

# EUROPEAN ANTIMICROBIAL RESISTANCE SURVEILLANCE SYSTEM (EARSS)



Feidhmeannacht na Seirbhíse Sláinte  
Health Service Executive

Quarter 4, 2005

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## Key points

- *S. aureus*: n=316 (Q3 2005, n=369); MRSA 41.8% (Q3, 37.9%)
- *S. pneumoniae*: n=103 (Q3, n=54); PNSP 13.6% (Q3, 20.4%)
- *E. coli*: n=376 (Q3, n=345); 3.2% resistant to third-generation cephalosporins (3GCs) (Q3, 5.2%); 19.1% to ciprofloxacin (Q3, 19.5%); 8.0% to gentamicin (Q3, 7.9%). Four isolates with multi-drug (MDR) resistance to ampicillin, 3GCs, ciprofloxacin and gentamicin (2 ESBL-positive) (Q3, 6 isolates). ESBLs detected in 8 isolates (2.7%) (Q3, 9 isolates or 3.3%)
- *E. faecalis*: n=68 (Q3, n=65); vancomycin resistance (VRE) 4.4% (Q3, 1.6%); high-level gentamicin (HLG) resistance: 39.3% (Q3, 46.4%)
- *E. faecium*: n=60 (Q3, n=47); VRE 38.3% (Q3, 29.8%); HLG resistance 42.9% (Q3, 46.5%)  
Nine isolates with MDR to ampicillin, HLG and vancomycin (Q3, 9 isolates)
- *K. pneumoniae*: n=42; One MDR isolate with resistance to ampicillin, 3GCs (ESBL-positive) and gentamicin
- *P. aeruginosa*: n=29; Two MDR isolates with resistance to piperacillin/tazobactam, ceftazidime, meropenem, ciprofloxacin and gentamicin

## Data analysis

In Quarter 4 (Q4) 2005, 42 laboratories (of 43 microbiology laboratories in Irish hospitals) participated in the surveillance of *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Escherichia coli* and the enterococci, *Enterococcus faecalis*/*E. faecium*. In Q4, 22 laboratories extended their participation to the two new EARSS pathogens, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. One EARSS laboratory was unable to provide data this quarter. The laboratories currently participating in EARSS in Ireland are listed at the end of this newsletter.

### *Staphylococcus aureus*

Routine susceptibility test results are submitted on the first invasive isolate (blood only) per patient per quarter. Susceptibility data are required for methicillin, oxacillin or ceftoxitin. All methicillin-resistant *S. aureus* (MRSA) isolates are referred to the National MRSA Reference Laboratory (NMRSARL) at St. James's Hospital, where minimum inhibitory concentrations (MICs) of oxacillin and vancomycin are performed.

#### Data from Participating Laboratories

In Q4 2005, data were submitted on 316 *S. aureus* isolates from 33 of the 42 laboratories participating in the surveillance of this pathogen. Of these, 132 (41.8%) were resistant to methicillin/oxacillin. Susceptibility data to the most

important anti-staphylococcal antibiotics for all *S. aureus* isolates are shown in Figure 1.

In comparison, there were 363 isolates from 35 (of 41) laboratories in Q4 2004 yielding 39.9% MRSA. The proportion of MRSA among *S. aureus* isolates for the year 2004 was 41.8%.

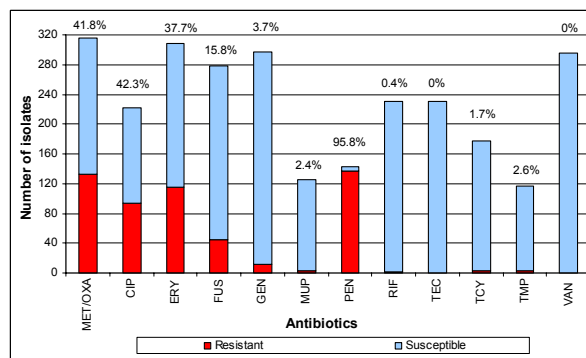
#### Data from National MRSA Reference Laboratory

Of the above 132 MRSA isolates, 102 were referred to the NMRSARL for further evaluation, along with 5 additional isolates (second strains of MRSA from the same specimen with a different antibiogram or an MRSA strain isolated subsequent to a methicillin-susceptible strain). No NMRSARL data were available on 30 isolates reported to EARSS at HPSC (formerly NDSC). Antibiogram results are shown in Figure 2.

MIC results (determined by Etest®) were available on 107 isolates referred. The majority (90%, n=96) exhibited oxacillin MICs of >256 mg/L. All isolates exhibited vancomycin MICs of ≤4mg/L. All isolates were tested by the Etest® macromethod for the detection of glycopeptide-intermediate *S. aureus* (GISA) or hetero-GISA (hGISA) strains. No GISA or hGISA were detected in Q4 2005.

In addition to the 102 EARSS isolates referred to the NMRSARL, in-house oxacillin and vancomycin MICs were available for two isolates not referred.

The overall adherence to the protocol for oxacillin and vancomycin MICs (required for MRSA isolates only, n=132) was 79% (n=104), which represents a decrease on that reported in Q3 2005 (90%).



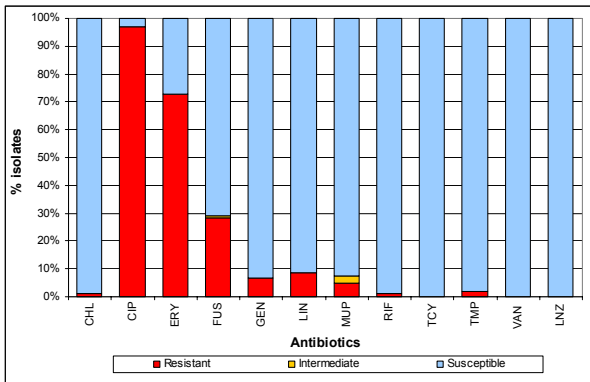
**Figure 1.** Susceptibility data for all invasive isolates of *S. aureus* (MRSA and MSSA) reported in Q4 2005. Percentage resistance is indicated above the bars.

Antibiotic codes: MET, methicillin; OXA, oxacillin; CIP, ciprofloxacin; ERY, erythromycin; FUS, fusidic acid; GEN, gentamicin; MUP, mupirocin; PEN, penicillin; RIF, rifampicin; TEC, teicoplanin\*; TCY, tetracycline; TMP, trimethoprim; VAN, vancomycin\*.

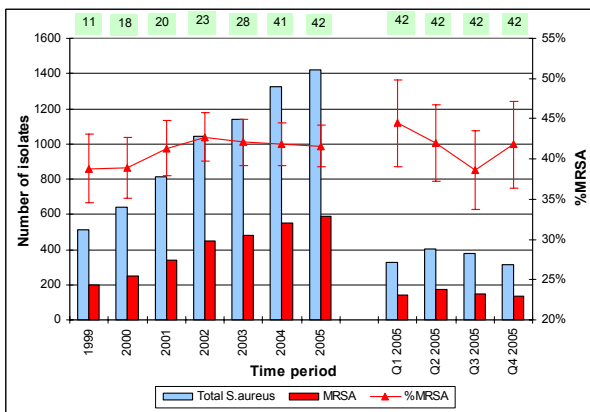
\* Disc diffusion does not detect glycopeptide-intermediate *S. aureus* (GISA) or hetero-GISA (hGISA).

#### *S. aureus* trends

The proportion of MRSA among *S. aureus* isolates observed in Q4 2005 (41.8%) was higher than that observed in Q3 2005 (37.9%). See Figure 3 for comparison with proportions for 1999-2005 (up to the end of Q4).



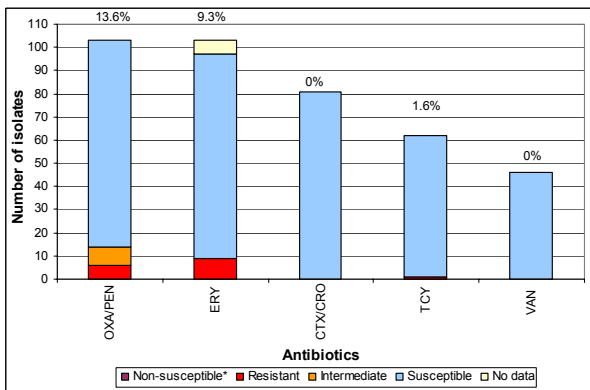
**Figure 2.** Antibiogram results for MRSA isolates (n=107) referred to NMRSARL in Q4 2005. Antibiotic codes: CHL, chloramphenicol; LIN, linezolid. See legend for Figure 1 for explanation of other antibiotic codes.



**Figure 3.** Trends for *S. aureus* – total numbers of *S. aureus*/MRSA and percentage MRSA with 95% confidence intervals. Data for 2005 provisional up to end of Q4; the numbers of participating laboratories by year-end are indicated above the bars

### Streptococcus pneumoniae

Routine susceptibility test results are submitted on the first invasive isolate (blood or CSF) per patient per quarter. Susceptibility data are required for penicillin or oxacillin and erythromycin. Laboratories are also asked to report on in-house MIC results for penicillin and cefotaxime or ceftriaxone, if available, on all penicillin-non-susceptible *S. pneumoniae* (PNSP) isolates.



**Figure 4.** Susceptibility data for invasive isolates of *S. pneumoniae* reported in Q4 2005. Percentage non-susceptible/resistance is indicated above the bars. Antibiotic codes: OXA, oxacillin; PEN, penicillin; ERY, erythromycin; CTX, cefotaxime; CRO, ceftriaxone; TCY, tetracycline; VAN, vancomycin. \* Level of susceptibility not determined by MIC.

In Q4 2005, data were submitted on 103 *pneumoniae* isolates (101 from blood and two from CSF) from 27 of the 42 laboratories participating in the surveillance of this pathogen. Of these, 14 (13.6%) were non-susceptible to penicillin. Nine (9.3%) of 97 isolates tested were resistant to erythromycin. Susceptibility data to the most important anti-pneumococcal antibiotics are shown in Figure 4.

In comparison, there were 104 isolates from 25 (of 41) laboratories in Q4 2004 yielding 8.7% PNSP. The proportion of PNSP among *S. pneumoniae* isolates for the year 2004 was 10.3%.

The overall adherence to the protocol for penicillin and cefotaxime/ceftriaxone MICs, which are required for PNSP isolates (n=14), was 64%, which is lower than in Q3 2005 (82%).

### Penicillin non-susceptibility and resistance to other drugs

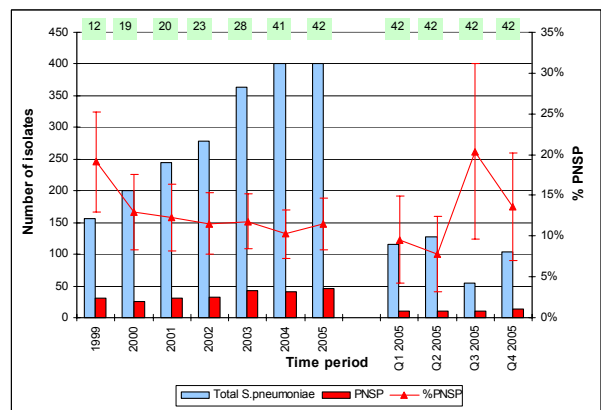
Penicillin and cefotaxime/ceftriaxone Etest results were available for 14 and nine, respectively, of the PNSP isolates reported. Six isolates were high-level resistant (MIC  $\geq 2.0$ mg/L) to penicillin while eight were intermediately resistant (MIC 0.12–1.0 mg/L). No resistance to cefotaxime was detected. Erythromycin resistance was reported in one PNSP and eight penicillin-susceptible isolates.

### Age and sex breakdown

Analysis of the pneumococcal data in Q4 2005 showed that 17 isolates (17%) were from children aged 0–4 years and 60 isolates (58%) were from adults >50 years. Of the 103 pneumococcal isolates, 61 (59%) were from males and 41 (40%) were from females.

### S. pneumoniae trends

The proportion of PNSP among *S. pneumoniae* isolates observed in Q4 2005 (13.6%) was lower than that observed in Q3 2005 (20.4%). See Figure 5 for comparison with proportions for 1999–2005 (up to the end of Q4).



**Figure 5.** Trends for *S. pneumoniae* – total numbers of *S. pneumoniae*/PNSP and percentage PNSP with 95% confidence intervals. Data for 2005 provisional up to end of Q4; the numbers of participating laboratories by year-end are indicated above the bars.

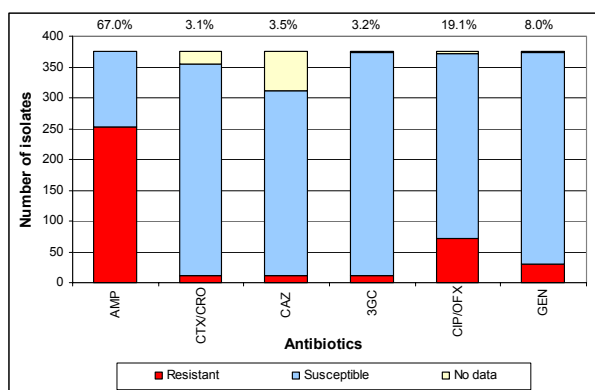
### Escherichia coli

Routine susceptibility test results are submitted on the first invasive isolate (blood or CSF) per patient per quarter. Susceptibility data are required for a broad-spectrum penicillin (ampicillin), a third-generation cephalosporin (3GC; cefotaxime or ceftriaxone and/or ceftazidime), a fluoroquinolone (ciprofloxacin or ofloxacin) and an aminoglycoside (gentamicin). Testing for extended-spectrum beta-lactamase (ESBL) production is also required by the protocol.

In Q4 2005, data were submitted on 376 *E. coli* isolates (375 from blood and one from CSF) from 36 of the 42 laboratories participating in the surveillance of this pathogen. Susceptibility data to the mandatory antibiotics required by the protocol are shown in Figures 6.

Thirty-one isolates from 12 laboratories exhibited multiple-resistance (defined as resistance to three or more of the mandatory antibiotic classes tested) in Q4 2005 compared with 31 in Q3 2005: four were resistant to ampicillin, 3GCs, ciprofloxacin and gentamicin (two ESBL-positive) (compared with 6 in Q3); seven were resistant to ampicillin, 3GCs and ciprofloxacin (five ESBL-positive); and 20 were resistant to ampicillin, ciprofloxacin and gentamicin.

Overall, the concordance with the EARSS protocol (excluding ESBL detection) was 99%, which is the same as that reported in Q3 2005. Data on ESBL detection were available on 292 isolates from 27 laboratories giving a concordance of 78% (Q3 2005, 80%). Twenty-six laboratories reported ESBL data on all or most of their *E. coli* isolates. Of the 292 isolates tested, eight were found to produce ESBLs (2.7%).

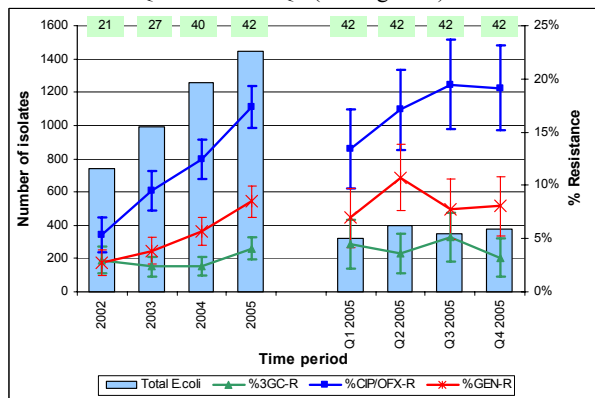


**Figure 6.** Susceptibility data to the mandatory antibiotics required by the EARSS protocol for invasive isolates of *E. coli* reported in Q4 2005. Percentage resistance, excluding isolates with no data, is indicated above the bars.

Antibiotic codes: AMP, ampicillin; CTX, cefotaxime; CRO, ceftriaxone; CAZ, ceftazidime; 3GC, Any third-generation cephalosporin; CIP, ciprofloxacin; OFX, ofloxacin; GEN, gentamicin.

### *E. coli* trends

In Q4 2005, the proportion of resistance to both ciprofloxacin and gentamicin remained at approximately the same level as in Q3 (19.1% and 8.0%, respectively, versus 15.9% and 7.9%), while the proportion of 3GCs decreased from 5.2% in Q3 to 3.2% in Q4 (see Figure 7).



**Figure 7.** Trends for *E. coli* – total numbers of *E. coli* and percentage resistance, with 95% confidence intervals, to third-generation cephalosporins (3GC), ciprofloxacin/ofloxacin (CIP/OFX) and gentamicin (GEN).

Data for 2005 provisional up to end of Q4; the numbers of participating laboratories by year-end are indicated above the bars.

## *Enterococcus faecalis*

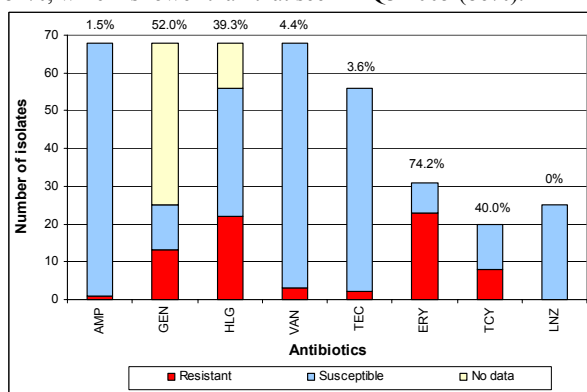
Routine susceptibility test results are submitted on the first invasive isolate (blood only) per patient per quarter. Susceptibility data are required for ampicillin, high-level gentamicin (HLG) and vancomycin.

In Q4 2005, data were submitted on 68 *E. faecalis* isolates from 22 of the 42 laboratories participating in the surveillance of this pathogen. Antibiotic susceptibility data are shown in Figure 8.

Two isolates were reported to be resistant to vancomycin and HLG in this quarter.

One isolate was reported as ampicillin-resistant. *E. faecalis* are typically ampicillin-susceptible so such reports may represent misidentification of the isolates as speciation of enterococci may be problematic.

Overall, the concordance with the EARSS protocol was 82%, which is lower than that seen in Q3 2005 (86%).

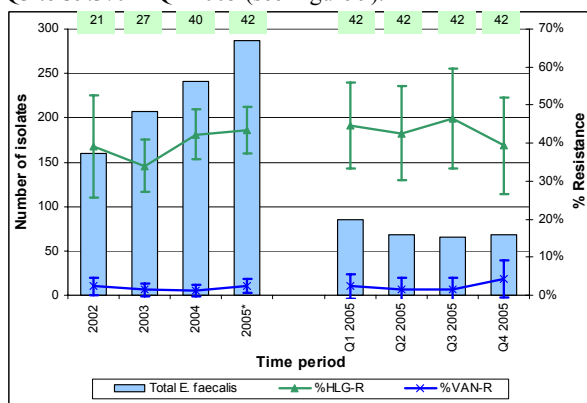


**Figure 8.** Susceptibility data for invasive isolates of *E. faecalis* reported in Q4 2005. Percentage resistance, excluding isolates with no data, is indicated above the bars.

Antibiotic codes: AMP, ampicillin; GEN, gentamicin (low potency disc); HLG, high-level gentamicin; VAN, vancomycin; TEC, teicoplanin; ERY, erythromycin; TCY, tetracycline; LNZ, linezolid.

### *E. faecalis* trends

In Q4 2005, 4.4% (n=3) of *E. faecalis* isolates were vancomycin-resistant, compared with 1.6% (n=1) in the previous quarter. The proportion of isolates that were resistant to high-level gentamicin decreased from 46.4% in Q3 to 39.3% in Q4 2005 (see Figure 9).



**Figure 9.** Trends for *E. faecalis* – total numbers of *E. faecalis* and percentage resistance, with 95% confidence intervals, to ampicillin (AMP), high-level gentamicin (HLG) and vancomycin (VAN).

Data for 2005 provisional up to end of Q4; the numbers of participating laboratories by year-end are indicated above the bars.

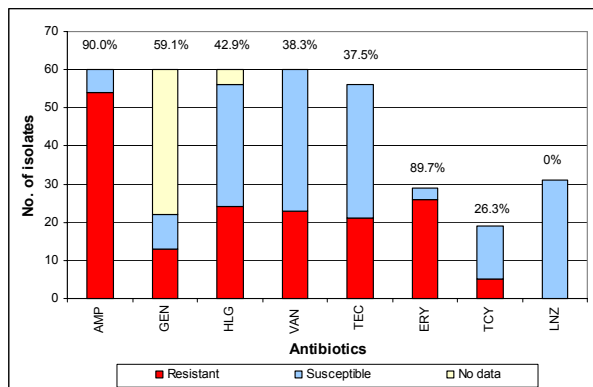
## *Enterococcus faecium*

Routine susceptibility test results are submitted on the first invasive isolate (blood only) per patient per quarter. Susceptibility data are required for ampicillin, high-level gentamicin and vancomycin.

In Q4 2005, data were submitted on 60 *E. faecium* isolates from 14 of the 42 laboratories participating in the surveillance of this pathogen. Antibiotic susceptibility data are shown in Figure 10.

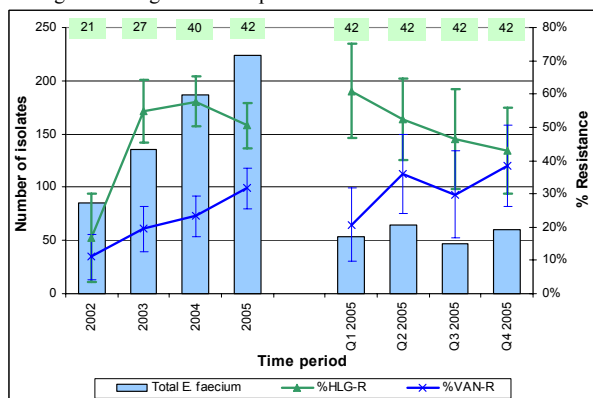
Sixteen isolates from five laboratories were reported with multiple-resistance to ampicillin, HLG and vancomycin in Q4 2005 compared with nine in Q3.

Overall, the concordance with the EARSS protocol was 93%, which is similar to that seen in Q3 (92%).



**Figure 10.** Susceptibility data to the mandatory antibiotics required by the EARSS protocol for invasive isolates of *E. faecium* reported in Q4 2005. Percentage resistance, excluding isolates with no data, is indicated above the bars.

See legend for Figure 8 for explanation of antibiotic codes.



**Figure 11.** Trends for *E. faecium* – total numbers of *E. faecium* and percentage resistance, with 95% confidence intervals, to ampicillin (AMP), high-level gentamicin (HLG) and vancomycin (VAN). Data for 2005 provisional up to end of Q4; the numbers of participating laboratories by year-end are indicated above the bars.

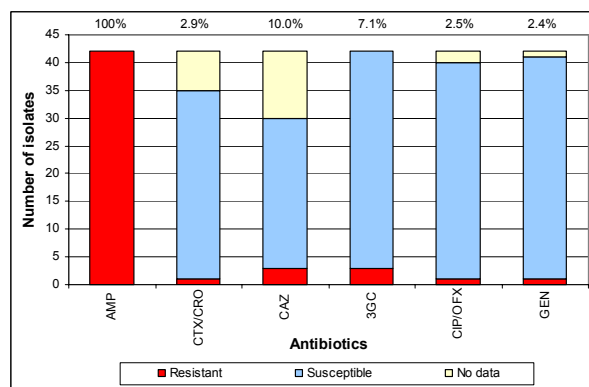
### *E. faecium* trends

In Q4 2005, the proportion of *E. faecium* isolates reported to be vancomycin-resistant was 38.3%, which represents an increase on the 29.8% reported in the previous quarter. The proportions of isolates resistant to ampicillin (90.0% compared with 93.3% for Q3 2005) and HLG (42.9% compared with 46.5%) were both lower in Q4 (see Figure 11).

### *Klebsiella pneumoniae*

Routine susceptibility test results (requirements are the same as for *E. coli*) are submitted on the first invasive isolate (blood or CSF) per patient per quarter.

In Q4 2005, data were submitted on 42 *K. pneumoniae* isolates from 15 of the 42 laboratories participating in EARSS. Antibiotic susceptibility data are shown in Figure 12. One MDR isolate was reported with resistance to ampicillin, 3GCs (ESBL-positive) and gentamicin. Of the 26 isolates tested, one (3.9%) was found to produce ESBL. Concordance with the protocol was 95%.



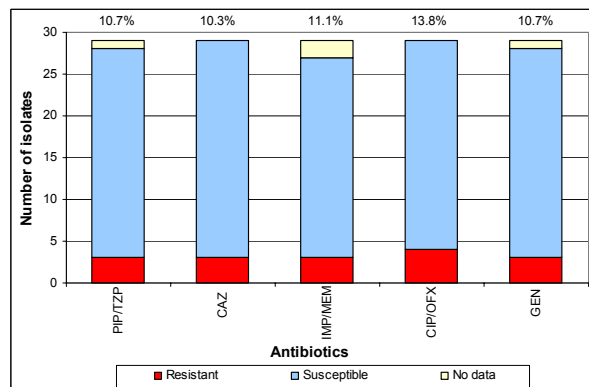
**Figure 12.** Susceptibility data to the mandatory antibiotics required by the EARSS protocol for invasive isolates of *K. pneumoniae* reported in Q4 2005. Percentage resistance, excluding isolates with no data, is indicated above the bars.

See legend for Figure 6 for explanation of antibiotic codes.

### *Pseudomonas aeruginosa*

Routine susceptibility test results are submitted on the first invasive isolate (blood or CSF) per patient per quarter. Susceptibility data are required for piperacillin or piperacillin/tazobactam, ceftazidime, a carbapenem (imipenem or meropenem), a fluoroquinolone (ciprofloxacin or ofloxacin) and an aminoglycoside (gentamicin).

In Q4 2005, data were submitted on 29 *P. aeruginosa* isolates from 11 of the 42 laboratories participating in EARSS. Antibiotic susceptibility data are shown in Figure 13. Two MDR isolates were reported with resistance to piperacillin/tazobactam, ceftazidime, meropenem, ciprofloxacin and gentamicin. Concordance with the protocol was 93%.



**Figure 13.** Susceptibility data to the mandatory antibiotics required by the EARSS protocol for invasive isolates of *P. aeruginosa* reported in Q4 2005. Percentage resistance, excluding isolates with no data, is indicated above the bars.

Antibiotic codes: PIP, piperacillin; TZP, piperacillin/tazobactam; CAZ, ceftazidime; IMP, imipenem; MEM, meropenem; CIP, ciprofloxacin; OFX, ofloxacin; GEN, gentamicin.

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**Participating Laboratories:** Adelaide, Meath & National Children's, Tallaght; Beaumont, Dublin; Blackrock Clinic; Bon Secours, Cork; Bon Secours, Glasnevin; Bon Secours, Tralee; Cappagh National Orthopaedic, Dublin; Cavan General; Cherry Orchard, Dublin; Connolly Memorial, Blanchardstown; Coombe Women's, Dublin; Cork University; Galway Clinic; Kerry General, Tralee; Letterkenny General; Louth County, Dundalk; Mater Misericordiae, Dublin; Mater Private, Dublin; Mercy, Cork; Mayo General, Castlebar; Midland Regional, Mullingar; Midland Regional, Portlaoise; Midland Regional, Tullamore; Mid-Western Regional, Limerick; Monaghan General; Mount Carmel, Churchtown; Naas General; National Maternity, Dublin; Our Lady of Lourdes, Drogheda; Our Lady's, Navan; Our Lady's Hospital for Sick Children, Crumlin; Portlucula, Ballinasloe; Rotunda, Dublin; Royal Victoria Eye & Ear, Dublin; Sligo General; St Columcille's, Loughlinstown; St James's, Dublin; St Luke's, Rathgar; St Michael's, Dun Laoghaire; St Vincent's University, Dublin; Temple St Children's University, Dublin; University College, Galway; Waterford Regional.