Antibiotic use in the Nordic countries: What are they (we) doing right?

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Rigshospitalet  
Copenhagen, Denmark
EARS-NET 2017: Blood culture isolates
ESAC-NET: Consumption of Antibacterials for systemic use (ATC group J01) in the community (primary care sector) in Europe, reporting year 2017
ESAC-NET: Consumption of Antibacterials for systemic use (ATC group J01) in the community (primary care sector) in Europe, reporting year 2017

High and significant correlation between antibiotic use and antibiotic resistance!
Therefore: Follow the antibiotics!
EU invitational conference organised by Danish National Health Board in 1998

3 day conference attended by leaders of national health boards of all EU-countries – and experts

Deliverable: The Copenhagen Recommendations for Antibiotic policy

**Copenhagen Recommendations:**

- Recognise AMR as major EU and global problem
- Encourage search for new AM
- Setup EU surveillance on AMR
- Collect data on supply and consumption of AM agents
- EU Encourage prudent use of AM
- EU, member states and nat.res.councils research on AMR high priority
- Review progress on recommendation

**Copenhagen Recommendations:**
- Recognise AMR as major EU and global problem
- Encourage search for new AM
- Setup EU surveillance on AMR
- Collect data on supply and consumption of AM agents
- EU Encourage prudent use of AM
- EU, member states and nat.res.councils research on AMR high priority
- Review progress on recommendation

**EU Council recommendation:**
- Recognise problem and promote strategy for prudent use of AM
- Establish surveillance on AMR
- Prescription only, guidelines, good practise for managing comm.dis., education of health professionals and information of public
- Cooperate, coordinate and report to EU
- "Intersectorial mechanism" for coordinated implementation of strategy
## Antibiotic policy issues re. EU Commission Recommendation

<table>
<thead>
<tr>
<th>Country</th>
<th>Monitoring System (R + U) – reporting to ECDC</th>
<th>Inter-sectonal mechanism</th>
<th>National treatment guidelines</th>
<th>Prescription only enforced</th>
<th>Education – student, MD, specialist, public</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>FINRES/FINRES-Vet</td>
<td>FiRe/EVIRA</td>
<td>+</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
<td>Sweden</td>
<td>SWEDRES/SVARM</td>
<td>STRAMA</td>
<td>+</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
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<td>NORM/NORM-VET</td>
<td>NORM</td>
<td>+</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
<td>Denmark</td>
<td>DANMAP</td>
<td>Antibiotikarådet</td>
<td>+</td>
<td>+</td>
<td>+++</td>
</tr>
</tbody>
</table>
Why is antimicrobial resistance (and use) so low in the Nordic countries?

• Primary health care
  • Allocation/rostering; Rapid diagnostics

• Pharmacy issues
  • Number of pharmacies; OTC, non-compliance; Re-imbursement

• Clinical microbiology
  • Medical specialty; Availability of laboratory facilities/speed of analysis

• Education
  • Medical students; Specialists; General public
Why is antimicrobial resistance (and use) so low in the Nordic countries?

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Importance of cultural differences for antibiotic use (European Union)

P = 0.001

Consumption of antibacterials for systemic use ATC J01 (DDD per 1,000 inh-days)

Majority protestants vs. Majority catholics

D. Monnet; ESAC-Net
Importance of cultural differences for antibiotic use (European Union)

Antibiotic consumption in primary care, 2017

P = 0.001

P < 0.0001
Overall Consumption of Systemic Antibacterials (ATC J01) in Primary Health Care, Fee-for-Service and Rostering of Patients by GPs, EU, 1997

POCTests in primary care
Reimbursed by National Health Insurance

Audit of respiratory tract infections in primary care 2001; by courtesy of Jens K. Møller
Why is antimicrobial resistance (and use) so low in the Nordic countries?

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- Education
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Overall Consumption of Systemic Antibacterials (ATC J01) in Primary Health Care and Consumption of Medicines Without Prescription, EU, 1996-1997

Consumption of Medicines Without Prescription, No. Inhabitants per Pharmacy, and Annual Revenues from Sales of Pharmaceuticals per Pharmacy, EU, 1996-1997

Sources: Eurobarometer 44.3, European Commission in Key Data on Health 2000, Eurostat; and GIRP and IMS Health.
10.5. Community pharmacies, 2015 (or nearest year)

Per 100,000 population

Spain: 47.2
Japan: 45.0
Belgium: 43.9
Korea: 41.8
Ireland: 37.5
Poland: 35.7
France: 34.0
Turkey: 31.5
Italy: 28.0
Portugal: 26.9
Canada: 26.7
Germany: 24.8
Hungary: **24.7**
OECD26: 23.6
Australia: 23.1
United Kingdom: 22.1
Switzerland: 21.3
Iceland: 21.3
Luxembourg: 19.2
Austria: 16.9
Norway: 15.4
Finland: 15.0
Sweden: 14.9
Netherlands: 13.3
United States: 11.7
Israel: 10.1
Denmark: 3.9
Correlation between number of pharmacies pr. 100,000 population and antibiotic use (ATC J01) in primary care (2017) in selected European countries
Monthly Tetracycline Prescription Rate and Tetracycline-Resistant *Escherichia coli* Hospital Isolates, Copenhagen and Frederiksberg Municipalities, 01/1994-12/1999

Change in subsidization: from 50 to 0%

Tetracycline-R *Escherichia coli* Hosp. Isolates (%), 5-month moving average

Tetracycline Use (# prescriptions per 10,000 inhabitants)

Figure 1. (a) Comparison of the number of ciprofloxacin trade names for oral use (thick line) and the median price per DDD registered monthly in PHC in Denmark (thin line), and the influence of the introduction of generics. The arrow marks the time of introduction of generic versions of ciprofloxacin. (b) The influence of removal of 50% reimbursement and of the introduction of generics on the total use of ciprofloxacin and median price per DDD registered monthly in PHC in Denmark (thin line). Consumption (thick line) is expressed in terms of DDDs per 1000 inhabitants per day. The arrows mark the times of removal of reimbursement of ciprofloxacin and the introduction of generic versions, respectively. 100 DDK≈13 EUR.

From: Effect of generics on price and consumption of ciprofloxacin in primary healthcare: the relationship to increasing resistance
J Antimicrob Chemother | © The Author 2010. Published by Oxford University Press on behalf of the British Society for Antimicrobial Chemotherapy. All rights reserved. For Permissions, please e-mail: journals.permissions@oxfordjournals.org
From: Effect of generics on price and consumption of ciprofloxacin in primary healthcare: the relationship to increasing resistance

Antibiotic resistance in *E. coli* from urine in primary care. DANMAP 2017
Why is antimicrobial resistance (and use) so low in the Nordic countries?

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• Education
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Antibiotic use (DDD/1000 inhabitants/day; ATC J01) in primary care in 2017 in European countries stratified according to whether they have **clinical microbiology** as medical specialty or not.

4-5 year residency, consultations on diagnosis and AB treatment; 24/7 call; infection control; design of treatment guidelines; monitoring of AB resistance

*UEMS SPECIALTY MEDICAL MICROBIOLOGY as of 1 June, 2018*
Why is antimicrobial resistance (and use) so low in the Nordic countries?

• Primary health care
  • Allocation/rostering; Rapid diagnostics

• Pharmacy issues
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• Clinical microbiology
  • Medical specialty; Availability of laboratory facilities/speed of analysis

• Education
  • Medical students; Specialists; General public

Figure 1. Percentage of European medical students who feel they need more education on antibiotic use, illustrated by country, 2015. The figure is based on responses from 7044 students and presents results aggregated first at medical school level within a country, then at country level.

Figure 2. Associations between national antibiotic susceptibility score, need for more education and global preparedness score. Countries were grouped into tertiles based on national antibiotic susceptibility score: low antibiotic susceptibility score, meaning higher resistance prevalence rates for four common pathogens; (n = 10); medium antibiotic susceptibility score (n = 9); and high antibiotic susceptibility score (n = 9). Comparisons were made using analysis of variance; *P < 0.05.
Questionaire to general public (ca. 1,000 individuals/country):
"Antibiotics are effective against cold and flu?"
Questionaire to general public (ca. 1.000 individuals/country):
"Antibiotics are effective against cold and flu ?”

MRSA-rate
1 – 5% 25-50%

Conclusion: Low AB use in Nordic countries

- EU-Antibiotic policy recommendations followed
- Intersectorial mechanism in place – ministry level
- Ab use and Ab R monitoring systems in place, both for human and veterinary sectors
- General practioner allocation/rostering
- Ab prescription rules enforced
- Pharmacy regulation, low prevalence
- Clinical microbiology as medical specialty
- Education enforced at all levels
Men: Forbrug af antibiotika totalt og meropenem på hospitaler i Europa

Table 3. Trends in consumption of antibiotics for systemic use in the hospital sector in EU/EEA countries, 2011–2015 (expressed as DDD per 1 000 inhabitants and per day)

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>0.97</td>
<td>0.96</td>
<td>0.96</td>
<td>0.96</td>
<td>0.98</td>
<td>&lt;0.01</td>
<td>N/A</td>
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<tr>
<td>Hungary</td>
<td>1.20</td>
<td>1.23</td>
<td>1.20</td>
<td>1.25</td>
<td>1.23</td>
<td>0.01</td>
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<tr>
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<td>1.47</td>
<td>1.44</td>
<td>1.39</td>
<td>1.41</td>
<td>1.40</td>
<td>&lt;0.02</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>1.48</td>
<td>1.40</td>
<td>1.41</td>
<td>1.48</td>
<td>1.40</td>
<td>&lt;0.01</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Poland (a)</td>
<td>1.43</td>
<td>1.43</td>
<td>1.43</td>
<td>1.43</td>
<td>1.43</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Portugal (c)</td>
<td>1.45</td>
<td>1.46</td>
<td>1.64</td>
<td>1.55</td>
<td>1.57</td>
<td>0.03</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Belgium</td>
<td>2.02</td>
<td>1.71</td>
<td>1.67</td>
<td>1.60</td>
<td>1.66</td>
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<td>1.60</td>
<td>1.65</td>
<td>1.67</td>
<td>1.57</td>
<td>1.67</td>
<td>0.01</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Slovenia</td>
<td>1.66</td>
<td>1.56</td>
<td>1.55</td>
<td>1.61</td>
<td>1.68</td>
<td>0.01</td>
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<tr>
<td>Luxembourg</td>
<td>2.02</td>
<td>2.02</td>
<td>2.00</td>
<td>1.81</td>
<td>1.78</td>
<td>&lt;0.07</td>
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<td>Estonia</td>
<td>1.86</td>
<td>2.11</td>
<td>1.91</td>
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<td>1.82</td>
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<tr>
<td>Croatia</td>
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<td>1.98</td>
<td>1.80</td>
<td>1.06</td>
<td>1.91</td>
<td>&lt;0.01</td>
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<td>N/A</td>
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<tr>
<td>Ireland</td>
<td>1.79</td>
<td>1.76</td>
<td>1.79</td>
<td>1.66</td>
<td>1.91</td>
<td>0.01</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

EU/EEA 1.96 1.98 2.05 2.01 2.05 0.02

Table 4. Trends in consumption of carbapenems in the hospital sector in EU/EEA countries, 2011–2015 (expressed as DDD per 1 000 inhabitants and per day)

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
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<td>Bulgaria</td>
<td>0.013</td>
<td>0.013</td>
<td>0.014</td>
<td>0.02</td>
<td>0.019</td>
<td>0.02</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Poland (a)</td>
<td>0.024</td>
<td>0.024</td>
<td>0.024</td>
<td>0.024</td>
<td>0.024</td>
<td>0.02</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Netherlands</td>
<td>0.018</td>
<td>0.019</td>
<td>0.020</td>
<td>0.019</td>
<td>0.021</td>
<td>0.02</td>
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<td>N/A</td>
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<td>Latvia</td>
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<td>0.019</td>
<td>0.022</td>
<td>0.027</td>
<td>0.033</td>
<td>0.03</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>France</td>
<td>0.030</td>
<td>0.021</td>
<td>0.033</td>
<td>0.033</td>
<td>0.033</td>
<td>0.03</td>
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<tr>
<td>Norway</td>
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<td>0.045</td>
<td>0.046</td>
<td>0.047</td>
<td>0.039</td>
<td>0.04</td>
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<tr>
<td>Hungary</td>
<td>0.028</td>
<td>0.022</td>
<td>0.027</td>
<td>0.042</td>
<td>0.046</td>
<td>0.055</td>
<td>N/A</td>
<td>N/A</td>
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<td>Lithuania (a)</td>
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<td>0.026</td>
<td>0.033</td>
<td>0.033</td>
<td>0.046</td>
<td>0.055</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Slovak (a)</td>
<td>0.027</td>
<td>0.034</td>
<td>0.042</td>
<td>0.048</td>
<td>0.048</td>
<td>0.055</td>
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<tr>
<td>Romania</td>
<td>0.023%</td>
<td>0.024%</td>
<td>0.024%</td>
<td>0.023%</td>
<td>0.024%</td>
<td>0.066</td>
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<td>N/A</td>
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<tr>
<td>Slovenia</td>
<td>0.036</td>
<td>0.036</td>
<td>0.032</td>
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<tr>
<td>Estonia</td>
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<td>0.056</td>
<td>0.063</td>
<td>0.073</td>
<td>0.079</td>
<td>0.085</td>
<td>N/A</td>
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<td>Croatia</td>
<td>0.085</td>
<td>0.056</td>
<td>0.063</td>
<td>0.073</td>
<td>0.079</td>
<td>0.085</td>
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<td>0.087</td>
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<td>0.083</td>
<td>0.087</td>
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<tr>
<td>Greece</td>
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<td>0.133</td>
<td>0.143</td>
<td>0.137</td>
<td>0.137</td>
<td>0.137</td>
<td>N/A</td>
<td>N/A</td>
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</tbody>
</table>

EU/EEA 0.048 0.053 0.060 0.058 0.054 0.062

Italy 0.073 0.073 0.076 0.081 0.065 0.065

Finland (b) 0.094 0.074 0.088 0.081 0.065 0.065

Belgium 0.097 0.062 0.062 0.063 0.065 0.065

United Kingdom (a) 0.064 0.071 0.071 0.071 0.071 0.071

Slovakia (a) 0.027 0.034 0.042 0.048 0.048 0.055

Croatia 0.085 0.056 0.063 0.073 0.079 0.085

Spain 0.085 0.056 0.063 0.073 0.079 0.085

Italy 0.085 0.056 0.063 0.073 0.079 0.085

N/A 0.085 0.056 0.063 0.073 0.079 0.085

Luxembourg 0.086 0.101 0.095 0.087 0.089 0.089

Malta 0.057 0.061 0.068 0.109 0.091 0.091

Malta 0.105 0.052 0.066 0.101 0.107 0.107

Cyprus 0.087 0.102 0.118 0.121 0.126 0.126

Portugal (c) 0.143 0.146 0.139 0.133 0.133 0.133

Greece 0.130 0.133 0.143 0.137 0.137 0.137

Greece 0.130 0.133 0.143 0.137 0.137 0.137

Greece 0.130 0.133 0.143 0.137 0.137 0.137

Greece 0.130 0.133 0.143 0.137 0.137 0.137
Thank you for your attention!