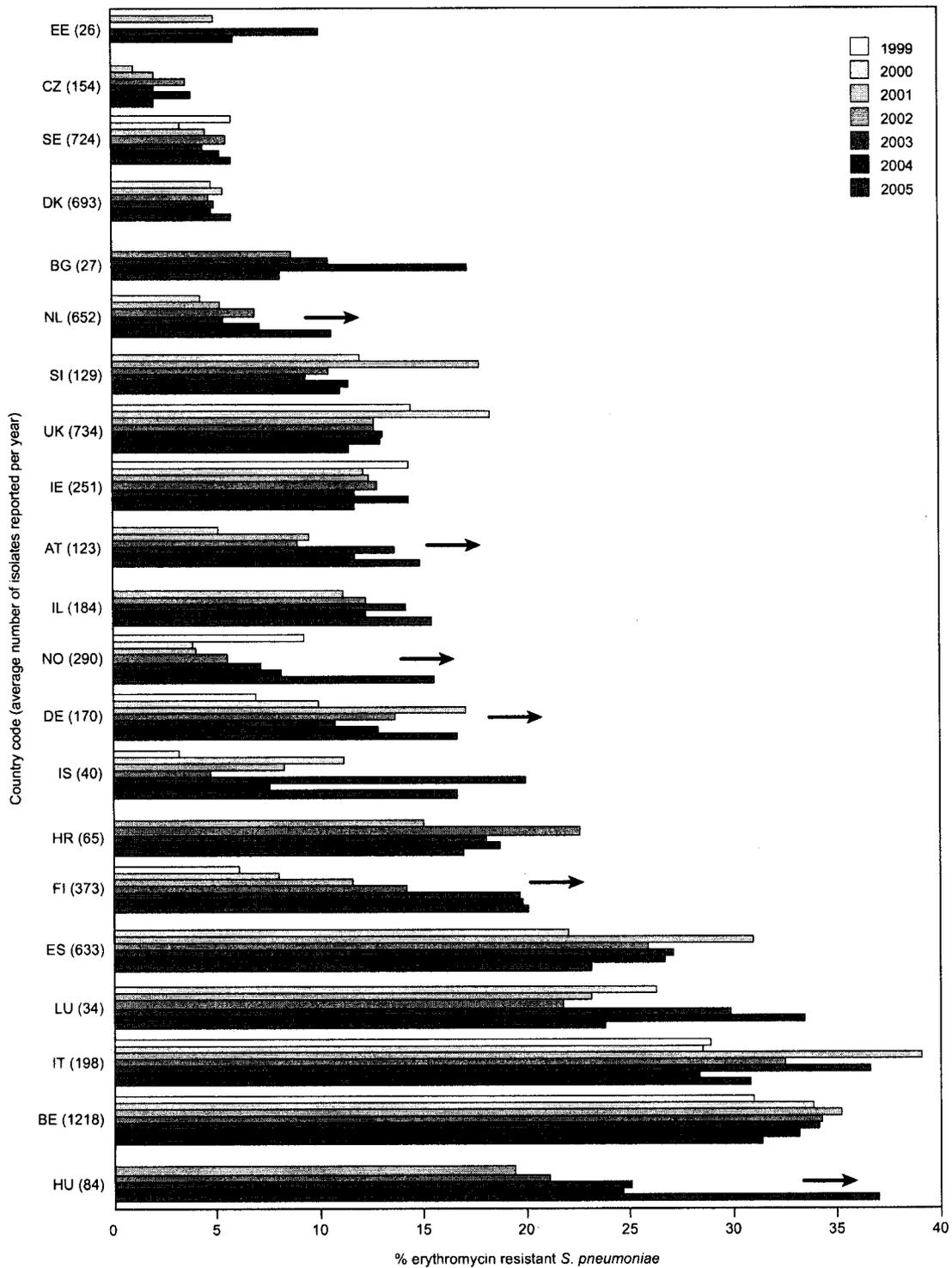


Figure 4.5. *Streptococcus pneumoniae*: trends of erythromycin resistance by country, 1999-2005. Only the countries that reported 20 or more isolates per year for at least 3 years were included. The arrows indicate statistically significant trends.

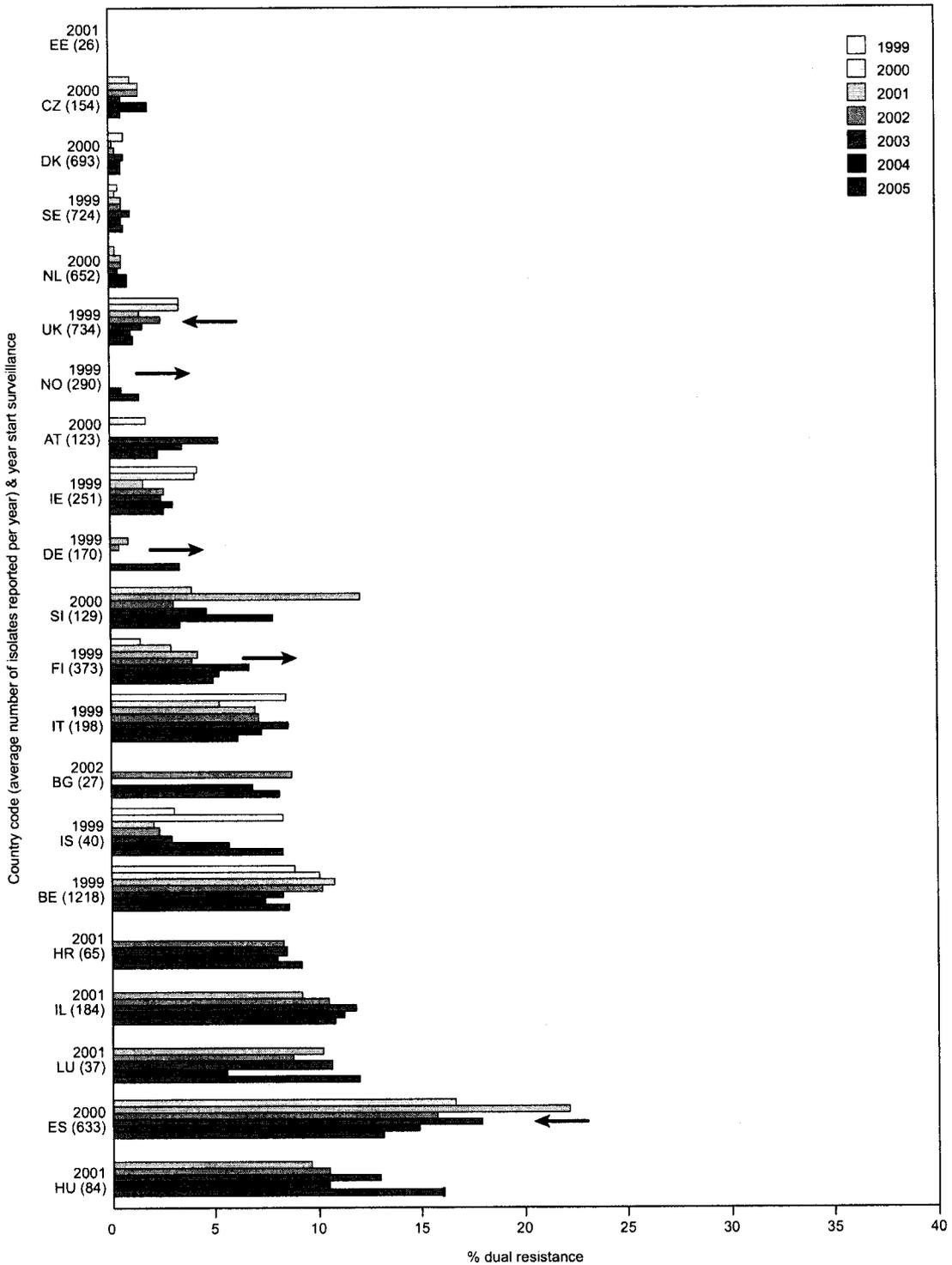


Figure 4.6. *Streptococcus pneumoniae*: trends of dual resistance to penicillin (intermediate and resistant) and erythromycin by country, 1999-2005. Only the countries that reported 20 or more isolates per year for at least 3 years were included. The arrows indicate statistically significant trends.

Table 4.1. Distribution of single penicillin (pnsp), single erythromycin (ensp) and dual penicillin-erythromycin resistance (dual) among the most common *S. pneumoniae* serogroups reported to EARSS per country in 2005. Only countries reporting serogroup information for more than 30 isolates were presented.

Serogroups	Belgium (n=1536)				Czech Republic (n=180)				Denmark (n=1081)				Iceland (n=35)				Slovenia (n=207)				United Kingdom (n=1182)			
	% of total	% PNSP	% ENSP	% dual	% of total	% PNSP	% ENSP	% dual	% of total	% PNSP	% ENSP	% dual	% of total	% PNSP	% ENSP	% dual	% of total	% PNSP	% ENSP	% dual	% of total	% PNSP	% ENSP	% dual
1	14	0	21	0	3	0	0	0	na	1	0	99	6	0	0	0	15	0	0	0	13	0	0	0
3	6	0	0	0	15	0	0	0	na	0	0	100	6	0	0	0	22	0	0	0	5	0	0	0
4	5	1	1	0	9	0	0	0	na	1	0	99	11	0	0	0	11	0	0	0	7	0	2	0
5	4	0	1	0	1	0	0	0	na	0	0	100	0	-	-	-	0	-	-	-	0	0	0	0
6	8	5	53	6	9	0	6	0	na	3	4	89	6	0	0	0	5	11	11	11	8	4	5	1
7	6	0	1	1	4	0	0	0	na	0	0	97	9	0	0	0	8	0	0	0	4	2	2	0
8	4	0	1	0	6	0	0	0	na	0	0	100	0	-	-	-	1	0	0	0	8	1	1	0
9	8	5	45	7	8	20	0	0	na	1	1	88	3	0	0	0	10	25	15	0	9	16	7	3
11	1	0	19	5	0	-	-	-	na	14	7	79	3	0	0	0	0	-	-	-	1	0	6	0
12	1	0	0	0	0	-	-	-	na	2	0	98	0	-	-	-	2	0	0	0	2	0	0	0
14	13	8	39	41	11	5	5	5	na	42	0	51	23	0	38	13	16	16	29	13	15	1	58	1
15	2	13	25	4	1	0	0	0	na	10	0	60	0	-	-	-	0	-	-	-	1	0	0	0
18	3	0	2	0	7	0	0	0	na	0	0	100	6	0	0	0	2	0	0	0	2	0	0	0
19	9	8	52	11	9	0	0	0	na	0	2	86	14	0	0	40	4	29	14	29	9	2	8	3
20	0	0	0	0	1	0	0	0	na	0	0	100	0	-	-	-	1	0	0	0	2	0	0	0
22	3	0	0	0	1	0	0	0	na	0	0	100	3	0	0	0	1	0	0	0	3	0	0	0
23	8	4	8	11	6	10	0	0	na	0	0	98	11	0	0	0	4	29	0	0	7	4	0	1
33	1	0	76	0	0	-	-	-	na	11	0	84	0	-	-	-	1	0	100	0	1	0	0	0
other	5	1	3	4	22	3	0	0	na	2	0	90	0	-	-	-	0	-	-	-	4	2	0	0
total	100	3	23	9	100	3	1	1	na	5	1	90	100	0	9	9	100	8	8	4	100	3	11	1

na: not available

4.2.4. Conclusions

The proportion PNSP keeps changing in the European region. It appears that in countries that reported high endemic prevalence in the previous years the situation improves. The reduction of full penicillin resistance may be the result of fitness trade-offs, in absence of extreme selection pressures. More unambiguous was the increase of erythromycin resistance observed in several countries. In contrast to this widespread observation, in the UK, Belgium and Hungary this trend has been reversed and a consistent decrease of *S. pneumoniae* resistant to erythromycin could be observed. The distribution of serogroups/serotypes reported to EARSS indicate that resistance is mainly confined to few serogroups, all of which are part of the currently available conjugate vaccines. Vaccination, especially in young children may represent an effective additional means of controlling antibiotic resistance in pneumococcal disease in Europe. Up to now, universal infant PCV immunization policy has been implemented in Luxembourg and will be introduced in Norway, the UK and the Netherlands in the course of 2006 with many countries following suit (6). To monitor the effect of these interventions, surveillance of the serotype distribution becomes even more urgent.

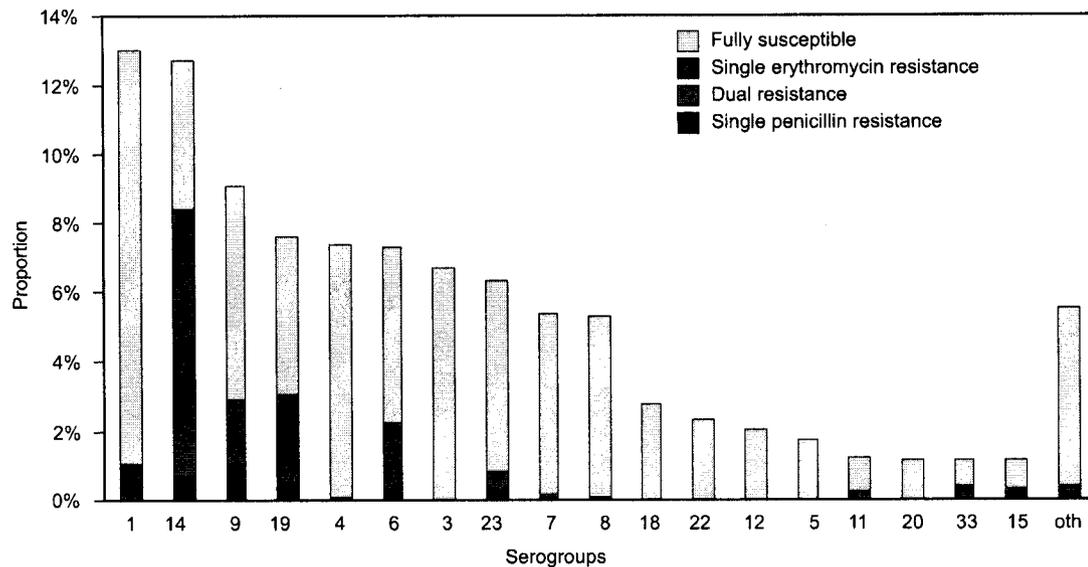


Figure 4.6a. The distribution of serogroups and the resistance profile (single penicillin, single erythromycin and dual penicillin-erythromycin resistance) per serogroup of *S. pneumoniae* isolates in the EARSS database, in 2005. Only countries that reported serogroup information for more than 30 isolates (Belgium, Czech Republic, Denmark, Iceland, Slovenia and the United Kingdom) were included in this figure. * Susceptible at least to penicillin & erythromycin.

4.3. *Staphylococcus aureus*

4.3.1. Clinical and epidemiological importance

Staphylococcus aureus is a gram-positive bacterium that colonizes the skin of about 30% of healthy humans. Although mainly a harmless coloniser, *S. aureus* can cause severe infection. Its oxacillin-resistant form (methicillin-resistant *S. aureus*, MRSA) is the most important cause of antibiotic-resistant health care-associated infections worldwide (28). Since health care-associated MRSA infections add to the number of infections caused by methicillin-susceptible *S. aureus*, a high incidence of MRSA adds to the overall burden of infections caused by this species in hospitals (21). Moreover, infections with MRSA may result in prolonged hospital stay and in higher mortality rates (8), owing mainly to the increased toxicity and limited effectiveness of alternative treatment regimens. MRSA is currently the most commonly identified antibiotic-resistant pathogen in hospitals in many parts of the world, including Europe, the Americas, North Africa and the Middle- and Far-East.

Resistance mechanisms. Beta-lactam antibiotics. *S. aureus* acquires resistance to methicillin and all other beta-lactam antibiotics through expression of the exogenous *mecA* gene, that codes for a variant penicillin binding protein PBP2' (PBP2a) with low affinity to beta-lactams, (22), thus preventing the drug induced inhibition of cell wall synthesis. The level of methicillin resistance (defined by its minimum inhibitory concentration, MIC) depends on the amount of PBP2' production, which is influenced by various genetic factors. Resistance levels of *mecA*-positive strains can thus range from phenotypically susceptible to highly resistant (5). Upon challenge with methicillin, a population of a heterogeneously resistant MRSA strain may quickly be outgrown by a subpopulation of highly resistant variants.

Glycopeptide antibiotics include vancomycin and teicoplanin. Both are very large molecules that through binding to the terminal amino acid residues (D-alanyl-D-alanine) of the peptide side chains in the growing peptidoglycan polymers inhibit the cross linking essential for cell wall stability. It is

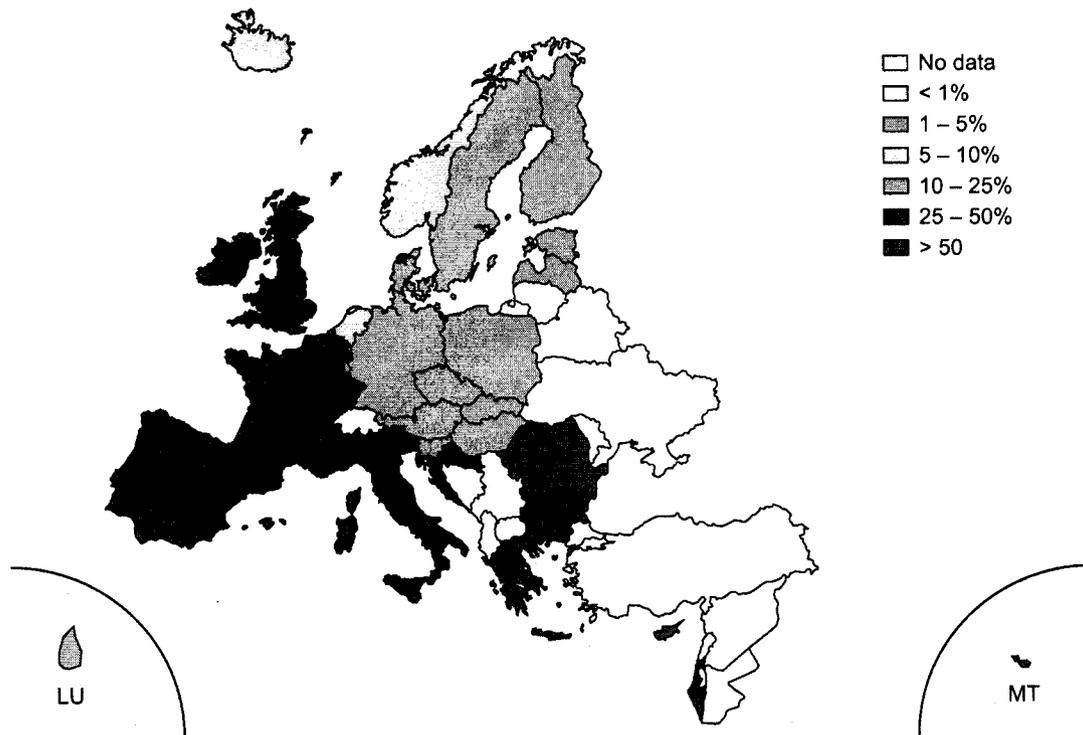


Figure 4.7. *Staphylococcus aureus*: proportion of invasive isolates resistant to oxacillin (MRSA) in 2005.

estimated that to block cell wall synthesis effectively, the glycopeptide antibiotic has to penetrate about 20 peptidoglycan layers, all with free D-alanyl-D-alanine targets, without being 'trapped', and this together with a poor penetration into infected tissues, limits the therapeutic effects of glycopeptides. Cell wall thickening of *S. aureus* thus increases its ability to resist vancomycin, and in *S. aureus* most strains with reduced vancomycin susceptibility have a markedly thicker cell wall (22). Vancomycin resistance is far more prevalent among enterococci, owing to different genetic resistance determinants.

4.3.2. *Staphylococcus aureus* resistance trends: 1999-2005

Beta-lactams

Of the 30 countries reporting AST results of invasive *S. aureus* isolates to EARSS in 2005 (n=27,095), 7 reported MRSA proportions below 3%. The prevalence in these, mainly northern countries, Iceland, Norway, Sweden and Estonia, remained relatively stable over time with MRSA proportions of 0%, 1%, 1% and 2% in 2005 respectively (Figure 4.8, Annex 3.2). However, a significant increase was observed for the Netherlands (from 0.34% to 0.93%), Denmark (from 0.28% to 1.70%) and Finland (0.95% to 2.91%) since 1999 (Figure 4.8).

Four countries, namely the Czech Republic, Slovakia, Hungary and Germany, which still reported less than 10% MRSA until 2001, saw in the last four years MRSA rates soaring (CZ 13%, SK 19%, HU 19% and DE 21% in 2005, Figure 4.8). By and large, central European countries reported resistance proportions below 25%, whereas all Southern countries reported higher levels of which eight had MRSA proportions over 40% (Figure 4.7, Annex 3.2). However, optimistic trends appear to be

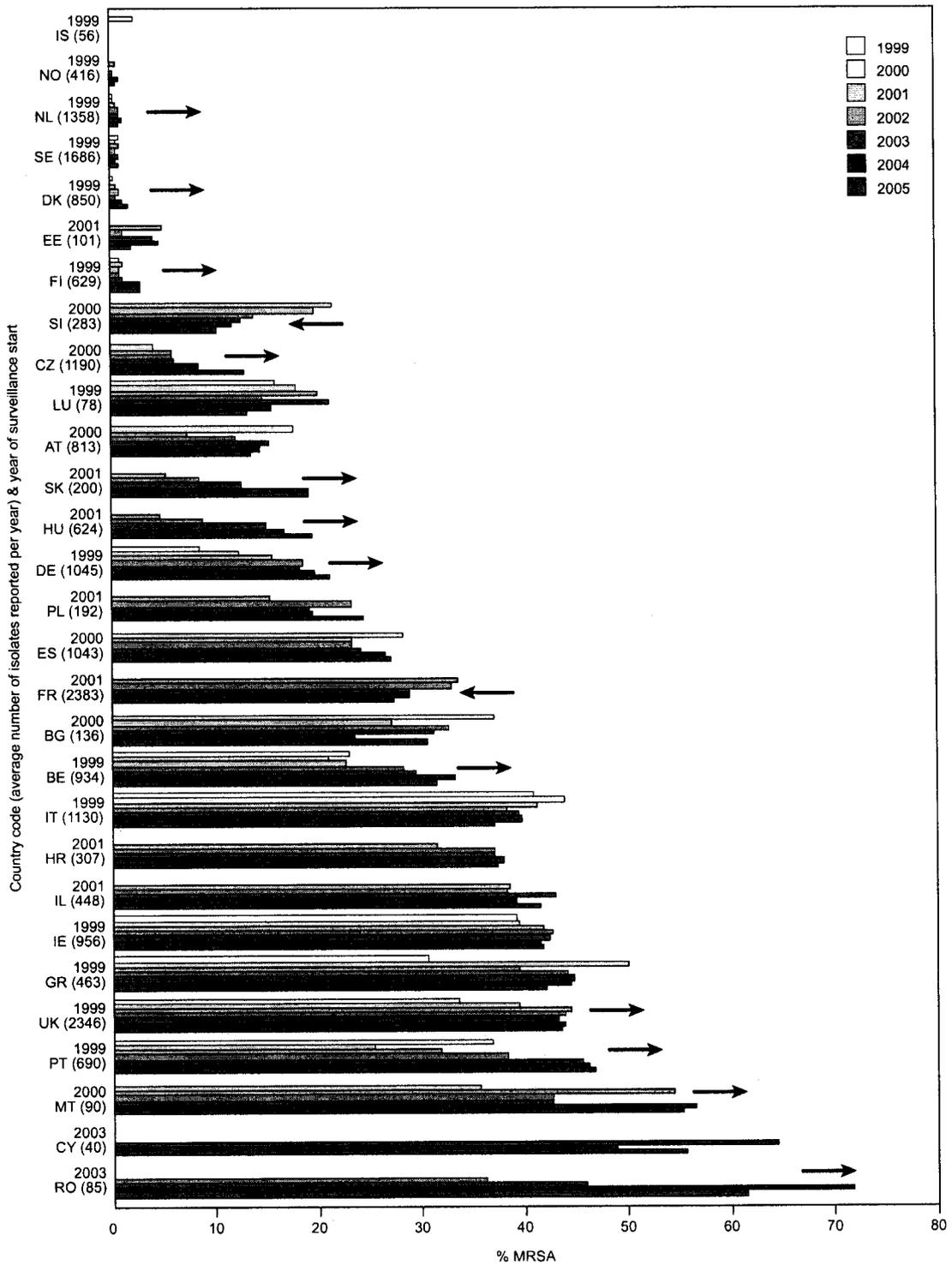


Figure 4.8. *Staphylococcus aureus*: trends of methicillin-resistance by country 1999-2005. Only the countries that reported 20 isolates or more per year for at least 3 years were included. The arrows indicate significant trends.

emerging as well. Two countries, Slovenia and France, show a consistent decrease over the past five to six years (SI from 21% in 1999 to 10% in 2005 and FR from 33% in 2001 to 27% in 2005, Figure 4.8). These improvements support the notion that MRSA is not an irreversible development but may be dealt with by appropriate long term control efforts. An apparent decrease in Italy is explained by consecutive changes among the enrolled laboratories during the last five years and unfortunately does not reflect a true trend.

4.3.3. MRSA by hospital department

It is well known that MRSA strains are more frequently isolated from ICU patients than non-ICU patients. This is supported by the EARSS database: for the majority of countries, the proportion MRSA was higher among ICU patients, except for most low-endemic countries. In some countries like Poland, Bulgaria, Croatia, Greece, the UK, Cyprus and Romania the proportion of MRSA found among ICU patients was over 60%. Although potentially due to selective sampling, the figures remain concerning, as it seems that ICU infection control procedures should be improved. As an exception Finland reported a relative low number of MRSA, but had a disproportionate high MRSA rate among ICU patients. At the same time, MRSA proportions significantly increased during the last two years. This observation could be consistent with outbreaks limited to ICU facilities in this country.

France, Israel, Ireland, Portugal and Malta also reported very similar MRSA proportions for ICU patients and patients from the other departments. This homogeneity may indicate similar exposure profiles such as high utilisation rates of intravascular devices in non-ICU patients.

As illustrated in figure 4.9, average MRSA proportion per country were by and large independent of the relative proportion of MRSA among the subgroups (ICU vs. non-ICU patients), mainly because the numbers of ICU isolates were much smaller.

4.3.4. Conclusions

Within the last seven years no less than twelve countries reported a significant increase in the proportion of MRSA. This trend was largely consistent throughout Europe and included low, medium as well as high endemic countries. At the same time it appears that this is not part of an irreversible secular trend as two European countries (Slovenia and France) succeeded in constantly reducing the proportion of MRSA among *Staphylococcus aureus* blood stream infections over the past five or six years.

4.4. Enterococci

4.4.1. Clinical and epidemiological importance

Enterococci belong to the residential flora of the gastrointestinal tract of humans, other mammals, birds and reptiles. Under normal circumstances they are harmless commensals, and are even believed to have positive effects on a number of gastrointestinal and systemic conditions (4;14;33). However, when the commensal relationship with the host is disrupted, enterococci can cause invasive disease (27). Though not as virulent as other gram-positive organisms, enterococci can cause a variety of clinical syndromes including endocarditis, bacteremia, meningitis, wound and urinary tract infections and are associated with peritonitis and intra-abdominal abscesses. In the USA, three to four nosocomial bloodstream infections per 10,000 hospital discharges are caused by enterococci (3), and contribute to patient mortality as well as additional hospital stay (30).

The vast majority of clinical enterococcal infections in humans are caused by *Enterococcus faecalis* in around 80% of clinical isolates and *Enterococcus faecium* in most of the remainder (23). Epide-

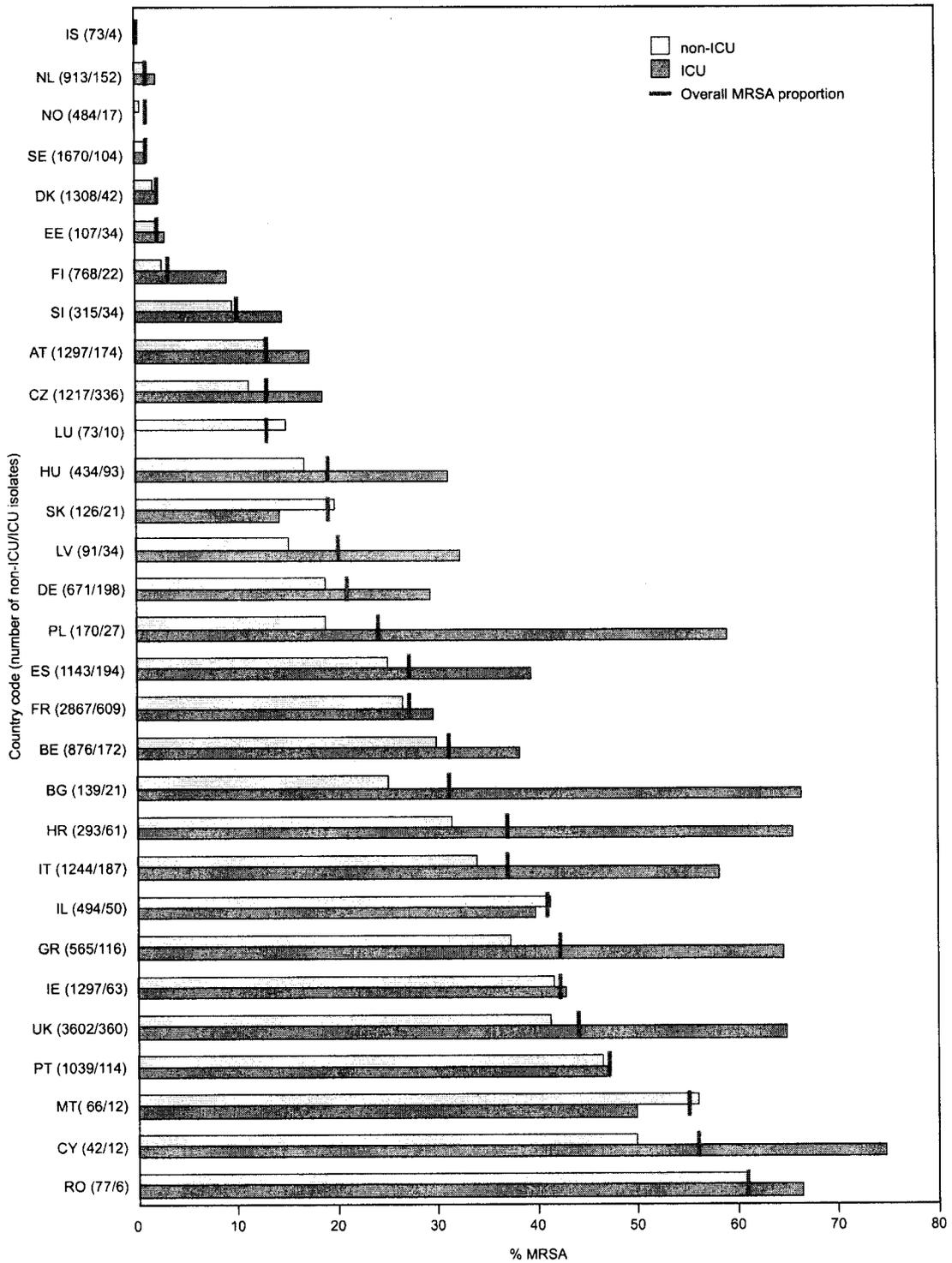


Figure 4.9. *Staphylococcus aureus*: proportion MRSA in ICU versus other hospital departments and the overall MRSA proportion, by country in 2005. Between brackets the number of isolates from non-ICU/ICU departments.

miological data collected over the last two decades have documented the emergence of enterococci, and in particular *E. faecium*, as important nosocomial pathogens, which is seen as the expansion of a major hospital adapted clonal complex (CC17) (47). The emergence of *E. faecalis* and *E. faecium* was paralleled by the increase glycopeptide and high-level aminoglycoside resistance both including important compounds for the treatment of human infections (43). Besides the fact that infections with these resistant enterococci are difficult to treat, Enterococci are highly tenacious and thus disseminate and spread between patients in the hospital setting easily.

Resistance mechanisms. Enterococci are intrinsically resistant to a broad range of antibiotics including cephalosporins, penicillinase-fast penicillins, sulphonamides and low concentrations of aminoglycosides (16). Patient safety in hospitals is challenged by the ability of enterococci to acquire additional resistance through transfer of plasmids and transposons, recombination, or mutation (34).

Beta-lactam antibiotics. By nature, enterococci have a low susceptibility to beta-lactam antibiotics – a consequence of intrinsically low-affinity PBPs. Complete penicillin resistance in *E. faecalis* is currently absent, though two possible mechanisms have been reported; i) the production of beta-lactamase (35) and ii) the overproduction and modification of penicillin-binding proteins (PBPs, particularly PBP5) (13).

Aminoglycosides. In addition to the intrinsic mechanism of low-level resistance, reducing the ability of the enterococcal uptake of the drug, enterococci have acquired genes conferring high level resistance to aminoglycosides (43). High-level resistance to streptomycin can be mediated by single mutations within a protein of the 30S ribosomal subunit, the target of aminoglycoside activity (7). In addition, different aminoglycoside-modifying enzymes have been identified, targeting 8 different aminoglycosides (7).

Glycopeptides. Vancomycin-resistance in enterococci was first encountered in France and England but showed the most dramatic increase in the United States and was attributed to the widespread use of vancomycin in US hospitals (9). Whereas vancomycin consumption was less pronounced in Europe, another glycopeptide, avoparcin, has been widely utilized in the farming community as growth promoter in animal husbandry from the late-1970s until it was banned in 1998. Glycopeptide resistance is due to the synthesis of modified cell wall precursors that show a decreased affinity for glycopeptides (31). Five phenotypes have been identified of which three have clinical relevance; i) VanA with high-level resistance to both vancomycin and teicoplanin, ii) VanB with a variable level of resistance to only vancomycin, iii) VanC with intrinsic low-level resistance to vancomycin and teicoplanin, (2), (38). The VanA and VanB phenotypes, mostly found among *E. faecalis* and *E. faecium*, may be transferred by plasmids and conjugative transposition.

4.4.2. *Enterococcus faecalis* resistance trends: 2001-2005

High-level aminoglycosides

In 2005, 26 countries reported AST results for invasive *E. faecalis* isolates (n= 5,216). Only two countries reported less than 20 isolates, namely Luxembourg (n=17) and Romania (n=4) (Annex 3.3). The proportion of high level aminoglycoside resistance varied between none in Iceland (n=20) and 54% in Greece (n=448). Figure 4.10 shows that apart from Iceland, only three other countries: France (15%, n=767), Sweden (19%, n=492) and Bulgaria; (24%, n=55) reported resistance below 25%, whereas the majority were between 25% and 50% (Figure 4.10, Annex 3.3).

During the EARSS surveillance period, this situation did not change substantially. Since 2001, a significant increase was only observed in the Netherlands (from 28% to 38%), Czech Republic (from

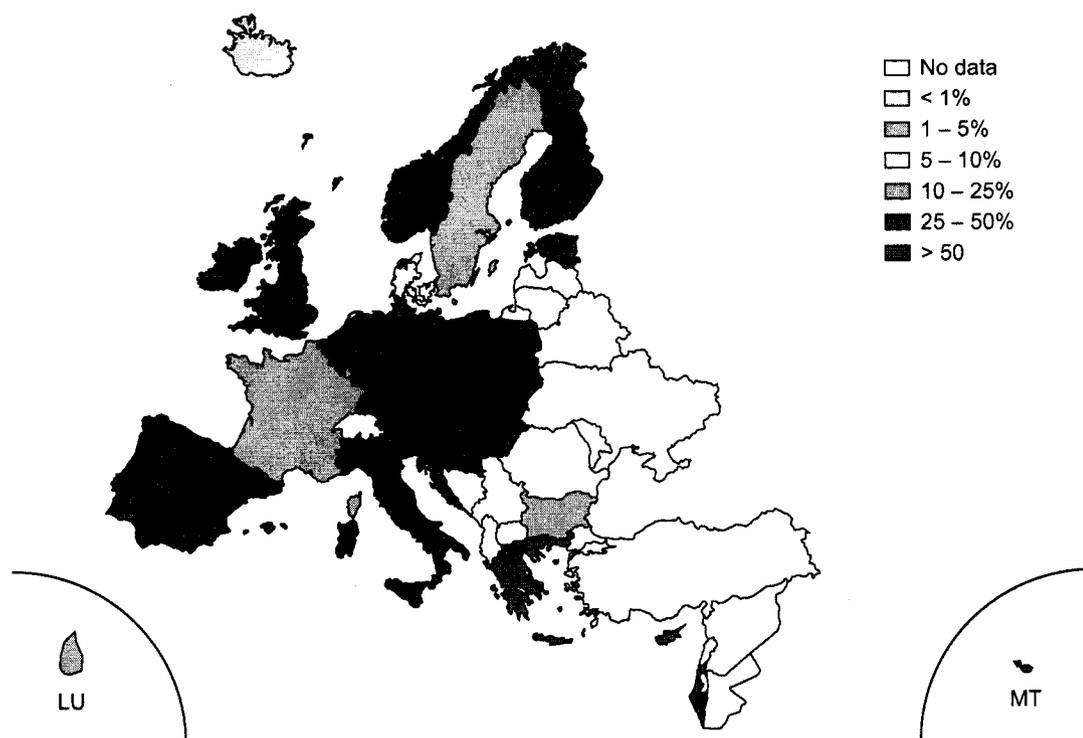


Figure 4.10. *Enterococcus faecalis*: proportion of invasive isolates with high-level resistance to aminoglycosides in 2005.

38% to 45%) and Estonia (from 22% in 2003 to 50% in 2005) and a decrease was only reported in Hungary (from 87% in 2003 to 40% in 2005) (Figure 4.11). In the Netherlands this increase was not observed for the subgroup of laboratories that reported data for all years.

4.4.3. *Enterococcus faecium* resistance trends: 2001-2005

Vancomycin

In general, the number of AST results reported for invasive *E. faecium* isolates is low (n=2,855). As a result, four of the 26 countries reported less than 20 isolates in 2005 (Iceland; n=9, Luxembourg; n=14, Romania; n=10, and Slovakia; n=3). In half of the countries that reported more than 20 isolates, vancomycin resistance was less or equal to 1% or even absent in 8 countries. This contrasts to 5 countries which reported more than 25% of VREF in 2005, which were Greece (37%; n=227), Ireland (31%; n=220), Israel (46%; n=71), Portugal (34%; n=95) and the UK (33%, n=224) (Figure 4.12, Annex 3.3).

Over the past 4 years, vancomycin resistance increased significantly in 5 countries (Germany, Czech Republic, Ireland, Greece and Israel) (Figure 4.13). The rapid expansion of *E. faecium* in these countries is typically the result of institutional outbreaks. It does thus not represent the situation for hospitals that have remained unaffected. Indeed in the Czech Republic and Israel most VREF originated from one institution.

The high proportion of VREF in Portugal showed a significant decrease from the high level reported in 2003. However from a single laboratory, high proportions of VREF were persistently reported ever since, in 2003 (67%, n=54), 2004 (76%, n=43) and 2005 (67%, n=37). As the number of isolates reported to the EARSS central database from this laboratory decreased, the overall proportion

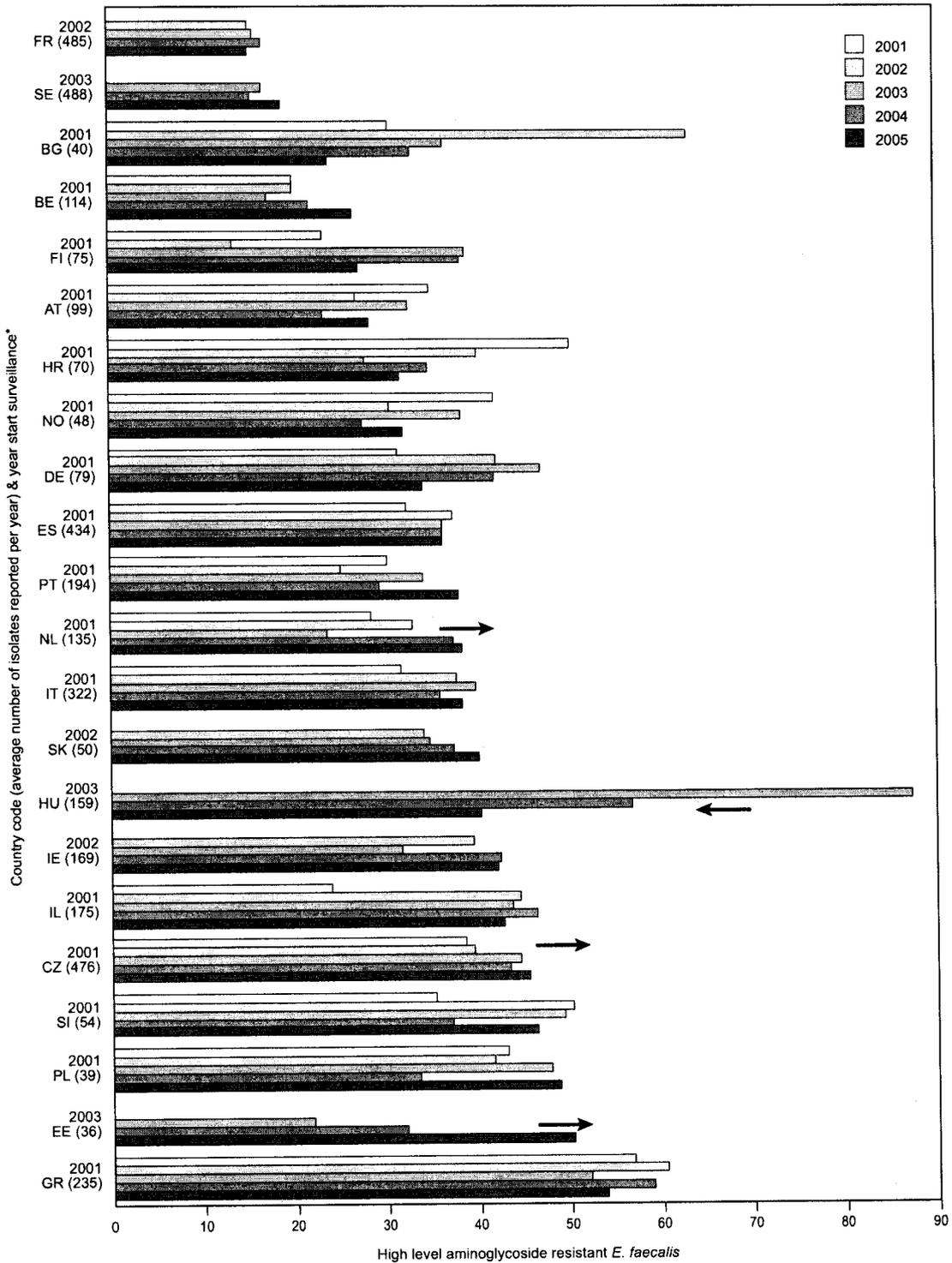


Figure 4.11. *Enterococcus faecalis*: trends of high-level aminoglycoside resistance by country 2001-2005. Only the countries that reported 20 isolates or more per year for at least 3 years were included.

* Either the first year of surveillance or the first year with 20 or more isolates reported.

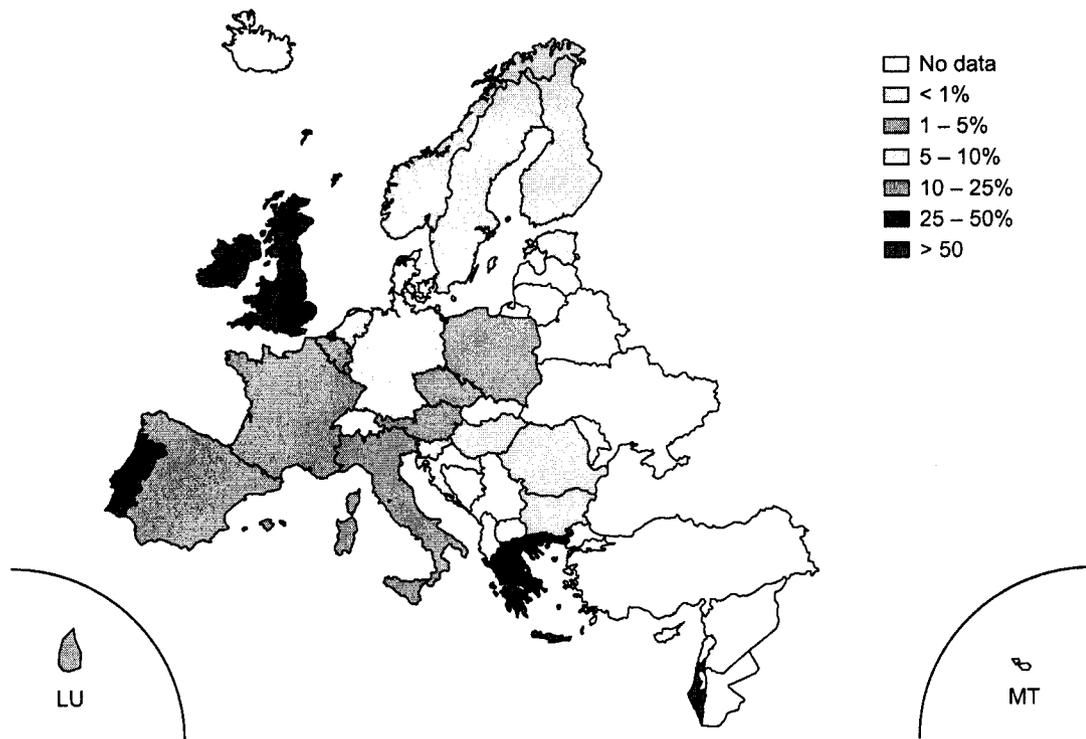


Figure 4.12. *Enterococcus faecium*: proportion of invasive isolates resistant to vancomycin in 2005.

of VREF in Portugal decreased as well (Figure 4.13), which may explain the overall reduction of VREF in this country.

4.4.4. Conclusions

With the ongoing spread of CC 17 in Europe outbreaks of vancomycin resistant *E. faecium* continues to afflict more and more hospitals in various countries. The spread of these hospital-adapted strains occurs on the background of high-level aminoglycoside resistance. The control of glycopeptide resistant Enterococci remains a formidable task for hospital infection control practitioners and it is not difficult to predict that these problematic pathogens will continue to remain a challenge.

4.5. *Escherichia coli*

4.5.1. Clinical and epidemiological importance

Escherichia coli is the most frequent gram-negative rod isolated from blood cultures in clinical settings. It is the most frequent cause of community and hospital-acquired urinary tract infections, is associated with spontaneous and surgical peritonitis, causes synergistic wound infections and is one of the most important food-borne pathogens worldwide (10;12;40).

Resistance mechanisms. *Beta-lactamases* hydrolyse the beta-lactam ring of beta-lactam antibiotics, which is crucial for their inhibition of PBPs in bacteria. In *E. coli* resistance to broad-spectrum penicillins such as ampicillin or amoxicillin is conferred by plasmid coded beta-lactamases of the SHV and TEM type, whereby TEM-1 accounts for up to 60% of aminopenicillins resistance. In 1982

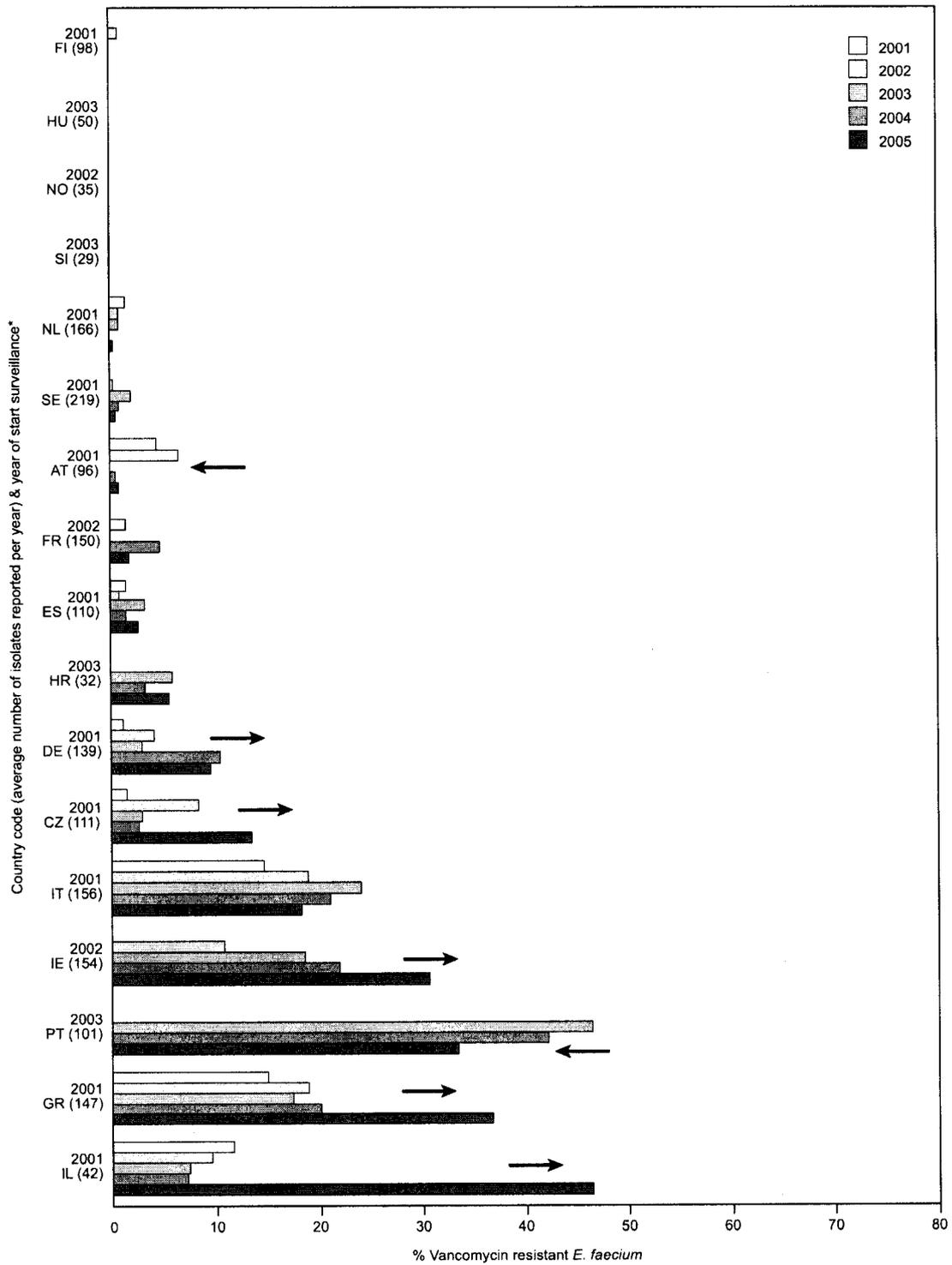


Figure 4.13. *Enterococcus faecium*: trends of vancomycin resistance by country 2001-2005. Only the countries that reported 20 isolates or more per year for at least 3 years were included. * Either the first year of surveillance or the first year with 20 or more isolates reported.

the first ESBL was identified during a hospital outbreak of *Klebsiella pneumoniae* in Germany. It was soon understood that single or multiple amino acid substitutions in the basic structure of SHV or TEM enzymes can alter their activity spectrum and enhance their hydrolyzing ability to include third generation cephalosporins and monobactams. Many ESBLs can be inhibited by beta-lactamase inhibitors such as clavulanic acid, sulbactam, or tazobactam. More than 200 ESBL variants are known to date. Most of them belong to three enzyme families TEM, SHV, and OXA (26). In *E. coli*, over 90% of ESBL resistance is mediated through TEM variants. Newly emerging ESBLs are CTX-M, and lately CMY-2, a plasmid encoded variant derived from the chromosomal AmpC locus (44).

Fluoroquinolones interact with DNA gyrase and topoisomerase IV which are enzymes that regulate conformational changes in bacterial DNA during replication and transcription. This leads to irreversible inhibition of DNA strand separation and eventually to cell death. Resistance to quinolones arises through stepwise mutations in the coding regions of the gyrase subunits (*gyrA* and *gyrB*) and DNA topoisomerase IV (*parC*). Accumulation of mutations in several of these genes increases the MIC in a stepwise manner. Low-level resistance to quinolones may also arise through changes in membrane porins or in genes regulating the activity of efflux pumps, resulting in lower membrane permeability and higher efflux of fluoroquinolones, respectively (20). In recent years, the plasmid-mediated QNR mechanism, protecting DNA from quinolone binding, is of concern because of its frequent association with CTX-M and CMY-type enzymes inactivating third generation cephalosporins(41).

Aminoglycosides block protein synthesis by binding to the ribosomes or by disruption of the outer membrane of gram-negative rods. Resistance to aminoglycosides is brought about by target modification of the large ribosomal subunit which excludes aminoglycoside molecules or by aminoglycoside modifying enzymes that acetylate, adenylate or phosphorylate their target molecules and thereby neutralize the biologic effect of aminoglycosides.

4.5.2. *Escherichia coli* resistance trends: 2001-2005

Aminopenicillins

Aminopenicillin resistance in *E. coli* is highly prevalent in Europe and this substance can no longer be regarded as a useful option for empirical treatment. Of the 29 countries reporting AST results of invasive *E. coli* isolates to EARSS (n=36,134), resistance proportions were above 30% in all countries (n=29) except for Sweden (26%). Still aminopenicillin resistance varies substantially between countries, from 26% in Sweden to 77% in Romania (Figure 4.17. Annex 3.4). It also varied substantially over time; from 2001 to 2005, aminopenicillin resistance increased significantly in 14 countries.

Third generation cephalosporins

Most countries (18 of 29) report less than 5% resistance against third generation cephalosporins in 2005. However this seemingly comfortable situation is no reason for complacency as resistance is rising in 23 of 28 countries with significant trends identified for 15. Moreover third generation cephalosporin resistance seems to take-off rather quickly even in countries with formerly very low resistance from levels around 1% in 2001 to around 3% in 2005, and it only seems a matter of time before more and more countries will report levels of more than 5% (Figure 4.14). Five countries already reported levels of 10% or more in 2005, namely Bulgaria (28%, n=203), Cyprus (16%, n=74), Portugal (12%, n=1076), and Romania (16%, n=80) (Figure 4.18). Unfortunately, the EARSS database does not receive sufficient information about the presence of ESBLs in the resistant strains to understand the detailed nature of this increasing problem.

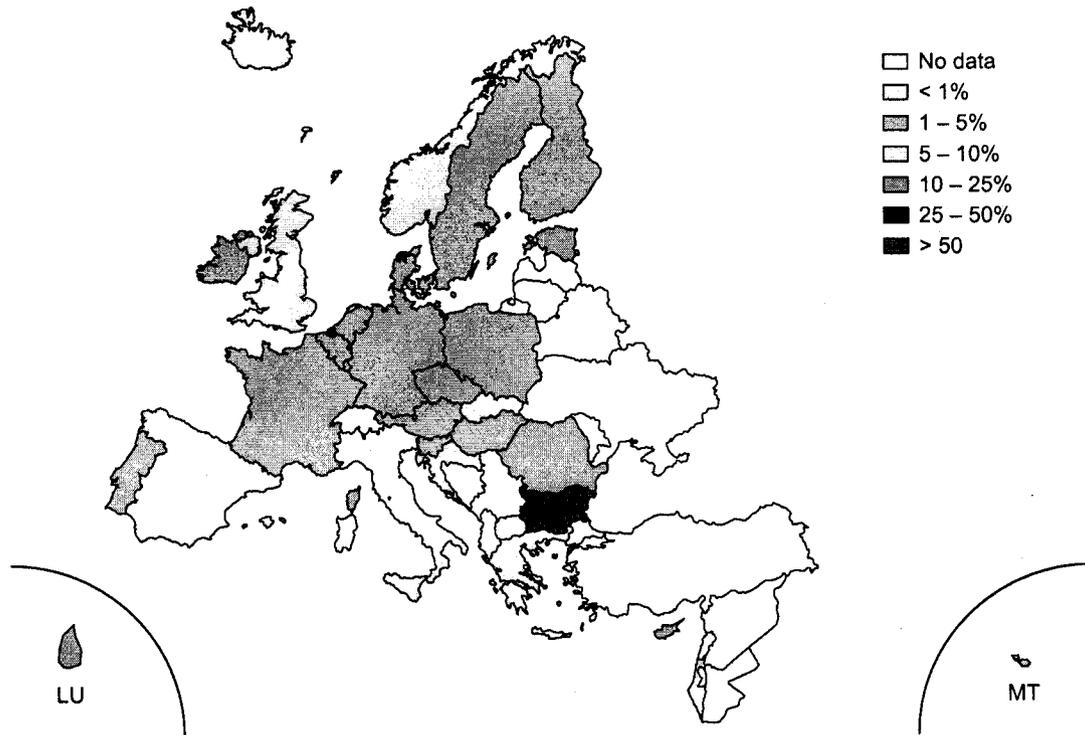


Figure 4.14. *Escherichia coli*: proportion of invasive isolates with resistance to third generation cephalosporins in 2005.

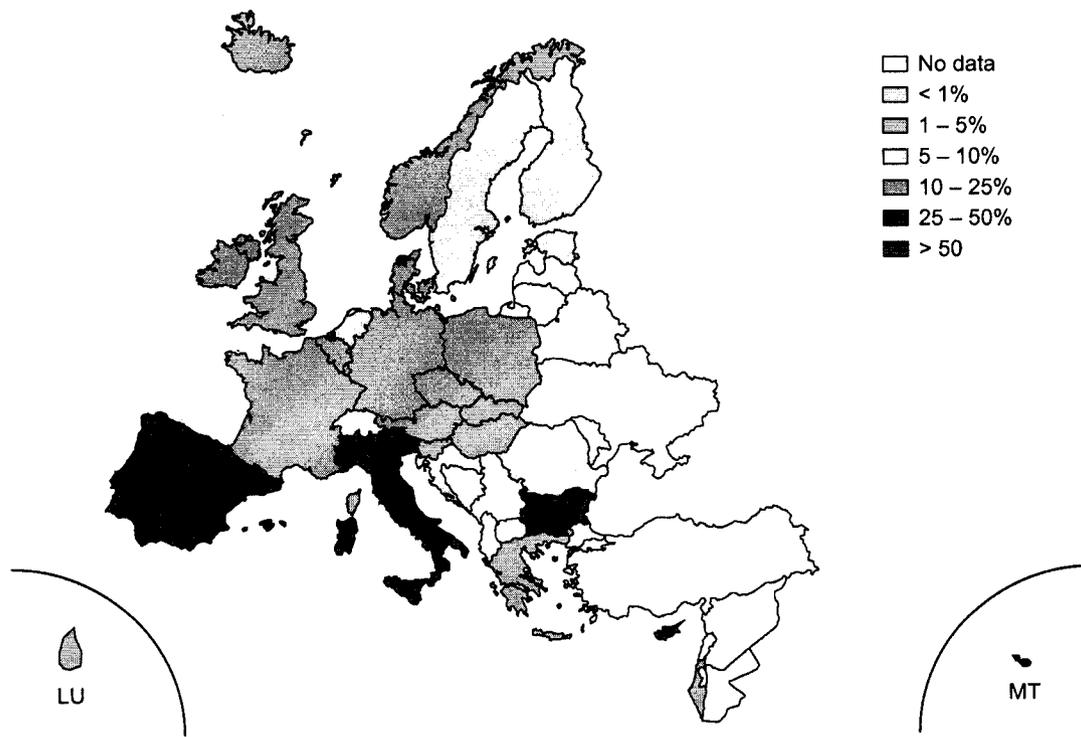


Figure 4.15. *Escherichia coli*: proportion of invasive isolates with resistance to fluoroquinolones in 2005.

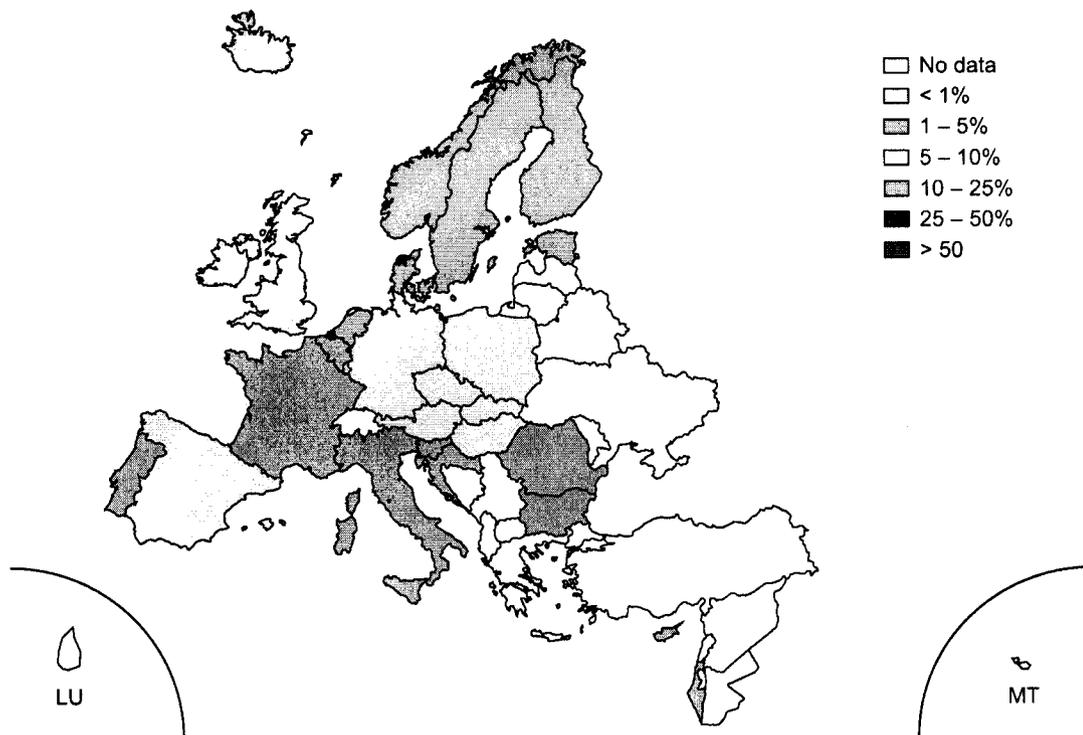


Figure 4.16. *Escherichia coli*: proportion of invasive isolates with resistance to aminoglycosides in 2005.

Fluoroquinolones

Fluoroquinolone resistance has consistently and substantially increased over the past five years all over Europe. Few countries have maintained levels at 5% or below, like Denmark (5%; n=758), Estonia (5%; n=151), Iceland (3%; n=117), and Norway (5%; n=1217) (Figure 4.19). At the same time the number of countries reporting fluoroquinolone-resistant *E. coli* above 25% have doubled within a year between 2004 and 2005 and now comprise six countries: Bulgaria (29%, n=196), Cyprus (29%, n=72), Spain (28%, n=2993), Italy (28%, n=1094), Malta (30%, n=87) and Portugal (29%, n=1086) (Figure 4.15, Annex 3.4). Of the 28 countries providing data, 25 showed a clear increase in resistance, and in 19 this trend was significant. The speed with which fluoroquinolones lose their activity against *E. coli* is next to no other compound pathogen combination under study by EARSS (Figure 4.19).

Aminoglycosides

The proportions of aminoglycoside resistance were quite evenly distributed over the lowest categories; resistance below 5% was reported by 9 countries, between 5% and 10% was reported by 13 and between 10% and 25% was reported by 7 countries, with the highest percentage reported by Bulgaria (24%, n=203) (Figure 4.16, Annex 3.4). Similar to the other resistance phenotypes under surveillance for *E. coli*, aminoglycoside resistance also witnessed an increase in numerous countries (16 out of 28) whereby 12 showed significant trends (Figure 4.20). For Spain the increase in the last year was due to laboratories that only started reporting since 2005; no increase in aminoglycoside resistance could be detected looking at Spanish laboratories that reported for all five years, therefore no significant trend was reported.

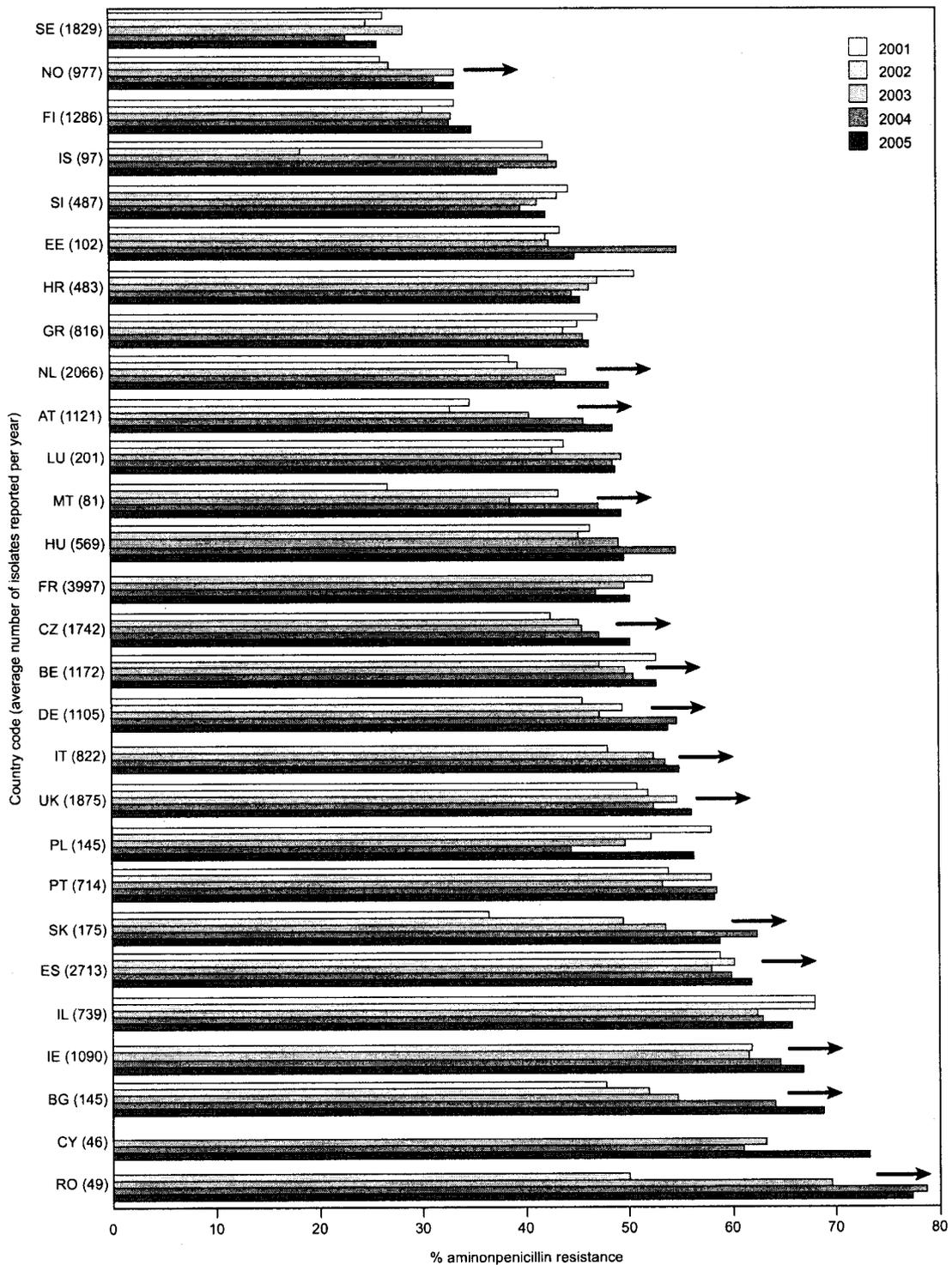


Figure 4.17. *Escherichia coli*: trends of aminopenicillin resistance by country, 2001-2005. Only the countries that reported 20 isolates or more per year for at least 3 years were included. The arrows indicate significant trends.

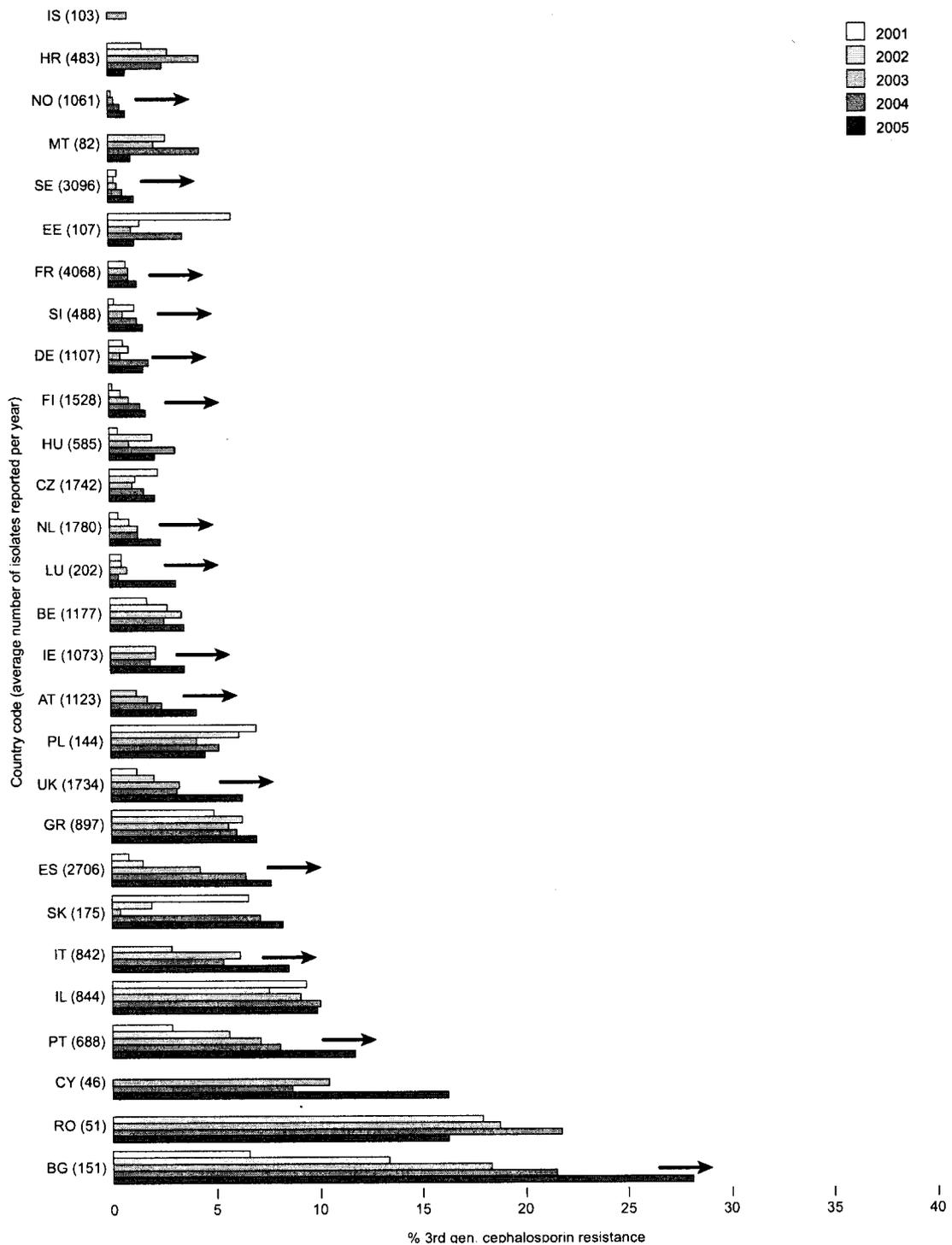


Figure 4.18. *Escherichia coli*: trends of third generation cephalosporin resistance by country, 2001-2005. Only the countries that reported 20 isolates or more per year for at least 3 years were included. The arrows indicate significant trends.

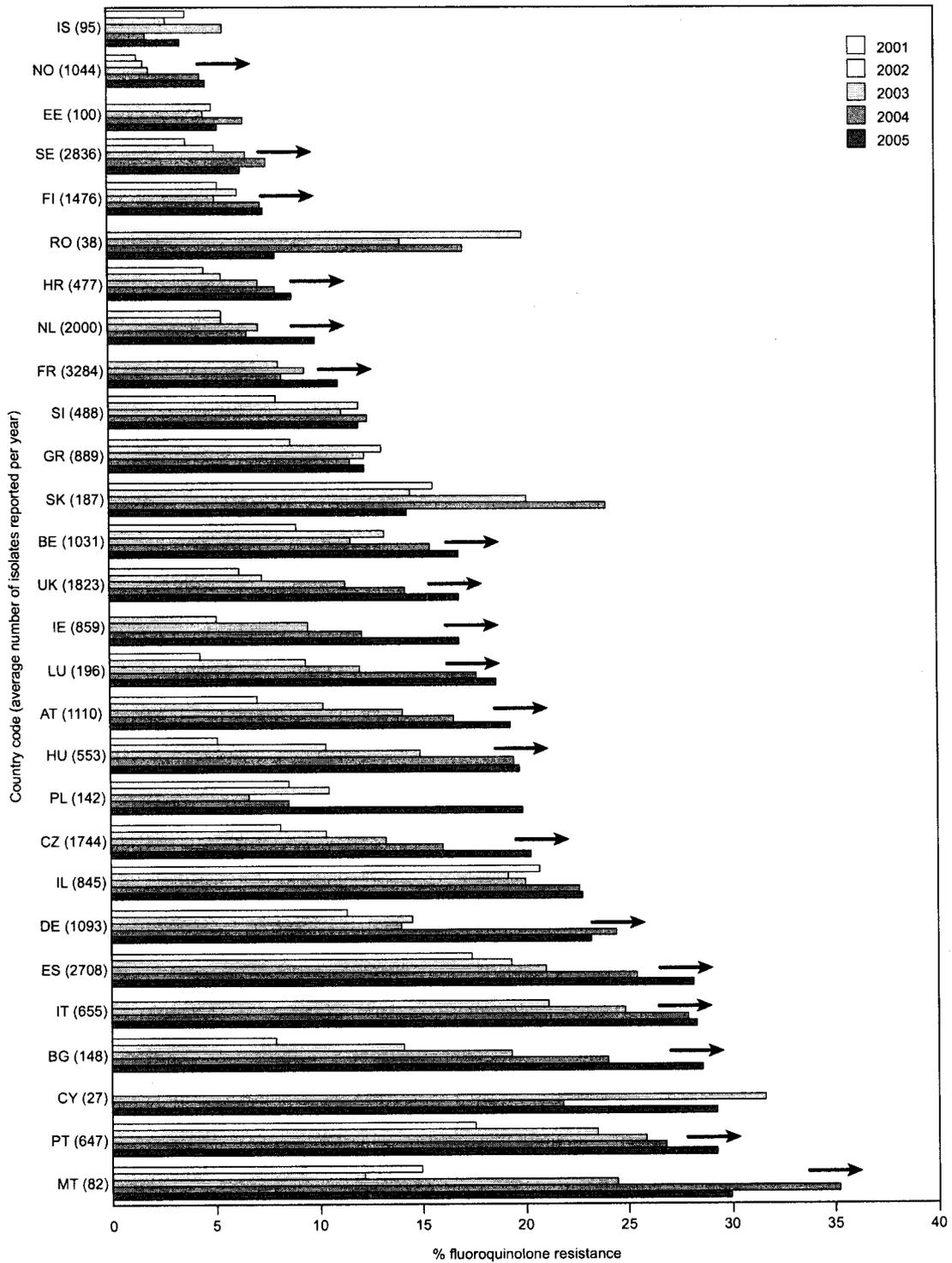


Figure 4.19. *Escherichia coli*: trends of fluoroquinolone resistance by country, 2001-2005. Only the countries that reported 20 isolates or more per year for at least 3 years were included. The arrows indicate significant trends.

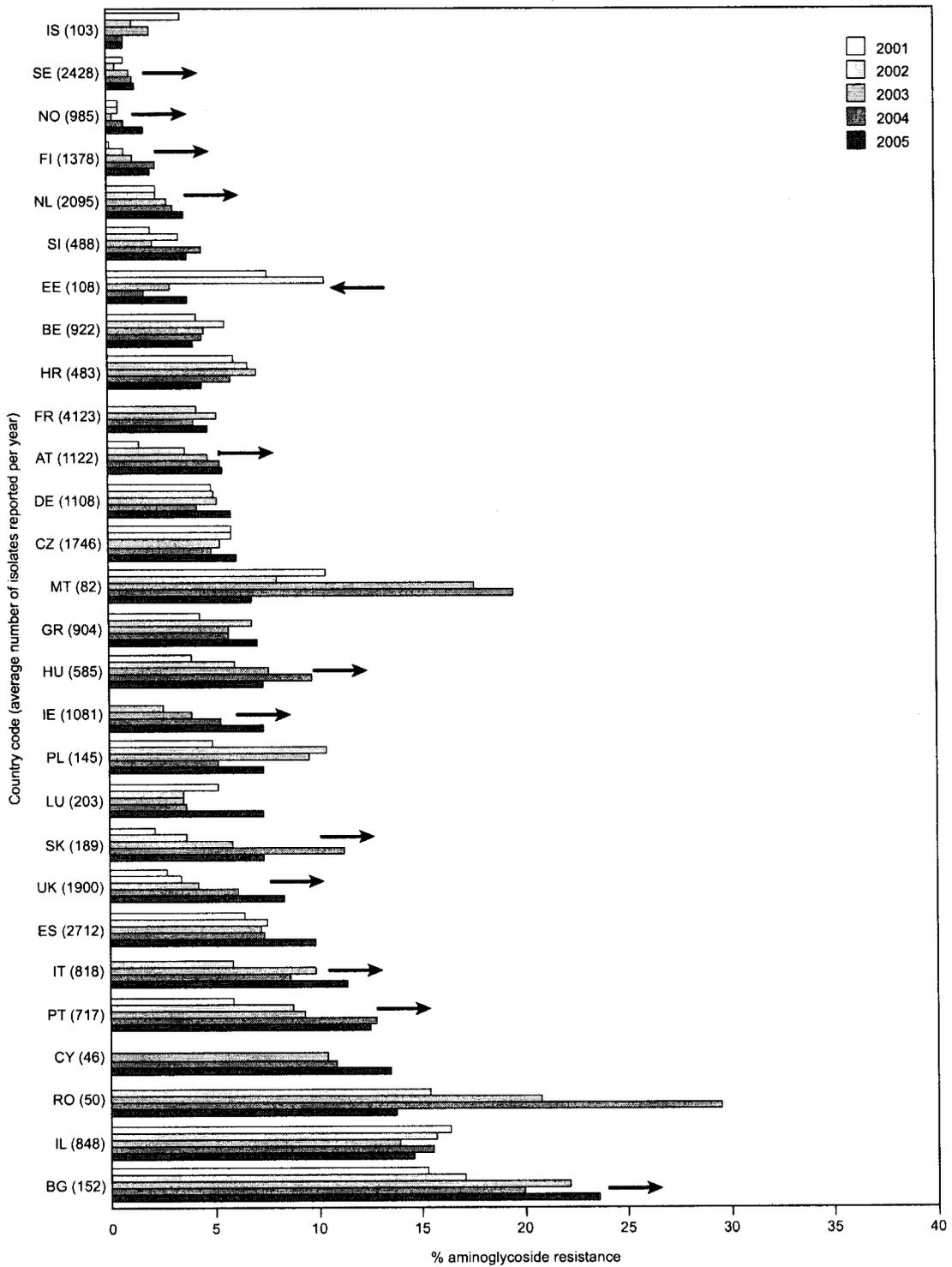


Figure 4.20. *Escherichia coli*: trends of aminoglycoside resistance by country, 2001-2005. Only the countries that reported 20 isolates or more per year for at least 3 years were included. The arrows indicate significant trends.

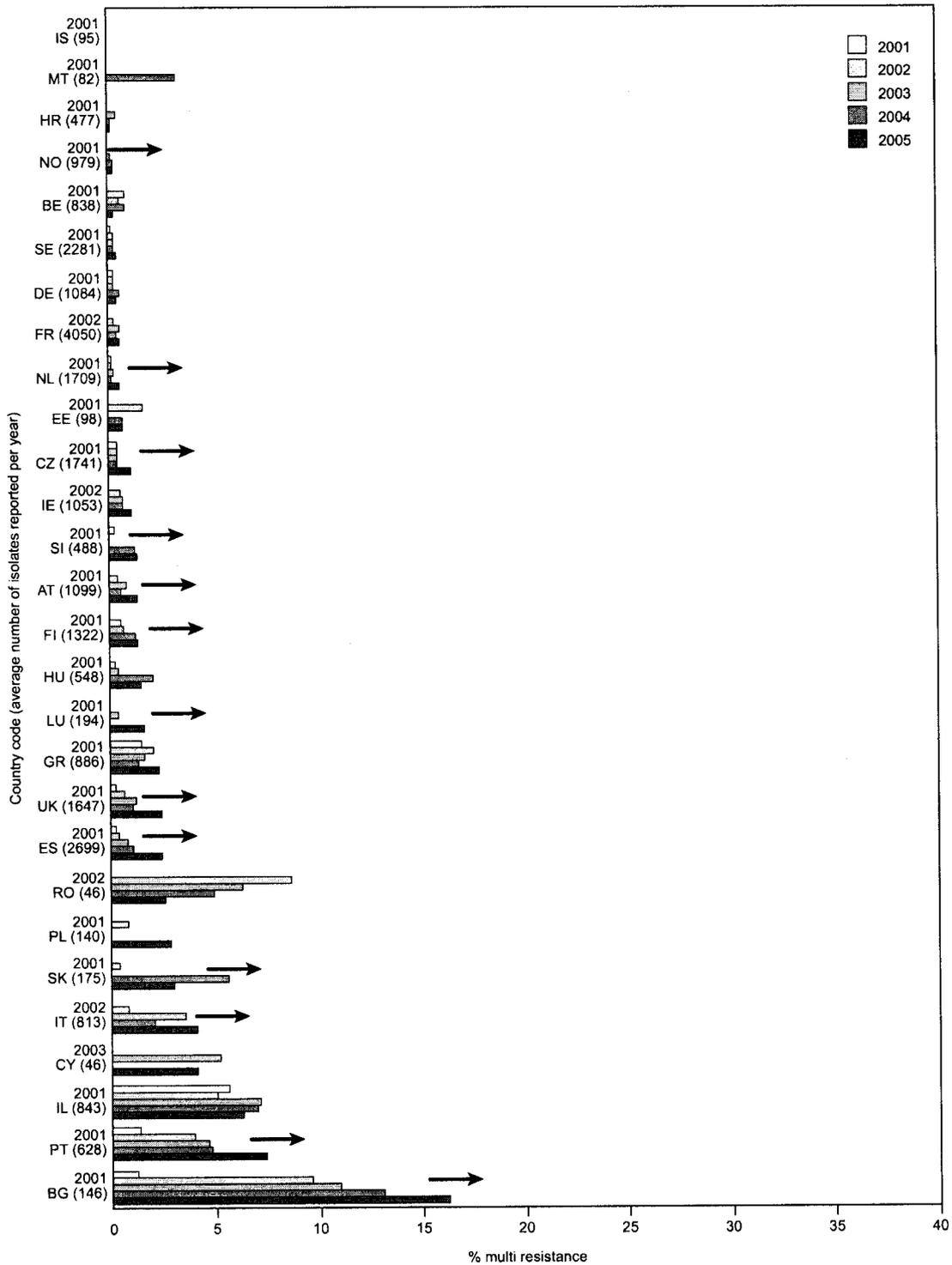


Figure 4.21. *Escherichia coli*: trends of combined resistance (resistant to fluoroquinolones, third generation cephalosporins, and aminoglycosides) by country, 2001-2005. Only the countries that reported 20 isolates or more per year for at least 3 years were included. The arrows indicate significant trends.

Combined resistance

It is not surprising that the overall increase of single compound resistance in *E. coli* is paralleled by a concomitant spread of phenotypes with combined resistance. Although combined resistance to third generation cephalosporins, fluoroquinolones and aminoglycosides was still below 2% in most countries (20 of 29) (Figure 4.21, Annex 3.4), 18 witnessed an increase, which in 13 countries was significant and unlikely due to random fluctuations. Table 4.2 gives an overview over the most common phenotypes (single and combine resistance) based on the average proportions reported from all 29 countries in 2005. In *E. coli*, single aminopenicillins resistance was the most frequently phenotype (33%), followed by the dual combination of aminopenicillins with fluoroquinolones (8%). The triple combination, aminopenicillins, fluoroquinolones and aminoglycoside came third (3%), followed by resistance to all four antimicrobials reported to EARSS (2.2%).

Please note that other compounds like trimethoprim, sulphamethoxazole, nitrofurantoin, tetracyclins etc. are not taken into account, as reporting of AST results for these substances is not obligatory in EARSS.

Table 4.2. Overall resistance and resistance combinations among invasive *Escherichia coli* isolates tested against all four classes of drugs (according to the EARSS protocol) (n=33,730) in Europe, 2005. The figures represent averages of the country percentages.

Resistance pattern	Average (%)
Single resistance (to indicated drug classes)	
Aminopenicillins	32.9
Fluoroquinolones	1.7
Third generation cephalosporins	0.0
Aminoglycosides	0.2
Resistance to two or more classes of antimicrobial drugs	
Aminopenicillins + fluoroquinolones	7.9
Aminopenicillins + third generation cephalosporins	1.1
Aminopenicillins + aminoglycosides	1.1
Fluoroquinolones + aminoglycosides	0.2
Aminopenicillins + fluoroquinolones + aminoglycosides	2.8
Aminopenicillins + fluoroquinolones + third generation cephalosporins	1.4
Aminopenicillins + aminoglycosides + third generation cephalosporins	0.6
Aminopenicillins + fluoroquinolones + aminoglycosides + Third generation cephalosporins	2.2

4.5.3. Conclusions

The Europe-wide increase of resistance of *Escherichia coli* to all of the antimicrobial classes recorded by EARSS is a disturbing development with seemingly inexorable vigor.

The highest resistance proportions have been reported for aminopenicillins ranging between 26 to 77%. Irrespective of this high level, resistance continues to increase in most of the countries, including those with proportions well above 60%. For fluoroquinolones the situation becomes progressively dire. Of the 28 countries providing data, 25 showed a clear increase in fluoroquinolone

resistance, and in 19 this trend could not be explained by random fluctuations. The speed with which fluoroquinolones lose their activity against *E. coli* is next to no other compound pathogen combination in the EARSS database. Combined resistance is a frequent occurrence, with co-resistance to 4 antimicrobial classes including third generation cephalosporins already among the fourth most common resistance patterns encountered in invasive *E. coli* in Europe, and undeniably these resistance traits are on the increase as well.

4.6. *Klebsiella pneumoniae*

4.6.1. Clinical and epidemiological importance

Bacteria of the genus *Klebsiella* are frequent colonizers of the gastrointestinal tract in humans but may also be found on skin, in the oro-pharynx and upper airways in hospitalized individuals. *K. pneumoniae* is associated with opportunistic infections in individuals with impaired immune systems, such as diabetics, alcoholics, and hospitalized patients with indwelling devices. The most common sites of infection are the urinary and the respiratory tract. Organisms can spread rapidly, from the gastrointestinal tract of patients and via the hands of hospital personnel to other patients, leading to nosocomial outbreaks. *Klebsiella pneumoniae* is the second most frequent cause of gram-negative blood stream infections after *Escherichia coli*. The mortality rate for *Klebsiella pneumoniae* community-acquired pneumoniae depends on the severity of the underlying condition and can be as high as 50%, even when appropriate antibiotic treatment is given.

Resistance mechanisms. Similar to *E. coli*, *K. pneumoniae* can be resistant to multiple antibiotics, and resistance traits are frequently acquired through plasmids. However, in contrast to *E. coli*, *K. pneumoniae* has a chromosomally encoded TEM beta-lactamase and is thus intrinsically resistance against aminopenicillins. Moreover, this organism readily acquires plasmid-mediated resistance determinants. Therefore, many novel ESBL variants were initially identified in *K. pneumoniae* and are only subsequently found in *E. coli*. Since resistance mechanisms do not significantly differ from those describe for *E. coli*, the reader is referred to the previous chapter for further detail (36).

4.6.2. *Klebsiella pneumoniae* resistance in 2005

EARSS began collecting AST results for invasive *K. pneumoniae* in 2005 and already 4,942 isolates were reported from 24 countries in this first year alone.

Third generation cephalosporins

Third generation cephalosporin resistance is rather heterogeneous across Europe. Some counties report proportions below 5%, Finland (2%, n=175), France (4%, n=824), Norway (1%, n=174), The Netherlands (4%, n=256) and Sweden (1%, n=281), whereas some Eastern European countries and Israel report 25% or more: Bulgaria (50%, n=34), Croatia (46%, n=112), Cyprus (33%, n=9), Czech republic (32%, n=478), Greece (61%, n=469), Hungary (31%, n=140), Israel (38%, n=125) and Poland (66%, n=53) (Figure 4.22, annex 3.5).

Fluoroquinolones

Fluoroquinolone resistance in Europe has a similar geographical pattern as third generation cephalosporins; the lowest proportions can be found in the northern part of Europe: Estonia (0%, n=35), Finland (3%, n=155), Ireland (3%, n=40), Iceland (0%, n=21), Norway (1%, n=172) and Sweden (5%, n=265) and the higher proportions in Eastern and Southern Europe: Bulgaria (26%, n=34), Czech republic (38%, n=478), Greece (54%, n=772), and Israel (30%, n=331) (Figure 4.23, Annex

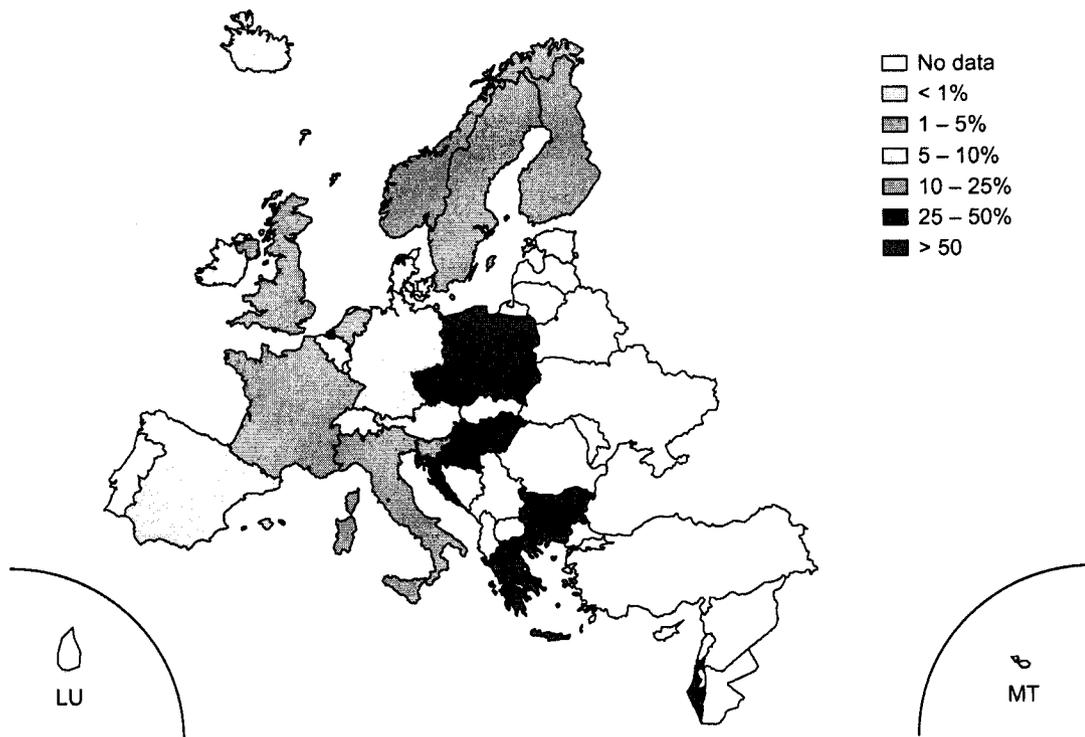


Figure 4.22. *Klebsiella pneumoniae*: proportion of invasive isolates resistant to third generation cephalosporins in 2005.

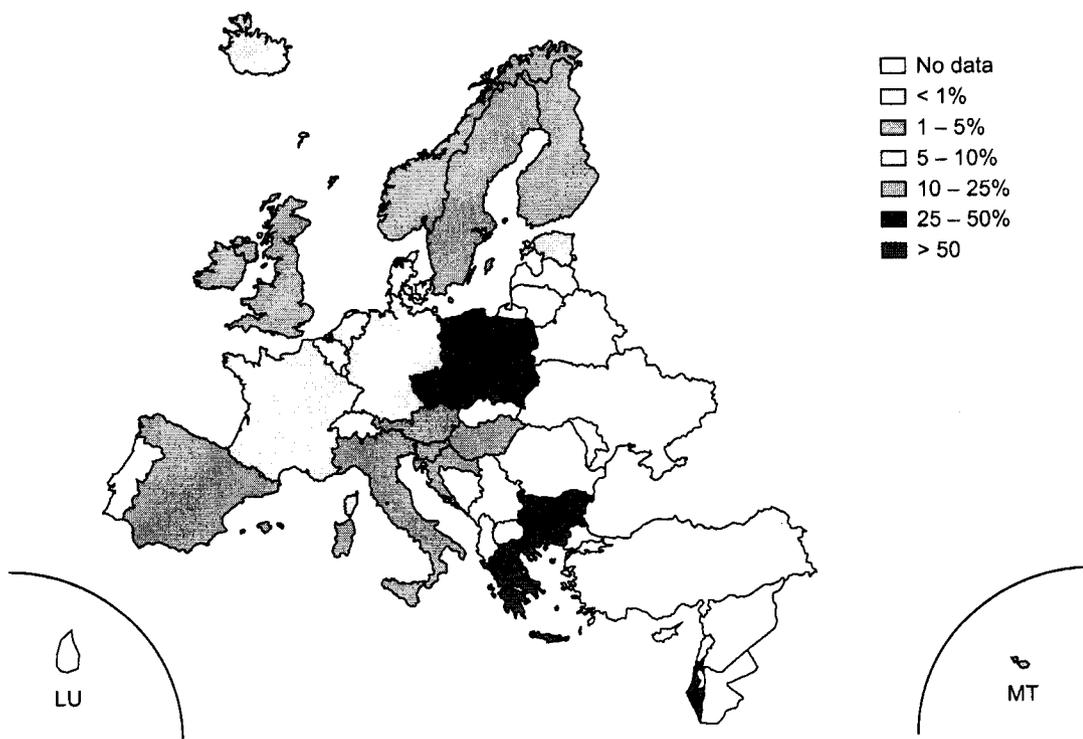


Figure 4.23. *Klebsiella pneumoniae*: proportion of invasive isolates resistant to fluoroquinolones in 2005.

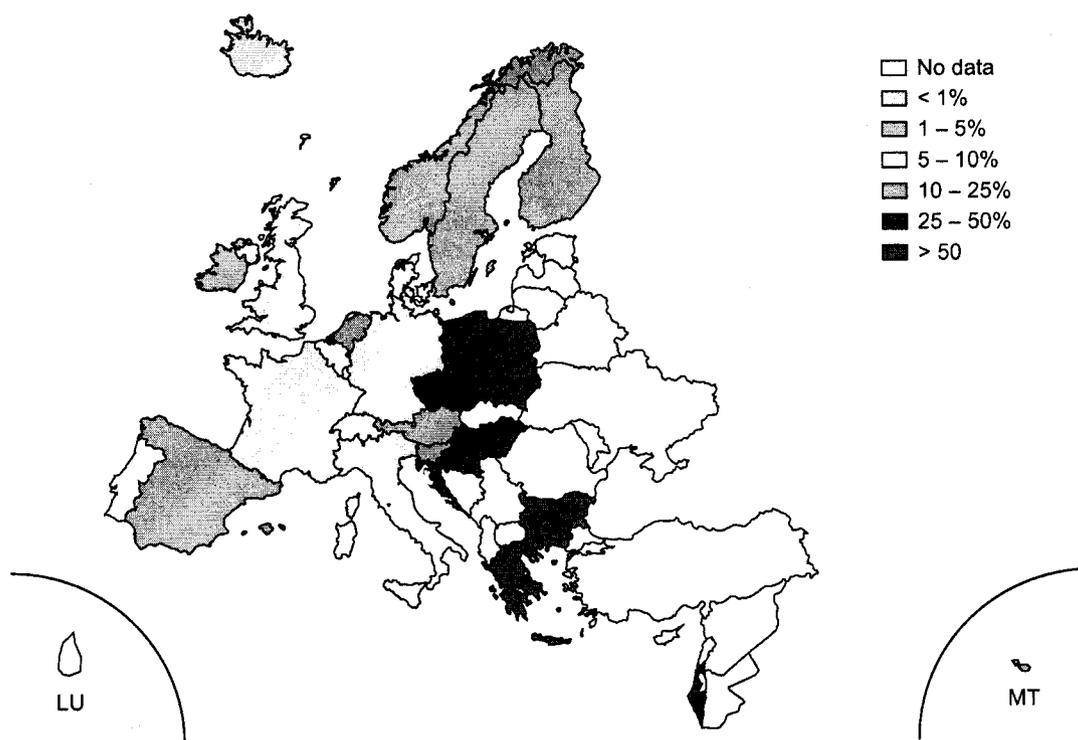


Figure 4.24. *Klebsiella pneumoniae*: proportion of invasive isolates resistant to aminoglycosides in 2005.

number 3.5).

Aminoglycosides

A very similar pattern as for third generation cephalosporins and fluoroquinolones can be found for aminoglycosides although low resistance proportions are also found in the middle European country Austria and the Southern European country Spain. Resistance proportions are below 5% in Austria (3%, n=89), Finland (3%, n=150), Ireland (5%, n=42) The Netherlands (5%, n=300), Norway (2%, n=174), Spain (4%, n=56), and Sweden (1%, n=279), and above 25% in Bulgaria (53%, n=34), Croatia (38%, n=112), Czech Republic (36%, n=477), Greece (60%, n=773), Hungary (30%, n=142), Israel (36%, n=331), and Poland (57%, n=53) (Figure 4.24, Annex 3.5).

Carbapenems

Carbapenems were reported voluntarily according to the routine procedures in place in participating laboratories from 22 of the 23 countries reporting on *K. pneumoniae* and therefore data were available for 67% of all isolates. Carbapenem resistance is still below 1% in most countries. Only Germany (2%, n=110) and Greece (28%, n=773) reported higher percentages reflecting the high number of ICU isolates in Greece. Most guidelines use breakpoints that are not designed to detect metallo-beta-lactamases and therefore our data do not capture the prevalence of these resistance determinants in Europe. ESGARS has developed a new protocol which may become part of the EARSS recommendation pending a decision at the annual plenary meeting. Since carbapenems are regarded as reserve antibiotics with life-saving potential when isolates show resistance to other antibiotics (37) it is important to monitor the susceptibility of this important group which may become increasingly threatened by the dissemination of metallo-beta-lactamases (Figure 4.25, Annex 3.5).

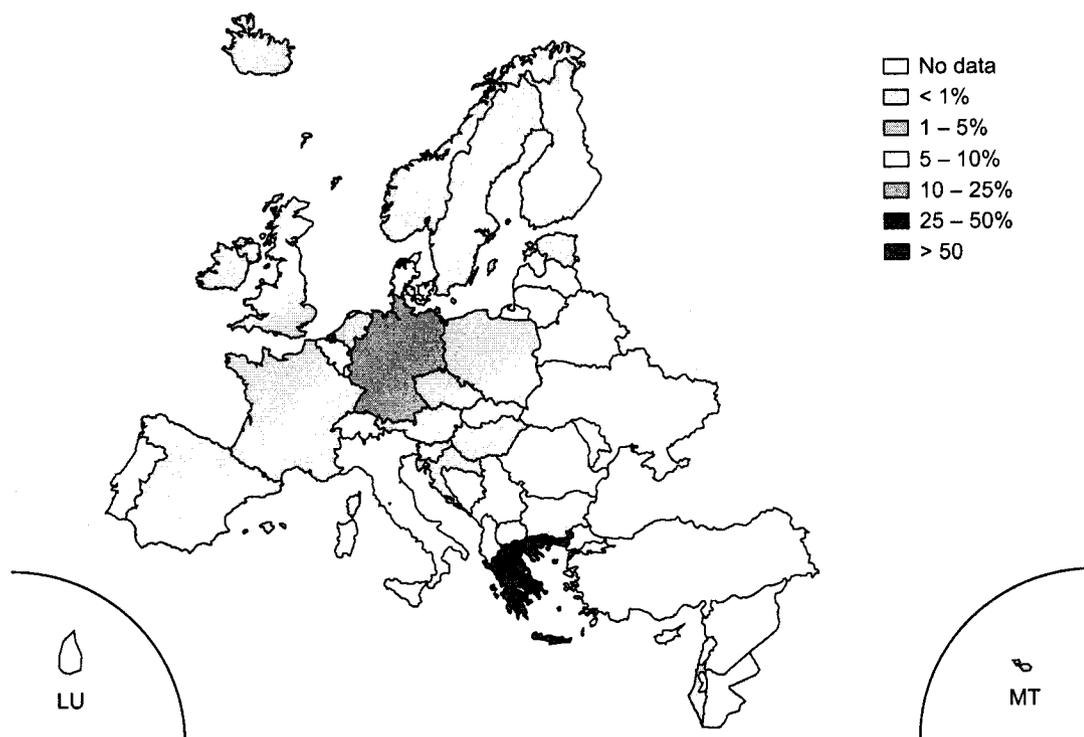


Figure 4.25. *Klebsiella pneumoniae*: proportion of invasive isolates resistant to carbapenems in 2005.

Table 4.3. Overall resistance and resistance combinations among invasive *Klebsiella pneumoniae* isolates tested against all four classes of drugs (according to the EARSS protocol) (n=4,610) in Europe, 2005. Intrinsic resistance against aminopenicillins is excluded; therefore results for only 3 classes are illustrated. The figures are averages of country percentages.

Resistance pattern	Average (%)
Overall resistance (to indicated drug classes)	
Fluoroquinolones	15.1%
Third generation cephalosporins	20.0%
Aminoglycosides	18.0%
(Carbapenems)	1.4%
Single resistance (to indicated drug classes)	
Fluoroquinolones	3.1%
Third generation cephalosporins	2.9%
Aminoglycosides	1.6%
Resistance to two or more classes of antimicrobial drugs	
Fluoroquinolones + third generation cephalosporins	2.9%
Fluoroquinolones + aminoglycosides	4.2%
Third generation cephalosporins + aminoglycosides	5.9%
Fluoroquinolones + third generation cephalosporins + aminoglycosides	9.6%

Combined resistance

In 2005, only 70% of the *Klebsiella pneumoniae* isolates displayed wild-type susceptibility (resistant to aminopenicillins only). All other isolates were resistant to at least one of the other antibiotic classes as well. As shown in table 4.3, single resistance is rather rare; the most frequent pattern is combined resistance against all four classes recorded by EARSS (10%). This suggests that the majority of invasive isolates carry multi-resistance plasmids coding for a combination of resistance determinants.

4.6.3. Conclusions

In *K. pneumoniae* a high prevalence of resistant strains to third generation cephalosporins, fluoroquinolones and aminoglycosides becomes evident in Eastern and Southeastern Europe. Many of these strains have combined resistance and the most frequent phenotype shows resistance to all three antimicrobial classes recorded by EARSS. Carbapenems seem to be still effective in most countries except Greece where the emergence of metallo-beta-lactamases jeopardizes the effectiveness of this reserve antibiotic. It will be necessary to closely monitor the effectiveness of carbapenems and make sure that its value is not put at stake through irresponsible prescribing in hospitals and ambulant care.

4.7. *Pseudomonas aeruginosa*

4.7.1. Clinical and epidemiological importance

Pseudomonas aeruginosa is a non-fermenting gram-negative bacterium that is ubiquitously present in aquatic environments in nature. It is an opportunistic pathogen for plants, animals and humans, and is a major and dreaded cause of infection among patients with localized and systemic immune defects. Because of its ubiquitous presence, its enormous versatility and intrinsic tolerance to many detergents, disinfectants and antimicrobial compounds is difficult to control *P. aeruginosa* in hospitals and institutional environments. Moreover, *P. aeruginosa* is a frequent cause for skin infections such as folliculitis and otitis externa in recreational and competitive swimmers. It causes the most important bacterial complication in patients with cystic fibrosis leading to chronic colonization and intermittent exacerbations ranging from bronchiolitis to acute lung syndrome. Finally, *P. aeruginosa* is a common pathogen found in burns units and in these locations almost impossible to eradicate by classical infection control procedures.

Resistance mechanisms. *P. aeruginosa* is intrinsically resistant to the majority of antimicrobial compounds due to its selective ability to exclude various molecules from penetrating its outer membrane. Acquired resistance in *P. aeruginosa* is caused by one or more of five mechanisms: i) mutational modification of antibiotic target sites such as gyrase, topoisomerase or ribosomal proteins which confer resistance to fluoroquinolones or aminoglycosides, ii) constitutional or inducible derepression of chromosomally coded AmpC beta-lactamase, iii) mutational loss of outer membrane proteins preventing the uptake of antimicrobial substances such as imipenem, iv) efficient efflux systems, that can confer resistance to beta-lactams, fluoroquinolones, tetracycline, chloramphenicol, trimethoprim and aminoglycosides, and v) plasmid-mediated expression of various beta-lactamases that can confer resistance to carbapenems (metallo-beta-lactamases) and aminoglycosides (32;39).

4.7.2. *Pseudomonas aeruginosa* resistance in 2005

EARSS began collecting AST results for invasive *P. aeruginosa* in 2005 and already 3,887 isolates were reported from 23 countries in this first year alone.

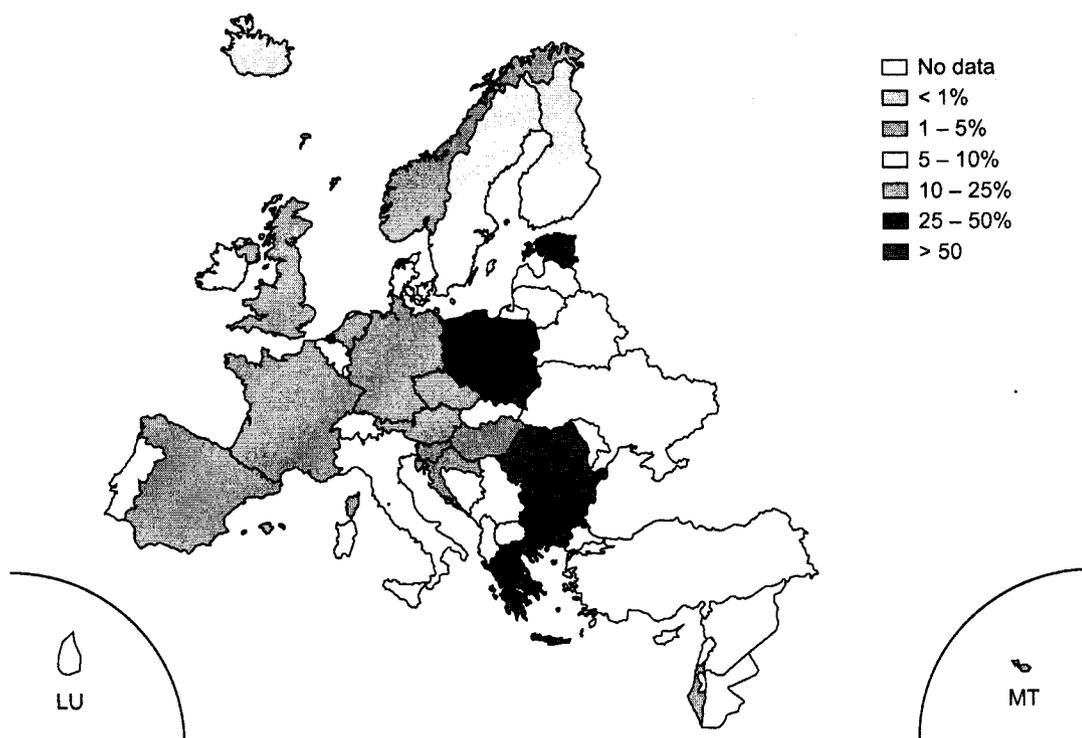


Figure 4.26. *Pseudomonas aeruginosa*: proportion of invasive isolates resistant to piperacillin in 2005.

Piperacillin

The proportion of piperacillin resistance was higher than that for the piperacillin-tazobactam combination owing to the fact that the beta-lactamase inhibitor, although not effective against the AmpC beta-lactamase, has some residual inhibitory effect on *P. aeruginosa*. In Figure 4.26 the resistance is shown for the combined formulation or piperacillin alone where only these data were available. Of the 23 countries reporting AST results of invasive *P. aeruginosa* isolates, 7 countries reported resistance proportions below 10%, namely Spain (4%, n=70), Finland (8%, n=108), Ireland (7%, n=28), Iceland (8%, n=13), the Netherlands (4%, n=184), Norway (3%, n=75) and the UK (2%, n=349). The highest resistance were reported from Bulgaria (50%, n=34), Poland (50%, n=26) and Romania (61%, n=23) (Figure 4.26, Annex 3.6).

Ceftazidime

The most Northern European countries have ceftazidime resistance proportions below 5%. Austria (7%, n=76), France (9%, n=905), the Netherlands (5%, n=209), Spain (6%, n=70) and Croatia (6%, n=71) report proportion just over 5%. In all other countries, resistance proportions are higher than 10% with some Eastern European countries (BG, CY, CZ) reporting rates of more than 25%: Bulgaria (45%, n=33), Cyprus (38%, n=8), Czech Republic (40%, n=257), Greece (27%, n=662), Poland (31%, n=26) and Romania (52%, n=23) (Figure 4.27, Annex number 3.6).

Fluoroquinolones

Ten (of 23) countries reported more than 25% fluoroquinolone resistance for invasive *P. aeruginosa* isolates, of which Bulgaria (47%, n=34), Czech Republic (45%, n=245), Malta (44%, n=45) and Romania (64%, n=22) reported even more than 40% resistance. Low resistance levels (<5%) were only found in Iceland (0%, n=13) and Norway (4%, n=89) (Figure 4.28, Annex 3.6).

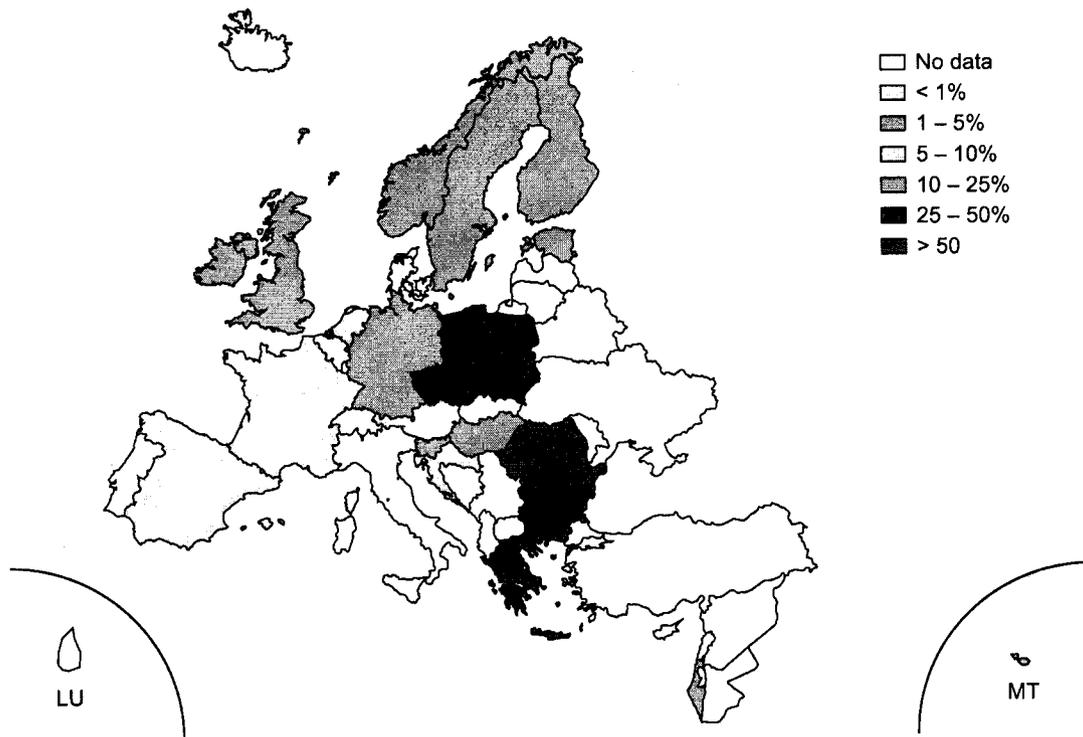


Figure 4.27. *Pseudomonas aeruginosa*: proportion of invasive isolates resistant to ceftazidime in 2005.

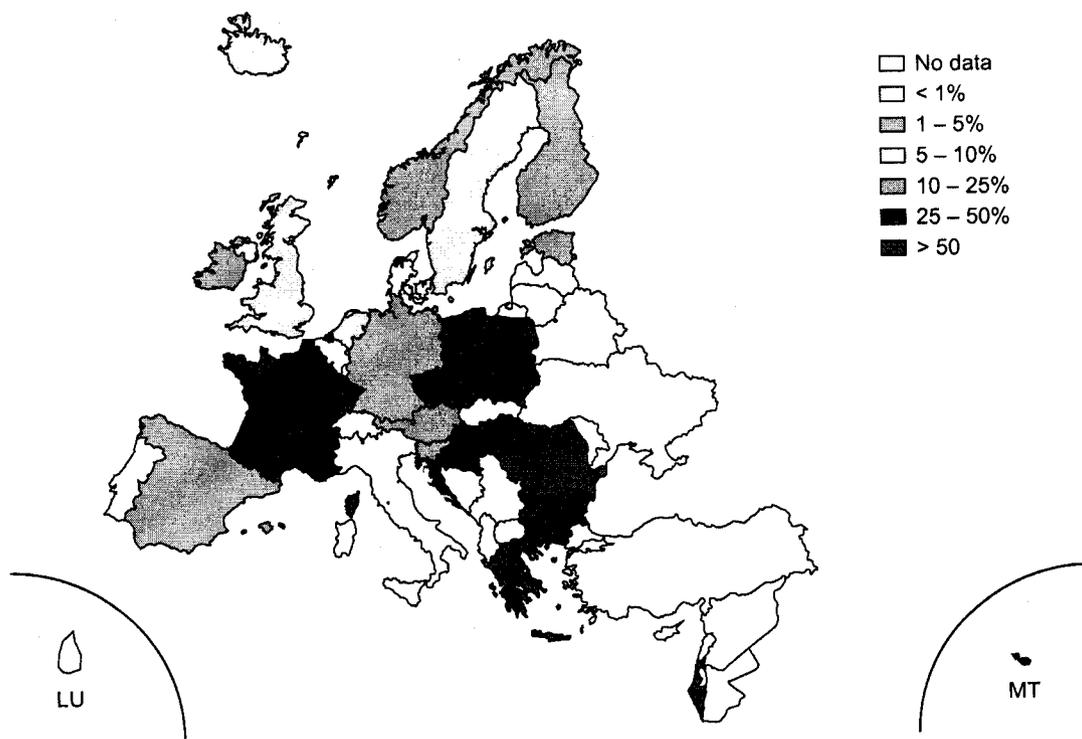


Figure 4.28. *Pseudomonas aeruginosa*: proportion of invasive isolates resistant to fluoroquinolones in 2005.

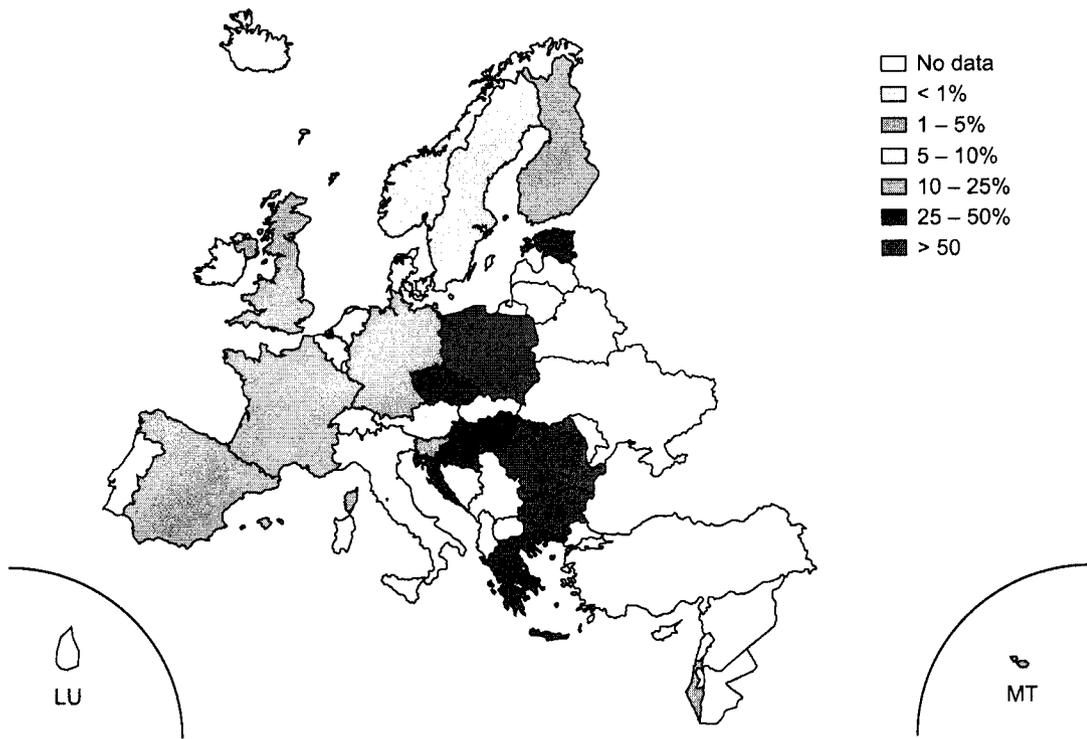


Figure 4.29. *Pseudomonas aeruginosa*: proportion of invasive isolates resistant to aminoglycosides in 2005.

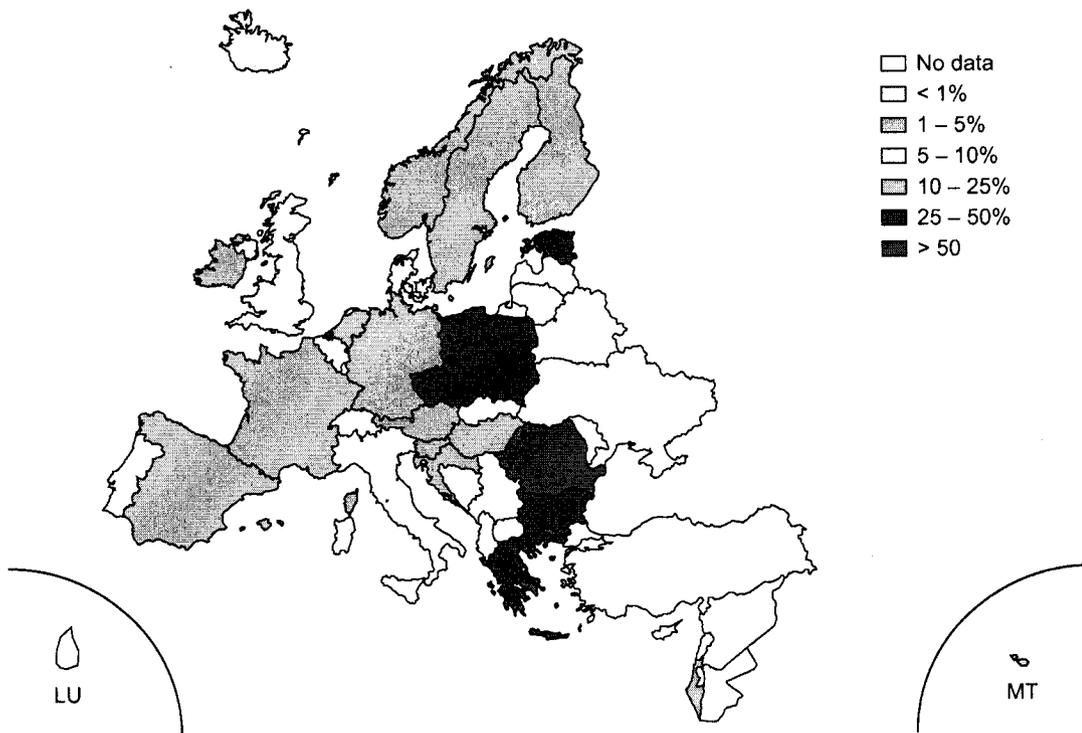


Figure 4.30. *Pseudomonas aeruginosa*: proportion of invasive isolates resistant to carbapenems in 2005.

Table 4.4. Overall resistance and resistance combinations among invasive *Pseudomonas aeruginosa* isolates tested against all five classes of drugs (as mentioned in the EARSS protocol) (n=3,197) in Europe, 2005. The figures are averages of country percentages.

Resistance pattern	Average (%)
Single resistance (to indicated drug classes)	
Piperacillin +/- tazobactam	1.0
Ceftazidime	1.6
Carbapenems	4.0
Fluoroquinolones	3.9
Aminoglycosides	1.7
Resistance to two classes of antimicrobial drugs	
Piperacillin +/- tazobactam + ceftazidime	0.8
Piperacillin +/- tazobactam + carbapenems	0.3
Piperacillin +/- tazobactam + fluoroquinolones	0.2
Piperacillin +/- tazobactam + aminoglycosides	0.6
Ceftazidime + carbapenems	0.1
Ceftazidime + fluoroquinolones	0.3
Ceftazidime + aminoglycosides	0.1
Carbapenems + fluoroquinolones	0.9
Carbapenems + aminoglycosides	0.5
Fluoroquinolones + aminoglycosides	2.1
Resistance to three classes of antimicrobial drugs	
Piperacillin +/- tazobactam + ceftazidime + carbapenems	1.4
Piperacillin +/- tazobactam + ceftazidime + fluoroquinolones	0.6
Piperacillin +/- tazobactam + ceftazidime + aminoglycosides	0.2
Piperacillin +/- tazobactam + fluoroquinolones + aminoglycosides	1.5
Piperacillin +/- tazobactam + carbapenems + fluoroquinolones	0.1
Piperacillin +/- tazobactam + carbapenems + aminoglycosides	0.3
Ceftazidime + carbapenems + fluoroquinolones	0.0
Ceftazidime + carbapenems + aminoglycosides	0.0
Ceftazidime + fluoroquinolones + aminoglycosides	0.5
Carbapenems + fluoroquinolones + aminoglycosides	1.2
Resistance to four or more classes of antimicrobial drugs	
Piperacillin +/- tazobactam + ceftazidime + carbapenems + fluoroquinolones	0.8
Piperacillin +/- tazobactam + ceftazidime + carbapenems + aminoglycosides	0.7
Piperacillin +/- tazobactam + ceftazidime + fluoroquinolones + aminoglycosides	1.3
Piperacillin +/- tazobactam + carbapenems + fluoroquinolones + aminoglycosides	2.1
ceftazidime + carbapenems + fluoroquinolones + aminoglycosides	1.0
Piperacillin +/- tazobactam + ceftazidime + carbapenems + fluoroquinolones + aminoglycosides	7.4

Aminoglycosides

Aminoglycoside resistance proportions varied largely between countries, with proportions of less than 1 % in north western Europe: Iceland (n=13), Norway (n=89) and Sweden (n=149) all report 0%. Levels were well over 25% in Eastern Europe: Croatia (35%, n=72), Czech Republic (28% n=230), Estonia (28% n=36), Greece (40%, n=696), Hungary (32% n=238) and Romania (64%, n=22) (Figure 4.29, Annex 3.6).

Carbapenems

Countries differ in the reporting routine for carbapenems. Some hardly or never test for meropenem (Austria, Spain, France, Malta, Sweden), whereas other mainly test for imipenem susceptibility (Czech Republic, Estonia, Finland, Ireland, Iceland). We took a pragmatic approach and combined the AST results for both drugs. With this restriction in mind, we were thus able to draw up the overall distribution carbapenem resistance without losing too much of valuable data (see figure 4.28).

Pseudomonas aeruginosa resistance proportions appear to be rather high all over Europe. The only two countries which report proportions of less than 5% are the Netherlands (5%, n=187) and Norway (4%, n=80). In south eastern Europe, Poland and Estonia, resistance proportions were over 25%: Bulgaria (38%, n=32), Estonia (38%, n=37), Greece (39%, n=698), Poland (27%, n=26) and Romania (61%, n=23) (Figure 4.30, Annex 3.6).

Combined resistance

As expected, *P. aeruginosa* isolates were often found to be multi-resistant. In our database, the dominant phenotype in Europe in 2005 combined resistance to all the five classes of antimicrobials recorded by EARSS (7.4%). The second and third most common pattern consisted of single resistance phenotypes to either carbapenems or fluoroquinolones (4.0 and 3.9% respectively) (Table 4.4). A clear AmpC phenotype with both piperacillin and ceftazidime resistance was surprisingly rare (only 0.8% of all resistant isolates). This may be due to selective uptake or hydrolysis kinetics of the two substances and poses the question if laboratories report susceptibility to either of the substances when an AmpC phenotype has been clearly identified - which could be misleading for clinicians.

4.7.3. Conclusions

Combined resistance is the dominant threat imposed by invasive *P. aeruginosa* in Europe. Since resistance in *P. aeruginosa* emerges readily during antibiotic treatment, the time when blood cultures are taken is crucial as any isolate collected after prolonged exposure with antimicrobial chemotherapy will predictably be a multi-resistant phenotype. Assuming the diagnostic habits in Europe are comparable the picture that our data suggest is that the geographical gradient observed for all other gram-negative pathogens namely lower resistance in the Northwest and increasing resistance towards the Southeast also holds for *P. aeruginosa*.

Chapter 5. Conclusions and Recommendations

In Europe the proportion *Streptococcus pneumoniae* that is not susceptible to penicillin (PNSP) keeps changing. It appears that in countries which reported high endemic prevalence in previous years the situation has improved. The reduction of full penicillin resistance may be the result of fitness trade-offs, in absence of extreme selection pressures. More obvious was the increase of erythromycin resistance observed in most countries. In contrast to this widespread observation, in the UK, Belgium and Hungary this trend appears to have been reversed and the beginning of a decrease of *S. pneumoniae* resistant to erythromycin could be observed. The distribution of serogroups/serotypes reported to EARSS indicate that resistance is mainly confined to few serogroups, all of which are included in the currently promoted conjugate vaccines. This suggests that vaccination, especially in young children, may represent an effective additional means of controlling antibiotic resistance in pneumococcal disease in Europe. Up to now, universal infant PCV immunization policy has been implemented in Luxembourg and the Netherlands and will be introduced in Norway and the UK in due course, with many countries following soon. To monitor the effect of these interventions, surveillance of the serotype distribution becomes ever more important.

For *Staphylococcus aureus* no less than twelve countries reported a significant increase in the proportion of MRSA within the last seven years. This trend was largely consistent throughout Europe and included countries with low, medium as well as high baseline MRSA endemicity. At the same time it appears that the MRSA pandemic is not an irreversible secular trend as two European countries (Slovenia and France) succeeded in constantly reducing the proportion of MRSA among *Staphylococcus aureus* blood stream infections over the past five or six years through rigorously implementing containment programs.

With the ongoing spread of clonal complex 17 in Europe, outbreaks of vancomycin resistant *E. faecium* continues to afflict more and more hospitals in various countries. The spread of these hospital-adapted strains occurs on the background of high-level aminoglycoside resistance. The control of glycopeptide resistant enterococci remains a formidable task for hospital infection control practitioners and it is not difficult to predict that these problematic pathogens will continue to remain an expanding challenge.

The Europe-wide increase of resistance of *Escherichia coli* to all antimicrobial classes recorded by EARSS is a disturbing development with seemingly inexorable vigor.

The highest resistance proportions have been reported for aminopenicillins ranging between 26 to 77%. Irrespective of this high level, resistance continues to increase in most of the countries, including those with proportions well above 60%. For fluoroquinolones, the situation becomes progressively dire. Of the 28 countries providing data, 25 showed a clear increase in fluoroquinolone resistance, and in 19 this trend is significant i.e. is unlikely due to random fluctuations. The speed with which fluoroquinolones lose their activity against *E. coli* is next to no other compound pathogen combination in the EARSS database. Combined resistance is a frequent occurrence, with co-resistance to four antimicrobial classes including third generation cephalosporins already among the four most common resistance patterns encountered in invasive *E. coli* in Europe, and undeniably these resistance traits are on the increase as well.

In *Klebsiella pneumoniae* a high prevalence of resistant strains to third generation cephalosporins, fluoroquinolones and aminoglycosides becomes evident in Eastern and Southeastern Europe. Many of these strains have combined resistance and the most frequent phenotype shows resistance to all three antimicrobial classes recorded by EARSS. Carbapenems seem to be still effective in most countries except for Greece, where the emergence of metallo-beta-lactamases jeopardizes the effectiveness of this class of reserve antibiotics. It will be necessary to closely monitor the effectiveness of carbapenems as it is clear that with increasing prevalence of multi-resistant phenotypes more of these antibiotics will be prescribed in the future. It is therefore important to reemphasize the importance of good microbiological diagnostic services to make sure that the value of these third-line drugs is not put at stake through irresponsible prescribing in hospitals and especially in ambulant care, for which oral carbapenems have been made available.

Combined resistance is the dominant threat imposed by invasive *Pseudomonas aeruginosa* in Europe. Since resistance in *P. aeruginosa* emerges readily during antibiotic treatment, the time when blood cultures are taken is crucial as any isolate collected after prolonged exposure with antimicrobial chemotherapy will predictably have a multi-resistant phenotype. Assuming the diagnostic habits in Europe are comparable, the picture that our data suggest is that the same geographical gradient observed for all other gram-negative pathogens, namely lower resistance in the Northwest and increasing resistance towards the Southeast, also holds for *P. aeruginosa*.

It appears that the overall threat imposed on European communities by the increasing loss of antimicrobial effectiveness continues unabated with the same speed as has been previously described by our network. This is shown most convincingly among the pathogens that are frequently transmitted in health care settings (MRSA and VRE) and for antimicrobial compounds that are available for oral administration and hence preferred in ambulatory care (aminopenicillins, macrolides, and fluoroquinolones). The growing availability of third-line antimicrobial drugs as oral formulations is in this context a matter of concern and underscores the need of locally or nationally advised prescribing practices for both ambulatory and hospital-based care.

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Annex 1. Technical Notes on data analysis

1.1. Technical Notes for table 1 of the Country Summary Sheets

Inclusion criteria

To be included in the analyses presented in table 1 of the country summary sheets (Annex 1), countries, laboratories and hospitals had to provide both denominator data and AST results in 2004. Necessary details for inclusion were information on blood culture frequencies for laboratories and the number of beds for hospitals.

Ranges

The ranges given by specific laboratories for occupancy rate, number of sets collected per patient, or number of blood culture bottles per set were averaged (e.g. 1 to 3 = 2).

Added up variables

Number of blood culture sets, number of hospital beds (total, ICU and psychiatry or long term care beds), number of patient-days, catchment population, and type of hospitals were added up by country.

Number of blood culture sets

The total number of bottles per set was defined as the number of bottles used per blood sample (and not per patient). If the number of blood culture sets was not available at laboratory level, it was calculated by:

$$\text{Total number of blood culture bottles} / \text{Total number of bottles per set}$$

Patient-days

If patient-days were not available at hospital level, these were calculated by:

$$\text{Number of beds} * (\text{Annual occupancy} / 100) * 365$$

Catchment population & Percentage of the total population covered.

The total catchment population was the sum of the catchment populations of university and general hospitals. Hospitals providing only a specific type of care (classified as 3=other, e.g. oncology or psychiatric hospitals) were not included as we considered this population as probably overlapping with the catchment populations of the other hospitals.

The percentage of population covered was then calculated by dividing the total catchment population by the estimated national population, which we derived from the CIA factbook available from the internet at www.cia.gov/cia/publications/factbook/. If the percentage of population covered exceeded 100%, this was set at 100%.

Averaged variables

Annual occupancy rate and length of stay were averaged per country. In these totals only laboratory/hospital questionnaires were included that provided information on all variables needed for the specific formula.

Annual occupancy rate

The average annual occupancy per country was calculated as:

$$[\sum(\text{Annual occupancy} / 100 * \text{Number of beds}) / \sum(\text{Number of beds})] * 100$$

Length of stay

The median length of stay per country was determined, since the values of the hospital-specific lengths of stay had a skewed distribution for some countries.

1.2 Technical notes for chapter 4

Resistance trend analysis

To determine significant trends over time, the Cochrane Armitage test was used, excluding countries reporting less than 20 isolates per year. In addition, at least three years of data had to be reported by country to be included in the analysis. To exclude possible biases in the trend analyses, a sensitivity analysis was done to determine the sensitivity of the trend analysis for using the complete dataset versus only the subgroup selection. When trends were influenced significantly by the differences in the composition of laboratories over the years this was indicated in the text.

Annex 2. Country Summary Sheets

In the following appendix, country-specific resistance information is presented together with denominator data and the characteristics of the participating laboratories and hospitals.

Explanation to the country summary sheets

General information about EARSS participating laboratories and hospitals

Table 1 and 2 and figure 1 give an indication of the sample size and the representativeness of the country-specific resistance data available to EARSS.

Table 1 displays results of the laboratories and hospitals that provided denominator data in 2004 (i.e. that responded to the questionnaire) and thus only includes the laboratories that 1) reported AST results to EARSS in 2004, and 2) provided blood culture information and the hospitals that 1) reported AST results to EARSS in 2004, and 2) provided their number of hospital beds. For details about the calculation of the average annual occupancy rate, the estimated catchment population and the percentage of the total population covered, we refer to the technical notes (Annex 2). If data were not available this is stated as “na”.

Table 2 gives the number of laboratories and isolates reported by year and by pathogen under EARSS surveillance for the period 1999 to 2005.

Figure 1 shows the geographic location of the laboratories reporting in 2005. The size of the dots in the maps represents the number of laboratories in that area:

Dot	•	●	●	●
Number of labs	1	5	10	15

Antibiotic resistance 1999-2005

Table 3 provides information on the proportion of invasive bacterial isolates non-susceptible (I+R) or resistant (R) to the antibiotics or antibiotic classes mentioned in the EARSS protocols. When interpreting Table 3 always check the number of isolates the proportions are based on given in Table 2.

Demographic characteristics

Table 4 gives the proportional distribution of the isolates reported by source, gender, age, and hospital department, and the proportion of resistance within the different groups, for the period 2004 and 2005.

The abbreviations used in this table stand for; PNSP = penicillin non-susceptible *S. pneumoniae*, MRSA = methicillin resistant *S. aureus*, FREC = fluoroquinolone resistant *E. coli*, VRE = vancomycin resistant *E. faecalis* or *E. faecium*, CRKP = third generation cephalosporin resistant *K. pneumoniae*, and CRPA = carbapenem resistant *P. aeruginosa*. If the number of isolates in a certain category accounts for less than 0.5% of the total number of isolates, the % total is set at 0 and the % resistance is not shown.

PNSP at laboratory level/ MRSA at hospital level

Figures 2 and 3 show the local variation in the proportions of PNSP and MRSA by laboratory and by hospital, respectively. Both figures are based on data from 2004 and 2005, only including the laboratories and hospitals that reported at least 5 isolates in these 2 years. The total number of laboratories or hospitals, the minimum, maximum, median, 1st and third quartile of the proportion of resistance is displayed in a box in the Figures. If an ‘X’ is displayed at the end of a hospital code this means that the hospital code is not provided; consequently, this can compass one or more unknown hospitals.

Austria

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2005, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	13/31
Hosps providing denom.data/ reporting data to EARSS	104/130
Number of blood culture sets	38.915
Number of hospital beds	38.432
Patient-days	10.606.105
Average occupancy rate (%)	na
Median length of stay (days)	na
Estimated catchment population	5.740.000
% total population covered	70%
Type of participating hospitals	
University/Tertiary	14%
General/Secondary	69%
Other	16%

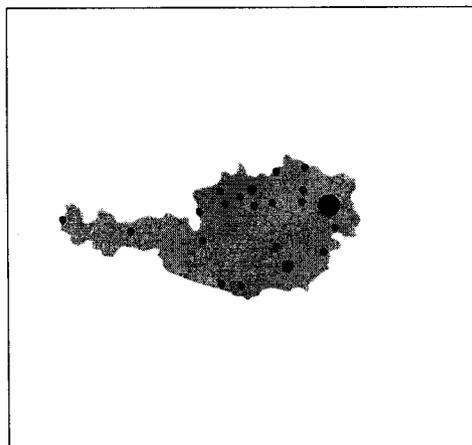


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	9	63	10	382	0	0	0	0	0	0	0	0
2001	8	53	9	278	8	260	6	67	0	0	0	0
2002	10	80	11	455	10	479	10	181	0	0	0	0
2003	19	162	20	871	21	985	19	327	0	0	0	0
2004	27	250	30	1419	31	1862	28	604	0	0	0	0
2005	30	290	32	1471	33	2059	30	568	7	89	8	77

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	.	<1	2	<1	1	1	<1
	Penicillin I+R	.	2	4	1	9	5	5
	Macrolides I+R	.	5	10	9	14	12	15
<i>S. aureus</i>	Oxacillin/Methicillin R	.	18	8	12	15	14	13
	<i>E. coli</i>							
<i>E. coli</i>	Aminopenicillins R	.	.	35	33	41	46	48
	Aminoglycosides R	.	.	2	4	5	5	5
	Fluoroquinolones R	.	.	7	10	14	17	19
	3rd gen. Cephalosporins R	.	.	<1	1	2	3	4
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	13	3	1	<1	1
	HL Aminoglycosides R	.	.	35	27	33	23	28
	Glycopeptides R	.	.	<1	<1	<1	<1	<1
<i>E. faecium</i>	Aminopenicillins I+R	.	.	86	84	85	85	84
	HL Aminoglycosides R	.	.	13	21	22	22	28
	Glycopeptides R	.	.	5	7	<1	<1	1
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	3
	Fluoroquinolones R	.	.	.	.	.	.	11
	3rd gen. Cephalosporins R	.	.	.	.	.	.	6
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	13
	Ceftazidime R	.	.	.	.	.	.	7
	Carbapenems R	.	.	.	.	.	.	10
	Aminoglycosides R	.	.	.	.	.	.	6
	Fluoroquinolones R	.	.	.	.	.	.	14

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=540		<i>S. aureus</i> n=2890		<i>E. coli</i> n=3903		<i>E. faecalis</i> n=819		<i>E. faecium</i> n=332		<i>K. pneumo.</i> n=88		<i>P. aeruginosa</i> n=77	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	94	5	100	14	100	18	100	0	100	1	100	6	100	10
CSF	6	10	0	0	0	0	0	0	0	0	0	0	0	0
Gender														
Male	55	4	56	15	38	20	61	0	54	2	52	7	68	10
Female	43	6	43	12	61	17	37	1	43	0	48	5	32	12
Unknown	2	0	1	13	1	32	1	0	3	0	0	0	0	0
Age (years)														
0-4	9	6	2	8	2	5	4	0	2	0	0	0	1	0
5-19	4	4	2	3	1	17	1	0	2	0	1	0	1	0
20-64	39	4	39	13	28	18	38	0	42	1	50	7	44	15
65 and over	47	6	57	15	69	18	57	0	55	1	49	5	53	7
Unknown	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital dep.														
ICU	13	6	12	20	7	20	19	1	28	1	10	0	17	15
Internal Med.	55	4	50	12	57	17	41	0	34	1	48	7	42	16
Surgery	1	0	11	19	10	17	15	0	17	0	17	7	19	7
Other	29	6	25	12	24	20	25	0	20	1	22	5	18	0
Unknown	1	14	2	11	2	23	1	0	1	0	3	0	4	0

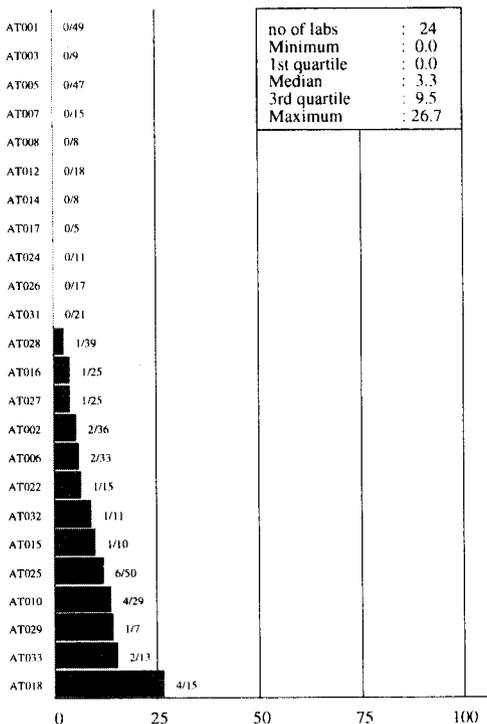
PNSP = Penicillin Non-Susceptible *S. pneumoniae*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

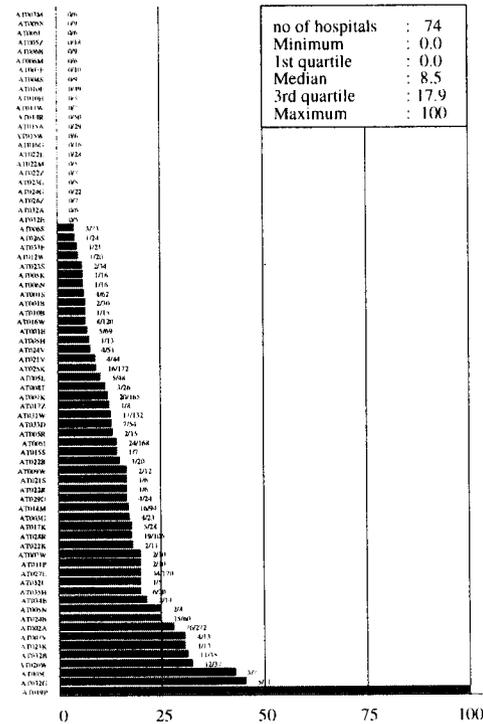
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Belgium

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	36/100
Hosps providing denom.data/ reporting data to EARSS	35/100
Number of blood culture sets	187,005
Number of hospital beds	16,815
Patient-days	4,626,468
Average occupancy rate (%)	77%
Median length of stay (days)	8
Estimated catchment population	3,046,147
% total population covered	29%
Type of participating hospitals	
University/Tertiary	26%
General/Secondary	74%
Other	0%

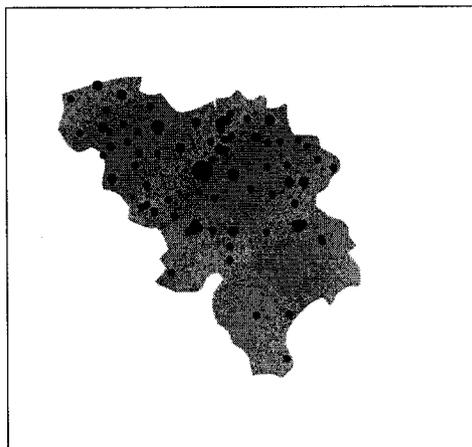


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	92	846	47	442	0	0	0	0	0	0	0	0
2000	90	909	42	657	0	0	0	0	0	0	0	0
2001	89	1093	47	941	23	226	19	42	0	0	0	0
2002	98	1210	48	1092	27	1184	23	205	0	0	0	0
2003	107	1488	47	1133	24	1326	16	146	0	0	0	0
2004	95	1443	49	1227	25	1601	18	228	0	0	0	0
2005	97	1539	41	1048	25	1592	19	224	0	0	0	0

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	4	5	<1	<1	<1	<1	3
	Penicillin I+R	13	16	13	14	12	9	12
	Macrolides I+R	31	34	35	34	34	33	31
<i>S. aureus</i>	Oxacillin/Methicillin R	23	21	23	28	29	33	31
<i>E. coli</i>	Aminopenicillins R	.	.	53	47	50	50	53
	Aminoglycosides R	.	.	4	6	5	5	4
	Fluoroquinolones R	.	.	9	13	12	15	17
	3rd gen. Cephalosporins R	.	.	2	3	3	3	4
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	<1	<1	1	2	<1
	HL Aminoglycosides R	.	.	20	20	17	22	26
	Glycopeptides R	.	.	<1	<1	1	<1	<1
<i>E. faecium</i>	Aminopenicillins I+R	.	.	60	56	78	63	61
	HL Aminoglycosides R	.	.	<1	5	<1	11	22
	Glycopeptides R	.	.	<1	<1	<1	5	14
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	.
	Fluoroquinolones R	.	.	.	.	.	.	.
	3rd gen. Cephalosporins R	.	.	.	.	.	.	.
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	.
	Ceftazidime R	.	.	.	.	.	.	.
	Carbapenems R	.	.	.	.	.	.	.
	Aminoglycosides R	.	.	.	.	.	.	.
	Fluoroquinolones R	.	.	.	.	.	.	.

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=2982		<i>S. aureus</i> n=2275		<i>E. coli</i> n=2794		<i>E. faecalis</i> n=363		<i>E. faecium</i> n=85		<i>K. pneumo.</i> n=0		<i>P. aeruginosa</i> n=0	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	96	11	100	32	100	16	100	0	100	9				
CSF	4	11	0		0		0		0					
Gender														
Male	53	11	59	32	42	16	61	0	55	11				
Female	46	10	41	33	57	16	37	0	41	6				
Unknown	2	12	1	12	1	21	2	0	4	33				
Age (years)														
0-4	20	15	4	8	3	8	6	0	5	0				
5-19	6	5	2	6	1	10	1	0	0					
20-64	32	6	32	26	26	16	29	0	32	4				
65 and over	42	13	60	39	71	16	64	0	64	13				
Unknown	0		1	16	0		0		0					
Hospital dep.														
ICU	13	11	17	40	2	21	24	0	25	5				
Internal Med.	32	10	35	30	7	19	31	0	29	4				
Surgery	2	4	12	34	2	31	8	0	2	0				
Other	31	11	28	31	9	17	25	0	35	13				
Unknown	21	11	8	31	80	15	12	0	8	29				

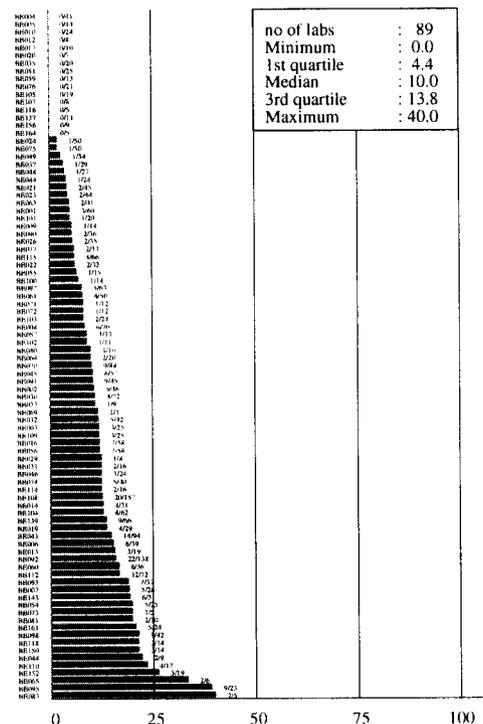
PNSP = Penicillin Non-Susceptible *S. pneumoniae*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

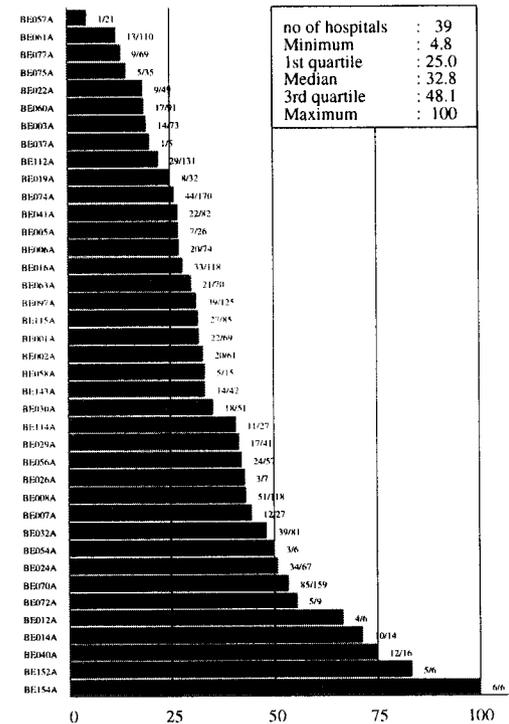
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Bulgaria

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	23/23
Hosps providing denom.data/ reporting data to EARSS	23/24
Number of blood culture sets	23,063
Number of hospital beds	10,703
Patient-days	2,630,314
Average occupancy rate (%)	82%
Median length of stay (days)	7
Estimated catchment population	5,778,683
% total population covered	77%
Type of participating hospitals	
University/Tertiary	35%
General/Secondary	48%
Other	17%

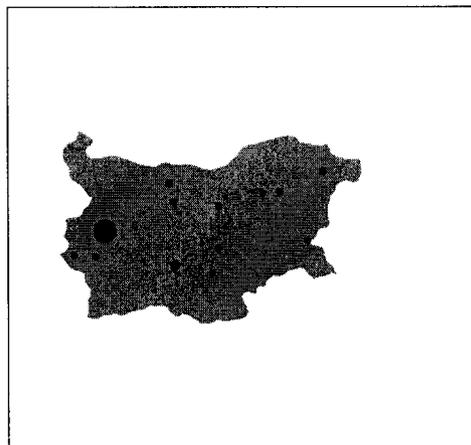


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	8	13	16	111	0	0	0	0	0	0	0	0
2001	8	16	17	103	15	98	11	30	0	0	0	0
2002	11	25	21	116	20	135	16	42	0	0	0	0
2003	13	22	20	157	20	158	16	49	0	0	0	0
2004	13	32	22	169	20	167	16	75	0	0	0	0
2005	16	43	26	160	23	203	21	95	15	34	9	34

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R		23	6	8	9	22	30
	Penicillin I+R		23	6	8	14	22	33
	Macrolides I+R		25	9	9	11	17	8
<i>S. aureus</i>	Oxacillin/Methicillin R		37	27	33	31	24	31
<i>E. coli</i>	Aminopenicillins R			48	52	54	64	69
	Aminoglycosides R			15	17	22	20	24
	Fluoroquinolones R			8	14	19	24	29
	3rd gen. Cephalosporins R			7	13	18	22	28
<i>E. faecalis</i>	Aminopenicillins I+R			5	26	7	15	8
	HL Aminoglycosides R			30	63	36	33	24
	Glycopeptides R			<1	<1	<1	2	<1
<i>E. faecium</i>	Aminopenicillins I+R			50	71	60	59	96
	HL Aminoglycosides R			33	83	60	62	56
	Glycopeptides R			<1	<1	<1	<1	<1
	3rd gen. Cephalosporins R							
<i>K. pneumoniae</i>	Aminoglycosides R							53
	Fluoroquinolones R							26
	3rd gen. Cephalosporins R							50
<i>P. aeruginosa</i>	Piperacillin R							50
	Ceftazidime R							45
	Carbapenems R							38
	Aminoglycosides R							53
	Fluoroquinolones R							47

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=75		<i>S. aureus</i> n=329		<i>E. coli</i> n=359		<i>E. faecalis</i> n=116		<i>E. faecium</i> n=49		<i>K. pneumo.</i> n=34		<i>P. aeruginosa</i> n=32	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	63	30	100	27	98	26	100	1	100	0	100	50	100	38
CSF	37	25	0	0	2	43	0	0	0	0	0	0	0	0
Gender														
Male	53	28	62	29	53	31	61	1	63	0	74	52	59	47
Female	47	29	38	24	47	21	39	0	37	0	26	44	41	23
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Age (years)														
0-4	9	57	10	25	7	12	11	0	16	0	6	50	6	0
5-19	5	0	5	20	2	25	1	0	2	0	3	100	0	0
20-64	57	26	56	28	46	27	50	2	47	0	56	58	56	28
65 and over	28	29	29	28	45	28	38	0	35	0	35	33	38	58
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital dep.														
ICU	19	29	14	44	12	39	15	0	24	0	15	60	34	36
Internal Med.	36	30	38	16	46	18	40	2	16	0	29	30	13	25
Surgery	1	0	14	40	13	35	11	0	16	0	21	43	13	0
Other	44	27	34	27	29	30	34	0	43	0	35	67	41	54
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0

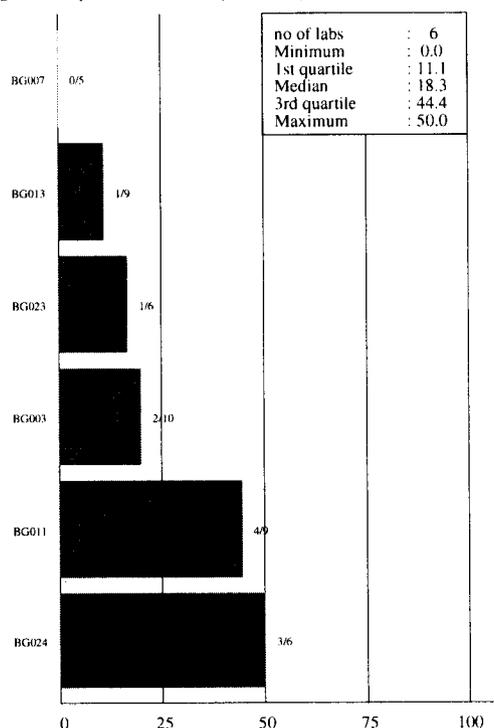
PNSP = Penicillin Non-Susceptible *S. pneumonia*
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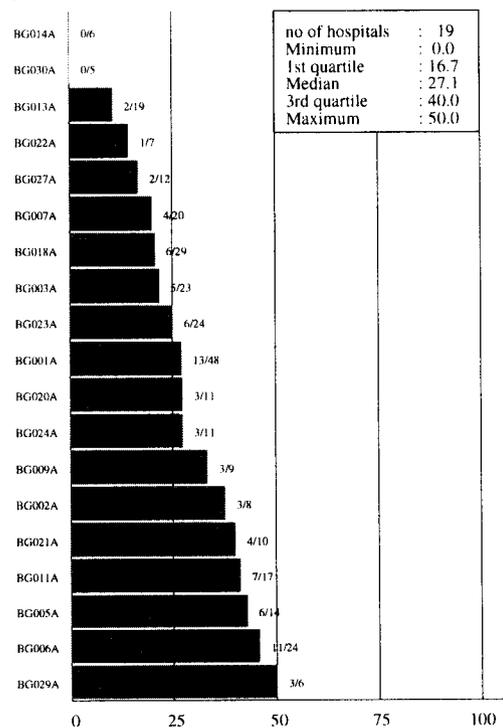
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Croatia

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	15/15
Hosps providing denom.data/ reporting data to EARSS	15/16
Number of blood culture sets	44,013
Number of hospital beds	8,431
Patient-days	2,780,926
Average occupancy rate (%)	90%
Median length of stay (days)	8
Estimated catchment population	3,600,000
% total population covered	80%
Type of participating hospitals	
University/Tertiary	27%
General/Secondary	73%
Other	0%

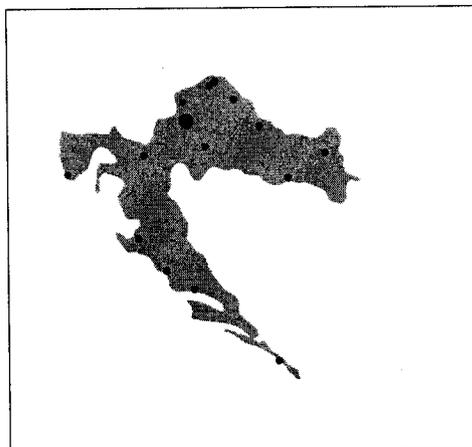


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	10	20	14	149	13	182	7	33	0	0	0	0
2002	14	90	14	279	15	490	13	96	0	0	0	0
2003	12	88	14	360	16	570	11	101	0	0	0	0
2004	12	103	13	392	14	535	11	115	0	0	0	0
2005	15	129	17	354	16	638	11	120	14	112	10	72

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	.	.	<1	<1	1	3	<1
	Penicillin I+R	.	.	15	19	20	17	17
	Macrolides I+R	.	.	15	23	18	19	17
<i>S. aureus</i>	Oxacillin/Methicillin R	.	.	32	37	37	38	37
	Aminopenicillins R	.	.	51	47	46	45	46
<i>E. coli</i>	Aminoglycosides R	.	.	6	7	7	6	5
	Fluoroquinolones R	.	.	5	5	7	8	9
	3rd gen. Cephalosporins R	.	.	2	3	4	3	<1
	Aminopenicillins I+R	.	.	13	5	4	5	6
<i>E. faecalis</i>	HL Aminoglycosides R	.	.	50	40	28	35	31
	Glycopeptides R	.	.	3	<1	<1	<1	1
	Aminopenicillins I+R	.	.	100	56	47	69	82
<i>E. faecium</i>	HL Aminoglycosides R	.	.	100	67	41	63	62
	Glycopeptides R	.	.	<1	22	6	3	6
	Aminoglycosides R	.	.	.	.	.	.	38
<i>K. pneumoniae</i>	Fluoroquinolones R	.	.	.	.	.	.	18
	3rd gen. Cephalosporins R	.	.	.	.	.	.	46
	Piperacillin R	.	.	.	.	.	.	25
<i>P. aeruginosa</i>	Ceftazidime R	.	.	.	.	.	.	6
	Carbapenems R	.	.	.	.	.	.	24
	Aminoglycosides R	.	.	.	.	.	.	35
	Fluoroquinolones R	.	.	.	.	.	.	34

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=232		<i>S. aureus</i> n=746		<i>E. coli</i> n=1171		<i>E. faecalis</i> n=171		<i>E. faecium</i> n=64		<i>K. pneumo.</i> n=112		<i>P. aeruginosa</i> n=72	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	97	16	100	38	100	8	100	1	100	5	100	46	100	24
CSF	3	33	0	.	0	.	0	.	0	.	0	.	0	.
Gender														
Male	59	18	63	38	41	10	63	1	64	2	64	50	63	22
Female	41	15	37	38	59	7	36	0	36	9	36	38	38	26
Unknown	0	.	0	.	0	.	1	0	0	.	0	.	0	.
Age (years)														
0-4	22	22	3	12	5	4	8	0	6	25	24	70	3	50
5-19	8	11	4	21	1	0	6	10	0	.	0	.	3	0
20-64	41	13	46	35	37	9	43	0	47	7	42	38	49	26
65 and over	30	20	47	43	57	8	43	0	47	0	34	37	46	21
Unknown	0	.	0	.	0	.	0	.	0	.	0	.	0	.
Hospital dep.														
ICU	15	9	17	59	8	6	16	0	14	0	14	50	28	20
Internal Med.	22	24	38	26	37	8	35	0	48	6	21	21	33	17
Surgery	1	50	13	70	3	14	17	0	11	0	13	43	18	46
Other	63	16	32	27	53	9	32	2	27	6	52	55	21	20
Unknown	0	.	0	.	0	.	0	.	0	.	0	.	0	.

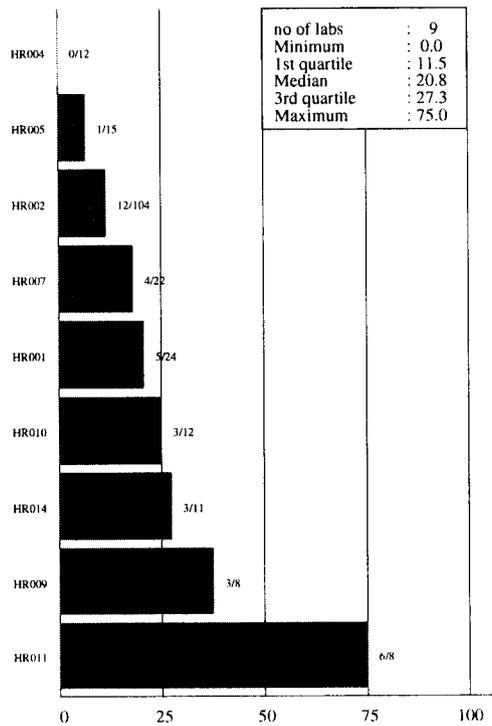
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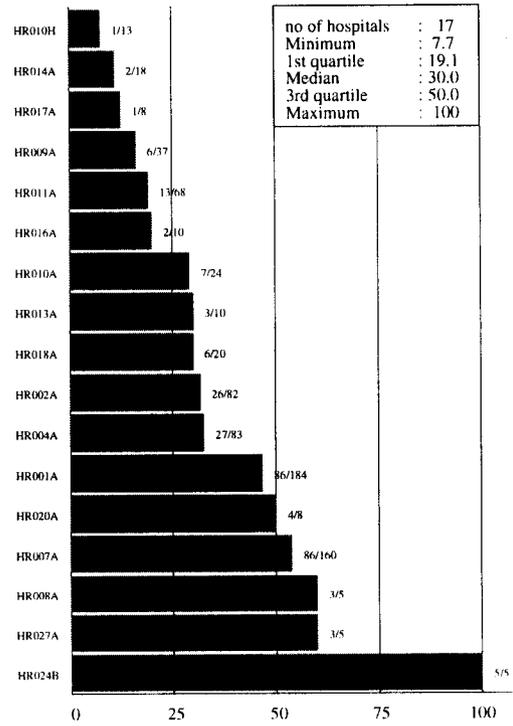
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Cyprus

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	4/5
Hosps providing denom.data/ reporting data to EARSS	5/5
Number of blood culture sets	6,369
Number of hospital beds	1,153
Patient-days	313,037
Average occupancy rate (%)	74%
Median length of stay (days)	5
Estimated catchment population	800,000
% total population covered	100%
Type of participating hospitals	
University/Tertiary	20%
General/Secondary	80%
Other	0%

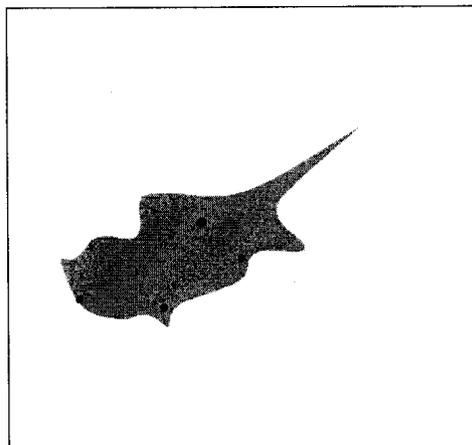


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	1	3	1	28	1	19	1	28	0	0	0	0
2004	1	7	3	39	4	46	3	38	0	0	0	0
2005	4	16	5	54	5	74	3	40	4	9	4	8

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	.	.	.	.	<1	<1	<1
	Penicillin I+R	.	.	.	.	<1	14	19
	Macrolides I+R	.	.	.	.	33	<1	13
<i>S. aureus</i>	Oxacillin/Methicillin R	.	.	.	.	64	49	56
<i>E. coli</i>	Aminopenicillins R	.	.	.	.	63	61	73
	Aminoglycosides R	.	.	.	.	11	11	14
	Fluoroquinolones R	.	.	.	.	32	22	29
	3rd gen. Cephalosporins R	.	.	.	.	11	9	16
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	.	.	<1	3	3
	HL Aminoglycosides R	.	.	.	.	43	77	71
	Glycopeptides R	.	.	.	.	<1	3	<1
<i>E. faecium</i>	Aminopenicillins I+R	.	.	.	.	100	100	80
	HL Aminoglycosides R	.	.	.	.	.	33	<1
	Glycopeptides R	.	.	.	.	<1	33	40
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	11
	Fluoroquinolones R	.	.	.	.	.	.	22
	3rd gen. Cephalosporins R	.	.	.	.	.	.	33
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	13
	Ceftazidime R	.	.	.	.	.	.	38
	Carbapenems R	.	.	.	.	.	.	13
	Aminoglycosides R	.	.	.	.	.	.	13
	Fluoroquinolones R	.	.	.	.	.	.	13

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=23		<i>S. aureus</i> n=93		<i>E. coli</i> n=118		<i>E. faecalis</i> n=70		<i>E. faecium</i> n=8		<i>K. pneumo.</i> n=9		<i>P. aeruginosa</i> n=8	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	70	19	100	53	100	26	100	1	100	38	100	33	100	13
CSF	30	14	0	0	0	0	0	0	0	0	0	0	0	0
Gender														
Male	57	23	66	51	50	37	60	0	63	20	78	29	88	14
Female	43	10	34	56	48	16	40	4	38	67	22	50	13	0
Unknown	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Age (years)														
0-4	9	0	4	0	3	0	0	0	0	0	0	0	0	0
5-19	9	50	2	50	3	33	0	0	0	0	0	0	0	0
20-64	4	0	6	33	11	31	1	0	13	100	0	0	0	0
65 and over	4	0	8	57	11	31	9	0	13	0	11	100	25	0
Unknown	74	18	80	57	72	26	90	2	75	33	89	25	75	17
Hospital dep.														
ICU	4	0	18	65	8	40	17	0	13	0	33	0	25	0
Internal Med.	70	19	35	45	52	26	37	0	25	50	56	40	38	0
Surgery	0	0	16	60	5	33	27	0	50	25	0	0	25	50
Other	26	17	30	50	33	23	19	8	13	100	11	100	13	0
Unknown	0	0	0	0	2	0	0	0	0	0	0	0	0	0

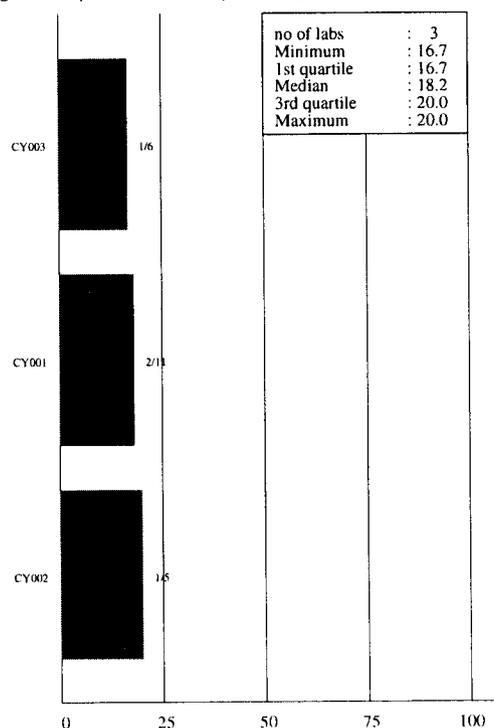
PNSP = Penicillin Non-Susceptible *S. pneumonia*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

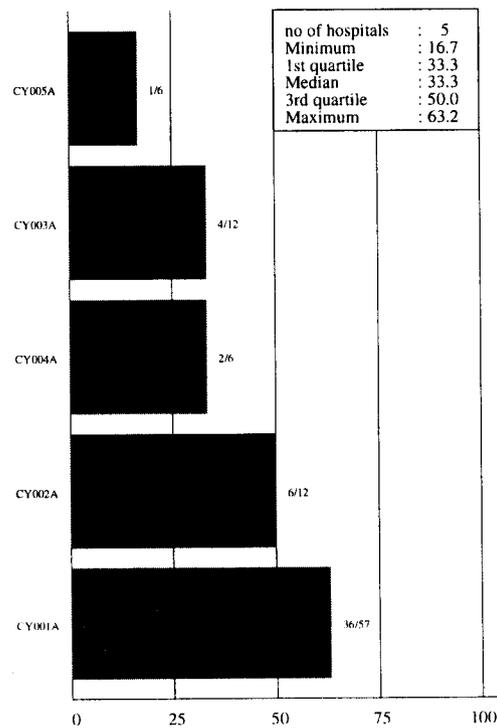
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Czech Republic

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2005, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	48/48
Hosps providing denom.data/ reporting data to EARSS	82/82
Number of blood culture sets	127,520
Number of hospital beds	44,180
Patient-days	12,365,539
Average occupancy rate (%)	79%
Median length of stay (days)	8
Estimated catchment population	9,298,105
% total population covered	91%
Type of participating hospitals	
University/Tertiary	27%
General/Secondary	67%
Other	6%

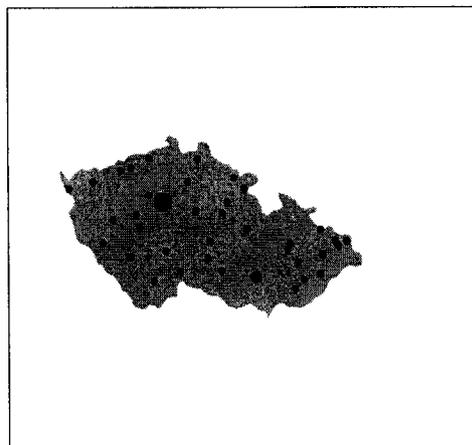


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	26	111	31	515	0	0	0	0	0	0	0	0
2001	32	154	39	1074	36	1176	34	461	0	0	0	0
2002	34	144	41	1168	40	1587	39	587	0	0	0	0
2003	32	204	45	1387	43	1766	44	630	0	0	0	0
2004	37	162	45	1444	44	1966	41	660	0	0	0	0
2005	39	194	47	1553	47	2234	45	758	37	478	36	257

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R		<1	<1	<1	<1	2	<1
	Penicillin I+R		4	7	8	2	6	4
	Macrolides I+R		1	2	4	2	4	2
<i>S. aureus</i>	Oxacillin/Methicillin R		4	6	6	6	9	13
	<i>E. coli</i>			42	45	45	47	50
<i>E. coli</i>	Aminopenicillins R			6	6	5	5	6
	Aminoglycosides R			8	10	13	16	20
	Fluoroquinolones R			2	1	1	2	2
	3rd gen. Cephalosporins R			3	2	4	<1	<1
<i>E. faecalis</i>	Aminopenicillins I+R			38	39	44	43	45
	HL Aminoglycosides R			2	<1	<1	<1	<1
	Glycopeptides R			67	73	80	81	92
<i>E. faecium</i>	Aminopenicillins I+R			33	35	48	43	69
	HL Aminoglycosides R			2	9	3	3	14
	Glycopeptides R							36
<i>K. pneumoniae</i>	Aminoglycosides R							38
	Fluoroquinolones R							32
	3rd gen. Cephalosporins R							21
<i>P. aeruginosa</i>	Piperacillin R							40
	Ceftazidime R							31
	Carbapenems R							28
	Aminoglycosides R							45
	Fluoroquinolones R							

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=356		<i>S. aureus</i> n=2997		<i>E. coli</i> n=4198		<i>E. faecalis</i> n=1101		<i>E. faecium</i> n=317		<i>K. pneumo.</i> n=478		<i>P. aeruginosa</i> n=257	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	83	5	100	11	100	18	100	0	100	10	99	32	99	31
CSF	17	5	0	0	0	0	0	0	0	0	1	75	1	50
Gender														
Male	65	4	60	11	41	21	64	0	53	8	60	35	63	34
Female	35	6	40	10	59	16	36	0	47	13	40	29	37	27
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Age (years)														
0-4	9	0	4	2	2	4	4	0	1	0	5	35	8	5
5-19	6	5	3	3	1	15	1	0	1	0	1	20	2	33
20-64	54	5	44	10	32	17	44	0	52	13	42	35	43	33
65 and over	31	6	49	13	65	19	50	0	46	7	51	30	47	34
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital dep.														
ICU	24	4	21	17	16	21	38	0	34	2	32	39	37	41
Internal Med.	43	6	49	9	54	19	32	0	24	6	40	26	30	22
Surgery	2	0	12	12	8	17	10	0	8	0	11	19	7	26
Other	31	4	18	9	22	15	20	0	34	23	17	44	26	29
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0

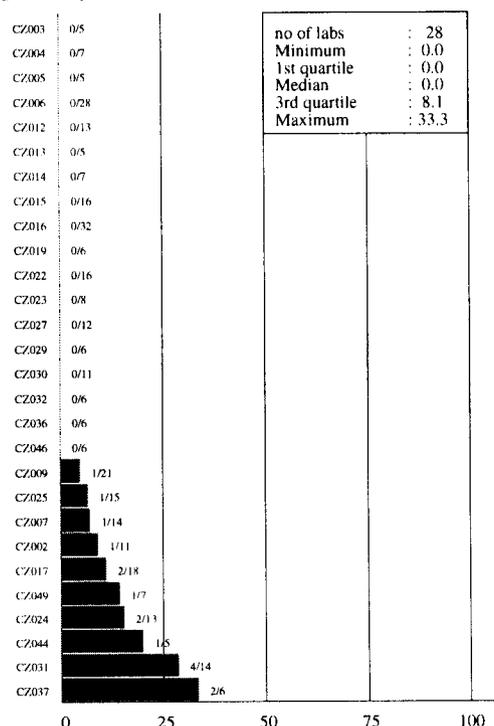
PNSP = Penicillin Non-Susceptible *S. pneumoniae*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

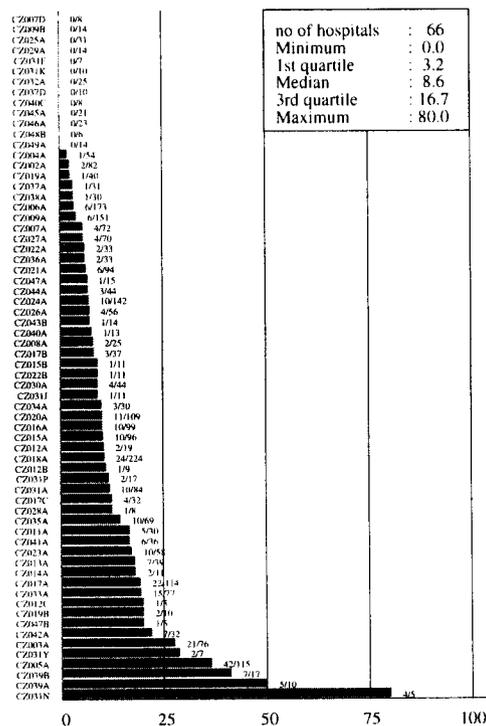
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Denmark

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2005, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	15/15
Hosps providing denom.data/ reporting data to EARSS	na
Number of blood culture sets	na
Number of hospital beds	na
Patient-days	na
Average occupancy rate (%)	na
Median length of stay (days)	na
Estimated catchment population	5,150,000 [*]
% total population covered	95% [*]
Type of participating hospitals	
University/Tertiary	na
General/Secondary	na
Other	na

* Except for *E. coli* : 1,940,000 (36%).

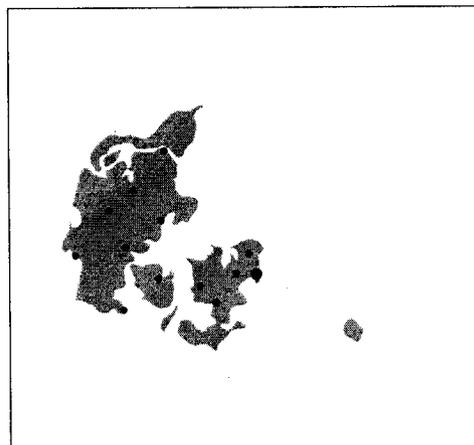


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	5	718	0	0	0	0	0	0	0	0
2000	5	410	4	501	0	0	0	0	0	0	0	0
2001	5	506	4	520	0	0	0	0	0	0	0	0
2002	5	366	5	752	0	0	0	0	0	0	0	0
2003	5	606	5	671	0	0	0	0	0	0	0	0
2004	15	1188	15	1436	0	0	0	0	0	0	0	0
2005	14	1081	15	1350	5	1283	0	0	0	0	0	0

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	.	<1	<1	<1	<1	<1	<1
	Penicillin I+R	.	4	3	4	3	3	4
	Macrolides I+R	.	5	5	5	5	5	6
<i>S. aureus</i>	Oxacillin/Methicillin R	<1	<1	<1	<1	<1	1	2
<i>E. coli</i>	Aminopenicillins R	.	.	.	.	.	.	39
	Aminoglycosides R	.	.	.	.	.	.	2
	Fluoroquinolones R	.	.	.	.	.	.	5
	3rd gen. Cephalosporins R	.	.	.	.	.	.	1
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	.	.	.	.	.
	HL Aminoglycosides R	.	.	.	.	.	.	.
	Glycopeptides R	.	.	.	.	.	.	.
<i>E. faecium</i>	Aminopenicillins I+R	.	.	.	.	.	.	.
	HL Aminoglycosides R	.	.	.	.	.	.	.
	Glycopeptides R	.	.	.	.	.	.	.
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	.
	Fluoroquinolones R	.	.	.	.	.	.	.
	3rd gen. Cephalosporins R	.	.	.	.	.	.	.
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	.
	Ceftazidime R	.	.	.	.	.	.	.
	Carbapenems R	.	.	.	.	.	.	.
	Aminoglycosides R	.	.	.	.	.	.	.
	Fluoroquinolones R	.	.	.	.	.	.	.

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=2269		<i>S. aureus</i> n=2786		<i>E. coli</i> n=758		<i>E. faecalis</i> n=0		<i>E. faecium</i> n=0		<i>K. pneumo.</i> n=0		<i>P. aeruginosa</i> n=0	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	92	4	100	1	100	5								
CSF	8	5	0		0									
Gender														
Male	49	3	60	2	44	5								
Female	51	4	37	1	56	4								
Unknown	0		3	1	0									
Age (years)														
0-4	8	5	4	1	1	0								
5-19	3	3	3	1	1	0								
20-64	37	3	37	1	28	7								
65 and over	53	4	56	2	70	4								
Unknown	0		0		0									
Hospital dep.														
ICU	0		4	2	3	9								
Internal Med.	0		38	1	49	5								
Surgery	0		15	3	20	3								
Other	0		15	1	28	5								
Unknown	100	4	29	1	0									

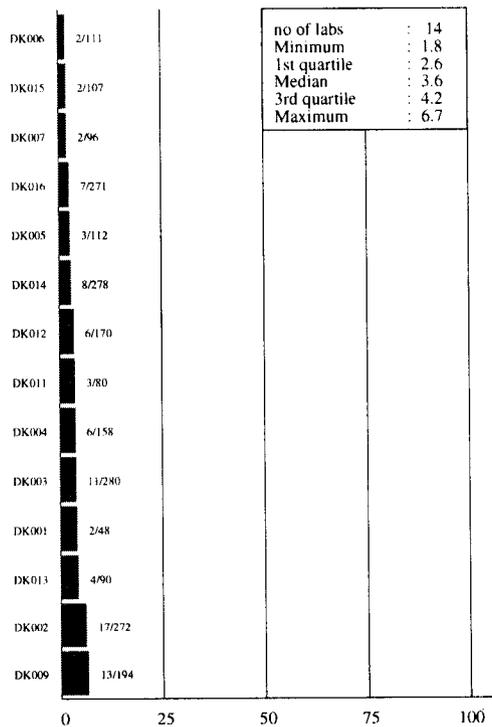
PNSP = Penicillin Non-Susceptible *S. pneumoniae*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

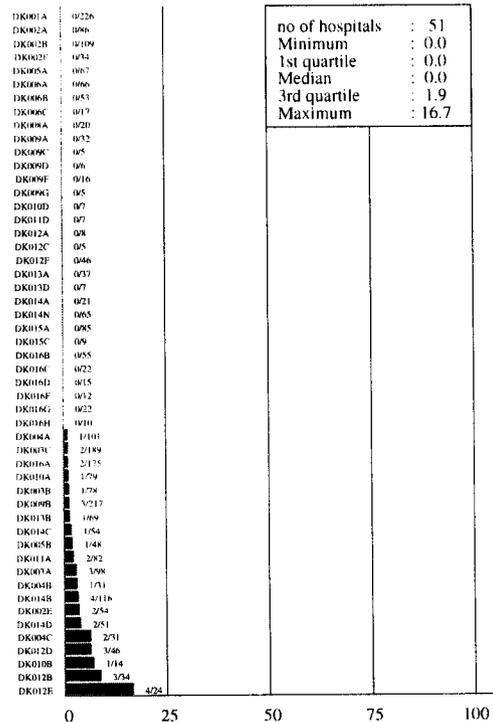
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Estonia

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	10/10
Hosps providing denom.data/ reporting data to EARSS	12/13
Number of blood culture sets	6,127
Number of hospital beds	4,995
Patient-days	1,326,411
Average occupancy rate (%)	73%
Median length of stay (days)	7
Estimated catchment population	1,300,000
% total population covered	100%
Type of participating hospitals	
University/Tertiary	33%
General/Secondary	67%
Other	0%

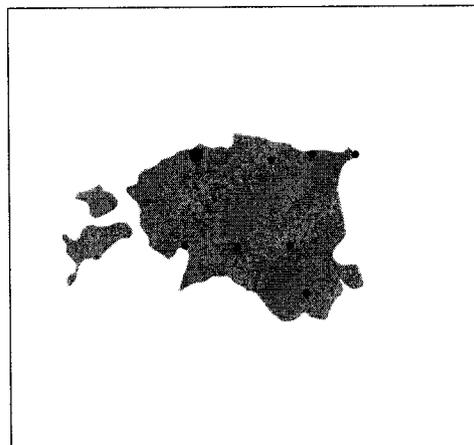


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	20	6	79	4	52	4	21	0	0	0	0
2002	5	21	8	81	6	67	3	13	0	0	0	0
2003	8	26	9	98	9	98	6	27	0	0	0	0
2004	6	40	9	104	10	166	5	63	0	0	0	0
2005	7	53	8	141	10	156	7	66	7	38	5	38

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	.	.	<1	<1	<1	<1	<1
	Penicillin I+R	.	.	<1	<1	<1	<1	2
	Macrolides I+R	.	.	5	<1	10	6	<1
<i>S. aureus</i>	Oxacillin/Methicillin R	.	.	5	1	4	5	2
	<i>E. coli</i>							
<i>E. coli</i>	Aminopenicillins R	.	.	43	42	42	55	45
	Aminoglycosides R	.	.	8	10	3	2	4
	Fluoroquinolones R	.	.	<1	5	5	6	5
	3rd gen. Cephalosporins R	.	.	6	2	1	4	1
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	8	10	4	14	14
	HL Aminoglycosides R	.	.	<1	50	22	32	50
	Glycopeptides R	.	.	<1	<1	<1	<1	<1
<i>E. faecium</i>	Aminopenicillins I+R	.	.	63	33	75	79	83
	HL Aminoglycosides R	.	.	63	67	50	79	74
	Glycopeptides R	.	.	<1	<1	<1	<1	<1
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	8
	Fluoroquinolones R	.	.	.	.	.	.	<1
	3rd gen. Cephalosporins R	.	.	.	.	.	.	8
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	27
	Ceftazidime R	.	.	.	.	.	.	18
	Carbapenems R	.	.	.	.	.	.	38
	Aminoglycosides R	.	.	.	.	.	.	28
	Fluoroquinolones R	.	.	.	.	.	.	14

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=93		<i>S. aureus</i> n=245		<i>E. coli</i> n=306		<i>E. faecalis</i> n=79		<i>E. faecium</i> n=41		<i>K. pneumo.</i> n=37		<i>P. aeruginosa</i> n=37	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	78	1	100	3	98	6	100	0	100	0	100	8	100	38
CSF	22	0	0	.	2	0	0	.	0	.	0	.	0	.
Gender														
Male	57	2	58	4	36	8	62	0	46	0	46	12	73	41
Female	42	0	40	2	62	5	37	0	49	0	46	6	24	33
Unknown	1	0	2	0	2	0	1	0	5	0	8	0	3	0
Age (years)														
0-4	9	0	10	0	5	0	18	0	20	0	16	17	5	0
5-19	6	0	6	0	3	0	1	0	5	0	0	.	8	67
20-64	47	2	50	5	43	5	35	0	44	0	46	6	41	73
65 and over	32	0	29	3	45	8	41	0	29	0	38	7	46	6
Unknown	5	0	5	0	4	8	5	0	2	0	0	.	0	.
Hospital dep.														
ICU	31	3	21	2	17	10	32	0	24	0	32	8	59	36
Internal Med.	25	0	31	5	36	5	18	0	12	0	22	0	11	0
Surgery	4	0	12	0	9	7	6	0	12	0	0	.	0	.
Other	39	0	36	3	38	5	43	0	51	0	46	12	30	55
Unknown	1	0	0	.	1	0	1	0	0	.	0	.	0	.

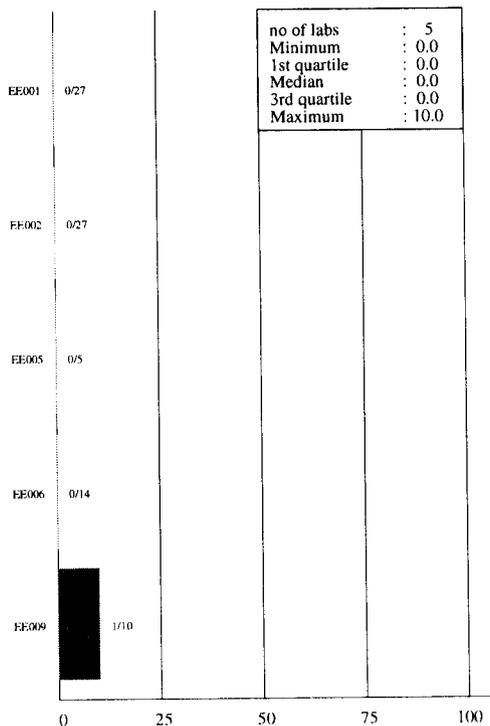
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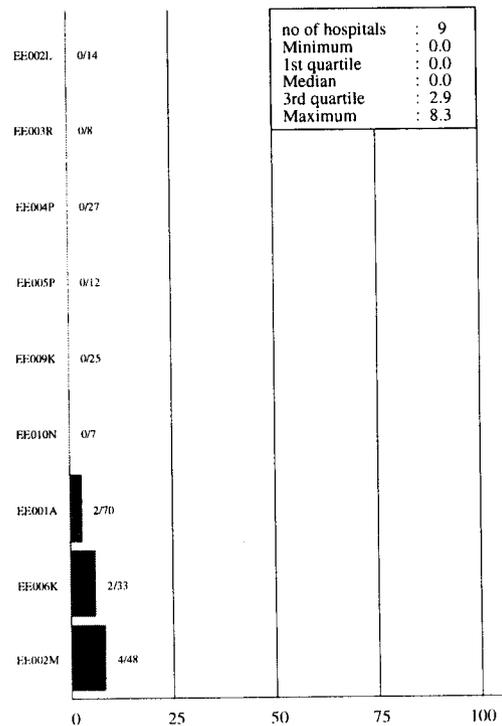
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Finland

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	15/17
Hosps providing denom.data/ reporting data to EARSS	15/17
Number of blood culture sets	158,679
Number of hospital beds	10,561
Patient-days	3,257,496
Average occupancy rate (%)	86%
Median length of stay (days)	5
Estimated catchment population	4,531,969
% total population covered	87%
Type of participating hospitals	
University/Tertiary	27%
General/Secondary	73%
Other	0%

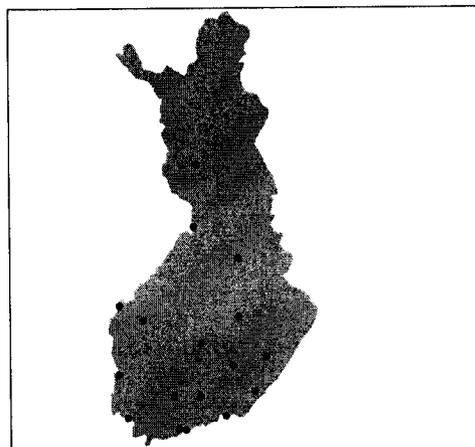


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	14	242	13	316	0	0	0	0	0	0	0	0
2000	9	176	12	362	0	0	0	0	0	0	0	0
2001	13	425	13	606	14	1284	13	274	0	0	0	0
2002	15	453	15	721	15	1330	14	278	0	0	0	0
2003	16	490	16	727	15	1450	15	266	0	0	0	0
2004	17	508	17	882	17	1749	17	336	0	0	0	0
2005	16	525	17	790	17	1924	17	341	14	175	13	108

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	<1	<1	1	2	2	<1	<1
	Penicillin I+R	4	5	9	6	10	8	7
	Macrolides I+R	6	8	12	14	20	20	20
<i>S. aureus</i>	Oxacillin/Methicillin R	<1	1	<1	<1	1	3	3
	<i>E. coli</i>			33	30	33	33	35
<i>E. coli</i>	Aminopenicillins R	.	.	<1	<1	1	2	2
	Aminoglycosides R	.	.	5	6	5	7	7
	Fluoroquinolones R	.	.	<1	<1	<1	2	2
	3rd gen. Cephalosporins R	.	.	1	2	<1	<1	<1
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	23	13	39	38	27
	HL Aminoglycosides R	.	.	<1	<1	<1	<1	<1
	Glycopeptides R	.	.	66	80	79	69	78
<i>E. faecium</i>	Aminopenicillins I+R	.	.	<1	<1	4	12	1
	HL Aminoglycosides R	.	.	<1	1	<1	<1	<1
	Glycopeptides R	.	.	.	.	.	.	3
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	3
	Fluoroquinolones R	.	.	.	.	.	.	2
	3rd gen. Cephalosporins R	.	.	.	.	.	.	8
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	5
	Ceftazidime R	.	.	.	.	.	.	15
	Carbapenems R	.	.	.	.	.	.	11
	Aminoglycosides R	.	.	.	.	.	.	16
	Fluoroquinolones R	.	.	.	.	.	.

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=1033		<i>S. aureus</i> n=1672		<i>E. coli</i> n=3396		<i>E. faecalis</i> n=422		<i>E. faecium</i> n=210		<i>K. pneumo.</i> n=175		<i>P. aeruginosa</i> n=99	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	96	8	100	3	100	7	100	0	100	0	100	2	99	15
CSF	4	2	0	.	0	.	0	.	0	.	0	.	1	0
Gender														
Male	55	8	61	4	35	8	65	0	59	0	49	2	68	10
Female	45	8	39	2	65	7	35	0	41	0	51	2	32	25
Unknown	0	.	0	.	0	.	0	.	0	.	0	.	0	.
Age (years)														
0-4	15	11	5	4	2	1	6	0	2	0	2	33	1	0
5-19	4	15	5	2	1	6	0	.	1	0	2	0	1	0
20-64	49	6	43	3	31	7	31	0	38	0	37	3	39	18
65 and over	32	8	47	3	66	8	63	0	60	0	59	1	59	14
Unknown	0	.	0	.	0	.	0	.	0	.	0	.	0	.
Hospital dep.														
ICU	1	8	3	9	1	13	7	0	3	0	1	0	5	40
Internal Med.	7	7	14	4	10	4	12	0	11	0	17	0	7	29
Surgery	1	0	7	5	4	5	9	0	17	0	11	0	5	0
Other	36	8	28	2	32	8	28	0	27	0	21	3	27	30
Unknown	55	7	49	3	53	7	44	0	43	0	50	3	56	5

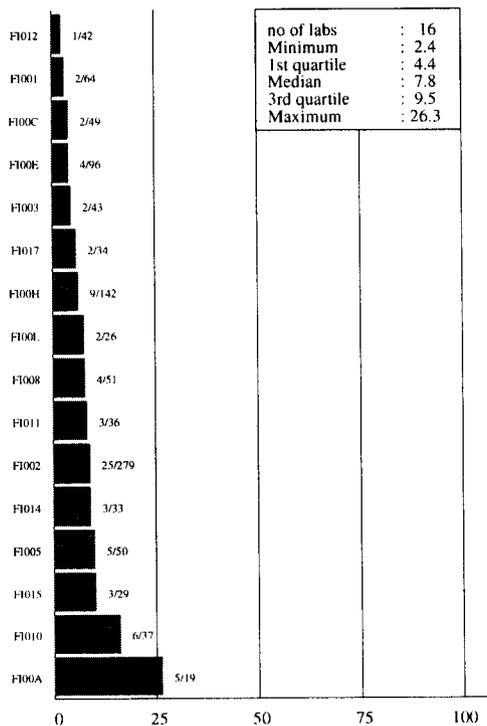
PNSP = Penicillin Non-Susceptible *S. pneumonia*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
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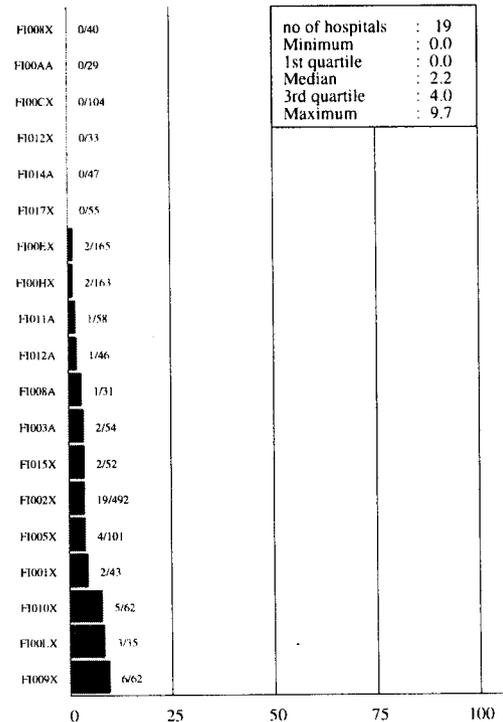
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



France

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	26/50
Hosps providing denom.data/ reporting data to EARSS	50/50
Number of blood culture sets	213,456
Number of hospital beds	29,009
Patient-days	8,149,296
Average occupancy rate (%)	77%
Median length of stay (days)	6
Estimated catchment population	na
% total population covered	na
Type of participating hospitals	
University/Tertiary	34%
General/Secondary	60%
Other	6%

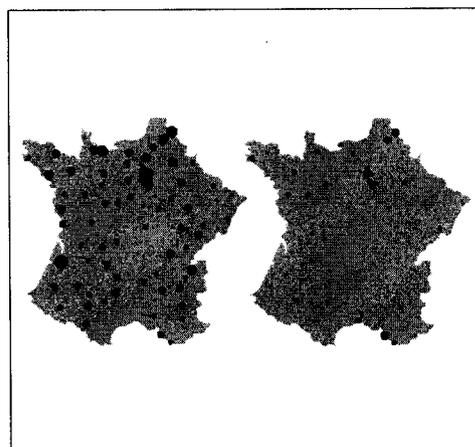


Figure 1. Geographic distribution of laboratories in 2005 (left: reporting on *S. pneumoniae*, right: reporting on all other pathogens)

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	329	1337	21	1714	0	0	0	0	0	0	0	0
2002	296	1132	21	1663	21	2495	21	467	0	0	0	0
2003	403	1389	21	1708	21	2267	21	483	0	0	0	0
2004	403	515*	50	3347	50	5678	50	882	0	0	0	0
2005	195	632**	50	3483	50	6056	47	1023	49	839	48	993

* First half of 2004 ** First half of 2005

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	.	.	11	8	.	.	5
	Penicillin I+R	.	.	47	48	43	39	36
	Macrolides I+R	.	.	49	53	48	45	41
<i>S. aureus</i>	Oxacillin/Methicillin R	.	.	33	33	29	29	27
	<i>E. coli</i>							
<i>E. coli</i>	Aminopenicillins R	.	.	.	52	50	47	50
	Aminoglycosides R	.	.	.	4	5	4	5
	Fluoroquinolones R	.	.	.	8	9	8	11
	3rd gen. Cephalosporins R	.	.	.	<1	<1	<1	1
	<i>E. faecalis</i>							
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	.	5	3	1	<1
	HL Aminoglycosides R	.	.	.	15	16	17	15
	Glycopeptides R	.	.	.	<1	<1	<1	<1
<i>E. faecium</i>	Aminopenicillins I+R	.	.	.	34	30	56	64
	HL Aminoglycosides R	.	.	.	10	23	21	24
	Glycopeptides R	.	.	.	2	<1	5	2
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	5
	Fluoroquinolones R	.	.	.	.	.	.	7
	3rd gen. Cephalosporins R	.	.	.	.	.	.	4
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	15
	Ceftazidime R	.	.	.	.	.	.	9
	Carbapenems R	.	.	.	.	.	.	14
	Aminoglycosides R	.	.	.	.	.	.	22
	Fluoroquinolones R	.	.	.	.	.	.	27

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=2469		<i>S. aureus</i> n=6830		<i>E. coli</i> n=11668		<i>E. faecalis</i> n=1472		<i>E. faecium</i> n=355		<i>K. pneumo.</i> n=824		<i>P. aeruginosa</i> n=984	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	77	48	100	28	100	10	100	0	100	3	100	4	100	14
CSF	23	46	0	0	0	0	0	0	0	0	0	0	0	0
Gender														
Male	54	33	60	27	44	11	63	0	62	4	58	5	60	14
Female	45	41	37	30	53	9	34	0	35	3	39	3	38	14
Unknown	1	33	3	23	3	6	2	0	3	0	2	0	2	24
Age (years)														
0-4	29	60	3	14	3	3	3	0	3	0	3	4	2	0
5-19	6	26	3	7	1	5	1	0	2	0	1	9	2	14
20-64	30	37	40	20	33	9	37	0	40	3	43	6	43	20
65 and over	34	49	53	36	62	10	58	0	54	4	52	3	53	10
Unknown	1	90	1	32	0	0	1	0	1	0	0	0	0	0
Hospital dep.														
ICU	0	0	17	30	9	12	25	0	23	4	15	8	25	24
Internal Med.	100	36	35	30	31	10	30	0	32	2	35	4	29	11
Surgery	0	0	15	29	12	11	17	0	15	4	16	2	14	14
Other	0	0	32	25	48	9	29	0	30	5	35	3	32	10
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0

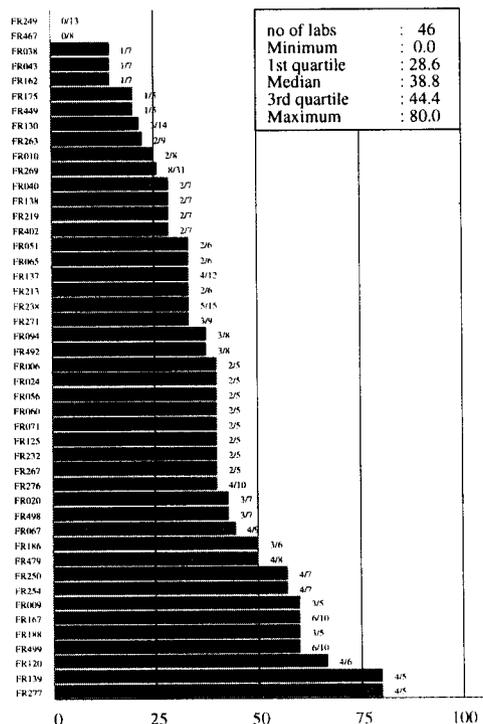
PNSP = Penicillin Non-Susceptible *S. pneumoniae*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporin Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

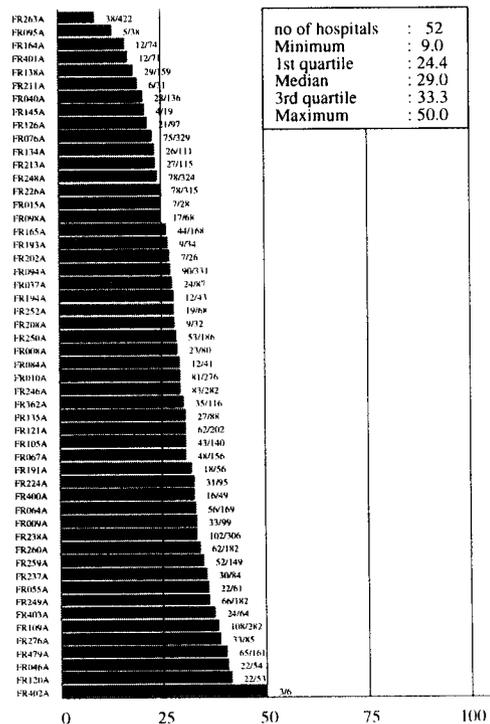
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Germany

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	8/23
Hosps providing denom.data/ reporting data to EARSS	20/60
Number of blood culture sets	29,561
Number of hospital beds	12,127
Patient-days	2,707,154
Average occupancy rate (%)	74%
Median length of stay (days)	8
Estimated catchment population	12,410,500
% total population covered	15%
Type of participating hospitals	
University/Tertiary	35%
General/Secondary	65%
Other	0%

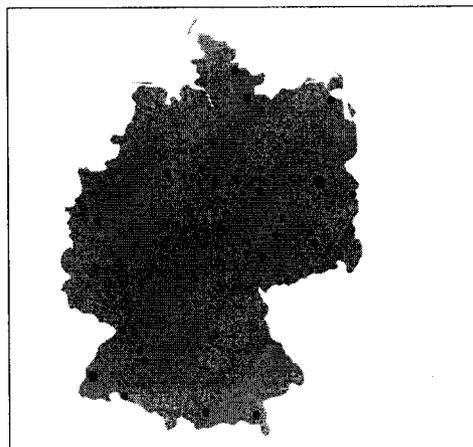


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	23	417	25	1239	1	166	1	44	0	0	0	0
2000	18	204	19	890	1	180	1	28	0	0	0	0
2001	21	211	22	1220	21	1269	20	294	0	0	0	0
2002	17	248	18	1066	16	1068	14	290	0	0	0	0
2003	17	175	20	919	19	997	17	347	0	0	0	0
2004	16	143	22	1106	22	1217	22	607	0	0	0	0
2005	15	130	17	874	17	1016	17	597	12	113	12	127

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	<1	<1	1	<1	<1	<1	<1
	Penicillin I+R	2	2	4	1	1	1	5
	Macrolides I+R	7	10	17	14	11	13	17
<i>S. aureus</i>	Oxacillin/Methicillin R	8	12	16	18	18	20	21
	Aminopenicillins R	36	47	46	49	47	55	54
<i>E. coli</i>	Aminoglycosides R	5	7	5	5	5	4	6
	Fluoroquinolones R	4	8	11	15	14	24	23
	3rd gen. Cephalosporins R	<1	<1	<1	<1	<1	2	2
<i>E. faecalis</i>	Aminopenicillins I+R	<1	<1	8	10	7	7	3
	HL Aminoglycosides R	.	.	31	42	47	42	34
	Glycopeptides R	<1	<1	<1	<1	<1	<1	<1
<i>E. faecium</i>	Aminopenicillins I+R	40	50	79	80	78	93	96
	HL Aminoglycosides R	.	.	43	68	47	61	49
	Glycopeptides R	<1	<1	1	4	3	11	10
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	9
	Fluoroquinolones R	.	.	.	.	.	.	5
	3rd gen. Cephalosporins R	.	.	.	.	.	.	6
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	17
	Ceftazidime R	.	.	.	.	.	.	11
	Carbapenems R	.	.	.	.	.	.	24
	Aminoglycosides R	.	.	.	.	.	.	13
	Fluoroquinolones R	.	.	.	.	.	.	22

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=273		<i>S. aureus</i> n=1980		<i>E. coli</i> n=2203		<i>E. faecalis</i> n=734		<i>E. faecium</i> n=454		<i>K. pneumo.</i> n=112		<i>P. aeruginosa</i> n=127	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	96	3	100	20	100	24	100	0	100	10	99	6	96	23
CSF	4	0	0	.	0	.	0	.	0	.	1	0	4	40
Gender														
Male	60	4	63	22	47	28	63	0	60	10	58	6	69	16
Female	37	1	36	18	52	20	37	0	40	9	42	6	31	40
Unknown	3	0	1	17	1	13	0	.	0	.	0	.	0	.
Age (years)														
0-4	13	9	3	2	2	2	4	0	2	11	3	0	7	0
5-19	3	0	2	10	1	20	1	0	2	38	1	0	3	25
20-64	35	2	40	19	33	29	43	1	52	12	47	11	48	36
65 and over	49	2	55	22	63	22	51	0	44	7	49	2	42	13
Unknown	0	.	0	.	1	29	0	.	0	.	0	.	0	.
Hospital dep.														
ICU	25	3	22	27	17	22	33	0	44	8	27	3	24	45
Internal Med.	38	3	38	18	41	19	26	0	20	5	33	0	26	15
Surgery	1	0	11	23	8	26	10	1	9	3	7	13	9	18
Other	32	3	22	16	28	32	26	1	24	22	33	14	40	18
Unknown	3	0	6	19	6	17	5	0	2	0	0	.	1	0

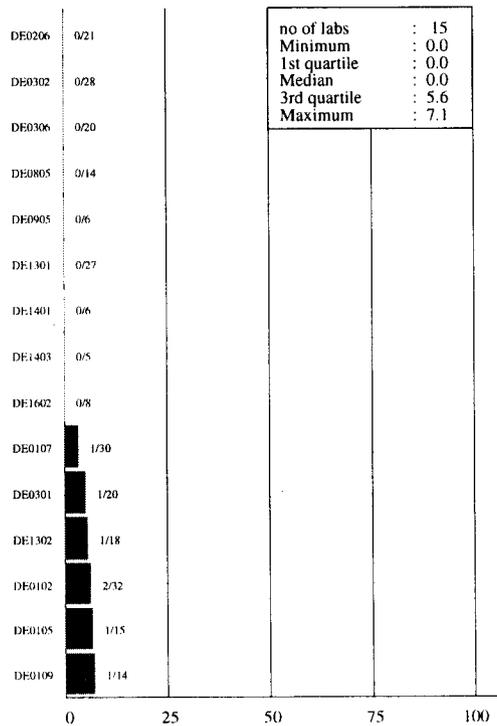
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CRPA = Carbapenem Resistant *P. aeruginosa*

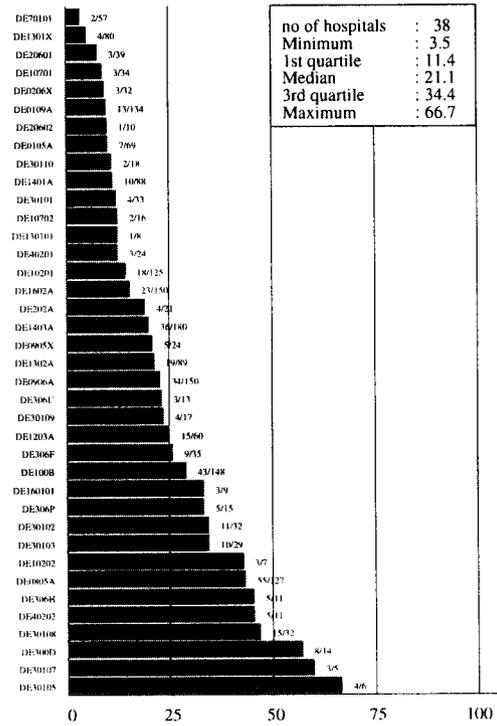
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Greece

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	29/39
Hospitals providing denom.data/ reporting data to EARSS	30/39
Number of blood culture sets	89,267
Number of hospital beds	10,504
Patient-days	2,781,858
Average occupancy rate (%)	86%
Median length of stay (days)	4
Estimated catchment population	8,067,261
% total population covered	75%
Type of participating hospitals	
University/Tertiary	30%
General/Secondary	57%
Other	13%



Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	19	192	0	0	0	0	0	0	0	0
2000	0	0	15	363	16	395	12	197	0	0	0	0
2001	0	0	25	360	26	619	25	304	0	0	0	0
2002	0	0	33	368	35	588	28	293	0	0	0	0
2003	0	0	34	666	35	1076	32	623	0	0	0	0
2004	0	0	35	609	39	1131	34	566	0	0	0	0
2005	0	0	35	681	35	1140	34	737	33	774	33	699

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	.	.	.	.	.	.	.
	Penicillin I+R	.	.	.	.	.	.	.
	Macrolides I+R	.	.	.	.	.	.	.
<i>S. aureus</i>	Oxacillin/Methicillin R	31	50	39	44	45	44	42
	Aminopenicillins R	.	42	47	45	44	46	46
<i>E. coli</i>	Aminoglycosides R	.	4	4	7	6	6	7
	Fluoroquinolones R	.	4	9	13	12	12	12
	3rd gen. Cephalosporins R	.	4	5	6	6	6	7
	Aminopenicillins I+R	.	8	8	4	4	4	3
<i>E. faecalis</i>	HL Aminoglycosides R	.	52	57	60	52	59	54
	Glycopeptides R	.	<1	7	13	7	4	4
	Aminopenicillins I+R	.	83	86	75	89	84	85
<i>E. faecium</i>	HL Aminoglycosides R	.	25	45	52	40	52	34
	Glycopeptides R	.	<1	15	19	18	20	37
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	60
	Fluoroquinolones R	.	.	.	.	.	.	54
	3rd gen. Cephalosporins R	.	.	.	.	.	.	61
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	30
	Ceftazidime R	.	.	.	.	.	.	27
	Carbapenems R	.	.	.	.	.	.	39
	Aminoglycosides R	.	.	.	.	.	.	40
	Fluoroquinolones R	.	.	.	.	.	.	39

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=0		<i>S. aureus</i> n=1290		<i>E. coli</i> n=2255		<i>E. faecalis</i> n=898		<i>E. faecium</i> n=404		<i>K. pneumo.</i> n=774		<i>P. aeruginosa</i> n=698	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood			100	43	100	12	100	4	100	30	98	60	97	37
CSF			0		0		0		0		2	83	3	88
Gender														
Male			12	49	10	12	9	5	14	29	9	43	10	51
Female			6	54	14	7	6	5	10	38	7	52	5	44
Unknown			83	42	76	13	85	4	76	29	84	63	85	37
Age (years)														
0-4			0		1	23	0		0		0		1	75
5-19			0		0		0		0		0		0	
20-64			1	57	2	20	1	0	4	44	2	50	2	33
65 and over			2	69	2	15	2	0	3	31	1	36	2	36
Unknown			97	42	96	12	97	4	93	29	96	61	96	39
Hospital dep.														
ICU			16	68	3	17	36	6	31	34	49	84	47	51
Internal Med.			66	35	78	10	44	3	50	30	34	32	39	24
Surgery			13	58	13	22	16	3	14	21	15	56	12	43
Other			3	29	2	8	1	9	2	29	2	43	1	17
Unknown			3	51	3	10	3	4	3	27	1	0	2	23

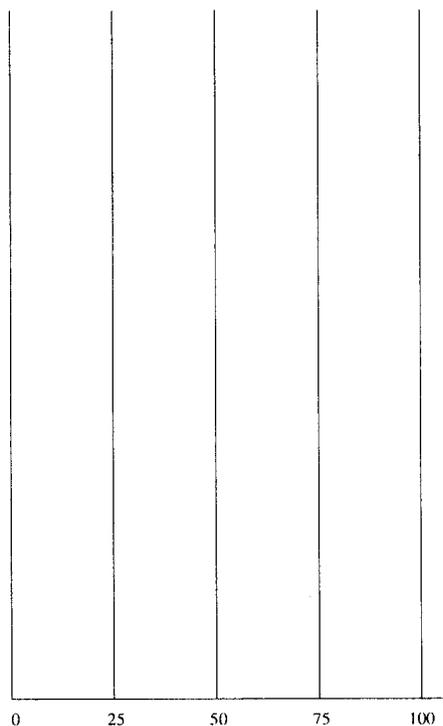
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VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

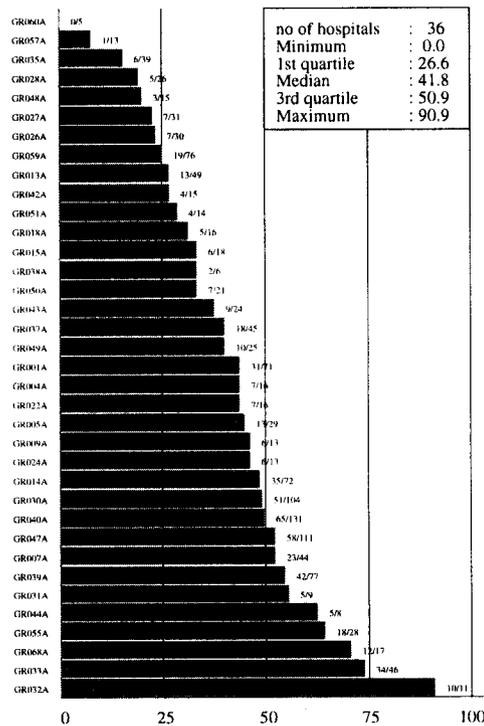
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Hungary

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	10/32
Hosps providing denom.data/ reporting data to EARSS	30/76
Number of blood culture sets	12,116
Number of hospital beds	17,034
Patient-days	4,331,778
Average occupancy rate (%)	76%
Median length of stay (days)	7
Estimated catchment population	10,000,000
% total population covered	100%
Type of participating hospitals	
University/Tertiary	10%
General/Secondary	80%
Other	10%

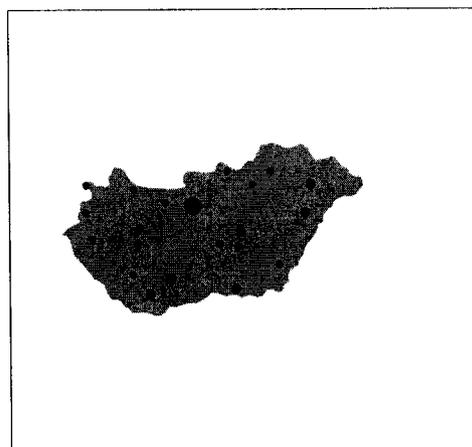


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	14	36	18	301	18	264	17	121	0	0	0	0
2002	17	61	24	413	24	354	23	169	0	0	0	0
2003	20	134	27	858	27	842	25	279	0	0	0	0
2004	26	143	30	1020	28	967	26	366	0	0	0	0
2005*	22	86	26	527	25	513	25	238	21	143	23	238

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005*
<i>S. pneumoniae</i>	Penicillin R	.	.	8	3	3	<1	2
	Penicillin I+R	.	.	22	23	24	16	22
	Macrolides I+R	.	.	19	21	25	25	37
<i>S. aureus</i>	Oxacillin/Methicillin R	.	.	5	9	15	17	19
	<i>E. coli</i>							
<i>E. coli</i>	Aminopenicillins R	.	.	46	45	49	55	50
	Aminoglycosides R	.	.	4	6	8	10	7
	Fluoroquinolones R	.	.	5	10	15	19	20
	3rd gen. Cephalosporins R	.	.	<1	2	<1	3	2
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	5	2	<1	2	2
	HL Aminoglycosides R	.	.	.	100	87	57	40
	Glycopeptides R	.	.	<1	<1	<1	<1	<1
<i>E. faecium</i>	Aminopenicillins I+R	.	.	100	89	91	95	91
	HL Aminoglycosides R	.	.	.	100	96	80	65
	Glycopeptides R	.	.	<1	<1	<1	<1	<1
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	30
	Fluoroquinolones R	.	.	.	.	.	.	25
	3rd gen. Cephalosporins R	.	.	.	.	.	.	31
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	12
	Ceftazidime R	.	.	.	.	.	.	11
	Carbapenems R	.	.	.	.	.	.	17
	Aminoglycosides R	.	.	.	.	.	.	32
	Fluoroquinolones R	.	.	.	.	.	.	27

* First half year of 2005.

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=229		<i>S. aureus</i> n=1547		<i>E. coli</i> n=1369		<i>E. faecalis</i> n=486		<i>E. faecium</i> n=105		<i>K. pneumo.</i> n=140		<i>P. aeruginosa</i> n=231	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	67	16	100	18	100	20	100	0	100	0	97	31	96	17
CSF	33	22	0	0	0	0	0	0	0	0	3	50	4	22
Gender														
Male	77	18	67	19	62	22	67	0	73	0	65	30	73	18
Female	23	21	33	15	37	16	33	0	27	0	34	35	27	14
Unknown	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Age (years)														
0-4	12	44	2	11	2	4	3	0	3	0	6	63	3	25
5-19	5	18	2	3	1	29	1	0	1	0	1	100	2	60
20-64	55	17	49	19	40	18	46	0	56	0	41	38	52	13
65 and over	28	11	47	17	57	21	49	0	40	0	52	22	42	20
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital dep.														
ICU	22	24	17	25	12	25	33	0	30	0	32	44	47	17
Internal Med.	19	14	29	16	30	19	20	0	17	0	21	17	12	11
Surgery	1	33	13	26	6	17	11	0	16	0	9	54	10	13
Other	46	18	22	13	35	21	18	0	25	0	19	22	18	26
Unknown	12	15	19	13	17	15	18	0	11	0	19	23	13	16

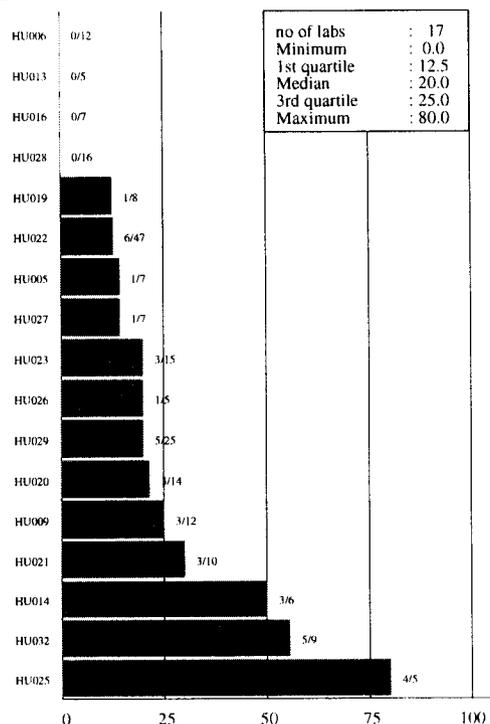
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VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

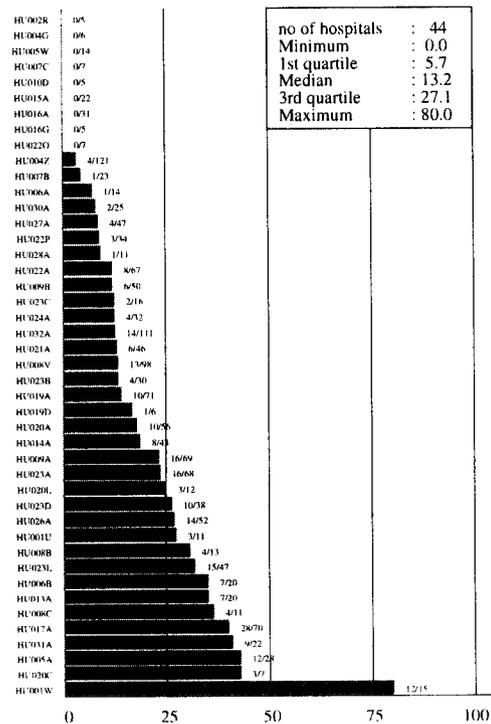
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=91		<i>S. aureus</i> n=132		<i>E. coli</i> n=230		<i>E. faecalis</i> n=40		<i>E. faecium</i> n=17		<i>K. pneumo.</i> n=22		<i>P. aeruginosa</i> n=13	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	98	13	100	0	100	3	100	0	100	0	100	0	100	8
CSF	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Gender														
Male	53	8	61	0	43	2	53	0	53	0	55	0	62	13
Female	47	19	38	0	57	3	48	0	47	0	45	0	38	0
Unknown	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Age (years)														
0-4	23	19	5	0	4	10	3	0	6	0	0	0	0	0
5-19	2	0	9	0	2	0	0	0	0	0	0	0	0	0
20-64	31	7	38	0	29	5	28	0	18	0	36	0	15	0
65 and over	44	15	47	0	65	1	70	0	76	0	64	0	85	9
Unknown	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Hospital dep.														
ICU	5	0	8	0	3	0	20	0	29	0	5	0	0	0
Internal Med.	10	11	18	0	11	0	28	0	18	0	18	0	0	0
Surgery	0	0	11	0	9	5	5	0	6	0	5	0	8	0
Other	78	15	60	0	75	3	45	0	47	0	73	0	85	9
Unknown	7	0	2	0	3	0	3	0	0	0	0	0	8	0

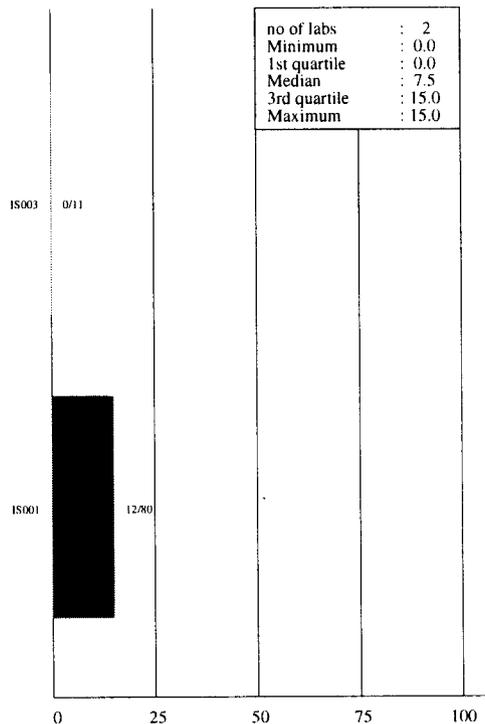
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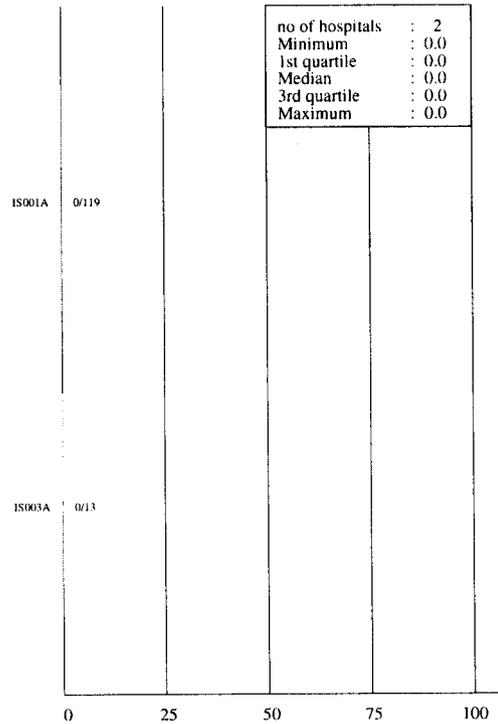
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Ireland

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	35/39
Hosps providing denom.data/ reporting data to EARSS	57/66
Number of blood culture sets	131,867
Number of hospital beds	13,262
Patient-days	4,136,385
Average occupancy rate (%)	85%
Median length of stay (days)	6
Estimated catchment population	3,920,000
% total population covered	98%
Type of participating hospitals	
University/Tertiary	19%
General/Secondary	54%
Other	26%

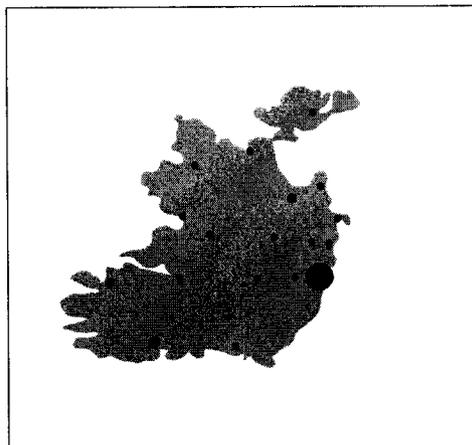


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	10	154	11	511	0	0	0	0	0	0	0	0
2000	18	202	18	632	0	0	0	0	0	0	0	0
2001	21	246	19	798	0	0	0	0	0	0	0	0
2002	20	277	22	998	20	736	15	250	0	0	0	0
2003	24	363	26	1108	26	978	21	348	0	0	0	0
2004	28	399	38	1286	37	1235	29	418	0	0	0	0
2005	31	397	38	1360	39	1424	33	502	15	42	11	29

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	3	5	2	2	3	3	3
	Penicillin I+R	19	13	12	12	12	10	11
	Macrolides I+R	14	12	12	13	12	14	12
<i>S. aureus</i>	Oxacillin/Methicillin R	39	39	42	42	42	41	42
<i>E. coli</i>	Aminopenicillins R	.	.	.	62	61	65	67
	Aminoglycosides R	.	.	.	3	4	5	7
	Fluoroquinolones R	.	.	.	5	10	12	17
	3rd gen. Cephalosporins R	.	.	.	2	2	2	4
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	.	8	5	<1	4
	HL Aminoglycosides R	.	.	.	39	32	42	42
	Glycopeptides R	.	.	.	2	<1	1	3
<i>E. faecium</i>	Aminopenicillins I+R	.	.	.	89	91	96	93
	HL Aminoglycosides R	.	.	.	17	54	56	52
	Glycopeptides R	.	.	.	11	19	22	31
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	5
	Fluoroquinolones R	.	.	.	.	.	.	3
	3rd gen. Cephalosporins R	.	.	.	.	.	.	7
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	7
	Ceftazidime R	.	.	.	.	.	.	10
	Carbapenems R	.	.	.	.	.	.	11
	Aminoglycosides R	.	.	.	.	.	.	7
	Fluoroquinolones R	.	.	.	.	.	.	14

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=796		<i>S. aureus</i> n=2646		<i>E. coli</i> n=2624		<i>E. faecalis</i> n=510		<i>E. faecium</i> n=401		<i>K. pneumo.</i> n=42		<i>P. aeruginosa</i> n=27	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	99	11	100	42	100	15	100	2	100	27	100	7	100	11
CSF	1	13	0	0	0	0	0	0	0	0	0	0	0	0
Gender														
Male	55	12	61	42	42	18	58	1	53	27	64	7	52	7
Female	44	9	38	41	57	12	41	3	47	27	36	7	48	15
Unknown	1	10	1	35	0	0	1	0	0	0	0	0	0	0
Age (years)														
0-4	16	13	6	14	4	2	9	0	3	8	2	100	4	0
5-19	4	6	3	9	1	5	1	0	1	67	2	0	0	0
20-64	36	8	39	32	32	16	34	3	42	32	21	0	48	23
65 and over	43	12	51	54	62	15	55	2	53	23	74	6	44	0
Unknown	0	0	0	1	12	0	0	0	0	0	0	0	4	0
Hospital dep.														
ICU	4	10	4	51	3	17	6	0	8	12	0	0	4	100
Internal Med.	15	10	13	46	14	10	11	0	7	21	17	14	7	0
Surgery	2	11	7	49	7	12	7	3	6	15	10	0	4	100
Other	27	8	15	32	19	8	15	1	7	10	19	0	30	0
Unknown	51	12	60	42	56	18	60	3	71	32	55	9	56	7

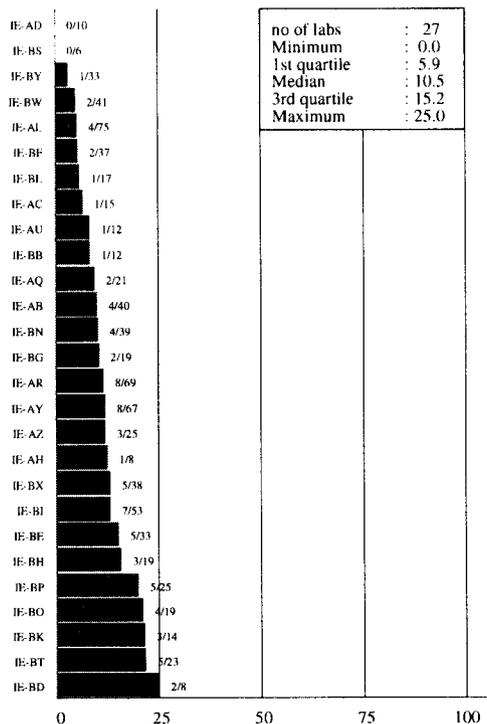
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CRPA = Carbapenem Resistant *P. aeruginosa*

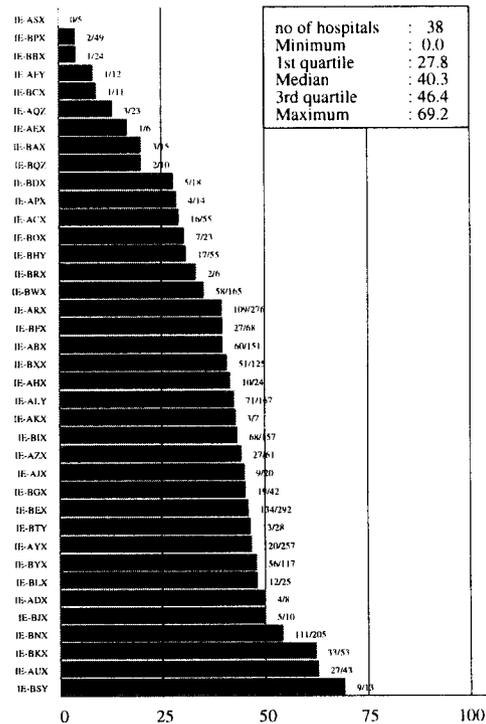
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Israel

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	5/5
Hosps providing denom.data/ reporting data to EARSS	5/5
Number of blood culture sets	131,998
Number of hospital beds	4,187
Patient-days	1,520,982
Average occupancy rate (%)	99%
Median length of stay (days)	4
Estimated catchment population	2,230,000
% total population covered	35%
Type of participating hospitals	
University/Tertiary	60%
General/Secondary	40%
Other	0%



Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	170	5	381	5	741	5	184	0	0	0	0
2002	5	177	5	468	5	865	5	254	0	0	0	0
2003	5	180	5	369	5	774	5	244	0	0	0	0
2004	5	190	5	475	5	916	5	288	0	0	0	0
2005	5	235	5	546	5	943	5	296	4	331	4	215

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	.	.	5	7	11	11	8
	Penicillin I+R	.	.	40	38	38	37	33
	Macrolides I+R	.	.	11	12	14	12	15
<i>S. aureus</i>	Oxacillin/Methicillin R	.	.	39	38	43	39	41
	<i>E. coli</i>							
<i>E. coli</i>	Aminopenicillins R	.	.	68	68	62	63	66
	Aminoglycosides R	.	.	16	16	14	16	15
	Fluoroquinolones R	.	.	21	19	20	23	23
	3rd gen. Cephalosporins R	.	.	9	8	9	10	10
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	<1	4	2	3	1
	HL Aminoglycosides R	.	.	24	44	43	46	43
	Glycopeptides R	.	.	<1	2	<1	1	<1
<i>E. faecium</i>	Aminopenicillins I+R	.	.	46	50	48	65	87
	HL Aminoglycosides R	.	.	33	42	38	18	20
	Glycopeptides R	.	.	12	10	8	8	46
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	36
	Fluoroquinolones R	.	.	.	.	.	.	30
	3rd gen. Cephalosporins R	.	.	.	.	.	.	38
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	13
	Ceftazidime R	.	.	.	.	.	.	17
	Carbapenems R	.	.	.	.	.	.	15
	Aminoglycosides R	.	.	.	.	.	.	23
	Fluoroquinolones R	.	.	.	.	.	.	25

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=425		<i>S. aureus</i> n=1021		<i>E. coli</i> n=1852		<i>E. faecalis</i> n=469		<i>E. faecium</i> n=111		<i>K. pneumo.</i> n=330		<i>P. aeruginosa</i> n=215	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	100	35	100	40	100	23	100	1	100	32	100	38	100	15
CSF	0		0		0		0		0		0		0	
Gender														
Male	58	39	61	41	39	29	52	1	54	37	61	44	60	17
Female	41	30	39	39	61	19	48	0	46	27	39	29	38	13
Unknown	1	0	1	50	0		0		0		0		1	0
Age (years)														
0-4	40	51	9	26	5	3	13	0	11	0	15	41	7	0
5-19	9	18	4	19	1	37	1	0	2	0	2	60	3	0
20-64	27	27	33	30	28	21	23	1	32	46	32	38	42	19
65 and over	24	24	52	51	65	24	62	1	56	32	51	36	47	16
Unknown	0		1	50	0		0		0		1	100	2	0
Hospital dep.														
ICU	6	36	9	46	3	35	10	4	16	56	13	43	18	24
Internal Med.	39	24	53	45	62	22	51	0	40	34	38	45	34	9
Surgery	1	0	8	41	10	27	9	0	8	11	15	23	13	11
Other	54	44	30	30	25	21	30	1	35	23	35	35	35	19
Unknown	0		0		0		0		1	100	0		0	

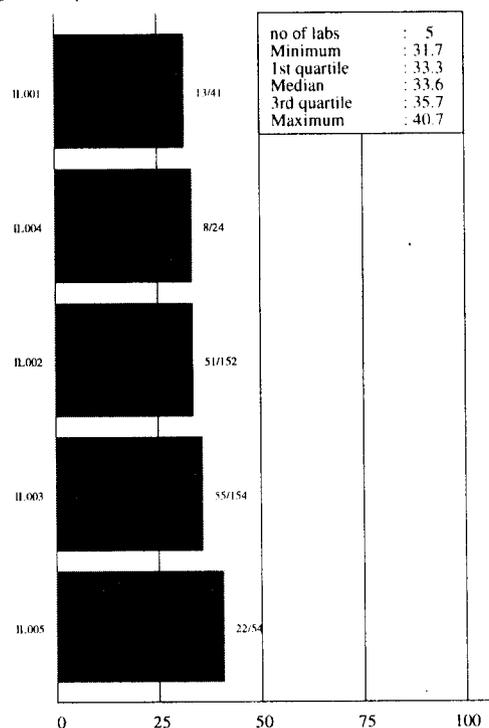
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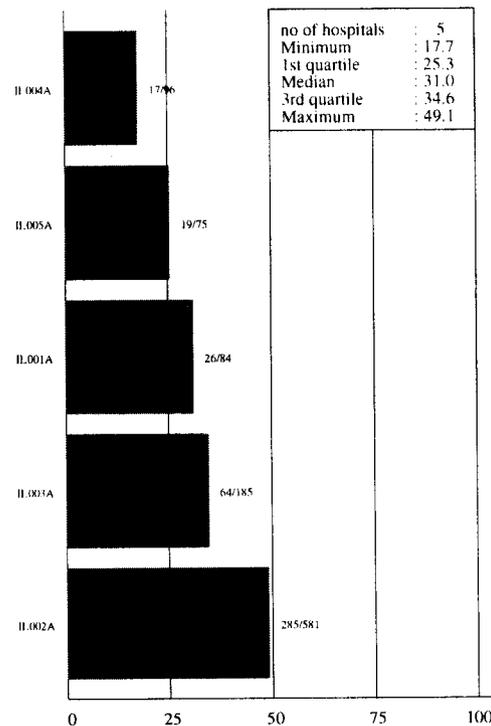
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Italy

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	24/43
Hosps providing denom.data/ reporting data to EARSS	25/45
Number of blood culture sets	91.337
Number of hospital beds	15,998
Patient-days	3,602,565
Average occupancy rate (%)	68%
Median length of stay (days)	7
Estimated catchment population	6,445,066
% total population covered	11%
Type of participating hospitals	
University/Tertiary	16%
General/Secondary	76%
Other	8%



Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	41	177	56	1158	0	0	0	0	0	0	0	0
2000	36	116	48	456	0	0	0	0	0	0	0	0
2001	39	121	53	839	0	0	42	297	0	0	0	0
2002	50	296	53	1343	17	618	49	602	0	0	0	0
2003	43	282	46	1465	17	923	44	634	0	0	0	0
2004	37	267	42	1219	14	645	40	576	0	0	0	0
2005	37	319	41	1431	16	1195	40	714	38	344	0	0

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	2	<1	4	2	5	5	5
	Penicillin I+R	13	11	9	11	13	14	9
	Macrolides I+R	29	28	39	32	37	28	31
<i>S. aureus</i>	Oxacillin/Methicillin R	41	44	41	38	39	40	37
<i>E. coli</i>	Aminopenicillins R	.	.	.	48	52	53	55
	Aminoglycosides R	.	.	.	6	10	9	11
	Fluoroquinolones R	.	.	.	21	25	28	28
	3rd gen. Cephalosporins R	.	.	.	3	6	5	8
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	3	6	4	4	4
	HL Aminoglycosides R	.	.	31	38	39	36	38
	Glycopeptides R	.	.	1	<1	2	2	3
<i>E. faecium</i>	Aminopenicillins I+R	.	.	69	79	80	78	77
	HL Aminoglycosides R	.	.	18	37	44	39	36
	Glycopeptides R	.	.	15	19	24	21	19
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	8
	Fluoroquinolones R	.	.	.	.	.	.	11
	3rd gen. Cephalosporins R	.	.	.	.	.	.	20
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	.
	Ceftazidime R	.	.	.	.	.	.	.
	Carbapenems R	.	.	.	.	.	.	.
	Aminoglycosides R	.	.	.	.	.	.	.
	Fluoroquinolones R	.	.	.	.	.	.	.

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=586		<i>S. aureus</i> n=2650		<i>E. coli</i> n=1737		<i>E. faecalis</i> n=850		<i>E. faecium</i> n=358		<i>K. pneumo.</i> n=343		<i>P. aeruginosa</i> n=0	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	88	10	100	38	100	28	100	2	100	20	100	20		
CSF	12	21	0	0	0	0	0	0	0	0	0	0		
Gender														
Male	47	16	49	41	29	27	52	3	55	21	33	22		
Female	31	6	30	38	30	23	31	2	30	19	26	18		
Unknown	22	9	21	34	41	33	17	1	15	17	41	19		
Age (years)														
0-4	9	13	1	23	1	4	2	0	1	0	5	75		
5-19	4	14	1	16	0	0	0	0	0	0	1	50		
20-64	27	8	24	30	20	33	23	6	24	18	25	23		
65 and over	39	12	46	43	36	27	47	1	42	19	39	15		
Unknown	22	13	28	38	42	27	28	2	33	23	30	14		
Hospital dep.														
ICU	6	12	12	59	5	29	19	3	13	26	13	35		
Internal Med.	35	11	38	35	44	24	33	3	29	14	31	16		
Surgery	2	0	12	38	10	27	10	1	15	19	15	23		
Other	47	11	20	26	17	38	19	3	23	19	20	26		
Unknown	10	15	18	45	23	28	19	2	20	26	20	6		

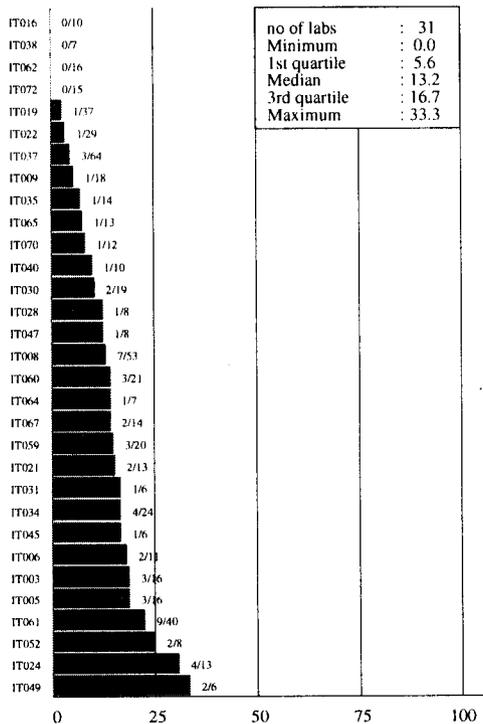
PNSP = Penicillin Non-Susceptible *S. pneumoniae*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

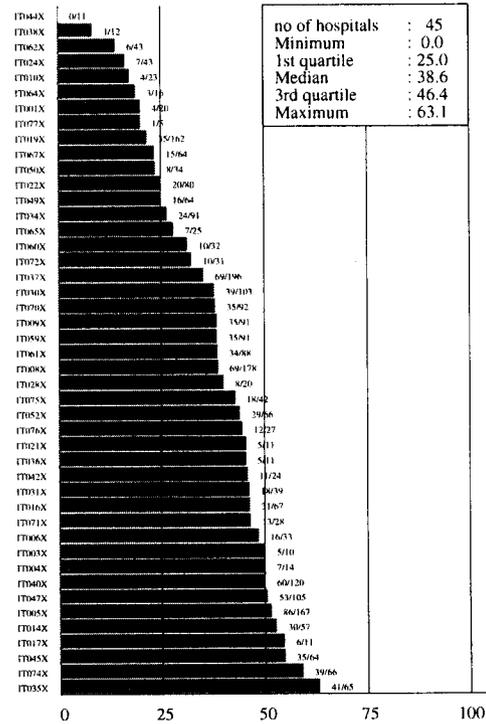
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Latvia

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	6/7
Hosps providing denom.data/ reporting data to EARSS	9/9
Number of blood culture sets	9,395
Number of hospital beds	4,603
Patient-days	1,276,513
Average occupancy rate (%)	79%
Median length of stay (days)	8
Estimated catchment population	1,801,593
% total population covered	78%
Type of participating hospitals	
University/Tertiary	44%
General/Secondary	33%
Other	22%

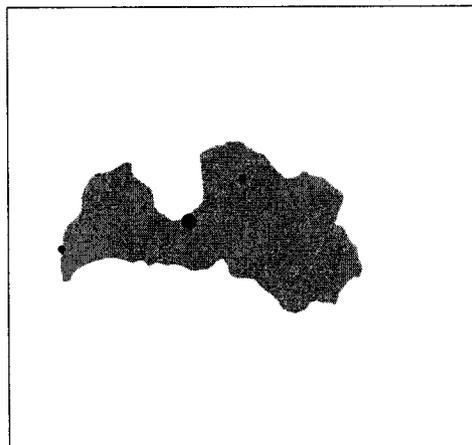


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	4	17	7	87	0	0	0	0	0	0	0	0
2005	5	36	7	125	0	0	0	0	0	0	0	0

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	.	.	.	.	.	<1	<1
	Penicillin I+R	.	.	.	.	.	<1	<1
	Macrolides I+R	.	.	.	.	.	7	3
<i>S. aureus</i>	Oxacillin/Methicillin R	.	.	.	.	.	25	20
<i>E. coli</i>	Aminopenicillins R	.	.	.	.	.	.	.
	Aminoglycosides R	.	.	.	.	.	.	.
	Fluoroquinolones R	.	.	.	.	.	.	.
	3rd gen. Cephalosporins R	.	.	.	.	.	.	.
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	.	.	.	.	.
	HL Aminoglycosides R	.	.	.	.	.	.	.
	Glycopeptides R	.	.	.	.	.	.	.
<i>E. faecium</i>	Aminopenicillins I+R	.	.	.	.	.	.	.
	HL Aminoglycosides R	.	.	.	.	.	.	.
	Glycopeptides R	.	.	.	.	.	.	.
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	.
	Fluoroquinolones R	.	.	.	.	.	.	.
	3rd gen. Cephalosporins R	.	.	.	.	.	.	.
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	.
	Ceftazidime R	.	.	.	.	.	.	.
	Carbapenems R	.	.	.	.	.	.	.
	Aminoglycosides R	.	.	.	.	.	.	.
	Fluoroquinolones R	.	.	.	.	.	.	.

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=53		<i>S. aureus</i> n=212		<i>E. coli</i> n=0		<i>E. faecalis</i> n=0		<i>E. faecium</i> n=0		<i>K. pneumo.</i> n=0		<i>P. aeruginosa</i> n=0	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	79	0	100	22	.	.	.	.	.	.	.	.	.	.
CSF	21	0	0	.	.	.	.	.	.	.	.	.	.	.
Gender														
Male	70	0	61	27	.	.	.	.	.	.	.	.	.	.
Female	30	0	38	15	.	.	.	.	.	.	.	.	.	.
Unknown	0	.	0	.	.	.	.	.	.	.	.	.	.	.
Age (years)														
0-4	2	0	11	4	.	.	.	.	.	.	.	.	.	.
5-19	9	0	6	8	.	.	.	.	.	.	.	.	.	.
20-64	66	0	51	24	.	.	.	.	.	.	.	.	.	.
65 and over	21	0	31	28	.	.	.	.	.	.	.	.	.	.
Unknown	2	0	1	33	.	.	.	.	.	.	.	.	.	.
Hospital dep.														
ICU	79	0	27	40	.	.	.	.	.	.	.	.	.	.
Internal Med.	9	0	33	16	.	.	.	.	.	.	.	.	.	.
Surgery	0	.	7	43	.	.	.	.	.	.	.	.	.	.
Other	11	0	33	10	.	.	.	.	.	.	.	.	.	.
Unknown	0	.	0	.	.	.	.	.	.	.	.	.	.	.

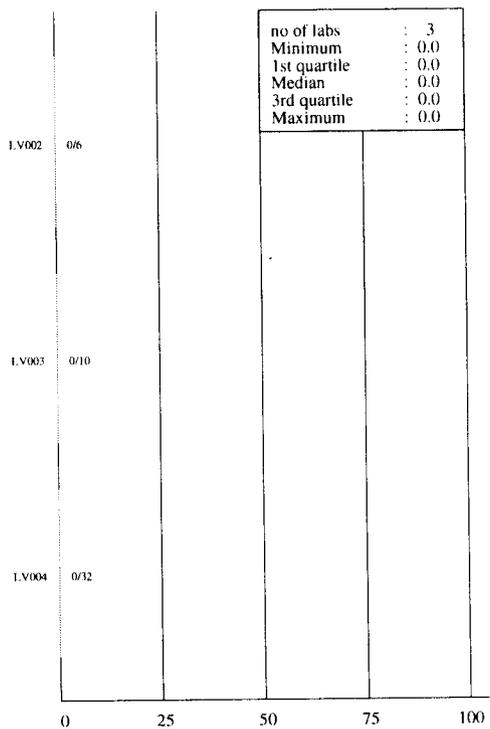
PNSP = Penicillin Non-Susceptible *S. pneumoniae*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

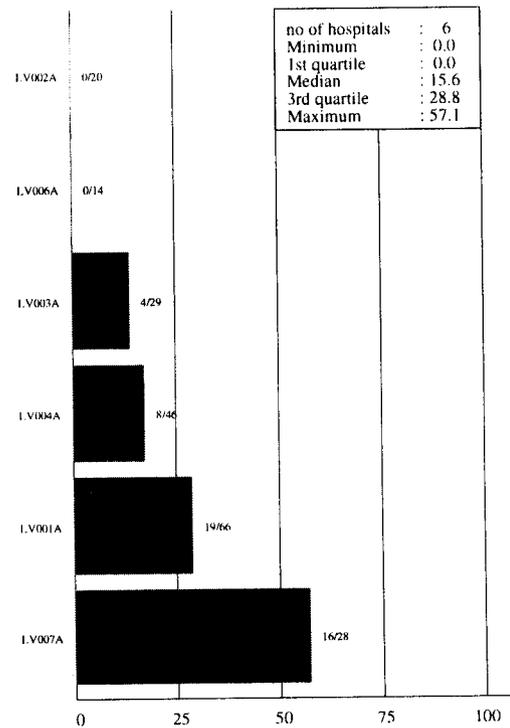
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Luxembourg

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	5/6
Hospitals providing denom.data/ reporting data to EARSS	6/8
Number of blood culture sets	10,445
Number of hospital beds	1,771
Patient-days	513,009
Average occupancy rate (%)	79%
Median length of stay (days)	5
Estimated catchment population	474,000
% total population covered	100%
Type of participating hospitals	
University/Tertiary	0%
General/Secondary	67%
Other	33%

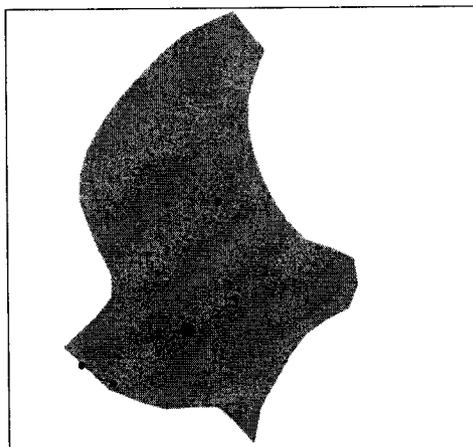


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	1	9	1	25	0	0	0	0	0	0	0	0
2000	5	22	4	67	0	0	0	0	0	0	0	0
2001	8	41	8	85	8	193	7	31	0	0	0	0
2002	7	27	9	95	9	193	8	30	0	0	0	0
2003	7	48	8	95	8	227	7	41	0	0	0	0
2004	6	36	7	96	7	216	5	28	0	0	0	0
2005	5	43	5	83	5	188	5	31	0	0	0	0

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	11	<1	7	7	<1	6	7
	Penicillin I+R	22	14	12	22	15	11	12
	Macrolides I+R	33	26	23	22	30	33	24
<i>S. aureus</i>	Oxacillin/Methicillin R	16	18	20	15	21	16	13
<i>E. coli</i>	Aminopenicillins R	.	.	44	43	49	49	49
	Aminoglycosides R	.	.	5	4	4	4	7
	Fluoroquinolones R	.	.	4	9	12	18	19
	3rd gen. Cephalosporins R	.	.	<1	<1	<1	<1	3
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	<1	<1	5	<1	<1
	HL Aminoglycosides R	.	.	13	17	32	18	24
	Glycopeptides R	.	.	<1	<1	<1	<1	<1
<i>E. faecium</i>	Aminopenicillins I+R	.	.	<1	60	100	50	36
	HL Aminoglycosides R	.	.	.	14	<1	<1	23
	Glycopeptides R	.	.	<1	<1	<1	<1	<1
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	.
	Fluoroquinolones R	.	.	.	.	.	.	.
	3rd gen. Cephalosporins R	.	.	.	.	.	.	.
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	.
	Ceftazidime R	.	.	.	.	.	.	.
	Carbapenems R	.	.	.	.	.	.	.
	Aminoglycosides R	.	.	.	.	.	.	.
	Fluoroquinolones R	.	.	.	.	.	.	.

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=79		<i>S. aureus</i> n=179		<i>E. coli</i> n=404		<i>E. faecalis</i> n=41		<i>E. faecium</i> n=18		<i>K. pneumo.</i> n=0		<i>P. aeruginosa</i> n=0	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	99	12	100	15	100	18	100	0	100	0	.	.	.	.
CSF	1	0	0	.	0	.	0	.	0	.	.	.	.	.
Gender														
Male	56	11	49	15	40	20	59	0	94	0	.	.	.	.
Female	44	11	51	14	59	17	41	0	6	0	.	.	.	.
Unknown	0	.	0	.	0	.	0	.	0	.	.	.	.	.
Age (years)														
0-4	8	17	4	0	2	0	7	0	6	0	.	.	.	.
5-19	10	13	4	38	0	.	0	.	0	.	.	.	.	.
20-64	39	6	42	9	30	18	41	0	33	0	.	.	.	.
65 and over	43	15	49	18	68	18	51	0	61	0	.	.	.	.
Unknown	0	.	0	.	0	.	0	.	0	.	.	.	.	.
Hospital dep.														
ICU	18	7	16	4	11	11	27	0	39	0	.	.	.	.
Internal Med.	24	11	25	20	34	18	27	0	6	0	.	.	.	.
Surgery	5	0	10	17	8	12	7	0	6	0	.	.	.	.
Other	30	13	22	15	23	26	27	0	39	0	.	.	.	.
Unknown	23	17	27	15	24	15	12	0	11	0	.	.	.	.

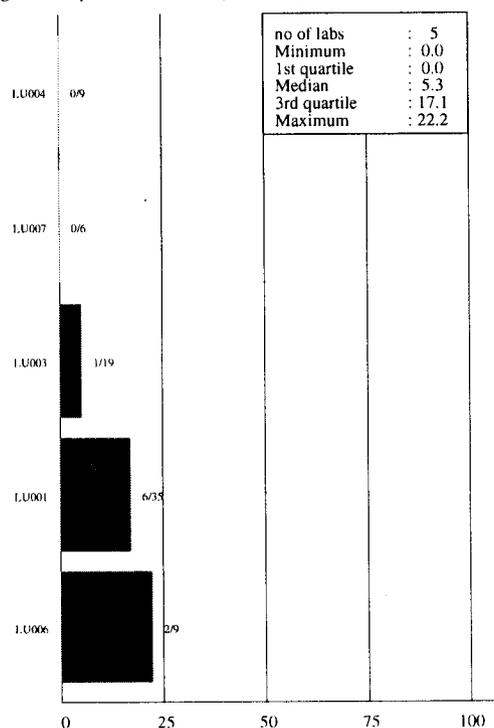
PNSP = Penicillin Non-Susceptible *S. pneumonia*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

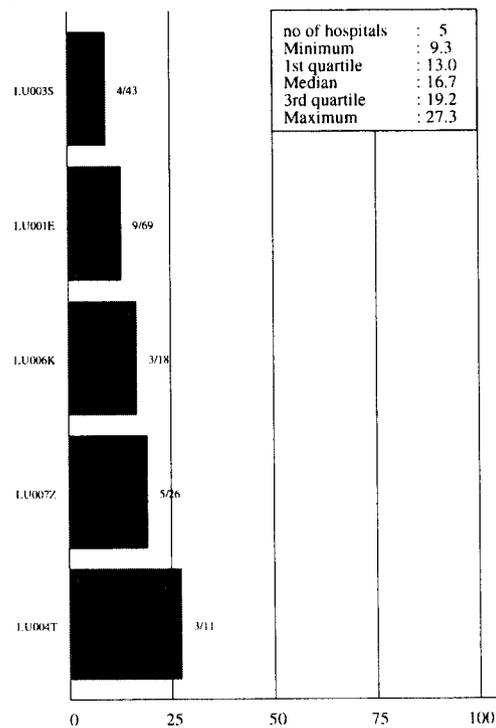
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Malta

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	1/1
Hosps providing denom.data/ reporting data to EARSS	4/4
Number of blood culture sets	4,329
Number of hospital beds	1,034
Patient-days	307,677
Average occupancy rate (%)	81%
Median length of stay (days)	8
Estimated catchment population	380,000
% total population covered	95%
Type of participating hospitals	
University/Tertiary	25%
General/Secondary	25%
Other	50%

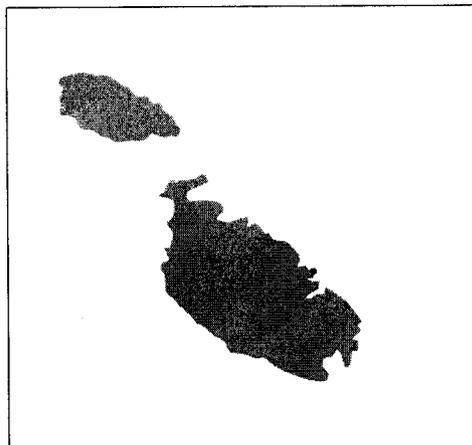


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	1	11	1	76	0	0	0	0	0	0	0	0
2001	1	12	1	83	1	67	1	13	0	0	0	0
2002	1	12	1	87	1	74	1	33	0	0	0	0
2003	1	9	1	122	1	91	1	26	0	0	0	0
2004	1	18	1	94	1	92	1	42	0	0	0	0
2005	1	13	1	78	1	87	1	38	1	18	1	45

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	.	<1	<1	<1	<1	<1	8
	Penicillin I+R	.	9	8	<1	<1	<1	15
	Macrolides I+R	.	36	18	25	38	25	46
<i>S. aureus</i>	Oxacillin/Methicillin R	.	36	54	43	43	56	55
	<i>E. coli</i>							
<i>E. coli</i>	Aminopenicillins R	.	.	27	43	39	47	49
	Aminoglycosides R	.	.	10	8	18	20	7
	Fluoroquinolones R	.	.	15	12	24	35	30
	3rd gen. Cephalosporins R	.	.	<1	3	2	4	1
	<i>E. faecalis</i>							
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	8	<1	5	<1	3
	HL Aminoglycosides R	.	.	8	17	29	44	32
	Glycopeptides R	.	.	<1	<1	<1	<1	<1
<i>E. faecium</i>	Aminopenicillins I+R	.	.	100	33	33	43	25
	HL Aminoglycosides R	.	.	<1	<1	50	<1	<1
	Glycopeptides R	.	.	<1	<1	<1	<1	<1
	<i>K. pneumoniae</i>							
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	17
	Fluoroquinolones R	.	.	.	.	.	.	11
	3rd gen. Cephalosporins R	.	.	.	.	.	.	6
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	22
	Ceftazidime R	.	.	.	.	.	.	11
	Carbapenems R	.	.	.	.	.	.	18
	Aminoglycosides R	.	.	.	.	.	.	16
	Fluoroquinolones R	.	.	.	.	.	.	44

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=31		<i>S. aureus</i> n=172		<i>E. coli</i> n=178		<i>E. faecalis</i> n=68		<i>E. faecium</i> n=12		<i>K. pneumo.</i> n=18		<i>P. aeruginosa</i> n=45	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	84	8	100	56	100	33	100	0	100	0	100	6	100	18
CSF	16	0	0	0	0	0	0	0	0	0	0	0	0	0
Gender														
Male	65	0	63	55	48	37	53	0	50	0	56	10	64	24
Female	35	18	37	58	52	28	47	0	50	0	44	0	36	6
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Age (years)														
0-4	23	14	11	47	4	0	7	0	8	0	6	0	4	0
5-19	6	0	5	44	2	33	3	0	8	0	6	0	2	0
20-64	29	0	38	48	28	34	43	0	17	0	44	13	53	29
65 and over	42	8	45	65	66	34	47	0	67	0	44	0	40	6
Unknown	0	0	1	100	0	0	0	0	0	0	0	0	0	0
Hospital dep.														
ICU	19	0	20	65	10	35	60	0	42	0	6	0	64	28
Internal Med.	42	0	44	50	46	31	12	0	42	0	39	14	22	0
Surgery	3	100	17	62	28	41	16	0	8	0	28	0	7	0
Other	19	17	10	61	5	11	3	0	8	0	11	0	4	0
Unknown	16	0	9	47	12	27	9	0	0	0	17	0	2	0

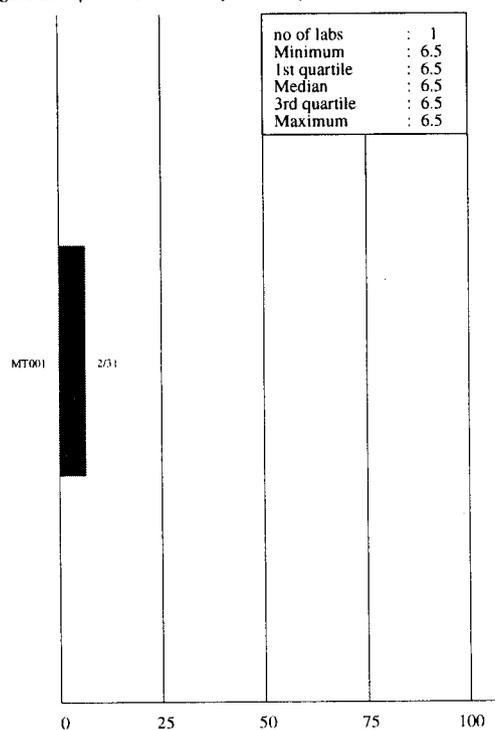
PNSP = Penicillin Non-Susceptible *S. pneumonia*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
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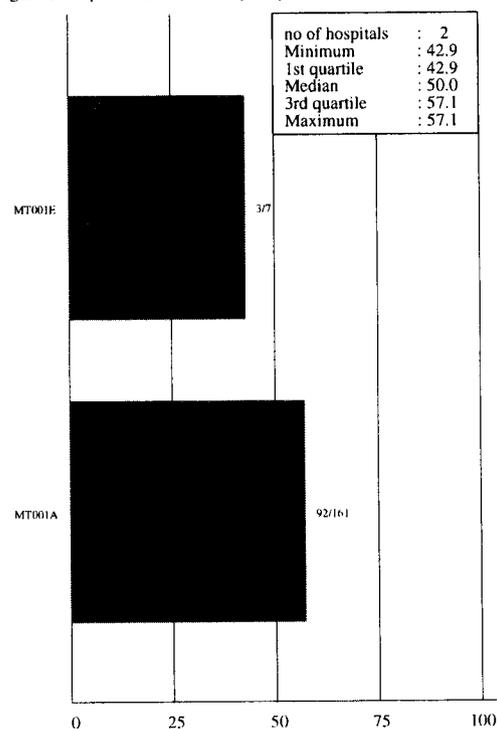
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Netherlands

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	13/22
Hosps providing denom.data/ reporting data to EARSS	18/39
Number of blood culture sets	123,924
Number of hospital beds	11,976
Patient-days	2,299,079
Average occupancy rate (%)	59%
Median length of stay (days)	7
Estimated catchment population	8,142,254
% total population covered	50%
Type of participating hospitals	
University/Tertiary	33%
General/Secondary	67%
Other	0%

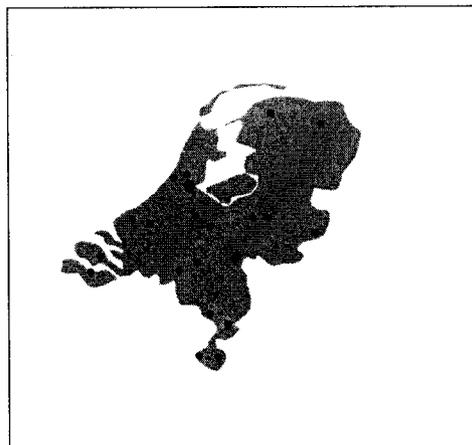


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	21	762	20	1224	0	0	0	0	0	0	0	0
2000	23	740	24	1388	12	1312	8	81	0	0	0	0
2001	20	723	21	1290	20	1864	14	275	0	0	0	0
2002	23	860	22	1502	22	2427	22	536	0	0	0	0
2003	24	886	22	1363	23	2143	23	482	0	0	0	0
2004	21	754	22	1336	21	2112	22	455	0	0	0	0
2005	23	802	23	1401	23	2199	23	565	16	301	16	210

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	<1	<1	<1	<1	<1	<1	<1
	Penicillin I+R	1	1	<1	1	1	2	1
	Macrolides I+R	.	4	5	7	5	7	11
<i>S. aureus</i>	Oxacillin/Methicillin R	<1	<1	<1	<1	1	1	<1
<i>E. coli</i>	Aminopenicillins R	.	37	39	39	44	43	48
	Aminoglycosides R	.	2	2	2	3	3	4
	Fluoroquinolones R	.	3	5	5	7	7	10
	3rd gen. Cephalosporins R	.	<1	<1	<1	1	1	2
<i>E. faecalis</i>	Aminopenicillins I+R	.	<1	2	3	4	3	3
	HL Aminoglycosides R	.	.	28	33	23	37	38
	Glycopeptides R	.	<1	<1	<1	1	<1	<1
<i>E. faecium</i>	Aminopenicillins I+R	.	33	64	23	30	42	61
	HL Aminoglycosides R	.	.	4	11	19	20	40
	Glycopeptides R	.	<1	2	1	<1	<1	<1
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	5
	Fluoroquinolones R	.	.	.	.	.	.	6
	3rd gen. Cephalosporins R	.	.	.	.	.	.	4
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	4
	Ceftazidime R	.	.	.	.	.	.	5
	Carbapenems R	.	.	.	.	.	.	5
	Aminoglycosides R	.	.	.	.	.	.	7
	Fluoroquinolones R	.	.	.	.	.	.	9

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=1556		<i>S. aureus</i> n=2737		<i>E. coli</i> n=4003		<i>E. faecalis</i> n=564		<i>E. faecium</i> n=380		<i>K. pneumo.</i> n=256		<i>P. aeruginosa</i> n=187	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	91	1	100	1	100	8	100	0	100	0	99	4	99	5
CSF	9	1	0	0	0	0	0	0	0	0	1	50	1	0
Gender														
Male	52	1	59	1	47	9	62	0	62	0	60	4	70	5
Female	46	1	39	1	49	7	34	0	38	0	40	4	30	4
Unknown	2	9	2	0	3	9	5	0	0	0	0	0	1	0
Age (years)														
0-4	9	3	9	2	4	2	9	0	9	0	4	0	4	0
5-19	5	2	6	1	4	10	7	0	3	0	1	67	3	17
20-64	39	1	36	1	31	10	35	0	40	0	37	5	35	5
65 and over	47	1	48	1	60	8	49	0	48	1	58	2	58	5
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital dep.														
ICU	8	1	9	2	7	10	25	0	18	0	13	13	21	13
Internal Med.	17	3	17	1	18	9	12	0	7	0	6	0	10	0
Surgery	2	0	9	1	6	6	7	0	4	0	6	0	4	13
Other	22	2	22	1	19	13	23	0	27	1	14	5	12	0
Unknown	51	1	42	1	49	7	34	0	43	0	61	3	52	3

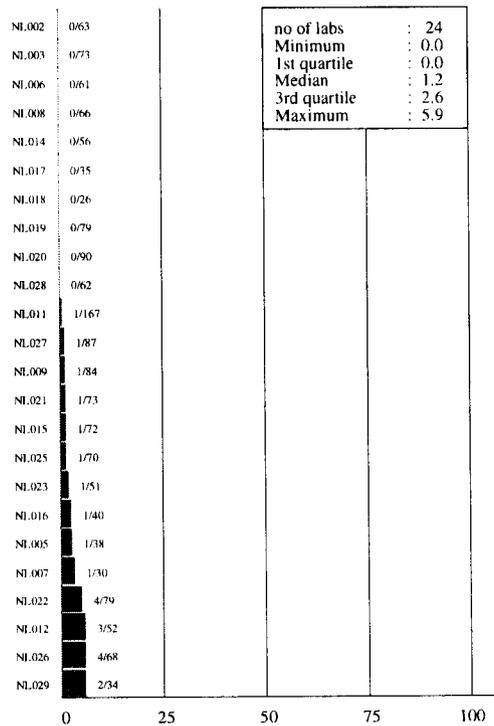
PNSP = Penicillin Non-Susceptible *S. pneumonia*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

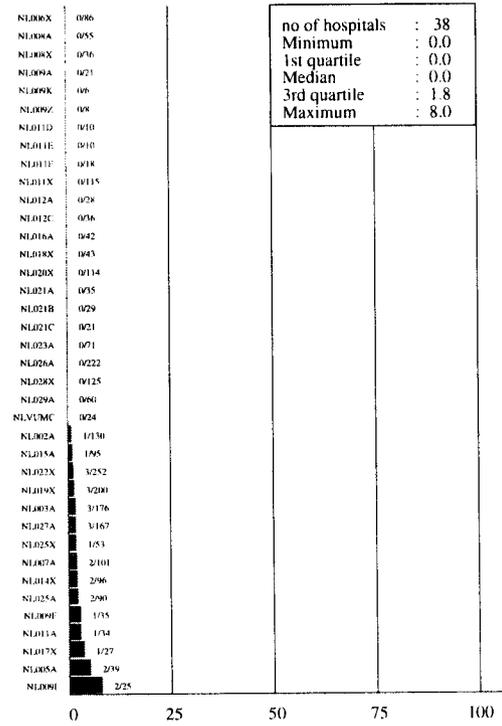
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Norway

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	6/8
Hosps providing denom.data/ reporting data to EARSS	8/31
Number of blood culture sets	45,369
Number of hospital beds	3,479
Patient-days	867,115
Average occupancy rate (%)	92%
Median length of stay (days)	5
Estimated catchment population	1,763,000
% total population covered	38%
Type of participating hospitals	
University/Tertiary	25%
General/Secondary	75%
Other	0%

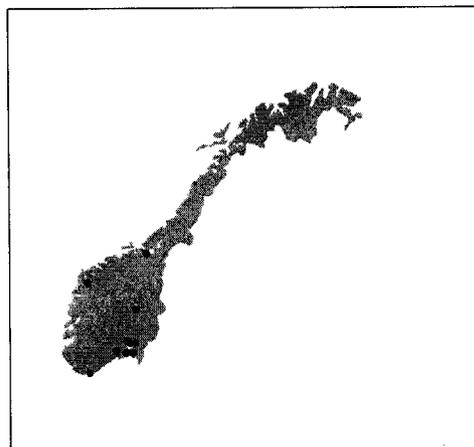


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	10	280	9	270	9	629	10	76	3	15	2	8
2000	10	396	10	362	10	847	10	106	2	21	3	6
2001	10	391	10	364	10	879	10	144	3	19	3	11
2002	10	421	10	460	10	1026	10	172	3	28	3	21
2003	10	484	10	471	10	1071	10	190	3	38	3	23
2004	10	562	10	482	10	1099	10	222	3	37	3	19
2005	10	569	10	501	10	1238	10	288	10	174	10	90

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	<1	<1	<1	<1	<1	<1	<1
	Penicillin I+R	2	1	1	<1	<1	1	2
	Macrolides I+R	9	4	4	6	7	8	16
<i>S. aureus</i>	Oxacillin/Methicillin R	<1	<1	<1	<1	<1	<1	<1
	<i>E. coli</i>	Aminopenicillins R	27	25	26	27	33	32	33
<i>E. coli</i>	Aminoglycosides R	<1	<1	<1	<1	<1	<1	2
	Fluoroquinolones R	2	2	1	2	2	4	5
	3rd gen. Cephalosporins R	<1	<1	<1	<1	<1	<1	<1
	<i>E. faecalis</i>	Aminopenicillins I+R	<1	3	3	4	4	<1	3
<i>E. faecalis</i>	HL Aminoglycosides R	23	11	42	30	38	27	32
	Glycopeptides R	<1	2	<1	3	<1	<1	<1
	<i>E. faecium</i>	Aminopenicillins I+R	19	36	30	50	46	77	73
<i>E. faecium</i>	HL Aminoglycosides R	<1	33	40	14	14	25	44
	Glycopeptides R	<1	<1	<1	<1	<1	<1	<1
	<i>K. pneumoniae</i>	Aminoglycosides R	<1	<1	<1	<1	<1	3	2
<i>K. pneumoniae</i>	Fluoroquinolones R	<1	<1	<1	<1	<1	<1	1
	3rd gen. Cephalosporins R	<1	<1	<1	<1	<1	<1	1
	<i>P. aeruginosa</i>	Piperacillin R	.	.	.	<1	<1	13	3
<i>P. aeruginosa</i>	Ceftazidime R	<1	20	<1	<1	<1	<1	3
	Carbapenems R	<1	<1	<1	<1	<1	6	4
	Aminoglycosides R	<1	<1	<1	<1	<1	5	<1
	Fluoroquinolones R	13	<1	9	<1	4	5	4

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=1131		<i>S. aureus</i> n=983		<i>E. coli</i> n=2316		<i>E. faecalis</i> n=376		<i>E. faecium</i> n=84		<i>K. pneumo.</i> n=211		<i>P. aeruginosa</i> n=98	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	95	2	100	1	100	5	100	0	100	0	100	1	99	4
CSF	5	2	0	0	0	0	0	0	0	0	0	0	1	0
Gender														
Male	46	3	58	0	45	6	74	0	62	0	57	0	66	2
Female	52	1	40	1	54	3	25	0	37	0	42	1	30	3
Unknown	2	6	1	7	1	11	1	0	1	0	1	50	4	50
Age (years)														
0-4	9	2	3	3	2	3	1	0	0	0	1	33	4	50
5-19	3	3	3	0	1	0	0	0	0	0	0	0	2	0
20-64	39	2	34	1	26	6	19	0	27	0	23	2	29	4
65 and over	49	2	59	0	71	4	80	0	73	0	75	0	65	2
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital dep.														
ICU	9	2	5	0	5	6	6	0	15	0	7	0	7	14
Internal Med.	53	1	47	1	47	4	45	0	26	0	35	1	38	3
Surgery	4	2	17	1	19	4	19	0	31	0	23	0	17	6
Other	30	3	29	1	26	6	27	0	26	0	33	0	35	0
Unknown	3	3	3	4	3	0	2	0	1	0	2	20	3	33

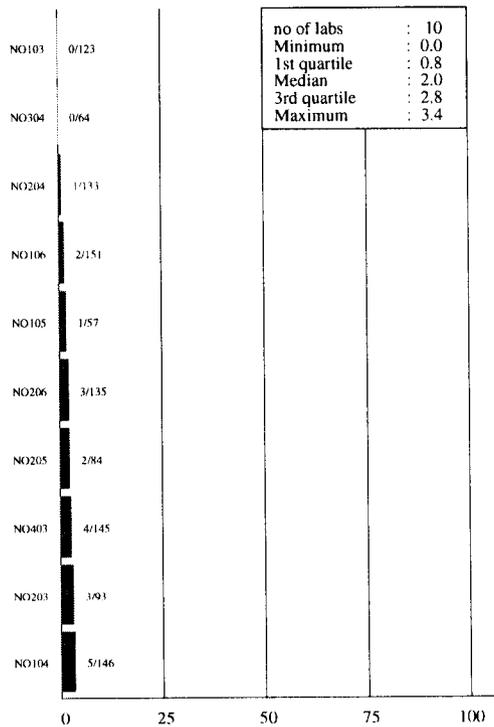
PNSP = Penicillin Non-Susceptible *S. pneumonia*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
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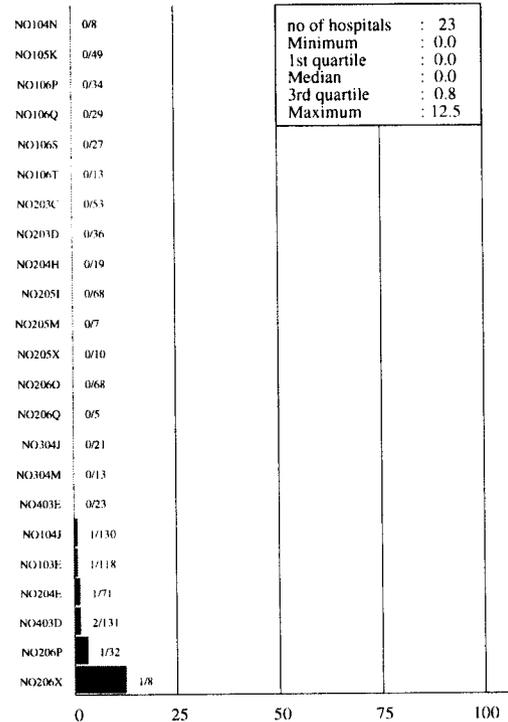
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Poland

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	36/36
Hosps providing denom.data/ reporting data to EARSS	36/36
Number of blood culture sets	51,924
Number of hospital beds	20,421
Patient-days	5,311,381
Average occupancy rate (%)	71%
Median length of stay (days)	7
Estimated catchment population	11,452,915
% total population covered	30%
Type of participating hospitals	
University/Tertiary	19%
General/Secondary	81%
Other	0%

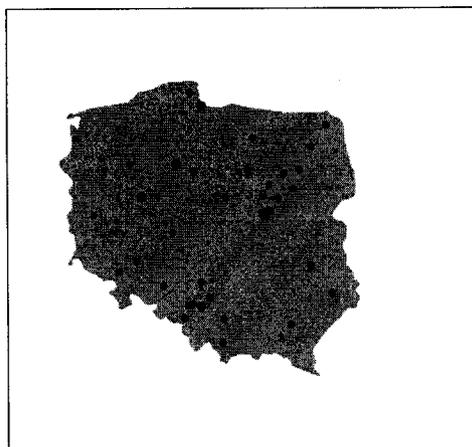


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	4	6	19	151	20	103	16	57	0	0	0	0
2002	7	10	21	186	22	135	19	56	0	0	0	0
2003	11	16	24	166	25	124	16	64	0	0	0	0
2004	11	16	30	262	29	192	23	52	0	0	0	0
2005	6	6	30	197	30	176	20	53	17	53	14	26

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	.	.	<1	30	19	<1	17
	Penicillin I+R	.	.	<1	30	19	<1	33
	Macrolides I+R	.	.	<1	67	14	19	33
<i>S. aureus</i>	Oxacillin/Methicillin R	.	.	15	23	19	19	24
<i>E. coli</i>	Aminopenicillins R	.	.	58	52	50	45	56
	Aminoglycosides R	.	.	5	11	10	5	7
	Fluoroquinolones R	.	.	9	11	7	9	20
	3rd gen. Cephalosporins R	.	.	7	6	4	5	5
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	5	12	<1	2	9
	HL Aminoglycosides R	.	.	43	41	48	33	48
	Glycopeptides R	.	.	<1	<1	<1	<1	<1
<i>E. faecium</i>	Aminopenicillins I+R	.	.	77	80	91	86	95
	HL Aminoglycosides R	.	.	73	73	55	100	60
	Glycopeptides R	.	.	<1	<1	<1	<1	5
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	57
	Fluoroquinolones R	.	.	.	.	.	.	34
	3rd gen. Cephalosporins R	.	.	.	.	.	.	66
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	50
	Ceftazidime R	.	.	.	.	.	.	31
	Carbapenems R	.	.	.	.	.	.	27
	Aminoglycosides R	.	.	.	.	.	.	56
	Fluoroquinolones R	.	.	.	.	.	.	31

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=22		<i>S. aureus</i> n=459		<i>E. coli</i> n=363		<i>E. faecalis</i> n=78		<i>E. faecium</i> n=27		<i>K. pneumo.</i> n=53		<i>P. aeruginosa</i> n=26	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	73	13	100	22	100	14	100	0	100	4	100	66	100	27
CSF	27	0	0	0	0	0	0	0	0	0	0	0	0	0
Gender														
Male	64	7	58	24	41	13	63	0	56	7	66	66	54	21
Female	36	13	42	19	58	14	37	0	44	0	34	67	46	33
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Age (years)														
0-4	23	0	9	12	9	3	1	0	15	0	21	91	19	20
5-19	5	0	3	7	1	0	0	0	0	0	0	0	0	0
20-64	55	8	49	24	44	12	47	0	48	8	45	71	38	30
65 and over	18	25	38	22	46	18	51	0	37	0	34	44	42	27
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hospital dep.														
ICU	5	0	12	53	6	17	10	0	26	14	23	83	38	40
Internal Med.	36	25	44	13	51	14	42	0	33	0	34	44	19	40
Surgery	0	0	15	35	15	18	24	0	26	0	17	67	15	0
Other	59	0	28	15	28	11	22	0	15	0	25	85	27	14
Unknown	0	0	0	0	0	0	1	0	0	0	2	0	0	0

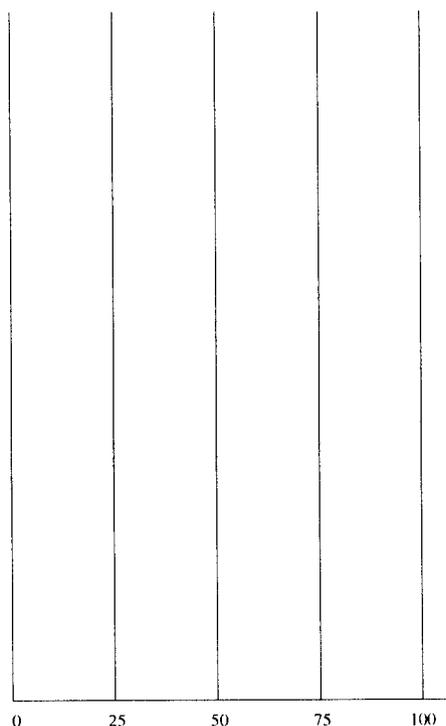
PNSP = Penicillin Non-Susceptible *S. pneumoniae*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

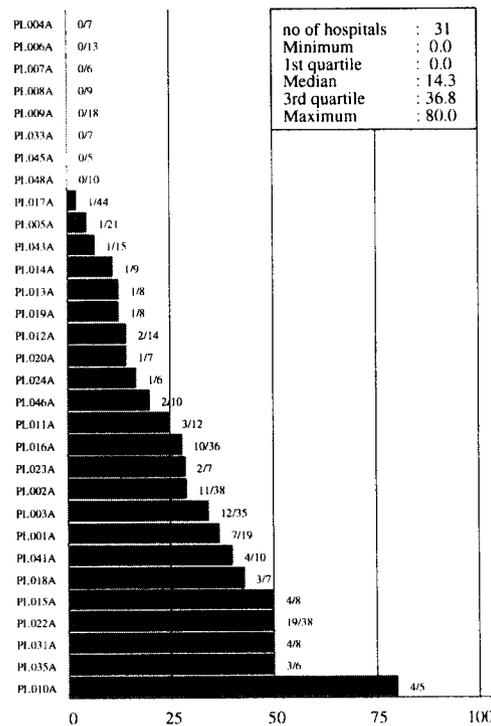
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Portugal

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	23/23
Hosps providing denom.data/ reporting data to EARSS	23/23
Number of blood culture sets	72,145
Number of hospital beds	10,527
Patient-days	2,388,639
Average occupancy rate (%)	79%
Median length of stay (days)	8
Estimated catchment population	8,840,081
% total population covered	83%
Type of participating hospitals	
University/Tertiary	17%
General/Secondary	57%
• Other	26%

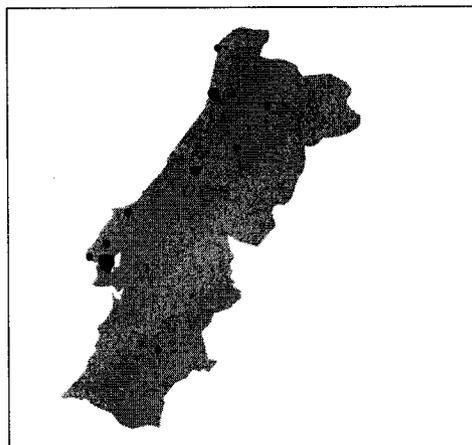


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	12	119	13	369	0	0	0	0	0	0	0	0
2000	11	97	8	150	0	0	0	0	0	0	0	0
2001	16	155	16	521	13	418	12	185	0	0	0	0
2002	14	184	16	543	17	444	13	101	0	0	0	0
2003	12	95	22	1033	21	792	18	398	0	0	0	0
2004	14	166	23	1063	19	761	19	410	0	0	0	0
2005	13	202	19	1153	19	1171	17	405	0	0	0	0

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	<1	<1	<1	<1	<1	<1	<1
	Penicillin I+R	17	29	25	20	20	27	17
	Macrolides I+R	9	11	.	<1	.	20	19
<i>S. aureus</i>	Oxacillin/Methicillin R	37	25	32	38	45	46	47
<i>E. coli</i>	Aminopenicillins R	.	.	54	58	53	58	58
	Aminoglycosides R	.	.	6	9	9	13	12
	Fluoroquinolones R	.	.	18	23	26	27	29
	3rd gen. Cephalosporins R	.	.	3	6	7	8	12
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	5	2	4	5	<1
	HL Aminoglycosides R	.	.	30	25	34	29	38
	Glycopeptides R	.	.	5	6	3	6	5
<i>E. faecium</i>	Aminopenicillins I+R	.	.	76	79	88	83	92
	HL Aminoglycosides R	.	.	23	33	55	66	68
	Glycopeptides R	.	.	21	.	47	42	34
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	.
	Fluoroquinolones R	.	.	.	.	.	.	.
	3rd gen. Cephalosporins R	.	.	.	.	.	.	.
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	.
	Ceftazidime R	.	.	.	.	.	.	.
	Carbapenems R	.	.	.	.	.	.	.
	Aminoglycosides R	.	.	.	.	.	.	.
	Fluoroquinolones R	.	.	.	.	.	.	.

* Proportion not given, due to a very low number of isolates.

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=368		<i>S. aureus</i> n=2216		<i>E. coli</i> n=1805		<i>E. faecalis</i> n=583		<i>E. faecium</i> n=199		<i>K. pneumo.</i> n=0		<i>P. aeruginosa</i> n=0	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	89	21	100	46	100	28	100	5	100	38	.	.	.	.
CSF	11	20	0	.	0	.	0	.	0	.	.	.	.	.
Gender														
Male	64	18	62	47	45	34	55	4	54	40	.	.	.	.
Female	36	28	38	45	55	24	45	7	45	37	.	.	.	.
Unknown	0	.	0	.	0	.	0	.	1	0	.	.	.	.
Age (years)														
0-4	13	35	2	6	1	4	1	0	2	50	.	.	.	.
5-19	5	35	2	17	1	15	1	0	2	0	.	.	.	.
20-64	41	15	38	38	35	24	36	5	36	47	.	.	.	.
65 and over	35	18	47	58	57	33	55	6	56	35	.	.	.	.
Unknown	7	40	10	39	5	16	6	11	4	14	.	.	.	.
Hospital dep.														
ICU	3	33	9	52	5	38	15	3	17	29	.	.	.	.
Internal Med.	17	13	26	53	27	33	28	5	20	26	.	.	.	.
Surgery	1	25	8	56	6	29	9	8	8	25
Other	76	22	45	37	61	26	45	7	52	49
Unknown	2	44	12	55	2	21	4	0	3	17

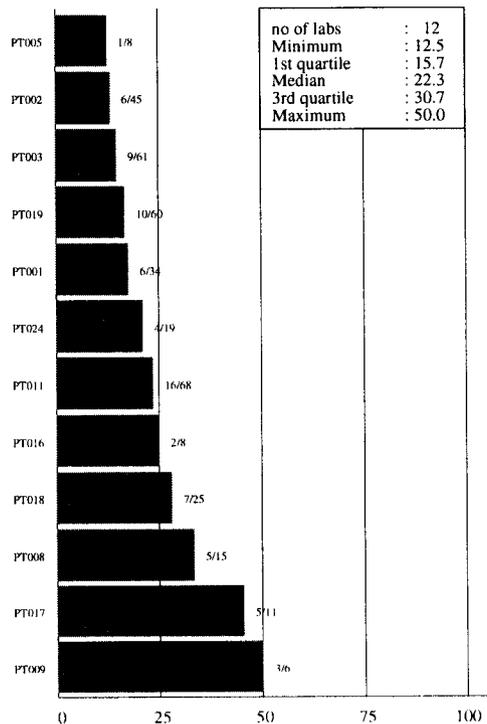
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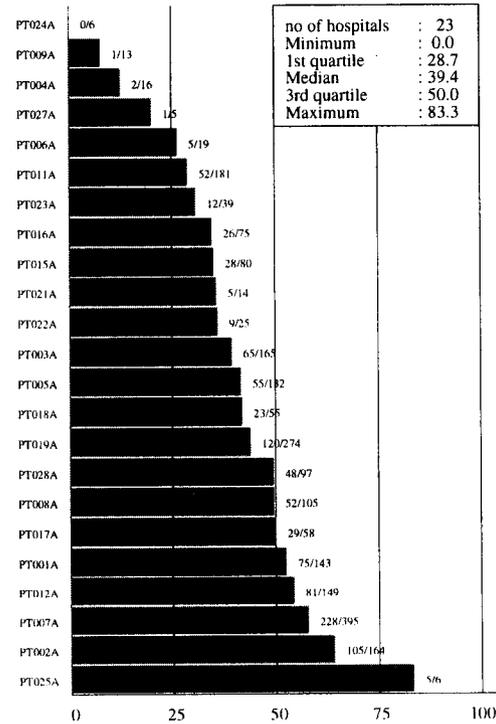
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Romania

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	13/20
Hosps providing denom.data/ reporting data to EARSS	16/20
Number of blood culture sets	15,122
Number of hospital beds	12,317
Patient-days	3,551,512
Average occupancy rate (%)	90%
Median length of stay (days)	7
Estimated catchment population	12,500,000
% total population covered	56%
Type of participating hospitals	
University/Tertiary	75%
General/Secondary	13%
Other	13%

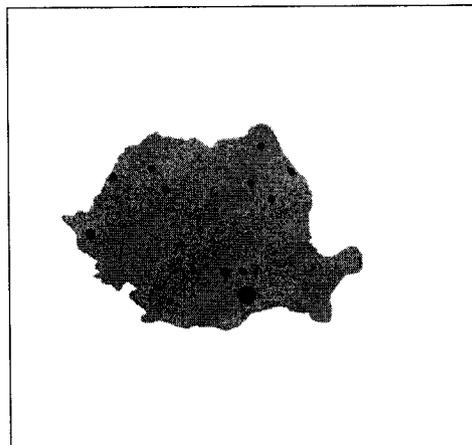


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	6	10	10	80	8	28	4	11	0	0	0	0
2003	4	22	9	85	9	50	5	12	0	0	0	0
2004	4	9	15	92	12	46	4	9	0	0	0	0
2005	5	18	13	83	13	80	7	14	0	0	2	23

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	.	.	.	10	23	11	22
	Penicillin I+R	.	.	.	50	36	11	39
	Macrolides I+R	.	.	.	10	27	<1	31
<i>S. aureus</i>	Oxacillin/Methicillin R	.	.	.	36	46	72	61
<i>E. coli</i>	Aminopenicillins R	.	.	.	50	70	79	77
	Aminoglycosides R	.	.	.	15	21	30	14
	Fluoroquinolones R	.	.	.	20	14	17	8
	3rd gen. Cephalosporins R	.	.	.	18	19	22	16
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	.	<1	<1	29	<1
	HL Aminoglycosides R	.	.	.	40	25	<1	50
	Glycopeptides R	.	.	.	<1	<1	<1	<1
<i>E. faecium</i>	Aminopenicillins I+R	.	.	.	100	86	100	100
	HL Aminoglycosides R	.	.	.	80	63	100	70
	Glycopeptides R	.	.	.	17	<1	<1	<1
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	.
	Fluoroquinolones R	.	.	.	.	.	.	.
	3rd gen. Cephalosporins R	.	.	.	.	.	.	.
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	61
	Ceftazidime R	.	.	.	.	.	.	52
	Carbapenems R	.	.	.	.	.	.	61
	Aminoglycosides R	.	.	.	.	.	.	64
	Fluoroquinolones R	.	.	.	.	.	.	64

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=27		<i>S. aureus</i> n=175		<i>E. coli</i> n=116		<i>E. faecalis</i> n=11		<i>E. faecium</i> n=12		<i>K. pneumo.</i> n=0		<i>P. aeruginosa</i> n=23	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	59	25	100	67	94	12	100	0	100	0	.	.	87	70
CSF	41	36	0	.	6	0	0	.	0	.	.	.	13	0
Gender														
Male	52	29	64	71	47	9	73	0	67	0	.	.	30	71
Female	41	36	36	60	52	13	27	0	33	0	.	.	35	38
Unknown	7	0	0	.	2	0	0	.	0	.	.	.	35	75
Age (years)														
0-4	22	67	29	70	24	11	27	0	50	0	.	.	0	.
5-19	22	17	11	37	8	33	0	.	0	.	.	.	30	43
20-64	26	14	41	69	40	11	27	0	8	0	.	.	0	.
65 and over	26	14	15	69	26	7	45	0	33	0	.	.	0	.
Unknown	4	100	5	88	3	0	0	.	8	0	.	.	70	69
Hospital dep.														
ICU	4	0	10	71	9	0	18	0	33	0	.	.	26	83
Internal Med.	0	.	11	47	19	5	18	0	8	0	.	.	0	.
Surgery	0	.	10	78	9	10	0	.	0	.	.	.	13	100
Other	89	33	50	66	60	16	45	0	33	0	.	.	30	43
Unknown	7	0	19	74	3	0	18	0	25	0	.	.	30	43

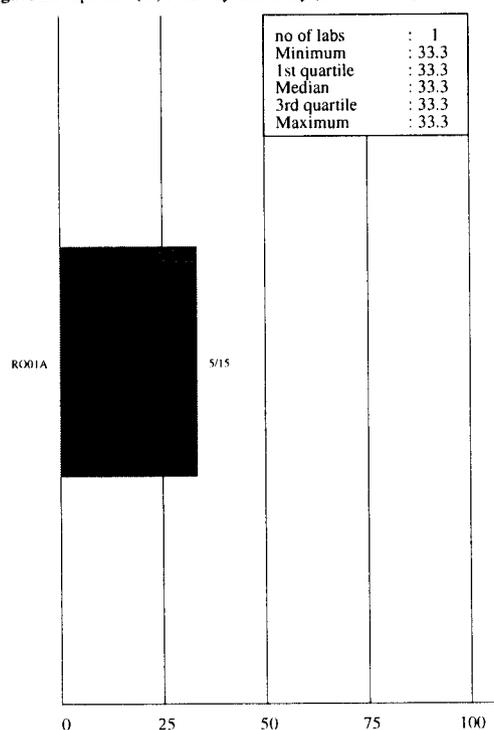
PNSP = Penicillin Non-Susceptible *S. pneumonia*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

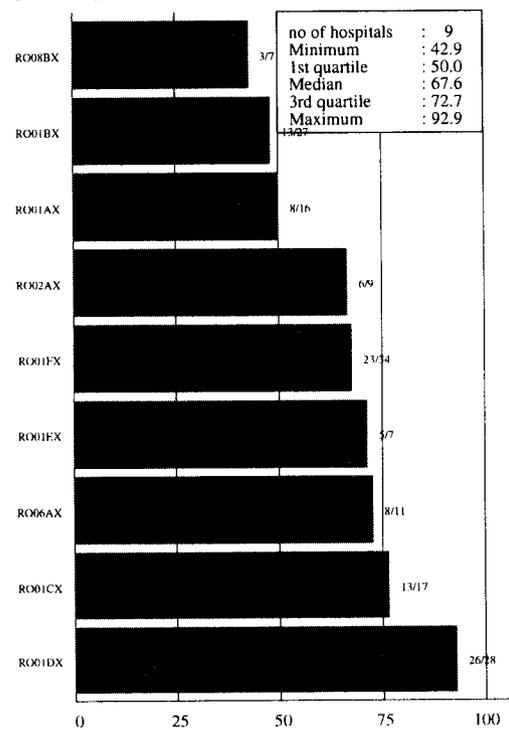
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Slovakia

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	13/15
Hosps providing denom.data/ reporting data to EARSS	20/23
Number of blood culture sets	21,035
Number of hospital beds	12,673
Patient-days	2,548,517
Average occupancy rate (%)	68%
Median length of stay (days)	7
Estimated catchment population	5,400,000
% total population covered	100%
Type of participating hospitals	
University/Tertiary	65%
General/Secondary	35%
Other	0%

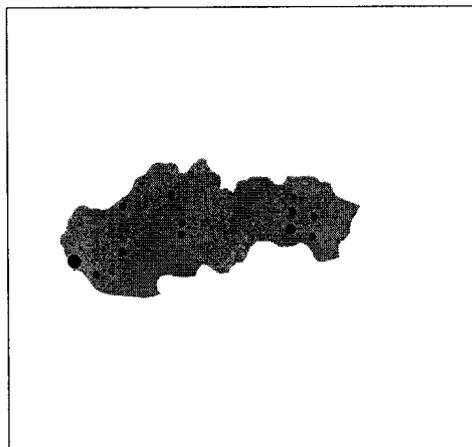


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	4	6	7	37	8	45	6	17	0	0	0	0
2002	9	16	14	259	14	215	12	79	0	0	0	0
2003	14	27	16	269	16	239	10	75	0	0	0	0
2004	9	17	15	289	15	310	12	82	0	0	0	0
2005*	4	8	12	147	13	134	8	46	0	0	0	0

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005*
<i>S. pneumoniae</i>	Penicillin R			<1	19	4	24	<1
	Penicillin I+R			<1	19	11	29	<1
	Macrolides I+R			20	29	<1	33	40
<i>S. aureus</i>	Oxacillin/Methicillin R			5	8	13	19	19
<i>E. coli</i>	Aminopenicillins R			36	49	54	62	59
	Aminoglycosides R			2	4	6	11	7
	Fluoroquinolones R			16	14	20	24	14
	3rd gen. Cephalosporins R			7	2	<1	7	8
<i>E. faecalis</i>	Aminopenicillins I+R			<1	4	<1	7	7
	HL Aminoglycosides R			58	34	35	37	40
	Glycopeptides R			<1	<1	<1	<1	<1
<i>E. faecium</i>	Aminopenicillins I+R			67	75	92	91	100
	HL Aminoglycosides R			50	75	60	45	33
	Glycopeptides R			<1	<1	<1	9	<1
<i>K. pneumoniae</i>	Aminoglycosides R							
	Fluoroquinolones R							
	3rd gen. Cephalosporins R							
<i>P. aeruginosa</i>	Piperacillin R							
	Ceftazidime R							
	Carbapenems R							
	Aminoglycosides R							
	Fluoroquinolones R							

* First half year of 2005.

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=25		<i>S. aureus</i> n=436		<i>E. coli</i> n=440		<i>E. faecalis</i> n=113		<i>E. faecium</i> n=14		<i>K. pneumo.</i> n=0		<i>P. aeruginosa</i> n=0	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	68	24	100	19	100	21	100	0	100	7				
CSF	32	13	0		0		0		0					
Gender														
Male	56	7	65	17	41	26	64	0	79	9				
Female	44	36	35	23	59	18	36	0	21	0				
Unknown	0		0		0		0		0					
Age (years)														
0-4	24	17	8	19	6	8	11	0	0					
5-19	12	33	3	27	2	40	1	0	0					
20-64	44	9	50	16	37	17	50	0	64	11				
65 and over	20	40	38	22	54	25	37	0	36	0				
Unknown	0		0		1	20	1	0	0					
Hospital dep.														
ICU	12	0	12	26	8	24	27	0	7	0				
Internal Med.	28	0	42	17	46	20	21	0	14	0				
Surgery	0		8	27	9	33	15	0	29	0				
Other	60	33	38	18	36	19	36	0	50	14				
Unknown	0		0		1	33	0		0					

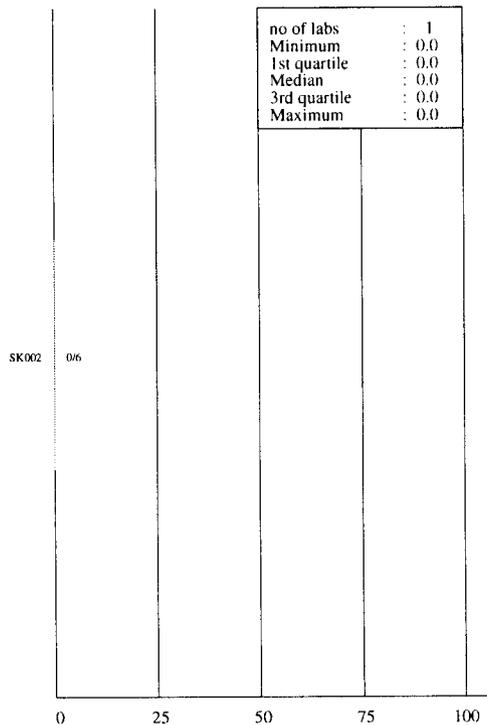
PNSP = Penicillin Non-Susceptible *S. pneumoniae*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

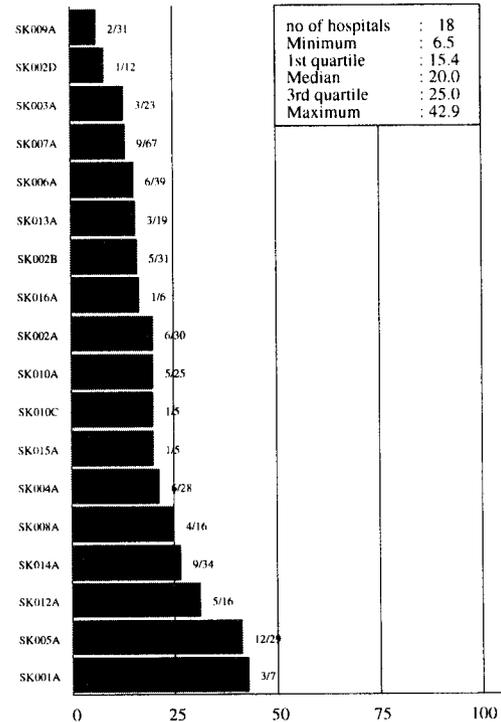
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Slovenia

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	11/11
Hosps providing denom.data/ reporting data to EARSS	14/14
Number of blood culture sets	36,276
Number of hospital beds	7,604
Patient-days	2,047,687
Average occupancy rate (%)	74%
Median length of stay (days)	6
Estimated catchment population	2,000,000
% total population covered	100%
Type of participating hospitals	
University/Tertiary	21%
General/Secondary	79%
Other	0%

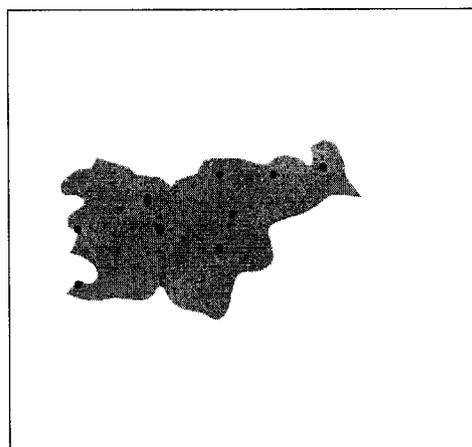


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	7	40	10	154	0	0	0	0	0	0	0	0
2001	10	156	10	270	10	398	10	54	0	0	0	0
2002	11	101	11	276	11	409	9	45	0	0	0	0
2003	11	172	11	299	11	401	10	76	0	0	0	0
2004	10	166	11	347	11	573	9	91	0	0	0	0
2005	11	208	11	349	11	657	11	119	10	78	8	38

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R		<1	<1	<1	2	2	2
	Penicillin I+R		23	20	19	15	25	11
	Macrolides I+R		12	18	10	9	11	11
<i>S. aureus</i>	Oxacillin/Methicillin R		21	20	14	13	12	10
<i>E. coli</i>	Aminopenicillins R			44	43	41	40	42
	Aminoglycosides R			2	3	2	5	4
	Fluoroquinolones R			8	12	11	12	12
<i>E. faecalis</i>	3rd gen. Cephalosporins R			<1	1	<1	1	2
	Aminopenicillins I+R			<1	<1	<1	<1	1
	HL Aminoglycosides R			35	50	49	37	46
<i>E. faecium</i>	Glycopeptides R			<1	<1	<1	<1	<1
	Aminopenicillins I+R			64	69	83	76	93
	HL Aminoglycosides R			50	62	82	56	47
<i>K. pneumoniae</i>	Glycopeptides R			<1	<1	<1	<1	<1
	Aminoglycosides R							17
	Fluoroquinolones R							14
<i>P. aeruginosa</i>	3rd gen. Cephalosporins R							19
	Piperacillin R							21
	Ceftazidime R							11
	Carbapenems R							13
	Aminoglycosides R							18
Fluoroquinolones R							29	

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=374		<i>S. aureus</i> n=696		<i>E. coli</i> n=1230		<i>E. faecalis</i> n=146		<i>E. faecium</i> n=64		<i>K. pneumo.</i> n=78		<i>P. aeruginosa</i> n=38	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	91	18	100	11	100	12	100	0	100	0	99	19	100	13
CSF	9	9	0	.	0	.	0	.	0	.	1	0	0	.
Gender														
Male	59	14	61	13	37	13	65	0	64	0	46	25	63	13
Female	41	22	39	8	63	12	35	0	36	0	54	14	37	14
Unknown	0	.	0	.	0	.	0	.	0	.	0	.	0	.
Age (years)														
0-4	17	38	4	0	2	0	4	0	3	0	10	0	3	0
5-19	5	0	4	7	1	0	0	.	0	.	5	50	3	0
20-64	36	9	38	9	30	11	27	0	41	0	33	27	39	13
65 and over	42	18	54	14	67	13	68	0	56	0	51	15	55	14
Unknown	0	.	0	.	0	.	0	.	0	.	0	.	0	.
Hospital dep.														
ICU	10	13	11	17	7	13	10	0	20	0	10	25	16	0
Internal Med.	38	13	44	8	53	12	48	0	38	0	27	19	34	23
Surgery	2	33	11	26	4	16	13	0	19	0	18	14	8	33
Other	51	21	34	8	36	12	29	0	23	0	45	20	42	6
Unknown	0	.	0	.	0	.	0	.	0	.	0	.	0	.

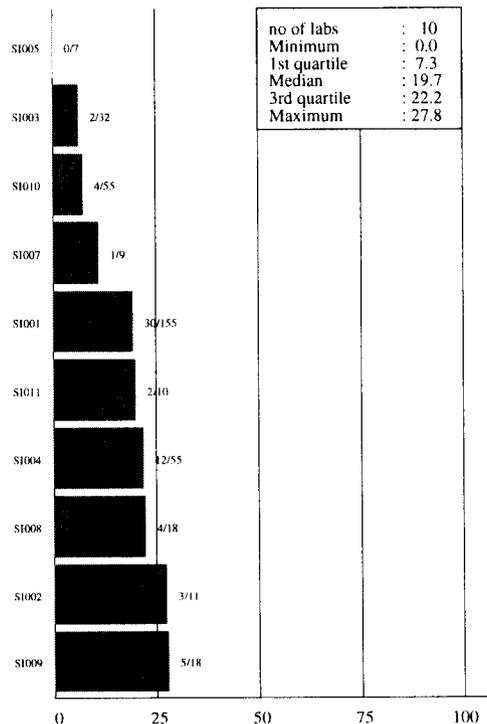
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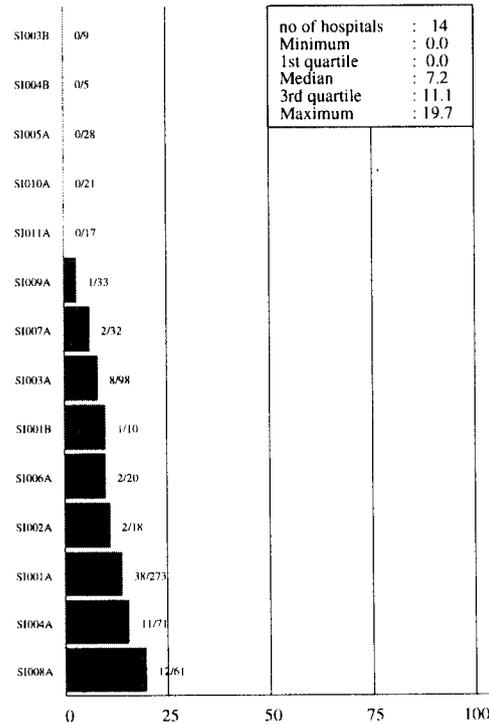
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=1422		<i>S. aureus</i> n=2863		<i>E. coli</i> n=6459		<i>E. faecalis</i> n=1062		<i>E. faecium</i> n=269		<i>K. pneumo.</i> n=56		<i>P. aeruginosa</i> n=70	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	95	27	100	27	100	27	100	0	100	2	100	7	97	15
CSF	5	22	0	0	0	0	0	0	0	0	0	0	3	100
Gender														
Male	64	25	66	27	51	30	65	0	64	2	61	9	71	14
Female	36	30	34	26	49	23	35	0	36	3	39	5	29	25
Unknown	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Age (years)														
0-4	15	40	4	7	3	8	7	0	10	0	4	0	4	0
5-19	5	8	3	10	1	11	1	0	0	0	0	0	0	0
20-64	39	23	38	21	29	25	30	0	29	6	36	5	44	26
65 and over	40	28	55	33	66	29	60	0	60	1	61	9	50	11
Unknown	1	18	1	12	1	0	2	0	1	0	0	0	1	0
Hospital dep.														
ICU	8	26	12	37	5	28	22	0	11	7	11	17	33	30
Internal Med.	28	30	35	27	30	29	25	0	28	3	36	5	19	8
Surgery	1	20	10	41	6	25	10	0	14	0	9	0	11	25
Other	60	26	42	21	58	25	41	0	44	2	45	8	36	8
Unknown	3	21	2	24	1	33	2	0	3	0	0	0	1	0

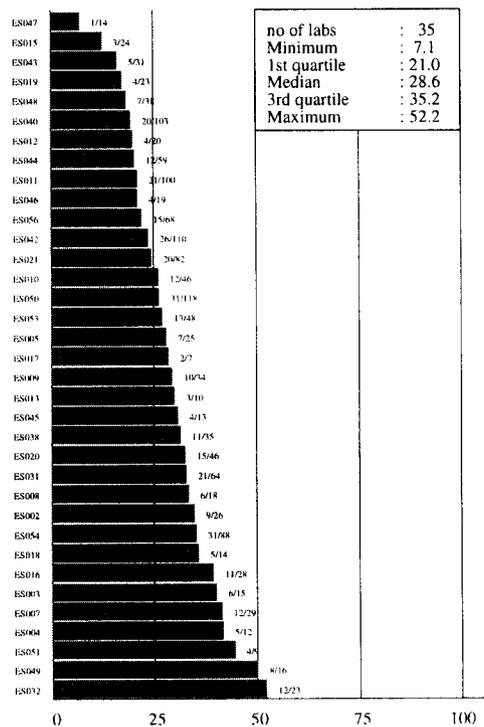
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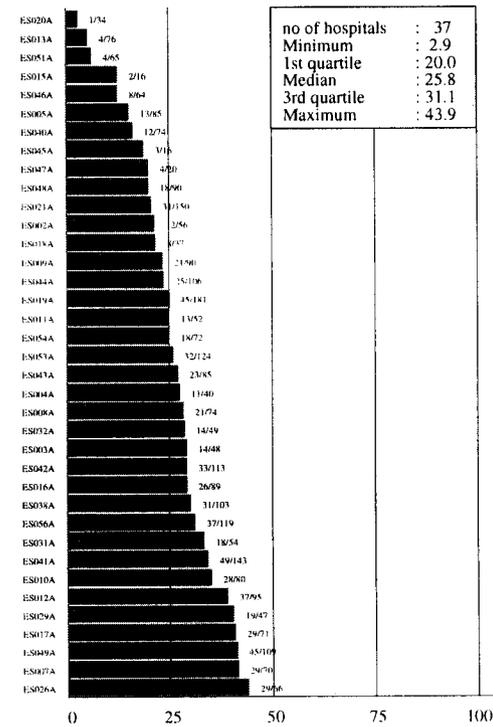
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Sweden

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2005, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	20/21
Hosps providing denom.data/ reporting data to EARSS	45/59
Number of blood culture sets	188,291
Number of hospital beds	17,285
Patient-days	4,971,229
Average occupancy rate (%)	83%
Median length of stay (days)	5
Estimated catchment population	6,388,281
% total population covered	71%
Type of participating hospitals	
University/Tertiary	18%
General/Secondary	82%
Other	0%

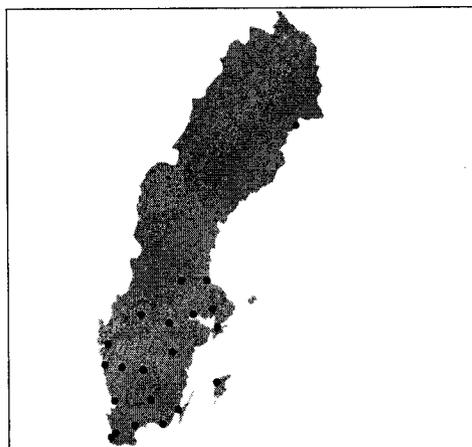


Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	24	805	24	1320	0	0	0	0	0	0	0	0
2000	19	803	19	1478	0	0	0	0	0	0	0	0
2001	20	788	20	1633	20	2800	20	671	0	0	0	0
2002	21	830	21	1836	21	3066	21	696	0	0	0	0
2003	21	917	21	1855	21	3350	21	850	0	0	0	0
2004	21	955	21	1906	21	3373	21	856	0	0	0	0
2005	21	1017	21	1774	21	3240	21	821	18	281	17	149

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	<1	<1	<1	<1	<1	<1	<1
	Penicillin I+R	1	2	3	2	5	3	4
	Macrolides I+R	6	3	5	6	4	5	6
<i>S. aureus</i>	Oxacillin/Methicillin R	<1	<1	<1	<1	<1	<1	1
<i>E. coli</i>	Aminopenicillins R	.	.	27	25	28	23	26
	Aminoglycosides R	.	.	<1	<1	1	1	1
	Fluoroquinolones R	.	.	4	5	7	8	6
	3rd gen. Cephalosporins R	.	.	<1	<1	<1	<1	1
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	<1	1	<1	<1	<1
	HL Aminoglycosides R	.	.	.	.	17	15	19
	Glycopeptides R	.	.	<1	<1	<1	<1	<1
<i>E. faecium</i>	Aminopenicillins I+R	.	.	75	75	77	78	74
	HL Aminoglycosides R	.	.	.	.	11	7	4
	Glycopeptides R	.	.	<1	<1	2	1	<1
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	1
	Fluoroquinolones R	.	.	.	.	.	.	5
	3rd gen. Cephalosporins R	.	.	.	.	.	.	1
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	9
	Ceftazidime R	.	.	.	.	.	.	5
	Carbapenems R	.	.	.	.	.	.	18
	Aminoglycosides R	.	.	.	.	.	.	<1
	Fluoroquinolones R	.	.	.	.	.	.	6

Demographic characteristics

Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=1972		<i>S. aureus</i> n=3680		<i>E. coli</i> n=6372		<i>E. faecalis</i> n=1159		<i>E. faecium</i> n=513		<i>K. pneumo.</i> n=281		<i>P. aeruginosa</i> n=57	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	97	3	100	1	100	7	100	0	100	1	100	1	100	18
CSF	3	3	0	.	0	.	0	.	0	.	0	.	0	.
Gender														
Male	51	4	63	1	47	8	71	0	61	0	58	1	65	16
Female	49	3	37	1	53	6	29	0	39	2	42	2	35	20
Unknown	0	.	0	.	0	.	0	.	0	.	0	.	0	.
Age (years)														
0-4	6	8	4	1	1	2	6	0	2	0	2	17	2	0
5-19	2	3	4	0	1	13	1	0	1	0	1	0	4	50
20-64	40	3	32	1	24	9	23	0	31	1	20	4	19	18
65 and over	52	3	60	1	74	6	70	0	65	1	76	0	75	16
Unknown	0	.	0	.	0	.	0	.	0	.	0	.	0	.
Hospital dep.														
ICU	8	1	6	0	4	5	7	0	8	5	6	0	11	50
Internal Med.	43	3	42	1	40	6	35	0	36	0	30	1	25	21
Surgery	4	3	16	1	19	8	23	0	27	1	27	0	16	0
Other	45	4	36	1	37	8	35	0	28	1	36	3	49	14
Unknown	0	.	0	.	0	.	0	.	0	.	0	.	0	.

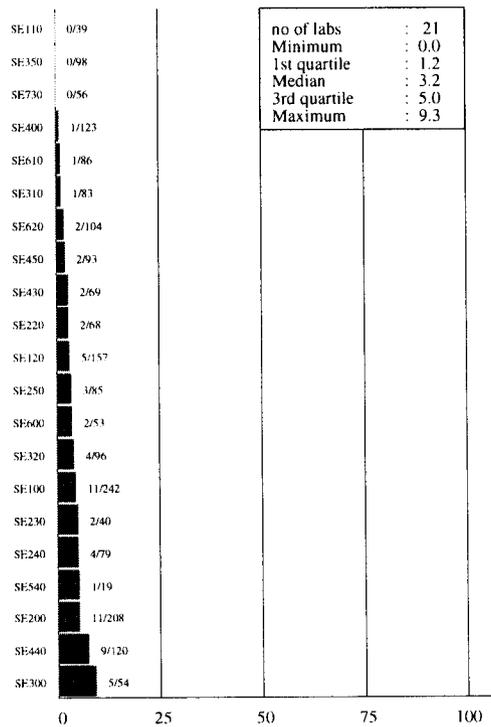
PNSP = Penicillin Non-Susceptible *S. pneumoniae*
VRE = Vancomycin Resistant Enterococcus

MRSA = Methicillin Resistant *S. aureus*
CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae*

FREC = Fluoroquinolone Resistant *E. coli*
CRPA = Carbapenem Resistant *P. aeruginosa*

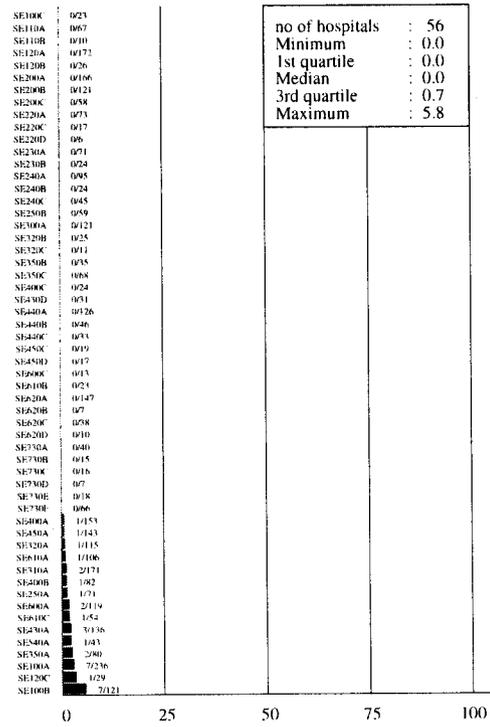
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



United Kingdom

General Information about EARSS participating laboratories and hospitals

Table 1. Reference data of 2004, based on laboratories/hospitals providing denominator data

	Total
Labs providing denom.data/ reporting data to EARSS	20/57
Hosps providing denom.data/ reporting data to EARSS	21/89
Number of blood culture sets	168,733
Number of hospital beds	12,684
Patient-days	2,804,193
Average occupancy rate (%)	81%
Median length of stay (days)	5
Estimated catchment population	4,102,967
% total population covered	7%
Type of participating hospitals	
University/Tertiary	14%
General/Secondary	86%
Other	0%



Figure 1. Geographic distribution of laboratories in 2005

Table 2. Number of laboratories and number of isolates reported for the period 1999-2005

Year	<i>S. pneumoniae</i>		<i>S. aureus</i>		<i>E. coli</i>		Enterococci		<i>K. pneumoniae</i>		<i>P. aeruginosa</i>	
	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates	Labs	Isolates
1999	22	242	23	659	0	0	0	0	0	0	0	0
2000	28	512	27	1492	0	0	0	0	0	0	0	0
2001	26	573	25	1517	20	1424	0	0	0	0	0	0
2002	23	617	21	1703	20	1958	0	0	0	0	0	0
2003	50	1334	51	3521	19	2253	0	0	0	0	0	0
2004	54	1058	54	3560	20	2091	0	0	0	0	0	0
2005	53	1373	58	3967	23	2359	27	598	23	425	25	438

Antibiotic resistance from 1999 to 2005

Table 3. Proportion of antibiotic non-susceptible isolates in percent

Pathogen	Antimicrobial classes	1999	2000	2001	2002	2003	2004	2005
<i>S. pneumoniae</i>	Penicillin R	4	4	3	3	1	<1	2
	Penicillin I+R	7	6	5	6	5	3	4
	Macrolides I+R	14	18	13	13	13	13	11
<i>S. aureus</i>	Oxacillin/Methicillin R	33	39	44	44	43	44	44
<i>E. coli</i>	Aminopenicillins R	.	.	51	52	55	53	56
	Aminoglycosides R	.	.	3	3	4	6	8
	Fluoroquinolones R	.	.	6	7	11	14	17
	3rd gen. Cephalosporins R	.	.	1	2	3	3	6
<i>E. faecalis</i>	Aminopenicillins I+R	.	.	.	.	.	.	2
	HL Aminoglycosides R	.	.	.	.	.	.	47
	Glycopeptides R	.	.	.	.	.	.	2
<i>E. faecium</i>	Aminopenicillins I+R	.	.	.	.	.	.	84
	HL Aminoglycosides R	.	.	.	.	.	.	53
	Glycopeptides R	.	.	.	.	.	.	33
<i>K. pneumoniae</i>	Aminoglycosides R	.	.	.	.	.	.	6
	Fluoroquinolones R	.	.	.	.	.	.	12
	3rd gen. Cephalosporins R	.	.	.	.	.	.	12
<i>P. aeruginosa</i>	Piperacillin R	.	.	.	.	.	.	2
	Ceftazidime R	.	.	.	.	.	.	3
	Carbapenems R	.	.	.	.	.	.	9
	Aminoglycosides R	.	.	.	.	.	.	3
	Fluoroquinolones R	.	.	.	.	.	.	8

Demographic characteristics

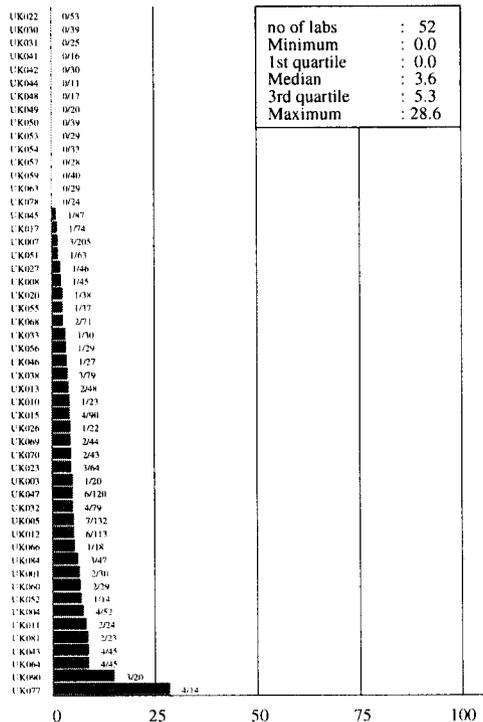
Table 4. Selected details on invasive isolates from the reporting period 2004 and 2005

Characteristic	<i>S. pneumo.</i> n=2431		<i>S. aureus</i> n=7527		<i>E. coli</i> n=4096		<i>E. faecalis</i> n=314		<i>E. faecium</i> n=224		<i>K. pneumo.</i> n=300		<i>P. aeruginosa</i> n=358	
	%tot	%PNSP	%tot	%MRSA	%tot	%FREC	%tot	%VRE	%tot	%VRE	%tot	%CRKP	%tot	%CRPA
Isolate source														
Blood	98	4	100	44	100	16	100	2	100	33	100	12	99	9
CSF	2	4	0	0	0	0	0	0	0	0	0	0	1	50
Gender														
Male	52	4	62	45	44	19	64	2	57	32	59	13	64	10
Female	47	3	37	41	55	13	36	1	43	34	41	11	36	8
Unknown	1	8	1	37	0	0	0	0	0	0	0	0	0	0
Age (years)														
0-4	13	1	4	23	3	7	9	0	6	62	5	6	4	0
5-19	5	8	3	15	1	7	1	0	5	58	2	17	3	40
20-64	36	3	37	36	26	18	33	2	36	38	32	15	34	16
65 and over	42	4	52	52	69	15	57	2	53	24	60	11	60	5
Unknown	3	1	4	46	0	0	0	0	0	0	0	0	0	0
Hospital dep.														
ICU	4	6	9	64	0	0	0	0	0	0	0	0	0	0
Internal Med.	22	4	28	44	0	0	0	0	0	0	0	0	0	0
Surgery	1	0	10	53	0	0	0	0	0	0	0	0	0	0
Other	38	3	40	37	0	0	0	0	0	0	0	0	0	0
Unknown	35	4	13	42	100	16	100	2	100	33	100	12	100	9

PNSP = Penicillin Non-Susceptible *S. pneumoniae* MRSA = Methicillin Resistant *S. aureus* FREC = Fluoroquinolone Resistant *E. coli*
 VRE = Vancomycin Resistant Enterococcus CRKP = 3rd gen. Cephalosporine Resistant *K. pneumoniae* CRPA = Carbapenem Resistant *P. aeruginosa*

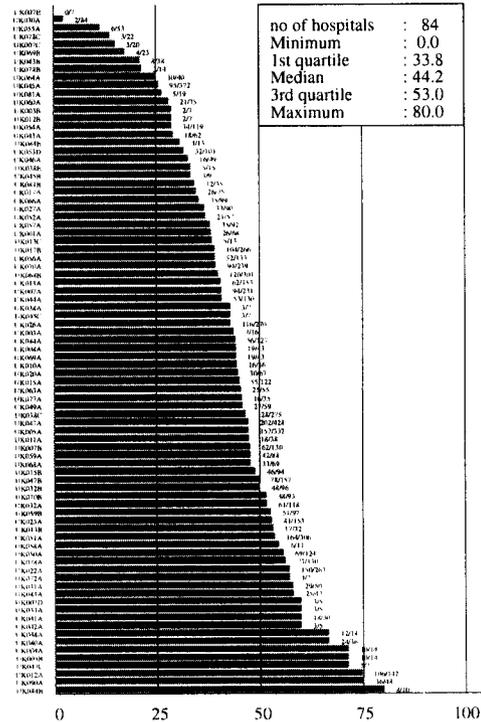
PNSP at laboratory level

Figure 2. Proportion (%) PNSP by laboratory (2004 & 2005)



MRSA at hospital level

Figure 3. Proportion (%) MRSA by hospital (2004 & 2005)



Annex 3. Overview of antibiotic resistance in Europe, 2005

Annex 3.1. The number (No) of invasive *S. pneumoniae* (SPN) isolates, and the proportion penicillin non-susceptible (PNSP), erythromycin non-susceptible (ENSP), single penicillin (PEN), single erythromycin (ERY) and dual resistant isolates, including 95% confidence intervals (95CI) reported per country in 2005.

Country	No SPN isolates tested for PEN/ERY	% PNSP (95CI)	% PRSP (95 CI)	% ENSP (95CI)	%Single PEN(95CI)	%Single ERY(95CI)	% DUAL (95CI)
AT	290/ 255	5 (3-9)	1 (0-3)	15 (11-20)	3 (1-6)	13 (9-17)	2 (1-5)
BE	1539/ 1539	12 (10-14)	3 (2-4)	31 (29-34)	3 (2-4)	23 (21-25)	9 (7-10)
BG	43/ 37	33 (20-49)	30 (18-46)	8 (2-23)	30 (16-47)	0 (0-12)	8 (2-23)
CY	16/ 16	19 (5-46)	0 (1-24)	13 (2-40)	6 (0-32)	0 (1-24)	13 (2-40)
CZ	194/ 191	4 (2-8)	0 (0-2)	2 (1-6)	3 (1-7)	2 (0-5)	1 (0-3)
DE	130/ 120	5 (2-10)	0 (0-4)	17 (11-25)	1 (0-5)	13 (8-21)	3 (1-9)
DK	1081/ 1081	4 (3-6)	1 (0-2)	6 (5-7)	4 (3-5)	5 (4-7)	1 (0-1)
EE	53/ 41	2 (0-11)	0 (0-8)	0 (0-11)	2 (0-14)	0 (0-11)	0 (0-11)
ES	740/ 733	25 (22-28)	9 (7-12)	23 (20-26)	11 (9-14)	10 (8-12)	13 (11-16)
FI	525/ 427	7 (5-9)	1 (0-2)	20 (17-24)	1 (1-3)	15 (12-19)	5 (3-8)
FR	632/ 632	36 (33-40)	5 (3-7)	41 (38-45)	4 (3-6)	9 (7-12)	32 (28-36)
HR	129/ 65	17 (11-25)	0 (0-4)	17 (9-29)	14 (7-25)	8 (3-18)	9 (4-20)
HU	86/ 81	22 (14-33)	2 (0-9)	37 (27-49)	5 (2-13)	21 (13-32)	16 (9-26)
IE	397/ 375	11 (8-15)	3 (1-5)	12 (9-16)	8 (5-11)	9 (6-13)	3 (1-5)
IL	235/ 233	33 (27-40)	8 (5-13)	15 (11-21)	23 (18-29)	5 (3-9)	11 (7-16)
IS	37/ 36	8 (2-23)	0 (0-12)	17 (7-33)	0 (0-12)	8 (2-24)	8 (2-24)
IT	319/ 276	9 (6-13)	5 (3-8)	31 (25-37)	4 (2-7)	25 (20-30)	6 (4-10)
LU	43/ 42	12 (4-26)	7 (2-20)	24 (13-40)	0 (0-10)	12 (4-26)	12 (4-26)
LV	36/ 34	0 (0-12)	0 (0-12)	3 (0-17)	0 (0-13)	3 (0-17)	0 (0-13)
MT	13/ 13	15 (3-46)	8 (0-38)	46 (20-74)	15 (3-46)	46 (20-74)	0 (1-28)
NL	802/ 641	1 (1-2)	0 (0-1)	11 (8-13)	0 (0-1)	10 (8-12)	1 (0-2)
NO	569/ 347	2 (1-4)	1 (0-2)	16 (12-20)	1 (0-3)	14 (11-18)	1 (1-4)
PL	6/ 6	33 (6-76)	17 (1-64)	33 (6-76)	17 (1-64)	17 (1-64)	17 (1-64)
PT	202/ 201	17 (12-23)	1 (0-4)	19 (14-25)	6 (4-11)	8 (5-13)	10 (7-16)
RO	18/ 13	39 (18-64)	22 (7-48)	31 (10-61)	23 (6-54)	0 (1-28)	31 (10-61)
SE	1017/ 924	4 (3-5)	0 (0-1)	6 (4-7)	3 (2-4)	5 (4-7)	1 (0-2)
SI	208/ 208	11 (7-16)	2 (1-5)	11 (7-16)	7 (4-12)	8 (5-12)	3 (1-7)
SK	8/ 5	0 (1-40)	0 (1-40)	40 (7-83)	0 (2-54)	40 (7-83)	0 (2-54)
UK	1373/ 1328	4 (3-5)	2 (1-2)	11 (10-13)	3 (2-4)	10 (9-12)	1 (1-2)
Total	10741/9900	10	2	18	4	11	10

Annex 3.2. The number (No) of invasive *Staphylococcus aureus* (SAU) isolates, and the proportion resistant to methicillin (MRSA) including 95% confidence intervals (95CI) reported per country in 2005.

Country	No SAU isolates	% MRSA	95CI
AT	1471	13%	(12-15)
BE	1048	31%	(29-34)
BG	160	31%	(24-38)
CY	54	56%	(41-69)
CZ	1553	13%	(11-15)
DE	874	21%	(19-24)
DK	1350	2%	(1-3)
EE	141	2%	(1-7)
ES	1337	27%	(25-30)
FI	790	3%	(2-4)
FR	3483	27%	(26-29)
GR	681	42%	(38-46)
HR	354	37%	(32-43)
HU	527	19%	(16-23)
IE	1360	42%	(39-44)
IL	546	41%	(37-46)
IS	77	0%	(0-6)
IT	1431	37%	(35-40)
LU	83	13%	(7-23)
LV	125	20%	(14-28)
MT	78	55%	(43-66)
NL	1401	1%	(1-2)
NO	501	1%	(0-2)
PL	197	24%	(19-31)
PT	1153	47%	(44-50)
RO	83	61%	(50-72)
SE	1774	1%	(1-2)
SI	349	10%	(7-14)
SK	147	19%	(13-27)
UK	3967	44%	(42-45)
Total	27095	25	

Annex 3.3. The number (No) of invasive *E. faecalis* and *E. faecium* isolates, and the proportion high level aminoglycoside resistant *E. faecalis*, and vancomycin resistant *E. faecium* (%R) including 95% confidence intervals (95CI) reported per country in 2005.

Country	High level aminoglycoside resistant <i>E. faecalis</i>		Vancomycin resistant <i>E. faecium</i>	
	No	%R (95CI)	No	%R (95CI)
AT	149	28 (21-36)	171	1 (0-5)
BE	136	26 (19-35)	43	14 (6-29)
BG	55	24 (14-37)	28	0 (0-15)
CZ	423	45 (40-50)	211	14 (10-19)
DE	97	34 (25-44)	256	10 (7-14)
EE	42	50 (34-66)	23	0 (0-18)
ES	473	36 (32-40)	141	3 (1-8)
FI	133	27 (20-36)	94	0 (0-5)
FR	767	15 (13-18)	194	2 (1-6)
GR	448	54 (49-58)	227	37 (31-44)
HR	86	31 (22-42)	34	6 (1-21)
HU	192	40 (33-47)	46	0 (0-10)
IE	240	42 (36-49)	220	31 (25-38)
IL	207	43 (36-50)	71	46 (35-59)
IS	20	0 (0-20)	9	0 (1-37)
IT	433	38 (34-43)	193	19 (14-25)
LU	17	24 (8-50)	14	0 (1-27)
NL	216	38 (32-45)	188	1 (0-3)
NO	119	32 (24-41)	57	0 (0-8)
PL	33	48 (31-66)	20	5 (0-27)
PT	288	38 (32-44)	95	34 (25-44)
RO	4	50 (9-91)	10	0 (1-34)
SE	492	19 (15-22)	253	1 (0-3)
SI	89	46 (36-57)	30	0 (0-14)
SK	25	40 (22-61)	3	0 (3-69)
UK	32	47 (30-65)	224	33 (27-40)
Total	5216	34	2855	14

Annex 3.4. The number of invasive *Escherichia coli* isolates (No), and the proportion aminopenicillins, third generation cephalosporins, fluoroquinolones, aminoglycosides and multi-resistance (%R) including 95% confidence intervals (95CI) reported per country in 2005.

Country	Aminopenicillins		Fluoroquinolones		third Cephalosporins		Aminoglycosides		Multi-resistance*	
	No	% R (95CI)	No	% R (95CI)	No	% R (95CI)	No	% R (95CI)	No	% R (95CI)
AT	2050	48 (46-51)	2049	19 (18-21)	2046	4 (3-5)	2053	5 (5-7)	2036	1 (1-2)
BE	1579	53 (50-55)	1461	17 (15-19)	1577	4 (3-5)	1274	4 (3-5)	1207	0 (0-1)
BG	189	69 (62-75)	196	29 (22-36)	203	28 (22-35)	203	24 (18-30)	196	16 (12-22)
CY	74	73 (61-82)	72	29 (19-41)	74	16 (9-27)	74	14 (7-24)	72	4 (1-13)
CZ	2234	50 (48-52)	2233	20 (19-22)	2233	2 (2-3)	2234	6 (5-7)	2233	1 (1-2)
DE	1014	54 (51-57)	1012	23 (21-26)	1012	2 (1-3)	1014	6 (5-8)	1006	0 (0-1)
DK	1283	39 (36-42)	758	5 (3-6)	957	1 (1-2)	1283	2 (1-3)	587	1 (0-2)
EE	151	45 (37-53)	151	5 (2-11)	155	1 (0-5)	156	4 (2-9)	150	1 (0-4)
ES	2995	62 (60-64)	2993	28 (27-30)	2997	8 (7-9)	2996	10 (9-11)	2992	3 (2-3)
FI	1519	35 (33-37)	1743	7 (6-9)	1918	2 (1-2)	1760	2 (2-3)	1575	1 (1-2)
FR	5722	50 (49-51)	6028	11 (10-12)	5835	1 (1-2)	6056	5 (4-5)	5808	0 (0-1)
GR	1039	46 (43-49)	1136	12 (10-14)	1139	7 (6-9)	1140	7 (6-9)	1136	2 (2-3)
HR	637	46 (42-49)	637	9 (7-11)	637	1 (0-2)	637	5 (3-7)	637	0 (0-1)
HU	510	50 (45-54)	468	20 (16-24)	510	2 (1-4)	513	7 (5-10)	466	2 (1-3)
IE	1422	67 (64-69)	1411	17 (15-19)	1404	4 (3-5)	1414	7 (6-9)	1392	1 (1-2)
IL	824	66 (62-69)	942	23 (20-26)	938	10 (8-12)	943	15 (12-17)	937	6 (5-8)
IS	128	38 (29-47)	117	3 (1-9)	130	0 (0-4)	130	1 (0-5)	117	0 (0-4)
IT	1176	55 (52-58)	1094	28 (26-31)	1191	8 (7-10)	1097	11 (10-13)	1090	4 (3-6)
LU	188	49 (42-56)	188	19 (13-25)	188	3 (1-7)	188	7 (4-12)	188	2 (0-5)
MT	87	49 (39-60)	87	30 (21-41)	87	1 (0-7)	87	7 (3-15)	87	0 (0-5)
NL	2137	48 (46-50)	2139	10 (9-11)	1890	2 (2-3)	2187	4 (3-5)	1882	1 (0-1)
NO	1233	33 (31-36)	1217	5 (4-6)	1236	1 (0-2)	1236	2 (1-3)	1213	0 (0-1)
PL	176	56 (49-64)	176	20 (14-27)	176	5 (2-9)	175	7 (4-13)	175	3 (1-7)
PT	1171	58 (55-61)	1086	29 (27-32)	1076	12 (10-14)	1170	12 (11-15)	1039	8 (6-9)
RO	79	77 (66-86)	75	8 (3-17)	80	16 (9-27)	80	14 (7-24)	75	3 (0-10)
SE	1904	26 (24-28)	3035	6 (5-7)	3198	1 (1-2)	3188	1 (1-2)	2991	0 (0-1)
SI	656	42 (38-46)	657	12 (10-15)	657	2 (1-3)	657	4 (3-6)	657	1 (1-3)
SK	97	59 (48-69)	132	14 (9-22)	97	8 (4-16)	134	7 (4-14)	97	3 (1-9)
UK	1987	56 (54-58)	2127	17 (15-19)	1892	6 (5-8)	2055	8 (7-10)	1689	2 (2-3)
Total	34261	50	35420	15	35533	4	36134	6	33730	2

* Multi-resistance was defined as being resistant to fluoroquinolones, third generation cephalosporins, and aminoglycosides irrespective of aminopenicillins susceptibility

Annex 3.5. The number of invasive *Klebsiella pneumoniae* isolates (No), and the proportion aminopenicillins, third generation cephalosporins, fluoroquinolones, aminoglycosides, carbapenems and multi-resistance (% R) including 95% confidence intervals (95CI) reported per country in 2005.

Country	Aminopenicillins		Fluoroquinolones		Third generation Cephalosporins		Aminoglycosides		Carbapenems		Multi-resistance*	
	No	% R (95CI)	No	% R (95CI)	No	% R (95CI)	No	% R (95CI)	No	% R (95CI)	No	% R (95CI)
AT	89	94 (87-98)	88	11 (6-20)	88	6 (2-13)	89	3 (1-10)	80	0 (0-6)	87	1 (0-7)
BG	31	97 (81-100)	34	26 (14-45)	34	50 (33-67)	34	53 (35-70)	30	0 (0-14)	34	21 (9-38)
CY	9	100 (63-99)	9	22 (4-60)	9	33 (9-69)	9	11 (1-49)	9	0 (1-37)	9	11 (1-49)
CZ	476	98 (97-99)	478	38 (34-43)	478	32 (28-37)	477	36 (32-41)	44	0 (0-10)	477	17 (14-21)
DE	112	95 (88-98)	113	5 (2-12)	112	6 (3-13)	112	9 (5-16)	110	2 (0-7)	111	3 (1-8)
EE	37	92 (77-98)	38	0 (0-11)	37	8 (2-23)	38	8 (2-22)	26	0 (0-16)	37	0 (0-12)
ES	56	82 (69-91)	56	11 (4-23)	56	7 (2-18)	56	4 (1-13)	54	0 (0-8)	56	4 (1-13)
FI	100	95 (88-98)	155	3 (1-8)	175	2 (1-6)	150	3 (1-7)	131	0 (0-4)	130	2 (1-7)
FR	792	98 (97-99)	838	7 (6-9)	824	4 (3-6)	838	5 (4-7)	753	0 (0-1)	824	2 (1-4)
GR	640	95 (93-97)	772	54 (51-58)	774	61 (57-64)	773	60 (56-63)	773	28 (25-31)	772	46 (42-49)
HR	111	99 (94-100)	110	18 (12-27)	112	46 (36-55)	112	38 (29-47)	112	0 (0-4)	110	15 (9-23)
HU	141	100 (97-100)	126	25 (18-33)	140	31 (24-40)	142	30 (23-39)	133	0 (0-3)	123	22 (15-30)
IE	42	98 (86-100)	40	3 (0-15)	42	7 (2-21)	42	5 (1-17)	26	0 (0-16)	40	0 (0-11)
IL	296	98 (96-99)	331	30 (25-36)	330	38 (33-43)	331	36 (31-42)	331	0 (0-2)	330	24 (20-29)
IS	22	100 (82-100)	21	0 (0-19)	22	0 (0-18)	22	0 (0-18)	21	0 (0-19)	21	0 (0-19)
IT	324	87 (83-91)	318	11 (8-15)	243	20 (16-24)	318	8 (6-12)	0	-	317	3 (1-6)
MT	17	88 (62-98)	18	11 (2-36)	18	6 (0-29)	18	17 (4-42)	18	0 (1-22)	18	0 (0-22)
NL	301	98 (95-99)	290	6 (3-9)	256	4 (2-7)	300	5 (3-8)	230	0 (0-2)	255	2 (1-5)
NO	173	98 (94-99)	172	1 (0-5)	174	1 (0-5)	174	2 (1-6)	159	1 (0-4)	172	0 (0-3)
PL	53	96 (86-99)	53	34 (22-48)	53	66 (52-78)	53	57 (42-70)	33	0 (0-13)	53	26 (16-41)
SE	145	64 (56-72)	265	5 (2-8)	281	1 (0-4)	279	1 (0-4)	16	0 (0-24)	263	0 (0-2)
SI	78	96 (88-99)	78	14 (8-24)	78	19 (12-30)	78	17 (10-27)	44	0 (0-10)	78	12 (6-21)
UK	364	96 (94-98)	372	12 (9-16)	300	12 (9-17)	395	6 (4-9)	275	0 (0-2)	280	6 (3-9)
Total	4409	95	4775	22	4436	24	4840	23	3408	7	4597	15

* Multi-resistance was defined as being resistant to fluoroquinolones, third generation cephalosporins, and aminoglycosides irrespective of aminopenicillins susceptibility

Annex 3.6. The number of invasive *Pseudomonas aeruginosa* isolates (No), and the proportion piperacillin (+/- tazobactam), ceftazidime, carbapenems, fluoroquinolones, aminoglycosides resistance (%R) including 95% confidence intervals (95CI) reported per country in 2005.

Country	Piperacillin+/- Tazobactam		Ceftazidime		Carbapenems		Fluoroquinolones		Aminoglycosides	
	No	% R (95CI)	No	% R (95CI)	No	% R (95CI)	No	% R (95CI)	No	% R (95CI)
AT	77	13 (7-23)	76	7 (2-15)	77	10 (5-20)	77	13 (7-23)	77	6 (2-15)
BG	34	50 (33-67)	33	45 (29-63)	32	38 (22-56)	34	47 (30-65)	34	53 (35-70)
CY	8	13 (1-53)	8	38 (10-74)	8	13 (1-53)	8	13 (1-53)	8	13 (1-53)
CZ	257	21 (16-26)	257	40 (34-46)	257	31 (26-37)	256	45 (39-52)	230	28 (22-34)
DE	126	17 (11-25)	123	11 (6-18)	127	24 (17-32)	125	19 (13-27)	127	13 (8-21)
EE	37	27 (14-44)	38	18 (8-35)	37	38 (23-55)	37	14 (5-30)	36	28 (15-45)
ES	70	4 (1-13)	70	6 (2-15)	70	17 (10-28)	70	14 (7-25)	70	4 (1-13)
FI	108	8 (4-16)	108	5 (2-11)	99	15 (9-24)	96	16 (9-25)	100	11 (6-19)
FR	929	15 (12-17)	905	9 (7-11)	984	14 (12-17)	985	27 (24-29)	971	22 (19-24)
GR	698	30 (27-34)	662	27 (24-31)	698	39 (35-42)	694	39 (36-43)	696	40 (36-44)
HR	72	25 (16-37)	71	6 (2-15)	72	24 (15-35)	71	34 (23-46)	72	35 (24-47)
HU	226	12 (9-18)	237	11 (7-15)	231	17 (13-23)	181	26 (20-33)	238	32 (27-39)
IE	28	7 (1-25)	29	10 (3-28)	27	11 (3-30)	29	14 (5-33)	28	7 (1-25)
IL	213	13 (9-18)	168	17 (12-23)	215	15 (11-21)	215	25 (20-32)	215	23 (18-30)
IS	13	8 (0-38)	13	8 (0-38)	13	8 (0-38)	13	0 (1-28)	13	0 (1-28)
MT	45	22 (12-37)	45	11 (4-25)	45	18 (9-33)	45	44 (30-60)	45	16 (7-30)
NL	184	4 (2-9)	209	5 (3-9)	187	5 (2-9)	200	9 (6-14)	210	7 (4-11)
NO	75	3 (0-10)	89	3 (1-10)	80	4 (1-11)	89	4 (1-12)	89	0 (0-5)
PL	26	50 (30-70)	26	31 (15-52)	26	27 (12-48)	26	31 (15-52)	25	56 (35-75)
RO	23	61 (39-80)	23	52 (31-73)	23	61 (39-80)	22	64 (41-82)	22	64 (41-82)
SE	22	9 (2-31)	149	5 (2-10)	57	18 (9-30)	133	6 (3-12)	149	0 (0-3)
SI	38	21 (10-38)	38	11 (3-26)	38	13 (5-29)	38	29 (16-46)	38	18 (8-35)
UK	349	2 (1-4)	376	3 (2-6)	358	9 (7-13)	412	8 (6-11)	394	3 (2-6)
Total	3658	19	3753	16	3761	20	3856	24	3887	21

National Antimicrobial Resistance Monitoring System Animal Isolates

Percent Resistance Cattle Slaughter ^a Isolates

Antimicrobial	1997 n=24	1998 n=284	1999 n=1610	2000 n=1388	2001 n=893	2002 n=1008	2003 n=670	2004 n=607	2005 n=329	2006 n=389
Amikacin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amoxicillin/Clavulanic Acid	8.3	2.5	3.9	9.9	11.8	17.7	21.0	13.5	21.0	18.5
Ampicillin	12.5	9.2	12.5	18.7	17.9	23.9	28.1	19.3	26.7	22.4
Apramycin	0.0	0.0	0.2	0.2	0.1	NT	NT	NT	NT	NT
Cefoxitin	NT	NT	NT	9.1	11.1	15.9	17.8	13.2	19.8	17.7
Ceftiofur	0.0	2.1	4.2	9.8	11.4	17.4	21.0	13.3	21.6	18.8
Ceftriaxone	0.0	0.0	0.1	0.1	0.1	0.2	0.1	1.3	2.1	1.0
Cephalothin	0.0	2.1	4.7	9.9	11.6	17.7	21.2	NT	NT	NT
Chloramphenicol	4.2	5.6	8.5	15.1	16.5	20.6	25.1	17.6	21.9	19.8
Ciprofloxacin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gentamicin	0.0	1.8	1.6	2.1	2.1	2.6	2.7	1.8	2.4	3.9
Imipenem	NT	NT	NT	NT	0.0	NT	NT	NT	NT	NT
Kanamycin	8.3	9.5	7.1	6.6	6.9	10.1	13.7	8.9	13.1	9.5
Nalidixic Acid	0.0	0.4	0.1	0.4	0.4	0.4	0.4	2.0	1.5	0.5
Streptomycin	12.5	16.2	15.4	21.3	20.3	25.9	28.7	20.9	24.3	23.7
Sulfamethoxazole (Sulfizoxazole in 2004)	20.8	15.5	15.0	19.9	19.7	22.3	25.1	22.7	27.4	24.2
Tetracycline	25.0	24.3	20.9	25.8	26.3	32.0	36.9	31.8	34.0	30.3
Ticarcillin	12.5	8.5	NT	NT	NT	NT	NT	NT	NT	NT
Trimethoprim/ Sulfamethoxazole	4.2	2.5	2.4	2.2	2.6	2.5	3.3	1.5	4.9	4.6

^a Isolates obtained from slaughter processing plants (carcass swabs & ground product).

National Antimicrobial Resistance Monitoring System Animal Isolates
Percent Resistance Chicken Slaughter^a Isolates

Antimicrobial	1997 n=214	1998 n=561	1999 n=1438	2000 n=1173	2001 n=1307	2002 n=1500	2003 n=1158	2004 n=1280	2005 n=1989	2006 n=1380
Amikacin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amoxicillin/Clavulanic Acid	0.5	2.0	4.9	7.3	4.5	10.2	9.7	12.4	12.1	12.9
Ampicillin	11.7	13.0	12.4	13.0	9.4	14.3	13.7	14.5	14.0	14.9
Apramycin	0.0	0.2	0.1	0.7	0.6	NT	NT	NT	NT	NT
Cefoxitin	NT	NT	NT	7.2	4.1	8.7	8.2	12.4	12.0	12.8
Ceftiofur	0.5	2.0	5.2	7.6	4.1	10.2	9.8	12.4	12.2	12.8
Ceftriaxone	0.0	0.5	0.0	0.1	0.0	0.3	0.1	0.5	0.3	0.1
Cephalothin	1.4	4.4	5.8	7.8	4.7	10.5	10.4	NT	NT	NT
Chloramphenicol	2.3	2.8	1.8	4.6	2.5	2.4	2.1	1.3	1.8	1.7
Ciprofloxacin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gentamicin	17.8	15.5	10.4	14.9	7.9	5.5	6.3	4.9	4.3	5.7
Imipenem	NT	NT	NT	NT	0.0	NT	NT	NT	NT	NT
Kanamycin	2.3	3.2	1.2	4.0	2.4	2.0	2.8	2.7	2.5	3.6
Nalidixic Acid	0.0	0.2	0.2	0.5	0.0	0.8	0.4	0.5	0.3	0.1
Streptomycin	24.3	27.8	27.5	28.6	21.0	22.9	19.6	22.2	23.3	21.2
Sulfamethoxazole (Sulfizoxazole in 2004)	24.8	23.8	15.9	18.4	11.8	8.9	10.3	11.9	8.5	10.7
Tetracycline	20.6	20.5	25.0	26.3	21.9	24.9	26.2	27.4	28.3	31.8
Ticarcillin	11.7	11.7	NT	NT	NT	NT	NT	NT	NT	NT
Trimethoprim/ Sulfamethoxazole	0.5	1.4	1.1	0.4	0.5	0.8	0.3	0.2	0.2	0.1

^a Isolates obtained from slaughter processing plants (carcass swabs & ground product).

National Antimicrobial Resistance Monitoring System Animal Isolates
Percent Resistance Swine Slaughter^a Isolates

Antimicrobial	1997 n=111	1998 n=793	1999 n=876	2000 n=451	2001 n=418	2002 n=379	2003 n=211	2004 n=308	2005 n=301	2006 n=304
Amikacin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amoxicillin/Clavulanic Acid	0.0	0.4	1.0	1.8	2.6	3.7	3.8	1.9	4.3	2.3
Ampicillin	16.2	12.9	10.8	18.8	11.7	13.7	12.8	16.2	13.6	11.5
Apramycin	2.7	1.4	1.8	0.4	0.7	NT	NT	NT	NT	NT
Cefoxitin	NT	NT	NT	1.3	2.2	2.9	4.3	1.9	3.7	2.0
Ceftiofur	0.0	0.1	1.9	1.3	2.2	3.2	4.3	1.9	3.7	2.0
Ceftriaxone	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cephalothin	0.0	0.1	0.8	2.4	2.2	3.2	3.8	NT	NT	NT
Chloramphenicol	11.7	8.4	8.0	12.4	7.7	10.0	8.5	12.7	10.6	7.9
Ciprofloxacin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gentamicin	0.9	0.8	1.1	1.3	1.4	0.8	0.5	1.3	2.7	2.0
Imipenem	NT	NT	NT	NT	0.0	NT	NT	NT	NT	NT
Kanamycin	11.7	7.2	6.7	9.3	6.9	4.2	5.7	3.9	5.0	8.6
Nalidixic Acid	0.0	0.0	0.0	0.2	0.0	0.3	0.0	0.0	0.3	0.0
Streptomycin	27.9	29.4	29.3	39.2	35.6	40.1	30.8	36.4	36.5	26.3
Sulfamethoxazole (Sulfizoxazole in 2004)	34.2	29.0	30.7	35.7	34.9	34.6	25.1	37.0	32.9	26.6
Tetracycline	52.3	47.5	48.4	54.3	53.1	57.8	43.1	58.8	54.8	62.8
Ticarcillin	16.2	12.9	NT	NT	NT	NT	NT	NT	NT	NT
Trimethoprim/ Sulfamethoxazole	1.8	0.3	1.1	0.9	0.0	1.6	2.4	1.6	2.3	2.0

^a Isolates obtained from slaughter processing plants (carcass swabs & ground product).

National Antimicrobial Resistance Monitoring System Animal Isolates
Percent Resistance Turkey Slaughter^a Isolates

Antimicrobial (Number of Isolates)	1997 n=107	1998 n=240	1999 n=713	2000 n=518	2001 n=550	2002 n=244	2003 n=262	2004 n=236	2005 n=227	2006 n=304
Amikacin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amoxicillin/Clavulanic Acid	4.7	0.4	4.3	3.5	6.9	3.7	1.5	4.7	3.5	5.6
Ampicillin	12.1	10.4	17.7	16.2	19.5	18.0	18.7	22.0	22.9	25.3
Apramycin	0.9	0.8	0.6	0.6	0.4	NT	NT	NT	NT	NT
Cefoxitin	NT	NT	NT	3.3	4.5	2.5	1.1	5.1	3.5	5.3
Ceftiofur	3.7	0.4	4.6	3.3	5.1	3.3	1.5	4.7	3.5	5.3
Ceftriaxone	0.0	0.0	0.8	0.4	0.2	0.0	0.4	0.4	0.9	0.0
Cephalothin	5.6	5.0	10.5	8.3	13.1	9.8	11.1	NT	NT	NT
Chloramphenicol	3.7	0.8	4.1	4.1	3.8	5.3	4.2	4.7	4.8	3.9
Ciprofloxacin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gentamicin	20.6	18.3	17.5	16.2	20.9	19.3	21.0	25.4	22.9	16.4
Imipenem	NT	NT	NT	NT	0.0	NT	NT	NT	NT	NT
Kanamycin	24.3	17.1	21.5	21.4	22.9	24.2	16.0	14.4	19.8	10.5
Nalidixic Acid	4.7	2.1	5.3	5.4	5.1	5.3	3.8	2.1	2.2	0.7
Streptomycin	34.6	40.8	43.6	41.9	46.7	37.7	29.4	33.9	40.1	28.9
Sulfamethoxazole (Sulfizoxazole in 2004)	37.4	32.1	36.0	25.1	38.0	30.3	28.2	36.4	37.0	27.3
Tetracycline	52.3	45.8	52.9	56.2	54.9	54.5	58.8	48.3	54.6	61.8
Ticarcillin	12.1	10.8	NT	NT	NT	NT	NT	NT	NT	NT
Trimethoprim/ Sulfamethoxazole	3.7	2.5	4.2	1.5	2.5	2.5	2.3	0.8	1.8	1.0

^a Isolates obtained from slaughter processing plants (carcass swabs & ground product).