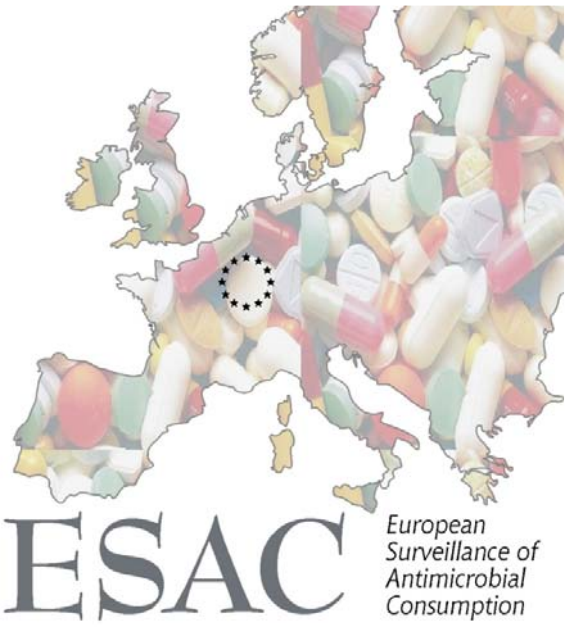
ESAC – European Surveillance of Antimicrobial Consumption

ESAC YEARBOOK 2009



ESAC YEARBOOK 2009

In 2001, the European Commission (Directorate-General SANCO – Health Monitoring Program) funded the European Surveillance of Antimicrobial Consumption (ESAC) project.
A pilot project was established from 2001 to 2003 (referred to as ESAC-1). The aim of the project was to collect comparable and reliable data on antibiotic use in Europe in ambulatory and hospital care from publicly available sources, and to assess the time trends in human exposure to antibiotics. In this project a 'network of networks' approach was adopted. A multidisciplinary management team based at the University of Antwerp, Belgium, established a network of dedicated national representatives (NR), collaborating on a voluntary basis. In each country, the national representative was to contact potential data providers. Data collection was aggregated at the level of the active substance (not at brand level), using the taxonomy of the Anatomical Therapeutic Chemical (ATC) classification system, as recommended by the World Health Organisation (WHO). The original data collection was limited to the ATC class J01. Consumption was expressed in defined daily doses (DDD).

In 2004, the European Commission (Directorate-General SANCO – Health Monitoring Program) decided to continue funding ESAC from 2004 to 2007 (referred to as ESAC-2). The main objective of the second phase of the ESAC project was to consolidate the continuous collection of comprehensive antibiotic consumption data. In addition, use data (i) on antibiotics not included in ATC class J01 (combinations for eradication of Helicobacter pylori, oral metronidazole, ornidazol, vancomycin, and colistin), (ii) at the package level, and (iii) of antimycotics for systemic use, were collected. In-depth consumption data for ambulatory care, hospital care, and nursing homes were investigated, and a pharmaco-economic evaluation was carried out. Finally, a set of twelve quality indicators for outpatient antibiotic use, which can be derived from ESAC data, were developed.

In 2007, the ESAC project was funded by the European Centre for Disease Prevention and Control (ECDC). The project aims to consolidate the continuous collection of comprehensive antimicrobial consumption data, from ambulatory and hospital care, from the 27 EU Member States, 3 European Economic Area/European Free Trade Association (EEA/EFTA) countries (Iceland, Norway and Switzerland), 3 candidate countries (Croatia, Former Yugoslavian Republic of Macedonia and Turkey) and 2 other countries (Russian Federation and Israel). Additionally, the project aims to deepen the knowledge of antibiotic consumption by focusing on specific consumption groups and/or patterns in collaboration with those countries where the appropriate data are available.

A new, easier to use interactive database is available at www.esac.ua.ac.be

Period of data collection: 2010

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SUMMARY

ESAC (European Surveillance of Antimicrobial Consumption) is an international network of national surveillance systems, collecting comparable and reliable antibiotic use data granted by ECDC (European Centre for Disease Prevention and Control; Grant Agreement GRANT/2007/001, Specific Agreement ECD.609).

ESAC aims to maintain a continuous, comprehensive and comparable (using ATC/DDD classification) database on antimicrobial consumption for all EU Member States, EU candidate countries and European Economic Area – European Free Trade Association (EEA–EFTA) countries, ensuring high standards of data collection, collation and validation (using national registers) in a timely fashion. ESAC aims to improve and expand the scope of the database on consumption data in consultation with ECDC. Additionally, the project aims to deepen the knowledge of antibiotic consumption by focusing on specific consumption groups and/or patterns in collaboration with those countries where the appropriate data are available.

The overall aim of the project is to consolidate the continuous collection of comprehensive antimicrobial consumption data, from ambulatory and hospital care, from the 27 EU Member States, 3 EEA/EFTA countries (Iceland, Norway and Switzerland), 3 candidate countries (Croatia, Former Yugoslavian Republic of Macedonia and Turkey) and 2 other countries (Russian Federation and Israel).

The ESAC yearbook 2009 covers the 1999-2009 consumption data for antimicrobials for systemic use (ATC group J01), antimycotics for systemic use (ATC group J02) and additional specific substances i.e. the data available in the ESAC database which were collected by the ESAC Management Team in 2010. Of the 35 participating countries, 32 were able to deliver 2009 outpatient data on antibiotic use, 21 hospital data and 2 total data, covering both sectors for 2009. Romania delivered for the first time 2009 outpatient data.

In summary, in 2009, the outpatient consumption of antimicrobials for systemic use (ATC group J01) varied from 10.19 Defined Daily Doses (DDD) per 1,000 Inhabitants per Day (DID) in Romania to 38.64 DID in Greece, with a median use of 18.97 DID and an interquartile range (25%-75%) of 15.15 to 23.10 DID. The most used J01 subgroup were the penicillins (J01C), followed by the macrolides (J01F) or tetracyclines (J01A) depending on the country. There seems to be a general increase in antimicrobial consumption since 2005. During the reported eleven years, the countries presented different temporal patterns. Some countries had continuous trends (increasing or decreasing), other countries showed stable use and the remaining countries have a sawtooth pattern. More and more countries have implemented or plan to implement actions to control antimicrobial resistance in the community through rational use of antimicrobials.

In 2009, the hospital consumption of antimicrobials for systemic use (ATC group J01) varied from 1.26 DID in Hungary to 3.33 in Greece. The most used subgroup in the hospital sector were the penicillins (J01C), followed by the cephalosporins and other beta-lactams (J01D) and the quinolones (J01M).

In 2009, 27 countries reported data on outpatient consumption of antimycotics and antifungals for systemic use (ATC group J02 & D01B), 2 did not report data on D01B. The use varied from 0.33 DID in Romania to 3.24 in Belgium. Terbinafine use represented more than 50% of total outpatient systemic antimycotic and antifungal use in 18 out of 24 countries.

ESAC also collected consumption data of other antimicrobials, such as antivirals and antituberculosis, next to antibiotics and antimycotics for systemic use. In 2009, total outpatient systemic antiviral use in 24 European countries varied from 0.47 DID in Malta to 4.78 DID in Latvia. In most countries nucleosides and nucleotides excluding reverse transcriptase inhibitors (ATC J05AB) represented more than 50% of the total outpatient antiviral use.

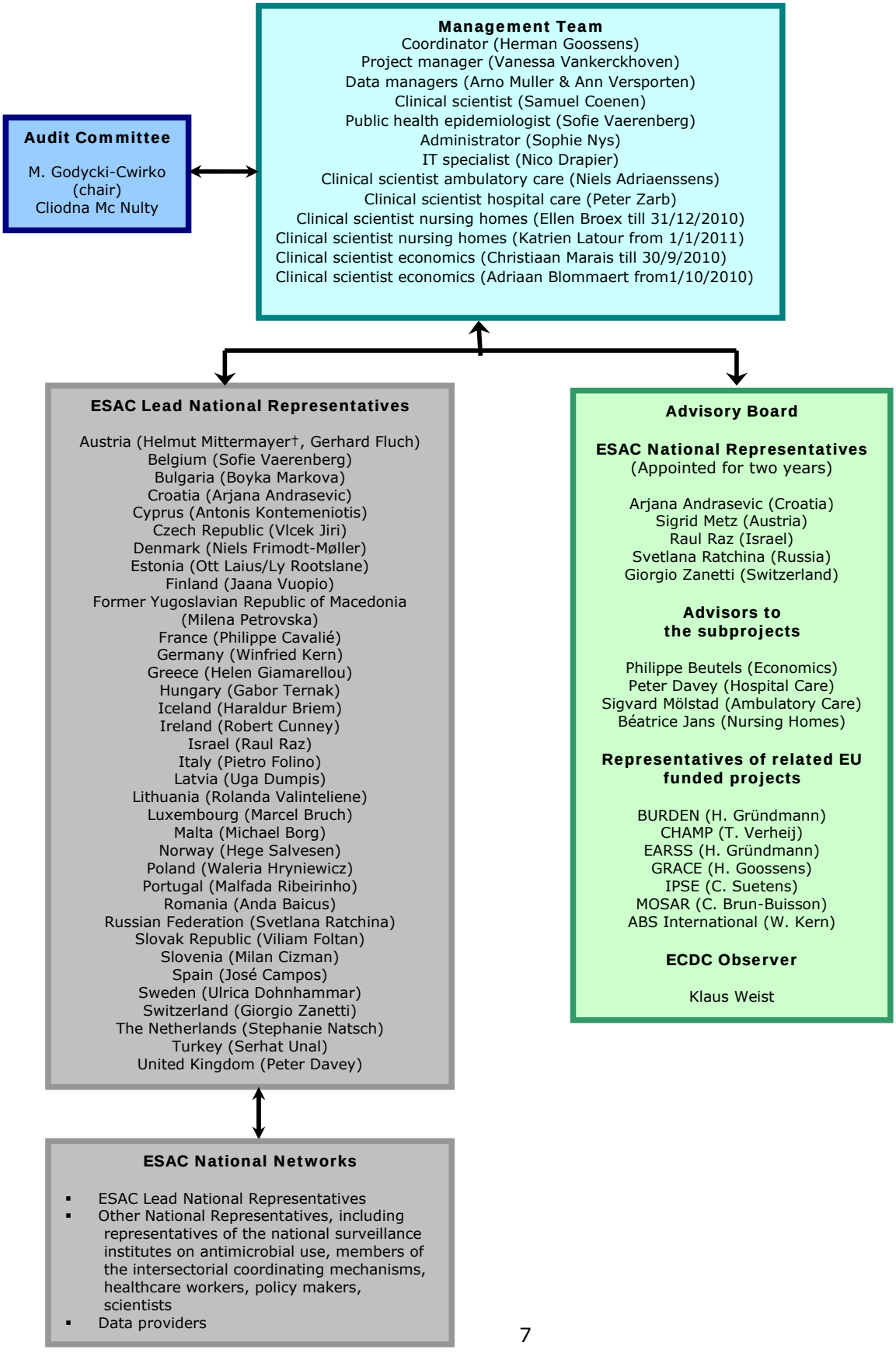
Finally, antibiotic consumption for specific groups has been studied in those countries where the appropriate data are available, and data has been collected for sub-national regions.

LIST OF ABBREVIATIONS AND RELATED PROJECTS

AB	Antibiotic
ABS International	Antibiotic Strategies International
AC	Ambulatory Care
ATC	Anatomical Therapeutic Chemical
BAPCOC	Belgian Antibiotic Policy Coordination Committee
BURDEN	Burden of Resistance and Disease in European Nations
CHAMP	Changing behaviour of Health care professionals And the general public towards a More Prudent use of antimicrobial agents
CP	Co-ordinating Practioner
DDD	Defined Daily Dose
DID	Defined Daily Doses per 1000 inhabitants per day
DPP	DDD per package
DRG	Disease related groups
EARSS	European Antimicrobial Resistance Surveillance System
EC	Socio-Economics
ECDC	European Centre for Disease Prevention and Control
EEA	European Economic Area
EFTA	European Free Trade Association
ESAC	European Surveillance of Antimicrobial Consumption
ESCMID	European Society of Clinical Microbiology and Infectious Diseases
ESF	European Science Foundation
EuroDURG	European Drug Utilisation Research Group
GP	General Practioner
GRACE	Genomics to combat Resistance against Antibiotics in Community-acquired LRTI in Europe
GRIN	General Practice Respiratory Infections Network
HC	Hospital Care
ICD	International Statistical Classification of Diseases and Related Health Problems
ICPC	International Classification of Primary Care
IPH	Institute of Public Health Brussels
IPSE	Improving Patient Safety in Europe
LNR	Lead National Representative
LTCF	Long Term Care Facility
MOSAR	Mastering Hospital Antimicrobial Resistance and its spread into the community
MS	Member State
MT	Management Team
NH	Nursing Homes
NN	National Network
NR	National Representative
PPS	Point Prevalence Survey
RoA	Route of Administration
SAR	Self-Medication with Antibiotics and Resistance Levels in Europe
TB	Tuberculosis
TC	Total Care
WHO	World Health Organisation

ESAC NETWORK ANNO 2011

ESAC Organisation chart



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CHAPTER 1. INTRODUCTION

ESAC (European Surveillance of Antimicrobial Consumption) is an international network of national surveillance systems, collecting comparable and reliable antibiotic use data. After a successful pilot phase of the ESAC project (2001-2004), another three-year term was approved by DG SANCO for the period 2004-2007 (Agreement number: 2003/211). This was followed by another 3 year-term from 2007-2010, granted by ECDC (Grant Agreement GRANT/2007/001, Specific Agreement ECD.609).
ESAC aims to maintain a continuous, comprehensive and comparable (using ATC/DDD classification) database on antimicrobial consumption for all Member States, candidate countries and EFTA-EEA countries, ensuring high standards of data collection, collation and validation (using national registers) in a timely fashion. ESAC aims to improve and expand the scope of the database on consumption data on antiviral, antimycotic and anti-TB drugs in consultation with ECDC. Additionally, the project aims to deepen the knowledge of antibiotic consumption by focusing on specific consumption groups and/or patterns in collaboration with those countries where the appropriate data are available.

A multi-disciplinary Management Team (MT) (with expertise in information technology, data management, microbiology, infectious diseases, epidemiology, ambulatory care medicine, hospital care medicine, pharmacology, and health economics) was installed at the University of Antwerp, Belgium, but also has members in Brussels, Dundee (UK) and Ljubljana (Slovenia). This MT ensures day-to-day management and monitoring of the network activities. Participating countries have established National Networks (NN) consisting of relevant experts in the field of antimicrobial consumption. These networks are coordinated by Lead National representatives (LNR). An Advisory Board was established which (i) provides scientific support to the MT and (ii) liaises with ECDC as well as EU funded projects on antimicrobial use and resistance. Next to an Advisory Board, an Audit Committee was established which monitors the progress of the project and helps resolve problems.

In the current report, Chapter 2 gives an overview of the aims and objectives as well as the methodology used in ESAC. In Chapter 3, data is presented on antimicrobial consumption in Europe from 1999 until 2009 whereas Chapter 4 provides an overview of the different subprojects collecting in-depth data on Ambulatory Care, Hospital Care, Nursing Homes, and Socio-Economics. Chapter 5 summarizes the dissemination activities of ESAC in 2010-2011. In Chapter 6 concluding remarks and future objectives are provided. Finally, data for 2009 at the country level can be found in the different country sheets in Appendix I.

CHAPTER 2. ESAC OBJECTIVES AND METHODOLOGICAL APPROACH

Aims and Objectives

The overall aim of the project is to consolidate the continuous collection of comprehensive antimicrobial consumption data, from ambulatory and hospital care, from the 27 Member States, 3 EEA/EFTA, 3 candidate countries (Croatia, Former Yugoslavian Republic of Macedonia and Turkey) and 2 other countries (Russian Federation and Israel). The project aims to provide the community with timely information, on antimicrobial consumption. The European database is used to develop (i) health indicators of antimicrobial use and (ii) evidence-based guidelines and educational tools to manage the risk of infections and antimicrobial resistance. The project provides regular feed-back to the relevant authorities of the participating countries.

Additionally, the project aims deepen the knowledge of antibiotic consumption by focusing on specific consumption groups and/or patterns in collaboration with those countries where the appropriate data are available. For hospital care, data will be collected for individual hospitals with a linkage of the consumption to the DRG (Disease Related Groups). For ambulatory care, detailed data will be collected on the consumption in specific age and sex categories, specific prescriber groups, specific high consumers groups and for specific indications (in collaboration with existing networks of sentinel practices). For nursing homes, detailed information will be collected on the frequency, indications, characteristics and seasonal variations of antibiotic prescriptions, as well as on the institutional determinants of antibiotic use. Additionally, the effects of socio-economic determinants on antimicrobial consumption of European countries will be explored, and regional variation within a particular country will be studied, by means of econometric models.

Data collection protocol version 2010

1. The 2009 data on antibiotic use, for ambulatory care (AC) and hospital care (HC) settings, has to be done according the **ATC/DDD classification, 2010 version**.

2. **ESAC aims to collect the core data at the product level**, expressed in number of packages (= using template 1). Therefore, ESAC needs 1) a "*valid national historical exhaustive* register file" including the available antibiotics at product level; 2) a consumption file including the number of packages consumed for each product (by product ID number) and 3) a population file whereby the population covers the dataset.

   Alternatively, if participating countries are not able to deliver data at product level due to objective constraints, data on volume of antibiotic consumption for 2009 should be collected at the ATC5 level whereby also the Route of Administration (RoA) have to be provided (= using template 2). As the number of antibiotics with multiple DDDs for an "Oral" and "Parenteral" is increasing over the time, use data for all ATC codes should be split up according to the route of administration.

3. The 2009 data will include **sub-national data**. ESAC uses the three-level hierarchical **NUTS classification** which follows existing administrative borders[1]. This classification should **preferably be used** for data collection. Depending on the availability of the data, the participating countries can deliver data at NUTS 1 (covers between 3 and 7 million inhabitants), NUTS 2 (covers between 800000 and 3 million inhabitants) or NUTS 3 (covers between 150000 and 80000 inhabitants) level or alternatively at the country level. Only the finest available level of data should be included. When another classification is used, please provide us the necessary information.

4. The **antimicrobials to be collected** are:

   1. antibacterials for systemic use (ATC therapeutic subgroup J01),
   2. antimycotics for systemic use (ATC therapeutic subgroup J02),
   3. antifungals for systemic use (ATC chemical subgroup D01BA),
   4. drugs for treatment of tuberculosis (ATC pharmacological subgroup J04A),
   5. antivirals for systemic use (ATC therapeutic subgroup J05),
   6. oral and rectal nitroimidazole derivates as antiprotozoals use (ATC chemical subgroup P01AB),
   7. oral vancomycin as intestinal antiinfectives use (ATC chemical substance A07AA09)

for the ambulatory and/or the hospital care sector or total care sector.

5. **Information on prices at product level** (template 1).
6. **Denominator data**:

The participating countries have to provide the population data covering the consumption datasets, so that the population data are collected at the same level as the consumption data. If you collect consumption data at the NUTS 3 level, you need to provide the population also at this level.

ESAC uses for the denominator the WHO mid-year population for the population at national level except in some participating countries where it is not applicable or justified[2].

[1] http://ec.europa.eu/eurostat/ramon/nuts/splash_regions.html
[2] http://data.euro.who.int/hfadb/

Important notes on the ATC/DDD classification, 2010 version:

- ATC updates

J01DD17	cefcapene
J01DE03	cefozopran
J01DH05	biapenem
J01DI01	ceftobiprole medocaril
J01EA03	iclaprim
J01XA04	dalbavancin
J01XA05	oritavancin
J01XX10	bacitracin
J05AR07	stavudine, lamivudine and nevirapine
J05AX10	maribavir

- DDD updates

ATC code	ATC level name	New DDD		
A06AH01	methylnaltrexone bromide	6	mg	P
A07AA05	polymyxin B	3	MU	O
J01DC07	cefotiam	1.2	g	O
J01DD17	cefcapene	0.45	g	O
J01DE03	cefozopran	4	g	P
J01DH04	doripenem	1.5	g	P
J01DH05	biapenem	1.2	g	P
J02AX05	micafungin	0.1	g	P
J05AG04	etravirine	0.4	g	O

Reference: http://www.whocc.no/atc_ddd_index/updates_included_in_the_atc_ddd_/

- Attention: Also include antifungals for systemic use (D01B):
  - D01BA01 griseofulvin
  - D01BA02 terbinafine
- Attention for the DDD's on combined products : see

List 1, page 32

- Attention:
  - vancomycine!
    - J01XA01 : route administration=P
    - A07AA09 : route administration=O
  - Metronidazole!
    - J01XD01: route administration=P
    - P01AB01: route administration=O and R

ESAC Templates for data collection:

Each type of data (register, consumption data, population data) has to be delivered using its respective excel template. Other excel files than the template will not be accepted.

If you choose **template 1**, you should deliver 3 files:

1. a valid national exhaustive *register file* including the available antibiotics at product level
2. *template 1 version of the consumption file* including the number of packages consumed at product level (by product ID number)
3. a *population file*

Alternatively, if you choose **template 2**, you should deliver 2 files:

1. *template 2 version of the consumption file* including data expressed in DDDs at ATC5 substance level + the route of administration
2. a *population file*

Parameters for the antibiotic register file: data at product level = Template 1

- Country: use ISO code
- See: http://www.iso.org/iso/english_country_names_and_code_elements
- Year of data collection
- Medicinal Product Package Code Value: the Medicinal Product Package Code Value (MPPCV) has to be a unique identifier of the medicinal product package (MPP). Because it is a key value in many tables it has to be stable in time, so MPP's that are no longer available on the market or that are no longer registered still can be identified for historical purposes (like prescription history).
- Label: Medicinal Product Package Label e.g.: Lanoxin compr 60 X 0,125 mg
- Size of the package: Content Quantity (e.g.: 60)
- Unit measurement of the size of the package: National Content Unit (e.g.: pcs, mg,...)
- Form: Galenic form (eg. Capsules, Solution, Injection)
- Route of administration: O, P, R, I for Oral, Parenteral, Rectal, Inhalation
- Strength: Quantity of the ingredient in each unit. In case of multi-ingredient Medicinal products this field has to contain the ingredient strength in which the DDD is expressed. E.g.: Amoxicillin/Clavulanic acid combinations: Strength expresses the strength of the amoxicillin. Other examples :
  - if J01DH51 (imipenem and enzyme inhibitor) : refer only to imipenem
  - if J01CR05 (piperacillin and enzyme inhibitor) : refer only to piperacillin

  - if J01CR02 (amoxicillin and enzyme inhibitor) : refer only to amoxicillin
- Strengths of parenteral fluids are expressed as the content of 1 ampulla or 1 perfusion package. Conversely, strengths of syrups are expressed as the content of 1 measure of sirup, this can be 5 ml, 2 ml...
- Unit measurement of strength: units of strength (mg, g, IU, UD, MU)
- WHO ATC Code at substance level (ATC5) + see remarks above.
- Salt: for methenamin, the associated salt (hippurate or mandelate) should be specified. For erythromycin, if the associated salt is ethylsuccinate and the galenic form is tablet, ethylsuccinate has to be specified, in all other cases (even ethylsuccinate and any other form than tablet), the salt should be left empty.
- Coding of Ethylsuccinate, mandelate and hippurate respectively as ESUC, MAND, HIPP.
- DPP: defined daily doses per package.
- Ingredient name: In case of multi-ingredient Medicinal products this field has to contain the ingredient in which the DDD is expressed.
- Product name: Medicinal Product name e.g.: LANOXIN, LANITOP
- National DDD when the WHO DDD does not exist or specific DDDs are used at the national level.
- Unit measurement of the National DDD (mg, g, IU, MU, …)
- Content of the package: i.e. the total amount of the first ingredient in the medicinal product package
- Unit measurement of the package content
- Basic ingredient quantity: (INBASQ: e.g. 200 mg/10 ml), used for describing concentration of fluids. It is very important to fill this field properly. To obtain good results one must apply the following rules for syrups/suspensions and ampullae/perfusion fluids: In syrups and solutions INBASQ describes the basic strength unit. Concerning perfusion fluids or ampullae this value is always 1 because the strength has to be expressed per amp or per perfusion package (see Strength rules)
- Unit measurement of the Basic ingredient quantity

Price information which should be added to the "register file" is described below. Please note that providing price data is voluntary as the data may not be available for your country in detail as requested here. We would ideally want price information to be provided for hospital and non-hospital based pharmacies separately, but prices can also be provided for only hospital or non-hospital pharmacies if both are not available.

- **Ex-factory price:** The total payment received by the pharmaceutical company for providing one package of the medication. This excludes distribution costs and the markup charged by the pharmacy for dispensing the medication. This can be provided in separate columns for hospital and / or ambulatory care pharmacies. If these prices differ between pharmacies, please provide the weighted average cost per package with the weight being consumption. For example, if the price is €10 at pharmacy A and €25 at pharmacy B with pharmacy A dispensing 10 packages and pharmacy B dispensing 20 packages, the weighted price is 10/(10+20)*€10 + 20/(10+20)*€25 = €20.
- **Ex-pharmacy price:** The total payment received by an average non-hospital-based pharmacy for providing one package of the medication. This is equivalent to the price tag on the package at the pharmacy. This can be provided in separate columns for hospital and / or ambulatory care pharmacies. Please use the same methodology described for ex-factory prices if the price differs by pharmacy.
- **Wholesale price:** The price per package for drugs that are distributed from pharmaceutical companies by wholesalers to pharmacies. This price will be between ex-factory and ax-pharmacy price. This can be provided in separate columns for hospital and / or ambulatory care pharmacies. Please use the same methodology described for ex-factory prices if the price differs by pharmacy.
- **Out of pocket price:** The total amount faced by an average patient for purchasing a package of the medication at a pharmacy. This amount should not include the amount

reimbursed by the national health insurance, but may include the amount covered by private insurers. This can be provided in separate columns for hospital and / or ambulatory care pharmacies. Please use the same methodology described for ex-factory prices if the price differs by pharmacy.

- **Other**: Any other price per package not covered by the four price definitions described above. This can be provided in separate columns for hospital and / or ambulatory care pharmacies. Please use the same methodology described for ex-factory prices if the price differs by pharmacy.

Parameters for the consumption data: Template 1

- Country: ISO code
- Year of data collection
- Sub-area level: NUTS Level (0=country, 1=NUTS1, 2=NUTS2, 3=NUTS3, 99=other classification)
- Sub-area identifier: when the sub-area level is 0 (country level), the ISO Country code has to used. For the other sub-area levels, the NUTS code has to be used or the other classification.
- Sector: AC (ambulatory care) / HC (hospital care) / TC (total care)
- Periodicity: Q (quarterly for AC / TC), Y (annually for HC (+quarterly if available))
- Medicinal Product Package Code Value: Same code as the MPPCV in the register.
- Volume: number of packages per medicinal product (used in a given period, sub-area and sector) for the four quarters or the complete year.

Parameters for the consumption data: template 2

- Country: ISO code
- Year of data collection
- Sub-area level: NUTS Level (0=country, 1=NUTS1, 2=NUTS2, 3=NUTS3, 99=other classification)
- Sub-area identifier: when the sub-area level is 0 (country level), the ISO Country code has to be used. For the other sub-area levels, the NUTS code has to be used or the other classification.
- Sector: AC (ambulatory care) / HC (hospital care) / TC (total care)
- Periodicity: Q (quarterly for AC / TC), Y (annually for HC (+quarterly if available))
- WHO ATC code at substance level (ATC5)
- WHO ATC name at substance level (ATC5)
- Route of administration: O, P, R, I (Oral, Parenteral, Rectal, Inhalation) or X when the route of administration is not available
- Salt
- Volume: number of DDDs (WHO ATC/DDD version 2010) for the corresponding substance (used in a given period , sub-area, sector, route of administration and salt) for the four quarters or the complete year.

Parameters for the population data: Template 1 and 2

- Country : ISO code
- Year of data collection
- Sub-area level: NUTS Level (0=country, 1=NUTS1, 2=NUTS2, 3=NUTS3, 99=other

classification)

- Sub-area identifier: when the sub-area level is 0 (country level), the ISO Country code has to used. For the other sub-area levels, the NUTS code has to be used or the other classification.
- Population covering the consumption data.

List 1 : DDD's combined products

Reference : http://www.whocc.no/ddd/list_of_ddds_combined_products/

J01AA20	Deteclo	Tab	Tetracycline 115.4 mg/Chlortetracycline 115.4 mg/ Demeclocycline 69.2 mg	2 UD (=2 tab)
J01CA20	Miraxid	Tab	Pivampicillin 0.25 g/Pivmecillinam 0.2 g	3 UD (=3 tab)
J01CA20	Miraxid mite	Tab	Pivampicillin 0.125 g/Pivmecillinam 0.1 g	6 UD (=6 tab)
J01CE30	Bicillin C-R, Bicillin A-P, Bicillin	Powder for inj	Comb. of Benzylpenicillin/Procain-benzylpenicillin/ Benzathine benzylpenicillin	3.6 g expressed as benzylpenicillin
J01CR50	Ampiclox	Tab	Ampicillin 0.25 g/Cloxacillin 0.25 g	4 UD (=4 tab)
J01CR50	Ampoxium	Powder for inj	Ampicillin 0.66 g/Oxacillin 0.33 g	2 UD (= 2 g)
J01CR50	Ampoxium	Caps	Ampicillin 0.125g/Oxacillin 0.125 g	8 UD (= 8 caps)
J01CR50	Co-fluampicil	Tab	Ampicillin 0.25 g/Flucloxacillin 0.25 g	4 UD (=4 tab)
J01EC20	Trisulfamid	Tab	Sulfacarbamide 0.167 g/Sulfadiazine 0.167 g/ Sulfadimidine 0.167 g	4 UD (=4 tab)
J01EE01	Bactrim, Eusaprim, Trimetoprim-sulfa	Inf.conc	Sulfamethoxazole 80 mg/Trimethoprim 16 mg	20 UD (=20 ml)
J01EE01	Bactrim, Eusaprim, Trimetoprim-sulfa	Mixt	Sulfamethoxazole 0.2 g/Trimethoprim 40 mg	8 UD (= 40 ml)
J01EE01	Bactrim, Eusaprim Trimetoprim-sulfa	Tab	Sulfamethoxazole 0.4 g /Trimethoprim 80 mg	4 UD (=4 tab)
J01EE02	Triglobe, Trimin Sulfa	Mixt	Sulfadiazine 0.205 g/Trimethoprim 45 mg	4 UD (=20 ml)
J01EE02	Triglobe, Trimin Sulfa	Tab	Sulfadiazine 0.41 g/Trimethoprim 90 mg	2 UD (=2 tab)
J01EE03	Lidaprim	Tab	Sulfametrole 0.8 g/Trimethoprim 0.16 g	2 UD (=2 tab)
J01EE03	Lidaprim	Powder for inj	Sulfametrole 0.8 g/ Trimethoprim 0.16 g per vial	2 UD (defined as 2 vials)
J01EE06	Sterinor	Tab	Sulfadiazin 0.25 g/Tetroxoprim 0.1 g	2 UD (=2 tab)
J01EE07	Berlocombin	Tab	Sulfamerazin 0.12 g/Trimethoprim 80 mg	4 UD (=4 tab)
J04AM02	Rifinah	Tab	Rifampicin 0.3 g/Isoniazid 0.15 g	2 UD (=2 tab)
J04AM02	Rifinah	Tab	Rifampicin 0.15 g/Isoniazid 0.1 g	4 UD (=4 tab)
J04AM02	Rimactazid	Tab	Rifampicin 0.15 g/Isoniazid 75 mg	4 UD (=4 tab)
J04AM05	Rifater	Tab	Rifampicin 0.12 g/Isoniazid 50 mg/ Pyrazinamide 0.3 g	6 UD (=6 tab)
J04AM05	Rimcure	Tab	Rifampicin 0.15 g/Isoniazid 75 mg/	4 UD (=4 tab)

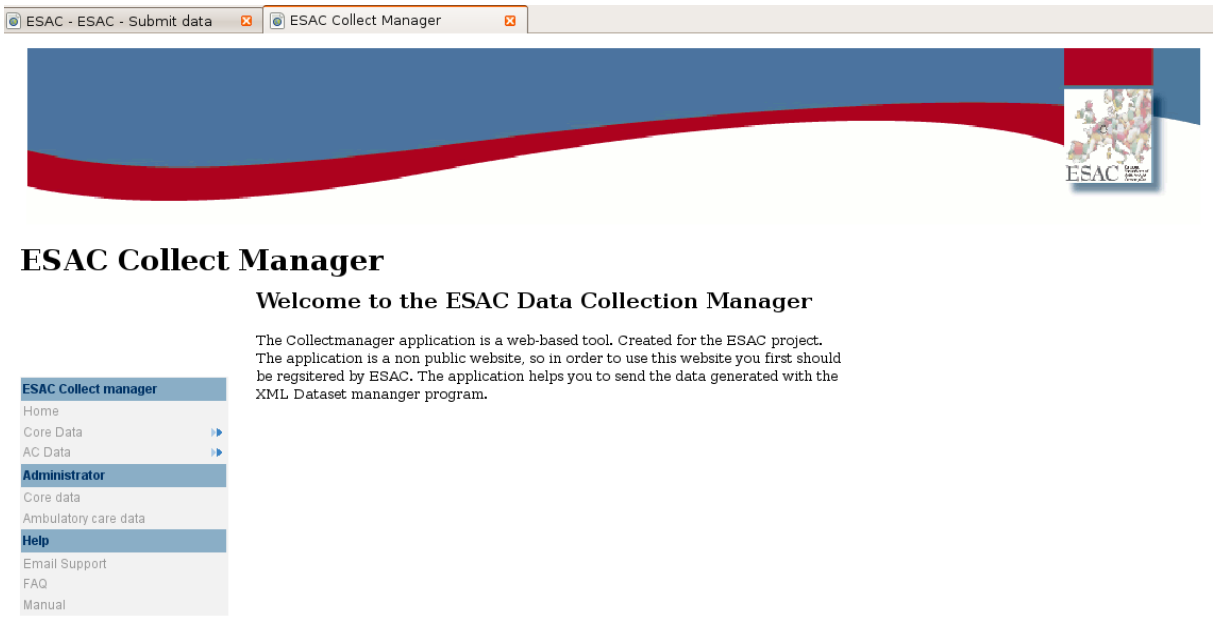
			Pyrazinamide 0.4 g	
J04AM06	Rimstar	Tab	Rifampicin 0.15 g/Ethambutol 0.275 g/ Isoniazid 75 mg/Pyrazinamide 0.4 g	4 UD (=4 tab)
J05AR01	Combivir	Tab	Lamivudine 0.15 g/Zidovudine 0.3 g	2 UD (=2 tab)
J05AR02	Kivexa	Tab	Abacavir 0.6 g/Lamivudine 0.3 g	1 UD (=1 tab)
J05AR03	Truvada	Tab	Emtricitabine 0.2 g/ Tenofovir disoproxil 0.245 g	1 UD (=1 tab)
J05AR04	Trizivir	Tab	Zidovudine 0.3 g/Lamivudine 0.15 g/ Abacavir 0.3 g	2 UD (=2 tab)
J05AR06	Atripla	Tab	Emtricitabine 0.2 g/Tenofovir disoproxil 0.245 g/ Efavirenz 0.6 g	1 UD (=1 tab)

Note: J01RA04 spiramycin, combinations with other antibacterials has no DDD.

ESAC Collect Manager Application

The ESAC IT team has developed the application which allows the countries to submit their data for dataprocessing and upload in the core database. It has the advantage that the questionnaire can be automatically uploaded as well.

Figure 2.1. ESAC Collect Manager



CHAPTER 3. ANTIMICROBIAL CONSUMPTION IN EUROPE IN 2009

In 2010, ESAC collected 2009 data on :

1. antibacterials for systemic use (ATC therapeutic subgroup J01),
2. antimycotics for systemic use (ATC therapeutic subgroup J02),
3. antifungals for systemic use (ATC chemical subgroup D01BA),
4. drugs for treatment of tuberculosis (ATC pharmacological subgroup J04A),
5. antivirals for systemic use (ATC therapeutic subgroup J05),
6. oral and rectal nitroimidazole derivates as antiprotozoals use (ATC chemical subgroup P01AB),
7. oral vancomycin as intestinal antiinfectives use (ATC chemical substance A07AA09)

in the ambulatory and/or hospital care sector in 32 out of 35 participating countries.

The 2009 data on antibiotic use, for ambulatory care (AC) and hospital care (HC) was asked to be delivered at the product level, expressed in number of packages. Therefore, a valid national register of available antibiotics was needed. Forteen out of the 32 participating countries were able to deliver valid data on antibiotic consumption by providing the number of packages consumed, using the ESAC template 1 format for data collection. Those countries were able to provide us with an exhaustif antibiotic consumption register. Data were processed using DDD as volume of antibiotic consumption at ATC5 level (template 2) for 18 countries. Worth noting, 10 countries did not deliver data using the proposed ESAC templates implicating a time consuming data processing.

For the very first time, we could welcome Romania. They provided ambulatory and hospital care antimicrobial consumption data for their country. For the year 2009, data for Greece are presented for ambulatory care (AC) and hospital care (HC) sectors separately; it was the consequence of a decision made in order to correctly account for parallel export. Luxembourg figures were retrospectively corrected for the insured population for the years 1997 until 2009. As a consequence, DID figures increased significantly as compared to previous publications. Finally, Estonia delivered retrospective ambulatory and hospital care data for the year 2006.

In this report, data on ATC subgroups J01, J02, D01BA and J05 will be presented.

Ambulatory care

Of the 35 participating countries (27 EU Member States, 3 EEA/EFTA countries, 3 candidate countries, and 2 others), 32 countries were able to deliver 2009 outpatient data on antibiotic use. Cyprus and Lithuania provided total data, covering both ambulatory care and hospital care settings. Romania delivered for the first time 2009 outpatient data.

The total outpatient use varied from 10.19 DID in Romania to 38.64 DID in Greece (Table 3.1). The median use and interquartile range (25%-75%) were respectively 18.97 DID and [15.15-23.10] DID. Additionally, Figure 3.1 shows a map of Europe presenting the total outpatient antibiotic use in Europe in 2009.

The distribution of total outpatient (AC) antibiotic use between 1999 and 2009 is shown for all participating countries in Figure 3.2. The general distribution of the outpatient use among the reporting countries shows a general decrease from 1999 to 2004 followed by a gradual median increase up to 2008. The years 2003 and 2005 however showed a higher consumption pattern as compared to the general observation made. For the year 2009, we observe a decrease of the median European outpatient antibiotic use.

When comparing the trends of outpatient antibiotic use per country, different complex temporal patterns were seen, including short-term increases or decreases and sudden changes (see Figure 3.3). Many of those changes can be explained. Please consult the country sheets in Annex I for more details.

Table 3.1 provides an overview of all outpatient antibiotic use data reported for the years 1997 – 2009.

Since 2004, many countries have implemented actions to control antimicrobial resistance through the rational use of antimicrobials. The effect of those antibiotic campaigns however seems difficult to quantify using only DID. To enable this exercise, next to this measurement unit, we aimed at valid calculations of PID (number of daily packages per 1000 inhabitants per day). Next to the ATC/DDD classification system, this simple unit of measurement could be helpful because it disregards changes in package size or changes in dosing. Using information on packages of antibiotic consumption will enable us a better understanding and interpretion, complementary to the ATC/DDD classification, of differences found between and within countries over the years.

Table 3.1: Total outpatient antibiotic use in Europe from 1997 to 2009 expressed in DDD per 1000 inhabitants and per day

country	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Austria		12.6	13.1	12.3	11.8	11.8	12.5	12.5	14.5	14.3	14.7	15.1	15.9
Belgium	25.4	26.4	26.2	25.3	23.7	23.8	23.8	22.7	24.3	24.2	25.4	27.7	27.5
Bulgaria[1)]			15.1	20.2	22.7	17.3	15.5	16.4	18.0	18.1	19.8	20.6	18.6
Croatia				18.4	18.5	22.6	23.4	23.0	23.4	21.2	22.5	23.4	21.2
Cyprus[2)]										31.9	33.9	32.8	34.4
Czech Rep.		18.2	18.6			13.9	16.7	15.8	17.3	15.9	16.8	17.4	18.4
Denmark	12.2	12.7	12.1	12.3	12.8	13.2	13.5	14.1	14.6	15.2	16.1	16.0	16.0
Estonia[3)]					14.4	11.7	11.1	10.4	11.7	11.8	12.7	11.9	11.1
Finland	19.4	18.4	18.4	19.0	19.8	17.9	18.7	17.2	18.1	17.4	18.3	17.9	18.0
France	33.1	33.6	34.1	33.2	33.2	32.2	28.9	27.0	28.9	27.9	28.6	28.0	29.6
Germany	13.0	13.3	13.6	13.6	12.8	12.7	13.9	13.0	14.6	13.6	14.5	14.5	14.9
Greece[4)]	25.1	24.9	28.5	29.4	29.6	30.6	31.3	33.0	34.7	41.0	43.2	45.2	38.6
Hungary		18.3	23.5	18.5	18.6	17.1	19.1	18.2	19.5	17.2	15.5	15.2	16.0
Iceland[5)]	22.2	23.1	21.7	20.5	20.0	20.6	20.3	21.4	23.2	20.0	19.2	20.6	19.4
Ireland		16.5	18.0	17.6	18.7	18.7	20.1	20.2	20.5	21.2	23.0	22.4	20.8
Israel						19.6	20.1	19.6	20.5	22.2	20.2	22.0	22.4
Italy			24.5	24.0	25.5	24.3	25.6	24.8	26.2	26.7	27.6	28.5	28.7
Latvia						11.0		11.8	12.3	12.0	12.1	11.0	10.5
Lithuania[2)]										22.7	24.1	25.1	19.7
Luxembourg[6)]	27.2	26.9	28.2	27.1	27.6	27.5	28.6	24.9	26.3	25.1	27.2	27.1	28.2
Malta											17.9	20.8	21.6
Norway		15.3			15.6	15.7	15.6	15.7	16.8	14.8	15.5	15.5	15.2
Poland		20.7	22.2	22.6	24.8	21.4		19.1	19.6		22.2	20.7	23.6
Portugal	23.1	23.3	25.2	24.9	24.5	26.5	25.1	23.8	24.5	22.7	22.1	22.6	22.9
Romania													10.2
Russian Fed.							9.8	9.3	9.1	9.6	10.2	10.0	12.2
Slovakia			25.7	27.6	29.1	26.7	27.6	22.5	25.1	22.5	24.8	23.4	23.8
Slovenia	17.5	19.3	19.8	18.0	17.4	16.3	17.0	16.7	16.3	14.7	16.0	15.0	14.4
Spain[7)]	21.3	20.6	20.0	19.0	18.0	18.0	18.9	18.5	19.3	18.7	19.9	19.7	19.7
Sweden	14.6	15.5	15.8	15.5	15.8	15.2	14.7	14.5	14.9	15.3	15.5	14.6	13.9
Switzerland								9.0					
The Netherlands	10.1	9.9	10.0	9.8	9.9	9.8	9.8	9.7	10.5	10.8	11.0	11.2	11.4
United Kingdom	17.0	16.2	14.8	14.3	14.8	14.8	15.1	15.0	15.4	15.3	16.5	16.9	17.3
N Countries	14	20	22	22	24	27	26	29	28	29	31	31	32

1) Bulgaria: total use until 2005, outpatient use from 2006. Change of data provider in 2006.
2) Cyprus, Lithuania: total use, including the hospital sector.
3) Estonia: total use for the year 2001.
4) Greece: total use for the years 2004 – 2008.
5) Iceland: total use until 2005, outpatient use from 2006.
6) Luxembourg: update of all years with insured population data.
7) Spain: reimbursement data, does not include over-the-counter sales without prescriptions.

Figure 3.1: Map of Europe showing total outpatient antibiotic use in 2009 in the participating countries (presented using 5 DID quintiles)

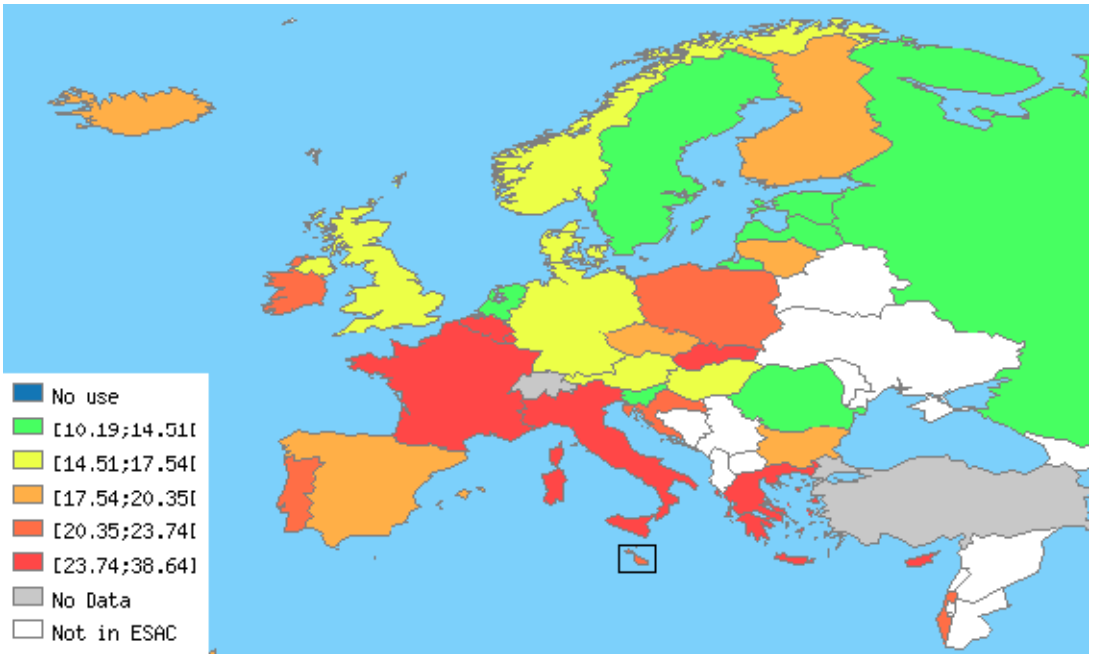


Figure 3.2: Distribution (boxplot) of outpatient antibiotic use between 1999 and 2009 among the participating countries

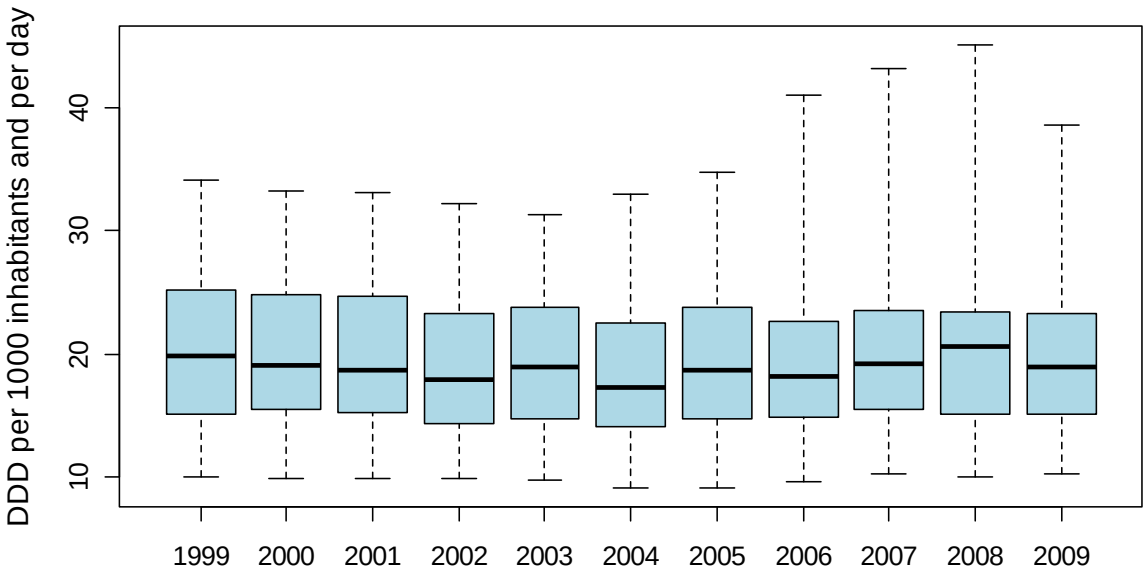
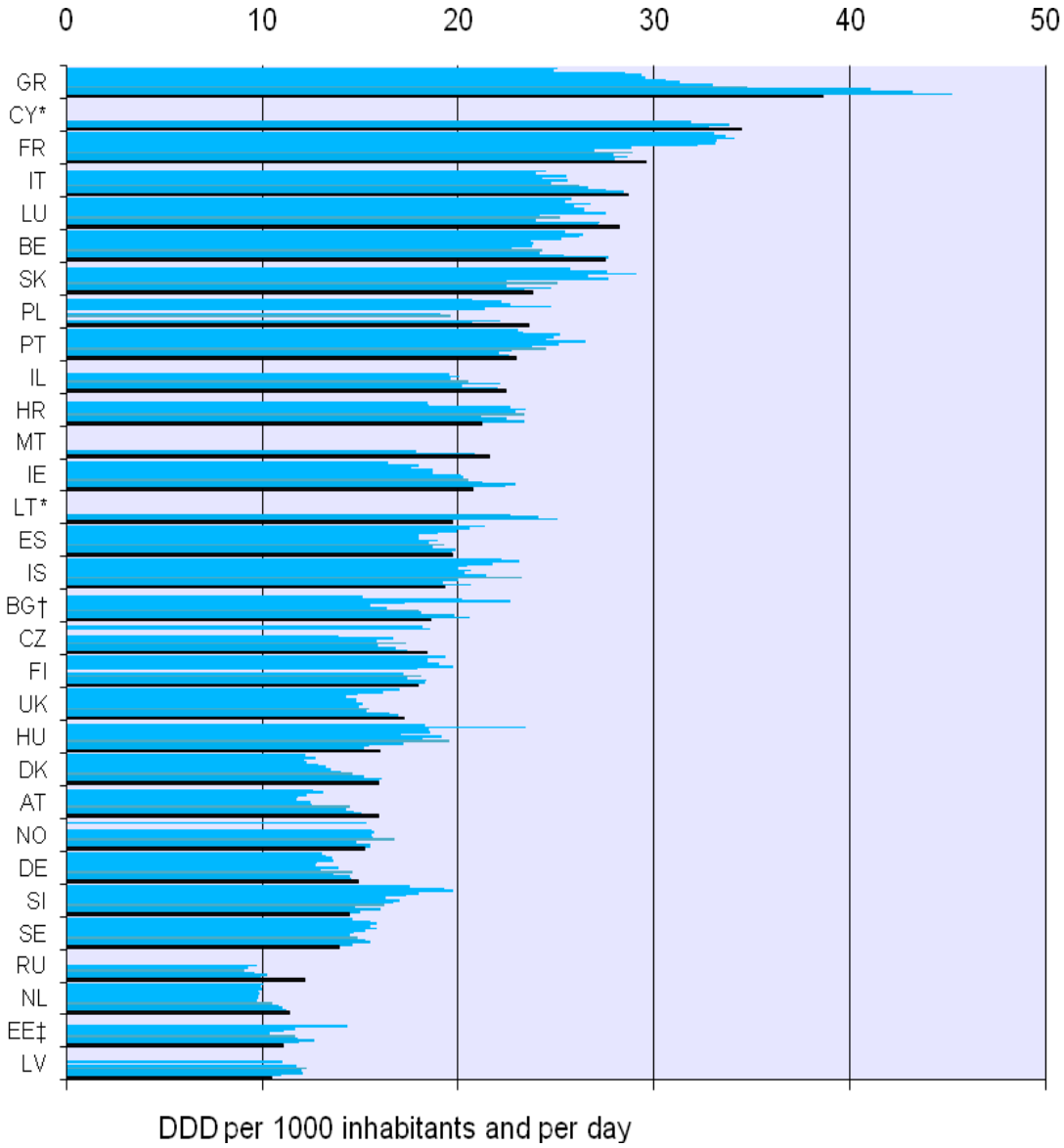


Figure 3.3: Trends of total outpatient antibiotic use (ATC group J01) in Europe from 1997 to 2009



Dark bars present 2009 data

Cyprus (CY), Lithuania (LT): total use, including the hospital sector.
Greece (GR): total use for the years 2004-2008.
Spain (ES): reimbursement data, does not include over-the-counter sales without prescription.
Bulgaria (BG): total use until 2005, outpatient use as from 2006.

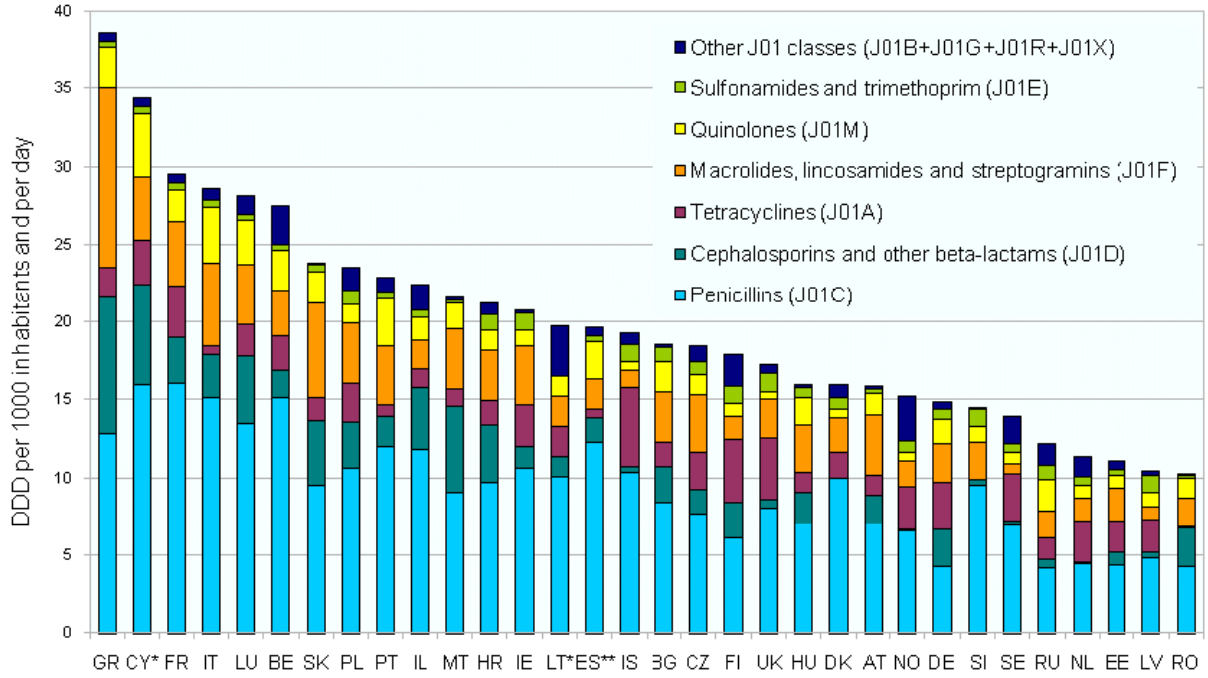
Table 3.2 and Figure 3.4 present 2009 outpatient antibiotic use for seven major antibiotic pharmacological subgroups according to the ATC classification: penicillins (J01C), cephalosporins and other beta-lactams (J01D), macrolides, lincosamides and streptogramins (J01F), tetracyclines (J01A), quinolones (J01M), sulphonamides and trimethoprim (J01E) and the other antibiotics including amphenicols (J01B), aminoglycosides (J01G), combinations (J01R) and other antibacterials (J01X).

Table 3.2: Outpatient antibiotic use in 2009 subdivided into the major antibiotic classes according to ATC classification (n=32 countries)

Country	Penicillins (J01C)	Cephalosporins and other beta-lactams (J01D)	Tetracyclines (J01A)	Macrolides, lincosamides and streptogramins (J01F)	Quinolones (J01M)	Sulfonamides and trimethoprim (J01E)	Other J01 classes	Total J01
Greece	12.89	8.68	2.00	11.54	2.63	0.36	0.54	38.64
Cyprus*	16.01	6.45	2.87	3.98	4.13	0.46	0.55	34.44
France	16.08	2.92	3.39	4.15	2.00	0.42	0.62	29.58
Italy	15.18	2.78	0.52	5.33	3.61	0.47	0.77	28.66
Luxembourg	13.47	4.33	2.08	3.87	2.81	0.39	1.24	28.19
Belgium	15.13	1.82	2.14	2.96	2.61	0.37	2.49	27.52
Slovakia	9.56	4.12	1.50	6.09	2.03	0.43	0.05	23.78
Poland	10.68	2.89	2.47	3.88	1.25	0.95	1.48	23.59
Portugal	12.00	1.96	0.72	3.83	3.04	0.43	0.96	22.94
Israel	11.82	3.96	1.20	1.90	1.44	0.50	1.60	22.42
Malta	9.08	5.50	1.10	3.89	1.66	0.18	0.18	21.59
Croatia	9.69	3.70	1.57	3.24	1.33	0.98	0.70	21.21
Ireland	10.66	1.33	2.74	3.79	0.94	1.13	0.17	20.76
Lithuania*	10.08	1.27	2.00	1.93	1.23	0.01	3.21	19.72
Spain**	12.31	1.56	0.60	1.90	2.42	0.30	0.59	19.68
Iceland	10.41	0.30	5.09	1.15	0.55	1.08	0.76	19.35
Bulgaria	8.40	2.30	1.62	3.20	1.97	0.86	0.25	18.59
Czech Republic	7.73	1.55	2.39	3.66	1.27	0.89	0.95	18.44
Finland	6.14	2.33	4.01	1.46	0.87	1.05	2.10	17.96
United Kingdom	8.03	0.58	3.96	2.51	0.48	1.18	0.52	17.27
Hungary	7.06	1.98	1.35	3.00	1.79	0.65	0.14	15.98
Denmark	10.00	0.03	1.62	2.25	0.52	0.75	0.80	15.97
Austria	7.09	1.80	1.27	3.93	1.33	0.29	0.22	15.93
Norway	6.59	0.13	2.71	1.68	0.51	0.73	2.88	15.23
Germany	4.27	2.39	3.09	2.51	1.48	0.73	0.43	14.90
Slovenia	9.51	0.42	0.00	2.33	1.08	1.06	0.01	14.42
Sweden	6.98	0.24	3.03	0.63	0.79	0.54	1.75	13.95
Russian Fed.	4.23	0.47	1.46	1.72	2.01	0.89	1.42	12.20
The Netherlands	4.48	0.04	2.68	1.46	0.89	0.56	1.27	11.39
Estonia	4.37	0.83	2.07	2.09	0.79	0.43	0.49	11.07
Latvia	4.80	0.43	2.10	0.87	0.85	1.09	0.33	10.48
Romania	4.31	2.47	0.11	1.84	1.26	0.16	0.04	10.19

* Cyprus, Greece, Lithuania: total use, including the hospital sector.
** Spain: reimbursement data, does not include over-the-counter sales without prescription.

Figure 3.4: Outpatient antibiotic (J01) use in 2009 subdivided into the major antibiotic classes according to ATC classification (N=32 countries)



* Cyprus, Lithuania: total use, including the hospital sector.
** Spain: reimbursement data, does not include over-the-counter sales without prescription.

Penicillins represented the most frequently prescribed antibiotic in all countries, ranging from 28.7% (Germany) to 66.0% (Slovenia) of the total outpatient antibiotic use. For cephalosporins, the proportional use ranged from 0.2% in Denmark to 25.5% in Malta, from 0.02% in Slovenia to 26.3% in Iceland for tetracyclines, from 4.5% in Sweden to 29.9% in Greece for macrolides, from 2.8% in the United Kingdom to 16.5% in the Russian Federation for quinolones, from 0.03% in Lithuania to 10.4% in Latvia for sulphonamides and trimethoprim and from 0.04% in Slovenia to 18.9% in Norway for the other J01 classes.

Figure 3.5 Outpatient use of tetracyclines in the participating countries in 2009

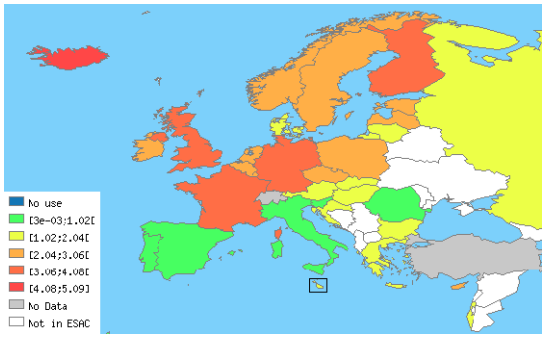
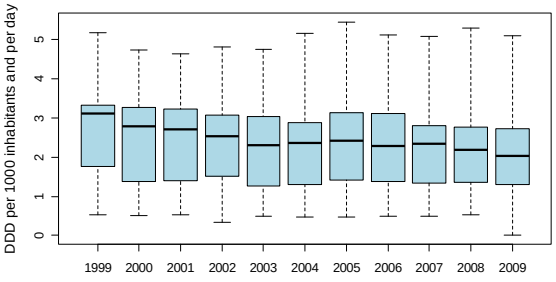


Figure 3.6: Distribution of outpatient use of tetracyclines during the study period (1999-2009)



The boxplots present the seven major antibiotic J01 subgroups (Figures 3.6 to 3.18). They show the median, the interquartiles 25%-75% and the minimum/maximum DID values of all participating countries for the years 1999-2009.

The outpatient use of tetracyclines varied from 0.003 DID in Slovenia to 5.1 DID in Iceland. Other countries that had a higher outpatient use (in DID) of tetracyclines in 2009 were Finland, the UK, France and Germany (Figure 3.5). The main used substance was doxycycline followed by lymecycline, minocycline and tetracycline. Since 1999, the outpatient use of this subgroup among the participating countries was in general decreasing up to 2004, increased up to 2007, and seems to decrease again since (Figure 3.6).

Figure 3.7: Outpatient use of penicillins in the participating countries in 2009

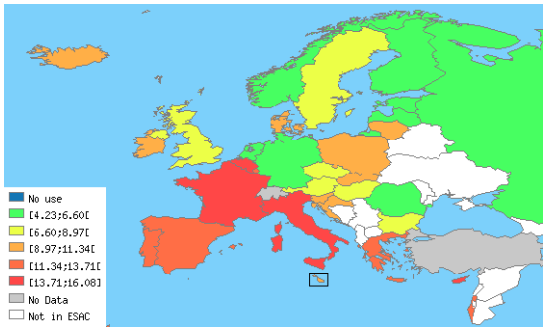
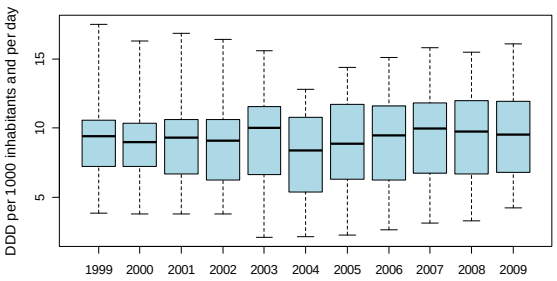


Figure 3.8: Distribution of outpatient use of penicillins during the study period (1999-2009)



In 2009, the outpatient use of penicillins varied from 4.2 DID in the Russian Federation to 16.1 DID in France (Figure 3.7). The main used sub-classes were penicillins with extended spectrum (J01CA) and combinations of penicillins, incl. beta-lactamase inhibitors. The two most used substances were amoxicillin (J01CA04) and amoxicillin and enzyme inhibitor (J01CR02). Phenoxymethylpenicillin is still highly used in the Scandinavian countries, it is the first penicillin class to be used in Denmark, Norway and Sweden where it represented more than half the consumption of this class of antibiotics and around 25% for Iceland and Finland. Overall penicillin use decreased up to 2004 to 8.4 DID and increased again with a maximum median use of 9.9 DID in 2007 (Figure 3.8).

Figure 3.9: Outpatient use of cephalosporins and other beta-lactams in the participating countries in 2009

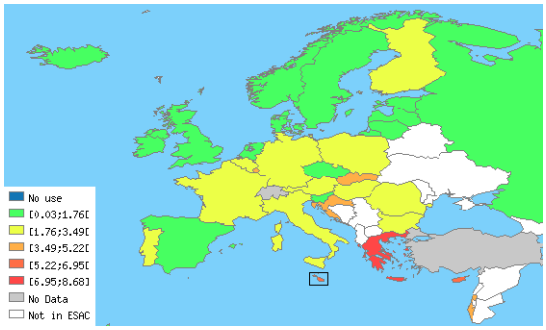
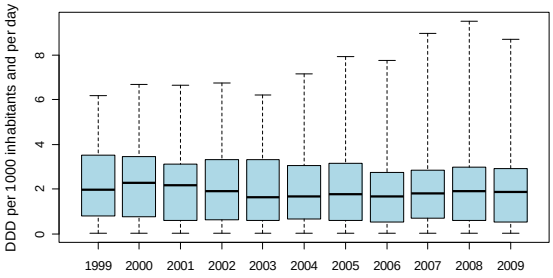


Figure 3.10: Distribution of outpatient use of cephalosporins and other beta-lactamsduring the study period (1999-2009)



The outpatient use of cephalosporins and other beta-lactam antibacterials varied from 0.03 DID in Denmark to 8.7 DID in Greece (Figure 3.9). Herewith, the cephalosporins group contributed for almost the entire total use within this class. But, expressed as country specific proportional use of total outpatient use, the countries Malta and Romania are leading. During the study period, the distribution of the use of this class followed more or less a wave shape (Figure 3.10).

Figure 3.11: Outpatient use of sulfonamides and trimethoprim in the participating countries in 2009

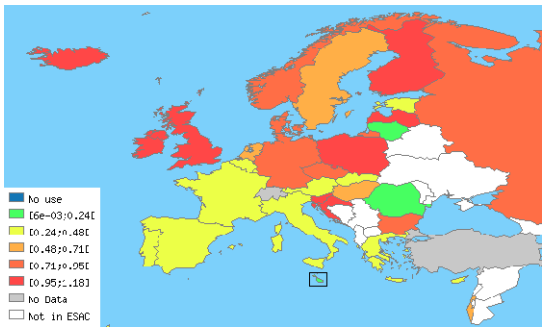
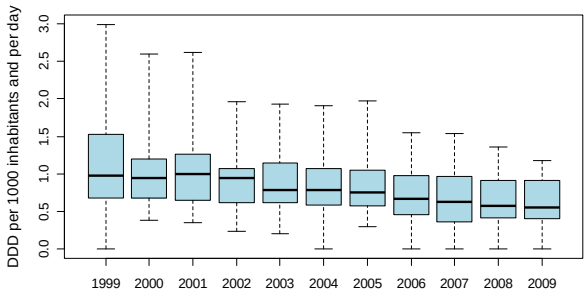


Figure 3.12: Distribution of outpatient use of sulfonamides and trimethoprim during the study period (1999-2009)



In 2009, the outpatient use of sulfonamides and trimethoprim varied from less than 0.01 DID in Lithuania to 1.2 DID in the United Kingdom (Figure 3.11). Almost all the use was a combination of sulfomethoxazole and trimethoprim (J01EE01). The general level of use of this class decreased continuously during the study period (Figure 3.12).

Figure 3.13: Outpatient use of macrolides, lincosamides and streptogramins in the participating countries in 2009

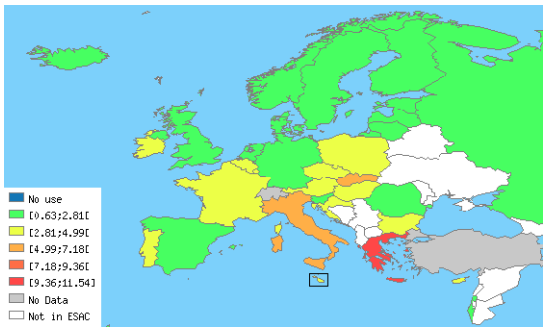
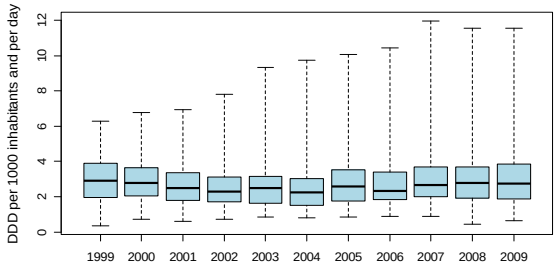


Figure 3.14: Distribution of use of macrolides, lincosamides and streptogramins during the study period (1999-2009)



The outpatient use of macrolides, lincosamides and streptogramins in 2009 varied from 0.6 DID in Sweden to 6.1 DID in Slovakia, and 11.5 DID in Greece (Figure 3.13). Greece always showed a very high use of this class of antibiotics over the years. The most used sub-group were the macrolides. In general, the most used substances in 2009 were clarithromycin (J01FA09) and azithromycin (J01FA10). In the UK, the most used substance was erythromycin (J01FA01). In France, the second most used substance in this group was pristinamycin (J01FG01), a streptogramin. Sweden reported the lowest use of this class, among which clindamycin (J01FF01), a lincosamide, was the most frequently used substance. The level of use of this class went down up to 2004; since then an increasing trend is seen. (Figure 3.14).

Figure 3.15: Outpatient use of quinolones in the participating countries in 2009

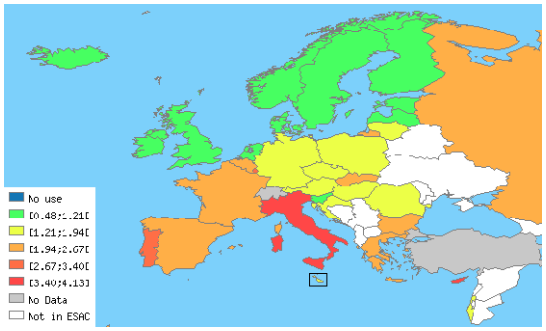
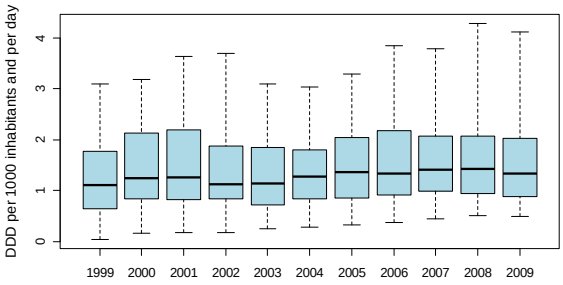


Figure 3.16: Distribution of outpatient use of quinolones during the study period (1999-2009)



The outpatient use of quinolones varied from 0.5 DID in the United Kingdom, Norway and Denmark to 4.1 DID in Cyprus (Figure 3.15). Fluoroquinolones (J01MA) represented almost the entire consumption within this class. The most used substances were ciprofloxacin (J01MA02) and norfloxacin (J01MA06). The consumption of this class slightly increased over the study period. A decrease in use is observed for the year 2009 (Figure 3.16).

Figure 3.17: Outpatient use of the other J01 classes (J01B, J01G, J01R, J01X) in the participating countries in 2009

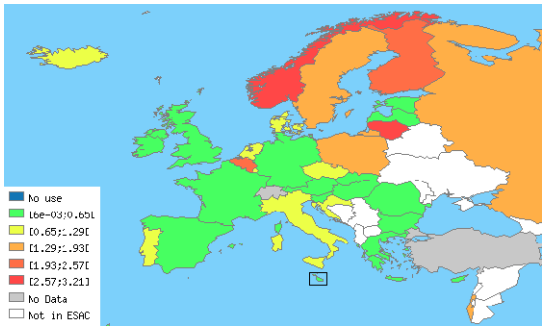
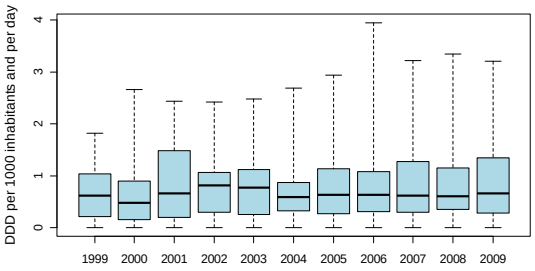


Figure 3.18: Distribution of outpatient use of the other J01 classes (J01B, J01G, J01R, J01X) during the study period (1999-2009)



The outpatient use of other J01 classes including amphenicols (J01B), aminoglycosides (J01G), combinations of antimicrobials (J01R) and others antimicrobials (J01X) varied from less than 0.01 DID in Slovenia to 3.2 DID in Lithuania (Figure 3.17). The most used sub-class were the others antimicrobials (J01X). High levels of use in Lithuania are mainly due to high consumption of metronidazole (J01XD01) and nitrofurantoin (J01XE01). Yet, this country provided total care data. The Scandinavian countries Sweden, Finland and Norway showed higher levels of use due to high consumption of methenamin (J01XX05). Belgium showed a high level of use as well, mainly due to high consumption of nitrofurantoin (J01XE01) and nifurtoinol (J01XE02). The level of use of this class remained stable since 2004 (Figure 3.18).

Hospital care

Twenty countries delivered national data on antibiotic use in hospitals for the year 2009; Belgium and Switzerland delivered 2008 data. Table 3.3 and Figure 3.19 present the 2009 hospital use data for seven major antibiotic pharmacological subgroups according to the ATC classification: penicillins (J01C), cephalosporins and other beta-lactams (J01D), macrolides, lincosamides and streptogramins (J01F), tetracyclines (J01A), quinolones (J01M), sulphonamides and trimethoprim (J01E) and the other antibiotics including amphenicols (J01B), aminoglycosides (J01G), combinations (J01R) and other antibacterials (J01X).

Proportional use of penicillins ranged from 19.7% in the Russian Federation to 55.7% in France. Fifteen out of 22 countries had a proportion of use of penicillins greater than one third. The proportion of cephalosporins use was highest in Bulgaria (44.5%), and low in Ireland (9.0%). Tetracycline use was the highest in Sweden (11.6%) and lowest in Luxembourg (0.7%). Macrolide use ranged from 2.8% in Romania to 16.4% in Malta; and quinolone use from 6.1% in Portugal to 20.4% in Hungary. Sulfonamide use was the highest in Sweden (5.2%) and lowest in Israel (0.1%). The use of other classes was highest in Finland (19.3%) and the Russian Federation (18.3%).

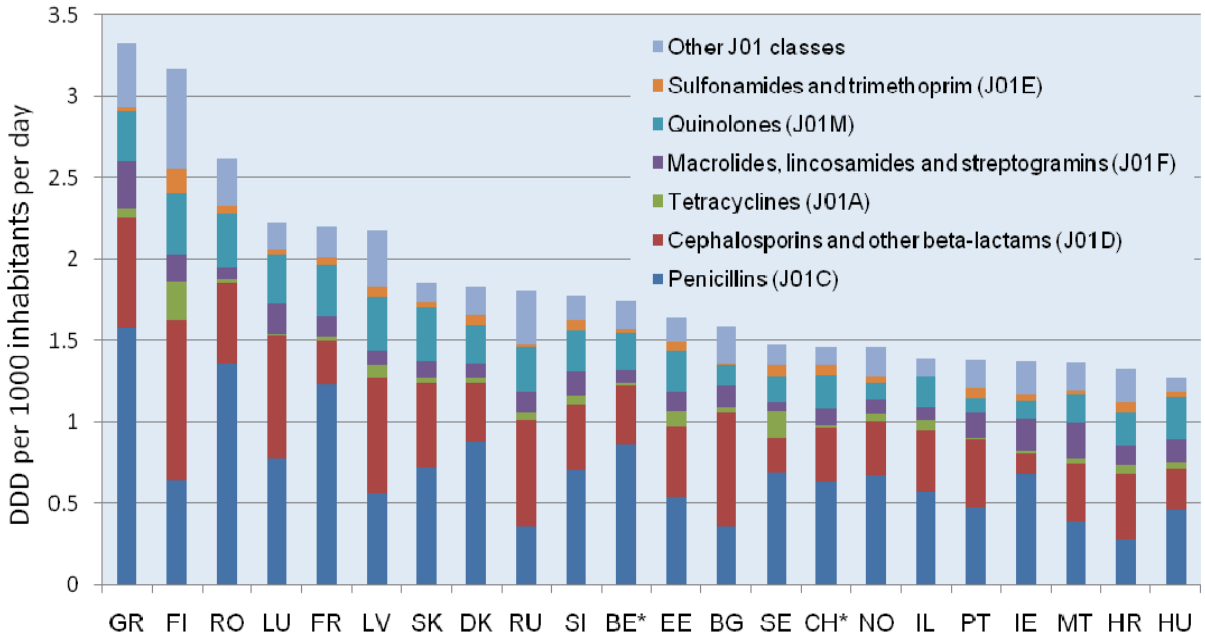
All the reporting countries derived a reliable estimate for national hospital exposure to antibiotics from wholesale data or from detailed consumption registration in all hospitals. Nevertheless, the reliability of the estimation of national aggregates of hospital antibiotic consumption must be critically evaluated. Particulary in Finland, where some remote primary health care centres and nursing homes were included into the hospital data, proportional use of "other antibiotics" can predominantly be attributed to the use of oral methenamine and nitrofurantoin.

Table 3.3: Hospital use of antimicrobials for systemic use (ATC group J01) in 2009 (N= 22 countries)

Country	Penicillins (J01C)	Cephalosporins and other beta-lactams (J01D)	Tetracyclines (J01A)	Macrolides, lincosamides and streptogramins (J01F)	Quinolones (J01M)	Sulfonamides and trimethoprim (J01E)	Other J01 classes	Total J01
Greece	1.58	0.67	0.05	0.29	0.31	0.03	0.39	3.33
Finland	0.64	0.98	0.24	0.17	0.38	0.15	0.61	3.17
Romania	1.36	0.49	0.03	0.07	0.33	0.04	0.29	2.62
Luxembourg	0.78	0.75	0.01	0.19	0.30	0.03	0.17	2.22
France	1.23	0.27	0.03	0.13	0.32	0.05	0.19	2.20
Latvia	0.57	0.70	0.08	0.09	0.33	0.06	0.35	2.18
Slovakia	0.72	0.52	0.02	0.11	0.33	0.03	0.12	1.85
Denmark	0.87	0.36	0.03	0.09	0.24	0.07	0.17	1.83
Russian Fed.	0.36	0.65	0.05	0.13	0.27	0.01	0.33	1.81
Slovenia	0.70	0.40	0.06	0.15	0.26	0.06	0.16	1.78
Belgium*	0.86	0.36	0.01	0.08	0.23	0.03	0.17	1.74
Estonia	0.54	0.43	0.10	0.12	0.25	0.05	0.15	1.64
Bulgaria	0.36	0.71	0.03	0.14	0.12	0.01	0.23	1.59
Sweden	0.69	0.21	0.17	0.06	0.15	0.08	0.12	1.47
Switzerland*	0.63	0.34	0.02	0.10	0.21	0.06	0.11	1.46
Norway	0.67	0.33	0.05	0.08	0.10	0.05	0.18	1.46
Israel	0.57	0.38	0.06	0.08	0.18	0.00	0.11	1.38
Portugal	0.48	0.42	0.02	0.15	0.08	0.06	0.17	1.38
Ireland	0.68	0.12	0.02	0.19	0.11	0.04	0.20	1.37
Malta	0.38	0.36	0.03	0.22	0.18	0.02	0.17	1.36
Croatia	0.28	0.39	0.06	0.12	0.21	0.06	0.21	1.32
Hungary	0.46	0.26	0.03	0.14	0.26	0.04	0.08	1.26

* Belgium and Switzerland: 2008 data

Figure 3.19: Hospital use of antimicrobials for systemic use (ATC group J01) in 2009 (N=22 countries)



* Belgium and Switzerland: 2008 data

Antimycotic and antifungal use in Europe

Table 3.4 and the figures 3.20 & 3.21 present the outpatient antimycotic (J02) and antifungal (D01B) use for the year 2009 for 27 European countries, expressed in DID and subdivided into the main used substances. Twentyfour countries provided both J02 and D01B data. Luxembourg and the Russian Federation did not report antifungal (B01B) use. Germany did not report antimycotic (J02) use.

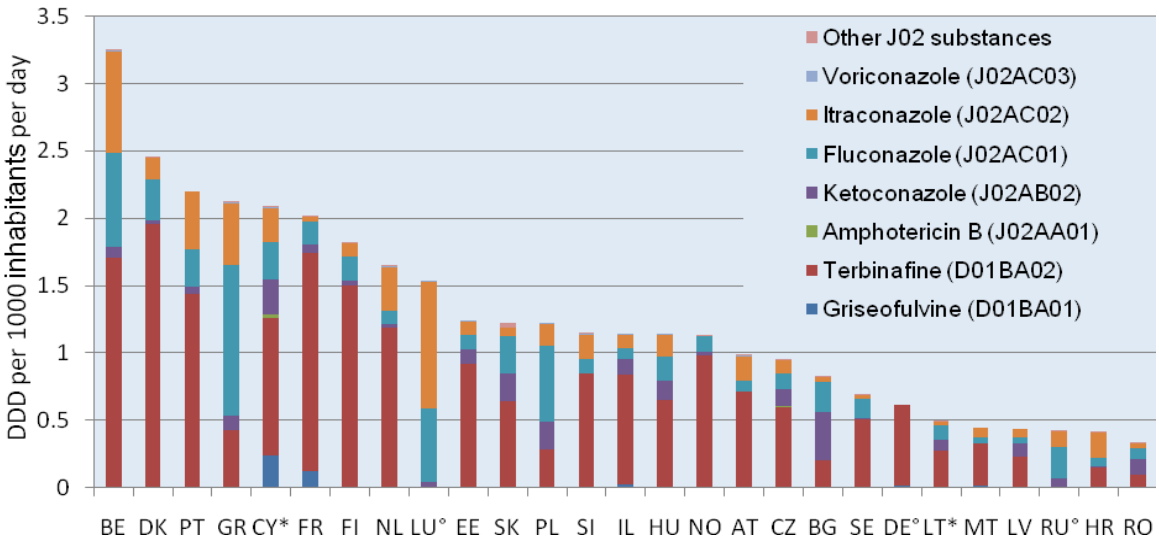
Among those countries which provided J02 and D01B data (n=24), total outpatient antimycotic and antifungal use varied with a factor 9.8 between the country with the highest (3.24 DID in Belgium) and lowest (0.33 DID in Romania) use. The proportion of terbinafine use varied between 19.9% and 87.1% in Greece and Norway respectively. Terbinafine use represented more than 50% of the total systemic antimycotic and antifungal use in 18 out of the 24 countries.

Table 3.4: Outpatient antimycotic and antifungal (J02 & D01B) use in 2009 subdvided into the main substances according to ATC classification

Country	Griseofulvine (D01BA01)	Terbinafine (D01BA02)	Amphotericin B (J02AA01)	Ketoconazole (J02AB02)	Fluconazole (J02AC01)	Itraconazole (J02AC02)	Other J02	Total J02 & D01B
Belgium	-	1.71	0.00	0.08	0.69	0.75	0.01	3.24
Denmark	-	1.96	0.00	0.03	0.30	0.16	0.00	2.45
Portugal	-	1.44	-	0.05	0.28	0.42	-	2.19
Greece	-	0.42	0.00	0.11	1.12	0.45	0.02	2.13
Cyprus*	0.23	1.02	0.03	0.26	0.28	0.25	0.01	2.09
France	0.12	1.62	-	0.06	0.17	0.03	0.00	2.01
Finland	-	1.50	0.00	0.03	0.18	0.10	0.01	1.82
The Netherlands	0.00	1.19	0.00	0.03	0.10	0.32	0.01	1.64
Luxembourg	-	-	0.00	0.04	0.54	0.94	0.00	1.53
Estonia	0.00	0.92	0.00	0.11	0.11	0.10	0.00	1.23
Slovakia	-	0.64	0.00	0.21	0.28	0.06	0.04	1.23
Poland	0.00	0.28	-	0.21	0.56	0.16	0.00	1.22
Slovenial	-	0.85	-	-	0.11	0.18	0.01	1.14
Israel	0.02	0.81	0.00	0.12	0.08	0.10	0.00	1.14
Hungary	-	0.65	-	0.15	0.17	0.17	0.00	1.14
Norway	0.00	0.98	0.00	0.03	0.11	0.00	0.00	1.13
Austria	-	0.71	0.00	-	0.07	0.18	0.01	0.98
Czech Republic	-	0.60	0.01	0.12	0.12	0.10	0.01	0.95
Bulgaria	-	0.20	-	0.36	0.23	0.03	0.00	0.82
Sweden	0.00	0.50	0.00	0.01	0.14	0.02	0.01	0.69
Germany	0.02	0.60	-	-	-	-	-	0.61
Lithuania*	-	0.27	-	0.08	0.11	0.03	0.00	0.49
Malta	0.02	0.31	-	0.01	0.04	0.07	-	0.44
Latvia	-	0.23	-	0.10	0.05	0.07	-	0.44
Russian Fed.	-	-	0.00	0.06	0.24	0.11	0.00	0.42
Croatia	-	0.14	-	0.01	0.06	0.19	0.00	0.41
Romania	-	0.10	-	0.11	0.08	0.04	0.00	0.33

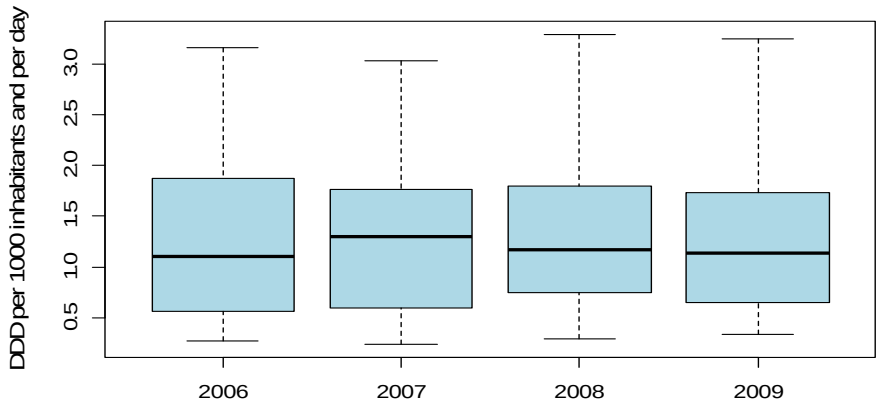
* Cyprus, Lithuania: total use, including the hospital sector.

Figure 3.20: Outpatient antimycotic and antifungal (J02 & D01B) use in 2009 subdivided into the main substances according to ATC classification



* Cyprus, Lithuania: total use, including the hospital sector.
° Luxembourg and the Russian Federation provided no D01B data; Germany provided no J02 data

Figure 3.21: Distribution (boxplot) of outpatient antimycotic (J02) and antifungal (D01B) use among the participating countries between 2006 and 2009.



Antiviral use in Europe

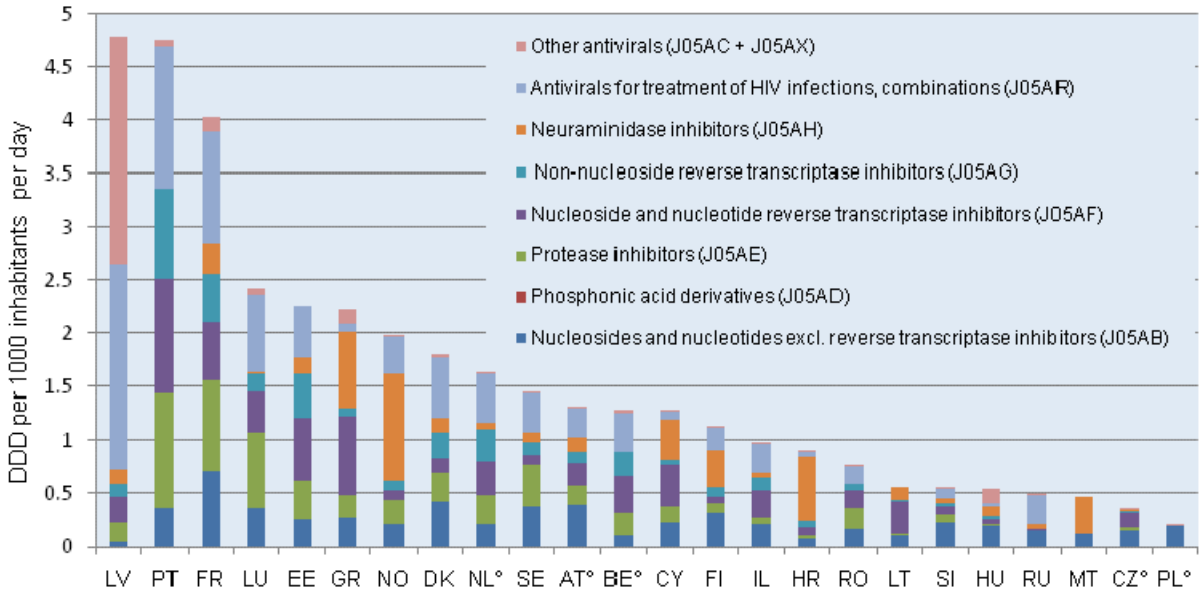
Table 3.5 and Figure 3.22 present data on total use (outpatient + hospital settings) of direct acting antivirals for systemic use (ATC J05) in 2009, aggregated at the level of the active substance, expressed in DDD (WHO ATC/DDD, version 2010) per 1000 inhabitants per day (DID) (N=19 countries). Five countries delivered only outpatient antiviral use data.

Total antiviral use (n=19 countries) varied with a factor 10.2 between the country with the highest (4.8 DID in Latvia) and lowest (0.47 DID in Malta) use. A high variation in use is observed within and between the different chemical subgroups of J05A.

Among those countries reporting total antiviral use, the country specific proportions of nucleosides and nucleotides excluding reverse transcriptase inhibitors (J05AB) use ranged from 1.0% in Latvia to 39.6% in Slovenia; from 0.8% in the Russian Federation to 28.9% in Luxembourg for protease inhibitors use (J05AE) and from 0.04 % in Malta to 54.1% in Lithuania for nucleosides and nucleotides reverse transcriptase inhibitors (J05AF). Country specific proportional use of antivirals for combinations of treatment of HIV infections (J05AR) is highest in the Russian Federation, Latvia, Denmark and Luxembourg representing more than 30% of total antiviral use.

Use of oseltamivir (J05AH02) in Europe increased from a median of 0.001 (maximum of 0.357) DID in 2008 to 0.104 (maximum of 0.980) DID in 2009, the year of the A/H1N1 pandemic, respectively.

Figure 3.22: Total antiviral consumption (J05A) use (AC+HC settings) in 2009 (N=24 countries)



° countries presenting outpatient use only

Table 3.5: Most frequently used antivirals for systemic use (J05A) in outpatient and hospital settings in 2009 (N=24 countries)

Country	Nucleosides and nucleotides excl. reverse transcriptase inhibitors (J05AB)	Protease inhibitors (J05AE)	Nucleoside and nucleotide reverse transcriptase inhibitors (J05AF)	Non-nucleoside reverse transcriptase inhibitors (J05AG)	Neura-minidase inhibitors (J05AH)	Antivirals for treatment of HIV infections, combina-tions (J05AR)	Other antivirals (J05AC + J05AD + J05AX)	all antivirals (J05A)
Latvia	0,05	0,18	0,24	0,12	0,14	1,93	2,13	4,78
Portugal	0,36	1,07	1,08	0,86	0,00	1,33	0,06	4,76
France	0,71	0,84	0,54	0,46	0,29	1,05	0,14	4,03
Luxembourg	0,37	0,70	0,38	0,18	0,01	0,73	0,06	2,42
Estonia	0,26	0,36	0,59	0,41	0,15	0,48	-	2,25
Greece	0,27	0,21	0,74	0,07	0,71	0,09	0,13	2,22
Norway	0,20	0,24	0,09	0,10	0,99	0,35	0,02	1,98
Denmark	0,42	0,27	0,14	0,25	0,13	0,57	0,03	1,80
The Netherlands°	0,22	0,26	0,32	0,30	0,06	0,46	0,01	1,63
Sweden	0,39	0,38	0,09	0,12	0,08	0,37	0,02	1,46
Austria°	0,40	0,18	0,20	0,10	0,15	0,26	0,02	1,31
Belgium°	0,10	0,22	0,34	0,24	-	0,36	0,03	1,28
Cyprus	0,23	0,14	0,39	0,05	0,37	0,08	0,00	1,27
Finland	0,32	0,08	0,06	0,09	0,36	0,21	0,02	1,14
Israel	0,22	0,06	0,25	0,13	0,04	0,27	0,01	0,97
Croatia	0,07	0,04	0,08	0,05	0,61	0,05	0,00	0,90
Romania	0,16	0,20	0,17	0,06	0,00	0,17	0,01	0,78
Lithuania	0,11	0,02	0,31	0,01	0,13	-	-	0,57
Slovenia	0,22	0,08	0,08	0,04	0,04	0,10	0,00	0,55
Hungary	0,19	0,03	0,04	0,02	0,09	0,03	0,15	0,55
Russian Fed.	0,15	0,00	0,01	0,01	0,04	0,28	0,00	0,49
Malta	0,12	-	0,00	0,00	0,35	-	-	0,47
Czech Republic°	0,15	0,03	0,14	0,02	0,00	-	0,00	0,34
Poland°	0,20	-	0,00	-	0,00	-	0,00	0,21

° countries presenting outpatient use only

CHAPTER 4. IN-DEPTH ANALYSES

Ambulatory Care

Ambulatory Care Scientific Advisor: Sigvard Mölstad, SE; Samuel Coenen, BE

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Data manager: Ann Versporten, BE

Aims

In ESAC-3 the Ambulatory Care Subproject aims to:

- collect national dispensing data linked to the patients' age and gender and the prescribers' speciality (protocol A)
- collect national or sample data of prescriptions by GPs linked to the patients' age and gender and to the indication (protocol B)
- validate further the available set of twelve indicators developed to assess the quality of antibiotic use in ambulatory care (quality indicators protocol)
- collect recommendations from evidence-based clinical guidelines, including antibiotic guides, developed for and applicable to the participating countries (guideline protocol).

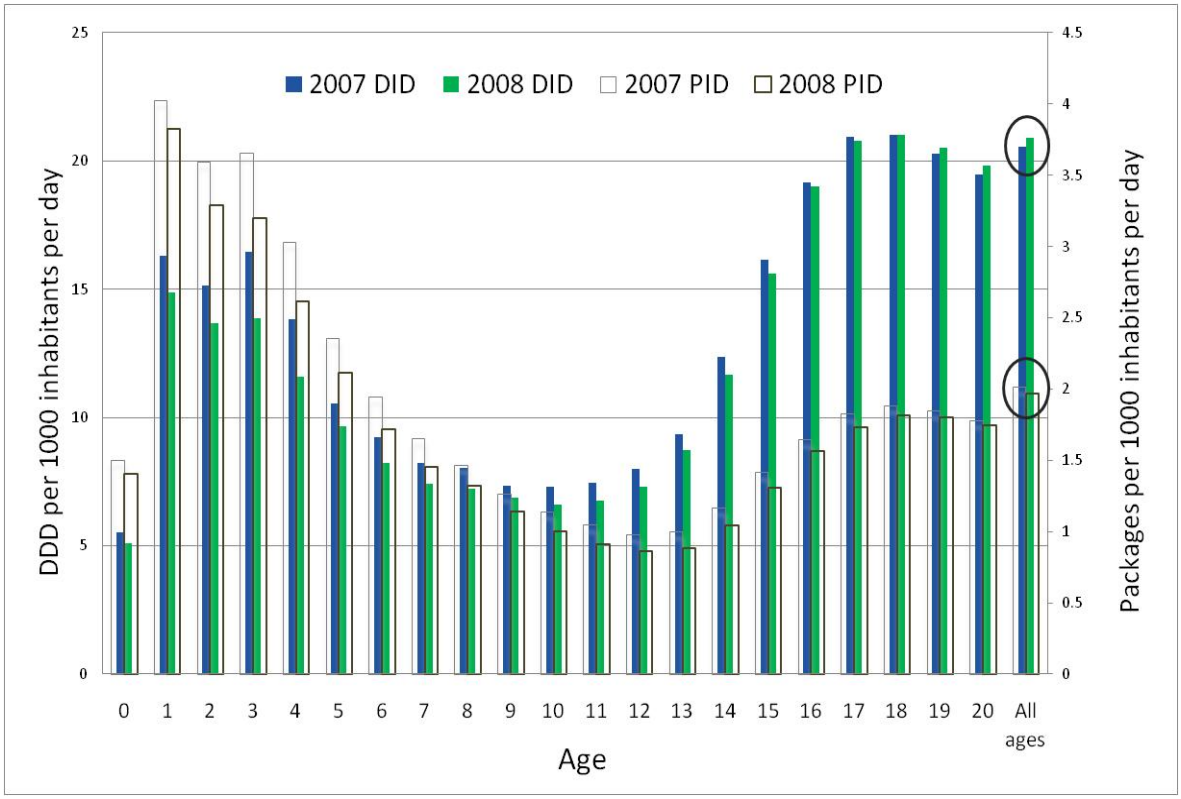
Protocol A & B

In ESAC-3, we continued to collect national dispensing data linked to the patients' age and gender and the prescribers' specialty (protocol A). Preliminary analysis of protocol A data showed that controlling for demographic differences only has a very limited impact on the observed variation between countries (see yearbook 2008). However, for a better understanding of outpatient antibiotic use, data linking antibiotic use to the patients' age and gender remain important. Figure 4.1 shows outpatient antibiotic use in young children and teenagers (ages 0-20 years). The number of DDD per 1000 inhabitants per day (DID) used differs greatly per age group, with higher use in young children and adolescents. In addition, this figure illustrates the importance of other outcome measures, like the number of packages per 1000 inhabitants per day (PID), to evaluate antibiotic use. In PID, which is probably a better proxy for the number of prescriptions or treatments, the highest use is observed in young children. To evaluate the effect of the first European Antibiotic Awareness Day, which focused on antibiotic use in children, antibiotic use data expressed in DID should best be linked to the patient's age, and if information on age is missing, be complemented with use data expressed in PID. While in DID, overall an increase of DID is observed between 2007 and 2008, in DID per age group a decrease is observed between 0 and 18 years, and in PID, a decrease is observed both overall and per age group. Applying this methodology, the 2008 EAAD appears to have been a success.

Since differences in the age and gender distribution seems to provide only a very limited explanation of the observed variation in outpatient antibiotic use between European countries, we also aspire to collect national or sample data of prescriptions by GPs linked to the patients' age and gender and to the indication (protocol B).
For this purpose we are collaborating with APRES (The appropriateness of prescribing antibiotics in primary health care in Europe with respect to antibiotic resistance; www.nivel.eu/apres), a European project lead by NIVEL in the Netherlands. By the end of 2011, nine European countries will try to deliver data using a protocol similar to that of our protocol B.

Data for protocol A & B can be submitted online using the ESAC Collect Manager. Participants are also asked to complete an online questionnaires on data characteristics of the protocol A and B data, respectively.

Figure 4.1: Outpatient antibiotic use in young children and teenagers (ages 0-20) versus all ages: use for Belgium, Denmark, Luxembourg and Norway, years 2007-2008.



Quality indicators protocol

Within the ESAC Ambulatory Care Subproject, two meetings were convened in 2008 and 2009, respectively, to produce a list of proposed evidence-based disease-specific outpatient antibiotic prescribing quality indicators, building on previous and similar development of drug-specific quality indicators, and in close collaboration with CHAMP (www.champ-antibiotics.org) and HAPPY AUDIT (www.happyaudit.org).

For each of the six main indications for antibiotic prescribing (acute otitis media, acute upper respiratory infection, acute/chronic sinusitis, acute tonsillitis, acute bronchitis/bronchiolitis, cystitis/other urinary infection) and for pneumonia (labelled by ICPC codes H71, R74, R75, R76, R78, U71 and R81, respectively), 3 quality indicators were proposed, i.e.

a. the percentage of patients with age and/or gender limitation prescribed an antibiotic;
b. the percentage of patients with age and/or gender limitation prescribed an antibiotic, receiving the recommended antibiotic;
c. the percentage of patients with age and/or gender limitation prescribed an antibiotic, receiving quinolones.

This proposed set (see Table 4.1) was scored by 40 experts from 25 countries. Already after the first scoring round, all indicators were rated as relevant on 7 dimensions (1. reducing antimicrobial resistance, 2. patient health benefit, 3. cost-effectiveness, 4. policy makers, 5. individual prescribers, 6. their evidence base, and 7. their range of acceptable use); except 3a. was scored 6 on cost- effectiveness. A paper on this work was accepted for publication in BMJ Quality & Safety (http://dx.doi.org/10.1136/bmjqs.2010.049049).

Guideline collection protocol

For guidelines on otitis media, sore throat, sinusitis and lower respiratory tract infections collaboration with CHAMP has been very successful. For guidelines on urinary tract infections as well as on skin and soft tissue infection from ESAC countries, we also co-operate with the APRES project.

Table 4.1: List of proposed disease-specific antibiotic prescribing quality indicators

N°	Title	Label
1a.	The percentage of patients aged between 18 and 75 years with acute bronchitis/bronchiolitis (ICPC-2-R: R78) prescribed antibacterials for systemic use (ATC: J01)	[R78_J01_%]
1b.	= 1a. receiving the recommended antibacterials (ATC: J01CA or J01AA)	[R78_RECOM_%]
1c.	= 1a. receiving quinolones (ATC: J01M)	[R78_J01M_%]
2a.	The percentage of patients older than 1 year with acute upper respiratory infection (ICPC-2-R: R74) prescribed antibacterials for systemic use (ATC: J01)	[R74_J01_%]
2b.	= 2a. receiving the recommended antibacterials (ATC: J01CE)	[R74_RECOM_%]
2c.	= 2a. receiving quinolones (ATC: J01M)	[R74_J01M_%]
3a.	The percentage of female patients older than 18 years with cystitis/other urinary infection (ICPC-2-R: U71) prescribed antibacterials for systemic use (ATC: J01)	[U71_J01_%]
3b.	= 3a. receiving the recommended antibacterials (ATC: J01XE or J01EA or J01XX)	[U71_RECOM_%]
3c.	= 3a. receiving quinolones (ATC: J01M)	[U71_J01M_%]
4a.	The percentage of patients older than 1 year with acute tonsillitis (ICPC-2-R: R76) prescribed antibacterials for systemic use (ATC: J01)	[R76_J01_%]
4b.	= 4a. receiving the recommended antibacterials (ATC: J01CE)	[R76_RECOM_%]
4c.	= 4a. receiving quinolones (ATC: J01M)	[R76_J01M_%]
5a.	The percentage of patients older than 18 years with acute/chronic sinusitis (ICPC-2-R: R75) prescribed antibacterials for systemic use (ATC: J01)	[R75_J01_%]
5b.	= 5a. receiving the recommended antibacterials (ATC: J01CA or J01CE)	[R75_RECOM_%]
5c.	= 5a. receiving quinolones (ATC: J01M)	[R75_J01M_%]
6a.	The percentage of patients older than 2 years with acute otitis media/myringitis (ICPC-2-R: H71) prescribed antibacterials for systemic use (ATC: J01)	[H71_J01_%]
6b.	= 6a. receiving the recommended antibacterials (ATC: J01CA or J01CE)	[H71_RECOM_%]
6c.	= 6a. receiving quinolones (ATC: J01M)	[H71_J01M_%]
7a.	The percentage of patients aged between 18 and 65 years with pneumonia (ICPC-2-R: R81) prescribed antibacterials for systemic use (ATC: J01)	[R81_J01_%]
7b.	= 7a. receiving the recommended antibacterials (ATC: J01CA or J01AA)	[R81_RECOM_%]
7c.	= 7a. receiving quinolones (ATC: J01M)	[R81_J01M_%]

J01: Antibacterials for systemic use; J01AA: Tetracyclines; J01CA: Penicillins with extended spectrum, J01CE: Beta-lactamase sensitive penicillins; J01EA: Trimethoprim and derivatives; J01M: Quinolone antibacterials; J01XE; Nitrofuran derivatives: J01XX: Other antibacterials.

Hospital Care

Hospital Care Scientific Advisor: *Peter Davey, UK*

Clinical Scientist Hospital Care: *Peter Zarb, MT*

Hospital Care Support: *Brice Amadeo, FR*

Background

Within ESAC-1, it was recognised that there was no unified hospital information on antimicrobial use across the European countries. The explanations included lack of standardised methods for producing valid data.

ESAC-3 used the methodology developed within the ESAC-2 Hospital Care subproject. A web application was specifically developed for data entry and automatic feedback for the two Point Prevalence Surveys (PPS 2008 & PPS 2009) which used a simplified version of the protocol of the 2006 PPS.

Aims

- To consolidate and enlarge the European network for point prevalence surveys.
- To have as many hospitals as possible pledged to our point prevalence survey so that the pledge is translated into improved antibiotic prescribing.
- To identify targets for quality improvement.
- To develop quality indicators of antimicrobial consumption in hospitals.

Methods

Patient records were the main source of information in order to try and find out what the physicians were aiming at treating. To achieve this, auditors could request additional information from nurses, pharmacists or doctors. There was no discussion about the appropriateness of prescribing. Staff were not to feel evaluated or that the intention was to implement a change in prescribing.

All patients on non-topical antibacterials and antifungals (J01, J02, A07AA, P01AB, D01BA, and J04AB02) at 8 am on the days of survey were included in the survey. Any patient who received one or more doses of prophylaxis in the 24h prior to 8 am on the day of the survey was considered so as to be able to determine whether surgical prophylaxis was prolonged >1 day. The Diagnosis Groups were categorised by anatomical site of infection treated or prevented (prophylaxis).

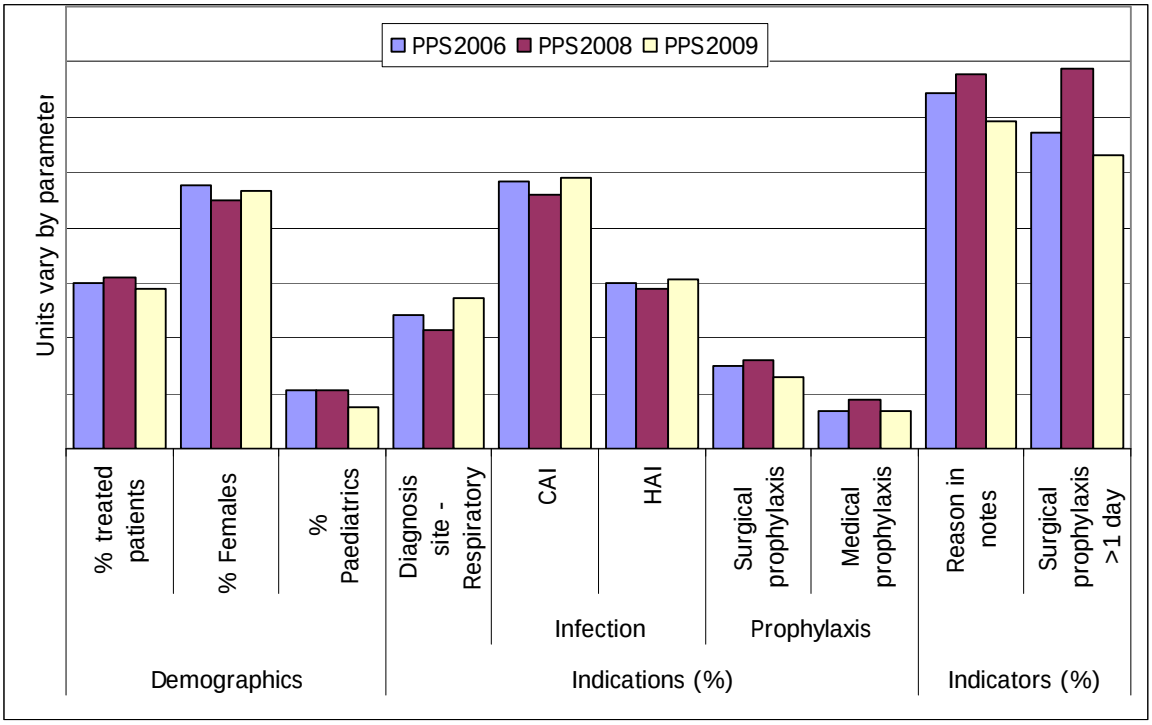
The survey was carried out from May to June 2009. The original aim to enroll twice as many hospitals compared to PPS-2008. However, more than three times as many hospitals participated. There was a high participation from Englan

Data collection

Overview of PPS Results

ESAC carried out three hospital PPS (2006, 2008 and 2009). An overview of the consistency in demographics, indications for antimicrobial use and performance inficators are summarized in Figure 4.2. This uniformity of results indicates a high degree of reiability of the methodology irrespective of the number of participants.

Figure 4.2: Distribution of percentage of parenteral therapies among hospitals



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The large number of participating hospitals in the 2009 PPS allowed for analysis by the pre-assigned categories (teaching and non-teaching **OR** primary, secondary, tertiary and specialty hospitals). Differences in the use of combination therapy were observed in both categorizations with teaching hospitals in the first subdvision and tertiary hospitals in the alternative subdivision showing higher use of combination therapy.

LS 2009

Originally it was intended that the same 50 hospitals that participated in PPS-2008 would collect 4 years of monthly data on antimicrobial use and optionally on antimicrobial resistance in collaboration with EARSS for the period 2005-2008. However, various hospitals could not provide the consumption data. Thus quarterly data were considered, but still a number of hospitals could not provide such data either. In addition, some hospitals that did provide consumption data did not participate in EARSS. Consumption data were aggregated only at the hospital level and were not split by ward categories i.e., general wards/ICU/paediatrics as most hospitals could not provide these data.
EARSS data were requested for the organisms listed in Table 4.3 for the hospitals (laboratories) which participated in both EARSS and ESAC. However, for the analysis currently in progress byt the biostatisticians at the University of Hasselt (UH) *E.coli* was dropped as this is more of a community related pathogen. The *Enteroccus* spp were also dropped in view of the very low numbers of invasive isolates.

Table 4.3: Organism List:

Staphylococcus aureus
Enterococcus faecalis
Enterococcus faecium
Escherichia coli
Klebsiella pneumoniae
Pseudomonas aeruginosa

For LS2009 consumption data mining was finished early in 2011 and statistical analysis is ongoing. Resistance data were handed to ESAC by ECDC in the beginning of October 2010. These were recently grouped by quarter by hospital for the three selected pathogens. The drug-bug combination being analyzed is shown in Table 4.4. In addition the total number of 'blood bottle sets' analyzed each year by the hospitals are also available for use as denominator for the years 2004 and 2006-2008. Since such data were not available for any hospital in 2005, 2004 data were used instead. It is worth noting that some hospitals had not submitted these data to EARSS for all the years.

Table 4.4: Drug-Bug combination:

Organism	Antibiotic Class
Staphylococcus aureus	Antipseudomonal penicillins (J01FA)
Staphylococcus aureus	Fluoroquinolones (J01MA)
Klebsiella pneumoniae	Fluoroquinolones (J01MA)
Klebsiella pneumoniae	3rd generation cephalosporins (J01DD)
Pseudomonas aeruginosa	Fluoroquinolones (J01MA)
Pseudomonas aeruginosa	3rd generation cephalosporins (J01DD)
Pseudomonas aeruginosa	Carbapenems (J01DH)

The successful PPS methodology has been adapted for use in the pilot ECDC-PPS on antimicrobial use and HAI in European hospitals in 2010. Both the methodology and the software developed by ESAC for PPS (WebPPS) were successfully implemented in over 60 hospitals. Furthermore, the methodology, using another modified version of the WebPPS is currently in use in another European initiative: Antibiotic Resistance and Prescribing in European Children (ARPEC) network, funded by the European Commission's Directorate-General for Health and Consumer Protection (DG SANCO).

Nursing Homes

Nursing Homes Scientific Advisor: *Béatrice Jans, BE*

Clinical Scientist Nursing Homes: *Ellen Broex, BE; Katrien Latour, BE*

Background

Since data on antibiotic consumption in NHs are scarce and resistant organisms can be abundantly present in these settings, a European wide network of NHs was set up in order to explore the antibiotic use. The IPSE project (Improving Patient Safety in Europe) - Workpackage 7 on long term care facilities (LTCF) showed that data on antimicrobial use in these settings were only available in 4 out of 17 European countries (DDDs in only one, and in relative frequencies of antimicrobials in the remaining 3 countries). In 2006, a pilot Point Prevalence Survey (ESAC-2 PPS) was designed and tested in a limited number of NHs (n = 12) in 2 selected countries (BE, UK). An overall antibiotic use prevalence of 7.6% (95% confidence interval 6.1%-9.3%) was observed at the NH resident level.
The PPS methodology appeared to be a useful, non labour-intensive tool and feasible et European level and was integrated in the ESAC-3 NH subproject.

Aims

The aims of the ESAC Nursing Home subproject are:

- To measure and describe antibiotic use and prescriptions among residents in European NHs using a standardized methodology;
- To explore determinants of antibiotic use at institutional and resident level.

Methods

The NH subproject contains two components:

- A national (questionnaire) survey on characteristics of and on national/regional regulating mechanisms for AB use and infection control in NHs in the participating countries (September 2008). An overview of the results can be found in the ESAC 2007 yearbook.
- Two consecutive PPS on AB use (April and November 2009) in participating NHs throughout Europe using:
  - a resident questionnaire for data collection on AB use and individual determinants
  - an institutional questionnaire in order to explore institutional determinants with possible impact on AB use/prescription in the participating NHs, and to collect aggregated denominator data on NH and population characteristics.

1. Antimicrobial use in European nursing homes: Results from the first point prevalence survey (April 2009)

Background

Facing the threat of antimicrobial resistance in healthcare settings, optimising the use of antibiotics (AB) in the nursing home (NH) population is an important priority of quality of care. However, data on AB-use in European (EU) NHs are scarce. The European Surveillance of Antimicrobial Consumption (ESAC) NH subproject team, funded by the European Centre for Disease Prevention and Control, carried out a methodology in order to measure AB use among residents living in EU NHs.

Aims

The aims of the ESAC NH subproject are to:
1. Create a broad EU network on antimicrobial use in NHs,
2. Develop a standardised method in order to measure AB-use,
3. Describe antimicrobial prescriptions in EU NHs: the frequency, indications, characteristics & seasonal variations,

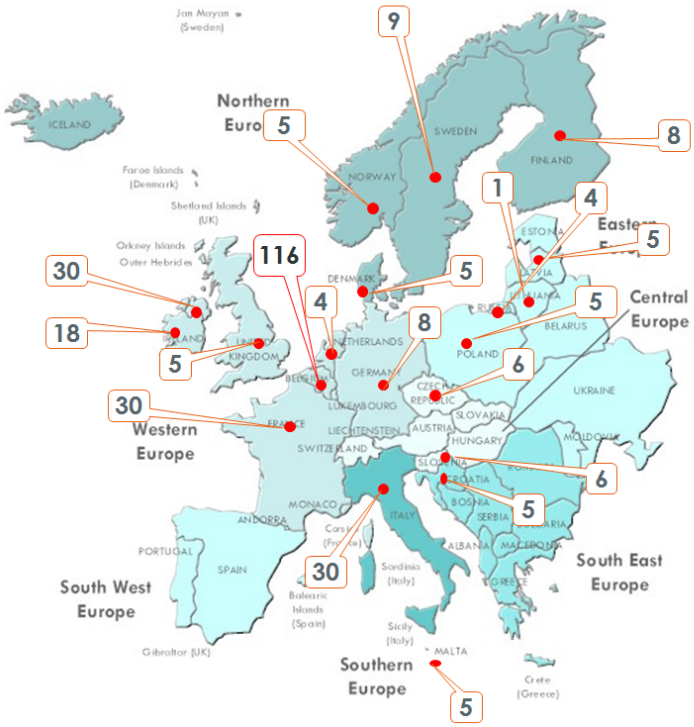
4. Explore determinants of AB-use on institutional and resident level in EU NHs

Methods

Participation rate during PPS-1: April 2009

During the month of April 2009 a point prevalence survey on antibiotic use was organised in 304 high skilled nursing homes (33,713 NH beds, 31,691 eligible residents) in 20 European countries (including 2 UK).

Figure 4.3: Countries with final data delivery for the NH-PPS 1 (April 2009) & Number of participating NHs & eligible residents by country



COUNTRY	n. NHs	n. eligible residents
Belgium	116	12,085
Croatia	5	1,290
Czech Republic	6	691
Denmark	5	319
Finland	8	1,706
France	29	2,211
Germany	8	425
Ireland	18	1,662
Italy	30	2,820
Latvia	5	1,195
Lithuania	1	126
Malta	5	320
Norway	5	568
Poland	5	692
Russia	4	1,740
Slovenia	6	1,421
Sweden	9	508
The Netherlands	4	712
UK: England	5	230
UK: N. Ireland	30	970
TOTAL	304	31,691

General characteristics of participating NHs

- The mean number of beds per NH in the participating countries ranged between 49 and 469. Among all participating NHs, the smallest facility counted 20 beds and the largest 650 beds.
- The median bed occupancy rate reached 97.4%. In 13 countries this rate was higher than 95%.
- Also care load indicators and risk factors in the total resident population of participating NHs were very different between facilities and between countries (Table 4.5)

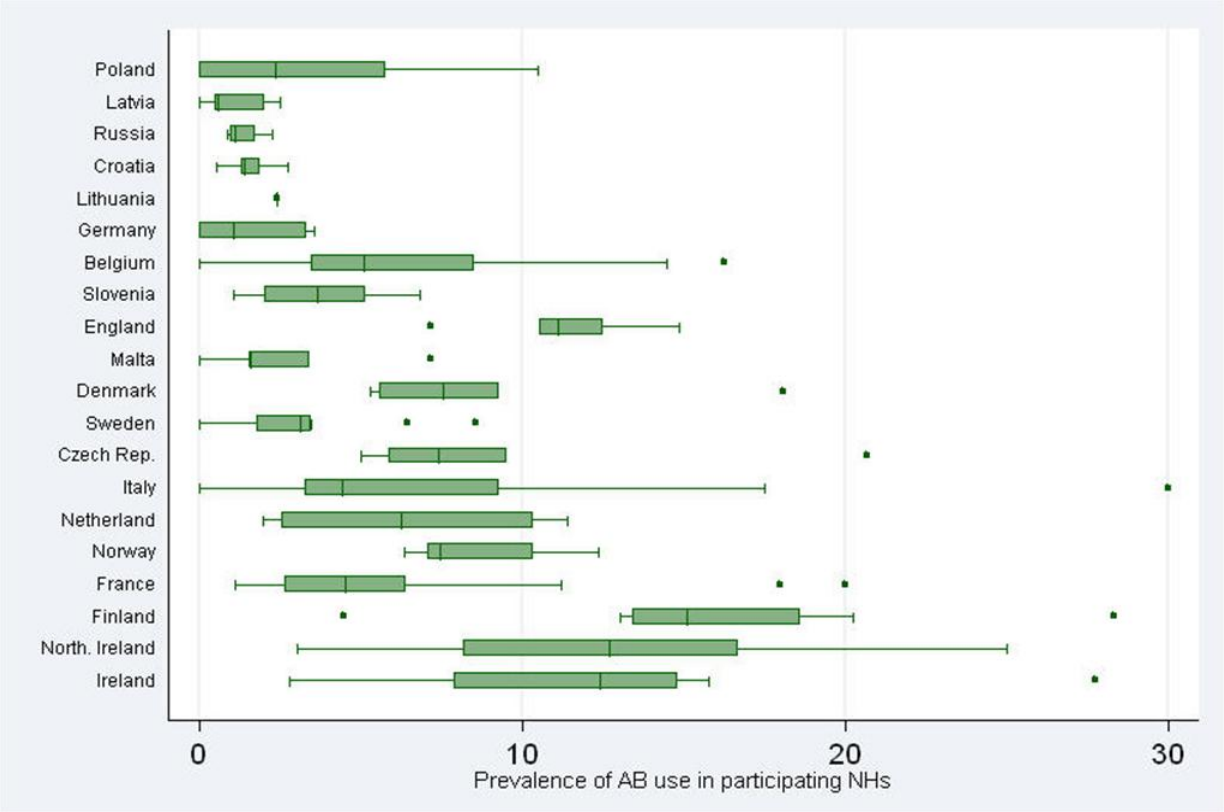
Table 4.5: Percentage of residents with care load indicators & risk factors in the total resident population

% residents with:	Country min.	Country max.	NH min.	NH max.
CARE LOAD INDICATORS				
Incontinence	10.3%	84.0%	1.8%	100.0%
Disorientation	6.7%	70.4	0.0%	100.0%
Impaired mobility	12.9%	76.8%	1.1%	100.0%
RISK FACTORS				
Urinary catheter	0.0%	35.0%	0.0%	56.7%
Vascular catheter	0.0%	3.6%	0.0%	17.4%
Wounds	1.7%	25.1%	0.0%	79.6%

Prevalence of AB use among residents in European NHs

Among 31,691 eligible residents from 304 NHs, 1874 residents (5.9%) used an antimicrobial on the day of the survey. The median prevalence of AB-use among participating facilities reached 5.4% (min. 0% - max. 30%). In 20 NHs (7%) a zero prevalence of AB use was observed. By country, the median prevalence of AB-use ranged from 0.6% to 15.1%.

Figure 4.4: Median prevalence of AB use in NHs in European countries



Characteristics of residents with AB therapy in European NHs

The median age of residents with an AB treatment was 85 years (min. 35 y. – max. 109 y.) and 28.2% were male residents. Thirty-two percent of them lived in the NH less than one year and 22.9% stayed recently (whithin the 3 previous months) in an acute care hospital.
The prevalence of care load indicators and risk factors was significantly higher among residents with an antibiotic treatment compared to residents without.

Antimicrobials prescribed in European NHs

In total, 1951 antimicrobial regimens were used on the day of the survey: 96% of the residents with ABs used a single molecule, 4% used more than one molecule (max. 3) for a single or for multiple infections.

ATC level 2:

A total of 95.3% of all prescribed molecules were antimicrobials for systemic use (J01).

ATC level 3:

The five most frequently prescribed molecules were: β-lactam antibacterials (J01C: 27.2%), other antibacterials (J01X: 25.5%), quinolones (J01M: 13.8%), other β-lactam antibacterials (J01D: 10.3%) and sulfonamides /trimethoprim (J01E: 9.9%).

Administration route for antimicrobial therapy

Of all antibiotics in use in NHs, 89.6% were administered orally and 9.4% was for parenteral use (IM/IV). The frequency of parenteral administration varied strongly by NH, ranging between 0 and 15%. Nasal application of mupirocin represented only 0.9% of all antimicrobial treatments and was only observed in 3 countries: Belgium, Northern Ireland and the Republic of Ireland.
In some countries, such as Italy, Russia, Poland and the Czech republic, the proportion of parenteral treatment was important (at least 25% of all treatments).

Type of antimicrobial treatments in European NHs

Half (54%) of all AB treatments were empirical. Among empirical treatments, 55% were administered for respiratory tract infections and 22% for urinary tract infections.
Prophylaxis was very frequent (29% of all AB prescriptions) and concerned particularly urinary tract infections (89% of all prophylaxis).
Only 16% was a documented treatment, 72% of the microbiologically documented treatments were administered for urinary tract infections and 8% for surgical wound infections.
Nasal decolonisation with mupirocin counted for only 1% of all treatments.

2. Antimicrobial use in European nursing homes: second point prevalence survey (November 2009)

Results

Participation in the second ESAC NH PPS (November 2009)

In November 2009, a second ESAC NH PPS was organised together with the pilot HALT PPS: Healthcare associated infections, AB-use (= ESAC-project), antimicrobial resistance and Infection control resources in LTCFs.
Eight countries participated only in the AB-PPS (ESAC), 13 countries combined the ESAC (AB) and HALT (infections) project. Compared to PPS 1, 2 additional countries registered for participation: Bulgaria and Hungary.
Finaly, during the second ESAC NH PPS, a total of 266 NHs (30,641 NH beds) from 22 countries collected prevalence data on antimicrobial use (Table 4.6.).

Table 4.6: Total number of participating NHs and eligible populations by country

Country	Number NHs	Total number ER
Belgium	103	11,160
Bulgaria	2	45
Croatia	5	1,281
Czech Republic	6	607
Denmark	5	325
Finland	8	1,765
France	8	599
Germany	5	474
Hungary	4	281
Ireland	11	843
Italy	28	2,610
Latvia	5	1,193
Lithuania	3	566
Malta	5	319
Norway	5	516
Poland	8	885
Russia	3	1,383
Slovenia	6	1,419
Sweden	7	352
The Netherlands	4	713
UK: England	5	249
UK: N. Ireland	30	984
TOTAL	266	28,569

General characteristics of participating NHs

The mean number of beds per NH was 115 beds. The smallest NH counted 17 beds, the largest 650 beds. On average 95.7% of the NH beds were occupied on the day of the PPS (median range by country: 80.6-99.2%).

Care load and risk factors in the total resident population varied widely by country (table 4.7).

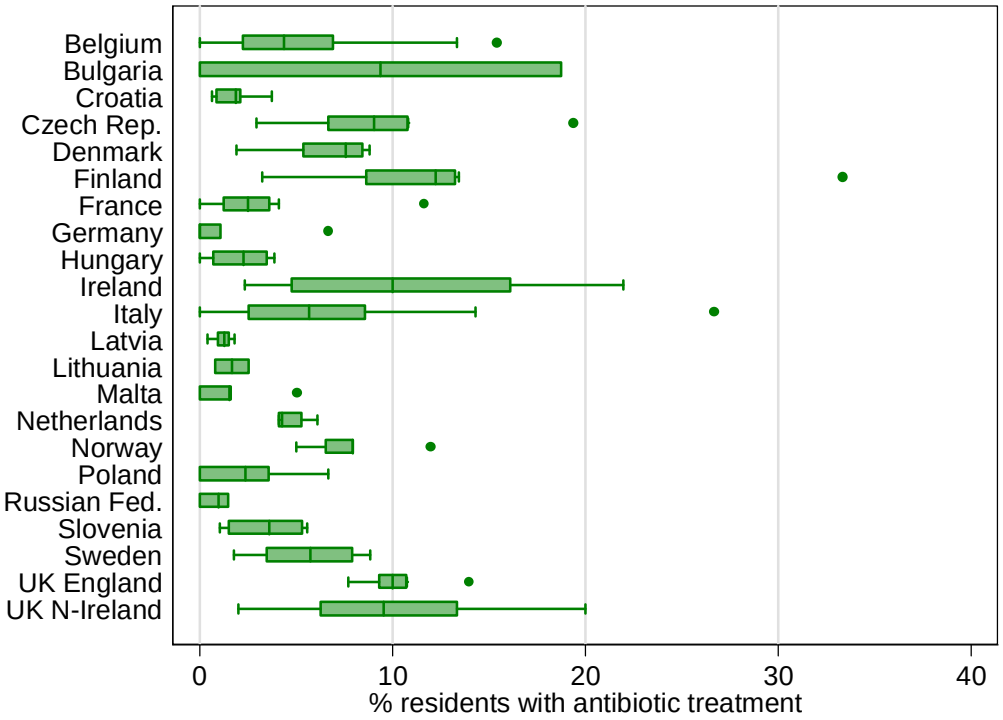
Table 4.7.: Care load indicators & risk factors in the total resident population (%)

% residents with:	Median % Country min.	Country max.	NH min.	NH max.
CARE LOAD INDICATORS				
Incontinence	18.9%	86.3%	10.5%	100.0%
Disorientation	2.9%	70.7%	2.7%	100.0%
Impaired mobility	8.1%	75.0%	2.3%	100.0%
RISK FACTORS				
Urinary catheter	0.0%	30.7%	0.0%	73.3%
Vascular catheter	0.0%	3.4%	0.0%	45.2%
Wounds	0.8%	28.0%	0.0%	52.9%

Prevalence of AB use among residents in European NHs

Among 28,569 eligible residents from 265 NHs, 1,433 residents (median: 5%, range by NH: 0-33.3%) used one or more antimicrobials on the day of the survey (1,486 regimens). In 26 NHs (9.8%) no antimicrobials were used at all. By country the median prevalence of antimicrobial use ranged from 0% to 12.2%.

Figure 4.5: Median prevalence of AB use in NHs in European countries



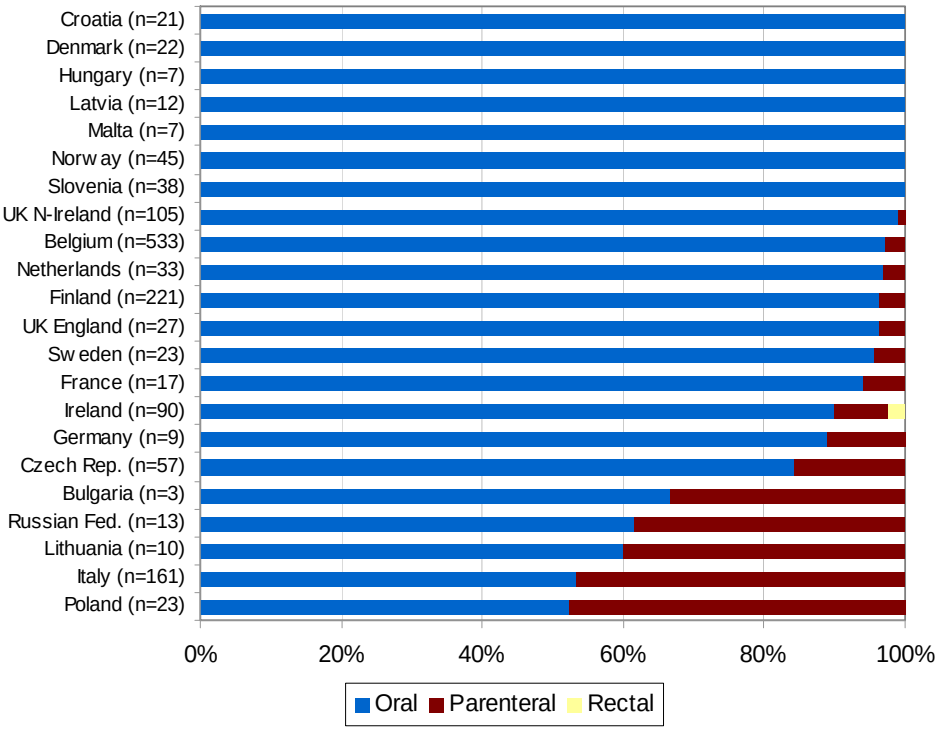
No important changes in the median prevalence of AB use by country were observed between the 2 consecutive PPS, demonstrating the reliability of the PPS methodology.

The % of AB use (5%) was comparable to the prevalence observed during the first PPS (5.4%). Both PPS took place during periods with a low incidence of respiratory tract infections (April and November).

The median age of residents with an AB was 84 years (min.31 y.- max. 106 y.) and 73.2% were female residents. Compared to the general NH population, among residents with AB therapy, care load was more important and risk factors were more often present.

Antimicrobials were mostly for oral use (90.3%), only 9.6% was administered IM/IV. Important differences were observed by country (Fig. 4.6)

Figure 4.6: Administration route for antimicrobials per country



In total, 96.2% of all prescribed molecules were antibacterials for systemic use (ATC class J01). Among these, beta-lactam antibacterials (J01C) were most often prescribed (28.8%, versus PPS-1: 27.2%), followed by other antibacterials (J01X: 26.9%, PPS-1: 25.5%), quinolones (J01M: 16%, PPS-1: 13.9%) and other beta-lactam antibacterials (J01D: 11.5%, PPS-1 10.3%). In European NHs, 56.3% of all prescribed antimicrobials were empirically prescribed (PPS-1: 54%): half of these concerned the treatment of respiratory tract infections. Prophylaxis was very frequent (27.3%, versus PPS-1: 29%), especially urophophylaxis (87.1% of all prophylactically prescribed ABs).

Table 4.8.: Antimicrobial therapy by type of treatment and by indication

			Prophylactic *n*=394		Empirical *n*=811		Documented *n*=236	
Infections	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
SSI	33	2.3	3	0.8	20	2.5	10	4.2
RTI	432	30.0	13	3.3	399	49.2	20	8.5
UTI	714	49.5	343	87.1	229	28.2	142	60.2
GII	19	1.3	0		12	1.5	7	3.0
BSI / SEP	14	1.0	2	0.5	4	0.5	8	3.4
Not specified	38	2.6	11	2.8	24	3.0	3	1.3
Other	76	5.3	22	5.6	39	4.9	15	6.4
Skin / non-surgical wound	115	8.0	-		84	10.4	31	13.1

Conclusions

The results in terms of prevalence rate, care load and risk factors from PPS-2 were very similar to those of the first PPS. Half of all AB treatments in NHs concern the urinary tract. In many countries an important volume of urophophylaxis is prescribed. There is a risk for inappropriate treatment of UTIs. Since the PPS methodology doesn't collect data on signs and symptoms this hypothesis can not be confirmed. There is urgent need for an in depth analysis and additional research in this field.

Socio-Economics

Socio-Economics Scientific Advisor: Philippe Beutels, BE

Clinical Scientist Socio-Economics: Adriaan Blommaert, BE

This is a small subproject that demands few additional data from participants. Some previous analyses from the literature were reviewed, noting the differences in formulation of the regression models and the results obtained. Antibiotic consumption for the period 1999 - 2007 was extracted from the ESAC-3 dataset. The following table shows the available data per year.

Table 4.9: Overview available DDD data per year and per country

Abbr	Country	1999	2000	2001	2002	2003	2004	2005	2006	2007
AT	Austria	ok	ok	ok	ok	ok	ok	ok	ok	ok
BE	Belgium	ok	ok	ok	ok	ok	ok	ok	ok	ok
BG	Bulgaria	ok	ok	ok	ok	ok	ok	ok	ok	ok
CH	Switzerland	x	x	x	x	x	ok	x	x	x
CY	Cyprus	x	x	x	x	x	x	x	ok	ok
CZ	Czech Republic	ok	x	x	ok	ok	ok	ok	ok	ok
DE	Germany	ok	ok	ok	ok	ok	ok	ok	ok	x
DK	Denmark	ok	ok	ok	ok	ok	ok	ok	ok	ok
EE	Estonia	x	x	x	ok	ok	ok	ok	x	ok
ES	Spain	ok	ok	ok	ok	ok	ok	ok	ok	ok
FI	Finland	ok	ok	ok	ok	ok	ok	ok	ok	ok
FR	France	ok	ok	ok	ok	ok	ok	ok	ok	ok
GR	Greece	ok	ok	ok	ok	ok	ok	ok	ok	x
HR	Croatia	x	ok	ok	ok	ok	ok	ok	ok	ok
HU	Hungary	ok	ok	ok	ok	ok	ok	ok	ok	ok
IE	Ireland	ok	ok	ok	ok	ok	ok	ok	ok	ok
IL	Israel	x	x	x	ok	ok	ok	ok	ok	ok
IS	Iceland	ok	ok	ok	ok	ok	ok	ok	ok	x
IT	Italy	ok	ok	ok	ok	ok	ok	ok	ok	ok
LT	Lithuania	x	x	x	x	x	x	x	ok	x
LU	Luxembourg	ok	ok	ok	ok	ok	ok	ok	ok	ok
LV	Latvia	x	x	x	ok	ok	ok	ok	ok	ok
NL	Netherlands	ok	ok	ok	ok	ok	ok	ok	ok	ok
NO	Norway	x	x	ok	ok	ok	ok	ok	ok	ok
PL	Poland	ok	ok	ok	ok	x	ok	ok	x	x
PT	Portugal	ok	ok	ok	ok	ok	ok	ok	ok	ok
RU	Russian Federation	x	x	x	x	ok	ok	ok	ok	ok
SE	Sweden	ok	ok	ok	ok	ok	ok	ok	ok	ok
SI	Slovenia	ok	ok	ok	ok	ok	ok	ok	ok	ok
SK	Slovakia	ok	ok	ok	ok	ok	ok	ok	ok	ok
UK	United Kingdom	ok	ok	ok	ok	ok	ok	ok	x	x

x = no data
ok = data available

Data collection

The methods for the data analysis were developed by Philippe Beutels, Niel Hens, Christiaan Marais, Adriaan Blommaert and Jose Cortinas. In 2010 the database of determinants was updated for the last time.

Through more intensive use of global databases (including Eurostat, OECD, WHO) the database was extended to include more variables and reduce previously missing values. Amongst others, more expansive data on agricultural factors and bacterial resistance were added to the database. Also, a questionnaire was sent to the 35 ESAC LNRs to enquire about information which is not available from the data sources consulted. This questionnaire asked LNRs to answer questions relating to the following:

- Procedures for patients to consult with physicians
- Doctor remuneration
- Treatment guidelines
- Feedback on Antibiotic prescription
- Doctor – Pharmacist role
- Marketing restrictions

Responses from the ESAC LNRs were received and the variables were added to the list of variables.

Data availability & analysis

Data was collected for 180 variables for the period 1999 – 2007 for the 35 ESAC countries. The data is not 100% available from the sources used in the data collection and therefore missing values have to be imputed. Missing values are imputed with a weighted average of the known values with the weight being determined by the distance in time between the known and unknown values. An error term will be added to the imputed values to capture the variability of each variable. Explanatory variables in the dataset for which a country has no information will not be imputed. A biclustering technique of the availability matrix will be used to choose an optimal set of rows and variables from the imputed database so that we have a subset of the database with 100% data availability.

The variables collected are summarized below by seven groups of variable types with information on the number of variables in each group and the data availability by group, before and after the imputation of missing values. The availability of data shown here are for the same country*year combinations as we have antibiotic consumption (see Table 4.10).

Table 4.10: Availability of variables by group, before and after imputation. The availability is calculated as an average of the availability between 1999 and 2007

Group	Number of variables	Availability before imputation	Availability after imputation
Agricultural factors	7	54.5%	92.1%
Burden of disease	35	80.7%	95.2%
Culture and perception of illness	26	42.4%	65.5%
Demographic factors	21	81.6%	96.8%
Education and knowledge about antibiotics	6	50.0%	93.2%
Healthcare system	73	71.7%	81.1%
Socioeconomic factors	12	59.3%	88.2%
Grand Total	180	68.2%	84.7%

The availability of data by country is shown below, before and after imputation of the missing values. The availability is only shown for country*year combinations where antibiotic consumption is known from the core ESAC database (see Table 4.10).

Table 4.11: Availability of variables by country, before and after imputation. The availability is calculated as an average of the availability between 1999 and 2007

Country	Availability before imputing	Availability after imputation
Austria	76.4%	92.1%
Belgium	61.2%	89.3%
Bulgaria	59.2%	77.4%
Croatia	55.6%	68.9%
Cyprus	34.7%	39.0%
Czech Republic	62.2%	79.7%
Denmark	74.7%	91.5%
Estonia	65.7%	79.1%
Finland	82.2%	97.2%
France	75.0%	92.1%
Germany	69.9%	85.3%
Greece	71.2%	84.2%
Hungary	72.2%	92.7%
Iceland	69.7%	81.4%
Ireland	72.6%	84.7%
Israel	47.4%	61.0%
Italy	71.5%	95.5%
Latvia	58.8%	71.8%
Lithuania	61.7%	74.0%
Luxembourg	66.5%	80.8%
Netherlands	78.8%	92.1%
Norway	76.3%	94.4%
Poland	56.0%	79.7%
Portugal	70.5%	88.7%
Russia	38.8%	49.7%
Slovakia	60.4%	78.5%
Slovenia	65.9%	82.5%
Spain	78.8%	99.4%
Sweden	78.3%	93.8%
Switzerland	71.1%	87.0%
United Kingdom	71.6%	85.9%

Data mining techniques (bagged regression trees and random forests) are used to indentify influential variables from the dataset. This technique was studied first to assess the influence of correlated covariates on the results. Based on this elaboration of methods, it was decided to use a backward selection approach on multiple random forests / bagged regression trees. The proposed methodology has been discussed with researchers that are currently exploring the effect of correlated variables on random forests and they have indicated that this methodology is a plausible approach.

The set of possibly important variables will then be entered with a forward selection scheme into a linear mixed model (LMM) with country as a random effect to determine a final set of important variables.

Preliminary results

The data mining techniques were applied to a biclustered subset of the database with optimal availability and also a subset of the database which contains all the variables that are 100% available. The results of this analysis were shared at the yearly ESAC meeting in Stockholm on

the 27th of May 2010. A list of 37 potentially important variables which were identified in the data mining exercise was shared with the participants of the meeting. From the list of 37 variables, the following four variables were indicated as the most important variables in explaining antibiotic consumption with a LMM:

Table 4.12: Significant variable in the linear mixed model with response global antibiotics use.

Significant variables	Beta	P-value
Death rate due to other acute respiratory infections	0.026817	0.0007
Most people can be trusted (1=Yes,2=No)	0.654451	0.0002
% of population aged 25 - 64 that attained upper secondary school	-0.005260	0.0007
Number of women per 100 men	-0.026136	0.0039

The fit of the LMM is not yet satisfactory and therefore the inclusion of a time effect into evolution of antibiotic consumption per country is currently being investigated. First attempts indicate that the women to men ratio may not be important in predicting antibiotic consumption, but the other three variables remain important.

The sources used in the database were validated after the May 2010 meeting which led to an increase in the availability of data. The availability of data shown in Tables 4.10 and 4.11 are representative of the most current version of the dataset.

Stepwise regression by multiple imputation generalized estimating equations

To enable interpretability, a subset of 56 variables was selected from the most recent database, based on biological and socioeconomic relevance. Biclustering of the availability matrix was used to select a complete dataset after imputation. The analysis was based on 19 countries: Austria, Belgium Bulgaria, Croatia, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Latvia, the Netherlands, Norway, Portugal, Slovenia, Spain, Sweden and the United Kingdom for all available years within 1999-2007.

Multiple imputation generalized estimation equations with a stepwise selection procedure were applied to fit models to the data using outpatient antibiotic use as dependent variable. Table 4.13 shows the selected variables by the stepwise procedure, ordered by their Wald statistic (significance) in the final model. All 6 variables displayed are significant at a 5% level.

Table 4.13: Selected predictors to model global antibiotic use in Europe. Position according to the Wald statistic of the final Gamma regression model.

Variable	Position Wald statistic
% of population aged 25 – 64 y who attained upper secondary school	1
Requirement for patients to register with a GP or the provision of financial incentives to do so (YES/NO)	2
Availability of treatment guidelines for GPs to treat respiratory tract infections (YES/NO)	3
% of population living in urban areas	4
Existence of restrictions for pharmaceutical companies to offer physicians complementary dinners (YES/NO)	5
Percentage intermediate and full resistance for E coli 3rd gen. ceph.	6

We find strong evidence that differences in overall antibiotic use over countries and years are determined by education, organization of the healthcare system and resistance. However signs

of the regression coefficients may be counterintuitive due to multicollinearity. The collinearity and interactions within the LNR-survey must be scrutinized in further analyses.

Subgroup analysis

The same stepwise procedure has been applied on subgroups of antibiotics. We modeled the proportion of a specific ATC class on a larger group of antibiotics with a Poisson model with an offset. This analysis was performed for 2 ATC subclasses: amoxillin (ATC J01CA04) and amoxillin with enzyme inhibitor (ATC J01CR02).

Table 4.14: Determinants consumption for amoxillin (ATC J01CA04) versus antibiotics for systematic use (J01) and beta-lactam antibacterials, penicillins (J01C). Position in selected poisson regression model for rates with position according to the Wald statistic. For each model the 5 variables with largest Wald statistic are displayed.

Variable	Position J01	Position J01C
Existence of restrictions for pharmaceutical companies to offer physicians complementary attendance to conferences (YES/NO)	1	3
Requirement for patients to consult a GP before they can consult a pulmonologist or the provision of financial incentives to do so (YES/NO)	2	1
Availability of treatment guidelines for pulmonologists to treat respiratory tract infections (YES/NO)	3	8
Requirement for patients to consult a GP before they can consult a pediatrician or the provision of financial incentives to do so (YES/NO)	4	2
Requirement for patients to register with a GP or the provision of financial incentives to do so (YES/NO)	5	-
Requirement for patients to register with a GP and switching to another GP is difficult(YES/NO)	11	4
Average population density per km2	8	5

Table 4.15: Determinants consumption of amoxicillin and enzyme inhibitor (ATC J01CR02) versus antibiotics for systematic use (J01) and beta-lactam antibacterials, penicillins (J01C). Position in selected poisson regressionmodel for rates with position according to the Wald statistic. For each model the 5 variables with largest Wald statistic are displayed

Variable	Position J01	Position J01C
Requirement for patients to consult a GP before they can consult a gynecologist	2	-
Average population density per km2	3	3
Availability of treatment guidelines for GPs to treat respiratory tract infections (YES/NO)	4	2
Existence of restrictions for pharmaceutical companies to offer physicians complementary dinners (YES/NO)	5	5
The extent to which people consider themselves religious	14	1
Requirement for patients to register with a GP and switching to another GP is difficult(YES/NO)	-	4

The subclass analysis reveals that the percentage occupied by amoxicillin with or without enzyme inhibitor compared to a larger group of antibiotics is strongly associated with the organization of the healthcare system. Guidelines on prescribing behavior and restrictions on commercial behavior of pharmaceutical companies have a significant impact on the relative consumption of these subclasses of antibiotics and explain differences between countries and years.

Further analyses

The variables of the LNR-survey comes up as very influential for determining differences in antibiotic use in Europe. The impact, collinearity and interaction of these variables must be further investigated.

Penalized estimating equations, an alternative data mining technique to determine relevant variables in longitudinal datasets under multicollinearity are currently being investigated through simulation studies. If successful, this technique will be applied to the most recent database.

The analysis of determinants at a regional level will depend on the ability of LNRs to collect regional data which at the moment does not look feasible.

Analysis of cost of antibiotics

Due to difficulties in obtaining price information for antibiotics from IMS it was decided that further efforts needed to be taken to obtain price information from other sources. Therefore, LNR's were asked to provide the following data, if available:

- **EX-FACTORY PRICE:** The total payment received by the pharmaceutical company for providing one package of the medication. This excludes distribution costs and the markup charged by the pharmacy for dispensing the medication
- **EX-PHARMACY PRICE:** The total payment received by an average non-hospital-based pharmacy for providing one package of the medication.
- **OUT OF POCKET PRICE:** The total amount faced by an average patient for purchasing a package of the medication at a pharmacy. This amount should not include the amount reimbursed by the national health insurance, but may include the amount covered by private insurers.

Some LNRs indicated that wholesale prices are available. These prices are understood to be greater than ex-factory prices and less than ex-pharmacy prices. An overview of the collected is described in Table 4.16.

Table 4.16: Price data collected

Country	Data available	Time period
Belgium	Ex-pharmacy	1999-2009
	Out of pocket	2001-2009
Bulgaria	Ex-factory	2005 - 2009
Croatia	Ex-factory	2009
	Out of pocket	
Denmark	Ex-pharmacy	2000-2009
Estonia	Ex-pharmacy	2006-2009
	Wholesale price	2003-2009
France	Wholesale price	1999-2008
	Out of pocket prices	
	Ex-pharmacy	
Ireland	Ex-factory	2002-2008
	Ex-pharmacy	
	Out of pocket	
Malta	Wholesale price (Hospital)	2010
Norway	Wholesale prices	1999- 2009

Country	Data available	Time period
	Out of pocket	
	Ex-pharmacy	
Portugal	Ex-pharmacy	2002 -2009
Slovakia	Ex-factory	1999; 2001; 2004 - 2010
	Ex-pharmacy	2001; 2004 -2010
	Out-of-pocket	1999; 2001; 2004 - 2010
Slovenia	Ex-pharmacy	2007 - 2010
	Ex-factory	
Spain	Ex-factory	2009-2010
	Ex-pharmacy	
Sweden	Ex-pharmacy	2006-2009
	Out-of-pocket	2006-2009
Switzerland	Ex-factory	2003-2009
	Ex-pharmacy	

CHAPTER 5. ESAC DISSEMINATION ACTIVITIES 2010-2011

Papers published in peer reviewed journals

Adriaenssens N., Coenen S., Kroes A., Versporten, A., Vankerckhoven, V., Muller, A., Blix, H.S., Goossens H. on behalf of the ESAC Project Group. *European Surveillance of Antimicrobial Consumption (ESAC): Systemic antiviral use in Europe.* J. Antimicrob. Chemother. (Accepted).

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Zarb P, Ansari F, Muller A, Vankerckhoven V, Davey PG, Goossens H. *Drug Utilization 75% (DU75%) in 17 European Hospitals (2000 - 2005): Results from the ESAC-2 Hospital Care Sub Project.* Curr Clin Pharmacol. 2011; 6(1): 62-70

Zarb P., Amadeo B., Muller A., Drapier N., Vankerckhoven V., Davey P., Goossens H., and on behalf of the ESAC-3 hospital care subproject group, *Identification of targets for quality improvement in antimicrobial prescribing: the web-based ESAC Point Prevalence Survey 2009.* J. Antimicrob. Chemother. 2011; 66: 443-449.

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Adriaenssens N, Coenen S, Muller A, Vankerckhoven V, Goossens H, on behalf of the ESAC Project Group. *European Surveillance of Antimicrobial Consumption (ESAC): Outpatient systemic antimycotic and antifungal use in Europe*. J. Antimicrob. Chemother. 2010; 65(4):769-74.

Coenen S, Adriaenssens N, Muller A, Vankerckhoven V, Goossens H, on behalf of the ESAC Project Group. *European Surveillance of Antimicrobial Consumption (ESAC): Gebruik van antischimmelpreparaten in de ambulante praktijk in Europa.* Huisarts Nu 2010;39(5):186-91.

Abstracts accepted for poster presentation

N. Adriaenssens, S. Coenen, S. Tonkin-Crine, T.J.M.Verheij, P. Little, H. Goossens and the ESAC Ambulatory Care Subproject Group. *European Surveillance of Antimicrobial Consumption*

(ESAC): disease-specific quality indicators for outpatient antibiotic prescribing. 21st European Congress of Clinical Microbiology and Infectious Diseases, Milan, Italy, May 7-10, 2011.

P. Beutels, C. Marais, N. Hens, A. Blommaert, J.A. Cortinas, S. Coenen, A. Muller, and H. Goossens. Identifying determinants of antibiotic use in Europe. 21st European Congress of Clinical Microbiology and Infectious Diseases, Milan, Italy, May 7-10, 2011.

B. Jans, K. Latour, E. Broex, R. Stroobants, G. Gavazzi, A. Muller, V. Vankerckhoven, and H. Goossens. *Antimicrobial prescriptions in Belgian nursing homes: Results from the European Surveillance of Antimicrobial Consumption point prevalence survey in nursing homes.* European Union Geriatric Medecine Society, Dublin, 29 September-1 October 2010.

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K. Latour, E. Broex, A. Muller, N. Drapier , V. Vankerckhoven, R. Stroobants, H. Goossens, B. Jans on behalf of the European Surveillance of Antimicrobial Consumption (ESAC) Nursing Home subproject group. *Antimicrobial prescribing for urinary tract infections in European nursing homes.* 21st European Congress of Clinical Microbiology and Infectious Diseases, Milan, Italy, May 7-10, 2011.

A. Versporten, S. Coenen, N. Adriaenssens, H. Goossens, and the ESAC Ambulatory Care Project Group. *European Surveillance of Antimicrobial Consumption (ESAC): outpatient antibiotic use in children and teenagers in Europe.* 21st European Congress of Clinical Microbiology and Infectious Diseases, Milan, Italy, May 7-10, 2011.

M. Rummukainen, O. Lyytikäinen, T. Kärki, M. Kanerva, M. Haapasaari, J. Ollgren, B. Jans, A. Muller, H. Goossens on behalf of the European Surveillance of Antimicrobial Consumption (ESAC) project group. *Repeated Point Prevalence Surveys on Antimicrobial Prescriptions in Finnish Nursing Homes, 2009-2010.* 21st European Congress of Clinical Microbiology and Infectious Diseases, Milan, Italy, May 7-10, 2011.

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N. Adriaenssens, S. Coenen, A. Versporten, A. Muller, P. Zarb, H. Goossens, and the ESAC Project Group. *European Surveillance of Antimicrobial Consumption: trends in systemic azole consumption in hospital care in Europe.* 21st European Congress of Clinical Microbiology and Infectious Diseases, Milan, Italy, May 7-10, 2011.

Reports

P. Zarb, A. Muller, B. Amadeo and the ESAC management team: *Report on Point Prevalence Survey of antimicrobial prescribing in European hospitals*, 2009.

E. Broex, B. Jans, K. Latour, H. Goossens, and the ESAC management team. *Results from the national survey of the characteristics of nursing homes*. ISBN Number: 9789057283017 Deposit number: D/2010/12.293/14. IPH/Epi-report number: 2010-049, 2010.

B. Jans, K. Latour, E. Broex, H. Goossens, and the ESAC management team. *Report on point prevalence survey of antimicrobial prescription in European nursing homes*, 2009. ISBN Number: 9789057283031 Deposit number: D/2010/12.293/16. IPH/EPI-report number: 2010-052, 2010.

E. Broex, B. Jans, and K. Latour. *European Surveillance of Antimicrobial Consumption (ESAC) Report on point prevalence survey of antimicrobial consumption in European nursing homes. November 2009*. ESAC-3: Nursing home subproject group. ISBN Number:9789057283123 Deposit number D/2011/2505/01, IPH/EPI-report number: 2011-01.

B. Jans, K. Latour, and E. Broex. *Het antibioticumvoorschrift in Woonzorgcentra in België: resultaten van de ESAC Nursing Home studie: april 2009*. Deposit number: D/2010/2505/67, IPH/EPI-report number 2010-058.

B. Jans, K. Latour, and E. Broex. *La prescription d'antibiotiques en Maison de repos et de soins en Belgique: résultats de l'étude ESAC - Maisons de Repos, avril 2009*. Deposit number: D/2010/2505/68, IPH/EPI-report number 2010-059.

N. Adriaenssens, S. Coenen on behalf of the ESAC Management Team. *Disease-specific antibiotic prescribing quality indicators repor*t. 10 September 2010.

Website

The ESAC website is accessible through the following link: http://www.esac.ua.ac.be.

The ESAC website contains 3 parts:

- An area for general information about the ESAC project.
- An area for the dissemination of results and knowledge.
- A password-protected area for the internal management of ESAC.

The electronic library (e-library):
ESAC publications as well as related publications and projects can be found here. Interestingly, all National Networks can add relevant article and projects on the E-library. Please note that the library is however not a subject of scientific review.

The public pages:
Public pages for lay people and the press were created on the ESAC website. For each of the countries participating in ESAC the following items can be consulted in the country's native languages:

- ESAC
  - What is ESAC?
  - Why ESAC?
  - Who to contact in your country?
- Antibiotics
  - Drugs?
  - Bugs
- Consumption antibiotics
  - In Europe
  - In your country
  - Defined Daily Dose
- Resistance antibiotics
  - What is resistance
  - What are the consequences
- Useful links

Figure 5.1: Screenshot of the ESAC homepage

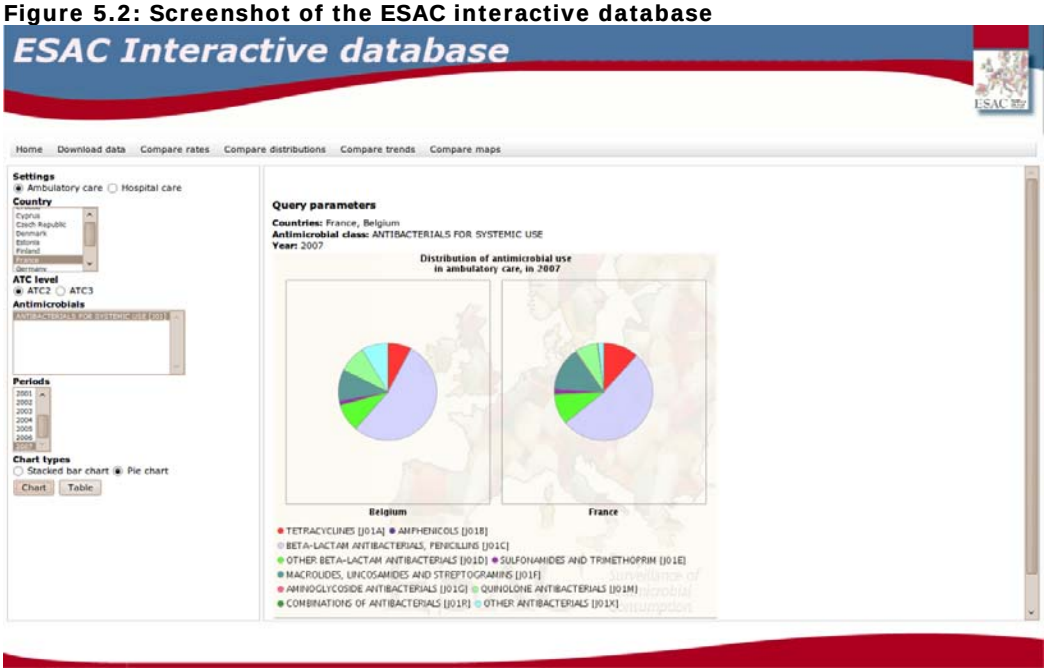
Interactive database

A new, easier to use interactive database containing ESAC data on antibiotics for the participating European countries has been released on our website. You can explore the database in 4 ways:

1. By comparing countries for one year
2. By comparing yearly trends for one country
3. By visualing maps of Europe
4. New: drug-specific quality indicators

The interactive database was updated with 2009 data.

Figure 5.2: Screenshot of the ESAC interactive database



As from July 1, 2011 the ESAC website will be taken over by ECDC. The current ESAC website will be re-directed to the ECDC portal.

Newsletter

The first ESAC Newsletter was available as of February 2008 and the most recent newsletter dates from May 2011. In each of the newsletters 4 of the National Networks present themselves and news on the core data and/or the subprojects is presented. Upcoming events are announced and previous events such as congresses are discussed. In the May 2011 newsletter, results from the different subprojects were published as well as an overview of the ESAC activities at the 21st European Congress of Clinical Microbiology and Infectious Diseases and the ESAC poster presenting the 2009 core data. The newsletter is made available 3 times per year.

A PDF version of the ESAC Newsletters can be downloaded from the ESAC website (http://www.esac.ua.ac.be).

CHAPTER 6. CONCLUSIONS AND FUTURE OBJECTIVES

ESAC successfully collected 2006, 2007, 2008 and 2009 consumption data on antimicrobials for systemic use (ATC group J01), antimycotics for systemic use (ATC group J02) and additional specific substances in 32 out of the 35 participating countries. These data have been instrumental for instance to evaluate the impact of awareness campaigns in EU Member States, such as Belgium and France, and will be crucial to monitor the impact of the EU Antibiotic Awareness Day in November, 2011. Additionally, the ESAC project aimed to deepen the knowledge of antibiotic consumption by focusing on specific consumption groups and/or patterns (Nursing Homes, Hospital Care, and Ambulatory Care) in collaboration with those countries where the appropriate data were available.

The AC subproject has 4 components. 1) Protocol A: linking age, gender and prescriber's specialtity. The information from Protocol A was valuable to evaluate the effect of the first European Antibiotic Awareness Day, which focused on antibiotic use in children, antibiotic use data expressed in DID which was linked to the patient's age, and if information on age was missing, was complemented with use data expressed in PID. Applying this methodology, the 2008 EAAD appeared to have been a success. 2) Protocol B: linking age, gender and indication. A collaboration was been set-up with the EU-project APRES to obtain this type of data. By the end of 2011, nine European countries will try to deliver data using a protocol similar to that of our protocol B. 3) Protocol assessing the quality of 12 indicators. In collaboration with the EU-project HAPPY AUDIT a proposed set of 7 QIs was scored as relevant for 7 dimensions. A paper on this work was accepted for publication in BMJ Quality & Safety. 4) Guidelines on otitis media, sore throat, sinusitis and lower respiratory tract infections were set-up in collaboration with the EU-project CHAMP. For guidelines on urinary tract infections skin and soft tissue infections, expertise was requested from the ESAC NNs and collaboration with APRES was set-up.

Twenty-eight European countries participated in the ESAC Hospital Care (HC). The HC subproject also has 4 components. 1) Point Prevalence Survey (PPS) in 2008 which was conducted in 50 hospitals from 28 European countries, 2) PPS in 2009 in 172 hospitals from 25 countries. The PPS 2008 and 2009 were conducted using the ESAC Web-PPS tool which was developed for data entry and automated data analysis. The PPS 2008 and PPS2009 reports have been published and decribed the relationship between prescribed antimicrobials, dose, site of infection, and indication at patient level. Also, each of the participating hospitals can consult their results by accessing their online report on the web-PPS website (until the end of June 2011). 3) 4-year Longitudinal Survey (LS) was conducted in 23 hospitals from PPS 2008 hospitals. The analysis of the results is still in progress at the time of print. 4) Basic hospital statistics. The aim is to define a standard dataset that should be considered in comparing antibiotic use. The ESAC Hospital Questionnaire is designed to collect information on hospital characteristics.

Twenty European countries participated in the ESAC Nursing Home (NH) subproject. The NH-subproject has 2 components. The first component (September 2008) was a descriptive study of the characteristics (structural, functional) of high skilled NHs and the regulating mechanisms concerning antibiotic use and infection control in these facilities in European countries. The results were presented in the ESAC 2007 yearbook. The second component concerned the organisation of 2 consecutive Point Prevalence Surveys (PPS) on antibiotic use in at least 5 high skilled NHs per country, one in April 2009 and the second in October 2009. The results from PPS1 and PPS2 were comparable. Half of all AB treatments in NHs targeted the urinary tract. In many countries an important volume of urophophylaxis is prescribed, which increases the risk for inappropriate treatment of UTIs.

The EC subproject has a single component: to construct a database on potential contextual determinants of antimicrobial consumption. Through the use of global databases (including Eurostat, OECD, WHO) and a LNR survey this database was constructed. Differences in overall antibiotic use over countries and years appeared to be determined by education, organization of the healthcare system and resistance. Also, a survey was performed on the price of antibiotics using local sources.

A JAC supplement on the core data and a special ESAC report will be published on more than 10 years of ESAC. As from July 1, 2011 the ESAC project will be transferred to ECDC and will continue as ESAC-Net.

ANNEX I: COUNTRY SHEETS

The country sheets presented in this section provide specific information on antimicrobial use for each of the reporting countries.

The country sheets are divided into four sections.

1) The first section presents information on the source and type of data reported by the participating countries as well as the population data used to report the antimicrobial consumption.
    a. Antimicrobial use data:
    Type of health care sector for which data are reported: ambulatory care / hospital care or total care.
    Type of consumption data: sales data or reimbursement data from health insurance systems.
    The coverage (in percentage) of the data: representativeness of the data reported in ESAC.
    Source of the consumption data: public or private.
    b. Population data:
    For comparison reasons, consumption data is reported in numbers of DDDs per 1000 inhabitants and per day (DID). ESAC uses the WHO population except when this population is not relevant, i.e. when using insurance data.
2) The second section presents the consumption of antimicrobials for systemic use (ATC class J01) split into 7 major classes based on the ATC classification. Several Tables and Figures are shown:
    a. A table presenting the data expressed in DDD per 1000 inhabitants per day (DID) for each of the health care sectors for which data are reported.
    b. For ambulatory care, two figures are shown:
        - A pie plot presenting the distribution of the relative consumption of the 7 classes
        - A bar plot presenting the trends of consumption of the 7 classes from 1998 to 2009
    c. For hospital care, one figure is shown:
        - A pie plot presenting the distribution of the relative consumption of the 7 classes
3) The third section presents the consumption of the major antimycotics for systemic use (ATC class J02). Data are presented in two ways:
    a. A table presenting the data expressed in DDD per 1000 inhabitants per day (DID) for each of the health care sectors for which data are reported.
    b. A figure presenting the distribution of the relative consumption of each of the major antimycotics for systemic use for each of the health care sectors for which data are reported.
4) The fourth section presents a comment on the antimicrobial consumption in order to facilitate interpretation. The National Networks provided general comments about the antimicrobial use in their respective countries whereas the Management Team added, when required, technical comments about the presentation of the data. The comments made by the National Networks and those made by the Management Team are preceeded respectively by National Networks and Management Team.

Reported data split by health care sectors for each of the participating countries for the year 2009

Country	Ambulatory care (N=30)	Hospital care (N=20)	Total care (N=2)
Austria	✓		
Belgium	✓		
Bulgaria	✓	✓	
Croatia	✓	✓	
Cyprus			✓
Czech Republic	✓		
Denmark	✓	✓	
Estonia	✓	✓	
Finland	✓	✓	
France	✓	✓	
Germany	✓		
Greece	✓	✓	
Hungary	✓	✓	
Iceland	✓		
Ireland	✓	✓	
Israel	✓	✓	
Italy	✓		
Latvia	✓	✓	
Lithuania			✓
Luxembourg	✓	✓	
Malta	✓	✓	
Netherlands	✓		
Norway	✓	✓	
Poland	✓		
Portugal	✓	✓	
Romania	✓	✓	
Russian Federation	✓	✓	
Slovakia	✓	✓	
Slovenia	✓	✓	
Spain	✓		
Sweden	✓	✓	
United Kingdom	✓		

Health care sector	Data type	Coverage	Data source
Ambulatory care	Reimbursement	100%	Health Insurance Company

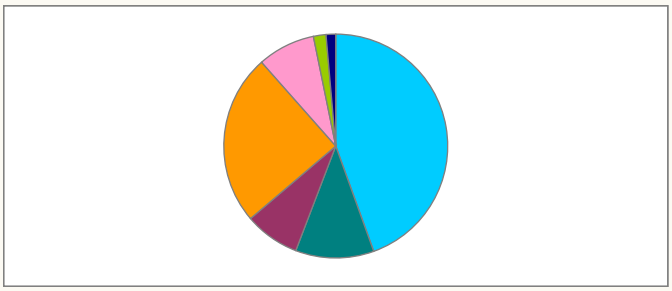
Population	Data source
8.368.842	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

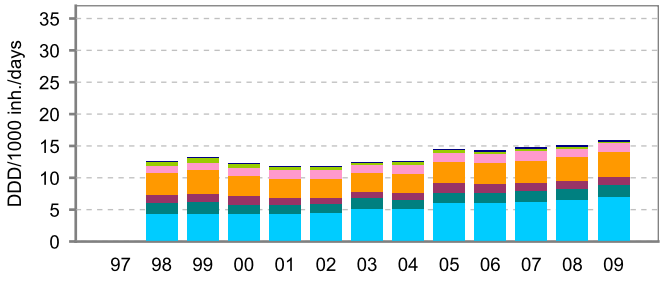
J01 classes	Ambulatory care
Beta-lactam antibacterials, penicillins (J01C)	7,09
Other beta-lactam antibacterials (J01D)	1,80
Tetracyclines (J01A)	1,27
Macrolides, lincosamides and streptogramins (J01F)	3,93
Quinolone antibacterials (J01M)	1,33
Sulfonamides and trimethoprim (J01E)	0,29
Other J01 substances	0,22
Total J01 classes	***15,93***

Distribution of J01 classes in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector

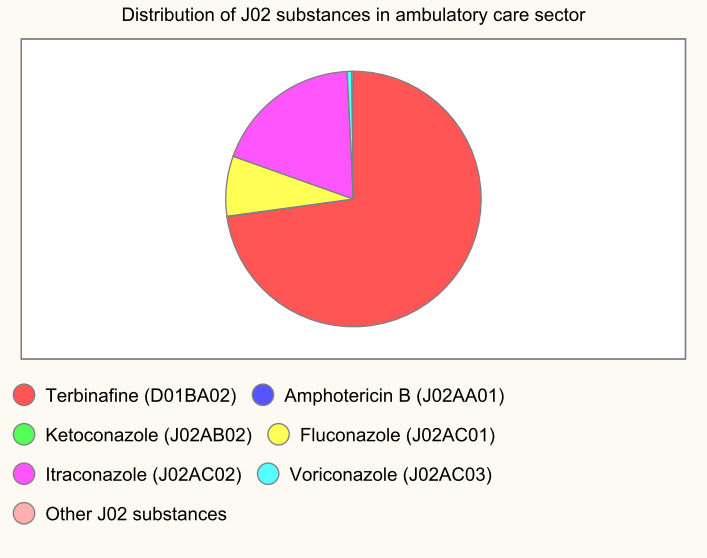


Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care
Terbinafine (D01BA02)	0,71
Amphotericin B (J02AA01)	<0.01
Ketoconazole (J02AB02)	0.00
Fluconazole (J02AC01)	0,07
Itraconazole (J02AC02)	0,18
Voriconazole (J02AC03)	<0.01
Other J02 substances	<0.01
Total J02 substances	***0,98***



Comments

National Network: The overall consumption is slowly raising during the last years in most of the AB groups especially in Penicillins. Cephalosporins were undulant over the years with a small increase since 2008. Macrolides, lincosamides and streptogramins reached the highest level in the last 12 years. The consumption of quinolones remained at a similar level as 2008. The decrease of sulfonamides and trimethoprim still continues. They have lost the importance of earlier years.

Health care sector	Data type	Coverage	Data source
Ambulatory care	Reimbursement	98%	Health Insurance Company

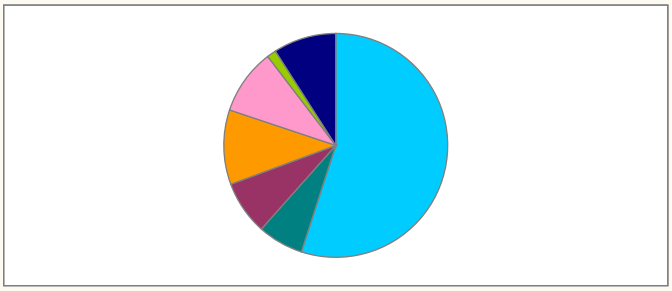
Population	Data source
10.646.804	Eurostat

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

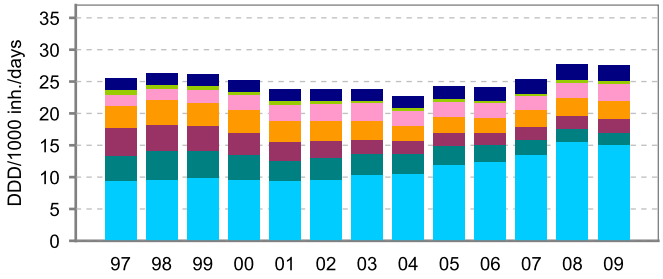
J01 classes	Ambulatory care
Beta-lactam antibacterials, penicillins (J01C)	15,13
Other beta-lactam antibacterials (J01D)	1,82
Tetracyclines (J01A)	2,14
Macrolides, lincosamides and streptogramins (J01F)	2,96
Quinolone antibacterials (J01M)	2,61
Sulfonamides and trimethoprim (J01E)	0,37
Other J01 substances	2,49
Total J01 classes	***27,52***

Distribution of J01 classes in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector

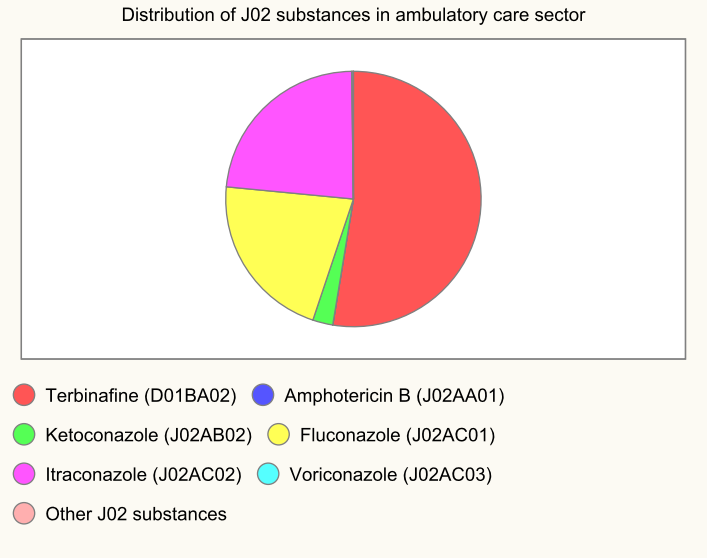


Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care
Terbinafine (D01BA02)	1,71
Amphotericin B (J02AA01)	<0.01
Ketoconazole (J02AB02)	0,08
Fluconazole (J02AC01)	0,69
Itraconazole (J02AC02)	0,75
Voriconazole (J02AC03)	<0.01
Other J02 substances	<0.01
Total J02 substances	***3,24***



Comments

National Network: In Belgium, antimicrobials for systemic use in human medicine are prescription-only medicines and sold by pharmacies. Data on Belgian consumption are reimbursement data provided by the National Institute of Insurance for Illness and Invalidity (RIZIV/INAMI). The population covered has been extended in 2008 to approximately 98%, which partially explains the rise in consumption that was seen that year. In comparison with 2008, 2009 shows a decrease of total DDD used in ambulatory care. Proportionally the largest decrease is seen for cephalosporins, while in absolute numbers the largest decrease is seen for penicillins. This is somewhat balanced by an increase in the use of quinolones, and the group of macrolides, lincosamides and other antibacterials (J01X). Belgian antibiotic guides for ambulatory care were released by the Belgian Antibiotic Policy Coordination Committee (BAPCOC) in 2006 and 2008 to encourage rational antibiotic use. In 2009 Belgium repeated a public campaign focusing on antibiotic use in children, the ninth campaign since the start in winter 2000-2001. The November issue of the Belgian centre for information on drugs (BCFI/CBIP) also focused on the rational use of antibiotics in treating acute respiratory infections in primary care. Overall antimycotic and antifungal use (J02, D01B) decreased by about 1.5%. Most used substances remain terbinafine (53%), itraconazole (23%) and fluconazole (21%). Although voriconazole (J02AC03) continues to be very infrequently used, the increase in percentage (26%) is interesting.

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	Marketing Research Company
Ambulatory care	Sales	100%	Marketing Research Company

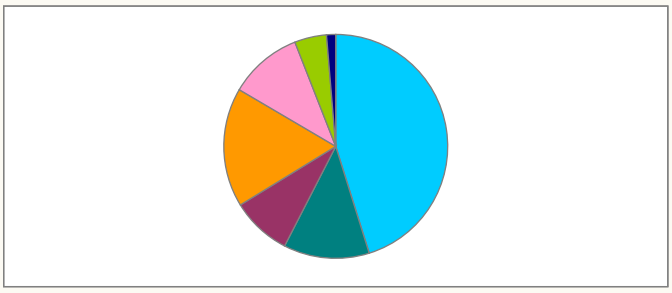
Population	Data source
7.563.710	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

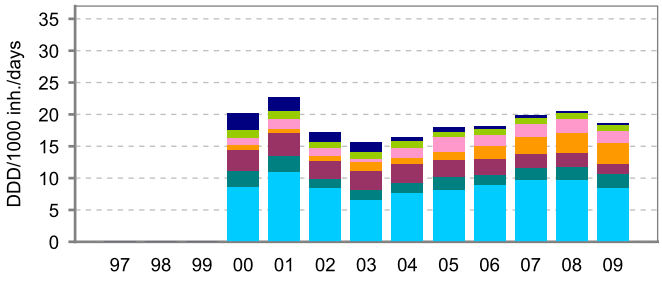
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	8,40	0,35
Other beta-lactam antibacterials (J01D)	2,30	0,70
Tetracyclines (J01A)	1,62	0,03
Macrolides, lincosamides and streptogramins (J01F)	3,20	0,14
Quinolone antibacterials (J01M)	1,97	0,12
Sulfonamides and trimethoprim (J01E)	0,86	0,01
Other J01 substances	0,25	0,23
Total J01 classes	***18,59***	***1,58***

Distribution of J01 classes in ambulatory care sector



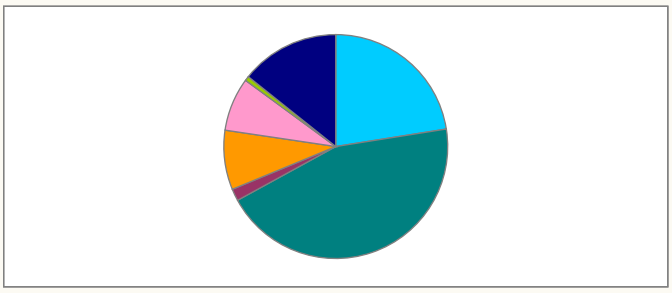
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



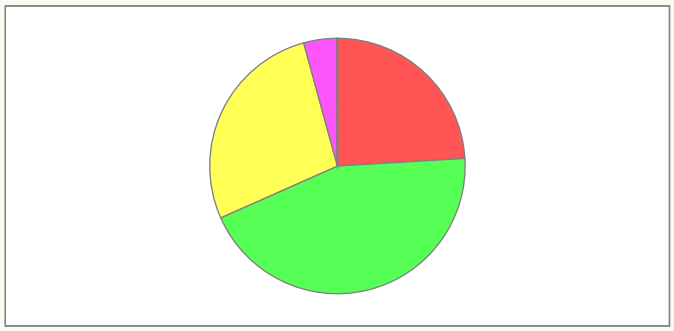
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

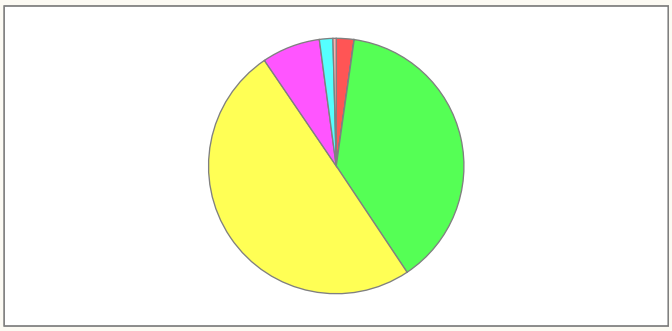
J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0,20	<0.01
Amphotericin B (J02AA01)	0.00	<0.01
Ketoconazole (J02AB02)	0,36	0,02
Fluconazole (J02AC01)	0,23	0,02
Itraconazole (J02AC02)	0,03	<0.01
Voriconazole (J02AC03)	<0.01	<0.01
Other J02 substances	<0.01	<0.01
Total J02 substances	***0,82***	***0,04***

Distribution of J02 substances in ambulatory care sector



Terbinafine (D01BA02) Amphotericin B (J02AA01)
Ketoconazole (J02AB02) Fluconazole (J02AC01)
Itraconazole (J02AC02) Voriconazole (J02AC03)
Other J02 substances

Distribution of J02 substances in hospital care sector



Terbinafine (D01BA02) Amphotericin B (J02AA01)
Ketoconazole (J02AB02) Fluconazole (J02AC01)
Itraconazole (J02AC02) Voriconazole (J02AC03)
Other J02 substances

Comments

National Network: Data on use of systemic antimicrobials in Bulgaria are obtained from two different sources over the years. In the period 1999–2004 a data provider is the State Medicines Agency (BDA) and all figures correspond to TC consumption of antibiotics. From 2005 to 2009 data are derived from a Marketing Research Company (IMS) and collected separately for AC and HC. The overall antibiotic consumption in Bulgaria fluctuates in the borders of 15 to 22 DIDs where the percentage of DIDs prescribed in AC amounts to 92 – 93%. In 2009 penicillins (mainly amoxicillin and amoxicillin with clavulanic acid) represented 45% of total use in AC. Other frequently used antibiotics were macrolides (mainly clarithromycin and azithromycin), cephalosporins (mainly cefuroxime) and fluoroquinolones (essentially ciprofloxacin), each representing 17%, 12% and 11% of the total use respectively. The consumption of tetracyclines decreased gradually more than twice in the past years while the consumption of sulfamethoxazole with trimethoprim remained almost constant. The overall consumption in HC increased with 2% from 2008. Over the past five years the main drugs prescribed in Bulgarian hospitals were cephalosporins (mainly cefuroxime and ceftriaxone, as well the combination of cefoperazone with sulbactam) and combinations of penicillins with beta-lactamase inhibitors. They represented 44% and 10% of total use in HC in 2009. Other extensively used antibiotics in HC sector were aminoglycosides, macrolides/lincosamides, and fluoroquinolones, each representing 10%, 9% and 8% of the total use respectively.

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	Marketing Research Company
Ambulatory care	Sales	100%	Marketing Research Company

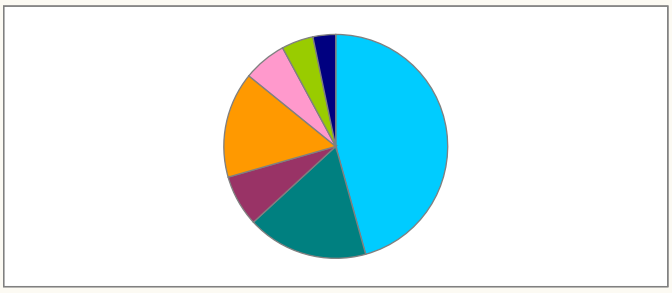
Population	Data source
4.555.219	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

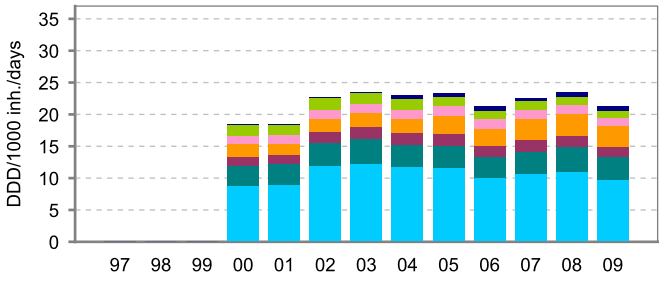
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	9,69	0,28
Other beta-lactam antibacterials (J01D)	3,70	0,39
Tetracyclines (J01A)	1,57	0,06
Macrolides, lincosamides and streptogramins (J01F)	3,24	0,12
Quinolone antibacterials (J01M)	1,33	0,21
Sulfonamides and trimethoprim (J01E)	0,98	0,06
Other J01 substances	0,70	0,21
Total J01 classes	***21,21***	***1,32***

Distribution of J01 classes in ambulatory care sector



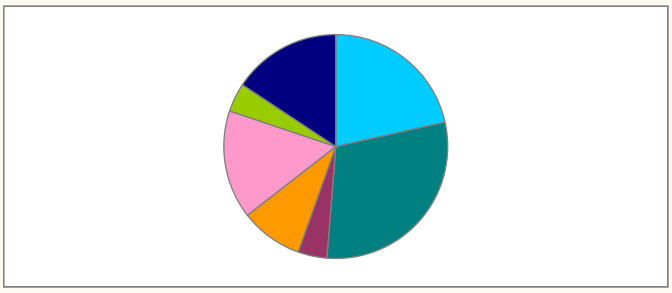
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



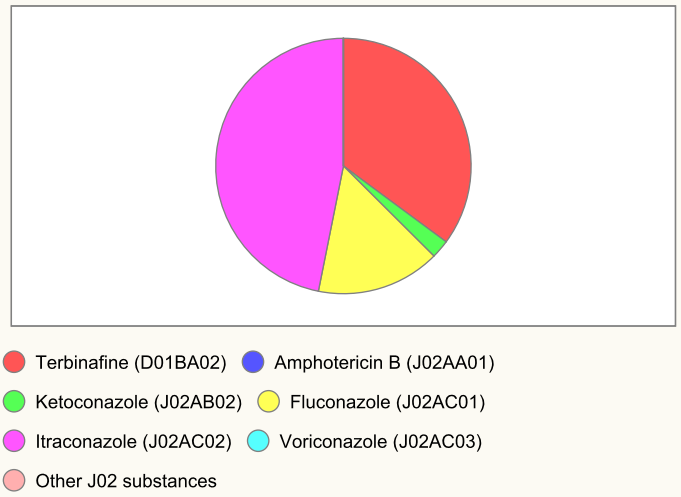
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

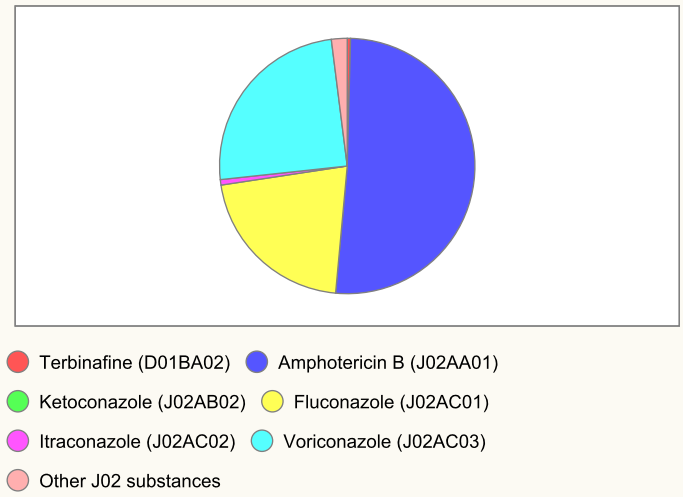
Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0,14	<0.01
Amphotericin B (J02AA01)	0.00	0,06
Ketoconazole (J02AB02)	<0.01	0.00
Fluconazole (J02AC01)	0,06	0,03
Itraconazole (J02AC02)	0,19	<0.01
Voriconazole (J02AC03)	<0.01	0,03
Other J02 substances	<0.01	<0.01
Total J02 substances	***0,41***	***0,12***

Distribution of J02 substances in ambulatory care sector



Distribution of J02 substances in hospital care sector



Comments

National Network: For many years the most widely used antibiotic in ambulatory care in Croatia is co-amoxiclav followed by amoxicillin. In 2009 the total antibiotic use in ambulatory care decreased, mostly due to the decrease in the consumption of co-amoxiclav, amoxicillin and the fluoroquinolones. However, consumption of oral 3rd generation cephalosporins increased. We hope that the national guidelines on sore throat that were launched in 2009 will contribute to the further reduction in antibiotic use and a switch toward narrow spectrum penicillins. We recorded a decrease in hospital consumption for almost all antibiotic classes although data for hospital specific antibiotics like carbapenems and glycopeptides are not sensitive enough to demonstrate shifts in consumption.

Health care sector	Data type	Coverage	Data source
Total care	Sales	100%	Ministry of Health

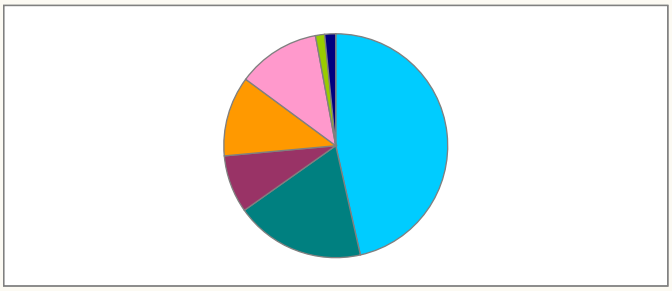
Population	Data source
803.100	National Institute for Statistics

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

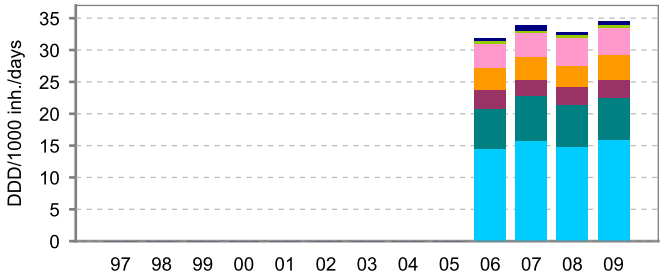
J01 classes	Total care
Beta-lactam antibacterials, penicillins (J01C)	16,01
Other beta-lactam antibacterials (J01D)	6,45
Tetracyclines (J01A)	2,87
Macrolides, lincosamides and streptogramins (J01F)	3,98
Quinolone antibacterials (J01M)	4,13
Sulfonamides and trimethoprim (J01E)	0,46
Other J01 substances	0,55
Total J01 classes	***34,45***

Distribution of J01 classes in total care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in total care sector

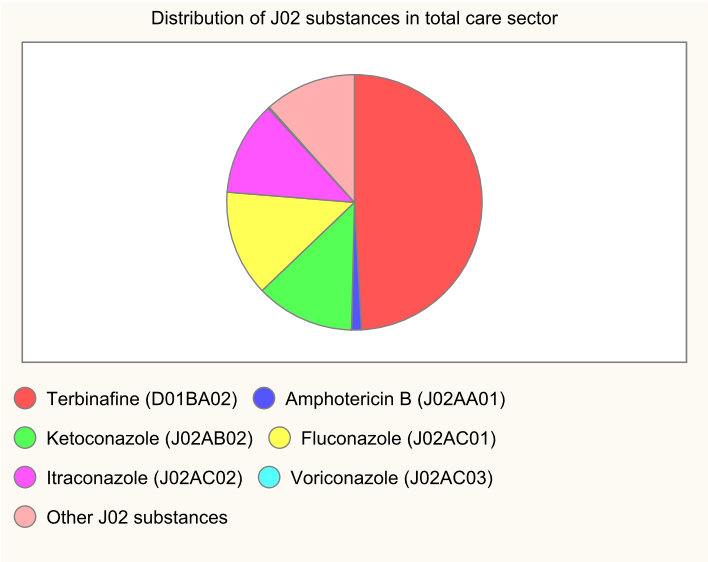


Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Total care
Terbinafine (D01BA02)	1,02
Amphotericin B (J02AA01)	0,03
Ketoconazole (J02AB02)	0,26
Fluconazole (J02AC01)	0,28
Itraconazole (J02AC02)	0,25
Voriconazole (J02AC03)	<0.01
Other J02 substances	0,24
Total J02 substances	***2,09***



Comments

National Network: Cyprus has joined the ESAC project since 2006 providing antibiotic consumption data which represents the total consumption (ambulatory and hospital care). Data are collected by Pharmaceutical Services, Ministry of Health and include the consumption in both private and public sectors, and cover 100% of the total antibiotic use. The data for the private sector cover sales in private pharmacies whereas data for public sector cover distribution from central pharmaceutical stores to governmental pharmacies. Approximately 75% of the total antibiotic use takes place in the private sector where the ambulatory care predominates. This can be attributed to the greater access to antibiotics in terms of number of products available in the private sector compared to the public sector. The most often prescribed antibiotic group are beta-lactam antibacterials (J01C, J01D) which represent 65% of the total antibiotic use. Our data reveal relatively high antibiotic consumption in comparison with other countries. Temporal changes in J01 consumption document a slight increasing trend, constantly observed for beta-lactam antibacterials (J01C), Quinolones (J01MA) and Macrolides (J01FA). In practice, Amoxicillin and enzyme inhibitor, Ciprofloxacin, Levofloxacin, Azithromycin Clarithromycin represent the most used substances.

Health care sector	Data type	Coverage	Data source
Ambulatory care	Reimbursement	100%	Health Insurance Company

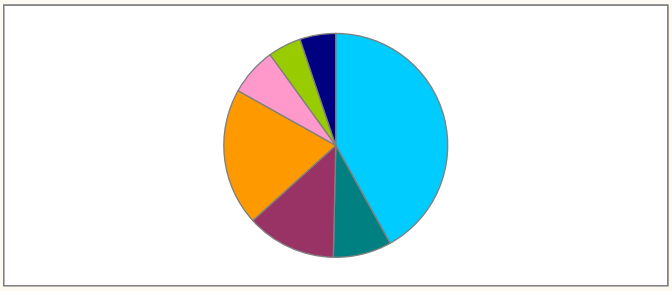
Population	Data source
10.368.944	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

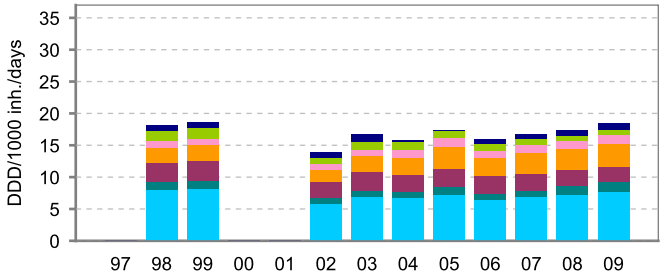
J01 classes	Ambulatory care
Beta-lactam antibacterials, penicillins (J01C)	7,73
Other beta-lactam antibacterials (J01D)	1,55
Tetracyclines (J01A)	2,39
Macrolides, lincosamides and streptogramins (J01F)	3,66
Quinolone antibacterials (J01M)	1,27
Sulfonamides and trimethoprim (J01E)	0,89
Other J01 substances	0,95
Total J01 classes	***18,44***

Distribution of J01 classes in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector

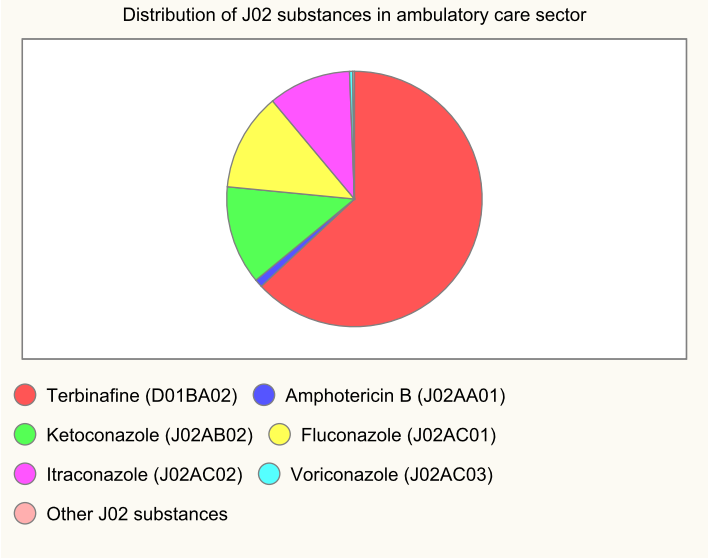


Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care
Terbinafine (D01BA02)	0,60
Amphotericin B (J02AA01)	<0.01
Ketoconazole (J02AB02)	0,12
Fluconazole (J02AC01)	0,12
Itraconazole (J02AC02)	0,10
Voriconazole (J02AC03)	<0.01
Other J02 substances	<0.01
Total J02 substances	***0,95***



Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	Medicines Agency
Ambulatory care	Sales	100%	Medicines Agency

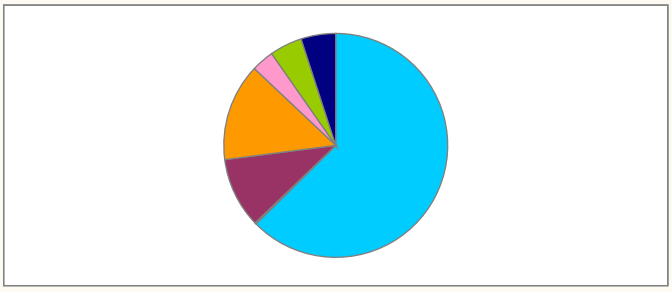
Population	Data source
5.511.451	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

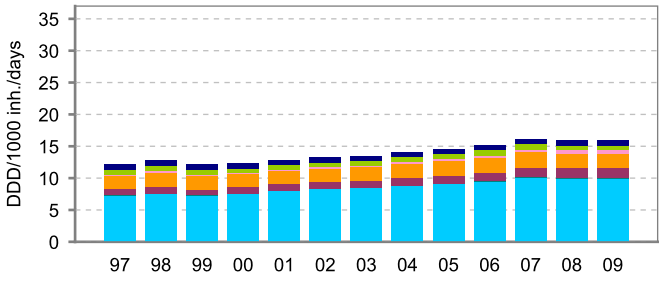
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	10,00	0,87
Other beta-lactam antibacterials (J01D)	0,03	0,36
Tetracyclines (J01A)	1,62	0,03
Macrolides, lincosamides and streptogramins (J01F)	2,25	0,09
Quinolone antibacterials (J01M)	0,52	0,24
Sulfonamides and trimethoprim (J01E)	0,75	0,07
Other J01 substances	0,80	0,17
Total J01 classes	***15,97***	***1,83***

Distribution of J01 classes in ambulatory care sector



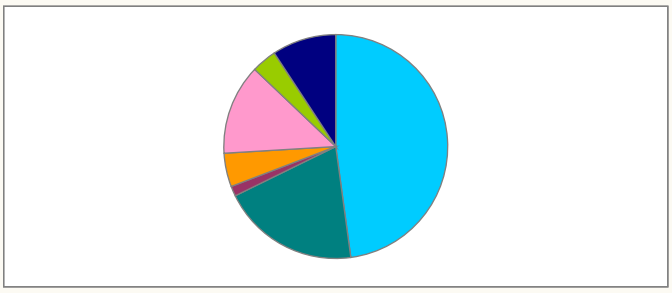
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



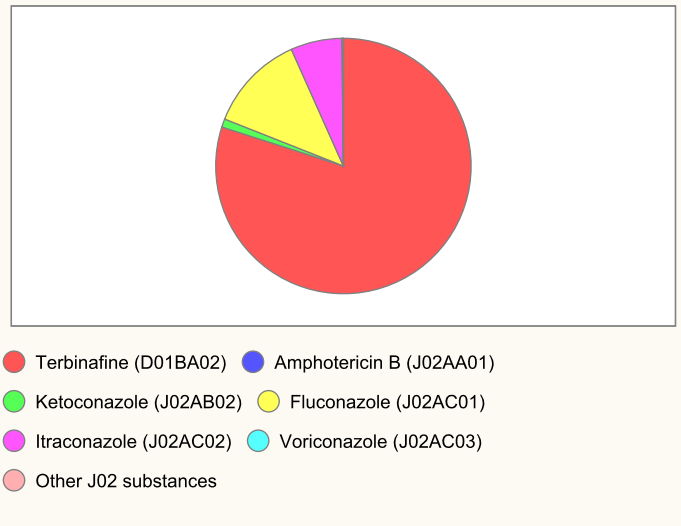
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

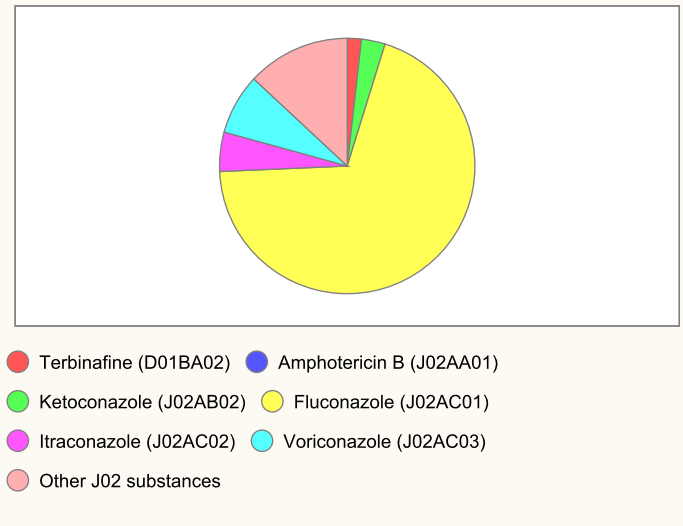
Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	1,96	<0.01
Amphotericin B (J02AA01)	0.00	0.00
Ketoconazole (J02AB02)	0,03	<0.01
Fluconazole (J02AC01)	0,30	0,14
Itraconazole (J02AC02)	0,16	<0.01
Voriconazole (J02AC03)	<0.01	0,01
Other J02 substances	<0.01	0,03
Total J02 substances	***2,45***	***0,20***

Distribution of J02 substances in ambulatory care sector



Distribution of J02 substances in hospital care sector



Comments

National Network: In Denmark, all antimicrobial agents for human use are prescription-only medicines and are sold by pharmacies in defined packages. Data on Danish drug use is obtained from the Danish Medicines Agency (DMA). In ambulatory care, the overall sales of antimicrobial agents have increased over the last ten years and are still characterised by the use of narrow-spectrum antimicrobial agents. In 2009, the overall consumption reached the same level as the two presiding years indicating that the increasing trend has levelled off. This year, most interestingly a decreasing use of beta-lactamase sensitive penicillins (0.18 DID) has been replaced by a similar increasing use of combinations of penicillins, including beta-lactamase inhibitors (0.18 DID). The percentage of DDDs prescribed in ambulatory care has remained stable at 90% for many years. The use of antimicrobial agents in hospitals has increased. Overall consumption (J01) in hospitals increased by 5% from 2008 when expressed in DDD/100 occupied bed-days. In hospitals the use of broad-spectrum antimicrobial agents is increasing (e.g. tetracyclines; combinations of penicillins. incl. beta-lactamase inhibitors; cephalosporins; carbapenems and fluoroquinolones) while the use of older more traditional agents is decreasing (e.g. beta-lactamase sensitive penicillins; aminoglycosides and imidazole derivatives).

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	Medicines Agency
Ambulatory care	Sales	100%	Medicines Agency

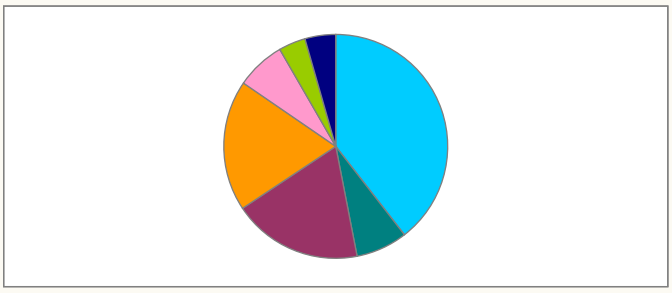
Population	Data source
1.340.415	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

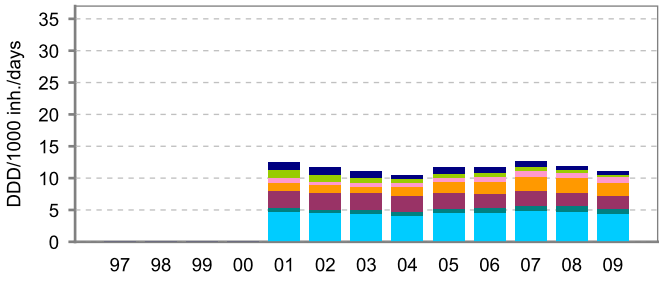
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	4,37	0,54
Other beta-lactam antibacterials (J01D)	0,83	0,43
Tetracyclines (J01A)	2,07	0,10
Macrolides, lincosamides and streptogramins (J01F)	2,09	0,12
Quinolone antibacterials (J01M)	0,79	0,25
Sulfonamides and trimethoprim (J01E)	0,43	0,05
Other J01 substances	0,49	0,15
Total J01 classes	***11,07***	***1,64***

Distribution of J01 classes in ambulatory care sector



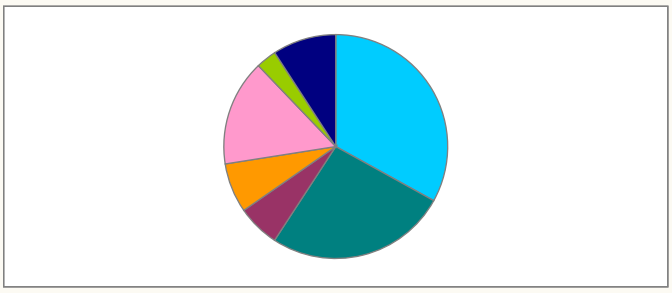
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



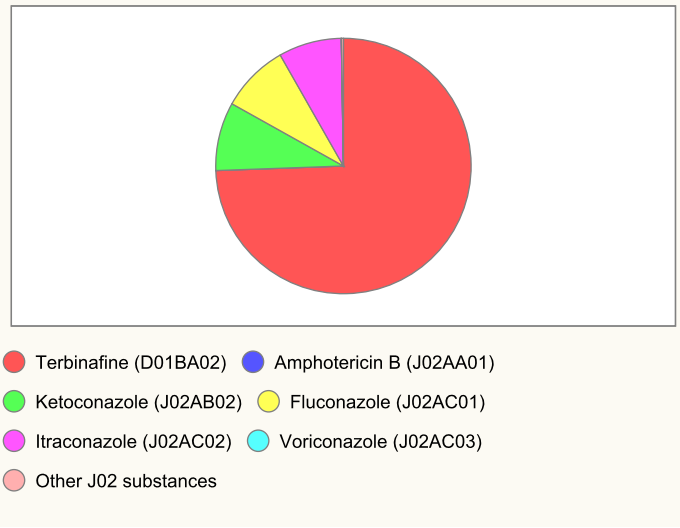
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

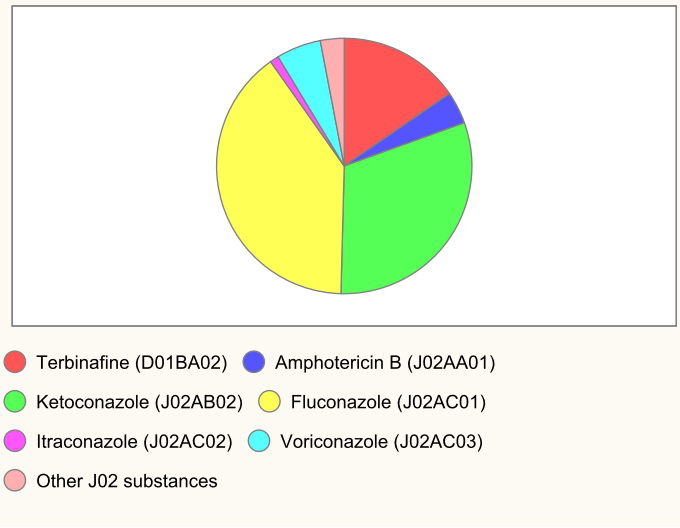
Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0,92	<0.01
Amphotericin B (J02AA01)	<0.01	<0.01
Ketoconazole (J02AB02)	0,11	0,01
Fluconazole (J02AC01)	0,11	0,02
Itraconazole (J02AC02)	0,10	<0.01
Voriconazole (J02AC03)	<0.01	<0.01
Other J02 substances	<0.01	<0.01
Total J02 substances	***1,23***	***0,05***

Distribution of J02 substances in ambulatory care sector



Distribution of J02 substances in hospital care sector



Comments

National Network: The use of antibiotics has been quite low and stable in Estonia over the past ten years if compared to the other European countries. During the last two years the total consumption has decreased about 6% per year and was 13 DDD/1000 inhabitants/day in 2009. The use of antibiotics of all groups decreased in 2009. Penicillins are the most commonly used antibiotics - both in ambulatory and hospital care. In ambulatory care the use of penicillins was almost 40% of total consumption in 2009. Mainly extended spectrum penicillins were used. Other more often used antibiotics were macrolides and lincosamides and tetracyclines. In hospitals the use of penicillins was 33% of total and cephalosporins were the antibiotics of second choice– about 25% of total use. Quinolones were also used more than other antibiotics in hospital care.

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	Medicines Agency
Ambulatory care	Sales	100%	Medicines Agency

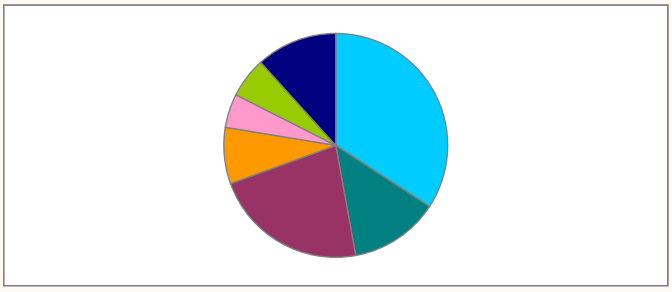
Population	Data source
5.351.347	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

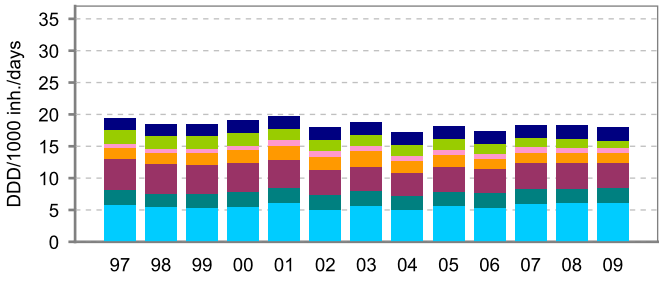
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	6,14	0,64
Other beta-lactam antibacterials (J01D)	2,33	0,98
Tetracyclines (J01A)	4,01	0,24
Macrolides, lincosamides and streptogramins (J01F)	1,46	0,17
Quinolone antibacterials (J01M)	0,87	0,38
Sulfonamides and trimethoprim (J01E)	1,05	0,15
Other J01 substances	2,10	0,61
Total J01 classes	***17,96***	***3,17***

Distribution of J01 classes in ambulatory care sector



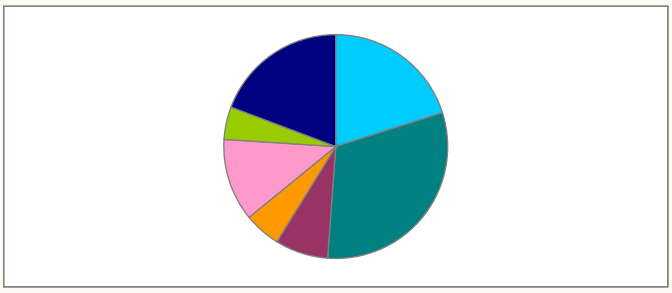
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



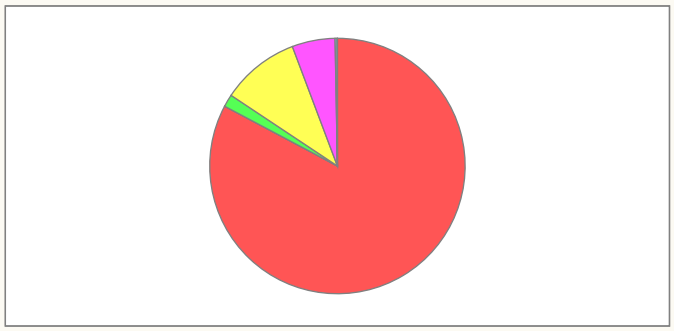
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

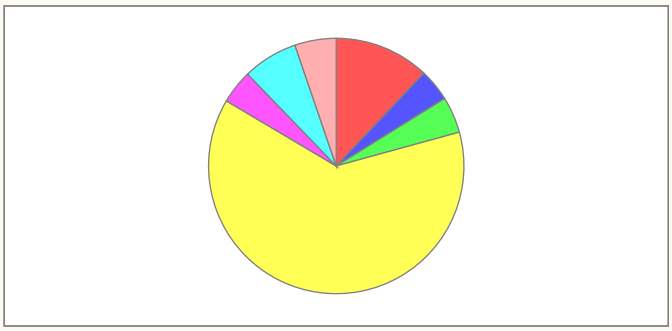
J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	1,50	0,02
Amphotericin B (J02AA01)	<0.01	<0.01
Ketoconazole (J02AB02)	0,03	<0.01
Fluconazole (J02AC01)	0,18	0,08
Itraconazole (J02AC02)	0,10	<0.01
Voriconazole (J02AC03)	<0.01	<0.01
Other J02 substances	<0.01	<0.01
Total J02 substances	***1,82***	***0,13***

Distribution of J02 substances in ambulatory care sector



Terbinafine (D01BA02) Amphotericin B (J02AA01)
Ketoconazole (J02AB02) Fluconazole (J02AC01)
Itraconazole (J02AC02) Voriconazole (J02AC03)
Other J02 substances

Distribution of J02 substances in hospital care sector



Terbinafine (D01BA02) Amphotericin B (J02AA01)
Ketoconazole (J02AB02) Fluconazole (J02AC01)
Itraconazole (J02AC02) Voriconazole (J02AC03)
Other J02 substances

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	Medicines Agency
Ambulatory care	Sales	100%	Medicines Agency

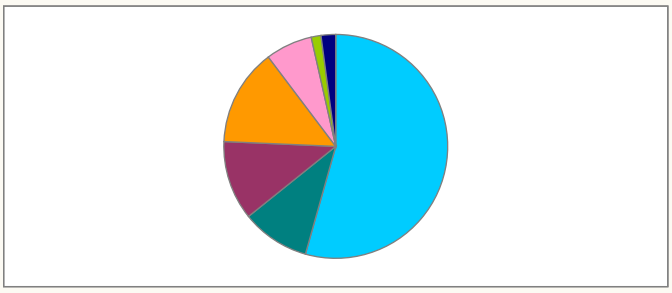
Population	Data source
64.494.000	National Institute for Statistics

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

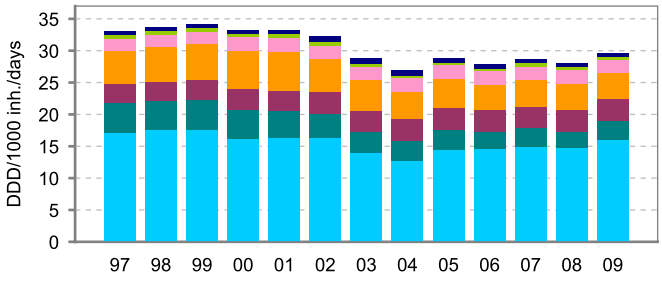
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	16,08	1,23
Other beta-lactam antibacterials (J01D)	2,92	0,27
Tetracyclines (J01A)	3,39	0,03
Macrolides, lincosamides and streptogramins (J01F)	4,15	0,13
Quinolone antibacterials (J01M)	2,00	0,32
Sulfonamides and trimethoprim (J01E)	0,42	0,05
Other J01 substances	0,62	0,19
Total J01 classes	***29,58***	***2,20***

Distribution of J01 classes in ambulatory care sector



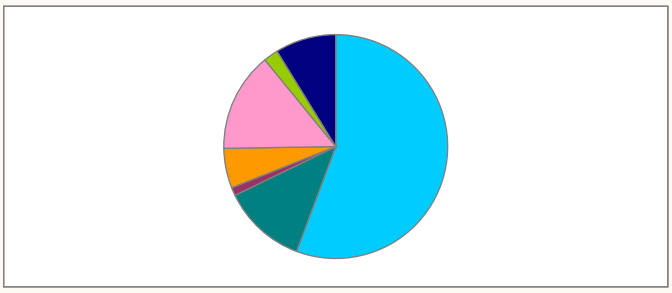
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



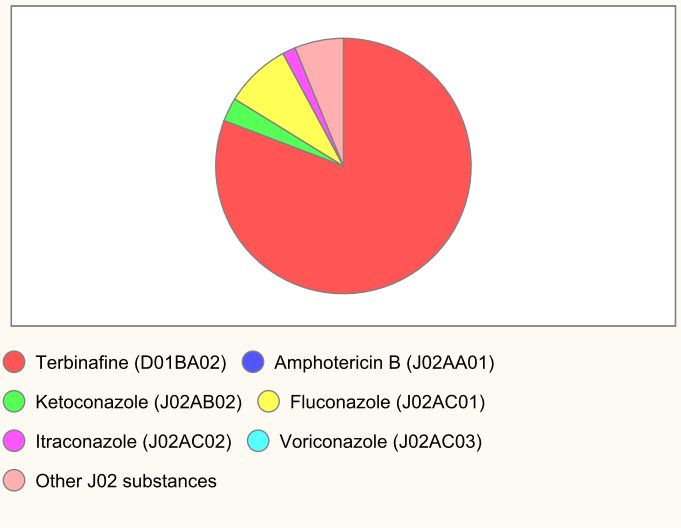
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

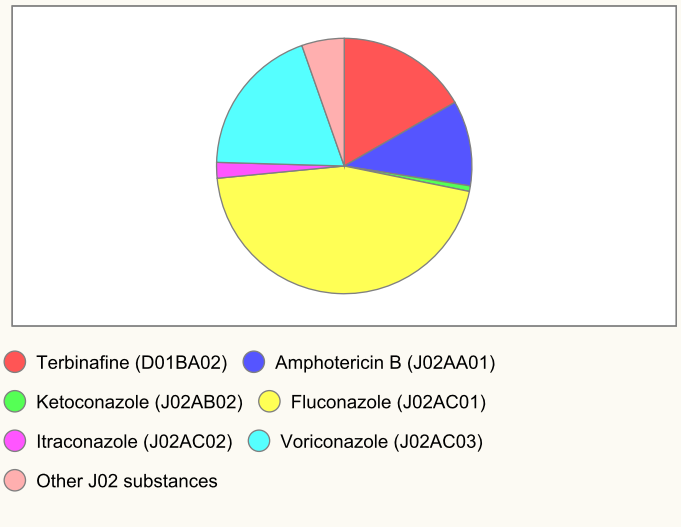
Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	1,62	0,02
Amphotericin B (J02AA01)	0.00	0,01
Ketoconazole (J02AB02)	0,06	<0.01
Fluconazole (J02AC01)	0,17	0,04
Itraconazole (J02AC02)	0,03	<0.01
Voriconazole (J02AC03)	0.00	0,02
Other J02 substances	0,12	<0.01
Total J02 substances	***2,01***	***0,10***

Distribution of J02 substances in ambulatory care sector



Distribution of J02 substances in hospital care sector



Comments

National Network: In ambulatory care, the antibiotic consumption (J01) increased by 5.6% in comparison with 2008. This upward trend seems probably be ascribed – at least partly - to the impressive rise in the incidence of flu syndromes and of winter pathologies during the year 2009. As these pathologies are often caused by virus, it is not established that all the additional consumption meets the requirements of the prudent use of antimicrobial agents. The dynamics set off in the beginning of the decade seems to lose momentum. Consequently the 2010 results are very expected because they will confirm or infirm this trend. In hospital care, when we use the standard indicator (DID), the consumption levels out since 2006. However, if we relate the consumption data to an activity indicator (the number of hospitalization days), we observe a very slight increase in the consumption from 2006 to 2009. The distribution of the consumption in ambulatory care highlights the prominent share of penicillins, especially amoxicillin alone or in combination with an enzyme inhibitor (J01C). By way of compensation, except for the other beta-lactam antibacterials (cephalosporins), the relative use of the other classes decreased in 2009. In the hospital care, the situation was quite different. The share of penicillins decreased whereas those of quinolones and macrolides stabilized. Nevertheless, just like in the ambulatory care, the share of cephalosporins went up significantly. The consumption of antimycotics for systemic use (J02) was nearly almost realized in ambulatory sector. Its level was small as compared with the antibiotic consumption and was characterized by its stability. As to antivirals for systemic use (J05), 2009 was an atypical year due to influenza A (H1N1) which caused significant sales of one specific antiviral in ambulatory care. If we exclude this exceptional factor, the growth of the consumption was moderate.

Health care sector	Data type	Coverage	Data source
Ambulatory care	Sales	90%	Statutory Health Insurance

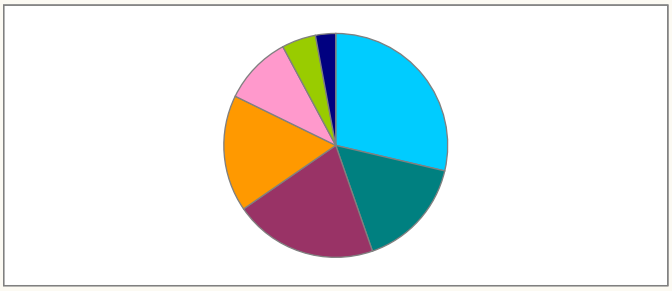
Population	Data source
70.011.508	Statutory Health Insurance

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

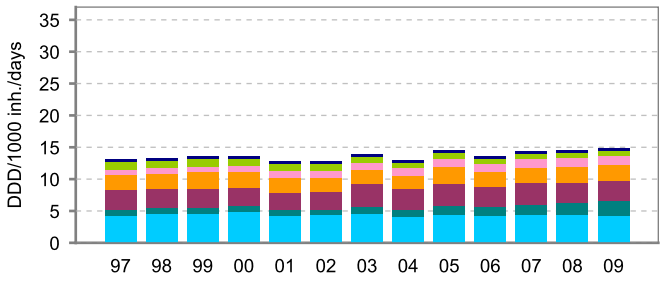
J01 classes	Ambulatory care
Beta-lactam antibacterials, penicillins (J01C)	4,27
Other beta-lactam antibacterials (J01D)	2,39
Tetracyclines (J01A)	3,09
Macrolides, lincosamides and streptogramins (J01F)	2,51
Quinolone antibacterials (J01M)	1,48
Sulfonamides and trimethoprim (J01E)	0,73
Other J01 substances	0,43
Total J01 classes	***14,90***

Distribution of J01 classes in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Comments

National Network: The database used is a sample which is projected on the total expenditure for drugs of the official statistics for German Statutory Health Insurance. It contains reimbursable pharmaceuticals bought in a pharmacy and available on prescription as well as reimbursable over-the-counter drugs in case of defined exceptions (e.g. for children). The antibiotic use density in Germany has slightly increased over the last decade. The relative proportions of different antibiotic drug classes have slightly changed. Oral cephalosporins, aminopenicillin/ß-lactamase inhibitor combinations (such as amoxicillin/clavulanic acid) and fluoroquinolones were prescribed more frequently while cotrimoxazole and tetracyclines were prescribed less frequently. The number one antibiotic has remained amoxicillin.

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	Medicines Agency
Ambulatory care	Sales	100%	Medicines Agency

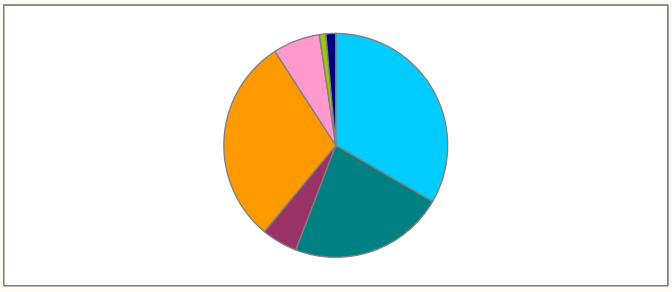
Population	Data source
11.161.337	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

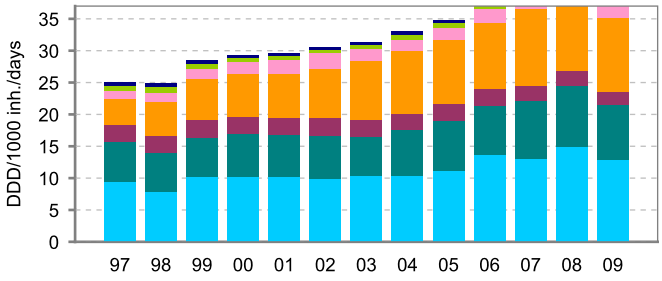
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	12,89	1,58
Other beta-lactam antibacterials (J01D)	8,68	0,67
Tetracyclines (J01A)	2,00	0,05
Macrolides, lincosamides and streptogramins (J01F)	11,54	0,29
Quinolone antibacterials (J01M)	2,63	0,31
Sulfonamides and trimethoprim (J01E)	0,36	0,03
Other J01 substances	0,54	0,39
Total J01 classes	***38,64***	***3,33***

Distribution of J01 classes in ambulatory care sector



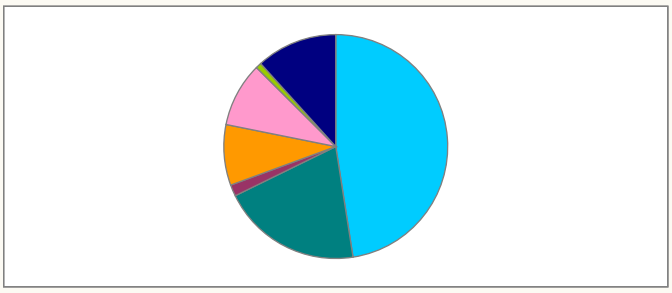
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



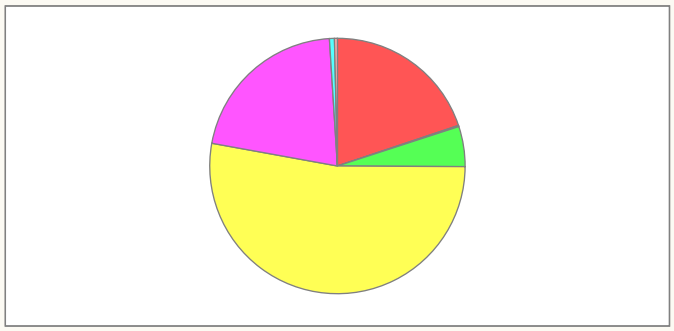
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

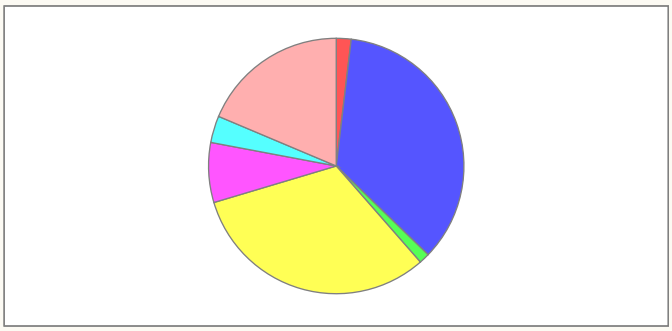
J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0,42	<0.01
Amphotericin B (J02AA01)	<0.01	0,05
Ketoconazole (J02AB02)	0,11	<0.01
Fluconazole (J02AC01)	1,12	0,04
Itraconazole (J02AC02)	0,45	<0.01
Voriconazole (J02AC03)	0,01	<0.01
Other J02 substances	<0.01	0,02
Total J02 substances	***2,13***	***0,13***

Distribution of J02 substances in ambulatory care sector



Terbinafine (D01BA02) Amphotericin B (J02AA01)
Ketoconazole (J02AB02) Fluconazole (J02AC01)
Itraconazole (J02AC02) Voriconazole (J02AC03)
Other J02 substances

Distribution of J02 substances in hospital care sector



Terbinafine (D01BA02) Amphotericin B (J02AA01)
Ketoconazole (J02AB02) Fluconazole (J02AC01)
Itraconazole (J02AC02) Voriconazole (J02AC03)
Other J02 substances

Comments

National Network: Data about antibiotic consumption in Greece are derived from a database of the National Organization for Medicines, after its help and official permission. This database was built for the survey of competence of the market in medicinal products and includes sales data of all these products (not only antibiotics) at a national level. Since 2006 data enter the database electronically from the pharma companies on a monthly basis (and this probably led to an obvious increase in sales consumption data). Sales data are available for ambulatory (AC) and hospital care (HC) (except for years 2004-2008 for which total consumption data are available). AC includes sales data from private sector pharmacies and also private hospitals, clinics, nursing homes and parallel exports. HC includes sales data to public hospitals. Since 2004 data about parallel exports are also available to the National Organization for Medicines and since 2008 are subtracted from ambulatory care and/or total consumption sales data. Sales data can be in a great extend cross-checked by the National Organization for Medicines, but this can not be done for declared data about parallel exports. Parallel exports proved to represent a very small fraction of estimated total antibiotic consumption. The electronic prescription program is going to be fully applied this year, after a pilot phase that started last October and proved to very efficient in reducing consumption of medicines in total. We hope that this program may be able to provide reliable antibiotic consumption and prescription data, at a national and also regional level (not available from the medicines database we currently have).

Management Team: Total care (AC + HC) has been reported for the year 2004 up to 2008.

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	Marketing Research Company
Ambulatory care	Sales	100%	Marketing Research Company

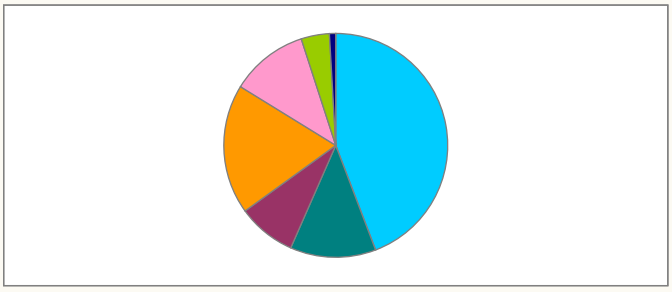
Population	Data source
10.030.975	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

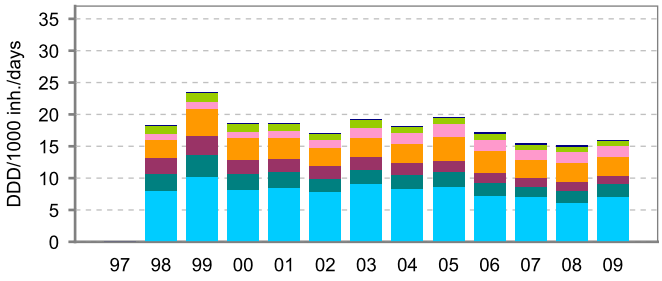
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	7,06	0,46
Other beta-lactam antibacterials (J01D)	1,98	0,26
Tetracyclines (J01A)	1,35	0,03
Macrolides, lincosamides and streptogramins (J01F)	3,00	0,14
Quinolone antibacterials (J01M)	1,79	0,26
Sulfonamides and trimethoprim (J01E)	0,65	0,04
Other J01 substances	0,14	0,08
Total J01 classes	***15,98***	***1,26***

Distribution of J01 classes in ambulatory care sector



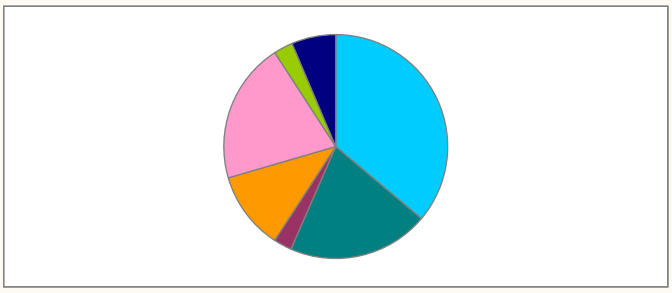
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



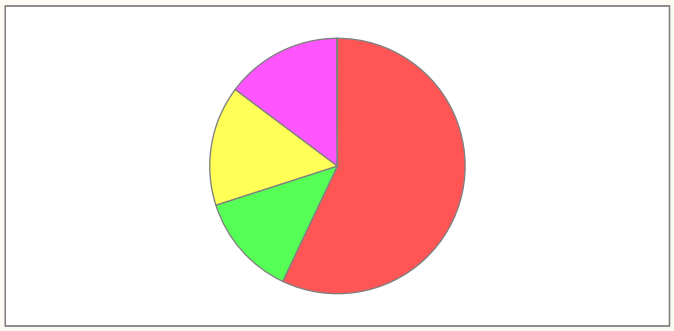
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

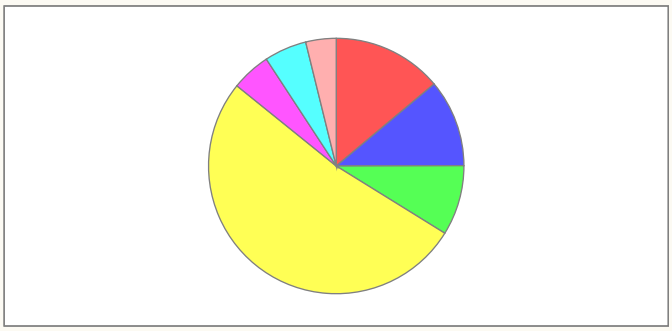
J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0,65	<0.01
Amphotericin B (J02AA01)	0.00	<0.01
Ketoconazole (J02AB02)	0,15	<0.01
Fluconazole (J02AC01)	0,17	0,02
Itraconazole (J02AC02)	0,17	<0.01
Voriconazole (J02AC03)	<0.01	<0.01
Other J02 substances	0.00	<0.01
Total J02 substances	***1,14***	***0,04***

Distribution of J02 substances in ambulatory care sector



Terbinafine (D01BA02) Amphotericin B (J02AA01)
Ketoconazole (J02AB02) Fluconazole (J02AC01)
Itraconazole (J02AC02) Voriconazole (J02AC03)
Other J02 substances

Distribution of J02 substances in hospital care sector



Terbinafine (D01BA02) Amphotericin B (J02AA01)
Ketoconazole (J02AB02) Fluconazole (J02AC01)
Itraconazole (J02AC02) Voriconazole (J02AC03)
Other J02 substances

Comments

National Network: In Hungary antibiotics are prescription-only and reimbursed medicines and available in pharmacies. Ambulatory care data covers data used up in the primary care, nursing homes, social homes, prisons, hospital out-patient departments. The hospital care antibacterial use was more or less stable, for the ambulatory care there was a visible decrease through 2006-2007. This decrement could be explained by the decreased reimbursement of antibacterials and because of the financial restrictions/enhanced control in the health care. Since many years, the penicillin combinations (namely the co-amoxiclav) is the most widely used agent in both the ambulatory and hospital care sector (almost 30% of all antibacterial use in both sectors in 2009). Slow realignment in the pattern of use could be observed in both sectors: e.g. the use of tetracyclines and sulfonamides have gradually decreased in the past years. Detailed ambulatory and hospital care antibiotic use data in Hungary has been published by the data provider team.

Health care sector	Data type	Coverage	Data source
Ambulatory care	Sales	100%	Directorate of Health

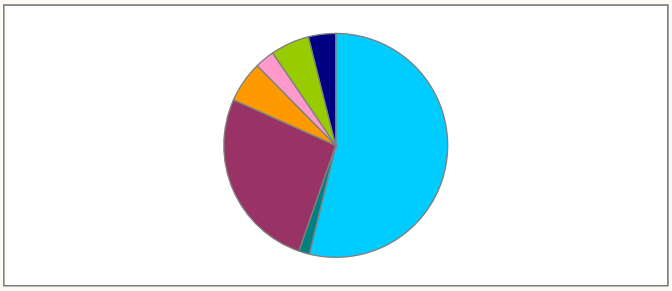
Population	Data source
319.246	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

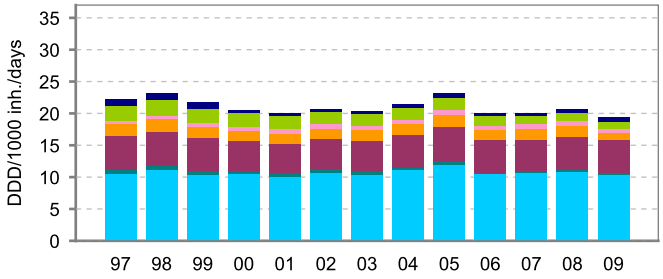
J01 classes	Ambulatory care
Beta-lactam antibacterials, penicillins (J01C)	10,41
Other beta-lactam antibacterials (J01D)	0,30
Tetracyclines (J01A)	5,09
Macrolides, lincosamides and streptogramins (J01F)	1,15
Quinolone antibacterials (J01M)	0,55
Sulfonamides and trimethoprim (J01E)	1,08
Other J01 substances	0,76
Total J01 classes	***19,35***

Distribution of J01 classes in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Comments

National Network: Antibacterial figures represent trends of total care (ambulatory and hospital care settings) for the years 1997 up to 2005. From 2006 onwards, figures describe the ambulatory prescriptions only. The reduced consumption of antibacterial agents in 2009 is not fully explained. It has to be kept in mind that these drugs are not reimbursed by the national health-care insurance, which may result in a reduced consumption of the drugs when the economy is troubled. Also, an increased awareness of the importance of prudent use of antibacterial agents among physicians and the general public may play a part. Emphasis was made on reducing azithromycine and tetracycline prescriptions. It may have contributed to 23% reduction of the prescriptions of azithromycine in 2009 as compared with the year before and the reduction was most pronounced in the age group 0–4 years and among the elderly. Tetracycline (in Iceland doxycycline) is used in great quantities in the age group 15-19 years, more than in any other neighboring countries. Although, there was a general reduction of 6% in prescriptions of doxycycline in 2009 as compared with the year before, there was an increase in the age group 15–19-year at the same time.

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	National hospital network
Ambulatory care	Sales	100%	Marketing Research Company

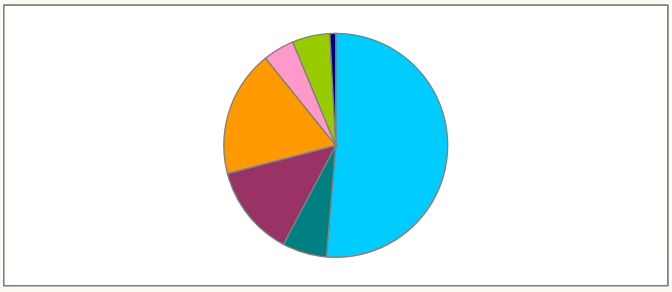
Population	Data source
4.459.500	National census data

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

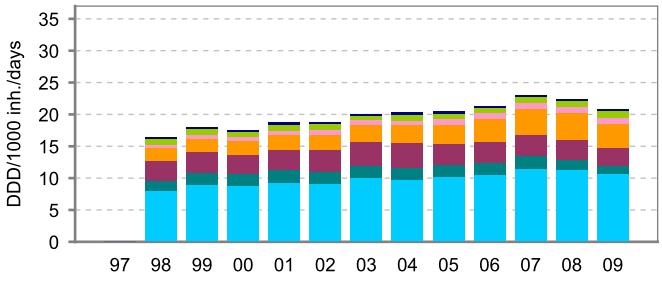
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	10,66	0,68
Other beta-lactam antibacterials (J01D)	1,33	0,12
Tetracyclines (J01A)	2,74	0,02
Macrolides, lincosamides and streptogramins (J01F)	3,79	0,19
Quinolone antibacterials (J01M)	0,94	0,11
Sulfonamides and trimethoprim (J01E)	1,13	0,04
Other J01 substances	0,17	0,20
Total J01 classes	***20,76***	***1,37***

Distribution of J01 classes in ambulatory care sector



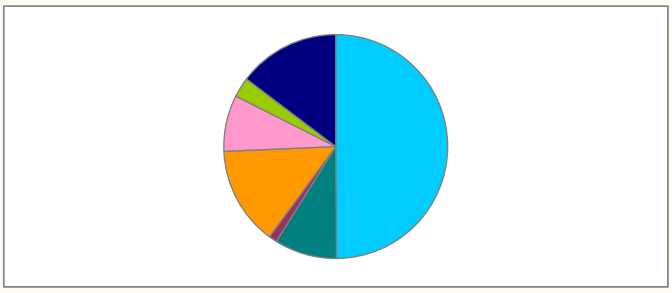
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector

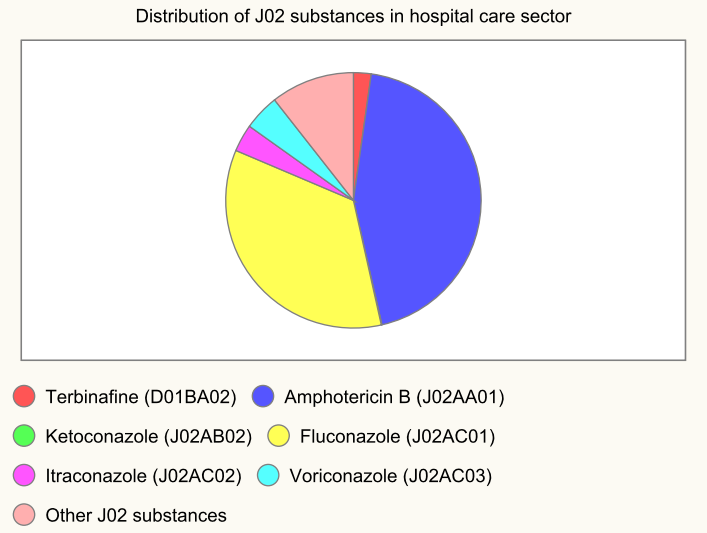


Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Hospital care
Terbinafine (D01BA02)	<0.01
Amphotericin B (J02AA01)	0,04
Ketoconazole (J02AB02)	<0.01
Fluconazole (J02AC01)	0,03
Itraconazole (J02AC02)	<0.01
Voriconazole (J02AC03)	<0.01
Other J02 substances	<0.01
Total J02 substances	***0,08***



Comments

National Network: Ambulatory care data are derived from sales data from the pharmacy wholesale market in Ireland and are thought to be an accurate measure of national antibiotic consumption. Seasonal peaks in antimicrobial consumption in Ireland have been shown to closely match peaks in respiratory viral activity. The development of an education programme and prescribing guidelines for General Practitioners, along with a public education campaign, in late-2008 coincided with the decrease in ambulatory antibiotic use. The decrease has continued into 2009. Hospital care data are directly from publically funded hospital pharmacy software systems. The Irish Health Services Executive sanctioned the appointment of additional antibiotic liaison hospital pharmacists in 2006/7, and national hospital antibiotic stewardship programmes began in 2008. Since then, here was an overall decrease in hospital antibiotic use, compared to previous years, with a considerable decrease in the consumption of quinolone antibiotics. The decrease has continued into 2009.

Health care sector	Data type	Coverage	Data source
Hospital care	Reimbursement	55%	Health Insurance Company
Ambulatory care	Reimbursement	55%	Health Insurance Company

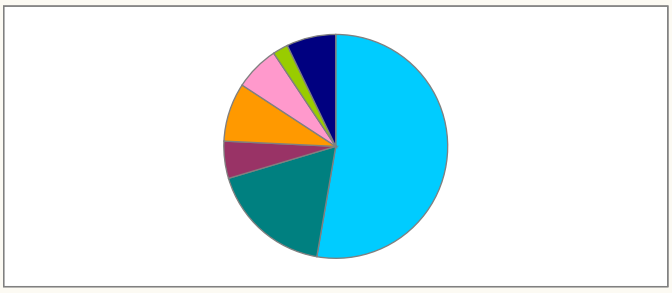
Population	Data source
3.956.042	Insurance company

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

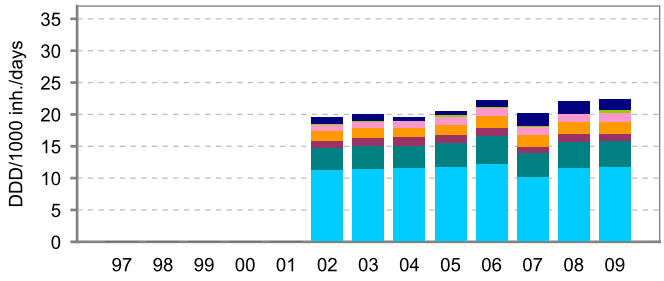
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	11,82	0,57
Other beta-lactam antibacterials (J01D)	3,96	0,38
Tetracyclines (J01A)	1,20	0,06
Macrolides, lincosamides and streptogramins (J01F)	1,90	0,08
Quinolone antibacterials (J01M)	1,44	0,18
Sulfonamides and trimethoprim (J01E)	0,50	<0.01
Other J01 substances	1,60	0,11
Total J01 classes	***22,42***	***1,38***

Distribution of J01 classes in ambulatory care sector



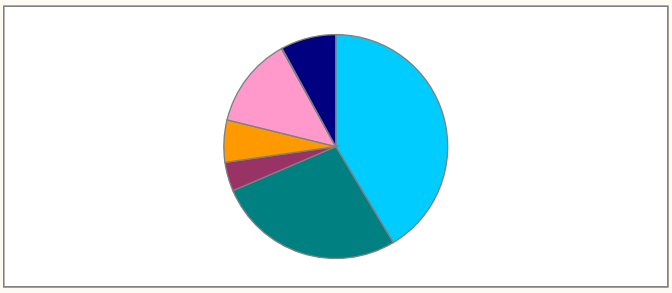
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



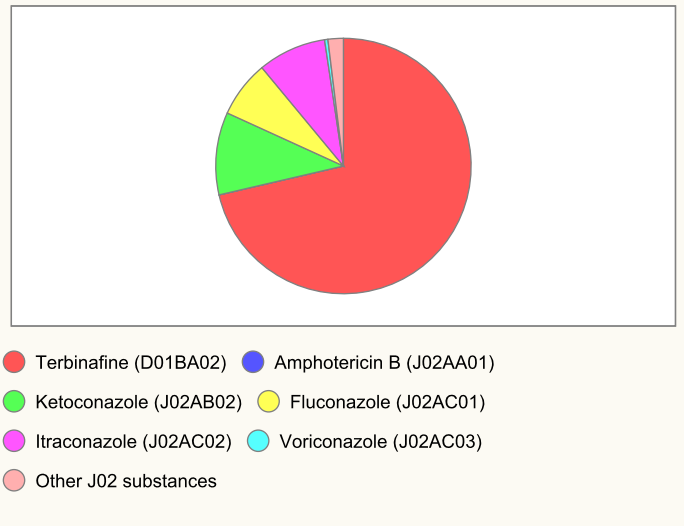
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

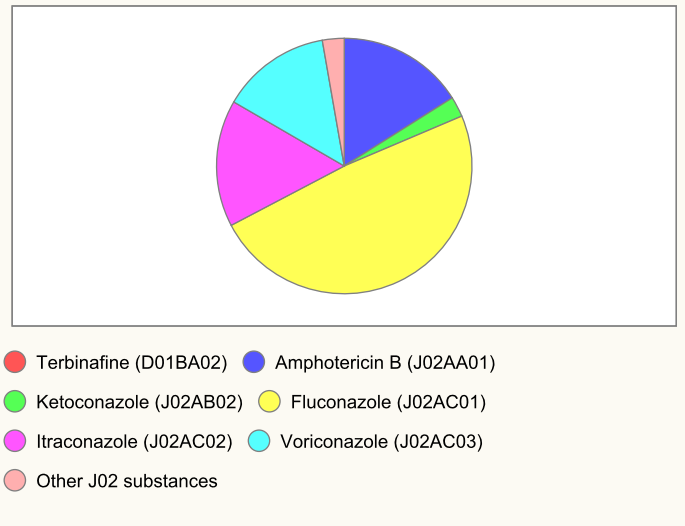
Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0,81	0.00
Amphotericin B (J02AA01)	<0.01	<0.01
Ketoconazole (J02AB02)	0,12	<0.01
Fluconazole (J02AC01)	0,08	<0.01
Itraconazole (J02AC02)	0,10	<0.01
Voriconazole (J02AC03)	<0.01	<0.01
Other J02 substances	0,02	<0.01
Total J02 substances	***1,14***	***0,02***

Distribution of J02 substances in ambulatory care sector



Distribution of J02 substances in hospital care sector



Comments

National Network: Beta-lactams, penicillin and cephalosporines are the most common antimicrobial agents used in Israel, as in other countries. Looking at the data changes in antibiotic consumption during 2002 - 2009, we do not see changes in the use of beta-lactams and macrolides and the use of tetracyclines is quite stable along the years. However, there is a significant and constant increase in the consumption of quinolones (ofloxacin and ciprofloxacin): 0.56 DDD. A very thorough and intense educational program, combined with control systems, are essential to control the increasing resistance rates, national and world wide.

Health care sector	Data type	Coverage	Data source
Ambulatory care	Reimbursement	100%	Medicines Agency

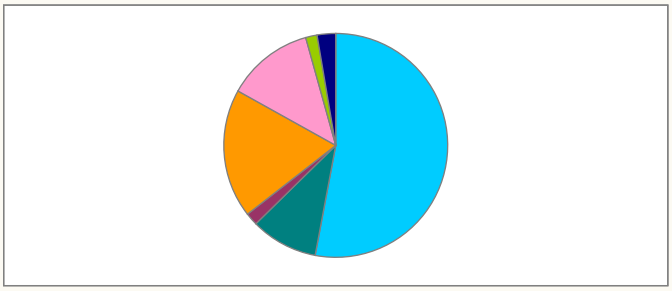
Population	Data source
59.870.124	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

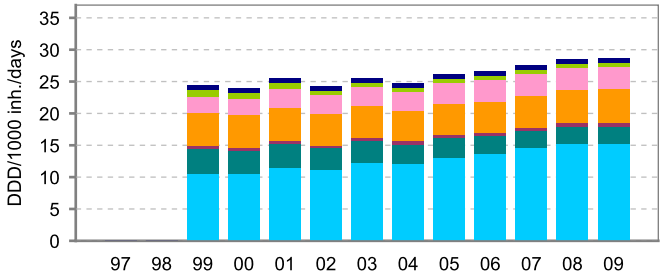
J01 classes	Ambulatory care
Beta-lactam antibacterials, penicillins (J01C)	15,18
Other beta-lactam antibacterials (J01D)	2,78
Tetracyclines (J01A)	0,52
Macrolides, lincosamides and streptogramins (J01F)	5,33
Quinolone antibacterials (J01M)	3,61
Sulfonamides and trimethoprim (J01E)	0,47
Other J01 substances	0,77
Total J01 classes	***28,66***

Distribution of J01 classes in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector

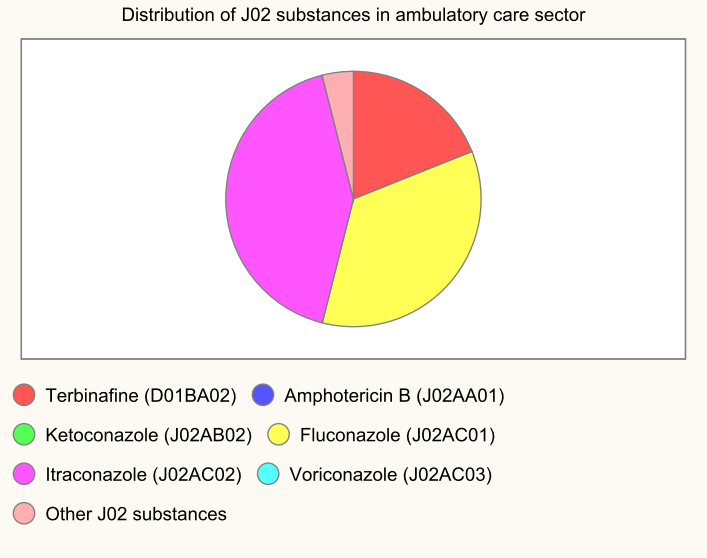


Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care
Terbinafine (D01BA02)	0,20
Amphotericin B (J02AA01)	0.00
Ketoconazole (J02AB02)	0.00
Fluconazole (J02AC01)	0,37
Itraconazole (J02AC02)	0,45
Voriconazole (J02AC03)	0.00
Other J02 substances	0,04
Total J02 substances	***1,06***



Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	Medicines Agency
Ambulatory care	Sales	100%	Medicines Agency

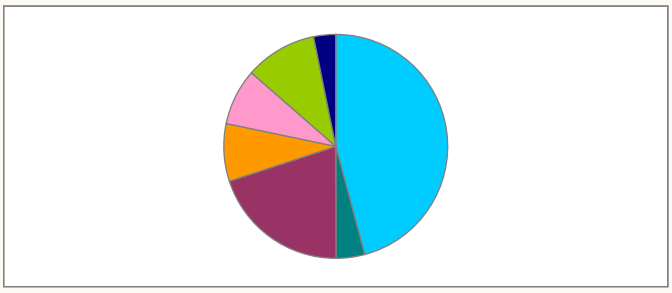
Population	Data source
2.249.364	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

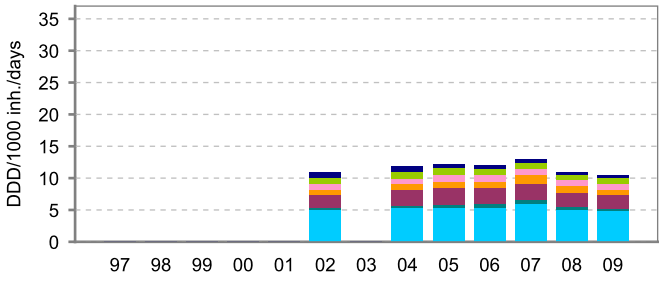
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	4,80	0,57
Other beta-lactam antibacterials (J01D)	0,43	0,70
Tetracyclines (J01A)	2,10	0,08
Macrolides, lincosamides and streptogramins (J01F)	0,87	0,09
Quinolone antibacterials (J01M)	0,85	0,33
Sulfonamides and trimethoprim (J01E)	1,09	0,06
Other J01 substances	0,33	0,35
Total J01 classes	***10,48***	***2,18***

Distribution of J01 classes in ambulatory care sector



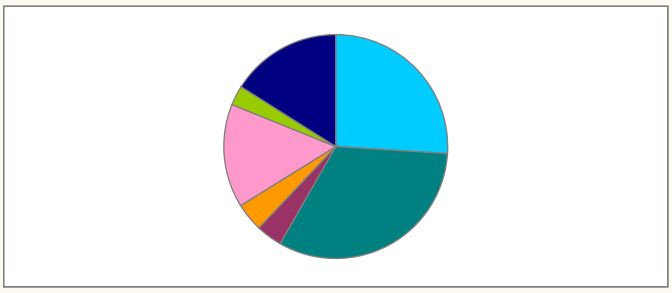
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



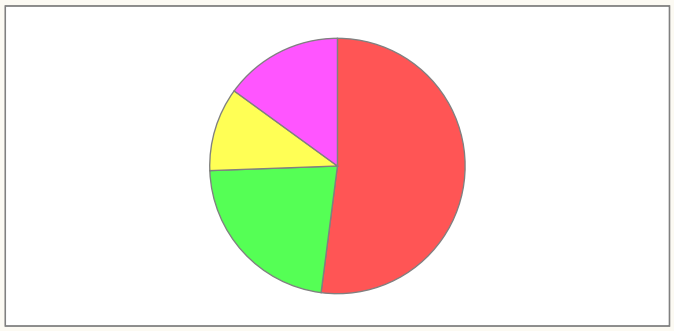
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

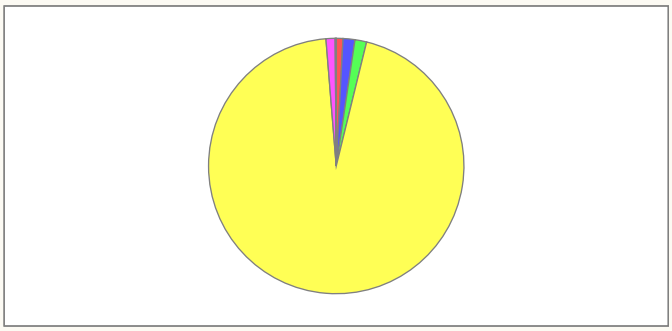
J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0,23	<0.01
Amphotericin B (J02AA01)	0.00	<0.01
Ketoconazole (J02AB02)	0,10	<0.01
Fluconazole (J02AC01)	0,05	0,03
Itraconazole (J02AC02)	0,07	<0.01
Voriconazole (J02AC03)	0.00	<0.01
Other J02 substances	0.00	<0.01
Total J02 substances	***0,44***	***0,03***

Distribution of J02 substances in ambulatory care sector



Terbinafine (D01BA02) Amphotericin B (J02AA01)
Ketoconazole (J02AB02) Fluconazole (J02AC01)
Itraconazole (J02AC02) Voriconazole (J02AC03)
Other J02 substances

Distribution of J02 substances in hospital care sector



Terbinafine (D01BA02) Amphotericin B (J02AA01)
Ketoconazole (J02AB02) Fluconazole (J02AC01)
Itraconazole (J02AC02) Voriconazole (J02AC03)
Other J02 substances

Comments

National Network: There are several explanations for further reduction of antibiotic use in Latvia in both ambulatory and hospital settings. In November 2008, there was an educational intervention in general practitioners that could influence prescribing in 2009. Due to health reform, many hospital beds were closed and that reduced the number of hospitalized patients that could lead to reduced antibiotic consumption. In addition, due to economical crisis, availability of healthcare services was reduced, both in ambulatory and hospital setting. Also significant emigration was observed. For small country like Latvia, all this factors could significantly influence the antibiotic prescribing pattern.

Health care sector	Data type	Coverage	Data source
Total care	Sales	100%	Medicines Agency

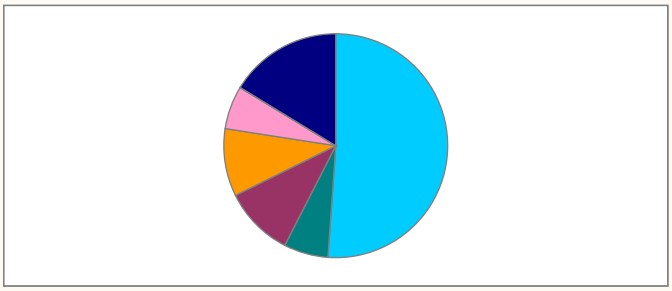
Population	Data source
3.339.400	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

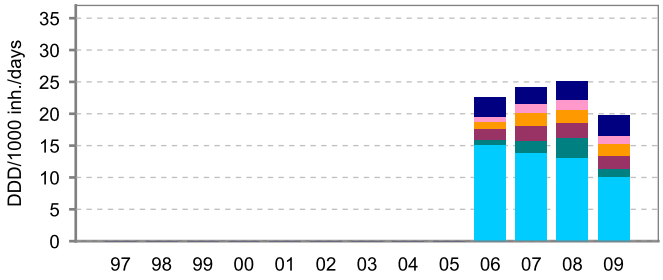
J01 classes	Total care
Beta-lactam antibacterials, penicillins (J01C)	10,08
Other beta-lactam antibacterials (J01D)	1,27
Tetracyclines (J01A)	2,00
Macrolides, lincosamides and streptogramins (J01F)	1,93
Quinolone antibacterials (J01M)	1,23
Sulfonamides and trimethoprim (J01E)	<0.01
Other J01 substances	3,21
Total J01 classes	***19,72***

Distribution of J01 classes in total care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in total care sector

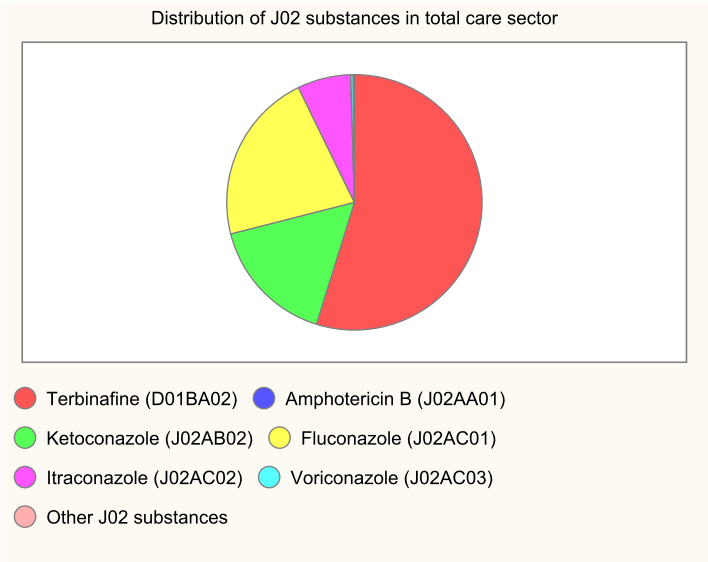


Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Total care
Terbinafine (D01BA02)	0,27
Amphotericin B (J02AA01)	0.00
Ketoconazole (J02AB02)	0,08
Fluconazole (J02AC01)	0,11
Itraconazole (J02AC02)	0,03
Voriconazole (J02AC03)	<0.01
Other J02 substances	<0.01
Total J02 substances	***0,49***



Comments

National Network: Data on antibiotic use Lithuania are obtained together with the sales of all medicines from wholesalers by the State Medicines Control Agency of Lithuania, further processed by Institute of Hygiene and represent the total consumption of antibiotics. The increase in consumption of antibiotics for systemic use (J01) was recorded in the period 2006-2008 (from 17,44 DID to 25,1 DID) mostly due to increased consumption of cephalosporins (J01D) and quinolones (J01M). According to 2009 data the striking decrease to 19,72 DID is observed. The biggest decrease is seen for penicillins (from 13,04 DID in 2008 to 10,08 DID in 2009) and cephalosporins (from 3,19 DID in 2009 to 1,26 DID in 2009). The reasons of such decrease are still unclear and need particular analysis and further observation.

Health care sector	Data type	Coverage	Data source
Hospital care	Reimbursement	100%	Community pharmacists
Ambulatory care	Reimbursement	>95%	Health Insurance Company

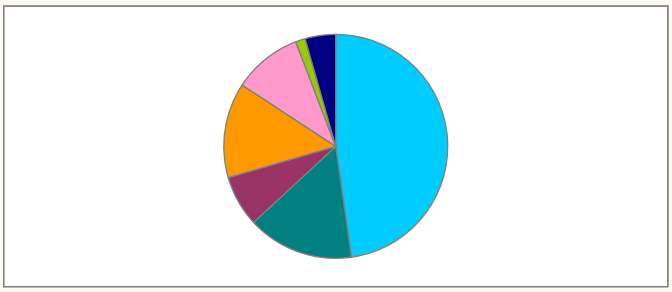
Population	Data source
470.660	National Insurance Regime

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

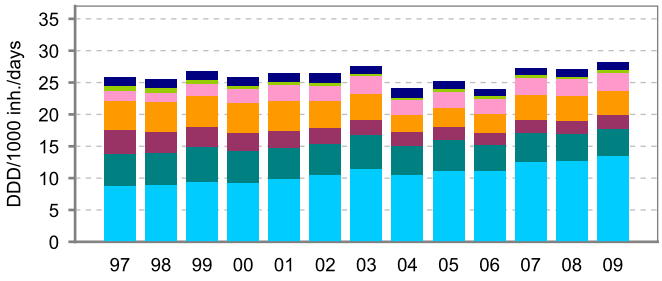
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	13,47	0,78
Other beta-lactam antibacterials (J01D)	4,33	0,75
Tetracyclines (J01A)	2,08	0,01
Macrolides, lincosamides and streptogramins (J01F)	3,87	0,19
Quinolone antibacterials (J01M)	2,81	0,30
Sulfonamides and trimethoprim (J01E)	0,39	0,03
Other J01 substances	1,24	0,17
Total J01 classes	***28,19***	***2,22***

Distribution of J01 classes in ambulatory care sector



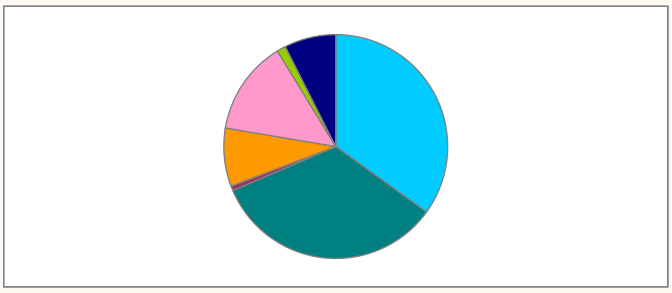
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



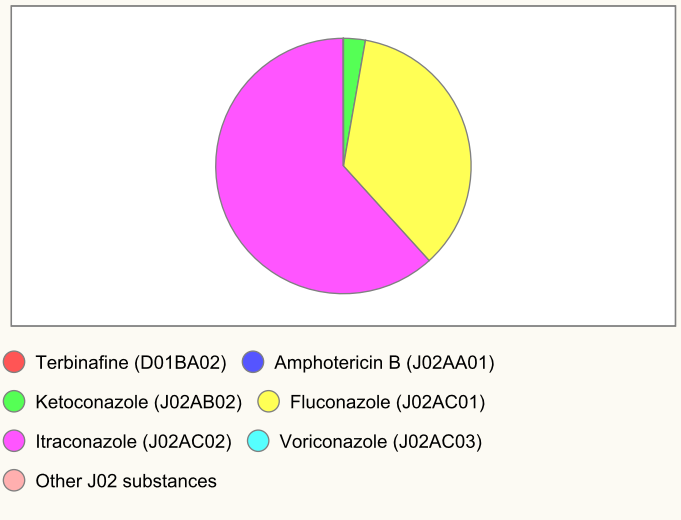
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

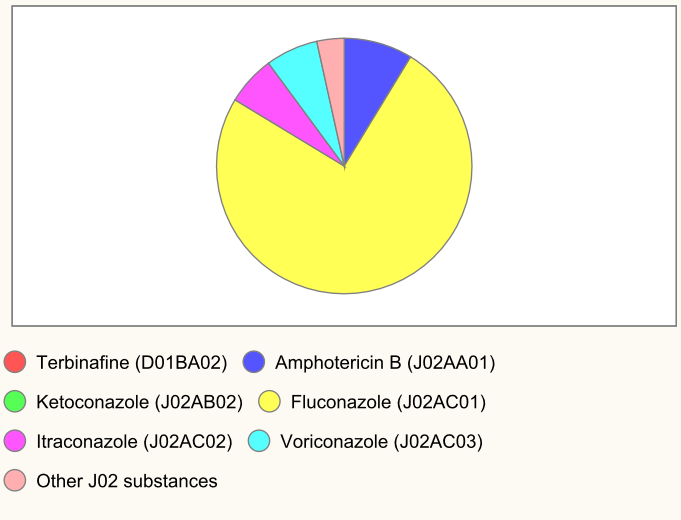
Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0.00	0.00
Amphotericin B (J02AA01)	<0.01	0,01
Ketoconazole (J02AB02)	0,04	0.00
Fluconazole (J02AC01)	0,54	0,12
Itraconazole (J02AC02)	0,94	<0.01
Voriconazole (J02AC03)	<0.01	0,01
Other J02 substances	0.00	<0.01
Total J02 substances	***1,53***	***0,16***

Distribution of J02 substances in ambulatory care sector



Distribution of J02 substances in hospital care sector



Comments

National Network: In Luxembourg antibacterial agents for systemic human use (J01) in ambulatory care are prescription-only and reimbursed medicines. Data based on drug prescription are provided by the Luxemburgish General Inspectorate of Social Security (IGSS) and refer to the insured resident population covered by the public health insurance regime which constitutes about 95% of the total population. When expressed in DDDs per thousand inhabitants per day (DID), the use of the entire group (J01) was high and increased further by 3.9% in comparison with 2008. The most used antibiotics were penicillins (J01CA/J01CR) with extended spectrum (mainly amoxicillin) and combinations of penicillins with beta-lactamase inhibitors (amoxicillin with clavulanic acid) each representing 16.8% and 29.9% of the total ambulatory care use respectively. Other frequently used antibiotics were cephalosporines, macrolides and fluoroquinolones, each representing 15.4%, 13.7% and 10.0% of the total use respectively. In the past decade, the use of penicillins (J01) increased continuously whereas a decrease of the use of tetracyclines was observed. Antibacterial agents for systemic human use (J01) in hospital care have been monitored since 1997. In 2009, antibiotic use decreased slightly and accounts for 7.3% of the total use. Reimbursement data at individual level made possible to determine the proportion of treated patients in the insured resident population. In 2009, 44.2% of the resident population have received at least one antibiotic treatment; 52.1% of them were prescribed antibiotics once, 24.7% of them twice, 11.6% of them three times, and 11,6% of them four or more times. The average consumption of the 1-, 2-, 3- and 4-time users during 2009 was 11.8, 11.6, 11,6 and 11.8 DDDs respectively.

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	95%	Ministry of Health
Ambulatory care	Sales	100%	National Antibiotic Committee

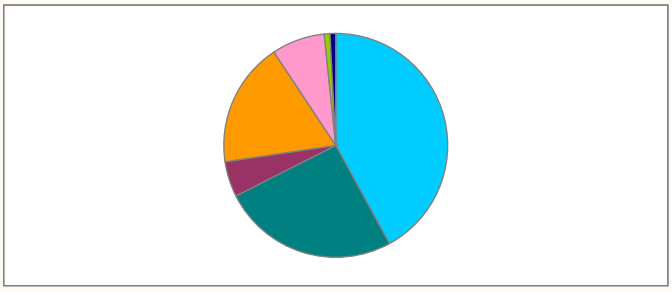
Population	Data source
413.290	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

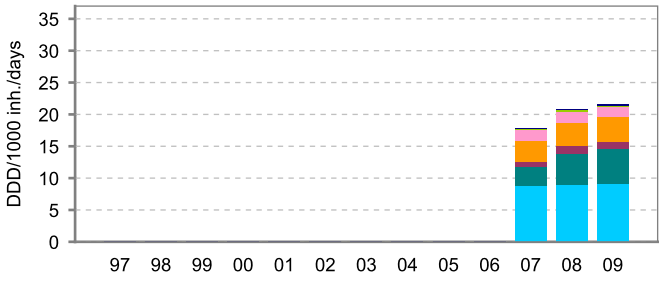
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	9,08	0,38
Other beta-lactam antibacterials (J01D)	5,50	0,36
Tetracyclines (J01A)	1,10	0,03
Macrolides, lincosamides and streptogramins (J01F)	3,89	0,22
Quinolone antibacterials (J01M)	1,66	0,18
Sulfonamides and trimethoprim (J01E)	0,18	0,02
Other J01 substances	0,18	0,17
Total J01 classes	***21,59***	***1,36***

Distribution of J01 classes in ambulatory care sector



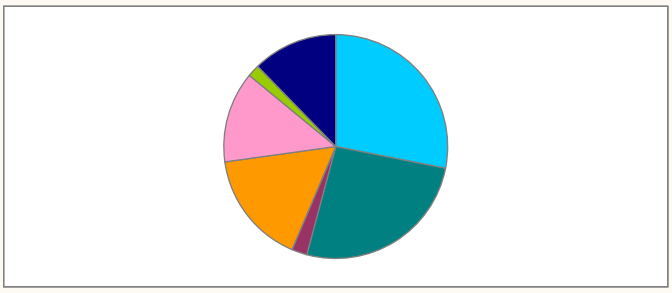
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector

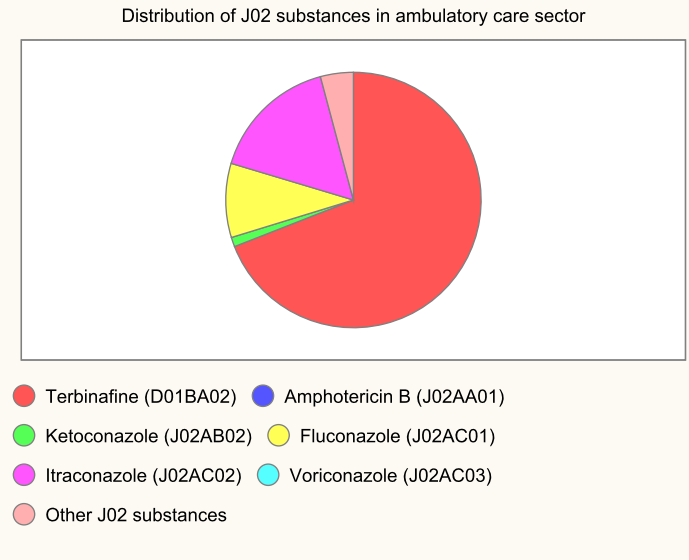


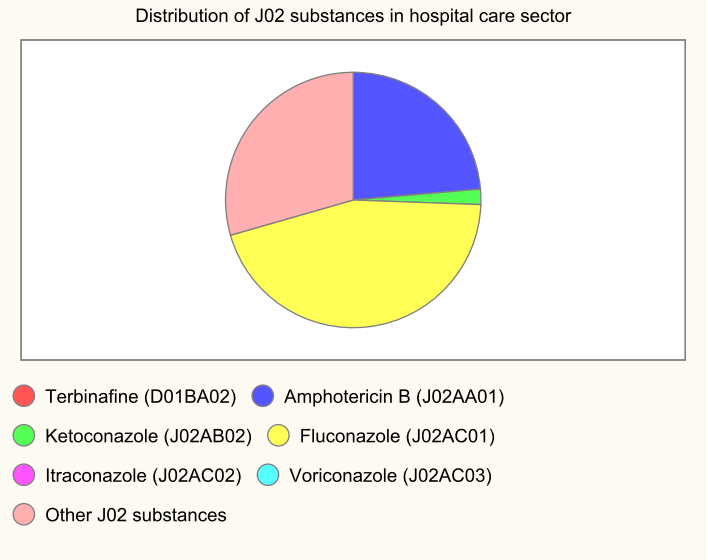
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0,31	0.00
Amphotericin B (J02AA01)	0.00	<0.01
Ketoconazole (J02AB02)	<0.01	<0.01
Fluconazole (J02AC01)	0,04	0,02
Itraconazole (J02AC02)	0,07	0.00
Voriconazole (J02AC03)	0.00	0.00
Other J02 substances	0,02	0,01
Total J02 substances	***0,44***	***0,04***





Comments

National Network: A striking feature of the Maltese hospital data is the heavy reliance on a limited number of drugs or drug classes. In J01 category there is > 50% reliance on -lactam antibacterials (J01C and J01D). Macrolides also contribute a high proportion of use which would be expected in ambulatory care but not in hospital care. Similarly, although use is very low for antifungals, this is almost exclusively based on amphotericin B and fluconazole, despite the fact that other triazole derivatives and an echinocardin are available on the national hospital formulary. The increase in AC consumption from 2007 to 2009 seems to be exclusively due to the increase in the use of second generation cephalosporins.

Health care sector	Data type	Coverage	Data source
Ambulatory care	Sales	90%	Community pharmacists

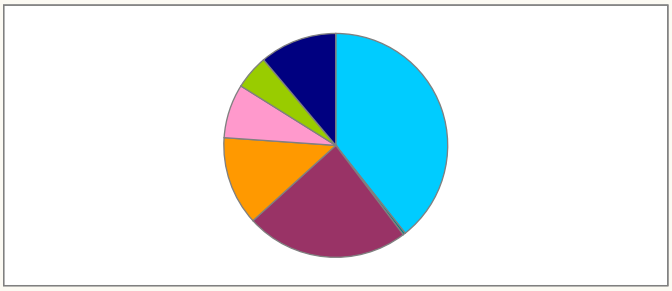
Population	Data source
15.227.000	Insurance system

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

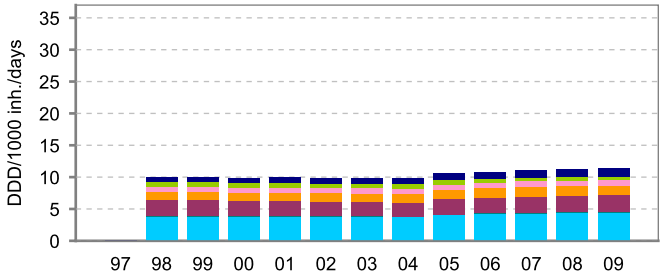
J01 classes	Ambulatory care
Beta-lactam antibacterials, penicillins (J01C)	4,48
Other beta-lactam antibacterials (J01D)	0,04
Tetracyclines (J01A)	2,68
Macrolides, lincosamides and streptogramins (J01F)	1,46
Quinolone antibacterials (J01M)	0,89
Sulfonamides and trimethoprim (J01E)	0,56
Other J01 substances	1,27
Total J01 classes	***11,39***

Distribution of J01 classes in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector

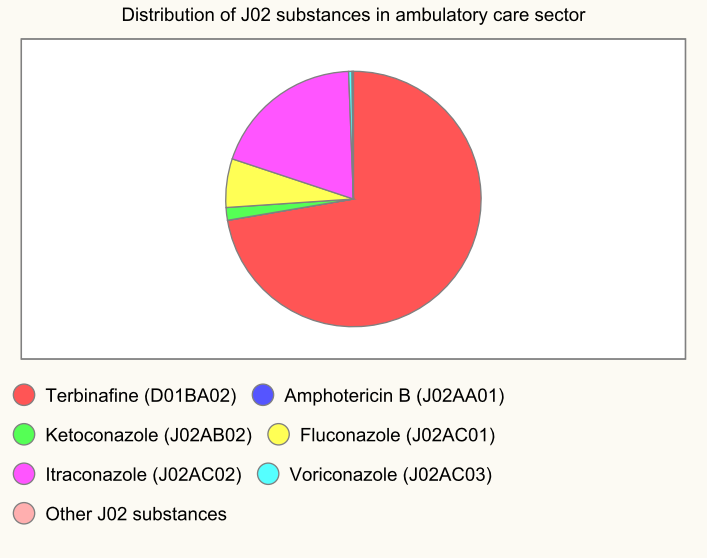


Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care
Terbinafine (D01BA02)	1,19
Amphotericin B (J02AA01)	<0.01
Ketoconazole (J02AB02)	0,03
Fluconazole (J02AC01)	0,10
Itraconazole (J02AC02)	0,32
Voriconazole (J02AC03)	<0.01
Other J02 substances	<0.01
Total J02 substances	***1,64***



Comments

National Network: Data on use of antibiotics in primary health care in the Netherlands are yearly published in the SWAB/RIVM NethMap report. Over the past 11 years the overall use of antibiotics for systemic use in primary health care remained rather constant. From 1998-2004, usage was 10 DDD/1000 inhabitant-days. Over the past five years, use gradually increased to 11 DDD/1000 inhabitant-days. Tetracyclines (mainly doxycyline) represented 24% of total antibiotic use in primary health care. Other frequently used antibiotics were penicillins with extended spectrum (mainly amoxicillin), combinations of penicillins with beta-lactamase inhibitors (essentially amoxicillin with clavulanic acid) and macrolides, each representing 17%, 16% and 13% of the total use respectively. In the past 11 years the use of penicillins with beta-lactamase inhibitors, macrolides and nitrofurantoin increased, whereas the use of tetracyclines and penicillins with extended spectrum decreased. Moreover, subtle shifts in the pattern of use within the various classes of antibiotics are observed. The use of macrolides increased from 1997 to 2005, but subsequently slightly decreased up until now. Within the class of macrolides we see a shift from erythromycin to the newer macrolides such as azithromycin and clarithromycin, the latter being the most commonly used macrolide. Overall consumption of fluorquinolones slightly increased, whereas the use of ciprofloxacin more than doubled. This increased use of ciprofloxacin seems to be offset by a decrease in ofloxacin and norfloxacin. The use of nitrofurantoin more than doubled, whereas the use of sulphonamides and trimethoprim decreased. These changes may be explained by the national guidelines of the Dutch College of General practitioners (NHG) that have been changed over the years with regard to the pharmacotherapy of urinary tract infections. In 2005, these guidelines were revised and because of lower resistance levels of nitrofurantoin was classified as the drug of first choice (5 days treatment). Trimethoprim is nowadays ranked as a urinary tract infection antibiotic of second choice.

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	National hospital network
Ambulatory care	sales	100%	National Institute

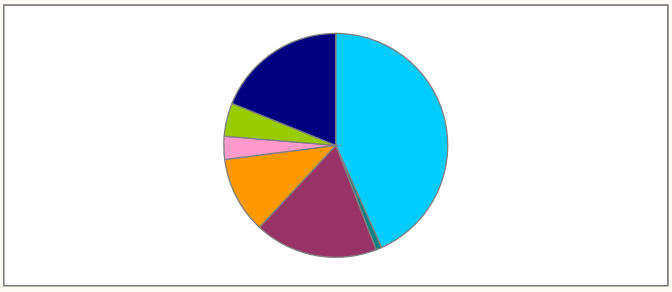
Population	Data source
4.829.800	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

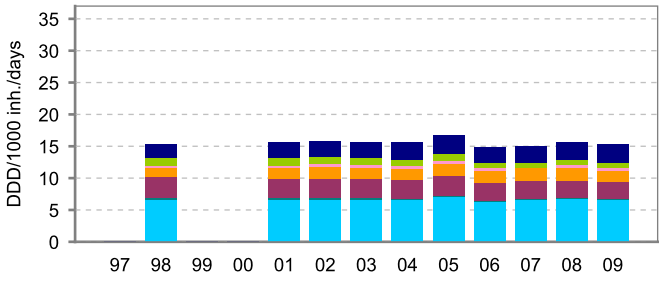
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	6,59	0,67
Other beta-lactam antibacterials (J01D)	0,13	0,33
Tetracyclines (J01A)	2,71	0,05
Macrolides, lincosamides and streptogramins (J01F)	1,68	0,08
Quinolone antibacterials (J01M)	0,51	0,10
Sulfonamides and trimethoprim (J01E)	0,73	0,05
Other J01 substances	2,88	0,18
Total J01 classes	***15,23***	***1,46***

Distribution of J01 classes in ambulatory care sector



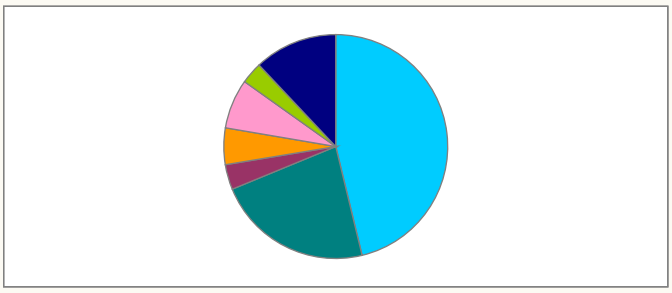
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



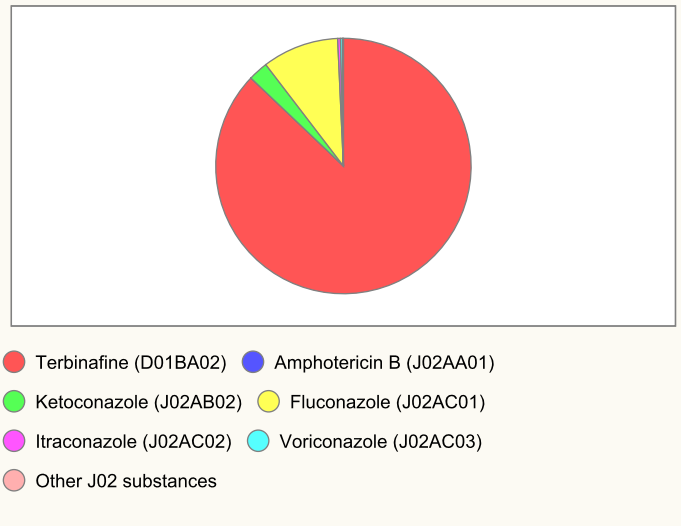
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

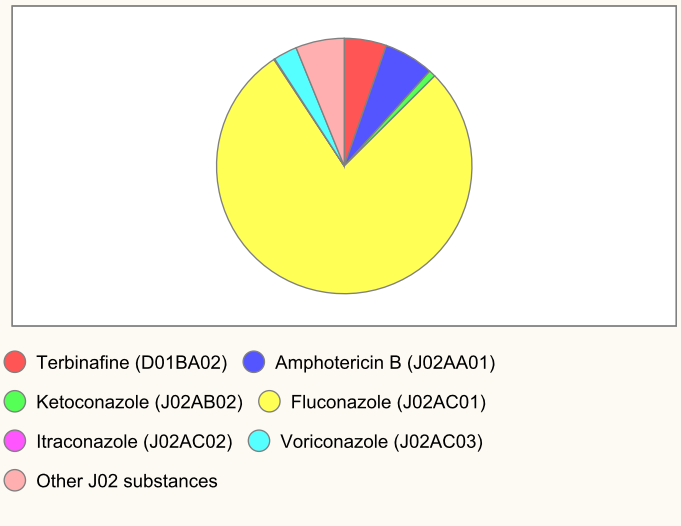
Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0,98	<0.01
Amphotericin B (J02AA01)	<0.01	<0.01
Ketoconazole (J02AB02)	0,03	<0.01
Fluconazole (J02AC01)	0,11	0,04
Itraconazole (J02AC02)	<0.01	<0.01
Voriconazole (J02AC03)	<0.01	<0.01
Other J02 substances	<0.01	<0.01
Total J02 substances	***1,13***	***0,05***

Distribution of J02 substances in ambulatory care sector



Distribution of J02 substances in hospital care sector



Comments

National Network: In Norway, antimicrobials are prescription-only medicines and the majority of antibacterial use in ambulatory care is not reimbursed. Data on use of antibiotics in Norway – both for humans and animals – are provided from the Norwegian Institute of Public Health and cover the entire population in Norway. Data on antimicrobial use are published in two annual publications; Drug consumption in Norway and NORM/NORM-vet. The overall sales of antibacterials for systemic use in Norway have been relatively stable for many years and is characterised by the use of narrow-spectrum antibacterials. In 2009 there was a reduction of use, in ambulatory care as well as in hospital care, compared to 2008. Phenoxymethylpenicillin is the drug most frequently used in Norway, representing 24% of all antibacterial use in ambulatory care measured in DDDs. In Norway, the sales of methenamine (J01XX05) is high, representing 17% of all antibacterial use measured in DDDs. Methenamine is a urinary tract antiseptic hardly used in other countries. In the ESAC report, data have been retrieved from different databases over the years, which results in some differences in the figures shown. From 2006, the data for ambulatory care have been retrieved from the Norwegian prescription database (NorPD) which contains data on all prescriptions to individuals with a personal identification number in Norway. Data for hospital care data are from 2006 collected from all hospital pharmacies to a common database. Before 2006, both ambulatory care and hospital care data were estimated from total wholesales data.

Health care sector	Data type	Coverage	Data source
Ambulatory care	Reimbursement	100%	National Health Fund

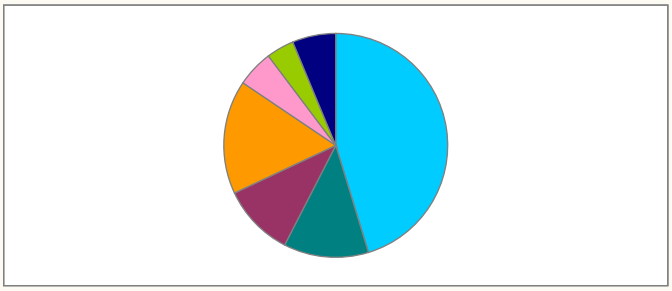
Population	Data source
38.167.329	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

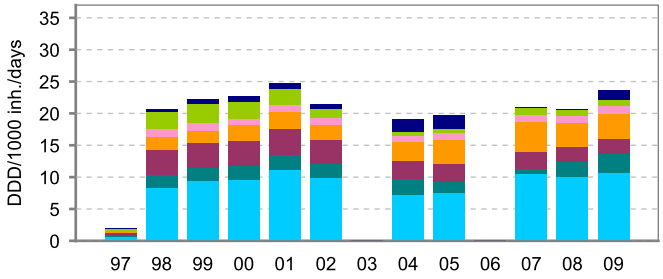
J01 classes	Ambulatory care
Beta-lactam antibacterials, penicillins (J01C)	10,68
Other beta-lactam antibacterials (J01D)	2,89
Tetracyclines (J01A)	2,47
Macrolides, lincosamides and streptogramins (J01F)	3,88
Quinolone antibacterials (J01M)	1,25
Sulfonamides and trimethoprim (J01E)	0,95
Other J01 substances	1,48
Total J01 classes	***23,59***

Distribution of J01 classes in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Comments

National Network: As in previous years the data on antibiotic usage in Poland is based on reimbursement data from the National Health Fund (NHF). The system completing the data has been under modernization so the results on antibiotic usage may be biased over the years. The example of this is the false rise of the usage of J01XE01 (furaginum - nitrofuran derivate) as it was not reported in preceding years. This of course results also in the rise of the whole J01X group. Concerning the coverage of the consumption data - all antibiotic are available only with doctor's prescription and are in some percentage reimbursed by NHF. Therefore the presented data should cover most of the primary care sales.

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	90%	Ministry of Health
Ambulatory care	Sales	100%	Ministry of Health

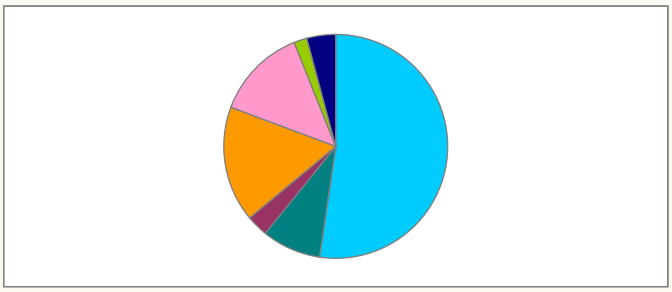
Population	Data source
8.194.887	National Health Service (NHS)

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

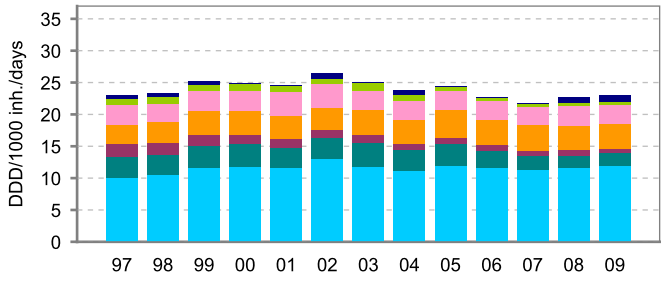
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	12,00	0,48
Other beta-lactam antibacterials (J01D)	1,96	0,42
Tetracyclines (J01A)	0,72	0,02
Macrolides, lincosamides and streptogramins (J01F)	3,83	0,15
Quinolone antibacterials (J01M)	3,04	0,08
Sulfonamides and trimethoprim (J01E)	0,43	0,06
Other J01 substances	0,96	0,17
Total J01 classes	***22,94***	***1,38***

Distribution of J01 classes in ambulatory care sector



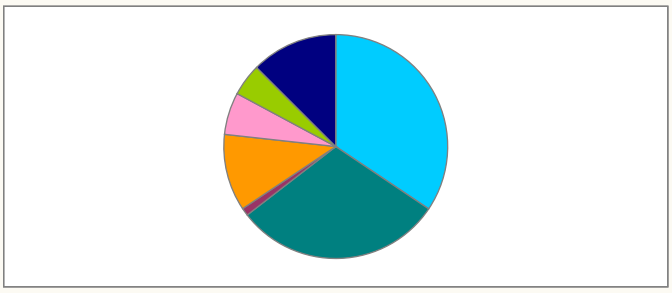
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



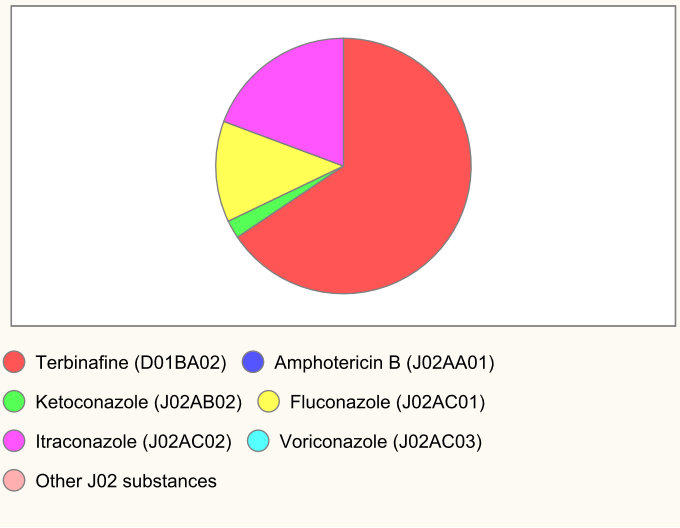
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

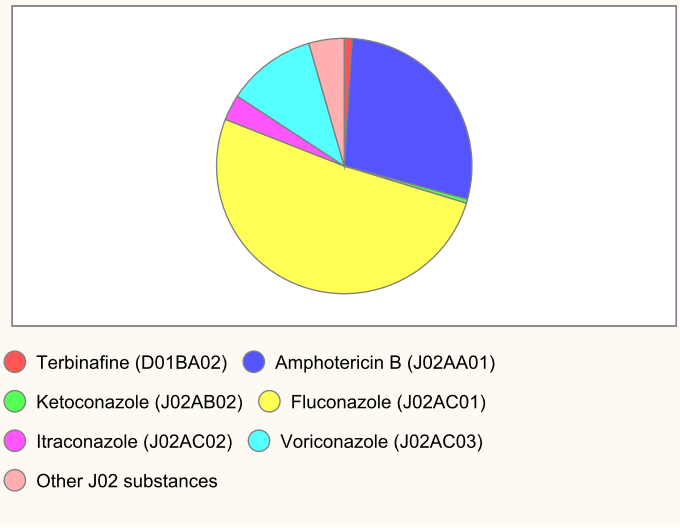
Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	1,44	<0.01
Amphotericin B (J02AA01)	0.00	0,02
Ketoconazole (J02AB02)	0,05	<0.01
Fluconazole (J02AC01)	0,28	0,04
Itraconazole (J02AC02)	0,42	<0.01
Voriconazole (J02AC03)	0.00	<0.01
Other J02 substances	0.00	<0.01
Total J02 substances	***2,19***	***0,08***

Distribution of J02 substances in ambulatory care sector



Distribution of J02 substances in hospital care sector



Comments

National Network: In 2009, ambulatory care utilization of antimicrobials reached 22.94 DID. This is an increase of 1.5% when compared to 2008. Ambulatory antimicrobial use slightly increased during the last two years, mainly due to an increase of use of penicilins (J01C) and other antibacterials (J01X). In fact, the most prescribed antibiotics were penicilins representing 52% of total antibiotic use; they increased with 3.5% when compared to 2008. Following are macrolides, lincosamides and streptogramins (J01F) with 17% and quinolones (J01M) with 13% of total use, both showing a small decrease. In hospital care, use of antimicrobials stand for 1.38 DID. Proportional hospital use of penicilins and other becta-lactams (J01D), mostly ceftriaxone, represent 34% and 30% respectively. Antifungal & antimycotic utilization increased with 12% in 2009 as compared to 2008, manly due to terbinafine. Although this seems a huge increase, it only stands for 0.19 DID.

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	95%	Ministry of Health
Ambulatory care	Reimbursement	100%	Ministry of Health

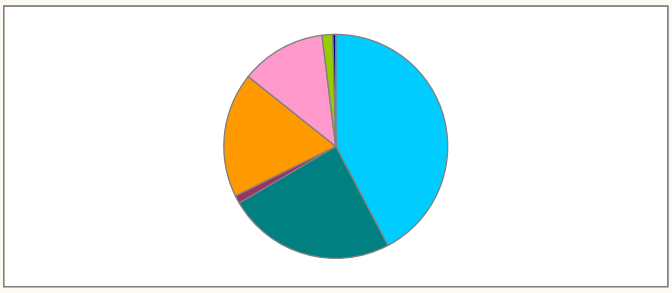
Population	Data source
21.469.960	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

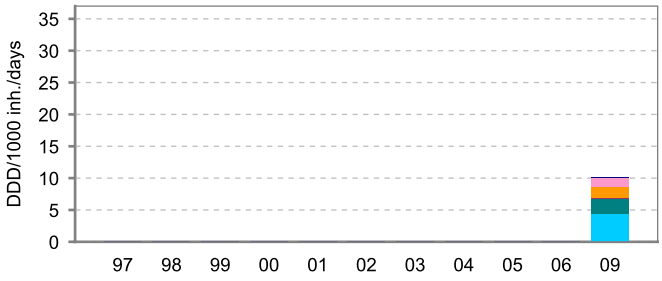
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	4,31	1,36
Other beta-lactam antibacterials (J01D)	2,47	0,49
Tetracyclines (J01A)	0,11	0,03
Macrolides, lincosamides and streptogramins (J01F)	1,84	0,07
Quinolone antibacterials (J01M)	1,26	0,33
Sulfonamides and trimethoprim (J01E)	0,16	0,04
Other J01 substances	0,04	0,29
Total J01 classes	***10,19***	***2,62***

Distribution of J01 classes in ambulatory care sector



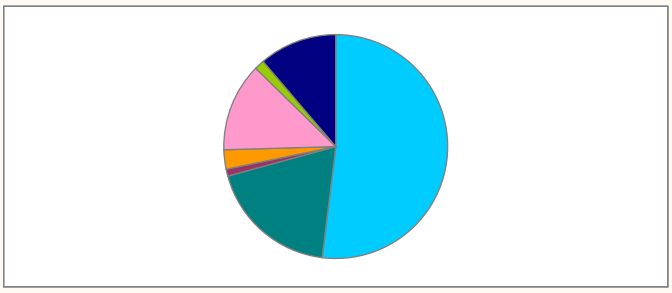
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



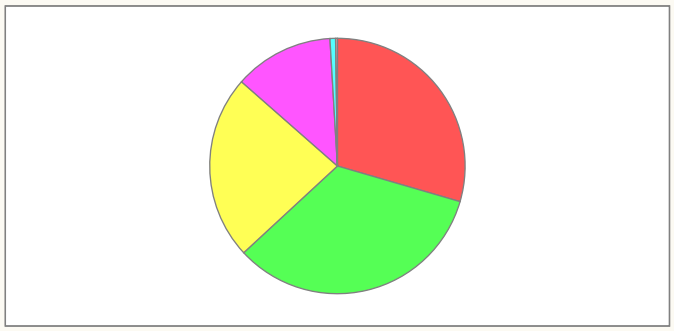
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

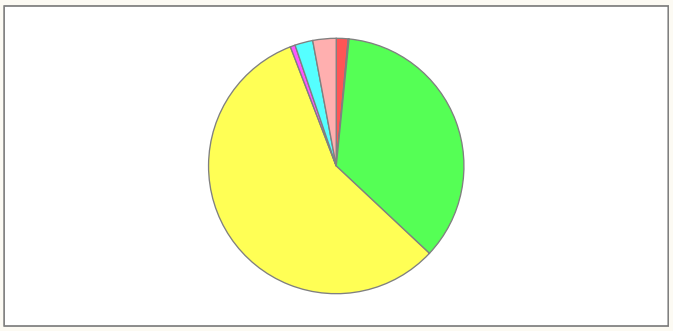
J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0,10	<0.01
Amphotericin B (J02AA01)	0.00	<0.01
Ketoconazole (J02AB02)	0,11	0,02
Fluconazole (J02AC01)	0,08	0,02
Itraconazole (J02AC02)	0,04	<0.01
Voriconazole (J02AC03)	<0.01	<0.01
Other J02 substances	<0.01	<0.01
Total J02 substances	***0,33***	***0,04***

Distribution of J02 substances in ambulatory care sector



Terbinafine (D01BA02) Amphotericin B (J02AA01)
Ketoconazole (J02AB02) Fluconazole (J02AC01)
Itraconazole (J02AC02) Voriconazole (J02AC03)
Other J02 substances

Distribution of J02 substances in hospital care sector



Terbinafine (D01BA02) Amphotericin B (J02AA01)
Ketoconazole (J02AB02) Fluconazole (J02AC01)
Itraconazole (J02AC02) Voriconazole (J02AC03)
Other J02 substances

Russian Federation 2009

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	Marketing Research Company
Ambulatory care	Sales	100%	Marketing Research Company

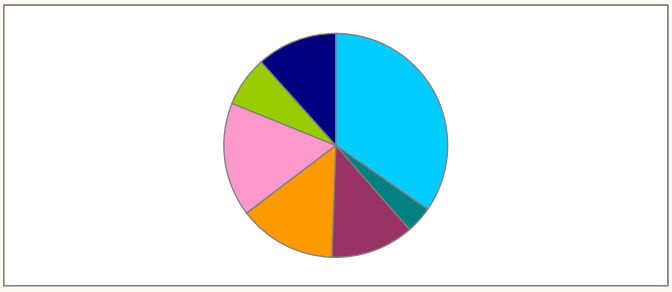
Population	Data source
141.914.509	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

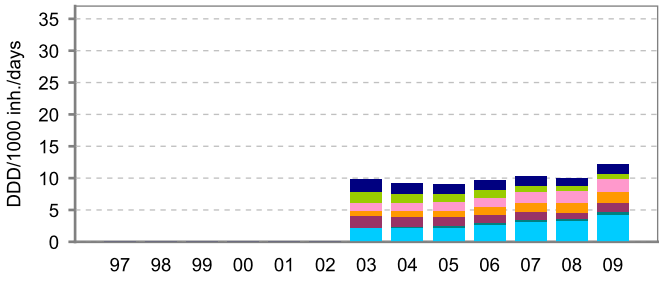
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	4,23	0,36
Other beta-lactam antibacterials (J01D)	0,47	0,65
Tetracyclines (J01A)	1,46	0,05
Macrolides, lincosamides and streptogramins (J01F)	1,72	0,13
Quinolone antibacterials (J01M)	2,01	0,27
Sulfonamides and trimethoprim (J01E)	0,89	0,01
Other J01 substances	1,42	0,33
Total J01 classes	***12,20***	***1,81***

Distribution of J01 classes in ambulatory care sector



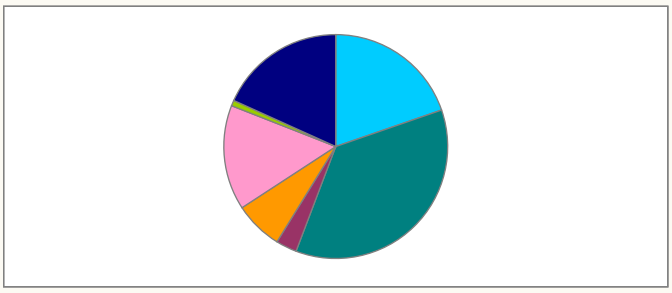
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



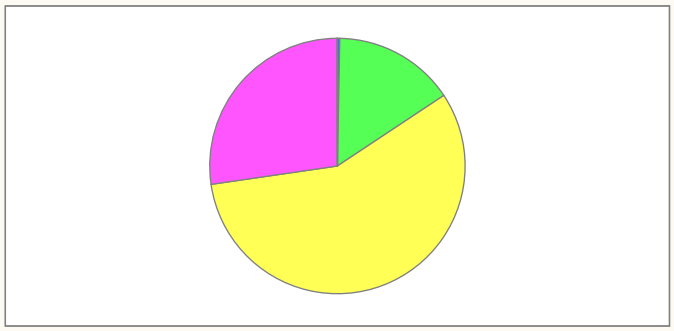
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

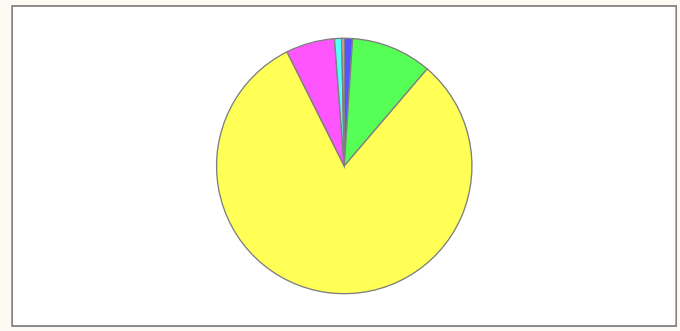
Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0.00	0.00
Amphotericin B (J02AA01)	<0.01	<0.01
Ketoconazole (J02AB02)	0,06	<0.01
Fluconazole (J02AC01)	0,24	0,02
Itraconazole (J02AC02)	0,11	<0.01
Voriconazole (J02AC03)	<0.01	<0.01
Other J02 substances	<0.01	<0.01
Total J02 substances	***0,42***	***0,02***

Distribution of J02 substances in ambulatory care sector



Distribution of J02 substances in hospital care sector



Comments

National Network: We observe a rather big increase in J01 consumption for the year 2009 as compared to 2008. This is an unexpected finding. But it coincides with the observed decrease of J01 consumption in hospital settings. Besides, it is possible that Russia has been under using systemic antimicrobials in ambulatory care for many years and now is moving towards moderate European users.

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	Medicines Agency
Ambulatory care	Sales	100%	Medicines Agency

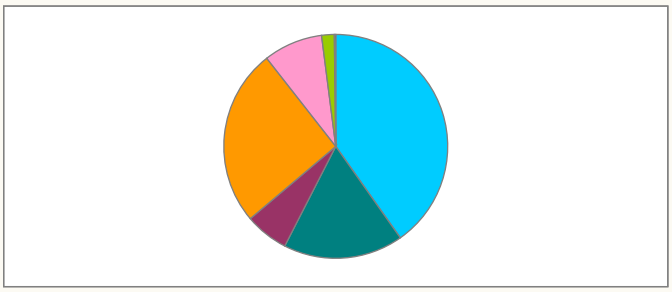
Population	Data source
5.421.937	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

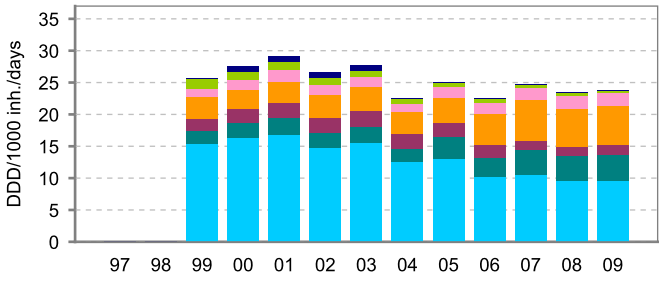
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	9,56	0,72
Other beta-lactam antibacterials (J01D)	4,12	0,52
Tetracyclines (J01A)	1,50	0,02
Macrolides, lincosamides and streptogramins (J01F)	6,09	0,11
Quinolone antibacterials (J01M)	2,03	0,33
Sulfonamides and trimethoprim (J01E)	0,43	0,03
Other J01 substances	0,05	0,12
Total J01 classes	***23,78***	***1,85***

Distribution of J01 classes in ambulatory care sector



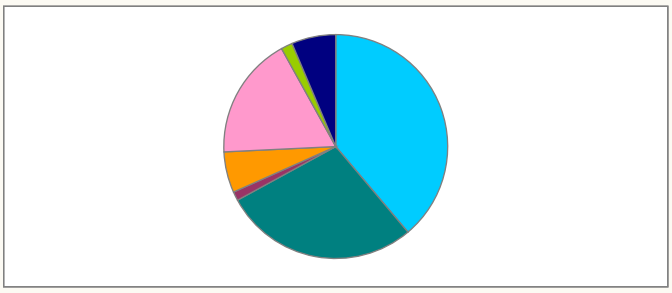
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



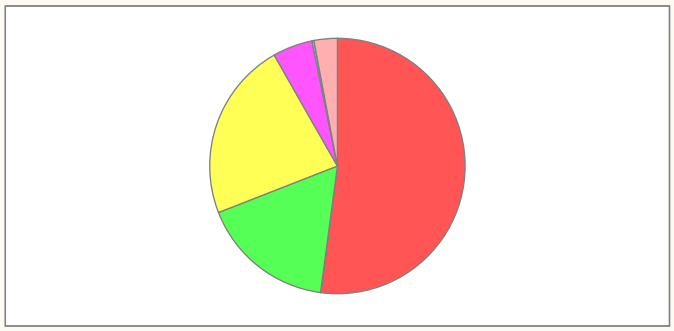
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

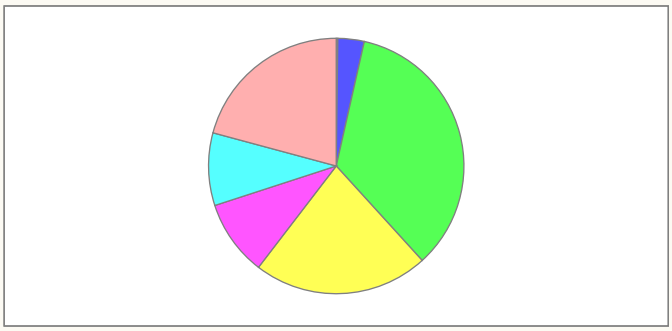
J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0,64	<0.01
Amphotericin B (J02AA01)	<0.01	<0.01
Ketoconazole (J02AB02)	0,21	0,04
Fluconazole (J02AC01)	0,28	0,03
Itraconazole (J02AC02)	0,06	0,01
Voriconazole (J02AC03)	<0.01	0,01
Other J02 substances	0,04	0,02
Total J02 substances	***1,23***	***0,12***

Distribution of J02 substances in ambulatory care sector



Terbinafine (D01BA02) Amphotericin B (J02AA01)
Ketoconazole (J02AB02) Fluconazole (J02AC01)
Itraconazole (J02AC02) Voriconazole (J02AC03)
Other J02 substances

Distribution of J02 substances in hospital care sector



Terbinafine (D01BA02) Amphotericin B (J02AA01)
Ketoconazole (J02AB02) Fluconazole (J02AC01)
Itraconazole (J02AC02) Voriconazole (J02AC03)
Other J02 substances

Comments

National Network: Since the financial cost of the antibiotic treatment in hospitals are significantly lower than those of the ambulant care, it is clear that ambulant care should be paid much more attention than before. The problem is that the majority of Slovak doctors prescribe antibiotics empirically, ie without the appropriate laboratory tests. In the project S-MedDial we want to focus on rational indication for laboratory tests of physicians in ambulant practice and to provide feedback to their own antibiotics prescriptions through the website. We continue the cooperation with the Ministry of Health and with medical faculties in special educational programs for antibiotic resistance in the form of leaflets, which is designed for patients but also for doctors. The cost development of antibiotics consumption in recent years has a growing trend. When measured in units of DDD, this increase is larger (around 16%). The average price per pack of antibiotics increased and reached 6.5 €. Most frequently prescribed antibiotics by the consumption of packaging in recent years were the group of beta-lactams antibiotics (mostly penicillins). High consumption was reported in the group of macrolides and quinolones. Around 80% of antibiotic consumption by packing can be attributed to ambulant care and only the remaining portion to hospital care. This means that only every fifth pack of antibiotics was used in hospitals. A very slow decrease in consumption of antibiotics in the ambulant care was accompanied by a very slow growth in the hospital care.

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	National hospital network
Ambulatory care	Sales	100%	National Institute

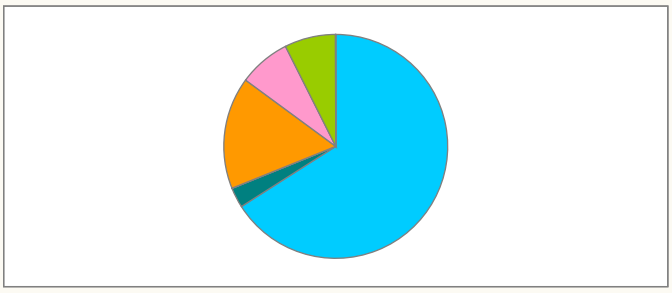
Population	Data source
2.042.335	WHO

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

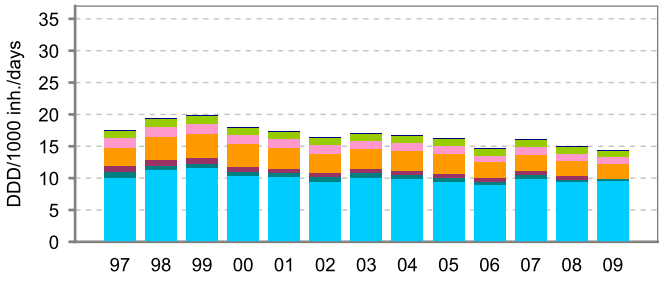
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	9,51	0,70
Other beta-lactam antibacterials (J01D)	0,42	0,40
Tetracyclines (J01A)	<0.01	0,06
Macrolides, lincosamides and streptogramins (J01F)	2,33	0,15
Quinolone antibacterials (J01M)	1,08	0,26
Sulfonamides and trimethoprim (J01E)	1,06	0,06
Other J01 substances	<0.01	0,16
Total J01 classes	***14,42***	***1,78***

Distribution of J01 classes in ambulatory care sector



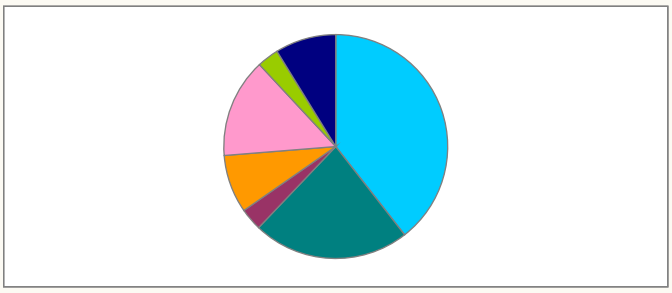
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



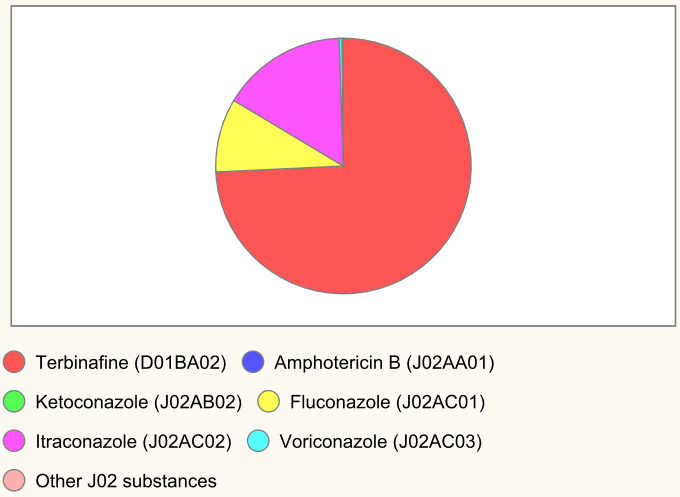
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

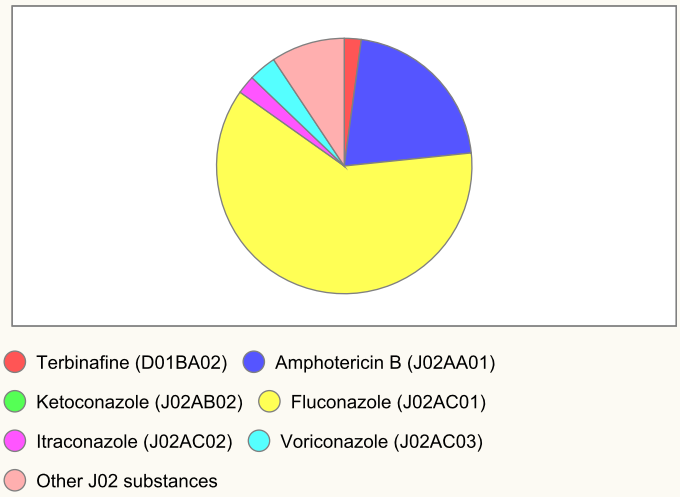
Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0,85	<0.01
Amphotericin B (J02AA01)	0.00	0,02
Ketoconazole (J02AB02)	0.00	0.00
Fluconazole (J02AC01)	0,11	0,06
Itraconazole (J02AC02)	0,18	<0.01
Voriconazole (J02AC03)	<0.01	<0.01
Other J02 substances	<0.01	<0.01
Total J02 substances	***1,14***	***0,09***

Distribution of J02 substances in ambulatory care sector



Distribution of J02 substances in hospital care sector



Comments

National Network: The consumption of antibiotics (J01) in AC declined in 2009 vs 2008 for 4.1% (27% reduction vs 1999 when we had the highest AC consumption). In 2009 the use of tetracyclines in AC declined with 0.05 DID (DDD/1000 inh/day) compared to previous years because of the shortage of doxycycline. The hospital pharmacies covered the therapy with tetracyclines for outpatients. So, more correct consumption in AC would be 14.47 DID and in HC 1.73 DID. Much work is needed to improve antimicrobial prescribing in AC and HC.

Health care sector	Data type	Coverage	Data source
Ambulatory care	Reimbursement	100%	Ministry of Health

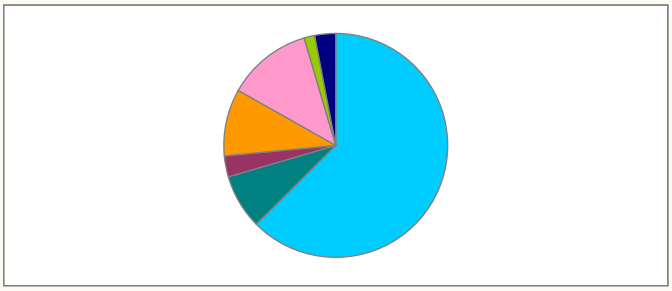
Population	Data source
46.745.807	National Institute of Statistics

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

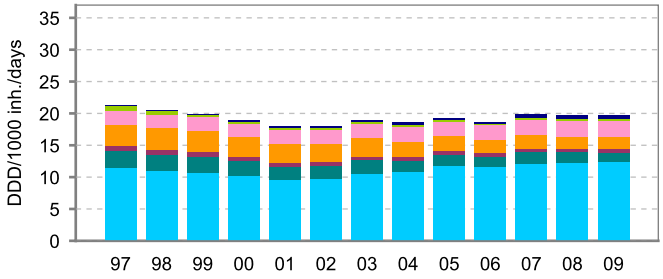
J01 classes	Ambulatory care
Beta-lactam antibacterials, penicillins (J01C)	12,31
Other beta-lactam antibacterials (J01D)	1,56
Tetracyclines (J01A)	0,60
Macrolides, lincosamides and streptogramins (J01F)	1,90
Quinolone antibacterials (J01M)	2,42
Sulfonamides and trimethoprim (J01E)	0,30
Other J01 substances	0,59
Total J01 classes	***19,68***

Distribution of J01 classes in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Comments

National Network: Since 1997 there has been a downward trend in the overall use of antibiotics in Spain until 2003 when a slight increase was detected. The pattern of use continues to be essentially the same, with broad-spectrum penicillins accounting for 63% of the overall use in 2009. The ratio amoxicillin/amoxicillin-clavulanic acid was maintained greater than 1 up to 2001 when an inversion occurred, reaching 0.6 in 2009. The increase in use of amoxicillin-clavulanic acid expressed in DDD per 1000 inhabitants per day was mostly due to the progressive increase of share of high-strength presentations, while the number of packages sold did not substantially change. The use of cephalosporins and macrolides has steadily decreased until 2009 where the historical minimum was reached (1.5 and 1.9 DID respectively); in 2007, however, a slight increase in both subgroups was observed due to cefuroxime and azithromycin consumption; the decrease in 2008 was due overall to cefuroxime, and erythromycin. The use of quinolones as a group appeared to be rather stable although there is a recent increase in the use of levofloxacin at the same time as moxifloxacin, norfloxacine and ofloxacine use decreased. In 2006 and 2007, the Spanish Ministry of Health launched two widely publicised campaigns on the rational use of antibiotics (TV, radio, and newspapers) focused on several key issues including over-the-counter consumption; according to these ESAC data, there is little or no impact in the use of antibiotics. Nevertheless, to assess the full impact of these campaigns other studies including over-the-counter consumption would be needed.

Health care sector	Data type	Coverage	Data source
Hospital care	Sales	100%	Pharmacy Service Agency
Ambulatory care	Sales	100%	Pharmacy Service Agency

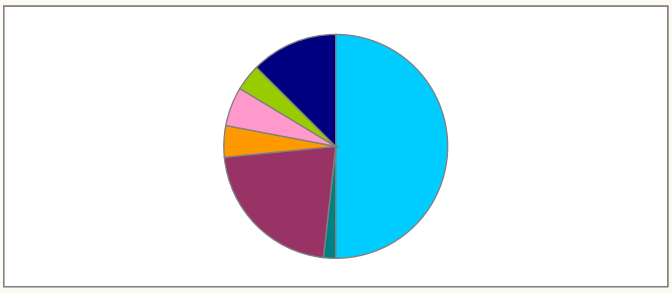
Population	Data source
9.256.347	Statistics Sweden (SCB)

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

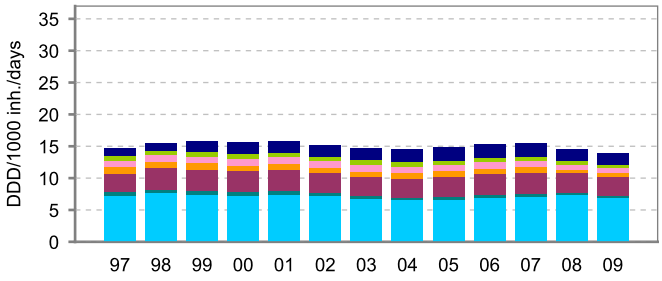
J01 classes	Ambulatory care	Hospital care
Beta-lactam antibacterials, penicillins (J01C)	6,98	0,69
Other beta-lactam antibacterials (J01D)	0,24	0,21
Tetracyclines (J01A)	3,03	0,17
Macrolides, lincosamides and streptogramins (J01F)	0,63	0,06
Quinolone antibacterials (J01M)	0,79	0,15
Sulfonamides and trimethoprim (J01E)	0,54	0,08
Other J01 substances	1,75	0,12
Total J01 classes	***13,95***	***1,47***

Distribution of J01 classes in ambulatory care sector



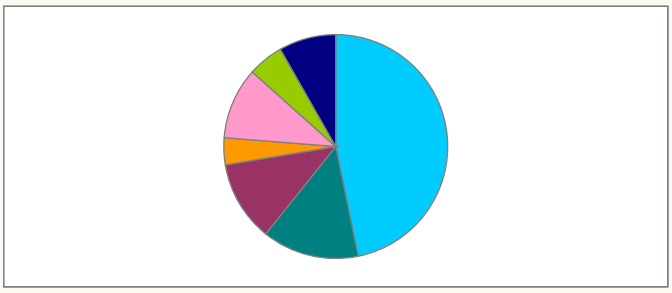
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Distribution of J01 classes in hospital care sector



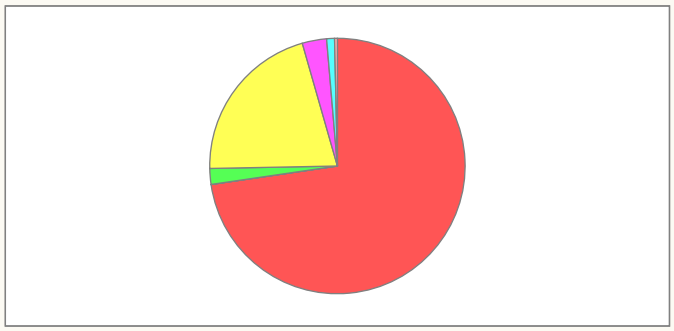
Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D) Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M) Sulfonamides and trimethoprim (J01E)
Other J01 substances

Antimycotics for systemic use (J02)

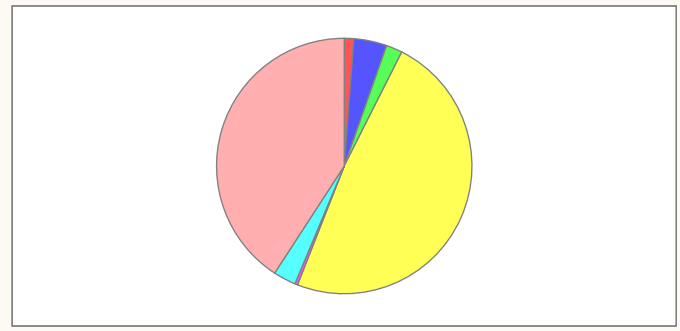
Use of antimycotics for systemic use expressed in DDD/1000 inh./day in 2009

J02 substances	Ambulatory care	Hospital care
Terbinafine (D01BA02)	0,50	<0.01
Amphotericin B (J02AA01)	<0.01	<0.01
Ketoconazole (J02AB02)	0,01	<0.01
Fluconazole (J02AC01)	0,14	0,04
Itraconazole (J02AC02)	0,02	<0.01
Voriconazole (J02AC03)	<0.01	<0.01
Other J02 substances	<0.01	0,04
Total J02 substances	***0,69***	***0,09***

Distribution of J02 substances in ambulatory care sector



Distribution of J02 substances in hospital care sector



Comments

National Network: After several years of small changes of antibiotics sales in Sweden, 2009 showed a marked decrease (5.5%). The decrease encompasses all age groups, all counties and almost all antibiotics. The greatest reduction was seen in the age group 0-6 years where sales decreased with 17.2%. Several reasons have been suggested in the analysis of this decrease, one of the major being the increased awareness of infection control issues and hand hygiene evoked by the outbreak of the pandemic influenza. Many daycare centers for children have developed hygiene curricula after initial studies showing promising results with less absence due to sickness. 30% of all children were treated with at least one course of antibiotics in 2009. Ten percent of all purchases of antibiotics commonly used to treat respiratory tract infections in children aged 0-6 years are followed by an additional course within 14 days. Beta-lactamase sensitive penicillins together with tetracyclines are the most commonly used antibiotics in outpatient care. Treatment of respiratory tract infections has been the subject of information campaigns in recent years and this is reflected in the sales of antibiotics. Seasonal variation in the sales of tetracyclines was less pronounced in 2009 than in previous years. Treatment of lower urinary tract infections in women has been the subject of information campaigns for several years. The proportion of the two recommended first line substances have been increasing for every year and now represent nearly 70% of sales of the substances used to treat this condition. In recent years, antibiotic use in hospital care has shown a shift from an extensive use of cephalosporins to an increased use of narrow spectrum penicillins. This continues and is even more pronounced in 2009. The regional differences are however evident regarding the use of newer classes of antibiotics such as carbapenems and piperacillin with tazobactam.

Health care sector	Data type	Coverage	Data source
Ambulatory care	Reimbursement	100%	Ministries of Health

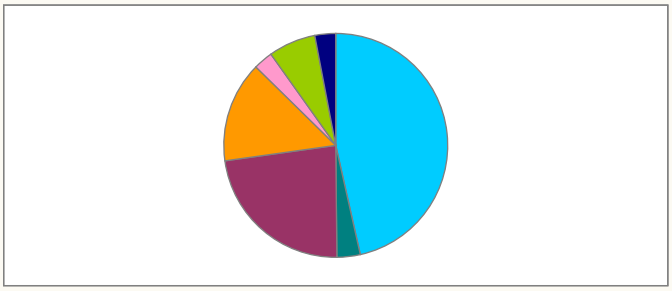
Population	Data source
61.791.900	Office for National Statistics

Antimicrobials for systemic use (J01)

Use of antimicrobials for systemic use expressed in DDD/1000 inh./day in 2009

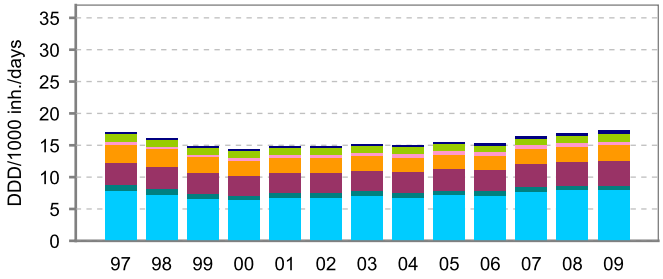
J01 classes	Ambulatory care
Beta-lactam antibacterials, penicillins (J01C)	8,03
Other beta-lactam antibacterials (J01D)	0,58
Tetracyclines (J01A)	3,96
Macrolides, lincosamides and streptogramins (J01F)	2,51
Quinolone antibacterials (J01M)	0,48
Sulfonamides and trimethoprim (J01E)	1,18
Other J01 substances	0,52
Total J01 classes	***17,27***

Distribution of J01 classes in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Trends of use of J01 in ambulatory care sector



Beta-lactam antibacterials, penicillins (J01C)
Other beta-lactam antibacterials (J01D)
Tetracyclines (J01A)
Macrolides, lincosamides and streptogramins (J01F)
Quinolone antibacterials (J01M)
Sulfonamides and trimethoprim (J01E)
Other J01 substances

Comments

National Network: The UK has seen a shift away from cephalosporins and quinolone usage over the past two years, possibly in response to Department of Health guidance recommending that these classes be avoided where possible in order to minimise risk of Clostridium difficile-associated diarrhoea (CDAD). There has been an increased volume of macrolide usage; this may represent replacement of 'respiratory' quinolones; there have also been increases in non-cephalosporin agents used for treatment of urinary tract infections, namely nitrofurantoin and trimethoprim. Again, this is in line with recently published public health guidance on empiric treatment. Usage of metronidazole and oral vancomycin, agents used to treat CDAD, are also increasing. Whilst numbers are small, there have also been increases in usage of parenteral agents traditionally confined to secondary care usage, such as meropenem and piperacillin-tazobactam, potentially indicating treatment of multi-drug resistant organisms in ambulatory care.