ECDC Point Prevalence Survey of healthcare-associated infections and antimicrobial use in European acute care hospitals, 2011-2012

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European Centre for Disease Prevention and Control (ECDC)
Surveillance of HAIs in European Union

- Since 2000, as the HELICS project and then the IPSE project, both financed by grants from the European Commission
- Coordinated by ECDC (Stockholm) since July 2008 (HAI-Net)

Modules:

- **Surgical site infections**: 16 countries
  - Similar to CDC NNIS/NHSN protocol, + discharge date and ICD-9 CM codes
  - Correction for post-discharge surveillance: in-hospital SSI incidence density
  - Stratification within NHSN operation categories (e.g. total vs. partial hip prosthesis)

- **HAI in intensive care units**: 14 countries
  - Patient-based risk factors for advanced risk adjustment (Standardized Infection Ratio)

But: still no EU-wide picture, participation low in several countries, no burden estimates → HAI **Point Prevalence Survey** (ECDC PPS)
To estimate the total burden of healthcare-associated infections (HAI) and antimicrobial use in European acute care hospitals

To describe HAI's and prescribed antimicrobials
  - By type of patient, specialty, type of healthcare facility
  - By EU country, adjusted or stratified

To disseminate results to those who need to know at local, regional, national and EU level
  - To raise awareness
  - To train personnel and reinforce surveillance structures and skills
  - To identify common EU issues and set up priorities
  - To evaluate the effect of strategies and guide policies (repeated PPS)

To provide a standardised tool for the identification of targets for quality improvement
EU point prevalence survey of healthcare-associated infections and antibiotic use: timeline, 2009-2012

- **ECDC PPS protocol development**: June 2009 to March 2011 (7 meetings)
  - Integration protocol of former ESAC hospital PPS for antimicrobial use
  - Concordance study EU vs CDC HAI case definitions*

- **Support projects**:
  - **Pilot** ECDC PPS (2010) (support University of Antwerp, InVS Paris, IPH Brussels)
  - **PPS training**: curriculum, train-the-trainers course (March 2011): HPA London, HPS Scotland
  - **Software**: HelicsWin.Net (IPH Brussels, ECDC since Sep 2011)
  - **ECDC HAI-Net Extranet**: Questions & Answers forum (PPS helpdesk group)
  - **Validation**: PPS validation pilot study (Glasgow Caledonian University, 2011), PPS validation contracts during full-scale PPS in 2012

ECDC point prevalence survey of healthcare-associated infections and antimicrobial use in acute care hospitals: materials

HelicsWin.Net v1.3
Software for the ECDC Point Prevalence Survey of Healthcare-Associated Infections and Antimicrobial Use in Acute Care Hospitals
http://ecdc.europa.eu

ECDC PPS Methodology

- **Protocol**
  - Standard: patient-based
  - Light: unit-based

- **Denominator data**
  - **Standard**: risk factors for every patient, incl. previous surgery, invasive devices, McCabe score
  - **Light**: aggregated denominator data by ward and patient/consultant specialty

- **HAI case definitions**
  - EU definitions: pneumonia, bloodstream infection, urinary tract infection, catheter-related infection, *C. difficile* infections, neonatal infections
  - US/CDC: other HAI (clinical sepsis included)

- **Antimicrobial use data**
  - ESAC hospital PPS protocol (ATC5, indication, route, diagnosis site)

European Prevalence Survey of Healthcare-Associated Infections and Antimicrobial Use
Form A. Patient-based data (standard protocol)

<table>
<thead>
<tr>
<th>Antimicrobial (generic or brand name)</th>
<th>Route</th>
<th>Indication</th>
<th>Diagnosis</th>
<th>notes</th>
<th>Reason in notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Route: P: parenteral, O: oral, R: rectal, I: inhalation; Indication: CI - LI - HI: treatment intention for community-acquired (CI), long/intermediate-term care-acquired (LI) or acute hospital-acquired infection (HI); surgical prophylaxis: SP1: single dose, SP2: one day, SP3: >1day; MP: medical prophylaxis; O: other; UI: Unknown indication; Diagnosis: see site list, only for treatment intention Reason in notes: Y/N

**Patient data (to collect for all patients)**

<table>
<thead>
<tr>
<th>Hospital code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ward name (abbr.)/Unit Id</td>
</tr>
<tr>
<td>Ward specialty</td>
</tr>
<tr>
<td>Survey date: ___ / ___ / _______ (dd/mm/yyyy)</td>
</tr>
<tr>
<td>Patient Counter:</td>
</tr>
<tr>
<td>Age in years: ____ yrs; Age if &lt; 2 year old: _____ months</td>
</tr>
<tr>
<td>Sex: M F</td>
</tr>
<tr>
<td>Date of hospital admission: ___ / ___ / yyyy</td>
</tr>
<tr>
<td>Consultant/Patient Specialty:</td>
</tr>
<tr>
<td>Surgery since admission:</td>
</tr>
<tr>
<td>O No surgery</td>
</tr>
<tr>
<td>O Minimal invasive/non-NHSN surgery</td>
</tr>
<tr>
<td>O NHSN surgery</td>
</tr>
<tr>
<td>O Unknown</td>
</tr>
<tr>
<td>McCabe score: O Non-fatal disease</td>
</tr>
<tr>
<td>O Ultimately fatal disease</td>
</tr>
<tr>
<td>O Rapidly fatal disease</td>
</tr>
<tr>
<td>O Unknown</td>
</tr>
<tr>
<td>Central vascular catheter: O No O Yes O Unk</td>
</tr>
<tr>
<td>Peripheral vascular catheter: O No O Yes O Unk</td>
</tr>
<tr>
<td>Urinary catheter: O No O Yes O Unk</td>
</tr>
<tr>
<td>Intubation: O No O Yes O Unk</td>
</tr>
<tr>
<td>Patient receives antimicrobial(s)(1): O No O Yes</td>
</tr>
<tr>
<td>Patient has active HAI(2): O No O Yes</td>
</tr>
<tr>
<td>Microorganism 1</td>
</tr>
<tr>
<td>Microorganism 2</td>
</tr>
<tr>
<td>Microorganism 3</td>
</tr>
</tbody>
</table>

(1) At the time of the survey, except for surgical prophylaxis 24h before 8:00 AM on the day of the survey; if yes, fill antimicrobial use data; (2) [infection with onset ≥ Day 3, OR SSI criteria met (survey in previous 30d/1yr), OR discharged from acute care hospital <48h ago, OR CDI and discharged from acute care hospital < 28 days ago OR onset < Day 3 after invasive device/procedure on D1 or D2] AND [HAI case criteria met on survey day OR patient is receiving (any) treatment for HAI AND case criteria are met between D1 of treatment and survey day]; if yes, fill HAI data

**Case definition code**

<table>
<thead>
<tr>
<th>HAI 1</th>
<th>HAI 2</th>
<th>HAI 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>relevant device in situ before onset(3)</td>
<td>O Yes O No</td>
<td>O Yes O No</td>
</tr>
<tr>
<td>O Unknown</td>
<td>O Unknown</td>
<td>O Unknown</td>
</tr>
<tr>
<td>Present at admission</td>
<td>O Yes O No</td>
<td>O Yes O No</td>
</tr>
<tr>
<td>Date of onset(4)</td>
<td>___ / ___ / _____</td>
<td>___ / ___ / _____</td>
</tr>
<tr>
<td>Origin of infection</td>
<td>O current hospital</td>
<td>O current hospital</td>
</tr>
<tr>
<td>O other hospital</td>
<td>O other hospital</td>
<td>O other hospital</td>
</tr>
<tr>
<td>O other origin/ unk</td>
<td>O other origin/ unk</td>
<td>O other origin/ unk</td>
</tr>
<tr>
<td>If BSI: source(5)</td>
<td>MO-code R(6)</td>
<td>MO-code R(6)</td>
</tr>
</tbody>
</table>

(3) relevant device use (intubation for PN, CVC/PVC for BSI, urinary catheter for UTI) in 48 hours before onset of infection (even intermittent use), 7 days for UTI; (4) Only for infections not present/active at admission (dd/mm/yyyy); (5) C-CVC, C-PVC, S-PUL, S-UTI, S-DIG, S-SSI, S-SST, S-OTH, UO, UNK; (6) AMR marker 0,1,2 or 9, see table

## HAI definitions: Active HAI on PPS day

### Definition of active HAI

<table>
<thead>
<tr>
<th>Onset of HAI(^1)</th>
<th>Case definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 3 onwards</td>
<td>AND Meets the case definition on the day of survey.</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Day 1 (day of admission) or Day 2: SSI criteria met at any time after admission (including previous surgery 30 days/1 year).</td>
<td>OR</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Day 1 or Day 2 AND patient discharged from acute care hospital in preceding 48 hours.</td>
<td>OR Patient is receiving treatment(^3) AND HAI has previously met the case definition between Day 1 of treatment and survey day.</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Day 1 or Day 2 AND patient discharged from acute care hospital in preceding 28 days if CDI(^2) present.</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Day 1 or Day 2 AND patient has relevant device inserted on this admission prior to onset.</td>
<td></td>
</tr>
</tbody>
</table>

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\(^1\) Date of onset of HAI: date of first signs or symptoms of the infection; if unknown, record the date when treatment was started for this infection or the date the first diagnostic sample was taken. If no treatment or sample, please estimate. Not to be recorded if signs/symptoms are present at admission.

\(^2\) CDI: Clostridium difficile infection

\(^3\) Any kind of treatment, not necessarily antimicrobial.
ECDC PPS: methodology

- **Sampling of hospitals**
  - Systematic random sample (25-50 hospitals per country) if possible, to estimate HAI prevalence 7% +/- 1%
  - If less hospitals than 25: include all hospitals

- **Inclusion & exclusion criteria**:
  - Inclusion: all patients present on ward at 8:00 AM on PPS day
  - Exclusion: Long-term care wards, day cases

- **Microbiological data available on day of the survey**

- **Participation** in 4 periods:
  - May-June 2011 (2 countries), Sep-Nov 2011 (10), May-June 2012 (19), Sep-Nov 2012 (2)

ECDC PPS: Training

- Training curriculum developed in 2010 (coordinated by HPA)
- Train-the-trainer course: London, March 2011 (2 participants from each country)
- On average: 3 courses of 7.25 hours organised per country
- Estimated number of hospital staff trained in PPS methodology: 2800 people
ECDC PPS report published 4 July 2013

ECDC point prevalence survey: healthcare-associated infections still a major public health problem, one in 18 patients in European hospitals affected

04 Jul 2013

The first Europe-wide point prevalence survey on healthcare-associated infections and antimicrobial use estimates that on any given day, about 80 000 patients – or one in 18 patients – in European hospitals have at least one healthcare-associated infection.

Conducted in more than 1 000 hospitals in 30 European countries, the survey provides the most comprehensive database on healthcare-associated infections and antimicrobial use in European acute care hospitals to date. The data are published as a report and also available online as an interactive database.

The data report and the database include data on the most common hospital pathogens and processes in European hospitals. The prevalence is based on data from intensive care units (ICUs). The most common types of infections are urinary tract infections and bloodstream infections. At least one out of 18 patients in European hospitals.

Based on the survey results, ECDC has made recommendations to member states. Increasing the skills for surveillance of healthcare-associated infections and improving associated infections among thousands of healthcare workers is also recommended.

Healthcare-associated infections are infections acquired in hospital or healthcare settings. Although some of these infections can be treated easily, they can cause problems for patients with a particular condition (treatment for this takes a healthcare-associated infection or an antimicrobial agent) at a time when they are already vulnerable.
Participation to ECDC PPS, 2011-2012: methods & material, period

- Protocol: Standard: 881 hospitals (93%), Light: 66 hospitals (7% DE, DK, RO, HR)
- Software: HelicsWin.Net (ECDC): 21/33 networks (64%)
- On average 2.38 data collection days/100 patients (Standard: 2.41 days, Light 2.02 days), 6 days per hospital (excl. data entry and validation)
- Period of data collection: May 2011- Nov 2012, median 50 days/country between start and end of national PPS

Source: ECDC PPS, 2011-2012
Participation in the EU-wide ECDC point prevalence survey (PPS), 2011-2012

- 30 countries (29 EU/EEA countries + Croatia), 33 PPSs (networks)
- Total no. of hospitals that performed ECDC PPS: 3 200 (FR: 2 000)
- Submitted to ECDC (hospital reports sent): 1 149 hospitals (ES: 177)
- Included in analysis (sample): 947 hospitals, 231 459 patients

Source: ECDC PPS, 2011-2012
Optimal or good representativeness: 25/33 (76%) countries
ECDC PPS: Hospital type and size

Hospital type
- Primary: 32%
- Secondary: 22%
- Tertiary: 12%
- Specialised: 6%
- Unknown: 28%

Comparison pilot PPS: tertiary 52%

Hospital size
- P50: 300 beds
- Median: 300 beds
- Mean: 390 beds
- EU/EEA mean (national data): 334 beds

Source: ECDC PPS, 2011-2012
Healthcare-associated infections (HAIs) in European hospitals

- Of all patients, 6% are infected with at least 1 HAI
- Of these patients, 92% have 1 HAI, 7% have 2 HAIs, and 1% have 3 HAIs.
- The most frequently reported microorganisms in HAIs:
  - *E. coli*
  - *S. aureus*
  - *Candida spp.*
  - *Enterococcus spp.*
  - *P. aeruginosa*
  - *Klebsiella spp.*
  - *C. difficile*
  - *Stenotrophomonas maltophilia*
  - *Enterobacter spp.*
  - *Proteus spp.*
  - *Aspergillus spp.*
  - *Acinetobacter spp.*

- For 54% of these, a microorganism was reported.
- 23% of these HAIs are already present at admission.
- 54% of those are associated with a previous stay at the same hospital.

**Types of HAIs**
- Pneumonia/Lower resp. tract: 33%
- Urinary tract: 16%
- Surgical site: 14%
- Bloodstream: 9%
- Gastrointestinal: 12%
- Systemic: 7%
- Skin/Soft tissue: 8%
- Other/Unspecified: 4%
- Other: 4%
Indicators for antimicrobial resistance:

- 41% MRSA (among 1071 reported *S. aureus* with known AST results)
- 33% third-generation cephalosporin-R *Enterobacteriaceae* (n=2851)
- 23% carbapenem-R *Klebsiella pneumoniae* (n=589)
- 81% carbapenem-R *Acinetobacter baumannii* (n=292)
- 10% glycopeptide-R *Enterococcus sp.* (n=755, *E. faecium* 19%)

Source: ECDC PPS, 2011-2012
Prevalence of HAI by hospital type and patient specialty

### HAI % by hospital type

- **Primary**
- **Secondary**
- **Tertiary**
- **Specialised**
- **Unknown**

### HAI % by specialty

- **Surgery**
- **Medicine**
- **Paediatrics**
- **ICU**
- **Gynaeco/obstetrics**
- **Geriatrics**
- **Psychiatry**
- **Rehabilitation/Other**
HAI type by specialty

Source: ECDC PPS, 2011-2012
Patient risk factors: HAI

- Multiple logistic regression model
- Only p<0.001 included
- Age, length of hospital stay, McCabe score, surgery since admission, intubation, urinary catheter, specialty
- Vascular catheters excluded from model (parenteral antimicrobial use)
- If HAI, length of hospital stay, invasive device, McCabe score before HAI
- Allows for calculation of probability of HAI for each patient (from 0 to 1)
- => Sum of individual probabilities for 1 hospital = N of expected HAI (E) based on EU risk model
- Standardized Infection Ratio (SIR) = Observed HAI / Expected HAI
### Patient risk factors of HAI s (1)

<table>
<thead>
<tr>
<th></th>
<th>N of patients</th>
<th>% of total</th>
<th>Pts with HAI %</th>
<th>Adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All patients (standard protocol)</strong></td>
<td>215 537</td>
<td>100</td>
<td>6.1</td>
<td>-</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-44 years (ref.)</td>
<td>47 100</td>
<td>21.9</td>
<td>3.4</td>
<td>ref. (1.1 - 1.7)</td>
</tr>
<tr>
<td>&lt;1 month</td>
<td>7 592</td>
<td>3.5</td>
<td>3.9</td>
<td>1.4 (1.1 - 1.7)</td>
</tr>
<tr>
<td>1-11 months</td>
<td>5 135</td>
<td>2.4</td>
<td>6.4</td>
<td>1.4 (1.2 - 1.7)</td>
</tr>
<tr>
<td>45-74 years</td>
<td>88 726</td>
<td>41.2</td>
<td>6.7</td>
<td>1.2 (1.1 - 1.3)</td>
</tr>
<tr>
<td>75-84 years</td>
<td>43 665</td>
<td>20.3</td>
<td>7.3</td>
<td>1.3 (1.2 - 1.4)</td>
</tr>
<tr>
<td>&gt;=85 years</td>
<td>23 319</td>
<td>10.8</td>
<td>6.4</td>
<td>1.2 (1.1 - 1.3)</td>
</tr>
<tr>
<td><strong>Male Gender</strong></td>
<td>101 137</td>
<td>46.9</td>
<td>6.9</td>
<td>1.1 (1.1 - 1.2)</td>
</tr>
<tr>
<td><strong>Length of stay (days)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-3 days</td>
<td>71 551</td>
<td>33.2</td>
<td>2.2</td>
<td>ref. (2.2 - 2.5)</td>
</tr>
<tr>
<td>4-7 days</td>
<td>58 713</td>
<td>27.2</td>
<td>5.7</td>
<td>2.3 (2.2 - 2.5)</td>
</tr>
<tr>
<td>8-14 days</td>
<td>42 059</td>
<td>19.5</td>
<td>7.9</td>
<td>2.9 (2.7 - 3.1)</td>
</tr>
<tr>
<td>&gt;=15 days</td>
<td>42 169</td>
<td>19.6</td>
<td>11.2</td>
<td>3.9 (3.6 - 4.2)</td>
</tr>
<tr>
<td>Unknown</td>
<td>1 045</td>
<td>0.5</td>
<td>4.9</td>
<td>1.6 (1.1 - 2.4)</td>
</tr>
<tr>
<td><strong>McCabe score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-fatal</td>
<td>142 925</td>
<td>66.3</td>
<td>4.3</td>
<td>ref. (1.6 - 1.8)</td>
</tr>
<tr>
<td>Ultimately fatal</td>
<td>34 780</td>
<td>16.1</td>
<td>10.3</td>
<td>1.7 (1.6 - 1.8)</td>
</tr>
<tr>
<td>Rapidly fatal</td>
<td>11 275</td>
<td>5.2</td>
<td>13.5</td>
<td>1.9 (1.8 - 2.1)</td>
</tr>
<tr>
<td>Unknown</td>
<td>26 557</td>
<td>12.3</td>
<td>6.6</td>
<td>1.2 (1.1 - 1.3)</td>
</tr>
<tr>
<td><strong>Surgery since admission</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No surgery</td>
<td>155 733</td>
<td>72.3</td>
<td>4.7</td>
<td>ref. (1.7 - 1.9)</td>
</tr>
<tr>
<td>NHSN surgery</td>
<td>43 456</td>
<td>20.2</td>
<td>10.1</td>
<td>1.8 (1.7 - 1.9)</td>
</tr>
<tr>
<td>Minimal/non-NSHN surgery</td>
<td>13 882</td>
<td>6.4</td>
<td>8.1</td>
<td>1.6 (1.5 - 1.8)</td>
</tr>
<tr>
<td>Unknown</td>
<td>2 466</td>
<td>1.1</td>
<td>7.1</td>
<td>1.2 (1.0 - 1.5)</td>
</tr>
<tr>
<td><strong>Presence of invasive devices</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intubation¹</td>
<td>4 796</td>
<td>2.2</td>
<td>30.8</td>
<td>2.2 (2.0 - 2.5)</td>
</tr>
<tr>
<td>Urinary catheter¹</td>
<td>36 783</td>
<td>17.1</td>
<td>14.2</td>
<td>2 (1.9 - 2.1)</td>
</tr>
<tr>
<td>Central vascular catheter</td>
<td>16 086</td>
<td>7.5</td>
<td>24.2</td>
<td>-</td>
</tr>
<tr>
<td>Peripheral vasc. catheter</td>
<td>99 867</td>
<td>46.3</td>
<td>7.6</td>
<td>-</td>
</tr>
</tbody>
</table>

1 before HAI onset if HAI during current hospital stay
### Patients with HAI (%)

<table>
<thead>
<tr>
<th>Specialty</th>
<th>N of patients</th>
<th>% of total</th>
<th>Pts with</th>
<th>Adjusted OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed &amp; other ICU</td>
<td>3 134</td>
<td>1.5</td>
<td>26.5</td>
<td>1.9 (1.7 - 2.2)</td>
</tr>
<tr>
<td>Surgical ICU</td>
<td>1 973</td>
<td>0.9</td>
<td>24.7</td>
<td>1.7 (1.4 - 1.9)</td>
</tr>
<tr>
<td>Burns care</td>
<td>184</td>
<td>0.1</td>
<td>22.8</td>
<td>3.3 (2.2 - 5.2)</td>
</tr>
<tr>
<td>Medical ICU</td>
<td>2 506</td>
<td>1.2</td>
<td>17.2</td>
<td>1.7 (1.4 - 1.9)</td>
</tr>
<tr>
<td>Haematology/BMT</td>
<td>3 547</td>
<td>1.6</td>
<td>16.4</td>
<td>2.8 (2.5 - 3.2)</td>
</tr>
<tr>
<td>Paediatric ICU</td>
<td>753</td>
<td>0.3</td>
<td>15.7</td>
<td>1.9 (1.4 - 2.5)</td>
</tr>
<tr>
<td>Transplant/cancer surgery</td>
<td>1 157</td>
<td>0.5</td>
<td>12</td>
<td>1.4 (1.1 - 1.7)</td>
</tr>
<tr>
<td>Neonatal ICU</td>
<td>2 138</td>
<td>1</td>
<td>10.9</td>
<td>1.7 (1.3 - 2.1)</td>
</tr>
<tr>
<td>Digestive tract surgery</td>
<td>4 384</td>
<td>2</td>
<td>10.2</td>
<td>1.5 (1.3 - 1.7)</td>
</tr>
<tr>
<td>Cardiovascular surgery</td>
<td>5 018</td>
<td>2.3</td>
<td>9.8</td>
<td>1.2 (1.1 - 1.4)</td>
</tr>
<tr>
<td>Infectious diseases</td>
<td>3 144</td>
<td>1.5</td>
<td>8.3</td>
<td>1.7 (1.4 - 2.0)</td>
</tr>
<tr>
<td>Nephrology</td>
<td>2 988</td>
<td>1.4</td>
<td>8</td>
<td>1.3 (1.1 - 1.6)</td>
</tr>
<tr>
<td>All other specialties (ref.)</td>
<td>106 861</td>
<td>49.6</td>
<td>5.9</td>
<td>ref</td>
</tr>
<tr>
<td>Geriatrics</td>
<td>8 982</td>
<td>4.2</td>
<td>5.6</td>
<td>0.8 (0.7 - 0.9)</td>
</tr>
<tr>
<td>Urology</td>
<td>5 656</td>
<td>2.6</td>
<td>5.4</td>
<td>0.7 (0.6 - 0.9)</td>
</tr>
<tr>
<td>Pneumology</td>
<td>8 721</td>
<td>4</td>
<td>4.5</td>
<td>0.8 (0.7 - 0.9)</td>
</tr>
<tr>
<td>Cardiology</td>
<td>12 330</td>
<td>5.7</td>
<td>4.3</td>
<td>0.9 (0.8 - 1.0)</td>
</tr>
<tr>
<td>Endocrinology</td>
<td>2 297</td>
<td>1.1</td>
<td>3.7</td>
<td>0.7 (0.5 - 0.9)</td>
</tr>
<tr>
<td>Ear/nose/throat surgery</td>
<td>2 963</td>
<td>1.4</td>
<td>2.8</td>
<td>0.6 (0.5 - 0.8)</td>
</tr>
<tr>
<td>Gynaecology</td>
<td>5 049</td>
<td>2.3</td>
<td>2.7</td>
<td>0.7 (0.6 - 0.9)</td>
</tr>
<tr>
<td>Rheumatology</td>
<td>1 487</td>
<td>0.7</td>
<td>2.6</td>
<td>0.5 (0.3 - 0.8)</td>
</tr>
<tr>
<td>Paediatrics general</td>
<td>7 856</td>
<td>3.6</td>
<td>1.8</td>
<td>0.6 (0.5 - 0.7)</td>
</tr>
<tr>
<td>Dermatology</td>
<td>1 298</td>
<td>0.6</td>
<td>1.4</td>
<td>0.3 (0.2 - 0.6)</td>
</tr>
<tr>
<td>Obstetrics / Maternity</td>
<td>11 444</td>
<td>5.3</td>
<td>1.1</td>
<td>0.4 (0.3 - 0.5)</td>
</tr>
<tr>
<td>Psychiatry</td>
<td>8 226</td>
<td>3.8</td>
<td>0.9</td>
<td>0.2 (0.2 - 0.3)</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>1 441</td>
<td>0.7</td>
<td>0.8</td>
<td>0.3 (0.1 - 0.5)</td>
</tr>
</tbody>
</table>
Differences in case-mix by country

ICU:
- 5% of total patient population
- HAI%: 19.5%, 16.4% of patients with HAI

Feedback of PPS results: risk adjustment

Observed HAI %: 6.2% (95%CI 1.7-15.0; P 63)
Expected HAI %: 7.3% (P 85)

Feedback of PPS results: risk adjustment

Observed vs predicted (expected) prevalence, based on patient risk factors

Observed (O) vs Expected (E) HAI prevalence

Standardised Infection Ratio (O/E)

Source: ECDC PPS, 2011-2012
Observed vs predicted HAI prevalence by country, ECDC PPS 2011-2012

Validation: Sensitivity by HAI prevalence in primary PPS

<table>
<thead>
<tr>
<th>Country</th>
<th>N of hosp.</th>
<th>N of pts</th>
<th>Se % (95% CI)</th>
<th>Sp % (95% CI)</th>
<th>pPPS HAI Pr % (95% CI)</th>
<th>True HAI Pr % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>30</td>
<td>1280</td>
<td>61.6 (51.3-71.8)</td>
<td>99.9 (99.8-100.0)</td>
<td>3.7 (2.8- 5.0)</td>
<td>5.9 (5.0- 7.1)</td>
</tr>
<tr>
<td>Hungary</td>
<td>5</td>
<td>274</td>
<td>74.1 (43.9-91.9)</td>
<td>99.6 (98.3-100.0)</td>
<td>4.5 (4.0- 5.2)</td>
<td>5.6 (3.3- 8.2)</td>
</tr>
<tr>
<td>Ireland</td>
<td>10</td>
<td>342</td>
<td>57.8 (36.9-75.4)</td>
<td>99.2 (98.0-99.8)</td>
<td>5.2 (4.2- 6.3)</td>
<td>7.7 (5.0-10.8)</td>
</tr>
<tr>
<td>Spain</td>
<td>5</td>
<td>239</td>
<td>94.0 (69.2-99.9)</td>
<td>99.0 (97.5-99.8)</td>
<td>7.7 (7.2- 8.2)</td>
<td>7.2 (5.4- 9.9)</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
<td>71.9</td>
<td>99.4</td>
<td>5.3</td>
<td>6.6</td>
</tr>
</tbody>
</table>
Catheter-related infections (% of all HAIs), ECDC PPS 2011-2012

Catheter-related infections (% of all HAIs)

- <4
- 4 to <6
- 6 to <8
- 8 to <12
- >=12
- Not included

Percentage of HAI s with microbiological results available on the PPS day, ECDC PPS 2011-2012

HAI s with microbiological results (%)
- <45
- 45 to <50
- 50 to <55
- 55 to <65
- >=65
- Not included

Non-visible countries
- Liechtenstein
- Luxembourg
- Malta

**Clostridium difficile infections, % of all HAIs, by country, ECDC PPS 2011-2012**

- Iceland
- Netherlands
- Slovakia
- Norway*
- UK-Northern Ireland
- Portugal
- Croatia*
- Estonia*
- Bulgaria
- Malta
- Italy
- Germany
- Luxembourg
- Austria*
- Greece
- France
- Spain
- Finland
- Austria*
- Ireland
- Poland
- Norway*
- UK-Scotland
- Denmark*
- Iceland
- Belgium
- Romania
- UK-Scotland
- Croatia*
- Slovenia
- Spain
- Greece
- France
- Slovakia
- Estonia*
- Bulgaria
- Malta
- Iceland

*C. difficile infections Other gastro-intestinal infections

Clostridium difficile, % of isolates in HAIs

Acinetobacter spp., % of isolates in HAIs

Enterobacteriaceae in HAIs non susceptible to 3rd Gen cephalosporins (%), ECDC PPS 2011-2012

Non-susceptible isolates (%)
- <20
- 20 to <30
- 30 to <40
- 40 to <50
- >=50
- <10 isolates or no data
- Not included

Antimicrobial use, ECDC PPS, 2011-2012

- Prevalence of antimicrobial use (AU):
  - 80 951/231 459 patients with ≥ 1 antimicrobial: **35.0%**
  - Country range: 21.4%-54.7%, bed-adjusted prevalence **32.7%**
  - ≥ 2 antimicrobial agents: 29.1% of 80951
- Route of administration: parenteral 70.6%

Prevalence of antimicrobial use by country, ECDC PPS 2011-2012

Patients on antimicrobials (%)
- <30
- 30 to <35
- 35 to <40
- 40 to <45
- >=45
- Not included

AU prevalence extrapolated to number of occupied beds: 32.7% (95% CI 29.4-36.2%)

## Validation of antimicrobial use prevalence

<table>
<thead>
<tr>
<th>Country</th>
<th>N of hosp.</th>
<th>N of pts</th>
<th>Se % (95%CI)</th>
<th>Sp % (95%CI)</th>
<th>pPPS AU Pr (%) (95%CI)</th>
<th>True AU Pr (%) (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>30</td>
<td>1280</td>
<td>93.1 (89.3-96.0%)</td>
<td>99.6 (99.1-99.9%)</td>
<td>42.4 (38.7-46.3%)</td>
<td>45.3 (43.7-47.4%)</td>
</tr>
<tr>
<td>Hungary</td>
<td>5</td>
<td>274</td>
<td>96.6 (87.9-99.6%)</td>
<td>98.8 (96.7-99.8%)</td>
<td>22.8 (20.7-24.9%)</td>
<td>22.6 (20.3-25.3%)</td>
</tr>
<tr>
<td>Ireland</td>
<td>10</td>
<td>342</td>
<td>93.5 (87.2-97.3%)</td>
<td>99.3 (97.4-99.9%)</td>
<td>34.4 (31.3-37.7%)</td>
<td>36.3 (33.7-39.2%)</td>
</tr>
<tr>
<td>Spain</td>
<td>5</td>
<td>239</td>
<td>96.8 (92.1-99.1%)</td>
<td>100.0 (96.6-100.0%)</td>
<td>45.4 (44.4-46.4%)</td>
<td>46.9 (44.0-49.1%)</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>95.0</strong></td>
<td><strong>99.4</strong></td>
<td></td>
<td></td>
<td><strong>36.3</strong></td>
<td><strong>37.8</strong></td>
</tr>
</tbody>
</table>

Prevalence of antimicrobial use by hospital type and patient risk factors

Prevalence of antimicrobial use and indication for antimicrobial use by specialty

**AU prevalence**

- Surgery
- Medicine
- Paediatrics
- Intensive care
- Obstetrics/gynaecology
- Geriatrics
- Psychiatry
- Rehabilitation/Other

**AU indication**

- Treatment community infection
- Treatment hospital infection
- Treatment LTCF infection
- Surgical prophylaxis
- Medical Prophylaxis
- Other
- Unknown

Observed vs predicted prevalence of antimicrobial use, ECDC PPS 2011-2012

Most frequently used antimicrobial agents (ATC 4th level)

- Comb. penicillins + BL-inhibitors
- Fluoroquinolones
- 3rd generation cephalosporins
- 2nd generation cephalosporins
- Aminoglycosides
- Penicillins, ext. spect. w/o BL-inh.
- Imidazole derivatives
- 1st generation cephalosporins
- Carbapenems
- Glycopeptide antibacterials
- Macrolides
- BL resistant penicillins
- Triazole derivatives
- Lincosamides

Percentage of antimicrobial agents (%)

Most frequently used antimicrobial agents (ATC 5th level)

- Ampicillin (J01CA01)
- Ampicillin and enzyme inhibitor (J01CR01)
- Benzylpenicillin (J01CE01)
- Sulfamethoxazole trimethoprim (J01EE01)
- Metronidazole (oral, rectal) (P01AB01)
- Clindamycin (J01FF01)
- Flucloxacillin (J01CF05)
- Clarithromycin (J01FA09)
- Fluconazole (J02AC01)
- Vancomycin (parenteral) (J01XA01)
- Meropenem (J01DH02)
- Amoxicillin (J01CA04)
- Levofloxacin (J01MA12)
- Metronidazole (parenteral) (J01XD01)
- Cefuroxime (J01DC02)
- Ceftriaxone (J01DD04)
- Ciprofloxacin (J01MA02)
- Amoxicillin and enzyme inhibitor (J01CR02)
- Piperacillin and enzyme inhibitor (J01CR05)
- Gentamicin (J01GB03)
- Piperacillin and enzyme inhibitor (J01CR05)
- Cefazolin (J01DB04)
- Meropenem (J01DH02)
- Amoxicillin (J01CA04)
- Levofloxacin (J01MA12)
- Metronidazole (parenteral) (J01XD01)
- Cefuroxime (J01DC02)
- Ceftriaxone (J01DD04)
- Ciprofloxacin (J01MA02)
- Amoxicillin and enzyme inhibitor (J01CR02)
- Piperacillin and enzyme inhibitor (J01CR05)

Prevalence of use of polymyxins and/or tigecycline

Correlation between oral metronidazole/vancomycin use and relative frequency of *C. difficile*

![Graph showing correlation between oral metronidazole/vancomycin use and relative frequency of *C. difficile*. The graph includes data points for various countries, with a correlation coefficient of Rho=0.55 and P<0.001. The source is ECDC PPS, 2011-2012.](image)
Percentage of antimicrobials administered via parenteral route

Parenteral route (% of antimicrobials)
- <60
- 60 to <70
- 70 to <80
- 80 to <90
- 90 to 100
- Not included

Non-visible countries
- Liechtenstein
- Luxembourg
- Malta

Percentage surgical prophylaxis > 1 day

Surgical prophylaxis > 1 day (% of SP)

Romania*
Denmark*
Malta
Slovakia
Greece
Bulgaria
Austria*
Cyprus
Germany
France
Croatia*
Portugal
Italy
Estonia*
Luxembourg
Slovenia
Latvia
Lithuania
UK-Wales
Netherlands
Hungary
Spain
Czech Republic*
Ireland
Poland
Finland
Iceland
Belgium
Norway*
UK-England
Sweden*
UK-Scotland
UK-Northern Ireland

*Poor data representativeness; Source: ECDC PPS, 2011-2012. SP=surgical prophylaxis
Percentage of antimicrobials prescribed for medical prophylaxis

Medical prophylaxis (% of antimicrobials)
- <5
- 5 to <10
- 10 to <15
- 15 to <20
- >=20
- Not included

Percentage of antimicrobials with reason for use in patient notes

Reason in notes (% of antimicrobials)
- <60
- 60 to <70
- 70 to <80
- 80 to <90
- 90 to 100
- Not included

ECDC PPS in acute care hospitals, 2011-2012: structure and process indicators

- Infection prevention and control indicators in 2011-2012: single bed rooms, alcohol hand rub consumption
- Mapping leads to action: e.g. measures to improve AHR data availability in UK-Scotland

ECDC PPS in acute care hospitals, 2011-2012: structure and process indicators

- Two indicators of infection prevention and control staffing
- Mapping leads to action: e.g. Czech Republic: National HAI Reference Centre (2012), new IPC guidance (2013)

IPC nurses (FTE/250 beds)

IPC doctors (FTE/250 beds)
Hospital-wide indicators for second ECDC PPS: based on SIGHT project

Hospital organisation, management, and structure for prevention of health-care-associated infection: a systematic review and expert consensus

Walter Zingg, Alison Holmes, Markus Dettenkofer, Tim Goetting, Federica Secci, Lauren Clack, Benedetta Allegranzi, Anna-Pelagia Magiorakos, Didier Pittet, for the systematic review and evidence-based guidance on organization of hospital infection control programmes (SIGHT) study group.

Despite control efforts, the burden of health-care-associated infections in Europe is high and leads to around 37,000 deaths each year. We did a systematic review to identify crucial elements for the organisation of effective infection-prevention programmes in hospitals and key components for implementation of monitoring. 92 studies published from 1996 to 2012 were assessed and ten key components identified: organisation of infection control at the hospital level; bed occupancy, staffing, workload, and employment of pool or agency nurses; availability of and ease of access to materials and equipment and optimum ergonomics; appropriate use of guidelines; education and training; auditing; surveillance and feedback; multimodal and multidisciplinary prevention programmes that include behavioural change; engagement of champions; and positive organisational culture. These components comprise manageable and widely applicable ways to reduce health-care-associated infections and improve patients' safety.

- Systematic review & expert opinion => 10 Key Components and proposed indicators
- HAI-Net experts: further define indicators for implementation in PPS II protocol (meeting and teleconferences)

Source: W. Zingg et al. Lancet Infectious Diseases, Published online Nov 11 2014.
Burden estimates in PPS

- **Prevalence:** total number of patients with >=1 HAI or >=1 antimicrobial on any given day in 2011-2012 in Europe
  - HAI: 81,089 (95% CI 64,624 – 105,895)
  - AU: 466,226 (95% CI 419,285 – 515,690)

- **Incidence:**
  - total number of patients with >=1 HAI per year: 3.2 Million (1.9 – 5.2 M)
  - total number of patients receiving antimicrobials per year: not possible (start date antimicrobial not collected)
  - HA-cases: MRSA 178,875/year, CDI 123,997/year, Carbapenem-R Enterobacteriaceae 97,111/year
Results at hospital level

- Hospital feedback reports (24 pp) sent by ECDC to national coordinator within 1 week after data submission to ECDC
- Detailed hospital results versus national and EU results, incl. standardization
- 95% confidence intervals relatively large for rare outcomes (HAI), ok for more frequent outcomes (AU)
- E.g. hospital incl. 300 patients:

<table>
<thead>
<tr>
<th>HAI prevalence 5%</th>
<th>HAI prevalence 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.8</td>
<td>6.8</td>
</tr>
<tr>
<td>8.1</td>
<td>14.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AU prevalence 25%</th>
<th>AU prevalence 50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.2</td>
<td>44.2</td>
</tr>
<tr>
<td>30.3</td>
<td>55.8</td>
</tr>
</tbody>
</table>
Discussion

- Largest EU-wide PPS of HAI and AU to date: 30 countries, good/optimal representativeness in 25/33 surveys (76%)
- 231 459 patients from 947 hospitals were included
- Patients with HAI: 6.0% (adjusted 5.7%), country range 2.3-10.8%
- 15 000 HAIs: respiratory 23%, SSI 20%, UTI 19%, BSI 11%, GI 8%
- Country ranking AMR markers significantly correlated with EARS-Net data; higher percentage R (HAI only)
- High levels of MDR gram-negatives and C. difficile
- Patients on antimicrobials: 35.0% (adjusted 32.7%), range 21.4-54.7%
- Prevalence of antimicrobial use similar to pilot PPS but slightly higher than previous ESAC PPSs
- Adjusted prevalence slightly lower than PPS database prevalence because of lower prevalence in larger countries
- Excessive prolongation of antimicrobial prophylaxis: overestimated in PPS, but valid comparison between hospitals/countries
Limitations

- PPS=1 picture
- Workload (but majority patient-based protocol)
- Representativeness: convenience sample in several countries, (very) small number of hospitals in 8/33 surveys
- Limited use of PPS results at hospital level: large confidence intervals (HAI prevalence > antimicrobial use)
- Validation: only done in few countries
- Poor availability of diagnostic tests in low resource EU countries: underestimation HAI prevalence
- Case definitions complex, no pediatric case definitions
- Infection control indicators do not always measure what they are supposed to
Recommendations

- Support to diagnostic testing capacity for HAI in EU/EEA Member States
- Standardised surveillance of alcohol hand rub consumption & *Clostridium difficile* infections
- Enhance EU surveillance of HAI with carbapenem-resistant gram-negative bacteria
- Improve antimicrobial prescribing, eg surgical prophylaxis
- Ensuring adequate numbers of specialised infection control staff
- Increase isolation capacity when rebuilding hospitals
- More training in PPS methodology (especially HAI case definitions)
- PPS II (2016-2017): Validation in all countries
More results...

Point prevalence survey interactive database: HAI-Net

PPS

The online database of the ECDC HAI-Net point prevalence survey (PPS) of healthcare-associated infections (HAIs) and antimicrobial use provides European reference data on HAIs and antimicrobial use in acute care hospitals in Europe. The reports of the database are provided through the European Surveillance System (TESSy). Data for the first EU-wide Point Prevalence Survey of HAI and antimicrobial use were collected over a period of 2 years (12 countries in 2011 and 21 countries in 2012) and are presented as a single period 2011-2012. Please refer to the ECDC PPS protocol for methodological details and to the report Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals 2011-2012 for interpretation of the results.

ACCESS THE DATABASE

ECDC PPS data representativeness

Prevalence of HAIs and antimicrobial use

Distribution of HAI types

Microorganisms and antimicrobial resistance in HAIs

ABOUT THE DATABASE

The HAI-Net interactive database displays the selected results in various formats, such as tables, graphs and maps. Please note that the Print and PDF icons above will only generate the default page of the database and not the variables selected.

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Access to ECDC Member States Data in TESSy by Third Parties.

HOW REPRESENTATIVE ARE THE DATA?

The data have been collected at the national level under the responsibility of each participating country during national point prevalence surveys following the ECDC PPS methodology.
100+ Experts from EU Member States, ESAC, WHO/Europe, ESICM, CDC

National PPS coordination teams and participating hospitals!!!
Thank you!

EUROPEAN ANTIBIOTIC AWARENESS DAY

A EUROPEAN HEALTH INITIATIVE

18 November 2015

Website:  http://antibiotic.ecdc.europa.eu
Facebook:  EAAD.EU
Twitter:   @EAAD_EU (#EAAD)
Percentage of single room beds

Infection prevention and control nurses: full-time equivalents (FTE) per 250 beds

Structure and process indicators: percentage of single room beds

Single-room beds (%)
- <5
- 5 to <10
- 10 to <20
- 20 to <30
- >=30
- Not included

Single room beds in participating hospitals (%): median = 11.1%

Acknowledgements - ECDC

The authors would also like to thank all ECDC colleagues who contributed to one or more of the various aspects of the ECDC PPS project and report, in particular Jolanta Griskeviciene (PPS helpdesk, follow-up of development of PPS metadata and validation reports in TESSy, data quality checks, training), and further – in alphabetical order, and not exhaustively – Lennart Adell Kind, Barbara Albiger, Catalin Albu, Andrew Amato-Gauci, Andrea Ammon, Bruno Ciancio, Denis Coulombier, Brenna Deckert, Lorenzo De Simone, Liselotte Diaz-Högberg, Daniel Faensen, Johan Giesecke, Gaetan Guyodo, Ewa Hellberg, Ole Heuer, Elmira Khazeeva, Piotr Kramarz, Valentina Lazdina, Eva Liljestedt, Anna-Pelagia Magiorakos, Silja Marma, Oana Mereuta-Buzatu, Guia Miniotti, Dominique L Monnet, Luciana Muresan, Sorin Ostafiev, Alberto Pedrini, Anastasia Pharris, Diamantis Plachouras, Vladimir Prikazsky, Chantal Quinten, Per Rolfhamre, Silvia Sarbu, Luisa Sodano, Pernille Sokoni, Gianfranco Spiteri, Marc Struelens, Boyana Todorova, Nicolas Van Lamsweerde, Klaus Weist, Zaib-un-Nisa, Phillip Zucs, the current and former ECDC Directors (Marc Sprenger and Zsuzsanna Jakab) and the ECDC Advisory Forum Members (especially Jean-Claude Desenclos who recommended that ECDC to organise a European PPS of HAI in 2007) for their support and advice throughout the project.
Alcohol handrub consumption (L/1000 patient-days), year before PPS

Alcohol hand rub consumption (L/1000 patient days)
- <10
- 10-19.9
- 20-29.9
- 30-39.9
- >=40
- No data
- Not included

Non-visible countries
- Liechtenstein
- Luxembourg
- Malta

Burden estimates: conversion from prevalence to estimated incidence

- Estimated Incidence (Rhame and Sudderth Formula)

\[
I_{\text{estimated}} = P \frac{LA}{(LN - INT)}
\]

- \( P \) = Prevalence
- \( LA \) = Average length of hospital stay: from hospital data (=LA cohort)
- \( LN \) = Average length of hospital stay of infected patients ???
- \( INT \) = Average length between date of admission and date of onset ???
- \((LN-INT) = \text{LoS infected patients since onset HAI}\

- “Cohort” = All hospitalised patients during one year (hypothetical)
- \( LA \): from hospital denominator data
- Many parameters possible to approximate \((LN-INT)_{\text{cohort}}\) from PPS data
  \( \text{Mean}(LN-INT), \text{median}(LN-INT), \text{mean}(LN)-\text{mean}(INT), \text{median}(LN)-... \)
- Arbitrary choice: 2 parameters, 1 higher and 1 lower estimate