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SURVEILLANCE REPORT

Surveillance of antimicrobial consumption in Europe

2011

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This report of the European Centre for Disease Prevention and Control (ECDC) was coordinated by Klaus Weist.
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Errata

On 5 September, the following corrections were made:

Note (c) to Figures 3.3, 3.10, 3.14, 3.17, 3.21, 3.25 and 3.28 was changed from 'Cyprus (2007–2010)' to 'Cyprus (2007–2011)'.

A number of other changes were made to correct minor typographical errors.

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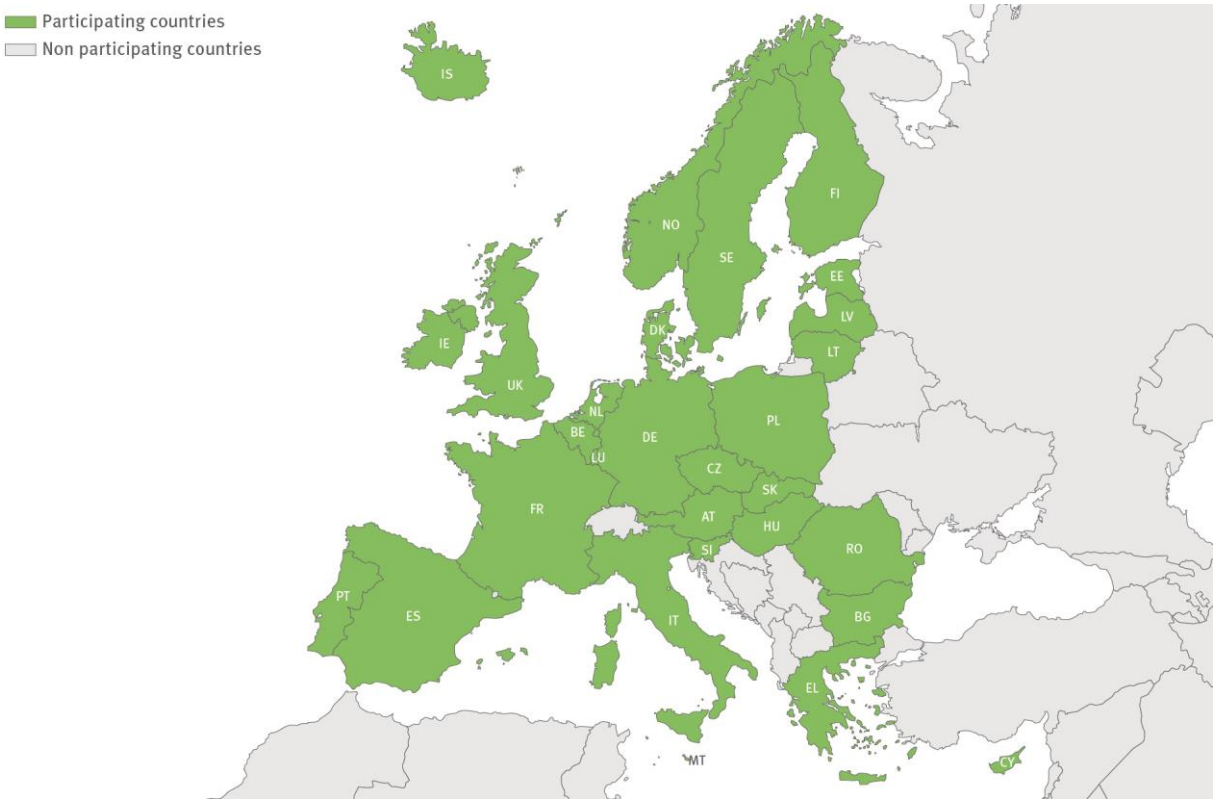
Abbreviations

ARPEC	Antibiotic Resistance and Prescribing in European Children project
ATC classification	Anatomical Therapeutic Chemical classification
DDD	Defined daily dose
EARS-Net	European Antimicrobial Resistance Surveillance Network
ECDC	European Centre for Disease Prevention and Control
EEA	European Economic Area
ESAC project	European Surveillance of Antimicrobial Consumption project
ESAC-Net	European Surveillance of Antimicrobial Consumption Network
ESVAC project	European Surveillance of Veterinary Antimicrobial Consumption project
EU	European Union
HAI-Net	Healthcare-associated Infections Surveillance Network
WHO	World Health Organization

EU/EEA countries participating in ESAC-Net, 2011



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

National institutions/organisations participating in ESAC-Net

Country	National institutes/organisations	website
Austria	Ministry of Health	www.bmg.gv.at
Belgium	Public Health, Food Chain Safety and Environment Scientific Institute of Public Health University of Antwerp (Laboratory of Medical Microbiology) National Institute for Health and Disability Insurance (INAMI-RIZIV)	www.health.belgium.be www.wiv-isp.be www.ua.ac.be www.inami.fgov.be/homefr.htm
Bulgaria	National Center of Infectious and Parasitic Diseases Alexander University Hospital, Medical University	www.ncipd.org
Cyprus	Directorate of Medical and Public Health Services Pharmaceutical Services	www.moh.gov.cy
Czech Republic	Charles University, Faculty of pharmacy	www.faf.cuni.cz
Denmark	Statens Serum Institut	www.ssi.dk
Estonia	Health Board State Agency of Medicines	www.terviseamet.ee www.ravimiamet.ee
Finland	National Institute for Health and Welfare	www.thl.fi
France	National Institute for Public Health Surveillance Agency for the Safety of Health Products	www.invs.sante.fr http://ansm.sante.fr
Germany	Robert Koch Institute Wissenschaftliches Institut der AOK (WIdO)	www.rki.de www.wido.de
Greece	Hellenic Center for Disease Control and Prevention National Organization for Medicines	www.keelpno.gr www.eof.gr
Hungary	National Center for Epidemiology University of Science of Szeged	www.oek.hu www.u-szeged.hu
Iceland	Centre of Health Security and Communicable Disease Control	www.landlaeknir.is/ www.lyfjastofnun.is/
Ireland	Health Protection Surveillance Centre	www.hpsc.ie
Italy	Ministry of Health National Institute of Health Italian Medicines Agency	www.salute.gov.it www.simi.iss.it www.agenziafarmaco.gov.it
Latvia	The Centre for Disease Prevention and Control (CDPC) of Latvia State Agency of Medicines of Latvia Pauls Stradins Clinical University Hospital	www.spkc.gov.lv www.vza.gov.lv www.stradini.lv
Lithuania	Institute of Hygiene	www.hi.lt
Luxembourg	Ministry of Health	www.ms.public.lu/fr/index.html
Malta	National Antibiotic Committee	www.nacmalta.info/ https://ehealth.gov.mt/healthportal/others/regulatory_councils/national_antibiotic_committee/introduction.aspx
Netherlands	National Institute for Public Health and the Environment Dutch working group on antibiotic policy	www.rivm.nl www.swab.nl
Norway	Norwegian Institute of Public Health	www.fhi.no
Poland	Ministry of Health National Institute of Public Health National Medicines Institute	www.mz.gov.pl www.pzh.gov.pl www.il.waw.pl
Portugal	National Authority of Medicines and Health Products	www.infarmed.pt
Romania	National Institute of Public Health National Institute of Research and Development for Microbiology and Immunology "Cantacuzino"	www.insp.gov.ro. www.cantacuzino.ro
Slovakia	Comenius University	www.uniba.sk

Country	National institutes/organisations	website
Slovenia	National Institute of Public Health University Medical Centre Ljubljana	www.ivz.si/ www.4.kclj.si
Spain	National Centres of Microbiology and Epidemiology Spanish Agency of Medicines and Medical Devices (AEMPS) University Hospital Son Espases University Hospital of Bellvitge	 www.aemps.gob.es www.hospitalsonespases.es/ www.bellvitgehospital.cat
Sweden	Swedish Institute for Communicable Disease Control	www.smi.se
United Kingdom	Public Health England Health Protection Scotland Public Health Agency University of Dundee University Hospital of South Manchester Public Health Wales The British Society for Antimicrobial Chemotherapy	www.hpa.org.uk www.hps.scot.nhs.uk www.dundee.ac.uk www.uhsm.nhs.uk www.wales.nhs.uk www.bsac.org.uk

Summary

This is the second annual report of the European Surveillance of Antimicrobial Consumption Network (ESAC-Net) published by ECDC. The report is based on antimicrobial consumption data from the community (primary care sector) and the hospital sector reported to ECDC for the year 2011 by 27 EU Member States and two EEA non-EU countries (Iceland and Norway).

Key findings

In the **community**, i.e. outside hospitals, consumption of antibacterials for systemic use (Anatomical Therapeutic Chemical (ATC) group J01) in 2011 was reported by 29 countries and varied by a factor of 3.1 between the highest consumption (35.1 defined daily doses (DDD) per 1 000 inhabitants and per day in Greece) and the lowest (11.4 DDD per 1 000 inhabitants and per day in the Netherlands). The median consumption was 19.5 DDD per 1 000 inhabitants and per day. The most commonly used subgroups of antibacterials were the combinations of penicillins including beta-lactamase inhibitors (ATC group J01CR) and penicillins with extended-spectrum (ATC group J01CA), followed by macrolides (ATC group J01FA) and tetracyclines (ATC group J01AA). A trend analysis performed on data on consumption of antibacterials for systemic use for the period 2007–2011 and including 22 ESAC-Net participating countries, showed a significant increase for three countries (Belgium, Malta and the United Kingdom). No significant decrease was observed. In 2011, an overall increase of 1.0 DDD per 1 000 inhabitants and per day in the median consumption of antibacterials for systemic use was observed compared with 2010. The largest increase in consumption of antibacterials for systemic use in the community was seen in Ireland, from 20.3 DDD per 1 000 inhabitants and per day in 2010, to 22.6 DDD per 1 000 inhabitants and per day in 2011. Luxembourg reported the largest decrease in consumption from 28.6 DDD per 1 000 inhabitants and per day in 2010 to 27.6 DDD per 1 000 inhabitants and per day in 2011.

For antibacterials for systemic use (ATC group J01) that are administered orally, ESAC-Net also reported consumption as a number of packages per 1 000 inhabitants and per day. In 2011, consumption of these antibacterials ranged from 1.2 packages per 1 000 inhabitants and per day (Sweden) to 4.9 packages per 1 000 inhabitants and per day (France). On average, 2.5 packages of antibacterials for systemic use (ATC group J01) were consumed per 1 000 inhabitants and per day. A few countries (Belgium, Bulgaria and Slovenia) moved up or down in the ranking by three or more places when consumption was expressed in packages per 1 000 inhabitants and per day instead of DDD per 1 000 inhabitants and per day.

In 2011, 25 countries reported data on consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01BA) in the community. Consumption varied by a factor of 7.9 between the highest consumption (3.3 DDD per 1 000 inhabitants and per day in Belgium) and the lowest (0.42 DDD per 1 000 inhabitants and per day in Romania). Terbinafine, ketoconazole, fluconazole and itraconazole accounted for 97.6% of the total antimycotic and antifungal consumption in the community in all countries. Terbinafine consumption accounted for more than 50% of the total systemic antimycotic and antifungal consumption in 19 (76%) countries.

In 2011, two of the 12 quality indicators from the former ESAC project, used to express consumption data of antibacterials for systemic use (ATC group J01) in the community [1, 2], showed a distinct variation across Europe. Additionally, significant, but divergent, trends were observed for the quality indicators measuring consumption of beta-lactamase-sensitive penicillins and combinations of penicillins including beta-lactamase inhibitors:

- Consumption of beta-lactamase-sensitive penicillins (ATC group J01CE) expressed as a percentage of the total consumption of antibacterials for systemic use (ATC group J01), varied from <0.1% in Italy and Latvia to 29.9 % in Denmark and 28.1% in Sweden. A trend analysis revealed a significant decrease in 12 countries (Austria, Belgium, Bulgaria, Denmark, Estonia, Finland, Germany, Italy, Luxembourg, the Netherlands, Norway and Poland) for this indicator between 2007 and 2011.
- Conversely, 10 countries (Austria, Cyprus, Denmark, Estonia, France, Germany, Italy, Luxembourg, Slovenia and the United Kingdom) had a significant increase in their consumption of combinations of penicillins including beta-lactamase inhibitors (ATC group J01CR) expressed as a percentage of the total consumption of antibacterials for systemic use.

Further, the ratio of the consumption of broad-spectrum penicillins/cephalosporins/macrolides to that of narrow-spectrum penicillins/cephalosporins/macrolides also showed large variation; from 0.2 in Sweden and Norway to 142.7 in Malta.

In the **hospital sector**, consumption of antibacterials for systemic use (ATC group J01) in the 18 countries that reported 2011 data varied from 1.0 DDD per 1 000 inhabitants and per day in the Netherlands, to 3.2 in Romania. The most frequently used subgroup in the hospital sector was penicillins (ATC group J01C), followed by cephalosporins (ATC group J01D) and quinolones (ATC group J01M).

In 2011, 17 countries reported consumption data of antimycotics and antifungals for systemic use (ATC groups J02 & D01BA) in the hospital sector, ranging from 0.03 DDD per 1 000 inhabitants and per day in Bulgaria to 0.2 DDD per 1 000 inhabitants and per day in Denmark. Overall, amphotericin B and fluconazole accounted for 71% of the total antimycotic and antifungal consumption in the hospital sector in participating countries. Fluconazole consumption alone accounted for more than 50% of the total systemic antimycotic and antifungal consumption in 12 (71%) these countries.

In 2011, data on total antiviral consumption (ATC group J05), jointly presented for both the community and the hospital sector, were available from 24 countries. Consumption varied by a factor of 11 between the highest (4.3 DDD per 1 000 inhabitants and per day in Portugal) and the lowest consumption (0.4 DDD per 1 000 inhabitants and per day in Lithuania). Based on indications for treatment with antivirals in ATC group J05, as suggested by the former ESAC project [3], most antivirals reported were 'HIV/AIDS antivirals' followed by 'herpes antivirals'. Lithuania showed a different pattern with the highest consumption being of antivirals active against influenza.

Conclusions

The results presented in this report document trends of antimicrobial consumption across Europe. The 2011 median consumption of antibacterials for systemic use (ATC group J01) in the community was slightly higher than that of 2010 and only three countries showed a significant increase over the five-year period ending in 2011. For the hospital sector, the 2011 median consumption of antibacterials for systemic use (ATC group J01) was similar to that of previous years and no significant trend can be observed in the consumption.

When analysing the data at ATC subgroup levels, significant, but divergent, trends were observed in both sectors highlighting an increase in consumption of some groups of antibacterials at the expense of others. Identification of the factors and reasons behind these changes remains difficult without additional data on prescriptions or indications for prescription and consumption. Additional detailed information on national programmes and campaigns on the prudent use of antimicrobials is needed before conclusions can be drawn about which factors may have influenced the trends.

Inter-country comparisons using the results presented in this report should be made with caution, as certain countries report their total consumption while most other countries only report data on the community consumption. In addition, reporting practices may vary from year to year even in the same country. Finally, there are differences in the sources of national data and in the availability of national registries of all antimicrobials available on the market in each country; the latter being a prerequisite for presenting comparable data on antimicrobial consumption.

ESAC-Net will continue to collect, analyse and report data from EU/EEA countries, both in the community and in the hospital sector, and provide independent reference information on antimicrobial consumption in Europe. At the European level, the data provided can facilitate the adoption of national targets by Member States to reinforce best practices for the use of antimicrobials.

ECDC provides public access to the ESAC-Net database at the 4th level of the ATC classification in this annual report and in an interactive database on the ECDC website [4], where country overview sheets summarising national results are also provided.

1 Introduction

The use and overuse of antimicrobials is one of the main factors responsible for the development and spread of antimicrobial resistance. This has become a serious threat to public health, notably because of the emergence and spread of highly-resistant bacteria, and because there are very few novel antimicrobial agents in the research and development pipeline. European countries increasingly implement, or plan to implement, actions to control antimicrobial resistance in the community through rational use of antimicrobials, including awareness campaigns on the prudent use of antibiotics. Access to information on antimicrobial consumption in Europe, and in particular the consumption of antibacterials, can be an important source for healthcare professionals and policy makers to monitor progress towards a more prudent use of antibiotics.

This report is based on antimicrobial consumption data from the community (primary care sector) and the hospital sector reported to ECDC for the year 2011 by 27 EU Member States and two EEA non-EU countries (Iceland and Norway).

It includes data for three major categories of antimicrobials:

- antibacterials for systemic use (ATC group J01);
- antimycotics for systemic use and antifungals for systemic use (ATC groups J02 & D01BA);
- antivirals for systemic use (ATC group J05).

The largest proportion of the antimicrobial consumption by humans takes place in the community, i.e. outside of hospitals. Each sector of the healthcare system, i.e., the community and hospital sectors, typically care for different types of patients. Thus, the typical patterns of antimicrobial consumption differ between them. That is why results of consumption of antimicrobials of the ATC groups J01, J02 & D01BA are presented separately for the two sectors.

However, consumption of antivirals for systemic use (ATC group J05) is reported for both sectors grouped together. This is because in several countries, certain antiviral classes even for primary care can only be dispensed in a hospital, while in other countries such antivirals are mostly dispensed in community pharmacies.

Two quantitative indicators are used to report antimicrobial consumption, the number of DDD per 1 000 inhabitants and per day and the number of packages per 1 000 inhabitants and per day.

The former ESAC project developed 12 quality indicators for antimicrobial consumption in the community based on a consensus of European antimicrobial surveillance experts [2]. It was concluded that these indicators could be used to better describe antimicrobial consumption and to assess changes in national antibiotic prescribing patterns in Europe. The indicators report consumption expressed in DDD per 1 000 inhabitants and per day for ATC group J01; percentage of the total consumption of antibacterials for systemic use (ATC group J01) corresponding to various subgroups; the ratio of the consumption of broad-spectrum and narrow spectrum antibacterials; and seasonal variations of the total consumption of antibacterials for systemic use. When comparing results of different countries for the 12 quality indicators, low values of the indicators suggest better quality, with the best quality being within the first quartile (p0–p25). Values within the second quartile (i.e., p25 < values ≤p50) suggest better quality than values of indicators in the third quartile, etc. Only the indicator describing the percentage of the total consumption of antibacterials for systemic use (ATC group J01) corresponding to the subgroup of beta-lactamase-sensitive penicillins is evaluated in the opposite way, i.e. high values of the indicator suggest better quality with the best quality being within the fourth quartile (p75–p100) This report presents the results of the quality indicators for 2011 consumption data.

European surveillance of antimicrobial consumption

ESAC-Net

ESAC-Net is the continuation of the former ESAC project (managed by the University of Antwerp until June 2011) and is a Europe-wide network of national surveillance systems providing independent reference data on antimicrobial consumption in Europe, reported by 29 EU/EEA countries. It collects and analyses data from the community (primary care) and the hospital sector.

The former ESAC project included point prevalence surveys of antimicrobial use conducted in 2008 and 2009 in acute care hospitals and in nursing homes across EU countries. These point prevalence surveys are now included as part of the activities of the Healthcare-Associated Infections Surveillance Network (HAI-Net) at ECDC [5]. Data on the prevalence of antimicrobial use in patients from European acute care hospitals in 2011–2012 are provided through the ECDC-coordinated Europe-wide point prevalence survey of healthcare-associated infections and antimicrobial use. Data on the prevalence of antimicrobial use among residents of long-term care facilities are collected by the ECDC-funded project Healthcare-Associated Infections and Antimicrobial use in European Long-Term Care Facilities (HALT-2).

The objectives of ESAC-Net are:

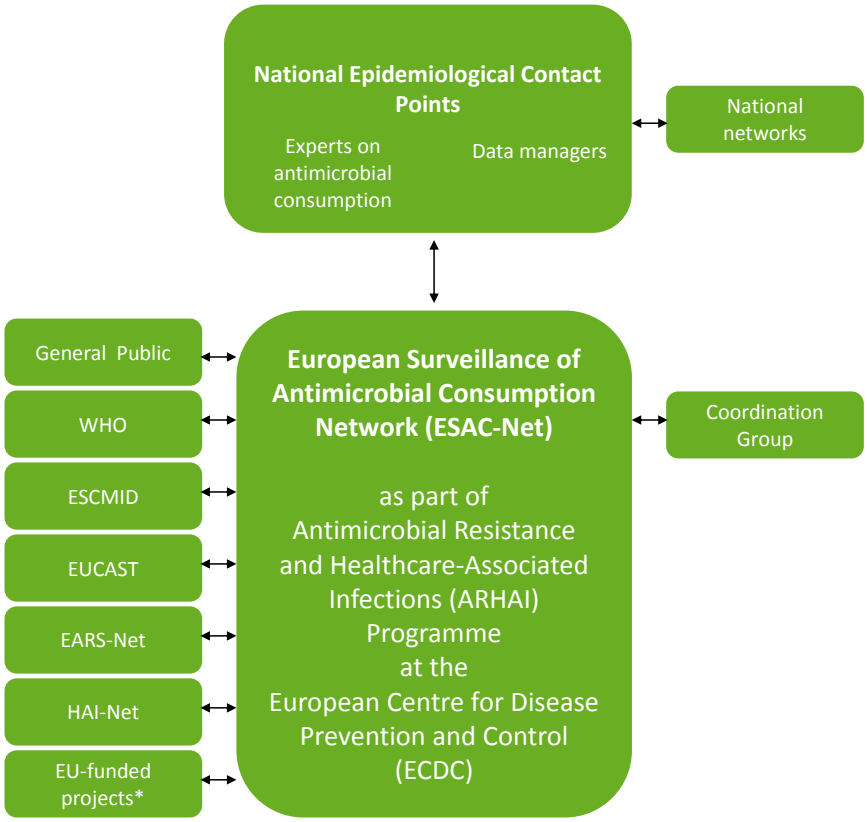
- to provide continuous surveillance of antimicrobial consumption in the European Union;
- to work towards comparable surveillance methods in the community and in the hospital sector;
- to analyse inter-country differences and provide regular feedback to participating Member States;
- to provide public access to information on antimicrobial consumption via the ESAC-Net interactive database [4].

To maintain and facilitate data reporting, ECDC ensures:

- validation of community (primary care) and hospital sector data;
- analysis of the trends in antimicrobial consumption overall and in the different ATC groups;
- public access to information on antimicrobial consumption in Europe through an interactive database;
- timely information and feedback to EU/EEA countries on indicators of antimicrobial consumption. These indicators provide a basis for monitoring the progress of EU/EEA countries towards prudent use of antimicrobials.

Figure 1.1 illustrates how the network is organised. Experts in antimicrobial consumption were nominated by each country to become network participants and they are supported by a coordination group. This group comprises representatives from ESAC-Net participating countries and members of the management team and advisory board of the former ESAC project. There are also observers in the coordination group from other EU projects including the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) and the Antibiotic Resistance and Prescribing in European Children (ARPEC). This coordination group discusses technical, epidemiological and other scientific aspects of antimicrobial consumption surveillance and makes suggestions to ECDC in order to further develop the network and improve its effectiveness.

Figure 1.1. Organisation of ESAC-Net



** EU-funded projects on antimicrobial consumption, e.g. ARPEC and ESVAC.*

2 Technical notes

2.1 Terminology and definitions

The term 'antimicrobial consumption' is used in this report whereas 'antimicrobial use' is applied to data from the point prevalence surveys in acute care hospitals, and in long-term-care facilities where data on the actual application of antimicrobials are retrieved from patient charts. These two projects are now part of ECDC's HAI-Net.

The term 'community' is used to designate the sector providing mainly primary care (general practitioner, specialists) outside of hospitals. The terms 'ambulatory care' and 'outpatient sector' were not used to avoid potential misinterpretations as being patient care in hospitals or other healthcare facilities that did not require the patient to stay overnight.

Antimicrobial consumption is expressed as a number of DDD per 1 000 inhabitants and per day. Complementary to this measurement unit, the number of packages per 1 000 inhabitants and per day is also used, provided that the country collects and reports data at the package level. Because the ATC/DDD system cannot take into account changes in package content, information on the sales of packages is deemed to improve the understanding and interpretation of differences in the levels and trends of consumption observed within countries and between countries.

Antimicrobials are grouped according to the Anatomical Therapeutic Chemical (ATC) classification. The 2012 version of the ATC/DDD index from the WHO Collaborating Centre for Drug Statistics methodology (Oslo, Norway) was applied. The ATC/DDD index is available at www.whocc.no/atc_ddd_index and contains all valid ATC codes and corresponding DDD.

The three major categories of antimicrobial considered in this report (ATC groups J01, J02 & D01BA, J05) are referred to by their ATC codes rather than the name of the active ingredient.

The group of antimicrobials 'antibacterials for systemic use' (ATC group J01) are often referred to by the public as 'antibiotics'. However, the term 'antibiotics' also includes agents such as topical antibacterials for which data are not collected by ESAC-Net, so throughout this report the term 'antibacterials for systemic use' has been used to refer to this group of antimicrobials.

In addition to the ATC classification, for two groups of antibacterials for systemic use, i.e. macrolides and quinolones, and for antivirals, further sub-classifications were used that are not supported by the ATC classification (Annex 1). These were introduced by the ESAC project [3, 6, 7].

2.2 Data collection and reporting for 2011

Data on antimicrobial consumption were collected for the community (primary care sector) and for the hospital sector, and for some countries aggregated data for both sectors were combined (total care), according to the 2012 reporting protocol [8].

The ESAC-Net metadata [8] are, for most variables, based on the ESAC project core data. In November 2011, training was provided for the ESAC-Net participants on how to prepare, upload and approve their national consumption data. The call for 2011 surveillance data started in August 2012 and was open until 31 October 2012. After uploading, each country approves its own data and the results are made available from the ECDC website.

There are two options for reporting ESAC-Net data to ECDC:

- The preferred standard option, i.e. reporting of national antimicrobial consumption data at the medicinal product level and expressed as a number of packages sold. For this option, a valid national register of available antimicrobials is required (national registry data).
- A 'light' version, i.e. when national registry data are not available, reporting of aggregated numbers of DDD from national antimicrobial consumption data at the ATC substance level.

Additionally, ESAC-Net encouraged participants to report data on the above variables by age group, gender and type of prescriber, as well as to report quarterly rather than yearly data.

2.3 Data validation and analysis

The ESAC-Net data validation process consists of three steps:

- A quality check of the data is performed by the European Surveillance System using its in-built validation rules for the ESAC-Net metadata [8] during the uploading of the national data. Following the data upload, each country approves its own data.

- Following this, each ESAC-Net participating country checks the data for consistency by comparing figures displayed in the European Surveillance System online reports to national figures.
- ESAC-Net experts and data managers perform a final data validation. This final validation step includes testing for outliers in terms of volume or patterns (e.g. comparison with the 2010 data from the ESAC project). When an inconsistency is detected, the European Surveillance System data managers or the network coordinator contact the country in question for clarification, and where applicable, data are corrected and re-uploaded (last re-upload for 2011 data was performed at the end of April 2013).

Indicators for reporting antimicrobial consumption

For the community data, two indicators are used to report antimicrobial consumption:

- the number of DDD per 1 000 inhabitants and per day;
- the number of packages per 1 000 inhabitants and per day.

For the hospital sector, and for the few countries for which only total care data (combined reporting of antimicrobial consumption data from the community and the hospital sector) were available, one indicator is used to report antimicrobial consumption:

- the number of DDD per 1 000 inhabitants and per day.

Retrospective changes

Member States can at any time upload or re-upload data to The European Surveillance System (TESSy), e.g. to make corrections.

The following countries re-uploaded 2010 data, which may result in differences between data published in this report and data in the 2010 ESAC-Net report:

- Austria: community, antibacterials for systemic use (ATC group J01);
- Bulgaria: hospital sector, antibacterials for systemic use (ATC group J01);
- Cyprus: community, antibacterials for systemic use (ATC group J01);
- Iceland: community, antibacterials for systemic use (ATC group J01);
- Latvia: community, hospital sector, antibacterials for systemic use (ATC group J01).

Additionally, all historical ESAC project data (1997–2009) have been re-validated [8] and uploaded to TESSy which resulted in slight differences in the consumption of antibacterials for systemic use (ATC group J01) compared with the 2010 ESAC-Net report where the data (1997–2009) were cited directly from the ESAC project yearbook [9] without verification. There are two exceptions: the 2002 national reference data from the Czech Republic for the community and similar data for Portugal in 2007 could not be uploaded to TESSy for technical reasons and are therefore not shown (see Tables A1 and A2 in Annex 2).

At the same time as an ESAC-Net report is published, data up to the 4th ATC group level (including all historical data since 1997) are made publically available via the interactive ESAC-Net database [4], where country overview sheets summarising the national results are also provided. The database always shows the latest version of the data, i.e. includes any data that has been added or re-uploaded by a country after the time of the report production. Therefore it is possible that data shown in this report may differ slightly from those available from the ESAC-Net interactive database.

Trend analysis

National trends in the consumption of antibacterials for systemic use (ATC group J01, including subgroups up to group level 4) and antimycotics and antifungals for systemic use (ATC groups J02 & D01BA) were assessed for the community and the hospital sector over the last five years (2007–2011). A linear regression was applied (significant p value < 0.05) with the dependent variable being antimicrobial consumption in DDD per 1000 inhabitants and per day and the explanatory variable being the year. Countries were excluded if they had (a) one or more years of missing data (Romania and Slovakia), (b) reported different types of data (sales or reimbursement) for different years (Hungary, Portugal and Romania), or (c) reported a mixture of community and total care data during the period of analysis (Greece, Iceland and Lithuania) (see Chapters 3.1.2–3.1.8, 3.2, 3.3, 4.1 and 4.2).

Map scales

For all maps shown in the report, countries are divided into seven categories. Countries reporting no consumption are differentiated from the countries that did not report data. Countries that did report consumption are divided into five categories specified as the five equidistant intervals between the minimum (excluding zero) and maximum values for 2011 data. This method displays the countries based on their position in the range of values and better highlights clusters and outliers.

2.4 Data sources

In 2011, data were collated from 27 EU Member States and two EEA countries (Iceland and Norway). The data sources for ESAC-Net are national sales and reimbursement data, including information from national drug registries. Data are collected at the product level for antibacterials for systemic use (ATC group J01), antimycotics and antifungals for systemic use (ATC groups J02 & D01BA), antimycobacterials (ATC group J04), and antivirals for systemic use (ATC group J05). In addition, data on a few other antimicrobials outside of ATC group J are also collected.

Population data from Eurostat, or from national statistical reports, are used for the denominator. When consumption data do not cover the whole population, countries must provide information on the population covered by the reported data.

Table 2.1 provides an overview by country of the healthcare sectors from which the data were provided: data type (origin of data), population coverage, and which of the four different categories of antimicrobials data were reported for. Twenty-five countries reported data from the community. Eighteen of these countries separately uploaded data from the hospital sector. Cyprus, Iceland, Lithuania and Slovakia were only able to report data from both sectors combined (total care).

Data on antimicrobial consumption in the community (primary care sector), were obtained from the Ministry of Health or the national medicines agencies by half of the countries. One third of the countries reported reimbursement data while the remaining countries reported sales data. Three countries reported both sales and reimbursement data. For most countries, the data coverage was reported as being 100%. Germany, Luxembourg, and the Netherlands reported data that covered 80–95% of the population. Most countries provided data on all antimicrobial categories under surveillance by ESAC-Net. Ireland, Poland, Spain and the United Kingdom only reported data on antibacterials for systemic use (ATC group J01).

For the hospital sector, half of the countries obtained antimicrobial consumption data from the Ministry of Health or national medicines agencies. Ireland, the Netherlands, Norway and Slovenia obtained the data from national hospital networks. Most countries reported sales data, but Belgium and Italy only reported reimbursement data, while five countries reported both reimbursement and sales data. The data coverage was 100% with the exception of Ireland, Luxembourg, the Netherlands, Portugal and Romania, which reported population coverage between 75 and 95%. All countries, except Ireland and the Netherlands, provided data on all categories under surveillance in ESAC-Net.

In 2011, 18 countries (62% of those reporting data for the community) chose the preferred standard option of uploading data to The European Surveillance System with complete national registry data to provide data for the community or for both healthcare sectors combined (total care). Twelve countries (67% of those reporting data for the hospital sector) used this standard option to provide data for the hospital sector.

Compared with 2010 data, two countries had changed the type of data reported: Hungary reported reimbursement data for the community for 2011 and Italy reported reimbursement data for the hospital sector for 2011. For 2011, Italy (community) and Portugal (hospital sector) reported additional reimbursement data. Cyprus, Romania and Slovakia reported data for 2011, which these countries had not been able to do for 2010. All countries except Hungary, which reported data from the national health insurance company for 2011, used the same data providers for 2011 as for 2010.

Table 2.1 provides information on the data sources used for denominator data. Thirteen countries provided a data coverage compatible with Eurostat data. This is the preferred approach. These countries did not need to provide national population data to ESAC-Net since TESSy automatically applies Eurostat population data for the calculations. The remaining countries provided their own population data. Three countries (Czech Republic, Germany and Luxembourg) provided and applied the population covered by health insurance.

Table 2.1. Overview of data sources used for surveillance of antimicrobial consumption, by country, 2011

Country	Sector	Consumption							Population data source
		Data provider	Data type	Data Coverage (%) (population under surveillance)	Antibacterials for systemic use (ATC group J01)*	Antimycotics and antifungals for systemic use (ATC groups J02 & D01BA)	Antimycobacterials (ATC group J04)	Antivirals for systemic use (ATC group J05)	
Austria	C	Health insurance company	Reimbursement	100	Y	Y	Y	Y	Eurostat
Belgium	C	Health insurance company	Reimbursement	100	Y	Y	Y	Y	Eurostat
	HC	Health insurance company	Reimbursement	100	Y	Y	Y	Y	Eurostat
Bulgaria	C	Market research company	Sales	100	Y	Y	Y	Y	National Statistics Agency
	HC	Market research company	Sales	100	Y	Y	Y	Y	National Statistics Agency
Cyprus	TC	Ministry of Health	Sales	100	Y	Y	Y	Y	Eurostat
Czech Republic	C	Health insurance company	Reimbursement	100	Y	Y	Y	Y	National Statistics Agency
Denmark	C	Ministry of Health	Sales	100	Y	Y	Y	Y	National Statistics Agency
	HC	Ministry of Health	Sales	100	Y	Y	Y	Y	National Statistics Agency
Estonia	C	Medicines Agency	Sales	100	Y	Y	Y	Y	Eurostat
	HC	Medicines Agency	Sales	100	Y	Y	Y	Y	Eurostat
Finland	C	Medicines Agency	Sales	100	Y	Y	Y	Y	Eurostat
	HC	Medicines Agency	Sales	100	Y	Y	Y	Y	Eurostat
France	C	Medicines Agency	Sales	100	Y	Y	Y	Y	National Statistics Agency
	HC	Medicines Agency	Sales	100	Y	Y	Y	Y	National Statistics Agency
Germany	C	Health insurance company	Reimbursement	85	Y	Y	Y	Y	National Statistics Agency
Greece	C	Medicines Agency	Sales	100					Eurostat
	HC	Medicines Agency	Sales	100					Eurostat
Hungary	C	Health insurance company	Reimbursement	99	Y	Y	Y	Y	Eurostat
Iceland	TC	Medicines Agency	Sales	100	Y	Y	Y	Y	National Statistics Agency
Ireland	C	Market research company	Sales	100	Y	N	N	N	National Statistics Agency
	HC	Hospital network	Sales/reimbursement	90	Y	Y	N	N	National Statistics Agency
Italy	C	Medicines Agency	Sales/reimbursement	100	Y	Y	Y	Y	Eurostat
	HC	Medicines Agency	Reimbursement	100	Y	Y	Y	Y	Eurostat
Latvia	C	Medicines Agency	Sales	100	Y	Y	Y	Y	Eurostat
	HC	Medicines Agency	Sales	100	Y	Y	Y	Y	Eurostat
Lithuania	TC	Medicines Agency	Sales	100	Y	Y	Y	Y	National Statistics Agency
Luxembourg	C	Health insurance company	Reimbursement	95	Y	Y	Y	Y	Health insurance company
	HC	Other	Sales	95	Y	Y	Y	Y	National Statistics Agency
Malta	C	Ministry for Health	Sales	100	Y	Y	Y	Y	Ministry of Health
	HC	Ministry for Health	Sales	100	Y	Y	Y	Y	Ministry of Health
Netherlands	C	Community pharmacists	Sales	92	Y	Y	Y	Y	Other
	HC	Hospital network	Sales	93	Y	N	N	N	National Statistics Agency
Norway	C	Other	Sales/reimbursement	100	Y	Y	Y	Y	National Statistics Agency
	HC	Hospital network	Sales/reimbursement	100	Y	Y	Y	Y	Other
Poland	C	Ministry of Health	Reimbursement	100	Y	N	N	N	Eurostat
Portugal	C	Ministry of Health	Sales	100	Y	Y	Y	Y	Ministry of Health
	HC	Ministry of Health	Sales/reimbursement	95	Y	Y	Y	Y	Ministry of Health
Romania	C	Health insurance company	Reimbursement	75	Y	Y	N	Y	Eurostat
	HC	Ministry of Health	Sales/reimbursement	75	Y	Y	N	Y	Eurostat
Slovakia	TC	Medicines Agency	Sales	100	Y	Y	Y	N	Eurostat
Slovenia	C	Other	Sales/reimbursement	100	Y	Y	Y	Y	National Statistics Agency
	HC	Hospital network	Sales/reimbursement	100	Y	Y	Y	Y	Other
Spain	C	Ministry of Health	Reimbursement	100	Y	N	N	N	National Statistics Agency
Sweden	C	Other	Sales	100	Y	Y	Y	Y	National Statistics Agency
	HC	Other	Sales	100	Y	Y	Y	Y	National Statistics Agency
United Kingdom	C	Ministry of Health	Reimbursement	100	Y	N	N	N	Eurostat

** oral and rectal nitroimidazole derivates as antiprotozoals (ATC subgroup P01AB), oral vancomycin as intestinal antiinfective (ATC chemical substance A07AA09) are reported but not shown in the report.*
C: community; HC: hospital care; TC: total care; Y: yes; N: no.

Comment

ESAC-Net aims for all network participants to use the ESAC-Net standard option for reporting antimicrobial consumption data (i.e., at the medicinal product level with a valid national register of available antimicrobials), thus ensuring a harmonised reporting of the consumption data in DDD by use of a standardised calculation procedure by TESSy. In addition, the standard option of ESAC-Net allows for a better validation and further analysis than the reporting of aggregated DDD ('light' option). For 2011 data, two thirds of the countries reporting community and hospital sector data, and three out of four countries reporting total care data, used this ESAC-Net standard option.

Analyses of antimicrobial consumption trends rely on countries consistently reporting data of the same type and provider. This is the case for most of the countries. However, Hungary reported reimbursement data for the community in 2011 and Portugal reported sales data for the community in 2011, and trends in these countries and healthcare sectors should therefore be interpreted with caution. The availability, in five countries, of reimbursement data in addition to sales data allowed for additional quality checks of the data.

Reimbursement data do not include antimicrobials obtained without a prescription and thus give an underestimate of antimicrobial consumption in the community in those countries where over-the-counter dispensation of antimicrobials is known to occur [10]. Where appropriate, this limitation is mentioned in the footnotes of tables and figures in this report.

3 Consumption of antimicrobials for systemic use in the community

This chapter covers data on consumption of antibacterials and of antimycotics and antifungals for systemic use in the community (i.e., outside hospitals).

3.1 Consumption of antibacterials for systemic use (ATC group J01)

3.1.1 Overall consumption of antibacterials for systemic use (ATC group J01)

Results

All 29 countries participating in ESAC-Net reported data on consumption of antibacterials for systemic use (ATC group J01) in the community for 2011. As in previous years, there were large inter-country variations in consumption. These variations were observed both for the total consumption of antibacterials for systemic use (ATC group J01) and for all subgroups of antibacterials for systemic use, i.e. at ATC group level 3.

Results for Cyprus, Iceland, Lithuania and Slovakia which reported total care data in 2011, are shown jointly with the consumption data for the community (primary care sector).

The total consumption of antibacterials for systemic use (ATC group J01) in the community ranged from 11.4 DDD per 1 000 inhabitants and per day (the Netherlands) to 35.1 DDD per 1 000 inhabitants and per day (Greece).

Figure 3.2 shows a north–south gradient with the lowest consumption (<20.9 DDD per 1 000 inhabitants and per day) in the north of Europe, e.g., Scandinavian and Baltic countries, and the highest consumption (≥20.9 DDD per 1 000 inhabitants and per day) in the south of Europe, e.g. Greece and Italy.

Between 2010 and 2011, consumption decreased in seven (24%) countries (Austria, Germany, Greece, Hungary, Iceland, Luxembourg and Portugal). However, the decrease for Iceland was small (0.04 DDD per 1 000 inhabitants and per day). During the same period, consumption slightly increased (less than 0.2 DDD per 1 000 inhabitants and per day) in four countries (the Netherlands (0.2), Slovenia (0.03), Sweden (0.1) and the United Kingdom (0.1)). Since 1997, the number of reporting EU/EEA countries increased substantially from 14 countries in 1997 to 29 countries in 2011. Table A1 of Annex 2 provides an overview, by country, for the period 1997–2011.

Consumption of seven major subgroups of antibacterials for systemic use (ATC group J01) in the community in 2011 is presented in Table 3.1 and in Figure 3.1. Results for the subgroups are presented in detail in Chapters 3.1.2 to 3.1.8.

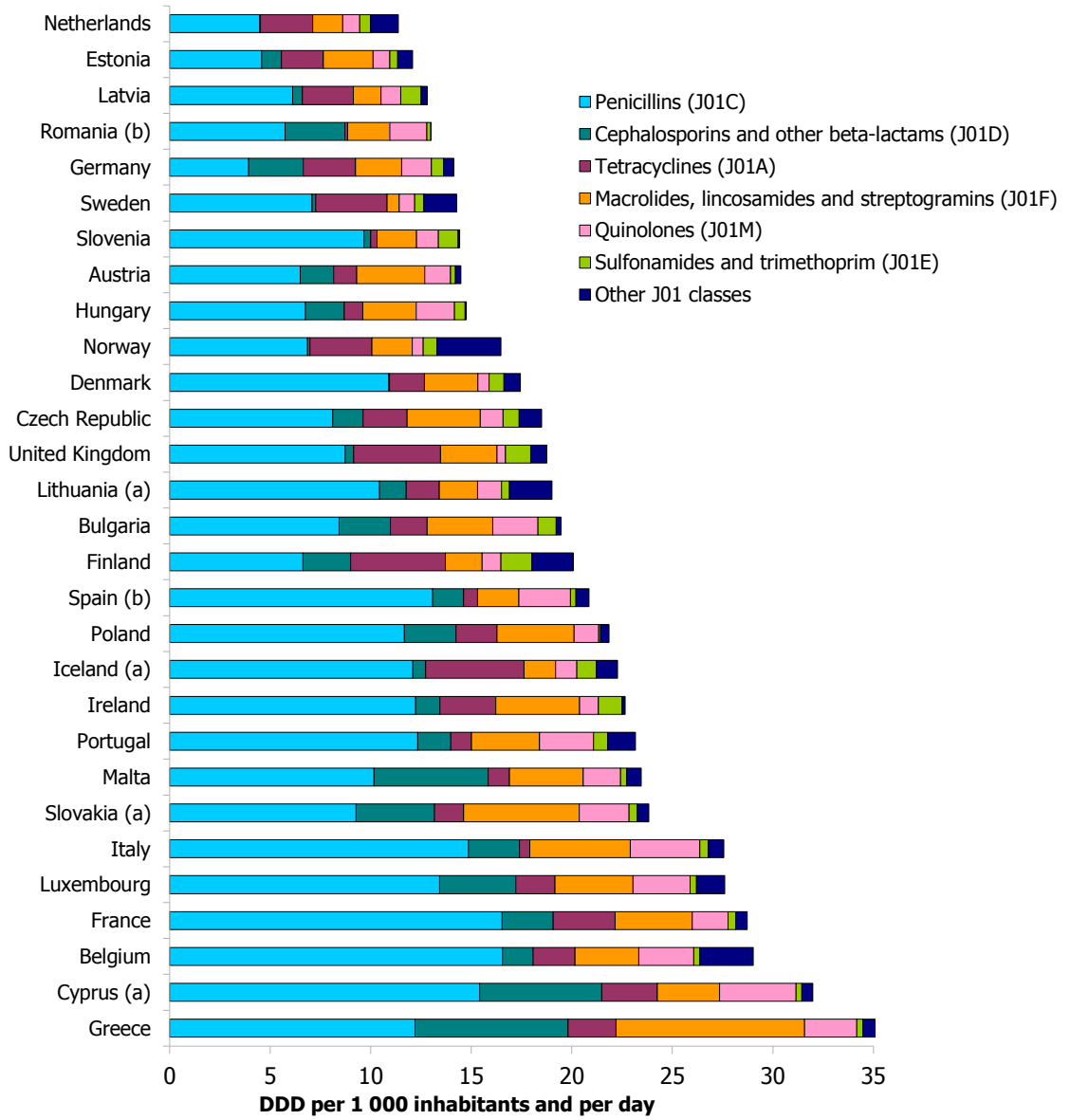
Consumption of amphenicols (ATC group J01B), aminoglycosides (ATC group J01G) and combinations of antibacterials (ATC group J01R) are presented together in Table 3.1 but in Figure 3.1 are included with other antibacterials (ATC group J01X) as 'other J01 classes'. In 2011, consumption of these three ATC groups (J01B, J01G and J01R) in the community varied from <0.01 DDD per 1 000 inhabitants and per day (Portugal with 0.0003) to 0.3 DDD per 1 000 inhabitants and per day (Malta).

Table 3.1. Consumption of antibacterials for systemic use (ATC group J01) at ATC group level 3 in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day

Country	Tetracyclines (J01A)	Beta-lactams, penicillins (J01C)	Other beta-lactam antibacterials (J01D)	Sulfonamides and trimethoprim (J01E)	Macrolides, lincosamides and streptogramins (J01F)	Quino-lones (J01M)	Other antibac-terials (J01X)	Sum (J01B, J01G, and J01R)	Total (ATC group J01)
Austria	1.2	6.5	1.7	0.2	3.4	1.3	0.3	<0.1	**14.5**
Belgium	2.1	16.5	1.5	0.3	3.2	2.7	2.6	<0.1	**29.0**
Bulgaria	1.8	8.4	2.6	0.9	3.3	2.3	<0.1	0.2	**19.5**
Cyprus [a]	2.8	15.4	6.1	0.3	3.1	3.8	0.5	0.1	**32.0**
Czech Republic	2.2	8.1	1.5	0.8	3.6	1.1	1.0	0.1	**18.5**
Denmark	1.7	10.9	0.1	0.7	2.7	0.6	0.8	<0.1	**17.4**
Estonia	2.1	4.6	1.0	0.4	2.5	0.8	0.7	<0.1	**12.1**
Finland	4.7	6.6	2.4	1.5	1.8	0.9	2.0	<0.1	**20.1**
France	3.1	16.5	2.6	0.4	3.8	1.8	0.5	<0.1	**28.7**
Germany	2.6	3.9	2.7	0.6	2.3	1.5	0.5	<0.1	**14.1**
Greece	2.4	12.2	7.6	0.3	9.4	2.6	0.6	0.1	**35.1**
Hungary	0.9	6.7	1.9	0.5	2.7	1.9	<0.1	<0.1	**14.7**
Iceland [a]	4.9	12.1	0.6	1.0	1.6	1.1	1.0	<0.1	**22.3**
Ireland	2.8	12.2	1.2	1.2	4.2	0.9	0.1	<0.1	**22.6**
Italy	0.5	14.9	2.5	0.4	5.0	3.5	0.7	0.1	**27.6**
Latvia	2.5	6.1	0.5	1.0	1.4	1.0	0.2	0.1	**12.8**
Lithuania [a]	1.6	10.4	1.3	0.4	1.9	1.2	2.0	0.1	**19.0**
Luxembourg	1.9	13.4	3.8	0.3	3.9	2.8	1.4	<0.1	**27.6**
Malta	1.1	10.2	5.7	0.3	3.7	1.9	0.4	0.3	**23.4**
Netherlands	2.6	4.5	<0.1	0.5	1.5	0.8	1.4	<0.1	**11.4**
Norway	3.1	6.8	0.1	0.7	2.0	0.6	3.2	<0.1	**16.5**
Poland	2.0	11.7	2.6	0.1	3.8	1.2	0.4	<0.1	**21.9**
Portugal	1.0	12.3	1.6	0.7	3.4	2.7	1.4	<0.1	**23.2**
Romania [b]	0.1	5.7	3.0	0.2	2.1	1.9	<0.1	<0.1	**13.0**
Slovakia [a]	1.5	9.3	3.9	0.4	5.8	2.5	0.4	0.2	**23.8**
Slovenia	0.3	9.7	0.3	1.0	2.0	1.1	0.1	<0.1	**14.4**
Spain [b]	0.7	13.1	1.5	0.3	2.1	2.6	0.4	0.2	**20.9**
Sweden	3.5	7.1	0.2	0.5	0.6	0.8	1.6	<0.1	**14.3**
United Kingdom	4.3	8.7	0.4	1.3	2.8	0.4	0.8	<0.1	**18.8**
EU median	**2.1**	**9.7**	**1.6**	**0.5**	**2.8**	**1.3**	**0.6**	**<0.1**	**19.5**

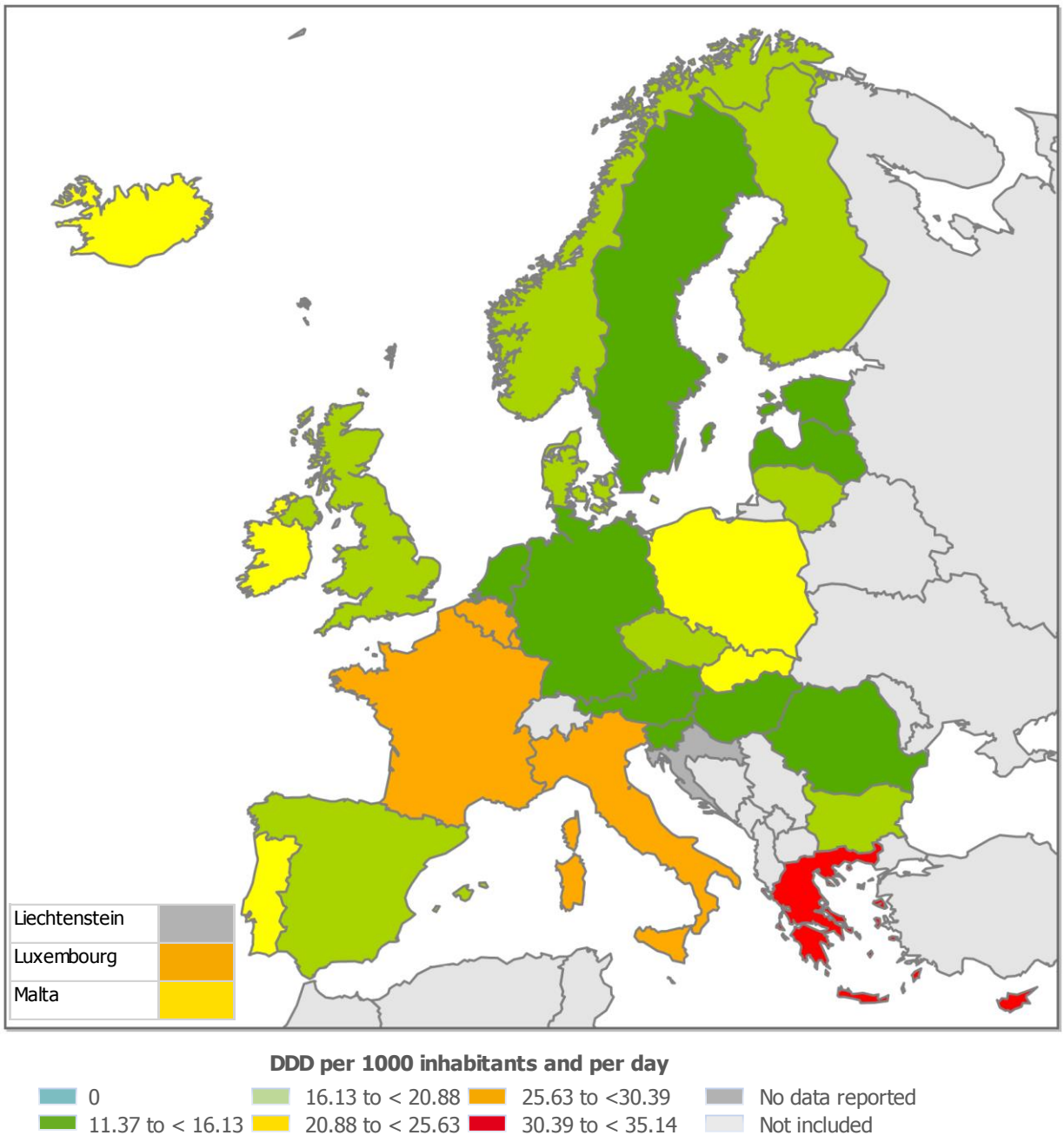
(a) Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Figure 3.1. Consumption of antibacterials for systemic use (ATC group J01) at ATC group level 3 in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day



(a) Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Figure 3.2. Consumption of antibacterials for systemic use (ATC group J01) in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day



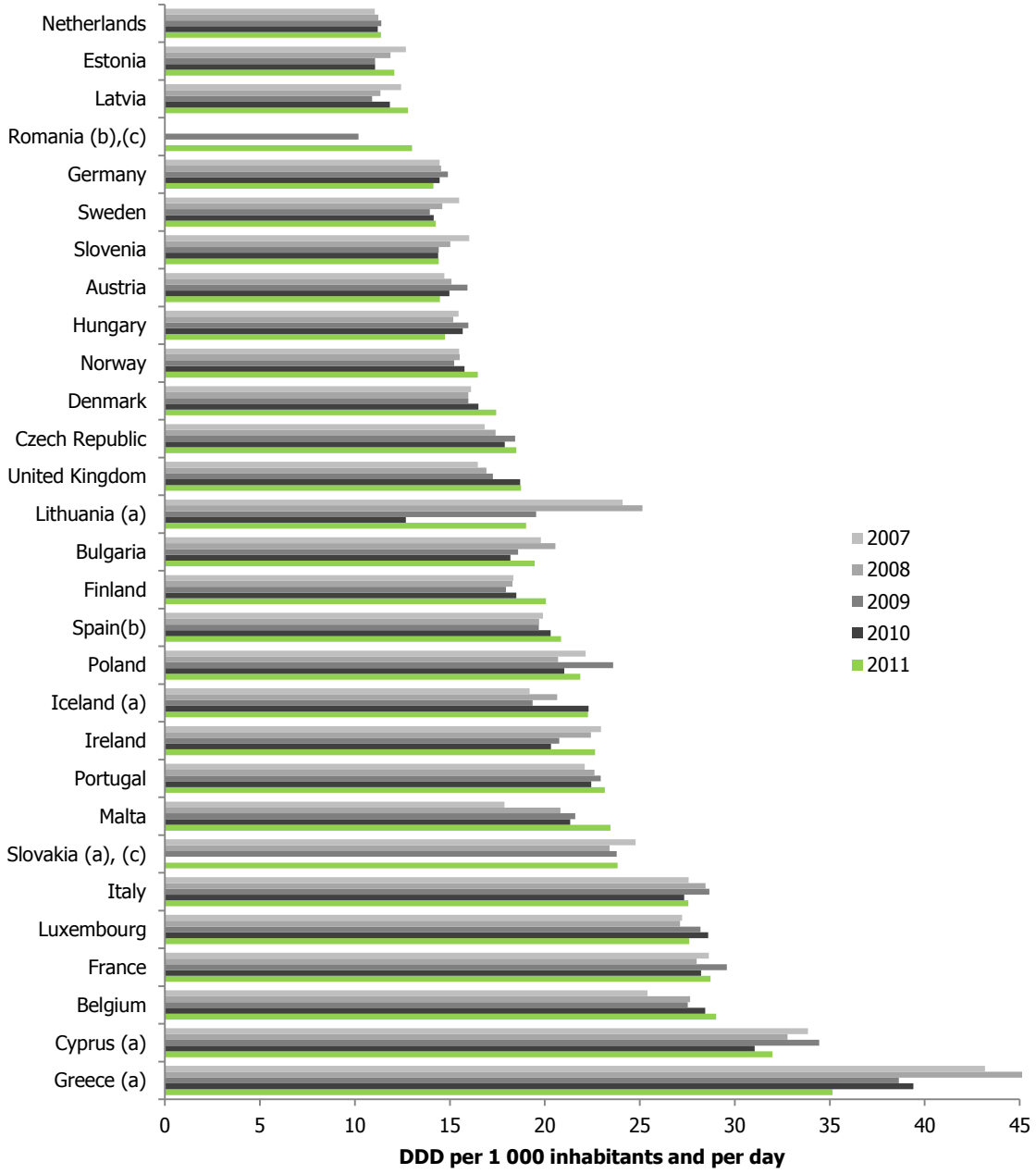
Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Trends

Trends in the consumption of antibacterials for systemic use (ATC group J01) in the community from 2007 to 2011 are presented in Figure 3.3 (see also Chapter 2.3 for trend analyses).

A significantly increasing trend in the consumption of antibacterials for systemic use (ATC group J01) over the last five years was observed for only three countries (Belgium, Malta and the United Kingdom). None of the ESAC-Net participating countries showed a significant decreasing trend in the consumption of antibacterials for systemic use (ATC group J01).

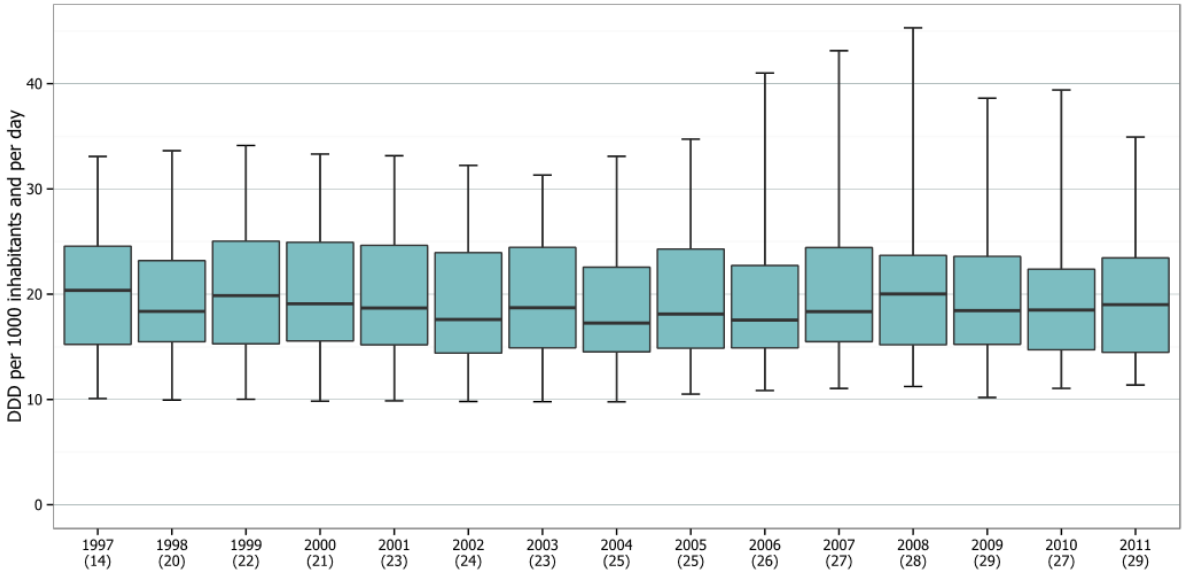
Figure 3.3. Trends of consumption of antibacterials for systemic use (ATC group J01) in the community, EU/EEA countries, 2007–2011, expressed as DDD per 1 000 inhabitants and per day



(a) Cyprus (2007–2011), Greece (2007, 2008, 2010), Iceland (2010, 2011), Lithuania (2007–2009, 2011) and Slovakia (2011) provided only total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.
(c) Romania (2007, 2008, 2010) and Slovakia (2010) did not report data for these years.

Overall trends in the consumption of antibacterials for systemic use (ATC group J01) in Europe are shown in Figure 3.4 for the period 1997–2011. Between 2010 and 2011, the median consumption for the 27 EU/EEA countries that reported data for both years increased by 1.0 DDD per 1 000 inhabitants and per day. The slope of the median of the consumption of antibacterials for systemic use did not indicate any increasing or decreasing trend.

Figure 3.4. Trends and inter-country variations of antibacterials for systemic use (ATC group J01) in the community, EU/EEA countries, 1997–2011, expressed as DDD per 1 000 inhabitants and per day



Boxes indicate the lower and the upper quartiles. The bold lines indicate the medians. Whiskers indicate the minimum and maximum values. For 1997–2009, only data from ESAC participating countries that also participated in ESAC-Net in 2011 are included. The number of participating countries is shown in parentheses.

Discussion

This is the first time that trends in antimicrobial consumption were assessed for each country using ESAC-Net data. Fourteen percent of the countries included in the trend analysis showed a significant increase in the overall consumption of antibacterials for systemic use over the five-year period.

In 2011, Portugal changed their data provider and reported consumption of antibacterials for systemic use (ATC group J01) from sales data covering the total population, whereas an extrapolation from the population covered by the reported data had been needed to calculate consumption in 2010. The slight increase of 0.72 DDD per 1 000 inhabitants and per day could actually indicate a steady state or even a slight decrease in consumption because in 2010, reimbursement data were reported that did not take into account over-the-counter sales without a prescription and other non-reimbursed courses.

Greece reported consumption data separately for both sectors in 2011, whereas the country reported total care data in 2010. Making the assumption that consumption in the hospital sector in Greece in 2010 was within the range reported for 2009 and 2011, this would mean a 3–7% decrease in consumption in the community in the country between 2010 and 2011. A possible explanation was reported by Greece as being the introduction in 2010 of an obligatory electronic prescription system, which may have limited the dispensation of antibacterials without a prescription by pharmacies as well as allowed authorities to evaluate prescribers.

Short-term decreases or increases in consumption of antibacterials for systemic use (ATC group J01) were reported in other EU/EEA countries. More information may be provided by the countries in the comments of the country overview sheets available via the ESAC-Net interactive database on the ECDC website [4].

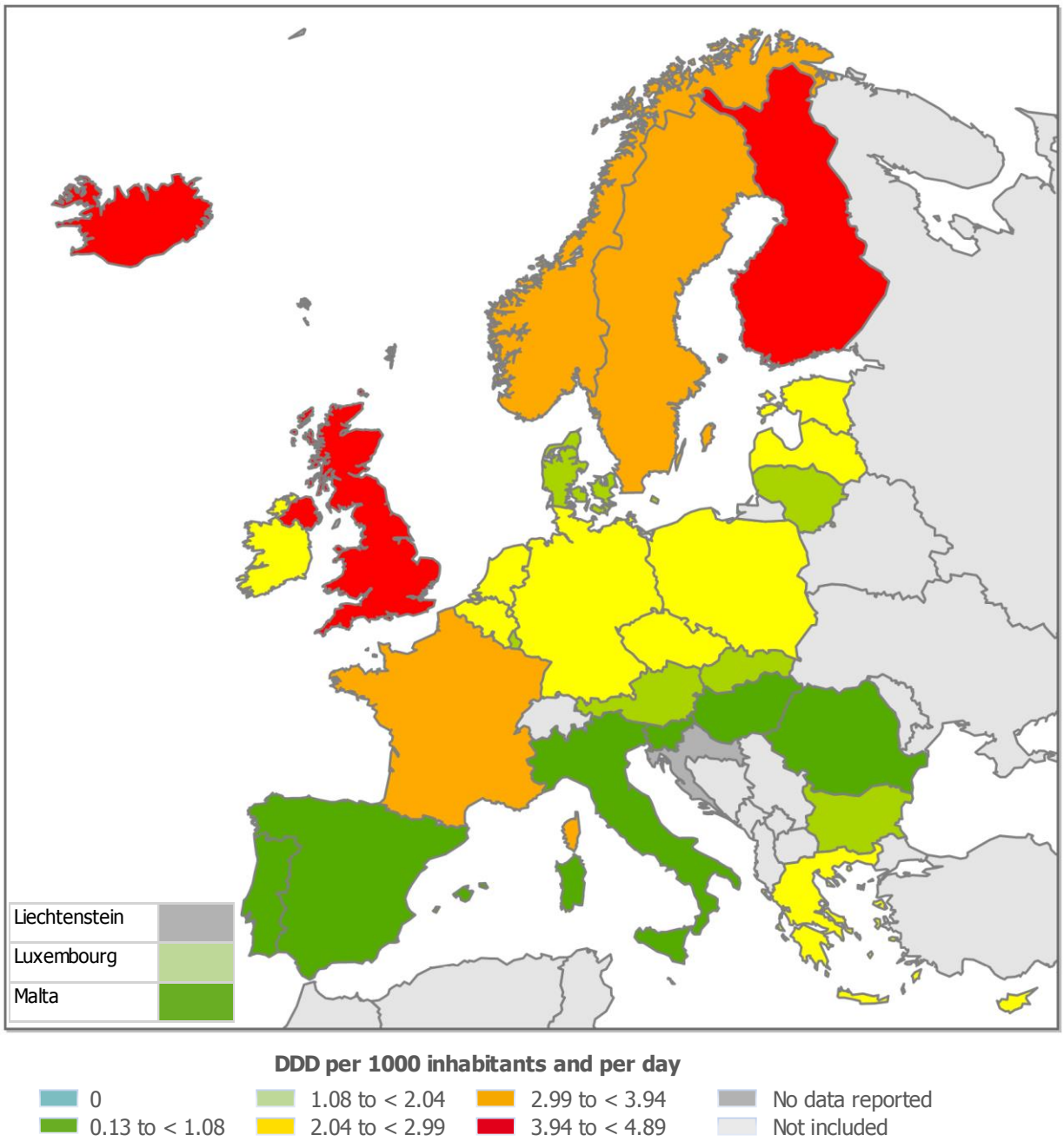
In 2011, the median consumption of antibacterials for systemic use (ATC group J01) in EU/EEA countries was at a similar level as in 2009 and 2010, whereas a general decrease had been observed from 1999 to 2004 followed by a gradual increase from 2004 to 2008 [9].

3.1.2 Tetracyclines (ATC group J01A)

Results

In 2011, consumption of tetracyclines (ATC group J01A) in the community ranged from 0.1 DDD per 1 000 inhabitants and per day (Romania) to 4.9 DDD per 1 000 inhabitants and per day (Iceland), with a median of 2.1 DDD per 1 000 inhabitants and per day (Table 3.1). Tetracycline consumption was generally lower in southern Europe than in northern and western Europe (Figure 3.5). Tetracycline consumption as a proportion of the total consumption of ATC group J01 ranged from less than 1.0% (Slovenia) to 24.8% (Sweden).

Figure 3.5. Consumption of tetracyclines (ATC group J01A) in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day



Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

The most consumed of all tetracyclines in the community in 2011 was doxycycline which, on average, accounted for 78% of the consumption of this group, followed by lymecycline, minocycline and tetracycline. This pattern is similar to that observed since 2009.

However, some countries have shown a different pattern of consumption of the various tetracyclines since 2009. In 2011, lymecycline was the most frequently consumed of all tetracyclines in the United Kingdom, representing 35.1%, while consumption of doxycycline represented 34.3% of consumption of this group.

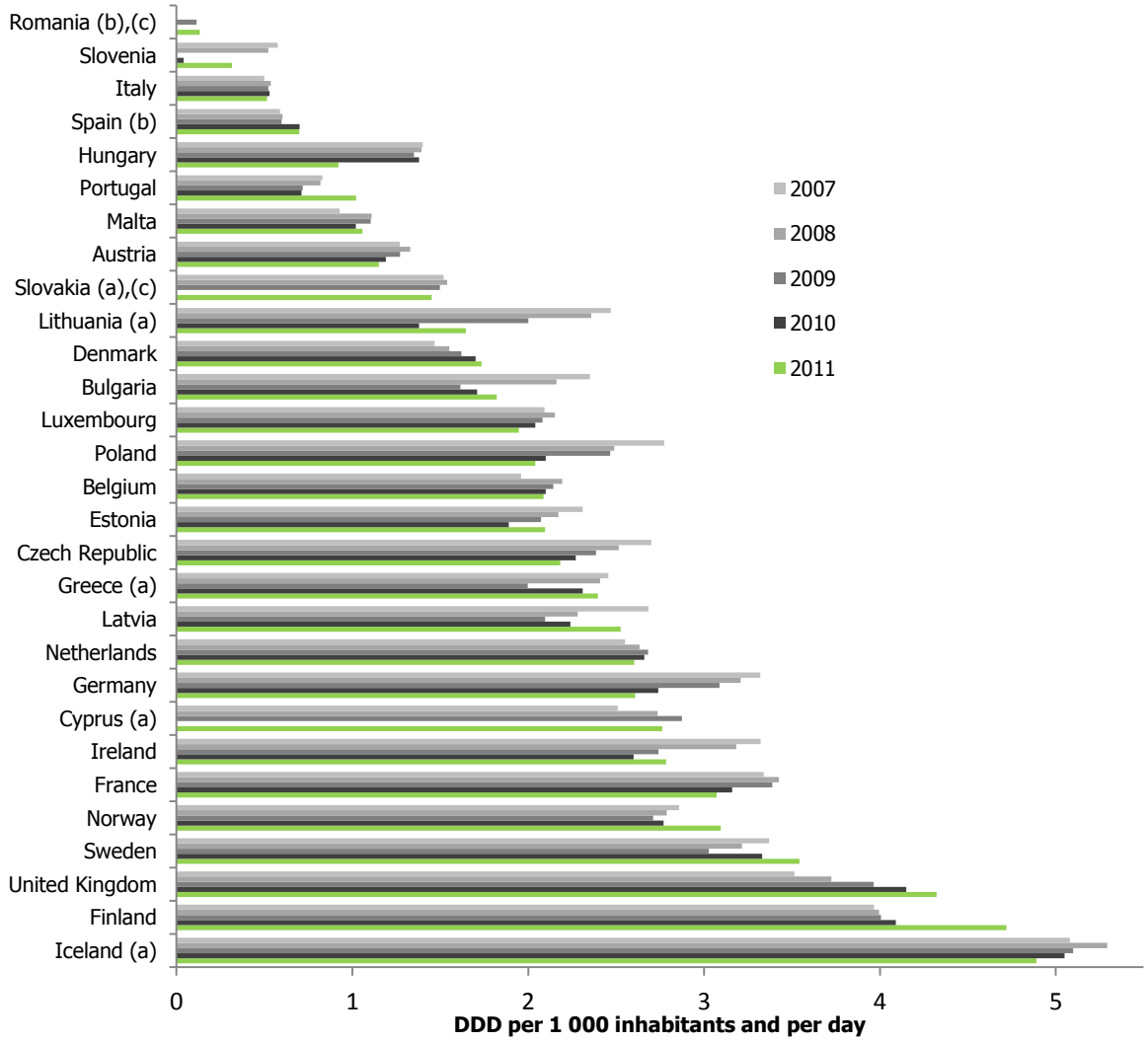
Doxycycline consumption represented less than 50% of the total consumption of tetracyclines only in Belgium, Denmark, and the United Kingdom in 2010, and in Belgium, Denmark, Ireland and the United Kingdom in 2011. For all other countries, doxycycline consumption accounted for more than 50% of the total consumption of tetracyclines.

Trends

Figure 3.6 shows the consumption of tetracyclines (ATC J01A) in the community per country between 2007 and 2011. A significant increase in the consumption of tetracyclines (ATC group J01A) was observed for Denmark, Spain and the United Kingdom over the five-year period 2007–2011. The Czech Republic, Germany and Poland showed a significant decrease in consumption of tetracyclines (ATC group J01A) during the same period.

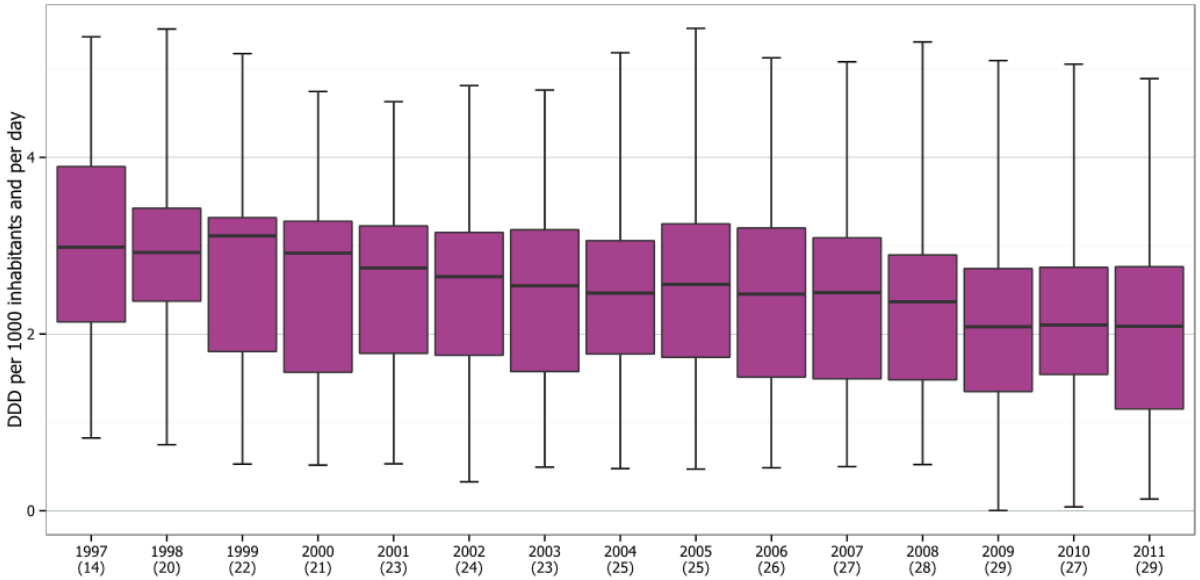
The European trend in the consumption of tetracyclines (ATC group J01A) in the community is shown in Figure 3.7 and indicates a significant decrease between 1997 and 2009. Between 2009 and 2011, the median consumption of tetracyclines in the community in the participating countries remained stable (2.1 DDD per 1 000 inhabitants and per day.

Figure 3.6. Trends of consumption of tetracyclines (ATC group J01A) in the community, EU/EEA countries, 2007–2011, expressed as DDD per 1 000 inhabitants and per day



(a) Cyprus (2007–2011), Greece (2007, 2008, 2010), Iceland (2010, 2011), Lithuania (2007–2009, 2011) and Slovakia (2011) provided only total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.
(c) Romania (2007, 2008, 2010) and Slovakia (2010) did not report data for these years.

Figure 3.7. Trends and inter-country variations of consumption of tetracyclines (ATC group J01A) in the community, EU/EEA countries, 1997–2011, expressed as DDD per 1 000 inhabitants and per day



Boxes indicate the lower and the upper quartiles. The bold lines indicate the medians. Whiskers indicate the minimum and maximum values. For 1997–2009, only data from ESAC participating countries that also participated in ESAC-Net in 2011 are included. The number of participating countries is shown in parentheses.

Discussion

National trends in less than 10% of countries included in the analyses showed a significant decrease in consumption of tetracyclines (J01A) between 2007 and 2011.

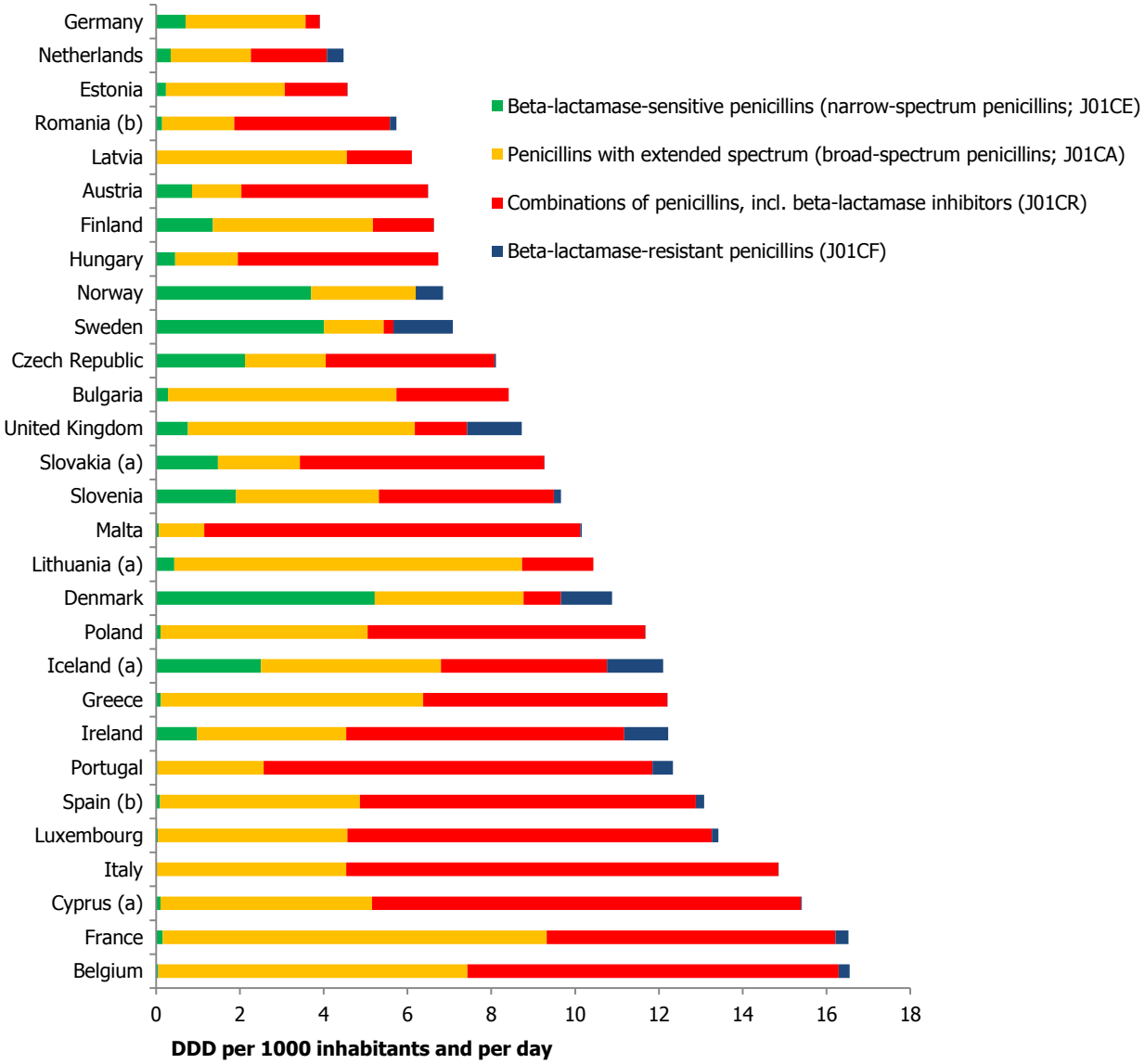
The ESAC project reported a significant decrease in consumption of tetracyclines (J01A) in the community during the period 1997–2009 [11]. Although the relative consumption of doxycycline within this group increased between 2009 and 2011, the median consumption of tetracyclines in the reporting EU/EEA countries did not increase during the same period.

3.1.3 Beta-lactams, penicillins (ATC group J01C)

Results

In all countries, penicillins (ATC subgroup J01C) were the most consumed antibacterial in the community. In 2011, consumption of penicillins ranged from 3.9 DDD per 1 000 inhabitants and per day (Germany) to 16.5 DDD per 1 000 inhabitants and per day (Belgium and France) (Table 3.1, Figure 3.8). The median consumption was 9.7 DDD per 1 000 inhabitants and per day among the countries reporting data for 2011. In 11 out of 29 countries, penicillins contributed to 50% or more of the total consumption of antibacterials for systemic use (ATC group J01) in the community, with Slovenia having the highest percentage (67% of the total antimicrobial consumption in the community) and Germany the lowest percentage (28%).

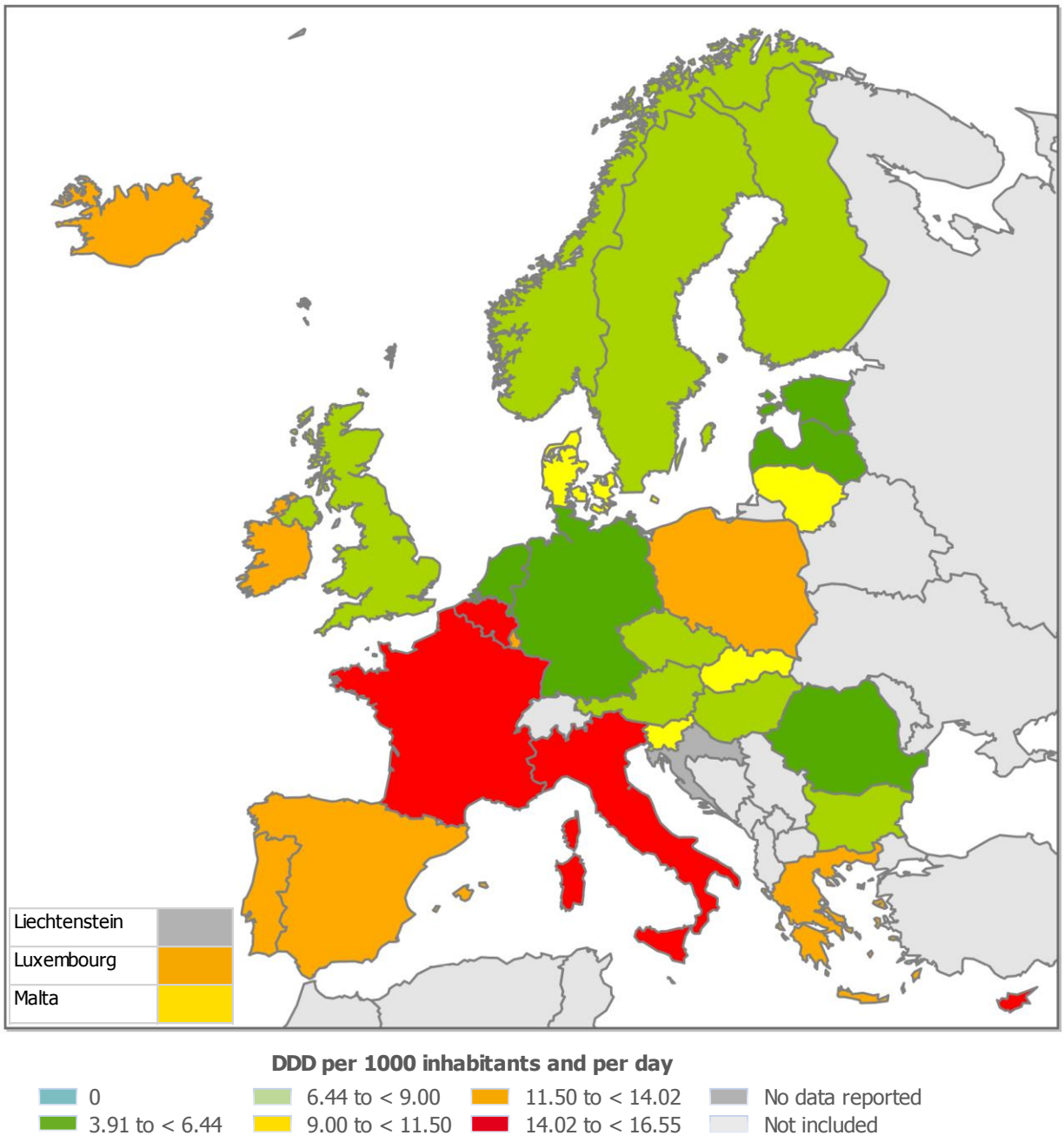
Figure 3.8. Consumption of broad- and narrow-spectrum penicillins in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day



(a) Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

As shown in Figure 3.8, the main subgroups of penicillins were penicillins with extended spectrum (ATC group J01CA) and combinations of penicillins, including beta-lactamase inhibitors (ATC group J01CR). In 2011, consumption of penicillins with extended spectrum (ATC group J01CA) ranged from 1.1 (Malta) to 9.2 (France) DDD per 1 000 inhabitants and per day. Consumption of combinations of penicillins, including beta-lactamase inhibitors (ATC group J01CR) ranged from <0.01 (Norway) to 10.3 (Italy) DDD per 1 000 inhabitants and per day.

Figure 3.9. Consumption of beta-lactams, penicillins (ATC group J01C) in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day



Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Consumption of amoxicillin (J01CA04, i.e. without enzyme inhibitor) ranged from 0.9 (Sweden) to 9.2 (France) DDD per 1 000 inhabitants and per day. Consumption of amoxicillin with enzyme inhibitor (J01CR02) ranged from <0.01 (Norway) to 10.3 (Italy) DDD per 1 000 inhabitants and per day. Phenoxymethylpenicillin (J01CE02) was the main beta-lactamase-sensitive penicillin in only three countries (Denmark, Norway and Sweden). The consumption of phenoxymethylpenicillin in these three countries accounted for 54% of the total consumption of this antibiotic in the 29 EU/EEA countries reporting data to ESAC-Net in 2011.

The proportion of combinations of penicillins, including beta-lactamase inhibitors (ATC group J01CR) among all beta-lactams, penicillins (ATC group J01C) ranged from 0.03% (Norway) to 88.3% (Malta).

In 2011, more than 50% of the consumption of antibacterials for systemic use (ATC group J01) in the community was made up of nine different antibacterial agents (doxycycline (J01AA02), amoxicillin (J01CA04), benzathine phenoxymethylpenicillin (J01CE10), phenoxymethylpenicillin (J01CE02), flucloxacillin (J01CF05), amoxicillin and

enzyme inhibitor (J01CR02), cefuroxime (J01DC02), clarithromycin (J01FA09) and methenamine (J01XX05)). Of these agents, six are penicillins (ATC group J01C). In 21 (72%) of the 29 EU/EEA countries, three or fewer different agents were responsible for more than 50% of the consumption of antibacterials for systemic use (ATC group J01). Amoxicillin, alone (ATC code J01CA04) or in combination with an enzyme inhibitor (J01CR02), was the antibacterial agent most often consumed in these 21 countries, with the exception of Denmark, Norway and Sweden where the most consumed agent was phenoxymethylpenicillin (J01CE02).

Trends

Among countries reporting data for the full period 2007–2011, consumption of penicillins (ATC group J01C) significantly increased in six countries (Belgium, the Czech Republic, Finland, Malta, Spain and the United Kingdom) and significantly decreased in only one country (Germany) (Figure 3.10).

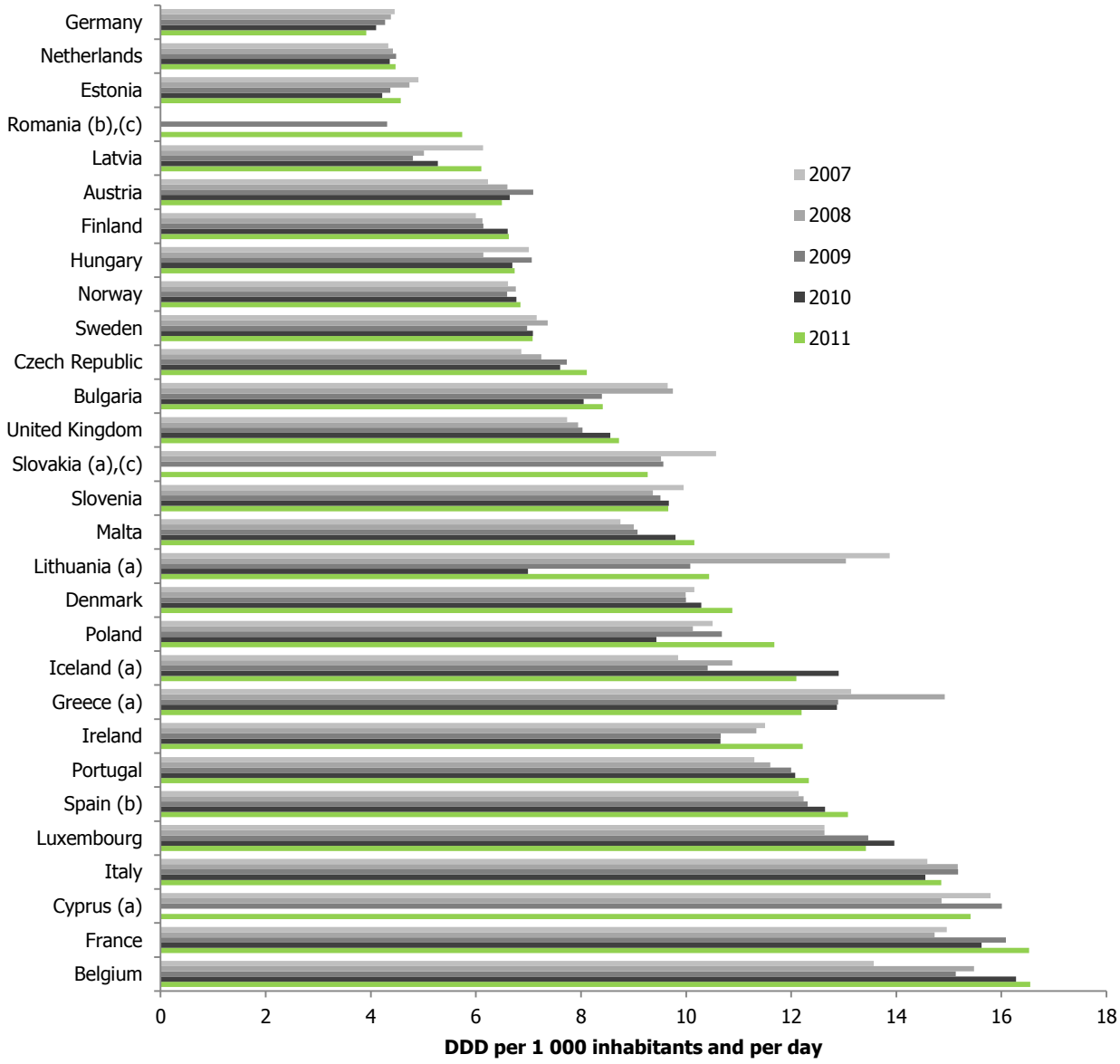
Two countries (Finland and Norway) reported a significant increase in the consumption of penicillins with extended spectrum (ATC group J01CA) whereas six countries (Cyprus, Estonia, Germany, Italy, Malta and Poland) reported a significant decrease in the consumption of this group.

Two countries (France and the United Kingdom) reported a significant increase in the consumption of beta-lactamase-sensitive penicillins (ATC group J01CE) and nine countries (Austria, Bulgaria, Estonia, Germany, Italy, Luxembourg, the Netherlands, Poland and Slovenia) reported a significant decrease in the consumption of this group of penicillins.

Eight countries reported a significant increase or decrease in consumption of beta-lactamase-resistant penicillins (ATC group J01CF).The consumption of this group increased in Denmark, the Netherlands, Norway and the United Kingdom, and decreased in Finland, Germany, Italy and Malta.

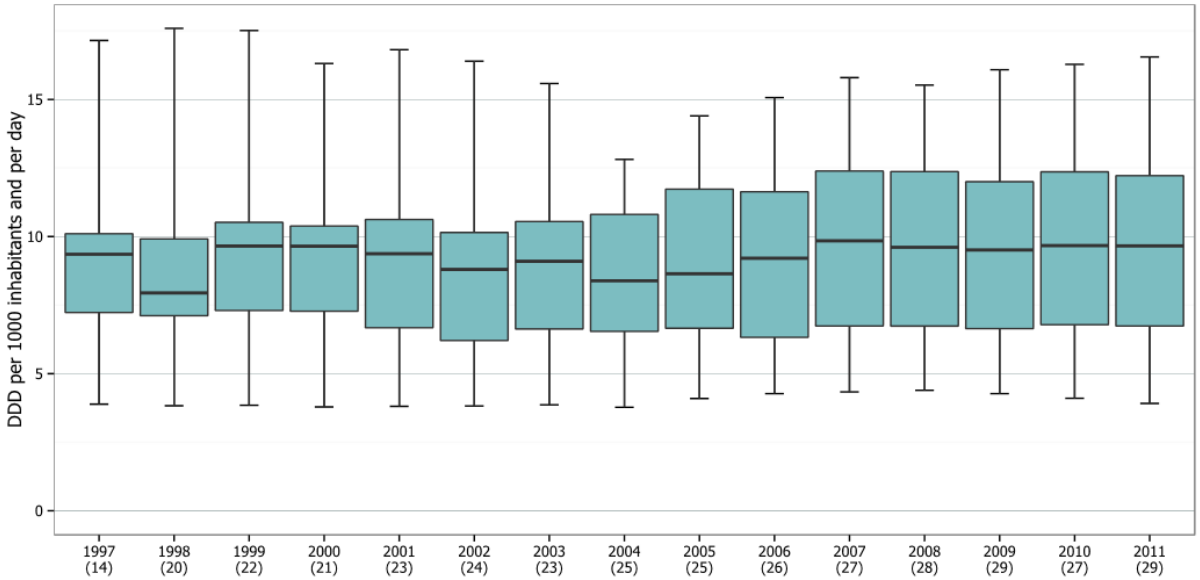
Consumption of combinations of penicillins, including beta-lactamase inhibitors (ATC group J01CR) significantly increased in eight countries (Denmark, Finland, Germany, Italy, Luxembourg, Malta, Spain and the United Kingdom). None of the participating countries reported a significant decrease.

Figure 3.10. Trends of consumption of beta-lactams, penicillins (ATC group J01C) in the community, EU/EEA countries, 2007–2011, expressed as DDD per 1 000 inhabitants and per day



(a) Cyprus (2007–2011), Greece (2007, 2008, 2010), Iceland (2010, 2011), Lithuania (2007–2009, 2011) and Slovakia (2011) provided only total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.
(c) Romania (2007, 2008, 2010) and Slovakia (2010) did not report data for these years.

Figure 3.11. Trends and inter-country variations of consumption of beta-lactams, penicillins (ATC group J01C) in the community, EU/EEA countries, 1997-2011, expressed as DDD per 1 000 inhabitants and per day



Boxes indicate the lower and the upper quartiles. The bold lines indicate the medians. Whiskers indicate the minimum and maximum values. For 1997–2009, only data from ESAC participating countries that also participated in ESAC-Net in 2011 are included. The number of participating countries is shown in parentheses.

The European trend in the consumption of penicillins (ATC group J01C) in the community is shown in Figure 3.11. The median consumption of beta-lactams, penicillins (ATC group J01C) did not change between 2010 and 2011 (9.7 DDD per 1 000 inhabitants and per day).

Discussion

Penicillins (ATC group J01C) are the most frequently prescribed and consumed antibacterials for systemic use in the community. The percentage of total consumption of antibacterials for systemic use (ATC group J01) corresponding to penicillins (ATC group J01C) has been suggested as a quality indicator for consumption in the community (Table 3.6).

Phenoxymethylpenicillin (ATC J01CE02) is the most commonly consumed penicillin in Scandinavian countries, where it is used as a first-line drug among the penicillins, whereas in other countries amoxicillin (J01CA04) and amoxicillin with enzyme inhibitor (J01CR02) are the most commonly consumed penicillins.

Over the five years 2007–2011, half of the countries included in the national trend analyses showed a significant increase in the consumption of broad-spectrum penicillins, either penicillins with extended spectrum (ATC group J01CA) or combinations of penicillins, including beta-lactamase inhibitors (ATC group J01CR). Conversely, the consumption of narrow-spectrum penicillins, either beta-lactamase-sensitive penicillins (ATC group J01CE) or beta-lactamase-resistant penicillins (ATC group J01CF) decreased significantly in more than half of the countries. Interestingly, in two countries, the use of beta-lactamase-sensitive penicillins (ATC group J01CE) significantly increased.

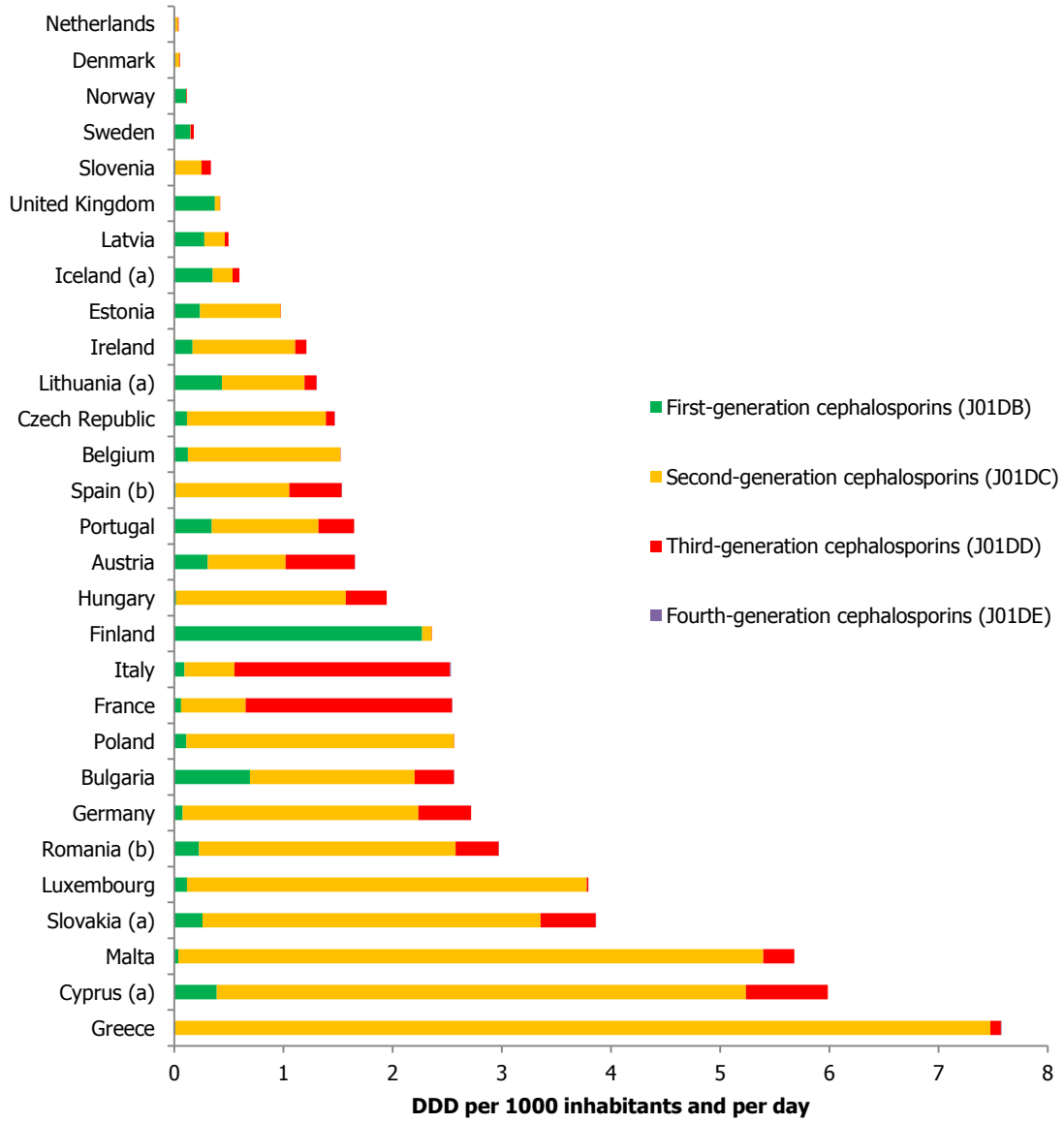
The ESAC project reported an overall significant increase in the consumption of penicillins (ATC group J01C) during the period 1997-2009 [12]. However, the EU median consumption remained stable between 2007 and 2011.

3.1.4 Other beta-lactam antibacterials (ATC group J01D)

Results

As shown in Figure 3.14 and Table 3.1, in 2011 the consumption of other beta-lactam antibacterials (ATC group J01D), the group which includes cephalosporins, ranged from 0.04 DDD per 1 000 inhabitants and per day (the Netherlands) to 7.6 DDD per 1 000 inhabitants and per day (Greece) with a median of 1.6 DDD per 1 000 inhabitants and per day. All reporting countries except Cyprus, Greece and Malta reported a consumption of less than 4.6 DDD per 1 000 inhabitants and per day (Table 3.1, Figure 3.13). The proportion of consumption of cephalosporins (ATC groups J01DB-DE) out of the total consumption of antibacterials for systemic use (ATC group J01) ranged from 0.3% (Denmark) to 24.2% (Malta). Consumption of other cephalosporins and penems (ATC group J01DI) were reported as zero consumption in 2011.

Figure 3.12. Consumption of first-, second-, third- and fourth-generation cephalosporins (ATC groups J01DB-DE) in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day



(a) Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

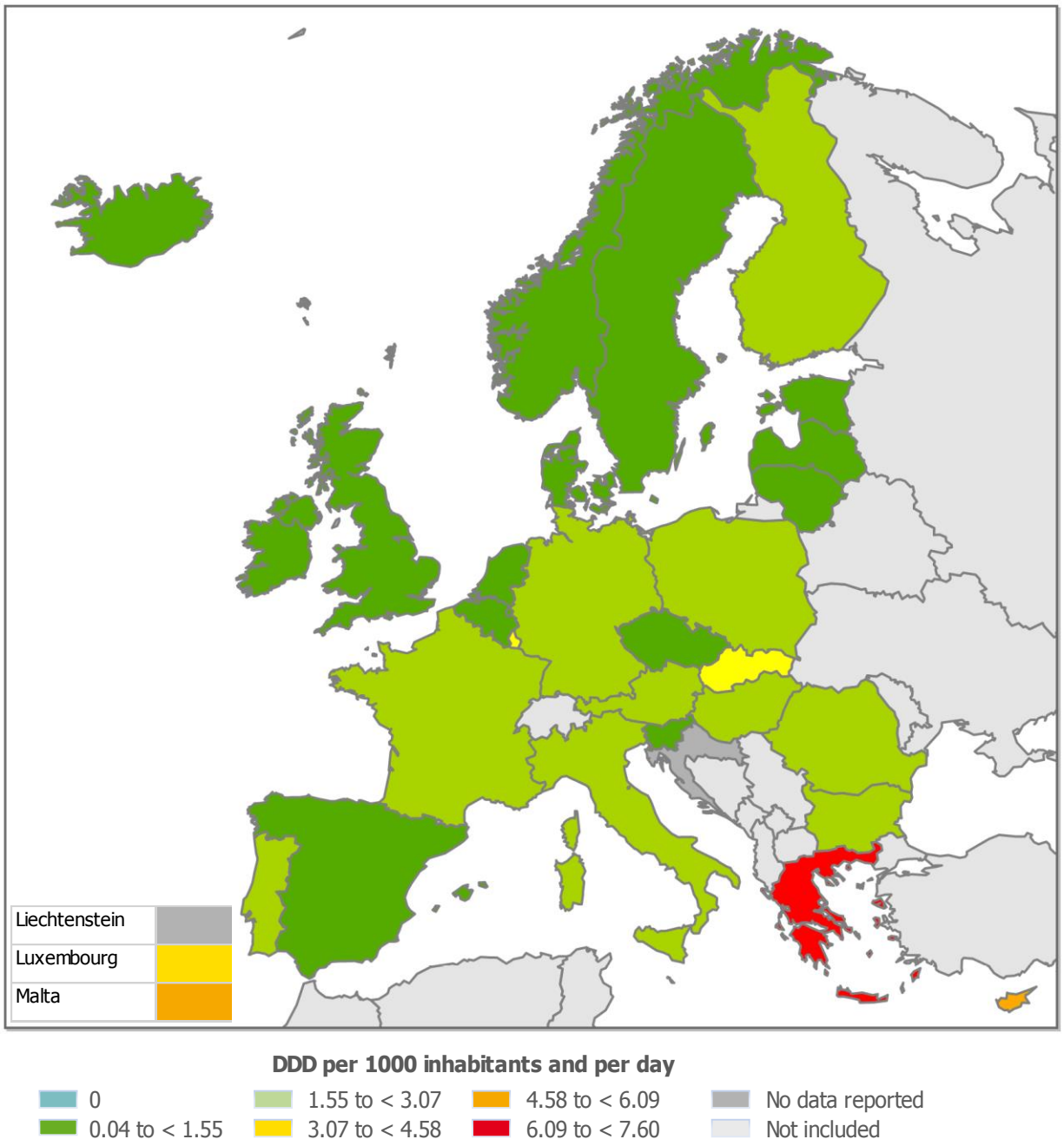
In 2011, the median proportion of first-generation cephalosporins (ATC group J01DB) among cephalosporins was 8.2% in the community. Consumption of first-generation cephalosporins ranged from 0.01 (Greece) to 2.3 (Finland) DDD per 1 000 inhabitants and per day (Figure 3.12).

As shown in Figure 3.12, second-generation cephalosporins (ATC group J01DC) were the most frequently consumed subgroup of cephalosporins. In 2011, consumption of second-generation cephalosporins ranged from <0.01 (Norway) to 7.5 (Greece) DDD per 1 000 inhabitants and per day.

In 2011, the consumption of third-generation cephalosporins (ATC group J01DD) was reported as 1.9 DDD per 1 000 inhabitants and per day in France and 2.0 in Italy. In these two countries, third-generation cephalosporins accounted for more than two thirds of all cephalosporin consumption.

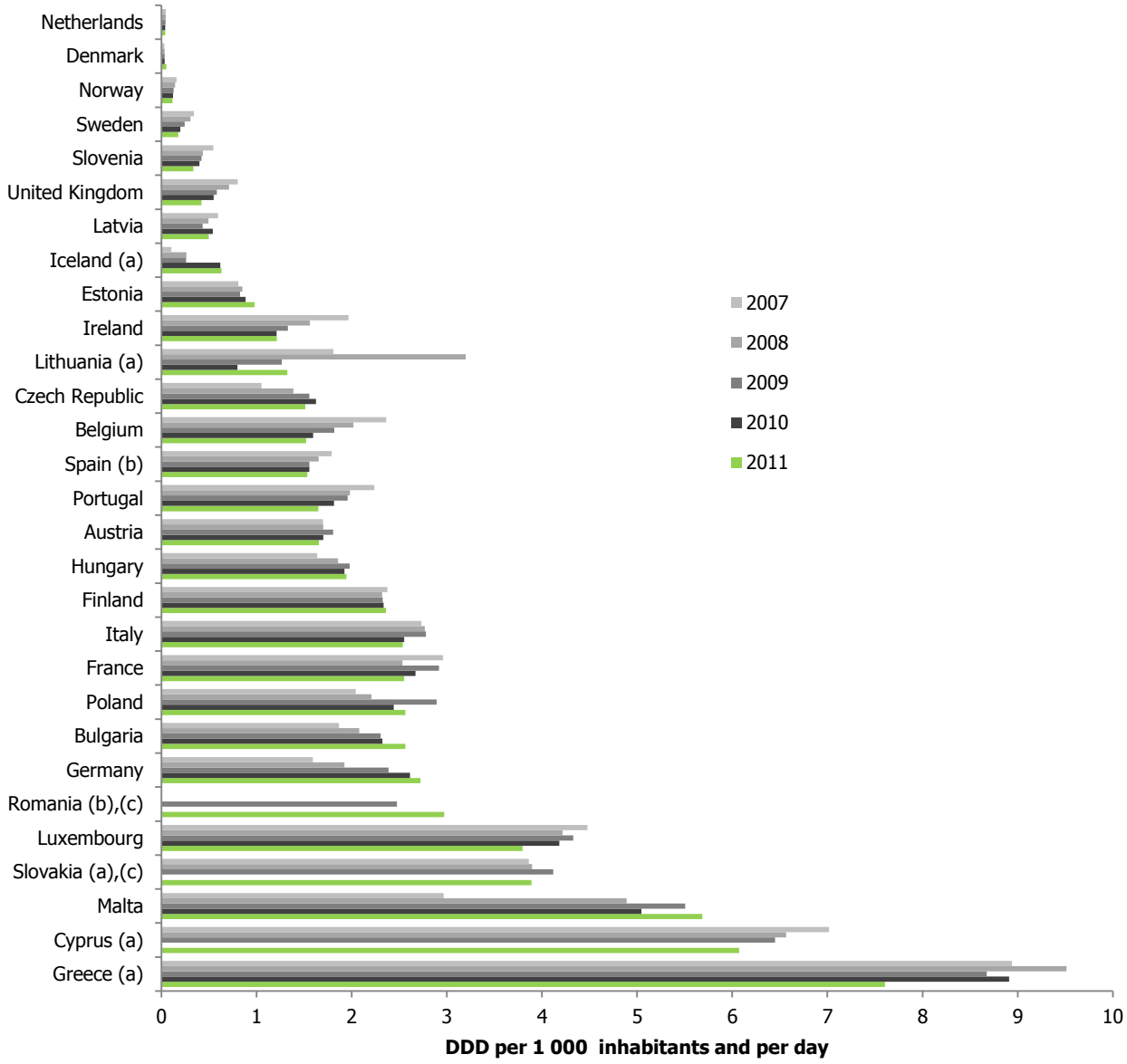
In 2011, the consumption of fourth-generation cephalosporins (ATC group J01DE) was very low. The highest consumption was reported as 0.005 DDD per 1 000 inhabitants and per day (Czech Republic); 19 countries reported zero consumption.

Figure 3.13. Consumption of other beta-lactam antibacterials (ATC group J01D) in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day



Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Figure 3.14. Trends of consumption of other beta-lactam antibacterials (ATC group J01D) in the community, EU/EEA countries, 2007–2011, expressed as DDD per 1 000 inhabitants and per day



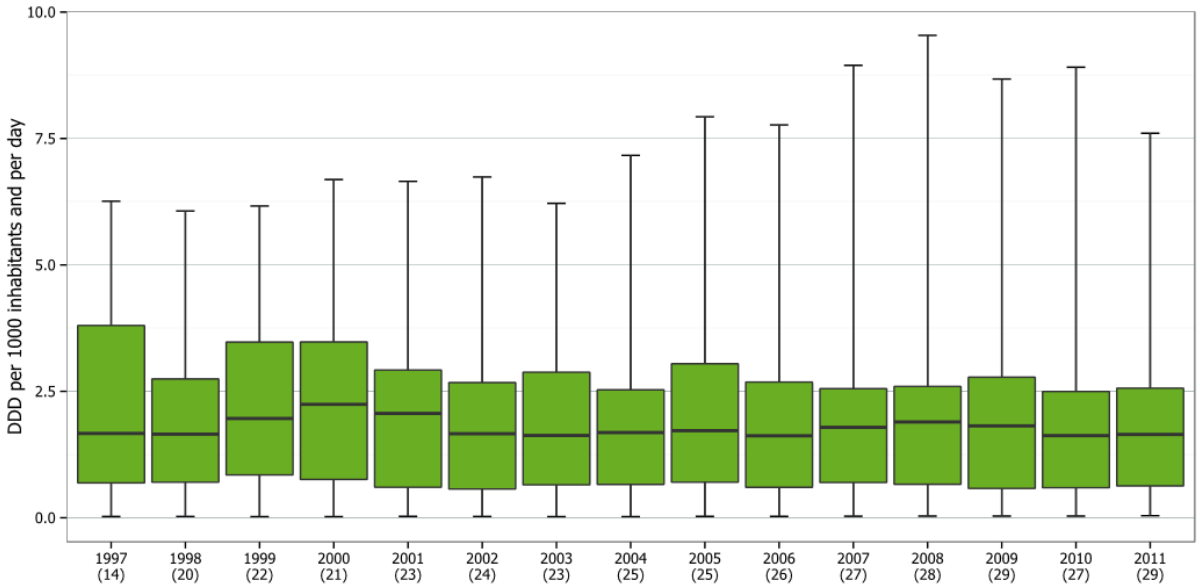
(a) Cyprus (2007–2011), Greece (2007, 2008, 2010), Iceland (2010, 2011), Lithuania (2007–2009, 2011) and Slovakia (2011) provided only total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.
(c) Romania (2007, 2008, 2010) and Slovakia (2010) did not report data for these years.

Trends

Among countries reporting data for the full period 2007–2011, community consumption of other beta-lactam antibacterials (ATC group J01D) increased significantly in three countries (Bulgaria, Estonia, and Germany) and decreased significantly in eight countries (Belgium, Ireland, the Netherlands, Norway, Slovenia, Spain, Sweden and the United Kingdom) during those five years (Figure 3.14).

None of the countries showed a significant increase in the consumption of first-generation cephalosporins (ATC group J01DB), whereas eleven countries (Belgium, Bulgaria, Cyprus, France, Germany, Ireland, Italy, Norway, Poland, Sweden and the United Kingdom) showed a significant decrease in consumption of this group.

Figure 3.15. Trends and inter-country variations of consumption of other beta-lactam antibacterials (ATC group J01D) in the community, EU/EEA countries, 1997–2011, expressed as DDD per 1 000 inhabitants and per day



Boxes indicate the lower and the upper quartiles. The bold lines indicate the medians. Whiskers indicate the minimum and maximum values. For 1997–2009, only data from ESAC participating countries that also participated in ESAC-Net in 2011 are included. The number of participating countries is shown in parentheses.

Four countries (Austria, Bulgaria, Estonia and Germany) showed a significant increase in the consumption of second-generation cephalosporins (ATC group J01DC) whereas six countries (Belgium, Italy, the Netherlands, Slovenia, Sweden and the United Kingdom) showed a significant decrease.

Four countries (Bulgaria, Estonia, Malta and Sweden) showed a significant increase in the consumption of third-generation cephalosporins (ATC group J01DD) and two countries (Spain and the United Kingdom) showed a significant decrease.

France and Spain showed a significant increase in the consumption of fourth-generation cephalosporins (ATC group J01DE). However, the consumption reported in these two countries in 2011 was very low: 0.0006 and 0.0001 DDD per 1 000 inhabitants and per day, respectively. Conversely, none of the countries showed a significant decrease.

Six countries (Austria, Cyprus, the Czech Republic, Germany, Luxembourg and the United Kingdom) showed a significant increase in the consumption of carbapenems (ATC group J01DH) whereas three countries (Italy, Spain and Sweden) showed a significant decrease.

The European trend in the community consumption of other beta-lactam antibacterials (ATC group J01D) is shown in Figure 3.15. The median consumption decreased from 1.9 DDD per 1 000 inhabitants and per day in 2008 to 1.6 DDD per 1 000 inhabitants and per day in 2011.

Discussion

The percentage of total consumption of antibacterials for systemic use (ATC group J01) corresponding to third- plus fourth-generation cephalosporins (ATC groups J01DD & J01DE) has been suggested as a quality indicator for consumption in the community (Table 3.6). Results from the former ESAC project suggest that variations in the consumption of second- and third-generation cephalosporins between countries and over time could be an indication of inappropriate use [13].

For both 2011 and 2010, Greece reported the highest consumption of other beta-lactam antibacterials (ATC J01D), but, in 2010, the country reported total consumption data including data from the hospital sector, which is the most likely explanation for a lower consumption of this group in 2011 than in 2010.

Over the period 2007–2011, the overall consumption of other beta-lactam antibacterials (ATC group J01D) decreased significantly in one third of the countries included in the trend analyses. This was mainly due to a decrease in consumption of the first- and second-generation cephalosporins (ATC groups J01DB and J01DC). Carbapenems (ATC group J01DH) are last-line antibacterials that are only administered parenterally. Their consumption significantly increased in nearly one third of the countries over the five-year period.

The ESAC project reported a significant increase in the consumption of other beta-lactam antibacterials (ATC group J01D) between 1997 and 2009 [13]. In 2010 and 2011, however, data from ESAC-Net show a small decrease since 2009 (Figure 3.15).

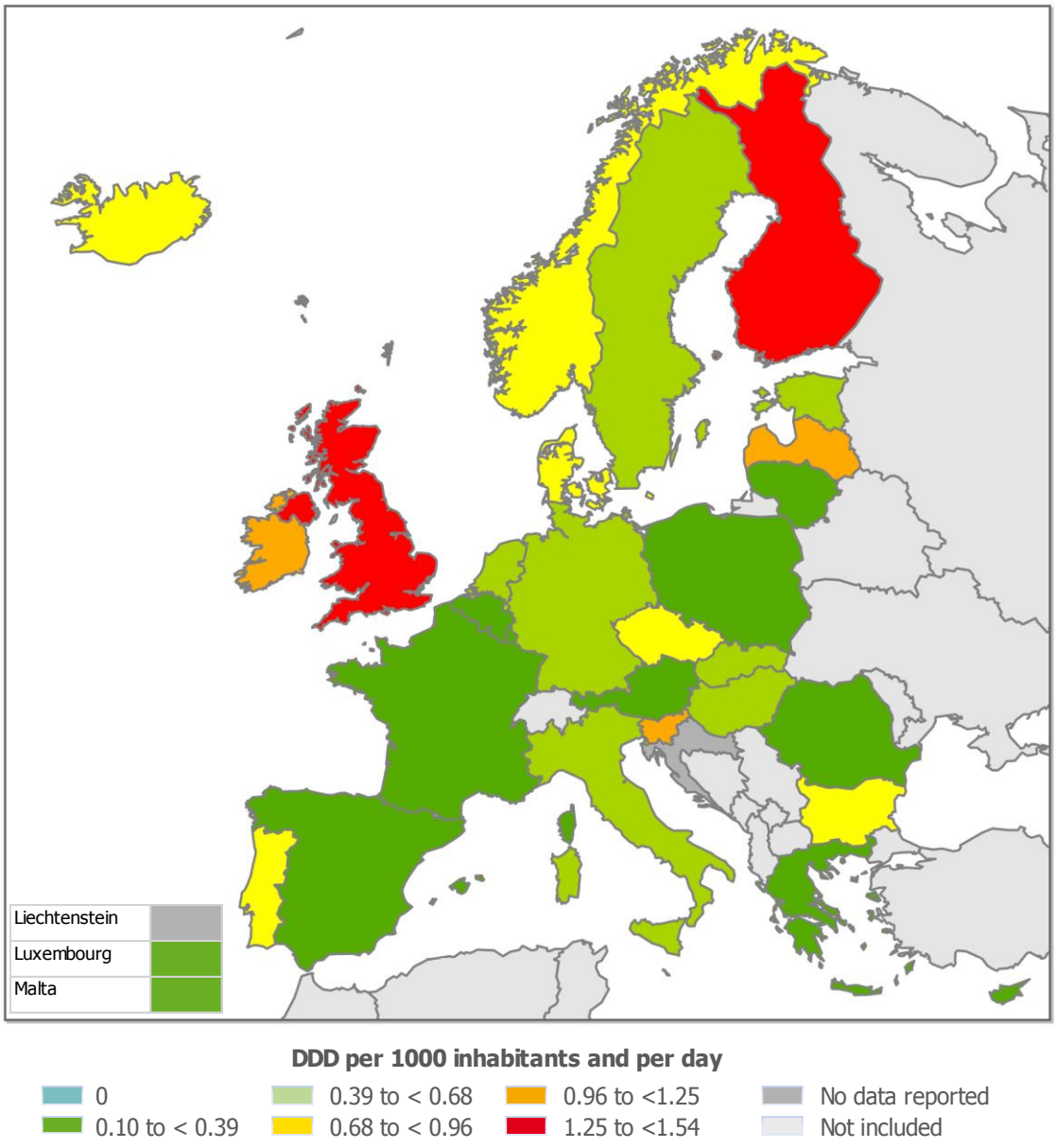
3.1.5 Sulfonamides and trimethoprim (ATC group J01E)

Results

In 2011, consumption of sulfonamides and trimethoprim ranged from 0.1 DDD per 1 000 inhabitants and per day (Poland) to 1.5 DDD per 1 000 inhabitants and per day (Finland) (Table 3.1, Figure 3.16). The proportion of sulfonamides and trimethoprim consumption out of the total consumption of antibacterials for systemic use (ATC group J01) ranged from 0.45% (Poland) to 8.0% (Latvia).

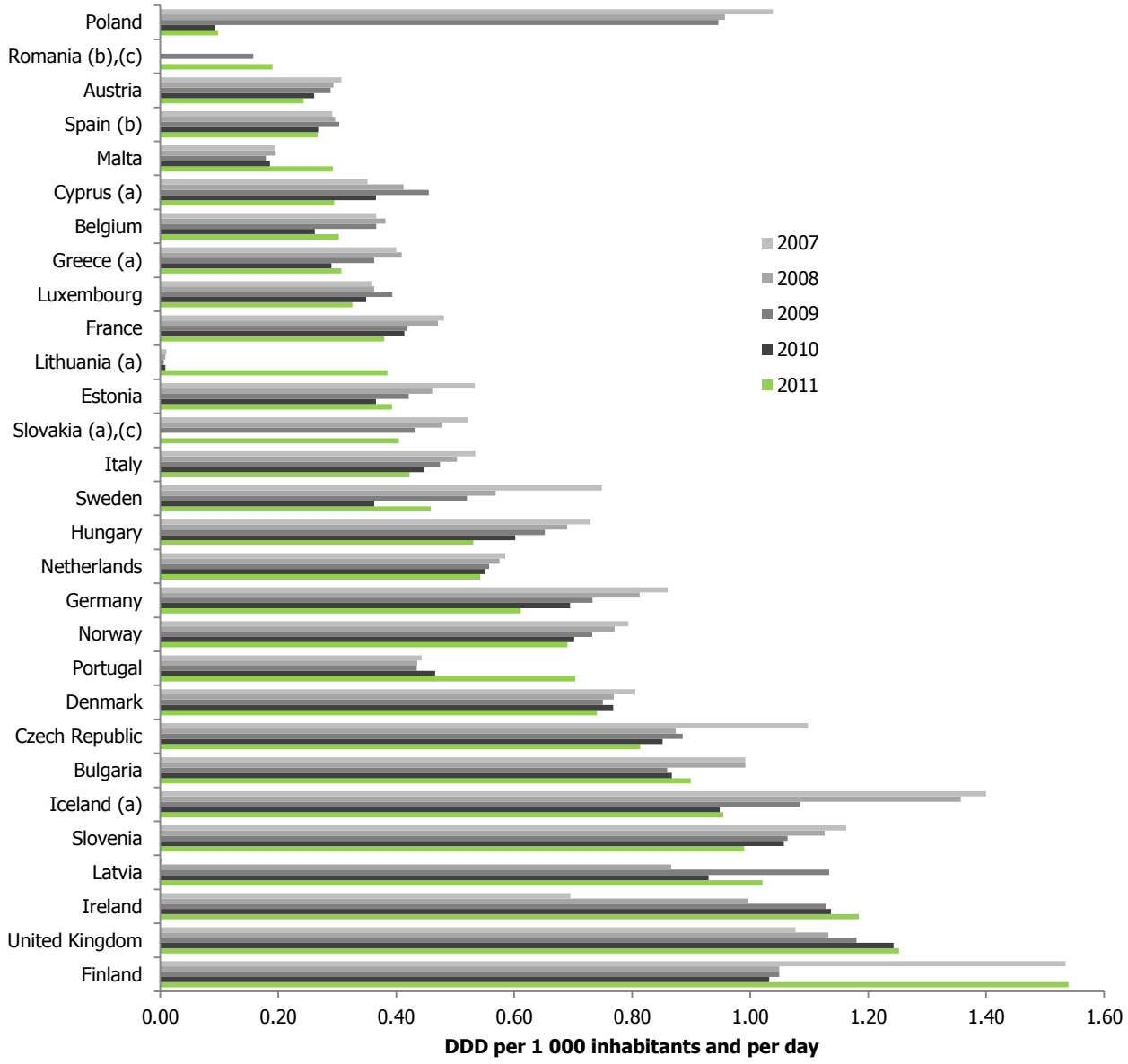
In 2011, the most consumed agents from ATC group J01E in the community were trimethoprim (J01EA01) alone and the combination of sulfamethoxazole and trimethoprim (J01EE01), which together made up 93.4% of the consumption of this group. In Ireland and in the United Kingdom, three quarters of the consumption in the ATC group J01E were reported as trimethoprim (J01EA01) with 0.9 and 1.0 DDD per 1 000 inhabitants and per day, respectively.

Figure 3.16. Consumption of sulfonamides and trimethoprim (ATC group J01E) in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day



Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Figure 3.17. Trends of consumption of sulfonamides and trimethoprim (ATC group J01E) in the community, EU/EEA countries, 2007–2011, expressed as DDD per 1 000 inhabitants and per day



(a) Cyprus (2007–2011), Greece (2007, 2008, 2010), Iceland (2010, 2011), Lithuania (2007–2009, 2011) and Slovakia (2011) provided only total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.
(c) Romania (2007, 2008, 2010) and Slovakia (2010) did not report data for these years.

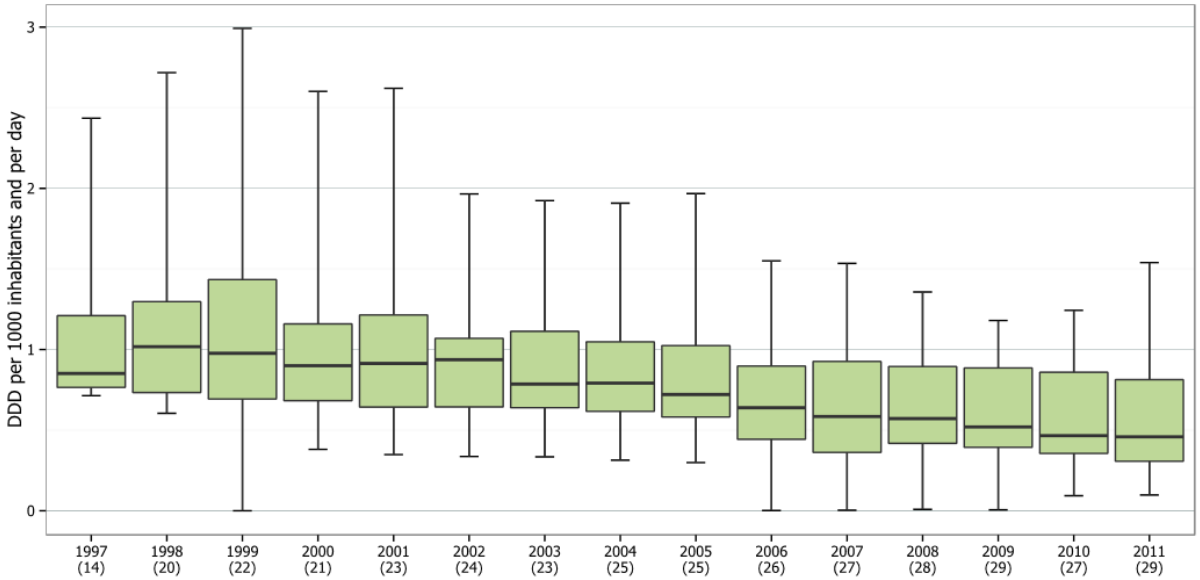
Trends

Figure 3.17 shows the consumption of sulfonamides and trimethoprim (ATC group J01E) in the community between 2007 and 2011 for each country. Among countries reporting data for that period, community consumption of sulfonamides and trimethoprim (ATC group J01E) significantly decreased in nine countries (Austria, Estonia, France, Germany, Italy, the Netherlands, Norway, Poland and Slovenia) (Figure 3.17). Two of the countries (Ireland and the United Kingdom) reported a significant increase in the consumption of this group.

Additionally, eight countries (Czech Republic, Estonia, France, Germany, Italy, the Netherlands, Poland and Slovenia) showed a significant decrease in the consumption of combinations of sulfonamides and trimethoprim, including derivatives (ATC group J01EE). The United Kingdom was the only country showing an increase in the consumption of this group.

As shown in Figure 3.18, the median consumption of sulfonamides and trimethoprim (ATC group J01E) in EU/EEA countries has slowly decreased from 2004 to 0.42 DDD per 1 000 inhabitants and per day in 2011.

Figure 3.18. Trends and inter-country variations of consumption of sulfonamides and trimethoprim (ATC group J01E) in the community, EU/EEA countries, 1997–2011, expressed as DDD per 1 000 inhabitants and per day



Boxes indicate the lower and the upper quartiles. The bold lines indicate the medians. Whiskers indicate the minimum and maximum values. For 1997–2009, only data from ESAC participating countries that also participated in ESAC-Net in 2011 are included. The number of participating countries is shown in parentheses.

Discussion

The consumption of sulfonamides and trimethoprim (ATC group J01E) is dominated by one substance, i.e. trimethoprim, used alone (ATC J01EA01) or in a combination with sulfamethoxazole (ATC J01EE01).

The large number of countries showing a significant decrease in the consumption of sulfonamides and trimethoprim (ATC group J01E) in the community between 2007 and 2011 is in line with the decreasing trend observed by the ESAC project for the period 1997-2009.

3.1.6 Macrolides, lincosamides and streptogramins (ATC group J01F)

Results

Macrolides, lincosamides and streptogramins (ATC group J01F) form the second most commonly used ATC subgroup in 14 of the reporting countries. In 2011, consumption ranged from 0.6 DDD per 1 000 inhabitants and per day (Sweden) to 9.4 DDD per 1 000 inhabitants and per day (Greece). Greece, Italy and Slovakia were the only countries that reported a consumption of macrolides, lincosamides and streptogramins (ATC group J01F) higher than 4.5 DDD per 1 000 inhabitants and per day in 2011 (Table 3.1, Figure 3.19).

The proportion of consumption of macrolides, lincosamides and streptogramins (ATC group J01F) out of the total consumption of antibacterials for systemic use (ATC group J01 group) ranged from 4.3% (Sweden) to 26.7% (Greece).

Table 3.2. Consumption of short-, intermediate- and long-acting macrolides for systemic use in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day

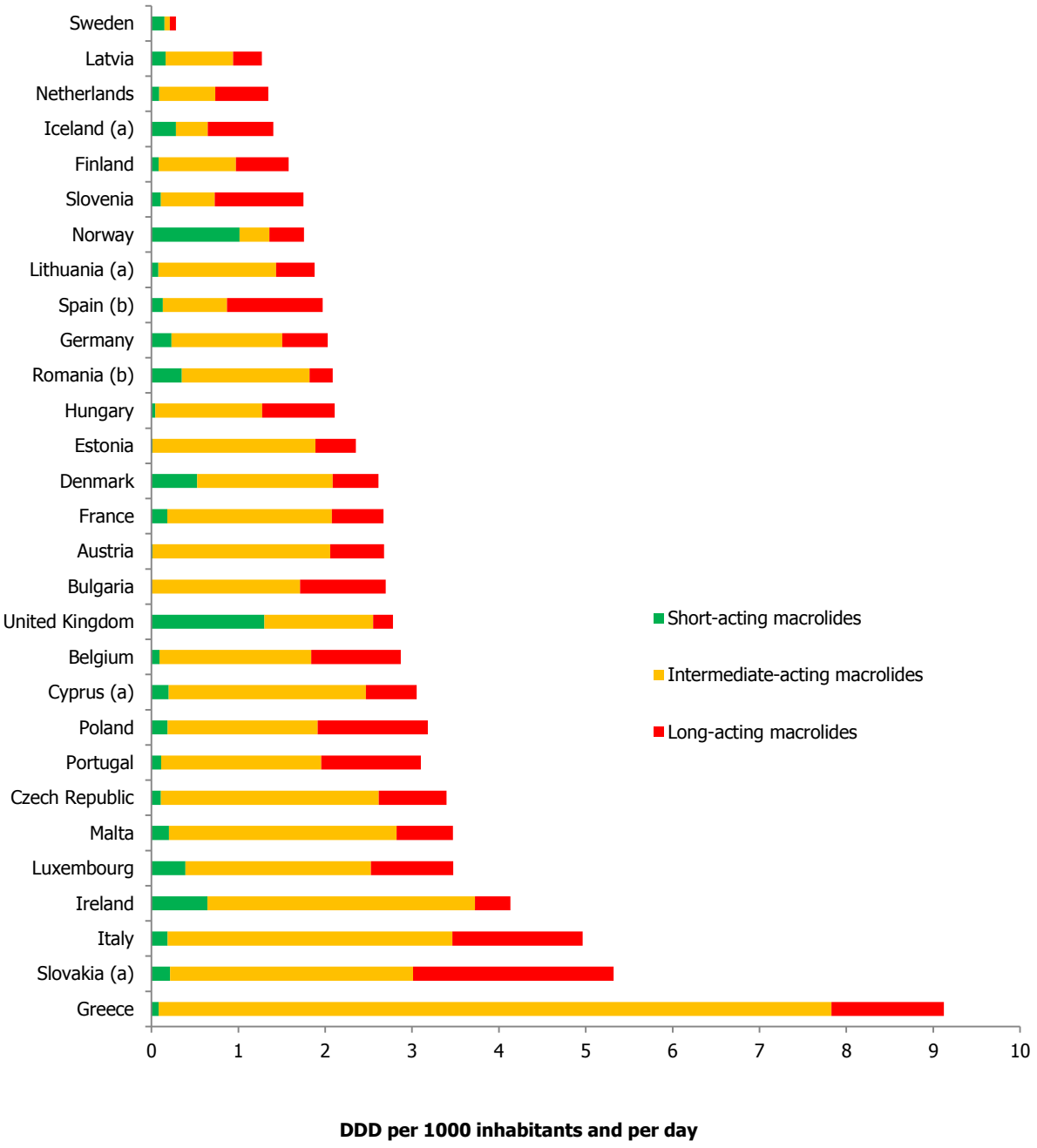
Country	Short-acting macrolides	Intermediate-acting macrolides	Long-acting macrolides	Total
Austria	0.01	2.05	0.62	2.68
Belgium	0.09	1.76	1.03	2.88
Bulgaria	0	1.71	0.99	2.70
Cyprus (a)	0.20	2.27	0.59	3.05
Czech Republic	0.11	2.51	0.78	3.40
Denmark	0.52	1.56	0.53	2.61
Estonia	0.01	1.87	0.47	2.35
Finland	0.08	0.89	0.61	1.58
France	0.18	1.89	0.60	2.67
Germany	0.23	1.28	0.52	2.03
Greece)	0.08	7.75	1.30	9.12
Hungary	0.04	1.23	0.85	2.13
Iceland (a)	0.28	0.36	0.76	1.40
Ireland	0.64	3.08	0.41	4.13
Italy	0.18	3.28	1.50	4.96
Latvia	0.16	0.78	0.33	1.27
Lithuania (a)	0.08	1.36	0.44	1.88
Luxembourg	0.39	2.14	0.95	3.47
Malta	0.20	2.62	0.65	3.47
Netherlands	0.09	0.65	0.61	1.34
Norway	1.01	0.34	0.40	1.76
Poland	0.18	1.73	1.26	3.35
Portugal	0.11	1.84	1.15	2.85
Romania (b)	0.35	1.47	0.27	2.09
Slovakia (a)	0.22	2.80	2.31	5.30
Slovenia	0.11	0.62	1.02	1.75
Spain (b)	0.13	0.74	1.10	1.97
Sweden	0.15	0.06	0.07	0.28
United Kingdom	1.30	1.25	0.23	2.78
EU median	**0.16**	**1.71**	**0.62**	**2.67**

A classification of macrolides is used as described by the ESAC project [7] according to the mean plasma elimination (Annex 1).
(a) Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

In 2011, the overall consumption of macrolides (ATC group J01FA) varied by a factor of 33 from 0.28 DDD per 1 000 inhabitants and per day (Sweden) to 9.1 DDD per 1 000 inhabitants and per day (Greece) (Table 3.2).

Among short-acting macrolides, erythromycin (ATC J01FA01) was the most consumed substance in the United Kingdom, where it accounted for 45% of the total consumption of macrolides (ATC group J01FA).

Figure 3.19. Consumption of short-, intermediate- and long-acting macrolides for systemic use in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day

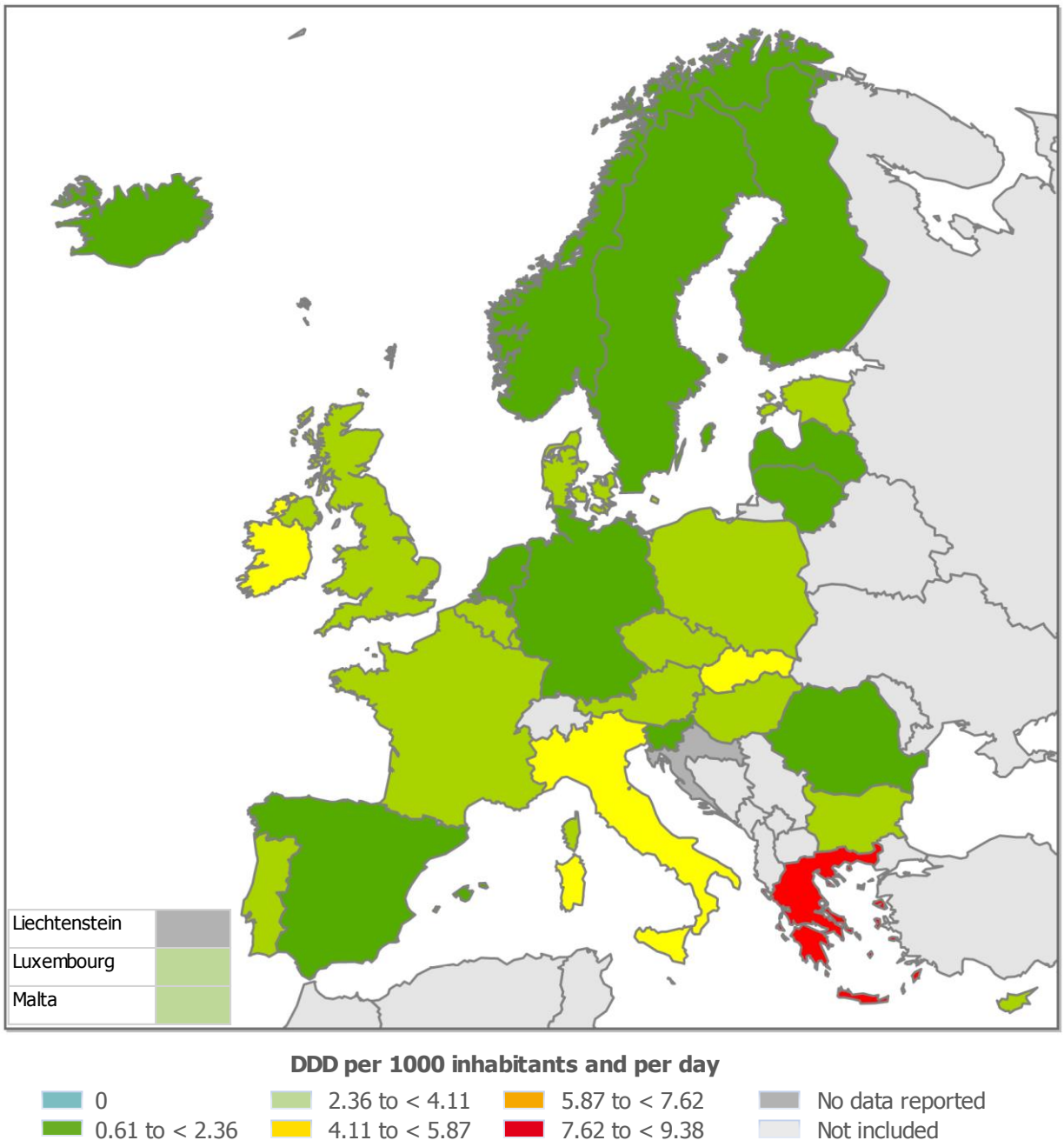


A classification of macrolides is used as described by the ESAC project [7] according to the mean plasma elimination (Annex 1).
(a) Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Intermediate-acting macrolides, mostly clarithromycin (ATC J01FA09), accounted for 64% of the total consumption of macrolides (ATC group J01FA) with a consumption ranging from 0.06 DDD per 1 000 inhabitants and per day (Sweden) to 7.7 DDD per 1 000 inhabitants and per day (Greece).

The consumption of long-acting macrolides, mostly azithromycin (J01FA10), ranged from 0.06 DDD per 1 000 inhabitants and per day (Sweden) to 2.3 DDD per 1 000 inhabitants and per day (Slovakia).

Figure 3.20. Consumption of macrolides, lincosamides and streptogramins (ATC group J01F) in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day

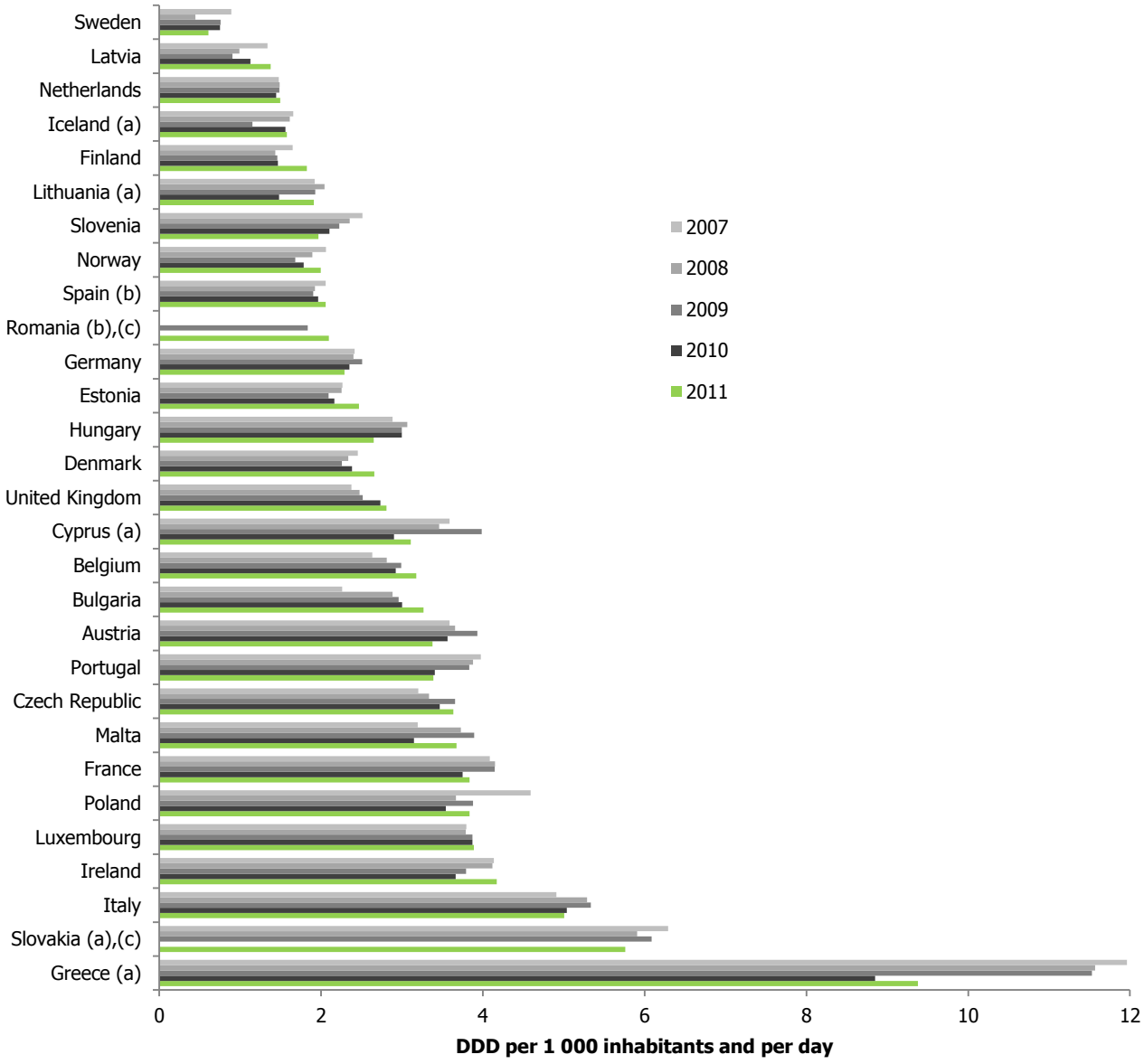


Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Trends

Temporal trends in the consumption of macrolides, lincosamides and streptogramins (ATC group J01F) are presented in Figure 3.21. Among countries reporting data for the period 2007–2011, community consumption of macrolides, lincosamides and streptogramins (ATC group J01F) significantly increased in four countries (Belgium, Bulgaria, Luxembourg and the United Kingdom), while only one country (Slovenia) reported a significant decrease in the consumption of this group.

Figure 3.21. Trends of consumption of macrolides, lincosamides and streptogramins (ATC group J01F) in the community, EU/EEA countries, 2007–2011, expressed as DDD per 1 000 inhabitants and per day



(a) Cyprus (2007–2011), Greece (2007, 2008, 2010), Iceland (2010, 2011), Lithuania (2007–2009, 2011) and Slovakia (2011) provided only total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.
(c) Romania (2007, 2008, 2010) and Slovakia (2010) did not report data for these years.

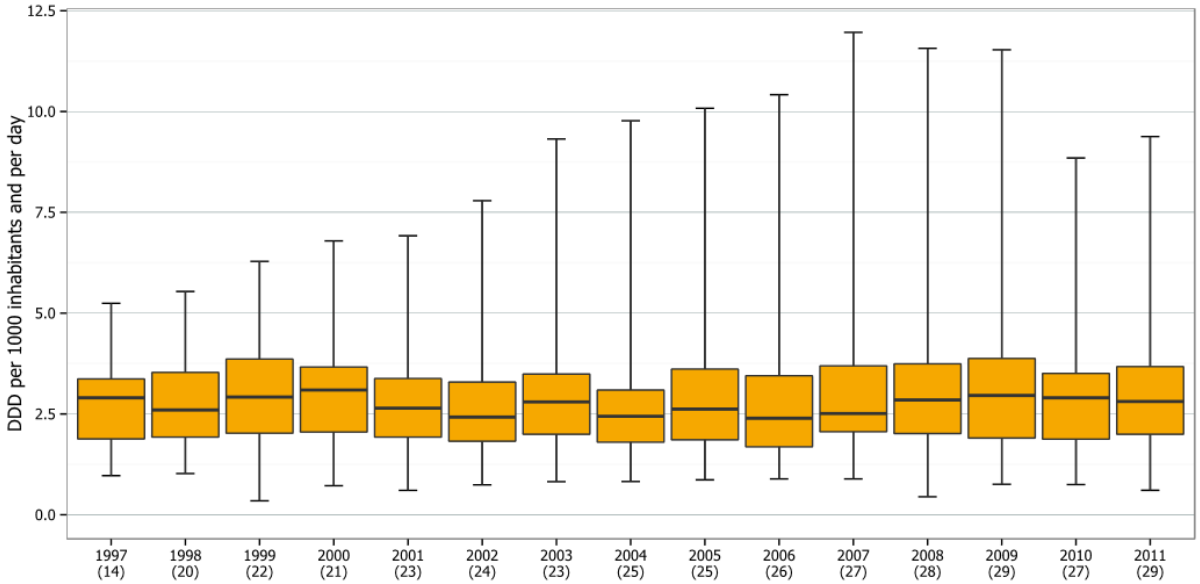
Belgium and the United Kingdom showed a significant increase in the consumption of macrolides (ATC group J01FA), whereas France and Slovenia showed a significant decrease.

Eleven countries (Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, Luxembourg, the Netherlands, Norway, Spain and the United Kingdom) showed a significant increase in the consumption of lincosamides (ATC group J01FF). None of the countries reported a significant decrease for this ATC group.

France showed a significant increase in consumption of streptogramins (ATC group J01FG). None of the countries reported a significant decrease in this group.

The median consumption of macrolides, lincosamides and streptogramins (ATC group J01F) decreased from 3.0 DDD per 1 000 inhabitants and per day in 2009 to 2.8 DDD per 1 000 inhabitants and per day in 2011 (Figure 3.22).

Figure 3.22. Trends and inter-country variations of consumption of macrolides, lincosamides and streptogramins (ATC group J01F) in the community, EU/EEA countries, 1997–2011, expressed as DDD per 1 000 inhabitants and per day



Boxes indicate the lower and the upper quartiles. The bold lines indicate the medians. Whiskers indicate the minimum and maximum values. For 1997–2009, only data from ESAC participating countries that also participated in ESAC-Net in 2011 are included. The number of participating countries is shown in parentheses.

Discussion

Macrolides (ATC group J01FA), in particular intermediate-acting substances, were the most often consumed antibacterials of the group comprising macrolides, lincosamides and streptogramins (ATC group J01F) in all countries, with the exception of Sweden where lincosamides (ATC group J01FF) were predominantly used.

More than 60% of the countries showed a significant increase in the consumption of lincosamides (ATC group J01FF) during the five-year period to 2011.

A significant increase in the consumption of macrolides and of lincosamides, and of the ratio of long-acting to intermediate-acting macrolide consumption (compositional data analysis for ESAC project data from 1997 to 2009) has previously been reported by the former ESAC project for the period 1997–2009 [7]. This report shows that the EU median consumption of macrolides, lincosamides and streptogramins (ATC group J01F) decreased between 2009 and 2011.

The large inter-country variation in the consumption of macrolides may indicate inappropriate use in some of the reporting countries.

3.1.7 Quinolone antibacterials (ATC group J01M)

Results

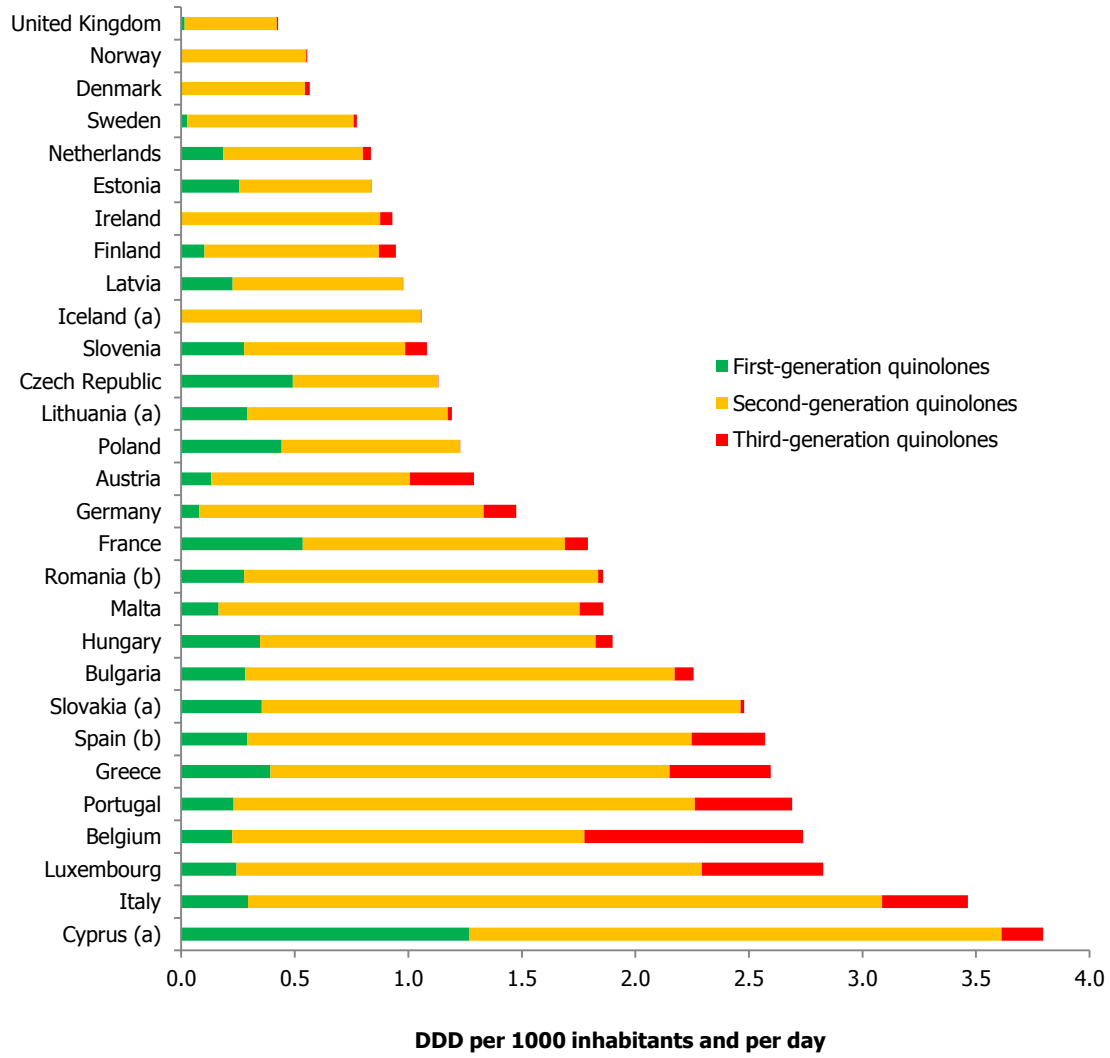
The pattern of community consumption of quinolone antibacterials (ATC group J01M) shows a gradient from northern to southern Europe (Figure 3.24). In 2011, consumption varied by a factor of 8.8 ranging from 0.43 DDD per 1 000 inhabitants and per day (United Kingdom) to 3.8 DDD (Cyprus), with a median consumption of 1.2 DDD per 1 000 inhabitants and per day (Tables 3.1, 3.3). The proportion of consumption of quinolone antibacterials (ATC group J01M) out of the total consumption of antibacterials for systemic use (ATC group J01) ranged from 2.3% (United Kingdom) to 14.3% (Romania).

Table 3.3. Consumption of first-, second- and third-generation quinolones for systemic use in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day

Country	First-generation quinolones	Second-generation quinolones	Third-generation quinolones	Total
Austria	0.13	0.87	0.28	1.29
Belgium	0.22	1.56	0.96	2.73
Bulgaria	0.28	1.89	0.08	2.26
Cyprus (a)	1.27	2.34	0.18	3.80
Czech Republic	0.49	0.64	<0.01	1.13
Denmark	0	0.55	0.02	0.57
Estonia	0.26	0.58	<0.01	0.84
Finland	0.10	0.77	0.07	0.95
France	0.54	1.15	0.10	1.79
Germany	0.08	1.25	0.14	1.48
Greece	0.39	1.76	0.45	2.60
Hungary	0.35	1.48	0.08	1.91
Iceland (a)	0	1.05	<0.01	1.06
Ireland	<0.01	0.88	0.05	0.93
Italy	0.29	2.79	0.38	3.46
Latvia	0.23	0.75	<0.01	0.98
Lithuania (a)	0.29	0.88	0.02	1.19
Luxembourg	0.24	2.05	0.53	2.83
Malta	0.16	1.59	0.10	1.86
Netherlands	0.18	0.62	0.03	0.83
Norway	0	0.55	<0.01	0.55
Poland	0.44	0.79	<0.01	1.22
Portugal	0.23	2.03	0.43	2.69
Romania (b)	0.28	1.56	0.02	1.86
Slovakia (a)	0.36	2.11	0.02	2.48
Slovenia	0.28	0.71	0.10	1.08
Spain (b)	0.29	1.96	0.32	2.57
Sweden	0.03	0.73	0.01	0.77
United Kingdom	0.01	0.41	0.01	0.43
EU median	**0.24**	**1.05**	**0.07**	**1.29**

A classification of quinolone antibacterials into three generations is used based on their chemical structure and antimicrobial activity as described by the ESAC project in [6] (Annex 1).
(a) Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Figure 3.23. Consumption of first-, second- and third-generation quinolones for systemic use in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day



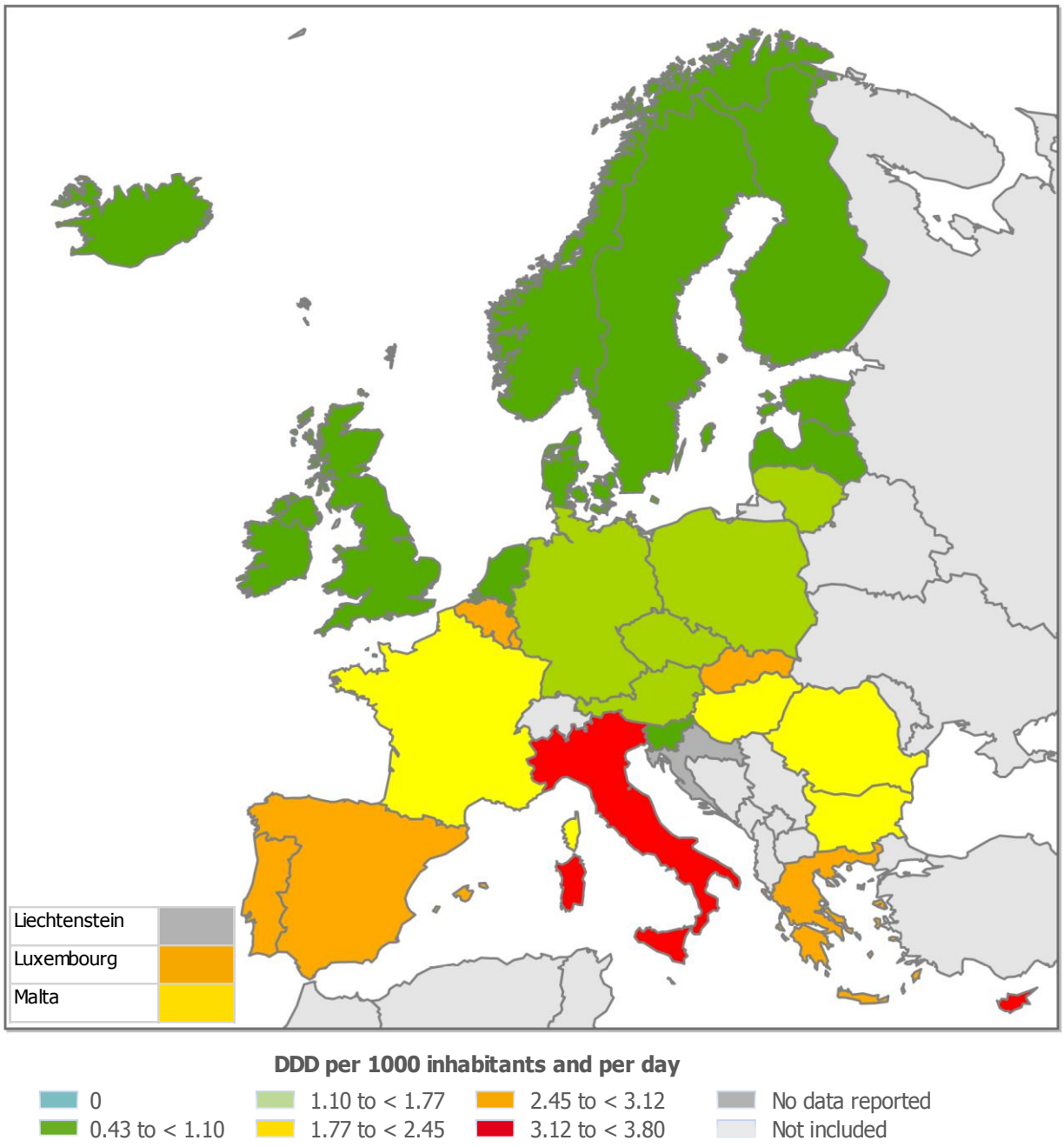
A classification of quinolone antibacterials into three generations is used based on their chemical structure and antimicrobial activity as described by the ESAC project in [6] (Annex 1).
(a) Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

In 2011, consumption of first-generation quinolones ranged from 0.01 DDD per 1 000 inhabitants and per day (United Kingdom) to 1.3 DDD per 1 000 inhabitants and per day (Cyprus). Denmark, Iceland and Norway reported no consumption of first-generation quinolones (Table 3.3).

In 2011, second-generation quinolones were consumed on average three times more often than first- and third-generation quinolones together. Ciprofloxacin (J01MA02) accounted for 73% of the consumption of second-generation quinolones in all countries. The lowest consumption of ciprofloxacin was reported from the United Kingdom and the highest from Slovakia with 0.36 and 1.8 DDD per 1 000 inhabitants and per day, respectively.

The proportion of consumption of third-generation quinolones out of the total consumption of quinolone antibacterials (ATC J01M) varied from 0.8% in Poland to 35.2% in Belgium.

Figure 3.24. Consumption of quinolone antibacterials (ATC group J01M) in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day



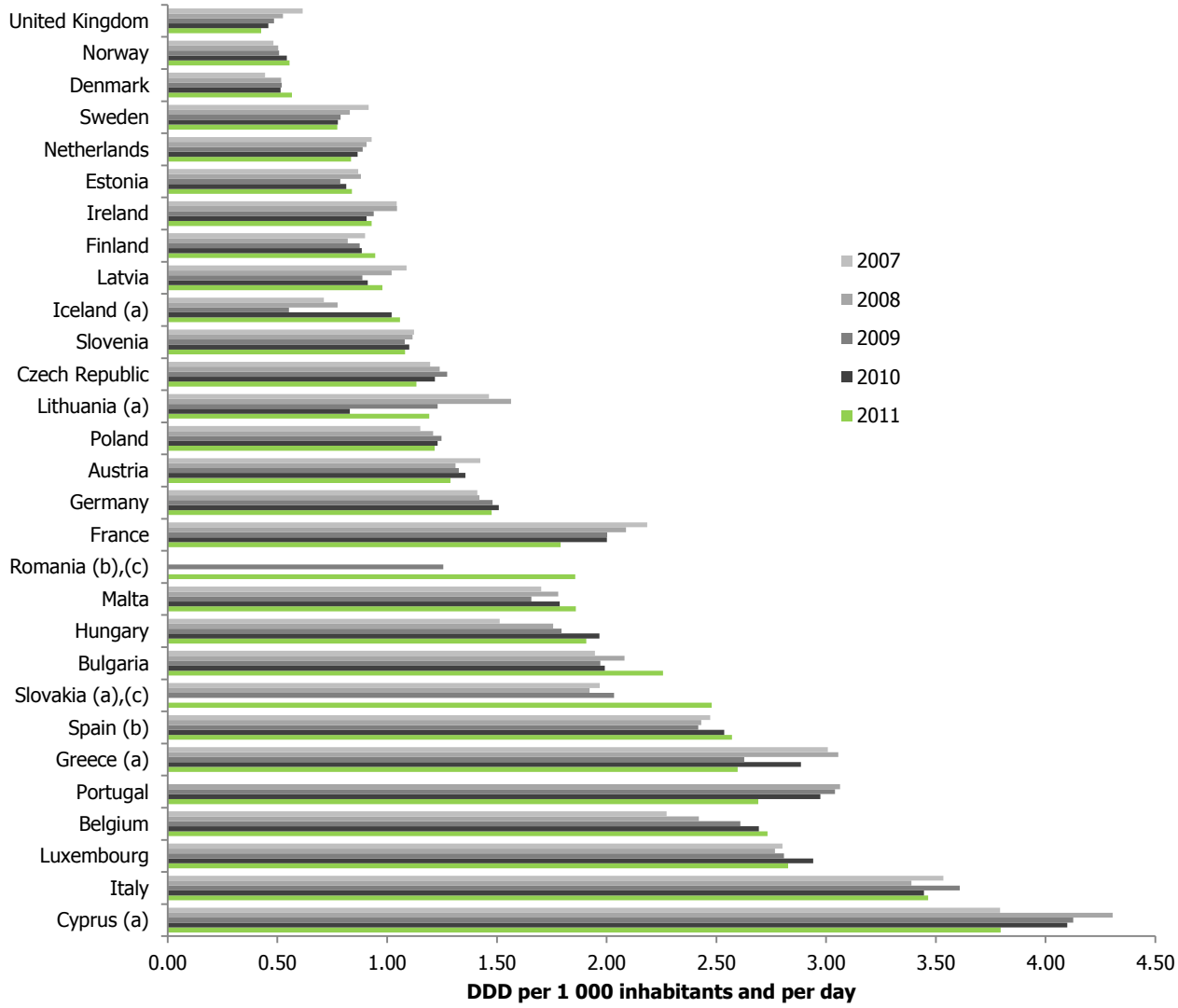
Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Trends

Temporal trends in the consumption of quinolone antibacterials (ATC group J01M) from 2007 to 2011 are presented in Figure 3.25. Among countries reporting data for the period 2007–2011, community consumption of quinolone antibacterials (ATC group J01M) increased significantly in two countries (Belgium and Norway), while four countries (France, the Netherlands, Sweden and the United Kingdom) showed a significant decrease in the consumption for this group.

Belgium and Norway showed a significant increase in the consumption of fluoroquinolones (ATC group J01MA) and France, the Netherlands, Sweden and the United Kingdom showed a significant decrease during 2007–2011.

Figure 3.25. Trends of consumption of quinolone antibacterials (ATC group J01M) in the community, EU/EEA countries, 2007–2011, expressed as DDD per 1 000 inhabitants and per day

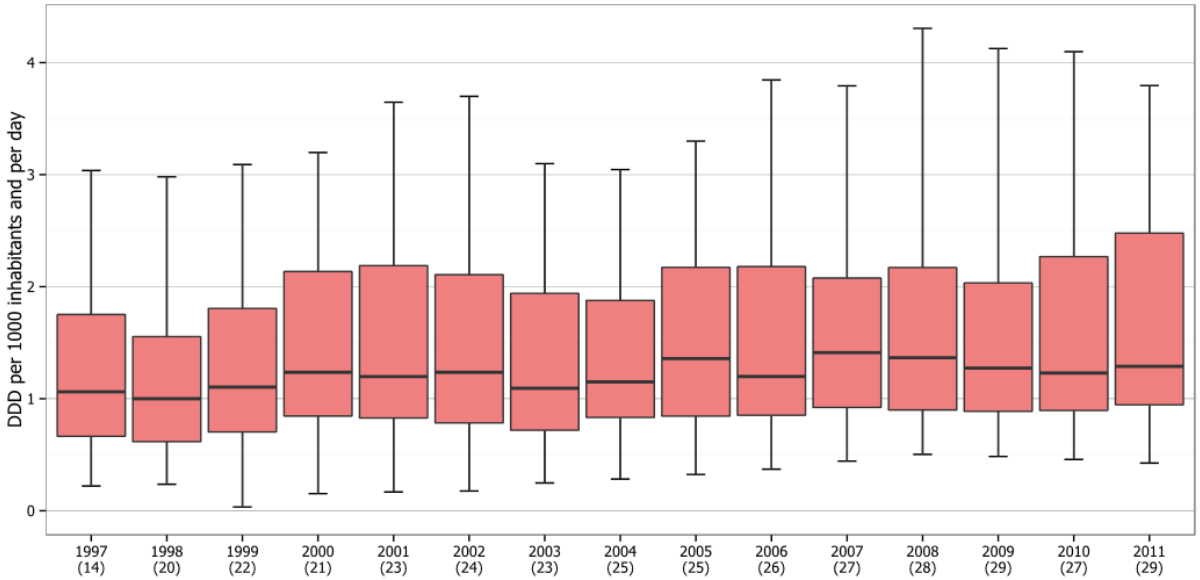


(a) Cyprus (2007–2011), Greece (2007, 2008, 2010), Iceland (2010, 2011), Lithuania (2007–2009, 2011) and Slovakia (2011) provided only total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.
(c) Romania (2007, 2008, 2010) and Slovakia (2010) did not report data for these years.

Additionally, seven countries (France, Italy, Latvia, the Netherlands, Slovenia, Spain and United Kingdom) showed a significant decrease in the consumption of other quinolones (ATC group J01MB).

As shown in Figure 3.26, the median consumption of quinolone antibacterials (ATC group J01M) increased from 1.1 DDD per 1 000 inhabitants and per day in 1997 to 1.4 DDD per 1 000 inhabitants and per day in 2007 and has slowly decreased since then to reach 1.3 DDD per 1 000 inhabitants and per day in 2011.

Figure 3.26. Trends and inter-country variations of consumption of quinolone antibacterials (ATC group J01M) in the community, EU/EEA countries, 1997–2011, expressed as DDD per 1 000 inhabitants and per day



Boxes indicate the lower and the upper quartiles. The bold lines indicate the medians. Whiskers indicate the minimum and maximum values. For 1997-2009, only data from ESAC participating countries that also participated in ESAC-Net in 2011 are included. The number of participating countries is shown in parentheses.

Discussion

Fluoroquinolones, mostly ciprofloxacin (J01MA02), made up almost the entire consumption of quinolone antibacterials (ATC group J01M).

Over the period 2007–2011, four countries showed a significant decrease in the consumption of fluoroquinolones (ATC group J01MA) in the community.

The total quinolone consumption in the community, as well as seasonal variation of this consumption, increased significantly between 1997 and 2009 [6]. During the same period, the ratio of third-generation to second-generation quinolone consumption also increased. However, no clear trend can be observed in the median consumption of quinolone antibacterials (ATC group J01M) between 2007 and 2011.

The large inter-country variation in the consumption of quinolone antibacterials (ATC J01M) may indicate inappropriate use in some of the reporting countries. Quinolone consumption is included in two proposed quality indicators for consumption in the community (J01MA_%, J01_SV, Table 3.6).

3.1.8 Other antibacterials (ATC group J01X)

Results

The pattern of community consumption of other antibacterials (ATC group J01X) shows a gradient from northern to southern Europe (Figure 3.27). In 2011, consumption varied widely ranging from 0.001 DDD per 1 000 inhabitants and per day (Romania) to 3.2 DDD per 1 000 inhabitants and per day (Norway) (Tables 3.1, 3.4 and Figure 3.29), with a median consumption of 0.6 DDD per 1 000 inhabitants and per day. The proportion of consumption of other antibacterials (ATC group J01X) out of the total consumption of antibacterials for systemic use (ATC group J01) ranged from 0.01% (Romania) to 19.2% (Norway).

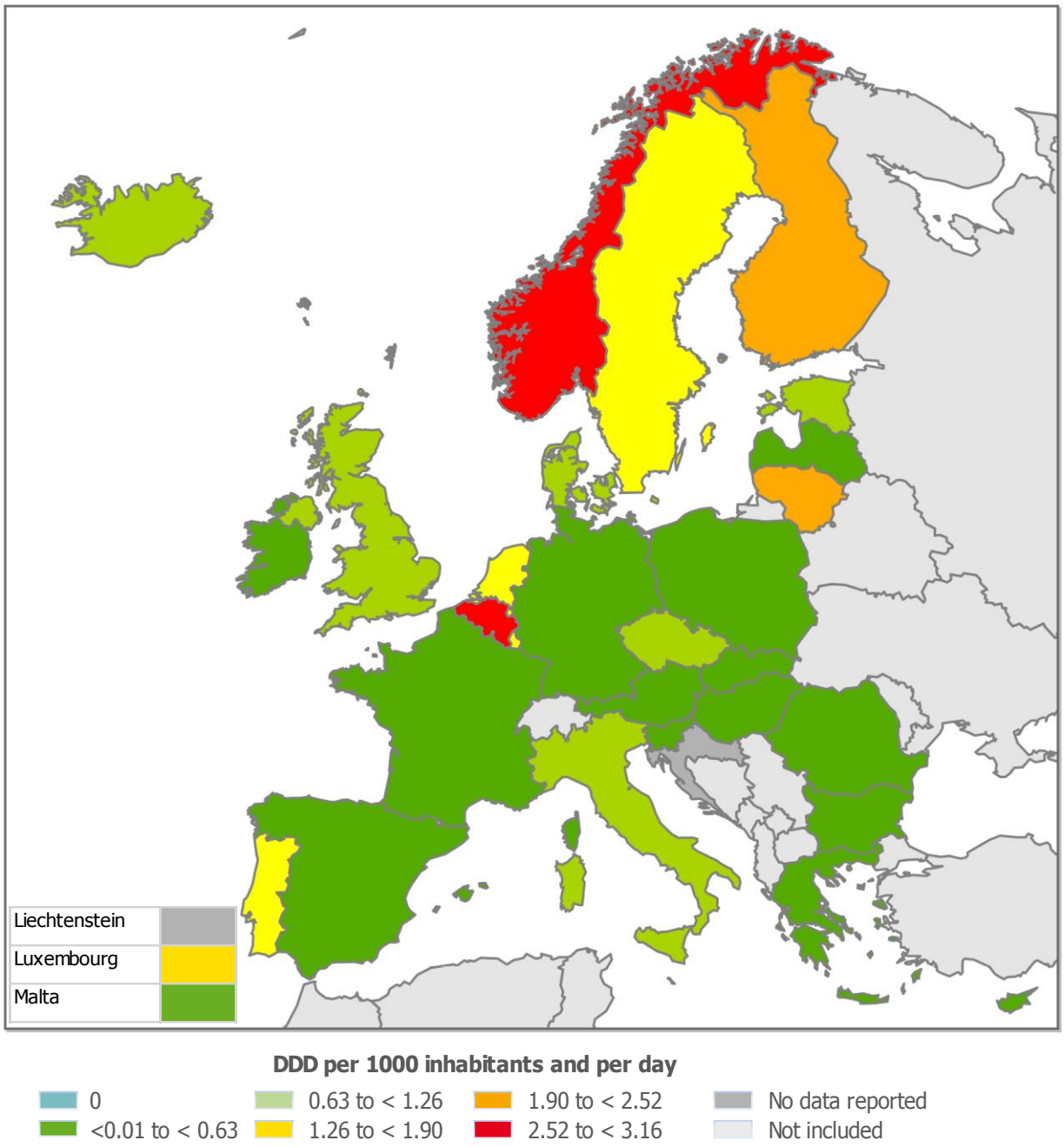
Nitrofurantoin (J01XE01) and nifurtoinol (J01XE02) accounted for more than 90% of the consumption of ATC group J01X in five countries (Belgium, the Czech Republic, Luxembourg, the Netherlands and Slovenia). The Nordic countries showed the highest levels of consumption of methenamine (J01XX05), varying from 1.3 and 1.6 DDD per 1 000 inhabitants and per day (Sweden and Finland, respectively) to 2.8 DDD per 1 000 inhabitants and per day (Norway).

Table 3.4. Consumption of other antibacterials (ATC group J01X) at ATC group level 4 in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day

Country	Glycopeptide antibacterials (J01XA)	Polymyxins (J01XB)	Steroid antibacterials (J01XC)	Imidazole derivatives (J01XD)	Nitrofuran derivatives (J01XE)	Other antibacterials (J01XX)	Total (ATC group J01X)
Austria	<0.01	0.01	0.04	<0.01	0.17	0.03	0.25
Belgium	<0.01	0.02	0	0	2.45	0.14	2.61
Bulgaria	<0.01	0	0	<0.01	0	<0.01	0.00
Cyprus (a)	0.04	0.01	<0.01	0.09	0.29	0.03	0.46
Czech Republic	0.01	0.01	0	0.05	0.95	<0.01	1.03
Denmark	<0.01	0.02	0.01	<0.01	0.50	0.26	0.80
Estonia	0	<0.01	<0.01	0.25	0.47	<0.01	0.72
Finland	<0.01	0	<0.01	<0.01	0.43	1.61	2.04
France	0	0.02	0.09	0	0.29	0.12	0.52
Germany	<0.01	0.01	0	<0.01	0.41	0.06	0.48
Greece	0.02	0.03	0.02	0.02	0.45	0.01	0.56
Hungary	0	<0.01	0	0	<0.01	0.04	0.04
Iceland (a)	0.02	0	0	0.05	0.60	0.37	1.04
Ireland	<0.01	0.07	0.01	<0.01	<0.01	0.01	0.09
Italy	0.01	<0.01	0	<0.01	0.22	0.44	0.66
Latvia	<0.01	0	0	<0.01	0.19	0.04	0.24
Lithuania (a)	0.01	0	0	0.73	1.18	0.05	1.97
Luxembourg	<0.01	<0.01	0	0	1.32	0.07	1.39
Malta	0	0.03	<0.01	0.11	0.28	0	0.43
Netherlands	<0.01	<0.01	<0.01	<0.01	1.31	0.04	1.35
Norway	<0.01	<0.01	<0.01	<0.01	0.33	2.82	3.16
Poland	0	<0.01	0	0.02	0.38	<0.01	0.40
Portugal	0	0	0.05	0	1.16	0.16	1.37
Romania (b)	0	<0.01	0	<0.01	0	0	0.00
Slovakia (a)	0.01	0.03	0	0.34	0	0.03	0.41
Slovenia	0	0	0	0	0.06	<0.01	0.06
Spain (b)	<0.01	0	0.01	<0.01	0.11	0.29	0.41
Sweden	<0.01	<0.01	0.02	<0.01	0.34	1.26	1.62
United Kingdom	<0.01	0.08	0.01	<0.01	0.69	0.02	0.79
EU median	**<0.01**	**0.01**	**0.01**	**<0.01**	**0.40**	**0.04**	**0.56**

(a) Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Figure 3.27. Consumption of other antibacterials (ATC group J01X) in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day

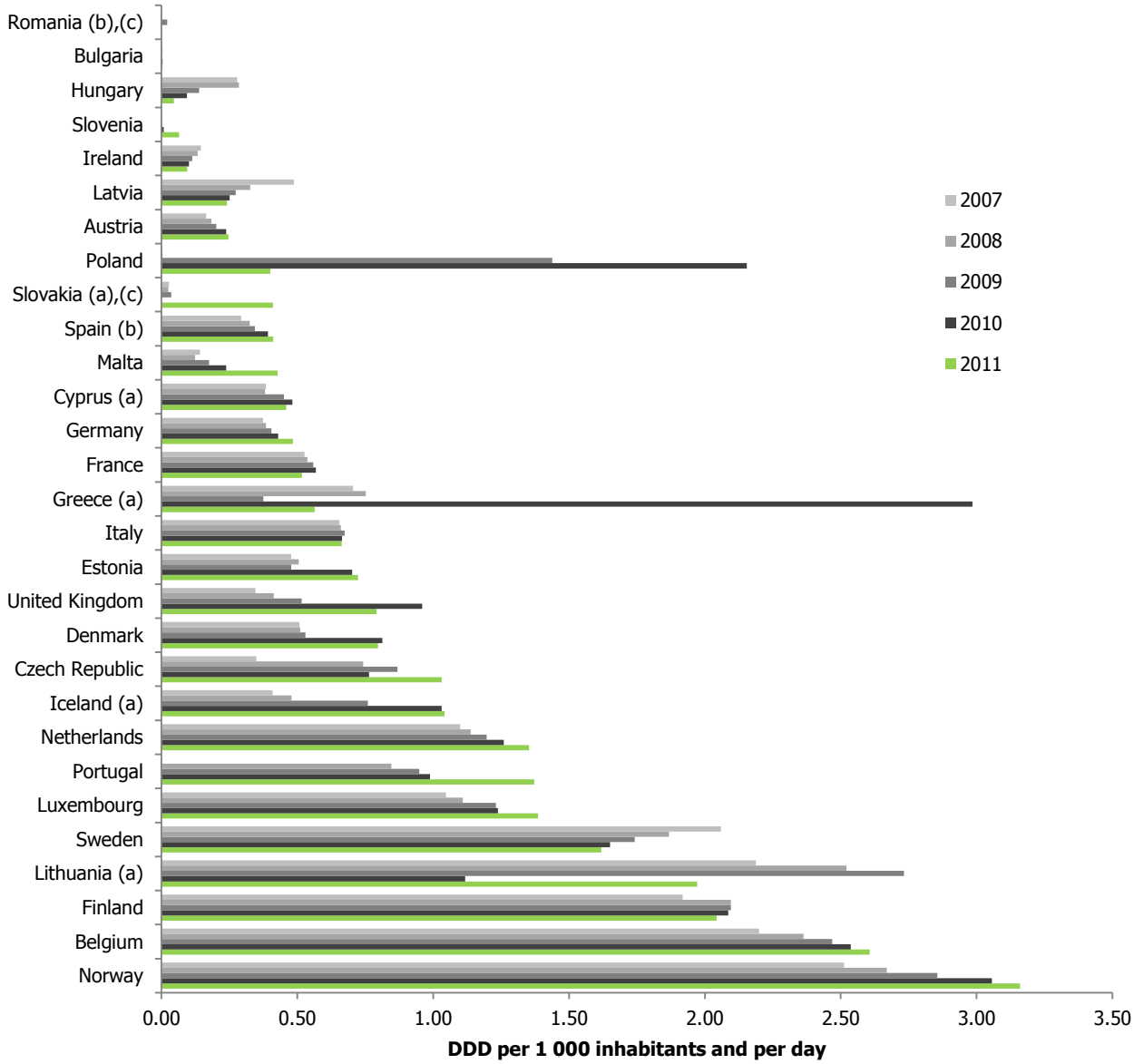


Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Trends

Temporal trends in the consumption of other antibacterials (ATC group J01X) for the period 2007–2011 are presented in Figure 3.28. Among countries reporting data for the period, community consumption increased significantly in nine countries (Austria, Belgium, Denmark, Germany, Luxembourg, Malta, the Netherlands, Norway and Spain), while three other countries (Ireland, Latvia and Sweden) showed a significant decrease in consumption for this group during the same period.

Figure 3.28. Trends of consumption of other antibacterials (ATC group J01X) in the community, EU/EEA countries, 2007–2011, expressed as DDD per 1 000 inhabitants and per day



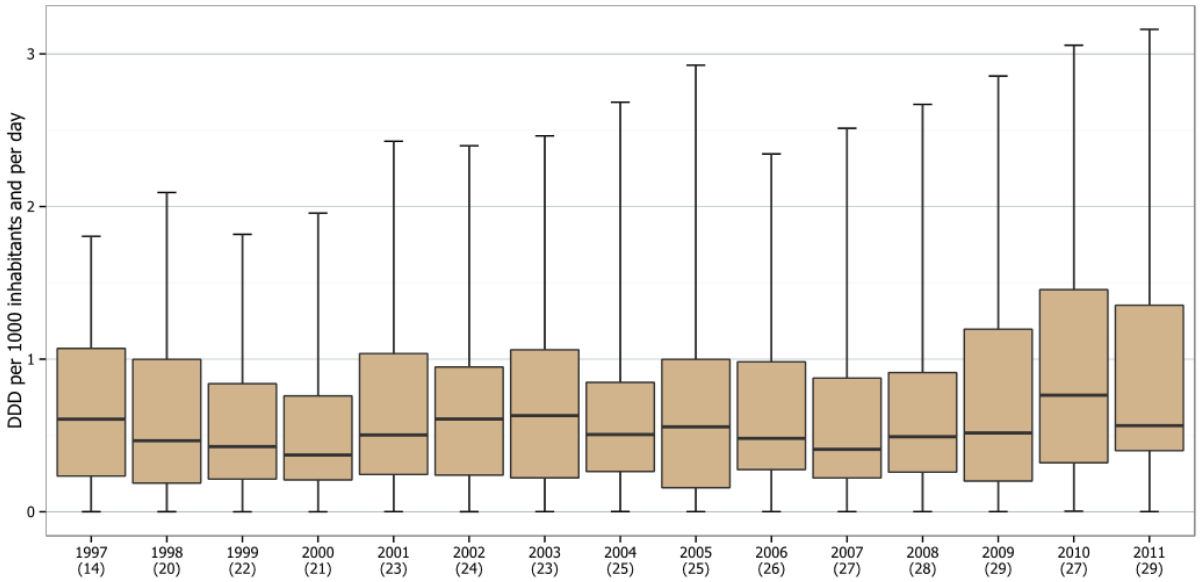
(a) Cyprus (2007–2011), Greece (2007, 2008, 2010), Iceland (2010, 2011), Lithuania (2007–2009, 2011) and Slovakia (2011) provided only total care data, i.e. including the hospital sector.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.
(c) Romania (2007, 2008, 2010) and Slovakia (2010) did not report data for these years.

Additionally, significant trends over the five-year period (2007–2011) were observed for other antibacterials (ATC group J01X) at the fourth ATC level:

- Community consumption of parenteral glycopeptide antibacterials (ATC group J01XA) increased significantly in two countries (Cyprus and Germany). None of the countries showed a significant decrease.
- Community consumption of polymyxins (ATC group J01XB) increased significantly in four countries (Belgium, Cyprus, Germany and Italy). None of the countries showed a significant decrease.
- Community consumption of steroid antibacterials (ATC group J01XC) only increased significantly in Austria, whereas ten countries (Belgium, Cyprus, Denmark, Finland, France, Ireland, the Netherlands, Spain, Sweden and the United Kingdom) showed a significant decrease in the consumption of this group.
- Community consumption of parenteral imidazole derivatives (ATC group J01XD) increased significantly in four countries (Denmark, Germany, Italy and Poland), whereas Spain showed a significant decrease in the consumption of this group.

- Community consumption of nitrofuran derivatives (ATC group J01XE) increased significantly in eleven countries (Austria, Belgium, Cyprus, Denmark, Germany, Luxembourg, Malta, the Netherlands, Spain, Sweden and the United Kingdom), whereas three countries (Ireland, Italy and Latvia) showed a significant decrease in the consumption of this group.
- Community consumption of other antibacterials (ATC group J01XX) increased significantly in ten countries (Austria, Belgium, the Czech Republic, Finland, France, Germany, Luxembourg, Norway, Poland and Spain), whereas two countries (Latvia and Sweden) showed a significant decrease in the consumption of this group.

Figure 3.29. Trends and inter-country variations of consumption of other antibacterials (ATC group J01X) in the community, EU/EEA countries, 1997–2011, expressed as DDD per 1 000 inhabitants and per day



Boxes indicate the lower and the upper quartiles. The bold lines indicate the medians. Whiskers indicate the minimum and maximum values. For 1997-2009, only data from ESAC participating countries that also participated in ESAC-Net in 2011 are included. The number of participating countries is shown in parentheses.

Discussion

Over the five years 2007–2011, 40% of the countries included in the trend analyses showed a significant increase in consumption of other antibacterials (ATC group J01X). The overall increase was mainly due to an increased use of nitrofuran derivatives (ATC group J01XE) and of other antibacterials (ATC group J01XX) including antibacterials such as fosfomycin (J01XX01), methenamine (J01XX05) and linezolid (J01XX08).

The high consumption of methenamine reported for the Nordic countries, e.g. representing 1.3 DDD per 1000 inhabitants and per year in Sweden, is affected by the long duration of treatment for methenamine compared to shorter treatments for other antibacterials of ATC group J01X.

Although community parenteral consumption of glycopeptide antibacterials (ATC group J01XA), fosfomycin (J01XX01) and linezolid (J01XX08) is low, these trends are important since these antibacterials have their main indications for use against severe, often multidrug-resistant pathogens in the hospital sector.

3.2 Consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01BA)

Results

In 2011, 25 countries reported data on consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01BA) in the community (Table 3.5).

The consumption varied by a factor of 7.9 ranging from 0.42 DDD per 1 000 inhabitants and per day (Romania) to 3.3 DDD per 1 000 inhabitants and per day (Belgium).

In 2011, terbinafine (D01BA02), ketoconazole (J02AB02), fluconazole (J02C01), and itraconazole (J02AC02) represented 97.6% of the total consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01BA) in the community in all countries.

Terbinafine (D01BA02) consumption alone accounted for more than 50% of the total consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01BA) in 19 (76%) of the reporting countries. The proportion of terbinafine consumption ranged from 15.8% (Luxembourg) to 86.0% (Norway).

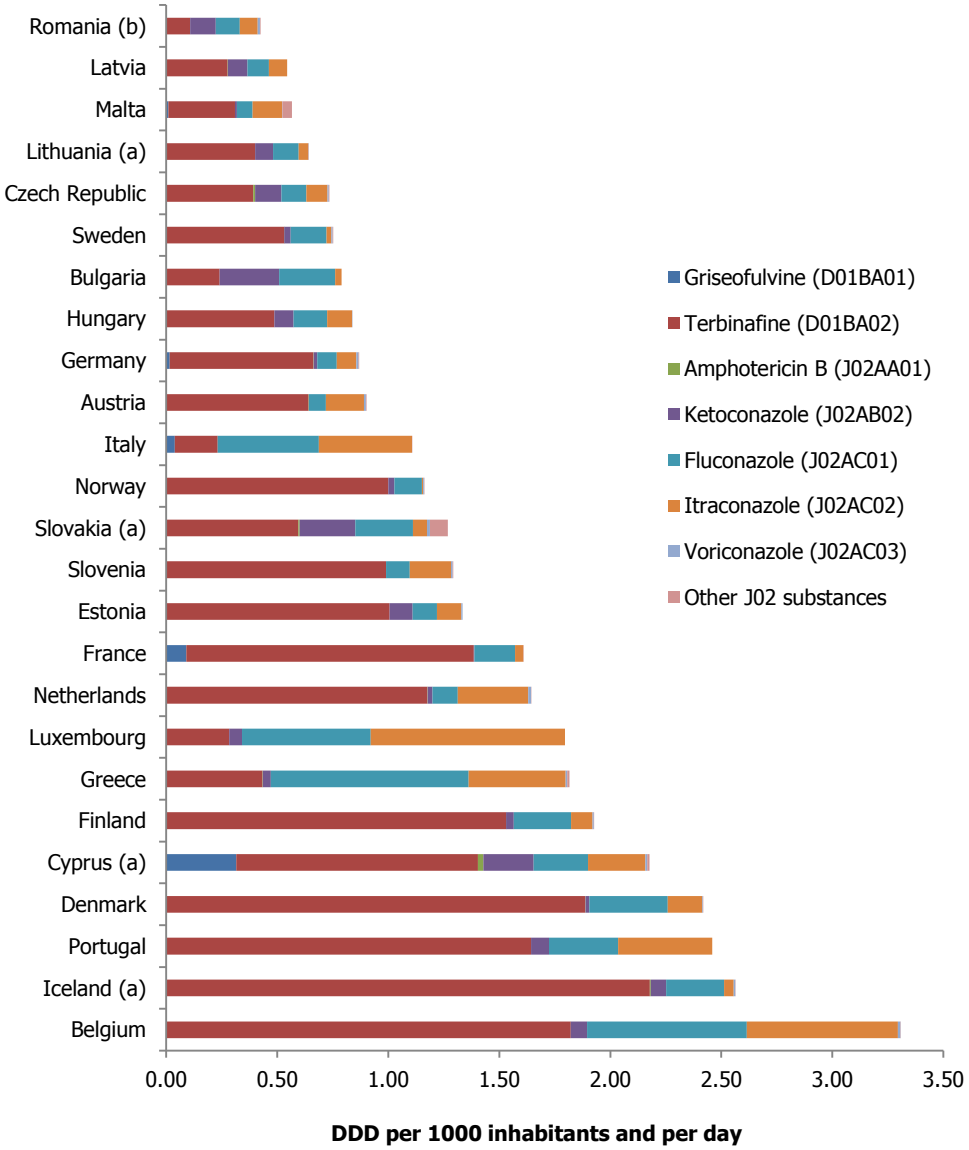
In the Netherlands and in Denmark, countries which are generally lower consumers of antibacterials for systemic use (ATC group J01), the total consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01BA) was 1.3 and 1.9 times higher, respectively, than the median total consumption of all countries (1.3 DDD per 1 000 inhabitants and per day).

Table 3.5. Consumption of antimycotics (ATC group J02) and antifungals (ATC group D01BA) for systemic use in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day

Country	Griseofulvine (D01BA01)	Terbinafine (D01BA02)	Amphotericin B (J02AA01)	Ketoconazole (J02AB02)	Fluconazole (J02AC01)	Itraconazole (J02AC02)	Voriconazole (J02AC03)	Other antimycotics for systemic use	Total (J02 & D01BA)
Austria	0	0.64	<0.01	0	0.08	0.17	0.01	<0.01	0.90
Belgium	0	1.82	0	0.07	0.72	0.68	0.01	<0.01	3.31
Bulgaria	0	0.24	0	0.27	0.25	0.03	<0.01	<0.01	0.79
Cyprus (a)	0.32	1.09	0.02	0.23	0.24	0.26	0.01	0.01	2.18
Czech Republic	0	0.39	0.01	0.12	0.11	0.10	0.01	<0.01	0.74
Denmark	0	1.89	<0.01	0.02	0.35	0.16	<0.01	<0.01	2.42
Estonia	<0.01	1.00	0	0.10	0.11	0.11	0.01	<0.01	1.33
Finland	0	1.53	<0.01	0.03	0.26	0.10	0.01	<0.01	1.93
France	0.09	1.29	0	<0.01	0.18	0.04	<0.01	<0.01	1.61
Germany	0.02	0.65	<0.01	0.02	0.09	0.09	0.01	<0.01	0.87
Greece	0	0.43	<0.01	0.04	0.89	0.44	0.01	0.01	1.82
Hungary	0	0.49	0	0.09	0.15	0.11	<0.01	<0.01	0.84
Iceland (a)	0	2.18	<0.01	0.07	0.26	0.04	0.01	<0.01	2.56
Italy	0.04	0.19	0	0	0.45	0.42	<0.01	<0.01	1.11
Latvia	0	0.28	<0.01	0.09	0.10	0.08	0	<0.01	0.54
Lithuania (a)	0	0.40	0	0.08	0.11	0.04	<0.01	<0.01	0.64
Luxembourg	0	0.28	0	0.06	0.58	0.88	0	<0.01	1.80
Malta	0.01	0.30	0	0.01	0.07	0.13	<0.01	0.04	0.57
Netherlands	<0.01	1.17	<0.01	0.02	0.11	0.32	0.01	<0.01	1.64
Norway	<0.01	1.00	<0.01	0.03	0.13	0.01	<0.01	<0.01	1.16
Portugal	0	1.64	0	0.08	0.31	0.42	0	0	2.46
Romania (b)	0	0.11	0	0.12	0.11	0.08	0.01	<0.01	0.42
Slovakia (a)	0	0.60	0.01	0.25	0.26	0.06	0.01	0.08	1.27
Slovenia	0	0.99	0	0	0.11	0.19	0.01	<0.01	1.29
Sweden	<0.01	0.53	<0.01	0.03	0.16	0.02	0.01	<0.01	0.75
EU median	**0**	**0.64**	**<0.01**	**0.06**	**0.16**	**0.11**	**0.01**	**<0.01**	**1.27**

(a) Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
(b) Romania provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Figure 3.30. Consumption of antifungals (ATC group D01BA) and antimycotics (ATC group J02) for systemic use in the community, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day



(a) Cyprus, Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
(b) Romania provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Trends

The analysis of trends in the community consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01BA) during 2007–2011 included 18 countries and only showed a significant increase for Estonia, Finland, Malta, Norway and Slovenia (see also Chapter 2.3 for trend analyses). No countries showed a significant decrease in the consumption of this group.

Discussion

Of all 14 substances under surveillance (12 antimycotics of ATC group J02 and two antifungals of ATC group D01BA), four substances dominated the consumption patterns as in previous years.

Seasonal variations of the consumption of antifungals and antimycotics for systemic use have previously been described [14]. Such variations were not analysed for this report. Similar to antibacterials for systemic use, the fact that seven countries (Austria, Belgium, the Czech Republic, Germany, Luxembourg, Portugal and Romania) reported reimbursement data may have resulted in underreporting as data on antifungals and antimycotics obtained without prescription or that were not reimbursed because products with a price below a reimbursement limit are not included in reimbursement databases [10, 14].

Nevertheless, ESAC-Net data and historical data from the ESAC project are publicly available, standardised and validated European reference data on consumption of antifungals and antimycotics for systemic use (ATC groups J02 & D01BA). These data can be used for monitoring and evaluating policies for appropriate prescribing of antimycotics and antifungals for systemic use in the community [14].

3.3 Quality indicators for consumption of antibacterials for systemic use (ATC group J01) in the community

Background

In 2007, the ESAC project published 12 consensus quality indicators for antimicrobial consumption in the community in Europe based on ESAC project data from 1997 to 2003. It was concluded that these indicators could be used to better describe antimicrobial consumption and to assess changes in national prescribing patterns in Europe, and that work towards improvement of indicator values could have an impact on reducing antimicrobial resistance, improving patient health benefit and cost-effectiveness and provide information for public health policy makers [2].

Results

The values for 2011 of the proposed quality indicators for the 29 reporting countries are presented in Table 3.6. In addition, the minimum value (p0), 25th percentile (p25), median (p50), 75th percentile (p75) and maximum value (p100) are displayed at the bottom of the table. For all quality indicators except J01CE_%, low values of the indicator suggest better quality with the best quality being within the first quartile (i.e., p0 ≤ values ≤ p25). For the indicator J01CE_%, high values of the indicator suggest better quality with the best quality being within the fourth quartile (i.e., p75 < values ≤ p100).

Quality indicators on total consumption of antibacterials for systemic use (ATC group J01) and subgroups

The first five indicators (displayed as J01, J01C, J01D, J01F and J01M) report consumption expressed in DDD per 1 000 inhabitants and per day for ATC group J01 and four subgroups, (i.e., J01C, J01D, J01F and J01M). The values correspond to the results presented in Chapter 3 (Table 3.1 and Figure 3.1).

The Netherlands reported values within the first quartile (p0-p25) for all five indicators. Latvia and Sweden reported values within the first quartile for ATC group J01 and for three other indicators. Luxembourg reported values within the fourth quartile (p75-p100) for all five indicators.

Quality indicators on the relative consumption of beta-lactamase-sensitive penicillins, combinations of penicillins including beta-lactamase inhibitors, third- and fourth-generation cephalosporins and fluoroquinolones

The next four indicators (displayed as J01CE_%, J01CR_%, J01DD+DE_% and J01MA_%) report on the percentage of the total consumption of antibacterials for systemic use (ATC group J01) corresponding to various subgroups: beta-lactamase-sensitive penicillins (ATC group J01CE), combinations of penicillins including beta-lactamase inhibitors (ATC group J01CR), third- and fourth-generation cephalosporins (ATC groups J01DD and J01DE), and fluoroquinolones (ATC group J01MA).

- Three countries (Denmark, Finland and Norway) reported values within the quartiles suggesting the best quality for all four indicators.
- Two countries (Cyprus and Italy) reported values within the quartiles suggesting the lowest quality for all four indicators.
- Indicator J01CE_% (relative consumption of beta-lactamase-sensitive penicillins) ranged from <0.1% to 29.9%. The Czech Republic, Denmark, Finland, Iceland, Norway, Slovakia, Slovenia and Sweden reported values within the fourth quartile, suggesting a better quality than all other quartiles.
- Indicator J01CR_% (relative consumption of combinations of penicillins including beta-lactamase inhibitors) ranged from <0.1% to 40.0%. Denmark, Finland, Germany, Latvia, Lithuania, Norway, Sweden and the United Kingdom showed values within the first quartile suggesting a better quality than all other quartiles.
- Indicator J01DD+DE_% (relative consumption of third- and fourth-generation cephalosporins) ranged from <0.1% to 7.2%. Belgium, Denmark, Estonia, Finland, Luxembourg, Norway, and Poland showed values within the first quartile, suggesting a better quality than all other quartiles.
- Indicator J01MA_% (relative consumption of fluoroquinolones) ranged from 2.3% to 14.3%. Denmark, Finland, Iceland, Ireland, Norway, Poland, Sweden and the United Kingdom showed values within the first quartile suggesting a better quality than all other quartiles.

Quality indicator on the ratio of broad- and narrow-spectrum antibacterials

The tenth quality indicator (displayed as J01_B/N) reports on the ratio of the consumption of broad-spectrum penicillins, cephalosporins and macrolides to the consumption of narrow-spectrum penicillins, cephalosporins and macrolides. The indicator values ranged from 0.17% in Sweden to 142.7% in Malta.

Quality indicators on seasonal variations of total consumption of antibacterials for systemic use and of consumption of quinolone antibacterials

The last two quality indicators (displayed as J01_SV and J01M_SV) report on seasonal variations of the total consumption of antibacterials for systemic use (ATC group J01) and of consumption of quinolone antibacterials (J01M). As these indicators are calculated based on consecutive winter quarters and summer quarters they start in July prior to the year of data reporting for the current report (the period for calculating seasonal variations for this report starts in July 2010) and ending one year later (i.e. in June 2011). These indicators could only be calculated for the 12 countries that provided quarterly data for the year of the second ESAC-Net report (2011 consumption data) and the year before (see legend of Table 3.6).

Indicator values for the seasonality of total consumption of antibacterials for systemic use (ATC group J01) ranged from 15.6 (Iceland) to 53.7 (Hungary).

The indicator values for seasonality of the consumption of quinolone antibacterials (J01M) ranged from -3.7 (Ireland) to 29.8 (Hungary).

Trends

Among countries reporting data for the period 2007–2011, trends for the first five quality indicators expressed in DDD per 1 000 inhabitants and per day for ATC group J01 and four subgroups, (i.e., J01C, J01D, J01F and J01M) are shown in the corresponding chapters (i.e. Chapters 3.1, 3.1.3, 3.1.4, 3.1.6 and 3.1.7).

Additionally, trends were assessed for the four indicators which report on the percentage of the total consumption of antibacterials for systemic use (ATC group J01) corresponding to the following subgroups: beta-lactamase-sensitive penicillins (displayed as J01CE_%), combinations of penicillins including beta-lactamase inhibitors (displayed as J01CR_%), third- and fourth-generation cephalosporins (displayed as J01DD+DE_%), and fluoroquinolones (displayed as J01MA_%).

None of the countries reported a significant increase of the indicator J01CE_%. A significant decrease for this indicator was observed in 12 countries (Austria, Belgium, Bulgaria, Denmark, Estonia, Finland, Germany, Italy, Luxembourg, the Netherlands, Norway and Poland).

Conversely, a significant increase of the indicator J01CR_% was observed in eleven countries (Austria, Cyprus, Denmark, Estonia, France, Germany, Ireland, Italy, Luxembourg, Slovenia and the United Kingdom). A significant decrease of this indicator was only observed in Latvia.

A significant increase of the indicator J01DD+DE_% was observed in six countries (Bulgaria, Estonia, Germany, Italy, Malta and Sweden). A significant decrease was observed in four countries (Austria, Ireland, Spain and the United Kingdom).

A significant increase of the indicator J01MA_% was observed in three countries (Bulgaria, Germany and Norway). A significant decrease was observed in five countries (the Czech Republic, Latvia, the Netherlands, Sweden and the United Kingdom).

Discussion

In the EU/EEA countries, trends of the results used for quality indicators J01CE_% and J01CR_% confirmed a significant decrease in the consumption of beta-lactamase-sensitive penicillins (ATC group J01CE) and a significant increase of the consumption of the broad-spectrum combinations of penicillins, including beta-lactamase inhibitors (ATC group J01CR). Conversely, trends in the proportion of third- and fourth-generations cephalosporins and of fluoroquinolones did not show an increasing or decreasing trend.

Any ranking of the countries should be interpreted with caution, as the indicators are not independent, e.g. an increase in the consumption of macrolides, lincosamides and streptogramins (ATC group J01F) will probably result in an increase of the ratio of broad- to narrow-spectrum penicillins, cephalosporins and macrolides. For countries where changes in the ranking suggest quality improvement, this could just reflect a relative change compared to other countries, e.g. that quality decreased in all countries but less in that specific country [1]. It should be emphasised that these indicators cannot by themselves indicate quality of antimicrobial use unless they are utilised with corresponding clinical data (e.g. resistance pattern).

Finally, 2011 data for the four countries (Cyprus, Iceland, Lithuania and Slovakia) that reported only total care data, i.e. including hospital sector data, were included in Table 3.6 because the largest proportion of consumption of antibacterials for systemic use (ATC group J01) is reported from the community. However, quality indicators from these four countries should be interpreted with caution because certain antibacterials, e.g. broad-spectrum antibiotics, represent a larger proportion of total consumption in the hospital sector than in the community.

Table 3.6. ESAC quality indicators for consumption data of antibacterials for systemic use (ATC group J01) from the community, EU/EEA countries, 2011

	Consumption (DDD per 1000 inhabitants and per day)					Relative consumption (%)				Broad/ narrow	Seasonal variation	
Country	J01*	J01C	J01D	J01F	J01M	J01CE_ % ǂ	J01CR_ %	J01DD +DE_%	J01MA_ %	J01_B/N	J01_SV	J01M_SV
Austria	14.47	6.50	1.65	3.38	1.29	5.9	30.8	4.4	8.9	7.79	28.5	14.6
Belgium	29.02	16.55	1.52	3.18	2.73	0.2	30.5	<0.1	9.4	64.32	-	-
Bulgaria	19.47	8.42	2.56	3.27	2.26	1.5	13.8	1.9	11.6	7.99	-	-
Cyprus (a)	31.99	15.41	6.07	3.11	3.80	0.3	32.0	2.3	11.9	29.74	-	-
Czech Republic	18.50	8.11	1.51	3.64	1.13	11.5	21.8	0.5	6.1	4.03	26.0	9.4
Denmark	17.44	10.88	0.05	2.66	0.57	29.9	5.1	<0.1	3.2	0.53	16.7	-3.7
Estonia	12.07	4.57	0.98	2.47	0.84	2.0	12.4	<0.1	7.0	9.98	35.7	8.4
Finland	20.06	6.63	2.36	1.82	0.95	6.8	7.2	<0.1	4.7	0.88	-	-
France	28.72	16.53	2.55	3.84	1.79	0.5	24.0	6.6	6.1	46.03	-	-
Germany	14.13	3.91	2.72	2.29	1.48	4.9	2.4	3.4	10.4	5.01	30.4	18.6
Greece	35.14	12.20	7.60	9.38	2.60	0.3	16.6	0.3	7.4	133.58	-	-
Hungary	14.75	6.74	1.91	2.65	1.91	3.1	32.5	2.5	12.8	18.86	53.7	29.8
Iceland (a)	22.27	12.10	0.63	1.58	1.06	11.2	17.8	0.3	4.8	1.76	15.6	4.8
Ireland	22.65	12.22	1.21	4.17	0.93	4.3	29.3	0.5	4.1	6.26	22.1	10.3
Italy	27.55	14.85	2.53	5.00	3.46	<0.1	<0.1	7.2	12.1	136.12	27.3	17.0
Latvia	12.80	6.10	0.50	1.38	0.98	<0.1	<0.1	0.3	7.3	7.66	-	-
Lithuania (a)	19.01	10.44	1.32	1.91	1.19	2.3	9.0	0.6	5.9	4.72	-	-
Luxembourg	27.60	13.42	3.79	3.89	2.83	0.2	31.5	<0.1	10.2	38.28	-	-
Malta	23.45	10.16	5.68	3.67	1.86	0.3	38.3	1.2	7.9	142.70	-	-
Netherlands	11.37	4.47	0.04	1.50	0.83	3.1	16.0	<0.1	7.2	7.40	-	-
Norway	16.48	6.85	0.12	2.00	0.55	22.4	<0.1	<0.1	3.4	0.21	-	-
Poland	21.86	11.78	2.56	3.84	1.22	0.5	30.3	<0.1	5.6	57.63	-	-
Portugal	23.16	12.33	1.65	3.39	2.69	0.1	40.0	1.4	11.6	32.26	28.4	10.2
Romania	13.00	5.74	2.97	2.10	1.86	1.1	28.6	3.0	14.3	11.58	-	-
Slovakia (a)	23.83	9.27	3.89	5.76	2.48	6.2	24.5	2.1	10.4	8.77	-	-
Slovenia	14.42	9.66	0.33	1.97	1.08	13.2	28.9	0.6	7.5	3.36	28.3	7.0
Spain	20.86	13.08	1.53	2.06	2.57	0.4	38.4	2.3	12.1	63.10	-	-
Sweden	14.26	7.08	0.18	0.61	0.77	28.1	1.6	0.2	5.4	0.17	-	-
United Kingdom	18.75	8.72	0.42	2.81	0.43	4.1	6.7	<0.1	2.3	1.15	15.8	5.7
p0	11.37	3.91	0.04	0.61	0.43	<0.1	<0.1	<0.1	2.3	0.17	15.6	-3.7
p25	14.47	6.74	0.63	2.00	0.95	0.3	12.1	0.1	5.6	4.03	20.7	6.6
p50	19.47	9.66	1.65	2.81	1.29	2.3	24.0	0.5	7.4	7.99	27.8	9.8
p75	23.45	12.22	2.56	3.67	2.48	6.2	30.8	2.3	10.4	38.28	28.9	15.2
p100	35.14	16.55	7.60	9.38	3.80	29.9	39.0	7.2	14.3	142.70	53.74	29.82

** Denominator for relative consumption; (a) Country provided only total care data, ǂ Indicators within the fourth quartile (i.e. values > percentile 75 (p75) suggest better quality than indicator values within the third quartile (i.e. p50 < values < p75) and so on.*

Definitions of indicator codes**

Indicators on consumption of antibacterials for systemic use (ATC group J01) and at ATC group level 3:

J01	J01_DID	Consumption of antibacterials for systemic use (J01) expressed in DDD per 1000 inhabitants and per day
J01C	J01C_DID	Consumption of penicillins (J01C) expressed in DDD per 1000 inhabitants and per day
J01D	J01D_DID	Consumption of cephalosporins (J01D) expressed in DDD per 1000 inhabitants and per day
J01F	J01F_DID	Consumption of macrolides, lincosamides and streptogramins (J01F) expressed in DDD per 1000 inhabitants and per day
J01M	J01M_DID	Consumption of quinolones (J01M) expressed in DDD per 1000 inhabitants and per day

Indicators on the relative consumption of antibacterials for systemic use (ATC group 3):

J01CE_%	J01CE_%	Consumption of beta-lactamase-sensitive penicillins (J01CE) expressed as percentage of the total consumption of antibacterials for systemic use (J01)
J01CR_%	J01CR_%	Consumption of combination of penicillins, including beta-lactamase inhibitor (J01CR) expressed as percentage of the total consumption of antibacterials for systemic use (J01)
J01DD+DE	J01DD+DE_%	Consumption of third- and fourth-generation cephalosporins (J01(DD+DE)) expressed as percentage of the total consumption of antibacterials for systemic use (J01)
J01MA_%	J01MA_%	Consumption of fluoroquinolones (J01MA) expressed as percentage of the total consumption of antibacterials for systemic use (J01)

Indicators on the ratio of broad and narrow spectrum antibacterials:

J01_B/N	J01_B/N	Ratio of the consumption of broad-spectrum (J01(CR+DC+DD+(F-FA01))) to the consumption of narrow-spectrum penicillins, cephalosporins and macrolides (J01(CE+DB+FA01))

Indicators on seasonal variation of antibacterials for systemic consumption (ATC group J01, subgroup J01M):

J01_SV	J01_SV	Seasonal variation of the total antibiotic consumption (J01) of a 12-month period starting in July and ending the following June, expressed as percentage: [(DDD (winter quarters)/DDD (summer quarters)-1] x 100
J01M_SV	J01M_SV	Seasonal variation of quinolone consumption (J01M) of a 12-month period starting in July and ending the following June, expressed as percentage: [(DDD (winter quarters)/DDD (summer quarters)-1] x 100

*** The second column shows the original labels of the quality indicators as described in the article 'European Surveillance of Antimicrobial Consumption (ESAC): quality indicators for outpatient antibiotic use in Europe' published in Qual Saf Health Care 2007;16:440–445.*

4 Consumption of antimicrobials for systemic use in the hospital sector

4.1 Consumption of antibacterials for systemic use (ATC group J01)

Results

For 2011, 18 countries reported data on consumption of antibacterials for systemic use (ATC group J01) in the hospital sector. The number of reporting countries increased from 10 countries in 1997 to 18 countries in 2011. Table A2 (see Annexes) provides an overview of the total consumption of antibacterials for systemic use (ATC group J01) in the hospital sector, reported for each country during the period 1997–2011.

In 2011, consumption of antibacterials for systemic use (ATC group J01) in the hospital sector varied from 1.0 (the Netherlands) to 3.2 (Romania) DDD per 1 000 inhabitants and per day with a median of 1.8 DDD per 1 000 inhabitants and per day (Table 4.1).

Table 4.1 and Figure 4.1 present the consumption of antibacterials for systemic use (ATC group J01) in the hospital sector, as a total and by subgroups.

Table 4.1. Consumption of antibacterials for systemic use (ATC group J01) by ATC group level 3 in the hospital sector, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day

Country	Tetracyclines (J01A)	Beta-lactams, penicillins (J01C)	Other beta-lactam antibacterials (J01D)	Sulfonamides and trimethoprim (J01E)	Macrolides, lincosamides and streptogramins (J01F)	Quinolones (J01M)	Other (J01B, J01G, J01R and J01X)	Total (ATC group J01)
Belgium	0.02	1.02	0.41	0.03	0.10	0.25	0.20	**2.0**
Bulgaria	0.02	0.19	0.79	0.01	0.12	0.13	0.19	**1.4**
Denmark	0.03	0.82	0.34	0.07	0.09	0.22	0.17	**1.7**
Estonia	0.06	0.60	0.52	0.05	0.19	0.22	0.21	**1.8**
Finland (a)	0.26	0.52	1.00	0.18	0.16	0.35	0.63	**3.1**
France	0.04	1.19	0.27	0.04	0.13	0.25	0.20	**2.1**
Greece	0.05	0.59	0.61	0.02	0.20	0.28	0.40	**2.1**
Ireland	0.02	0.90	0.16	0.05	0.27	0.13	0.26	**1.8**
Italy	0.02	0.82	0.43	0.04	0.17	0.45	0.52	**2.5**
Latvia	0.15	0.67	0.59	0.06	0.15	0.33	0.94	**2.9**
Luxembourg	0.01	0.73	0.68	0.04	0.15	0.27	0.16	**2.0**
Malta	0.05	0.56	0.37	0.03	0.21	0.23	0.23	**1.7**
Netherlands	0.03	0.44	0.16	0.03	0.07	0.13	0.12	**1.0**
Norway	0.06	0.67	0.33	0.04	0.08	0.10	0.18	**1.5**
Portugal (b)	0.02	0.51	0.43	0.07	0.16	0.09	0.19	**1.5**
Romania	0.02	1.29	0.67	0.03	0.12	0.32	0.75	**3.2**
Slovenia	0.02	0.67	0.36	0.05	0.14	0.26	0.16	**1.7**
Sweden	0.20	0.79	0.19	0.07	0.06	0.16	0.12	**1.6**
EU median	**0.03**	**0.67**	**0.42**	**0.04**	**0.14**	**0.24**	**0.20**	**1.8**

(a) Finland: data include consumption in remote primary healthcare centres and nursing homes.
(b) Portugal: data correspond to public hospitals only.

The proportion of consumption of tetracyclines (ATC group J01A) out of the total consumption of antibacterials for systemic use (ATC group J01) ranged from 0.5% (Luxembourg) to 12.6% (Sweden).

The proportion of consumption of penicillins (ATC group J01C) ranged from 13.4% (Bulgaria) to 56.0% (France). Three countries (Belgium, Ireland and France) had the subgroup of penicillins with enzyme inhibitors (J01CR) make up ≥50% of the total consumption of antibacterials for systematic use (ATC group J01).

The proportion of consumption of cephalosporins and other beta-lactams (ATC group J01D) was the highest in Bulgaria (54.2%), and the lowest in Ireland (8.9%).

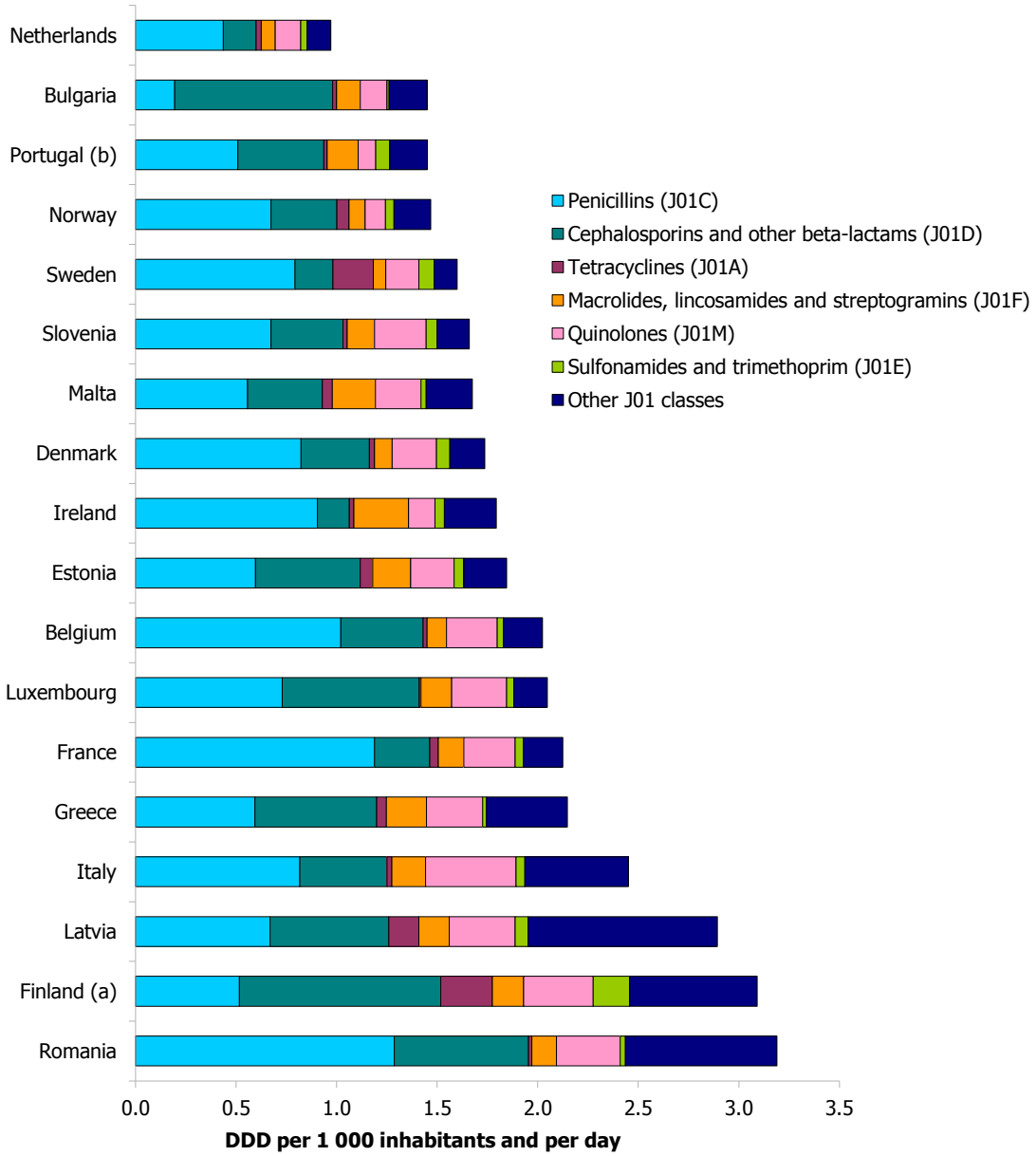
The proportion of consumption of sulfonamides and trimethoprim ranged from 0.2% (Greece) to 5.3% (Finland).

The proportion of consumption of macrolides, lincosamides and streptogramins (ATC group J0F) ranged from 3.9% (Sweden) to 15.1% (Ireland).

The proportion of the consumption of quinolone antibacterials (ATC group J0M) ranged from 6.0% (Portugal) to 18.4% (Italy).

In 2011, consumption of penicillins with enzyme inhibitors (ATC group J01CR) varied from 0.03 (Norway) to 0.8 (Belgium) DDD per 1 000 inhabitants and per day with a median of 0.4 DDD per 1 000 inhabitants and per day. Penicillins with enzyme inhibitors accounted for ≥75% of the consumption of penicillins (ATC group J01C) in four countries (Bulgaria, Greece, Italy and Luxembourg).

Figure 4.1. Consumption of antibacterials for systemic use (ATC group J01) in the hospital sector in EU/EEA countries, 2011, at group level 3, expressed as DDD per 1 000 inhabitants and per day



(a) Finland: data include consumption in remote primary healthcare centres and nursing homes.
(b) Portugal: data correspond to public hospitals only.

In 2011, consumption of carbapenems (ATC group J01DH) varied by a factor of 20, from 0.02 (the Netherlands) to 0.4 DDD per 1 000 inhabitants and per day (Finland). The proportion of consumption of carbapenems (ATC group J01DH) out of antibacterials for systemic use (ATC group J01) ranged from 0.6% (Romania) to 11.6% (Finland) with a median of 3.2%.

In 2011, consumption of glycopeptide antibacterials (ATC group J01XA) varied from 0.01 (Bulgaria) to 0.09 (Greece) DDD per 1 000 inhabitants and per day. The proportion of consumption of glycopeptide antibacterials (ATC group J01XA) out of antibacterials for systemic use (ATC group J01) ranged from 0.3% (Romania) to 4.0% (Greece) with a median of 1.8%.

Trends

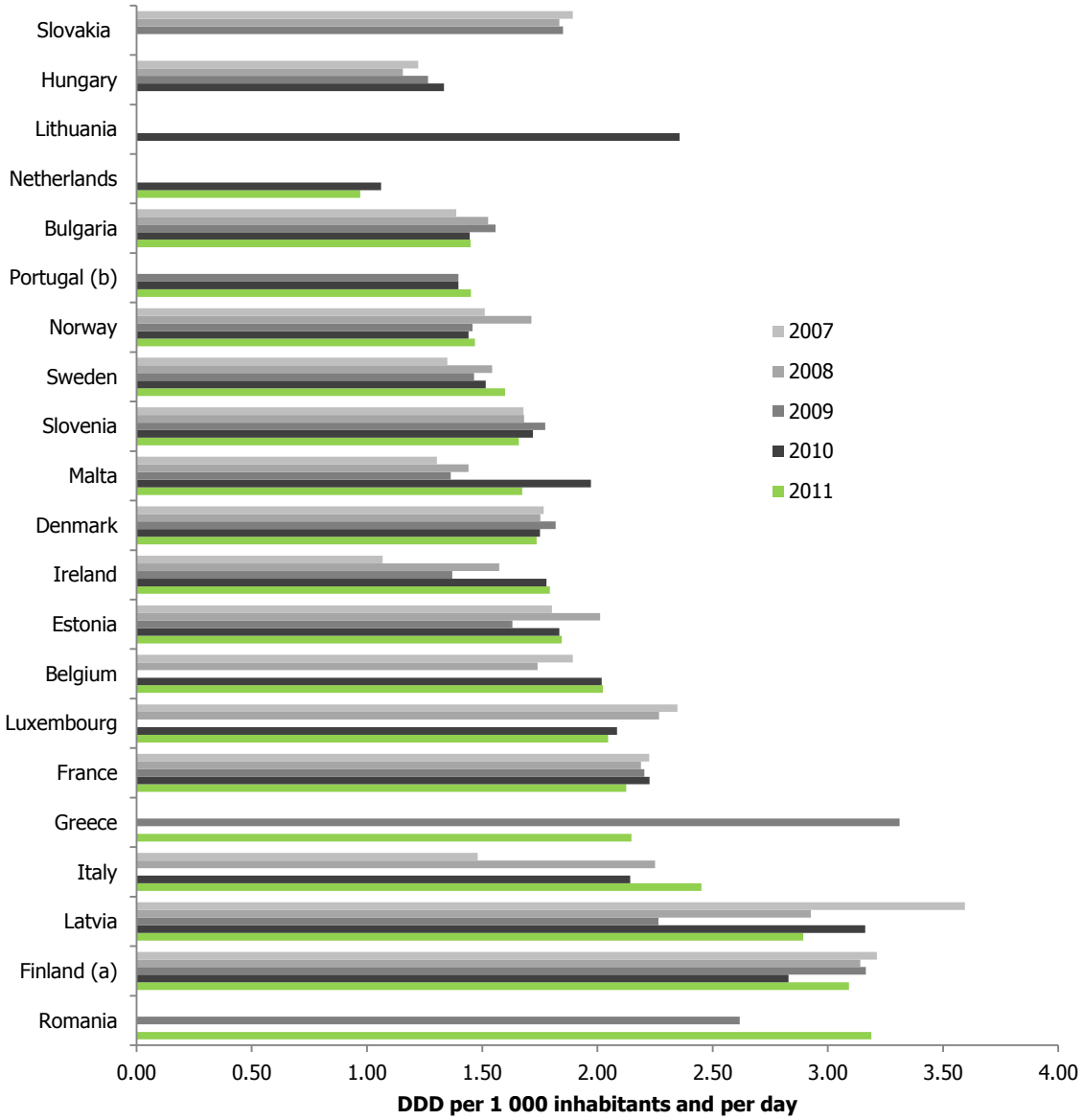
Trends in the consumption of antibacterials for systemic use (ATC group J01) in the hospital sector from 2007 to 2011 are presented in Figure 4.2 (see also Chapter 2.3 for trend analyses). Among 11 countries reporting data for the period 2007–2011 and included in the trend analysis, consumption in the hospital sector did not differ significantly for the whole group of antibacterials for systemic use (ATC group J01).

Additionally, significant trends in consumption in the hospital sector over the five-year period (2007–2011) were observed for six sub-groups of antibacterials for systemic use (ATC group J01) and for three selected subgroups at the 4th ATC group level.

- Consumption of tetracyclines (ATC group J01A) increased significantly in Ireland, whereas none of the countries showed a significant decrease.
- Consumption of beta-lactams, penicillins (ATC group J01C) increased significantly in two countries (Ireland and Sweden), whereas only one country (Denmark) showed a significant decrease. In the subgroup penicillins with enzyme inhibitors (J01CR), consumption increased significantly in six countries (Denmark, Ireland, Malta, Norway, Slovenia and Sweden), whereas no significant decrease was reported.
- Consumption of other beta-lactam antibacterials (ATC group J01D) significantly increased in two countries (Bulgaria and Ireland) while two countries (Norway and Sweden) showed a significant decrease. For the subgroup carbapenems (J01DH), consumption increased significantly in five countries (Denmark, France, Ireland, Norway and Slovenia), whereas no significant decrease was reported.
- Consumption of sulfonamides and trimethoprim (ATC group J01E) did not change significantly in any country included in the trend analysis for the period 2007–2011.
- Consumption of macrolides, lincosamides and streptogramins (ATC group J01F) changed significantly only in one country: Slovenia reported a significant decrease in consumption.
- Consumption of quinolone antibacterials (ATC group J01M) did not significantly increase in any country included in the trend analysis for the period 2007–2011, only one country (France) showed a significant decrease in the consumption of this group.
- Among other antibacterials (ATC group J01X), consumption of the subgroup glycopeptide antibacterials (J01XA) increased significantly in four countries (Denmark, Ireland, Slovenia and Sweden) and no significant decrease was reported.

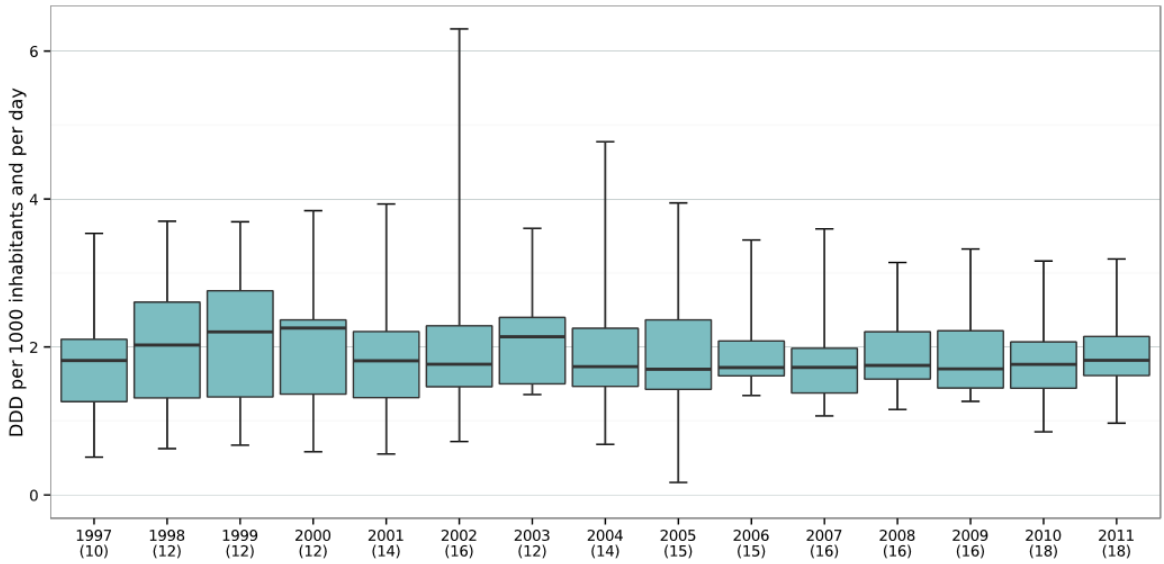
In 2011, the median consumption of antibacterials for systemic use (ATC group J01) was 1.8 DDD per 1 000 inhabitants and per day and did not change between 2010 and 2011 (Figure 4.3).

Figure 4.2. Trends of consumption of antibacterials for systemic use (ATC group J01) in the hospital sector in EU/EEA countries, 2007–2011, expressed as DDD per 1 000 inhabitants and per day



(a) Finland: data include consumption in remote primary healthcare centres and nursing homes.
(b) Portugal: data correspond to public hospitals only.

Figure 4.3. Trends and inter-country variations of consumption of antibacterials for systemic use (ATC group J01) in the hospital sector, EU/EEA countries, 1997–2011, expressed as DDD per 1 000 inhabitants and per day



Boxes indicate the lower and the upper quartiles. The bold lines indicate the medians. Whiskers indicate the minimum and maximum values. For 1997–2009, only data from ESAC participating countries that also participated in ESAC-Net in 2011 are included. The number of participating countries is shown in parentheses.

Discussion

In 2011, there was no major change in the pattern of consumption of antibacterials for systemic use (ATC group J01) in the hospital sector compared to 2010. In contrast to consumption in the community (primary care), consumption in the hospital sector does not show a clear geographical gradient and the median consumption has remained at about the same level since 2001. In line with this observation is the finding that none of the countries showed significantly decreasing or increasing trends for antimicrobials for systemic use (ATC group J01) during the five-year period 2007–2011.

The distribution of the consumption of antibacterials for systemic use (ATC group J01) between subgroups at the 3rd ATC group level did not change in 2011 compared to 2010. Consumption of penicillins (ATC group J01C) and of other beta-lactam antibacterials (ATC group J01D, includes cephalosporins) accounted for one third of the total consumption of antibacterials for systemic use (ATC group J01).

However, a substantial number of countries showed a significant increase in the consumption of last-line antibacterials such as carbapenems (ATC group J01DH) or glycopeptides (ATC group J01XA).

In Finland, data from the hospital sector include consumption in remote primary healthcare centres and nursing homes, which results in a higher consumption rate than most other countries (Tables 4.1 and A.2, and Figures 4.1 and 4.2).

4.2. Consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01BA)

Results

In 2011, 17 countries reported data on consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01BA) in the hospital sector (Table 4.2). The Netherlands reported on the consumption of antibacterials for systemic use (ATC group J01), but not on antimycotics or antifungals.

The median consumption was 0.08 DDD per 1 000 inhabitants and per day. Consumption varied by a factor of 10 from 0.03 DDD per 1 000 inhabitants and per day (Bulgaria) to 0.21 DDD per 1 000 inhabitants and per day (Denmark).

In 2011, amphotericin B (J02AA01) and fluconazole (J02AC01) accounted for 71% of the total consumption of antimycotics and antifungals for systemic use in the hospital sector in the reporting countries. Fluconazole consumption as a proportion of the total varied from 36% (Greece) to 91% (Latvia). It made up more than 50% of the total consumption in 12 (71%) reporting countries.

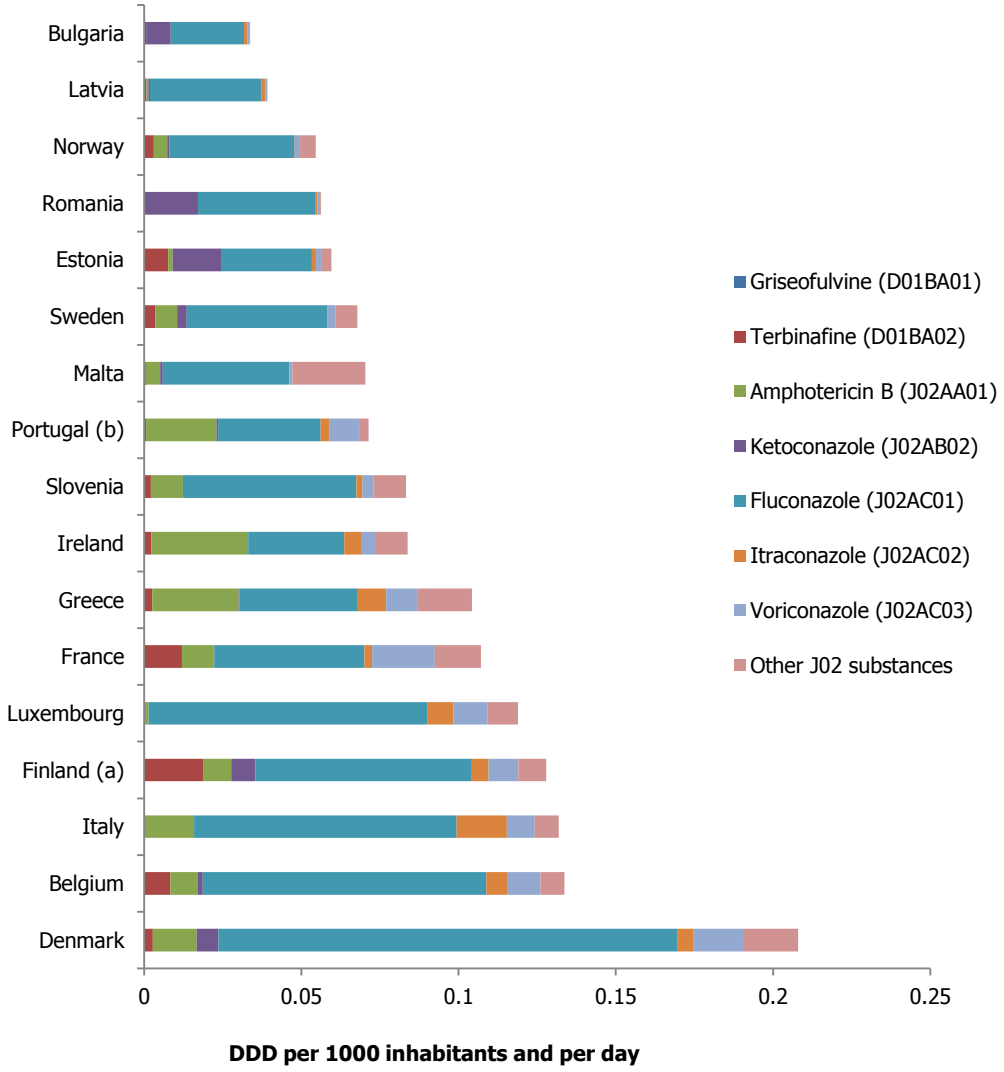
For Malta, no consumption was reported for ATC group D01BA as terbinafine is not on the Government Hospital Formulary List.

Table 4.2. Consumption of antimycotics (ATC group J02) and antifungals (ATC group D01BA) for systemic use in the hospital sector, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day

Country	Griseofulvine (D01BA01)	Terbinafine (D01BA02)	Amphotericin B (J02AA01)	Ketoconazole (J02AB02)	Fluconazole (J02AC01)	Itraconazole (J02AC02)	Voriconazole (J02AC03)	Other antimycotics for systemic use	Total (J02 & D01BA)
Belgium	0	0.008	0.009	0.002	0.090	0.007	0.010	0.008	0.134
Bulgaria	0	0.001	0	0.008	0.023	0.001	0.001	<0.001	0.034
Denmark	0	0.003	0.014	0.007	0.146	0.005	0.016	0.018	0.208
Estonia	0	0.008	0.002	0.015	0.029	0.001	0.002	0.003	0.060
Finland (a)	0	0.019	0.009	0.008	0.069	0.006	0.010	0.009	0.128
France	0	0.012	0.010	<0.001	0.048	0.003	0.020	0.015	0.107
Greece	0	0.003	0.027	<0.001	0.038	0.009	0.010	0.017	0.104
Ireland	0	0.002	0.031	0	0.031	0.006	0.005	0.010	0.084
Italy	0	<0.001	0.016	0	0.084	0.016	0.009	0.008	0.132
Latvia	0	0.001	0.001	0.001	0.036	0.001	0.001	<0.001	0.039
Luxembourg	0	<0.001	0.001	0	0.089	0.008	0.011	0.010	0.119
Malta	<0.001	0	0.005	0.001	0.040	0	0.001	0.023	0.070
Norway	0	0.003	0.004	0.001	0.040	<0.001	0.002	0.005	0.055
Portugal (b)	0	0.001	0.022	0.001	0.033	0.003	0.010	0.003	0.071
Romania	0	0	0	0.017	0.038	0.001	0.001	0.001	0.056
Slovenia	0	0.002	0.010	0	0.055	0.002	0.004	0.010	0.083
Sweden	0	0.004	0.007	0.003	0.045	<0.001	0.002	0.007	0.068
EU median	**0**	**0.003**	**0.009**	**0.001**	**0.040**	**0.003**	**0.005**	**0.008**	**0.083**

(a) Finland: data include consumption in remote primary healthcare centres and nursing homes.
(b) Portugal: data correspond to public hospitals only.

Figure 4.4. Relative consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01BA) in the hospital sector, EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day



(a) Finland: data include consumption in remote primary health care centres and nursing homes.
(b) Portugal: data correspond to public hospitals only.

Trends

The analysis of trends in the hospital consumption of antimycotics and antifungals for systemic use (ATC groups J02 & D01BA) during 2007–2011 included 17 countries and showed no significant increase or decrease in the consumption of these groups.

Discussion

The pattern of consumption of antimycotics and antifungals for systemic use in the hospital sector was different from the community pattern. In the hospital sector, the prevailing substance was fluconazole as opposed to terbinafine in the community. The number of substances consumed in the hospital sector was also higher than in the community probably due to a broader diversity of infections and pathogens and a different case mix of the patients. However, the ratio of antimycotics and antifungals for systemic use over antibacterials for systemic use were similar both for the hospital sector and the community with around 5%.

5 Consumption of antivirals for systemic use (ATC group J05) in both the community and the hospital sector

Results

Twenty-four countries reported data to ESAC-Net on antivirals for systemic use (ATC group J05). The data are presented together for the community and the hospital sector (Table 5.1 and Figure 5.1). Austria, the Czech Republic, Germany, Hungary and the Netherlands only reported data on consumption of antivirals for systemic use (ATC group J05) in the community.

Total consumption of antivirals for systemic use (ATC group J05) showed an almost 11-fold difference from 0.4 DDD per 1 000 inhabitants and per day (Lithuania) to 4.3 DDD per 1 000 inhabitants and per day (Portugal).

The median consumption in the reporting countries was the highest (0.29 DDD per 1 000 inhabitants and per day) for antivirals for treatment of HIV infections, combinations (ATC group J05AR). Nucleosides and nucleotides excluding reverse transcriptase inhibitors (ATC group J05AB) and protease inhibitors (ATC group J05AE) were the next most used groups with 0.25 and 0.22 DDD per 1 000 inhabitants and per day, respectively. For these three ATC groups (J05AB, J05AE, J05AR), France reported the highest consumption of all reporting countries with 0.68, 0.83 and 1.07 DDD per 1 000 inhabitants and per day, respectively. The lowest consumption of nucleosides and nucleotides excluding reverse transcriptase inhibitors (ATC group J05AB) was reported by Bulgaria (0.08 DDD per 1 000 inhabitants and per day). The lowest consumption of protease inhibitors (ATC group J05AE) was reported by Lithuania (0.01 DDD per 1 000 inhabitants and per day). The lowest consumption of nucleoside and nucleotide reverse transcriptase inhibitors (ATC group J05AF) was reported by Slovenia (0.03 DDD per 1 000 inhabitants and per day).

Table 5.2 and Figure 5.1 show the distribution of total consumption of antivirals for systemic use (ATC group J05) into seven categories based on their main indication: 'HIV/AIDS antivirals' 'HIV/hepatitis B antivirals', 'hepatitis C antivirals', 'herpes antivirals', 'influenza antivirals', and one group for remaining substances (Annex 1).

The relative consumption of 'HIV/AIDS antivirals' out of the total antiviral consumption ranged from 17.7% (Lithuania) to 83.9% (Estonia). Total consumption of 'HIV/AIDS antivirals' accounted for 61.7% of the total consumption of antivirals for systemic use (ATC group J05) in the reporting countries.

Greece reported the highest proportion of consumption of the group 'HIV/hepatitis B antivirals' (26.9%) and of the group 'hepatitis B antivirals' (22.0%). The proportion of the consumption of 'hepatitis C antivirals' out of the total consumption of antivirals for systemic use (ATC group J05) ranged from 1.1% (Denmark) to 26.4% (Latvia). For the group 'herpes antivirals', the proportion of total consumption of antivirals for systemic use (ATC group J05) ranged from 3.6% (Romania) to 40.1% (Slovenia).

In 2009, the year of the influenza pandemic, the ESAC project reported a median consumption of oseltamivir (ATC code J05AH02) of 0.10 DDD per 1 000 inhabitants and per day (maximum reported by Norway with 0.98 DDD per 1 000 inhabitants and per day). One year earlier, in 2008, the ESAC project had reported a median consumption of oseltamivir of just 0.001 DDD per 1 000 inhabitants and per day (maximum reported by Finland with 0.36 DDD per 1 000 inhabitants and per day). For 2011, i.e. two years after the influenza pandemic, the median consumption of oseltamivir was 0.007 DDD per 1 000 inhabitants and per day, a level similar to the pre-pandemic level in 2008. In 2011, the highest consumption of oseltamivir was 0.13 DDD per 1 000 inhabitants and per day in Lithuania, where it represented one third of the total consumption of antivirals for systemic use (ATC J05) in that country.

Table 5.1. Total consumption of antivirals for systemic use (ATC group J05) in both sectors (community and hospital care sector), EU/EEA countries, 2011, expressed as DDD per 1 000 inhabitants and per day

Country	Nucleosides and nucleotides excl. reverse transcriptase inhibitors (ATC group J05AB)	Protease inhibitors (ATC group J05AE)	Nucleoside and nucleotide reverse transcriptase inhibitors (ATC group J05AF)	Non-nucleoside reverse transcriptase inhibitors (ATC group J05AG)	Neura-minidase inhibitors (ATC group J05AH)	Antivirals for treatment of HIV infections, combinations (ATC group J05AR)	Other antivirals (ATC groups J05AC, J05AD, J05AX)	Total (ATC group J05)
Austria (a)	0.39	0.20	0.20	0.11	0.04	0.18	0.06	1.18
Belgium	0.13	0.45	0.23	0.22	0.01	0.67	0.07	1.79
Bulgaria	0.08	0.05	0.10	0.01	0.03	0.06	0.43	0.76
Cyprus	0.20	0.14	0.38	0.09	<0.01	0.15	0.01	0.96
Czech Republic (a)	0.18	0.04	0.16	0.02	<0.01	0.03	0.01	0.55
Denmark	0.47	0.31	0.49	0.33	0.01	0.25	0.05	1.92
Estonia	0.25	0.80	0.35	0.63	0.02	0.59	0.01	2.66
Finland	0.42	0.18	0.06	0.07	0.02	0.26	0.03	1.04
France	0.68	0.83	0.48	0.34	0.01	1.07	0.23	3.64
Germany (a)	0.25	0.28	0.27	0.14	0.01	0.49	0.08	1.52
Greece	0.30	0.23	1.01	0.06	0.01	0.32	0.07	1.99
Hungary (a)	0.18	0.02	0.09	0.03	<0.01	0.03	0.17	0.53
Iceland	0.42	0.15	0.05	0.03	0.01	0.31	<0.01	0.97
Italy	0.45	0.62	0.71	0.21	<0.01	0.82	0.12	2.94
Latvia	0.27	0.12	0.08	0.17	0.02	0.15	0.01	0.82
Lithuania	0.14	0.01	0.04	<0.01	0.16	0.06	<0.01	0.40
Luxembourg	0.35	0.25	0.26	0.16	<0.01	0.81	0.11	1.93
Malta	0.17	0.17	0.07	0.07	<0.01	0.16	<0.01	0.65
Netherlands (a)	0.24	0.32	0.29	0.29	0	0.73	0.06	1.93
Norway	0.24	0.29	0.08	0.08	0.01	0.45	0.03	1.17
Portugal	0.36	1.16	0.90	0.81	<0.01	1.06	0.01	4.29
Romania (b)	0.26	0.23	0.25	0.06	<0.01	0.19	0.02	1.01
Slovenia	0.22	0.10	0.03	0.05	0.01	0.03	0.01	0.45
Sweden	0.41	0.19	0.12	0.13	0.01	0.55	0.04	1.45
EU median	**0.25**	**0.22**	**0.21**	**0.10**	**0.01**	**0.29**	**0.05**	**1.18**

(a) Austria, the Czech Republic, Germany, Hungary and the Netherlands only reported consumption data from the community
(b) Romania provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Table 5.2. Total consumption of antivirals for systemic use (ATC group J05) from both sectors (community and hospital care sector), EU/EEA countries, grouped into categories of their main indication (adopted from [3] (see Annex 1), 2011, expressed as DDD per 1 000 inhabitants and per day

Country	HIV/AIDS antivirals	HIV/hepatitis B antivirals	Hepatitis B antivirals	Hepatitis C antivirals	Herpes antivirals	Influenza antivirals	Others	Undefined	Total (ATC group J05)
Austria (a)	0.56	0.16	0.03	0.06	0.34	0.04	0	0	1.18
Belgium	1.45	0.14	0.05	0.03	0.10	0.01	<0.01	0	1.79
Bulgaria	0.13	0.06	0.03	0.04	0.05	0.03	0.43	0	0.76
Cyprus	0.45	0.26	0.05	0.05	0.15	<0.01	0	0	0.96
Czech Republic (a)	0.10	0.12	0.04	0.04	0.15	<0.01	0.10	0	0.55
Denmark	0.97	0.43	0.04	0.02	0.45	0.01	0	0	1.92
Estonia	2.23	0.15	<0.01	0.13	0.12	0.02	0	0	2.66
Finland	0.56	0.04	<0.01	0.07	0.34	0.02	0	0	1.04
France	2.38	0.26	0.12	0.10	0.58	0.01	0	0.19	3.64
Germany (a)	1.01	0.15	0.10	0.06	0.19	0.01	0	<0.01	1.52
Greece	0.69	0.54	0.44	0.09	0.22	0.01	0.02	0	1.99
Hungary (a)	0.10	0.05	0.03	0.08	0.10	<0.01	0.16	0	0.53
Iceland	0.50	0.03	0.01	0.05	0.37	0.01	0	0	0.97
Italy	1.81	0.31	0.34	0.13	0.32	<0.01	0.01	0	2.94
Latvia	0.50	0.03	0	0.22	0.06	0.02	0	0	0.82
Lithuania	0.07	0.02	0.02	0.07	0.07	0.16	0	0	0.40
Luxembourg	1.35	0.14	0.08	0.05	0.30	<0.01	0.02	0	1.93
Malta	0.41	0.06	0	0.03	0.14	<0.01	0	0	0.65
Netherlands (a)	1.43	0.17	0.09	0.02	0.22	0	0	0	1.93
Norway	0.86	0.04	0.03	0.06	0.18	0.01	<0.01	<0.01	1.17
Portugal	3.30	0.50	0.13	0.12	0.24	<0.01	0	0	4.29
Romania (b)	0.57	0.16	0.13	022	0.04	<0.01	<0.01	0	1.01
Slovenia	0.20	0.03	<0.01	0.04	0.18	0.01	0	0	0.45
Sweden	0.92	0.07	0.04	0.05	0.36	0.01	0	0	1.45
EU median	**0.63**	**0.13**	**0.04**	**0.06**	**0.18**	**0.01**	**0**	**0**	**1.18**

(a) Austria, the Czech Republic, Germany, Hungary and the Netherlands only reported consumption data from the community
(b) Romania provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

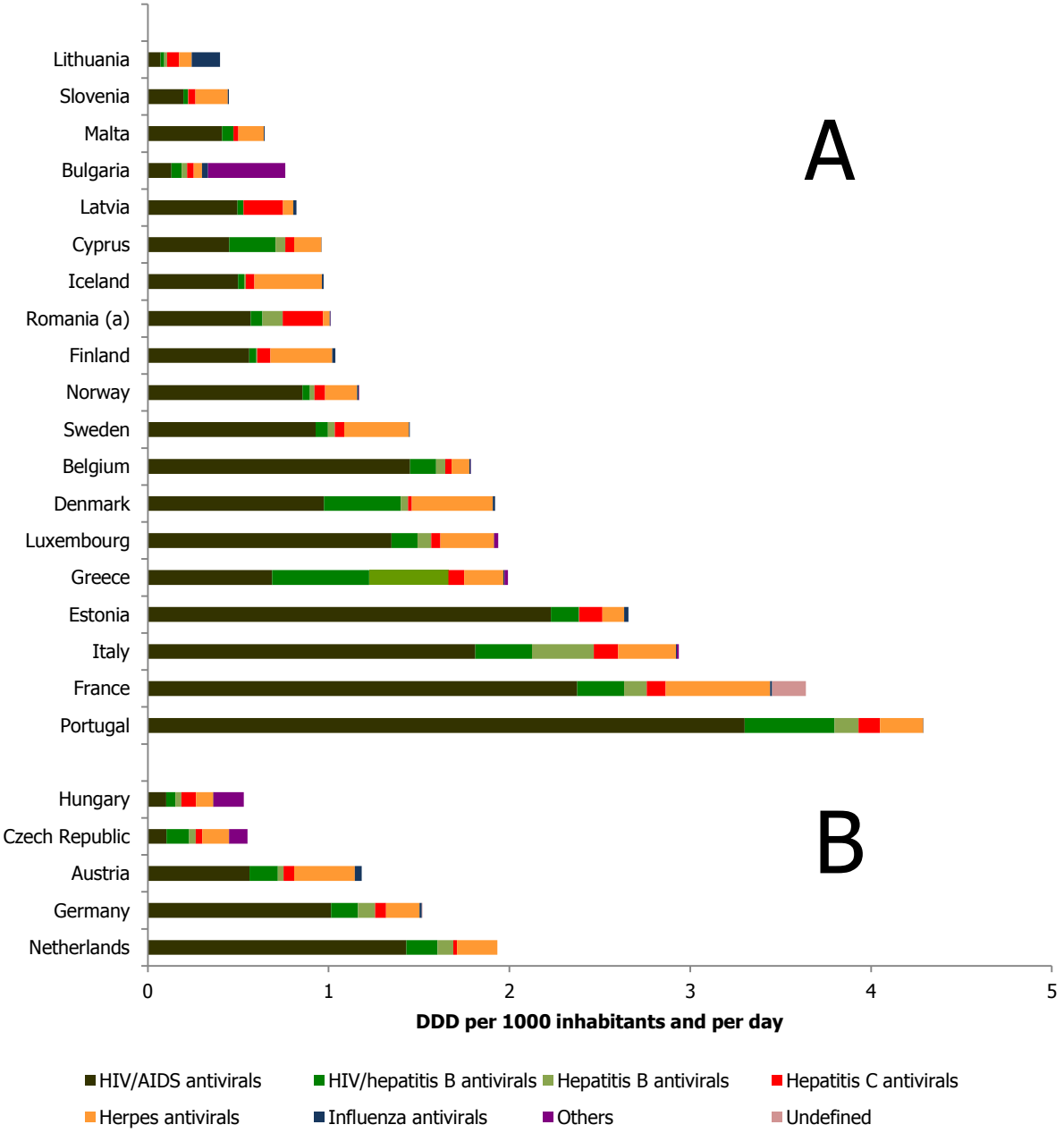
Discussion

In contrast to the consumption of antibacterials for systemic use (ATC group J01) and of antimycotics and antifungals for systemic use (ATC groups J02 & D01BA), for which results are presented separately for each of the two healthcare sectors, consumption of antivirals for systemic use (ATC group J05) is presented for both sectors grouped together. A comparison of the European consumption of antivirals for systemic use (ATC group J05) within one single sector would be less useful as the patterns of the distribution of total consumption of antivirals differ considerably between countries [15]. In some countries, dispensing of certain antiviral classes is limited to the hospital sector. The actual total consumption of antivirals for systemic use (ATC group J05) in Austria, the Czech Republic, Germany, Hungary and the Netherlands is underestimated since these countries did not report data on consumption in the hospital sector.

Within the ATC groups of antimicrobials for systemic use (ATC groups J01, J02 & D01BA, and J05), antivirals for systemic use (ATC group J05) showed the highest variation between countries. As shown for antibacterials for systemic use (ATC group J01), future data analysis may highlight certain socioeconomic or structural determinants that may explain these variations [16].

Following a suggestion from the ESAC project [3] to allocate the unique substances from the ATC classification into seven groups according to their main indication, this proposed classification was adopted to allow a more clinically relevant description of the consumption of antivirals for systemic use (Annex 1). The group 'HIV/AIDS antivirals' accounted for more than half of the total European consumption of antivirals for systemic use (ATC J05) and therefore consumption of this group is a major determinant of inter-country variations. Because antivirals are often used for the treatment of long-lasting infections similar to chronic diseases, data on consumption of antivirals may be interpreted differently from data on consumption of antibacterials. The large inter-country variation of total consumption of antivirals for systemic use (ATC group J05) may reflect the burden of viral infections rather than overuse or misuse as might be the case for antibacterials. For example, using data from 2008, the ESAC project showed a strong correlation between consumption of 'HIV/AIDS antivirals' and the number of HIV/AIDS patients [3].

Figure 5.1. Total consumption of antivirals for systemic use (ATC group J05) from both sectors (A) (community and hospital care sector) and from the community only (B), EU/EEA countries, grouped into categories of their main indication (adopted from [3] (see annex1), 2011, expressed as DDD per 1 000 inhabitants and per day



(a) Romania provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

6 Analysis of antimicrobial consumption data as packages

6.1 Number of packages for antibacterials for systemic use per 1 000 inhabitants and per day (ATC group J01, oral administration)

Results

In 2011, 20 countries reported data on the number of consumed packages of antibacterials for oral use. The total consumption of antibacterials for systemic use (ATC group J01, oral administration) in the community ranged from 1.2 packages per 1 000 inhabitants and per day (Sweden) to 4.9 packages per 1 000 inhabitants and per day (France). On average, 2.5 packages of antibacterials for systemic use (ATC group J01) were consumed per 1 000 inhabitants and per day.

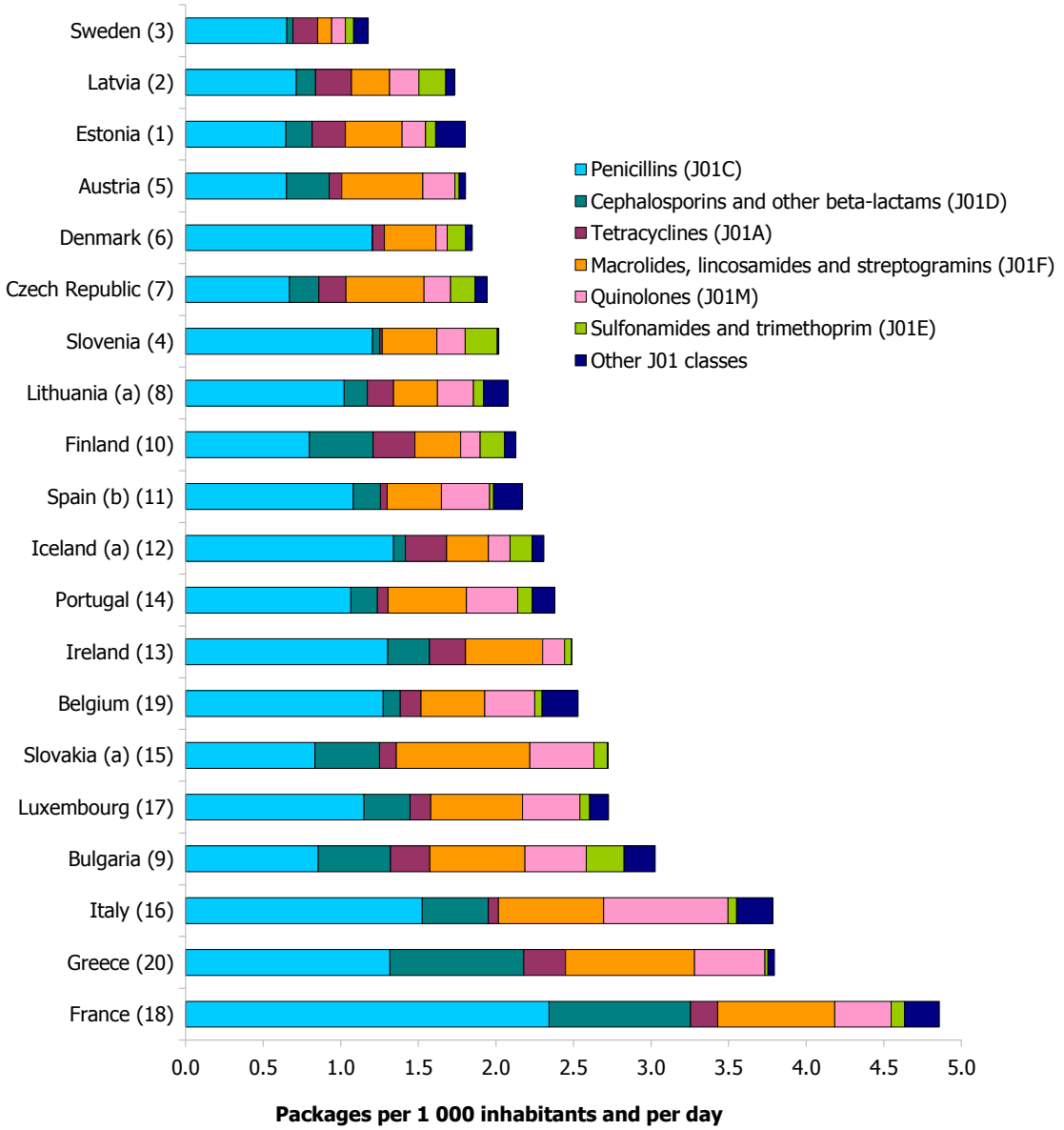
When considering major ATC groups, consumption ranged from 0.10 packages per 1 000 inhabitants and per day for sulfonamides and trimethoprim (ATC group J01E) to 1.1 packages per 1 000 inhabitants and per day for penicillins (ATC group J01C).

Table 6.1. Consumption of packages of antibacterials for systemic use (ATC group J01, oral administration) in the community, EU/EEA countries, 2011, expressed as packages per 1 000 inhabitants and per day

Country	Tetracyclines (J01A)	Beta-lactams, penicillins (J01C)	Other beta-lactam antibacterials (J01D)	Sulfonamides and trimethoprim (J01E)	Macrolides, lincosamides and streptogramins (J01F)	Quinolones (J01M)	Other (J01B, J01G, J01R and J01X)	Total (ATC group J01)
Austria	0.08	0.65	0.27	0.03	0.52	0.21	0.04	1.80
Belgium	0.13	1.28	0.11	0.05	0.41	0.32	0.23	2.53
Bulgaria	0.25	0.86	0.46	0.24	0.61	0.40	0.20	3.03
Czech Republic	0.17	0.67	0.19	0.16	0.50	0.17	0.08	1.94
Denmark	0.08	1.20	<0.01	0.12	0.33	0.07	0.04	1.85
Estonia	0.21	0.65	0.17	0.07	0.37	0.15	0.19	1.80
Finland	0.27	0.80	0.41	0.16	0.30	0.13	0.07	2.13
France	0.18	2.34	0.91	0.08	0.76	0.36	0.22	4.86
Greece	0.27	1.32	0.86	0.02	0.83	0.45	0.04	3.79
Iceland (a)	0.27	1.34	0.08	0.14	0.27	0.14	0.07	2.31
Ireland	0.23	1.30	0.27	0.04	0.50	0.14	<0.01	2.49
Italy	0.06	1.52	0.43	0.06	0.68	0.80	0.23	3.78
Latvia	0.23	0.71	0.12	0.17	0.24	0.19	0.06	1.73
Lithuania (a)	0.17	1.02	0.15	0.07	0.28	0.23	0.16	2.08
Luxembourg	0.14	1.15	0.30	0.06	0.59	0.37	0.12	2.73
Portugal	0.07	1.07	0.17	0.09	0.50	0.33	0.15	2.38
Slovakia (a)	0.11	0.83	0.41	0.09	0.86	0.41	<0.01	2.70
Slovenia	0.02	1.20	0.05	0.21	0.35	0.18	<0.01	2.02
Spain (b)	0.04	1.08	0.17	0.03	0.35	0.31	0.19	2.17
Sweden	0.16	0.65	0.04	0.05	0.09	0.09	0.09	1.18
EU median	**0.16**	**1.08**	**0.19**	**0.09**	**0.44**	**0.25**	**0.12**	**2.34**

(a) Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
(b) Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Figure 6.1. Consumption of packages of antibacterials for systemic use (ATC group J01, oral administration) in the community in EU/EEA countries, 2011, at group level 3, expressed as packages per 1 000 inhabitants and per day



(a) Iceland, Lithuania and Slovakia provided total care data, i.e. including the hospital sector.
(b) Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.
The numbers in parentheses indicate the ranking of the country when community consumption of antibacterials for systemic use (ATC group J01) is expressed as DDD per 1 000 inhabitants and per day (see Figure 3.1).

Discussion

Antimicrobial consumption expressed in DDD per 1 000 inhabitants and per day cannot be directly extrapolated to a number of prescriptions per patient. However, the ESAC project used the number of consumed packages as a proxy for the number of prescription or treatments.

In the 2010 report, the number of DDD per package was analysed to validate packages as a proxy for prescription. The average number of DDD per package was calculated for the three main ATC groups under surveillance: antibacterials for systemic use (ATC group J01), antimycotics and antifungals for systemic use (ATC groups J02 & D01BA) and antivirals for systemic use (ATC group J05) and stratified by routes of administration and healthcare sectors. It was concluded that, for the community, the number of packages of antibacterials for systemic use (ATC group J01, oral administration) may be an acceptable surrogate for prescriptions of theses antibacterials.

The indicator DDD per 1 000 per inhabitants and per day may not be sufficient to describe the prescription of antimicrobials in the EU Member States. Compared with the ranking of antimicrobial consumption expressed as DDD per 1 000 inhabitants, only three countries (Latvia, Lithuania and Slovakia) retained the same ranking when

the results were expressed as packages per 1 000 inhabitants and per day. A few countries showed an increase (Bulgaria and Slovenia) or decrease (Belgium) of their ranking position by more than three ranks when consumption was expressed in packages per 1 000 inhabitants and per day instead of DDD per 1 000 inhabitants and per day. In a recent study it was shown that for countries dispensing complete packages, e.g. Belgium, antimicrobial community consumption data expressed as the number of packages might be a more appropriate measure to assess the antibiotic prescribing over time and the impact of awareness campaigns [17].

Antibacterials for systemic use (ATC group J01) are often used to treat acute infections. In 2011, on average 2.5 packages antibacterials for systemic use (ATC group J01) per 1 000 inhabitants and per day were consumed in the 20 countries that reported data on packages. Should further information become available on the average duration of treatments and the actual used daily doses, it would be possible to extrapolate the number of prescriptions and treatments.

7 General discussion and perspectives

European countries increasingly implement, or plan to implement, actions to control antimicrobial resistance in the community through rational use of antimicrobials, including awareness campaigns on the prudent use of antibiotics. Data from the ESAC project [9, 18] have been instrumental at national level for the evaluation of such campaigns and this second surveillance report of ESAC-Net provides similar data for EU/EEA countries in 2011.

In line with the goals of the former ESAC project, the scope of ESAC-Net is to encourage all network participants to report national antimicrobial consumption data at the medicinal product level by providing national registry data and the number of packages for each product. This standard version, in contrast to the 'light' option, is the preferred format for reporting data to ESAC-Net as it offers better opportunities for internal data validation and additional material for further analyses. For instance, the national registries include information from participating countries on the number of individual products available on the market, which has been shown to be associated with the level of consumption [19]. In 2011, two thirds of the reporting countries used the preferred format for reporting data on antimicrobial consumption in the community. Participating countries are still encouraged to report data on community consumption stratified by age or age class in order to explore differences between age groups and trends in the age distribution of antimicrobial consumption.

The quality of antimicrobial consumption data also depends on the type of data available for a given sector. For ESAC-Net, countries provide sales or/and reimbursement data that have both advantages and drawbacks. The major drawback of reimbursement data is that they cannot record antimicrobials dispensed without a prescription and non-reimbursed prescribed antimicrobials [10]. For this reason, countries that report reimbursement data and are known to have a substantial proportion of antimicrobials dispensed without a prescription, are indicated as such in the tables and figures in this report. Even though it presents a potential bias, ESAC-Net will continue the joint analysis of sales and reimbursement data. A change of data provider and/or type of data could also introduce bias in the consumption rates reported. However, the number of countries each year that change data provider and/or types of data is small. There were two changes in 2011: Hungary reported reimbursement data for the community, and Italy reported sales data for the community.

In 2011, consumption of antibacterials for systemic use (ATC group J01) in the community in Europe varied considerably between countries and showed a north-to-south gradient. A gradual increase in the median overall consumption in the community was reported by the ESAC project between 2004 and 2008, but for 2011, ESAC-Net data did not show evidence of an overall increase.

For the first time, this report provides trend analyses of consumption data from both sectors (community and hospital sector) for the countries that consistently reported data for the period 2007–2011. The overall consumption of antibacterials for systemic use (ATC group J01) did not increase or decrease significantly during this period in most of the countries; only three showed a significant increase. However, the trend analyses of subgroups of antibacterials for systemic use revealed significant trends in the consumption of penicillins in more than half of the countries included in the analyses, e.g. indicating a shift in consumption of beta-lactamase-sensitive penicillins towards consumption of broad-spectrum antimicrobials, i.e. combinations of penicillins including beta-lactamase inhibitors (ATC group J01R).

A second antimicrobial consumption indicator, expressed as packages per 1 000 inhabitants, was applied for community consumption of orally administered antibacterials for systemic use (ATC group J01) in 20 countries. The changes in the ranking positions of some countries compared with their ranking when applying the indicator DDD per 1 000 per inhabitants and per day indicate the need for more than one single indicator to correctly describe antimicrobial consumption in EU/EEA countries. Very recently, a Belgian study showed that for countries dispensing complete packages for community prescriptions, consumption data expressed by the number of packages might be a more appropriate measure to assess prescribing patterns over time and the impact of awareness campaigns [17].

The former ESAC project developed and published 12 quality indicators for antimicrobial consumption in the community based on a consensus of European antimicrobial surveillance experts [2]. Data on these quality indicators are reported by ESAC-Net but, as stated in the report summary, comparisons between countries should be made with caution. Nevertheless, these indicators could be used by healthcare professionals and policy makers to monitor progress towards a more prudent use of antibiotics in the community.

For the hospital sector, the types of healthcare settings that are included differ across European countries. For example, since the beginning of the ESAC project, data from Finland, the country with the second highest consumption of antibacterials for systemic use (ATC group J01) in the hospital sector in 2011, include data from nursing homes and from remote primary healthcare centres. For this reason, antimicrobial consumption from the hospital sector in Finland cannot be compared with that of other countries.

One main driver for the selection and spread of the multidrug-resistant bacteria responsible for healthcare-associated infections such as carbapenemase-producing *Enterobacteriaceae* is the use of antimicrobials in patients admitted to hospital. Although the median European consumption of antimicrobials for systemic use (ATC group

J01) in the hospital sector has remained at the same level since the beginning of the ESAC project, analyses of subgroups of last-line antibacterials are showing significant increasing trends. For example, consumption of carbapenems showed a significant increase in half of the countries included in the trend analysis for the period 2007–2011.

For the time being, ESAC-Net employs the same measurement of unit (DDD per 1 000 inhabitants and per day) for both the community and the hospital sector. Reporting of antimicrobial consumption data from the hospital sector could still be improved and poses the next challenge for this type of surveillance. An ESAC-Net working group within the ESAC-Net Coordination Group will explore options to develop and agree on measurement units specifically for the hospital sector and reports of hospital-based consumption data. Availability of antimicrobial consumption data at the hospital level in EU/EEA countries would allow the antimicrobial consumption data from ESAC-Net to be linked with antimicrobial resistance data from the European Antimicrobial Resistance Surveillance Network (EARS-Net). A prerequisite for this type of analysis, however, would be the harmonisation of hospital codes and denominator data between ESAC-Net and EARS-Net.

Unlike the consumption of antibacterials for systemic use (ATC group J01) and of antimycotics and antifungals for systemic use (ATC groups J02 & D01BA), for which results are presented separately for the community and for the hospital sector, consumption of antivirals for systemic use (ATC group J05) was reported for both sectors grouped together. While the distribution of consumption of antimicrobials of the ATC groups J01 and J02 & D01BA shows that the largest proportion of consumption takes place in the community, the largest consumption of antivirals may take place in the community or in the hospital sector depending on the country. In several countries, dispensing of certain antiviral classes is limited to the hospital sector or to the community only. To some extent, surveillance of antiviral consumption shows an essential difference compared to the consumption of antibacterials, as antivirals are often used for the treatment of long-lasting infections similar to chronic diseases. In 2011, antiviral consumption showed the highest inter-country variation of all three main antimicrobial groups under surveillance, and may reflect the burden of viral diseases rather than targets for improving practices and a more prudent use of antiviral agents.

At this stage, data collected by the ESAC project and by ECDC on drugs for treatment of tuberculosis (ATC group J04A), use of oral and rectal nitroimidazole derivates as antiprotozoals (ATC group P01AB), and oral vancomycin used as a non-absorbable intra-intestinal antiinfective (ATC A07AA09) are only available to network members via the TESSy database access. These data would require validity and quality checks of the data before they are made publicly available.

Additional data, notably for the community, would be required to identify the possible reason for temporal changes observed over the 13 years of surveillance of antimicrobial consumption conducted by the ESAC project and continued by ESAC-Net. Such data would include prescriptions, indications or information on national interventions for a more prudent use of antimicrobials. Without such additional data, it remains difficult to explain the changes observed in the consumption of different groups of antimicrobials over time.

Antimicrobial consumption in humans is presented in this ESAC-Net report. Data on the sales of veterinary antimicrobial agents used in animals are produced by the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) project [20]. Both consumption of antimicrobials in humans and in animals are associated with the development and spread of antimicrobial resistance. Inter-agency work aims to integrate data on antimicrobial consumption and on antimicrobial resistance in humans and in animals in a single European report envisaged for 2014.

ECDC provides public access to the ESAC-Net database at the 4th level of the ATC classification in this annual report and in an interactive database on the ECDC website [4].

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Annex 1. Further sub-classification of macrolides, quinolones and antivirals

Classification of macrolides into short-, intermediate- and long-acting macrolides*

Short-acting		Intermediate-acting		Long-acting	
ATC code	**Substance**	**ATC code**	**Substance**	**ATC code**	**Substance**
J01FA01	erythromycin	J01FA06	roxithromycin	J01FA10	azithromycin
J01FA02	spiramycin	J01FA07	josamycin	J01FA13	dirithromycin
J01FA03	midecamycin	J01FA09	clarithromycin		
J01FA05	oleandomycin	J01FA14	flurithromycin		
J01FA08	troleandomycin	J01FA15	telithromycin		
J01FA11	miocamycin				
J01FA12	rokitamycin				

*Macrolides subdivided into short-acting (half-life <4h), intermediate-acting (half-life 4–24h) and long-acting (half-life >24h) macrolides. Adapted from [8].

Classification of quinolones into three generations*

First generation		Second generation		Third generation	
J01MA06	norfloxacin	J01MA01	ofloxacin	J01MA05	temafloxacin
J01MB01	rosoxacin	J01MA02	ciprofloxacin	J01MA13	trovafloxacin
J01MB02	nalidixic acid	J01MA03	pefloxacin	J01MA14	moxifloxacin
J01MB03	piromidic acid	J01MA04	enoxacin	J01MA15	gemifloxacin
J01MB04	pipemidic acid	J01MA07	lomefloxacin	J01MA16	gatifloxacin
J01MB05	oxolinic acid	J01MA08	fleroxacin	J01MA17	prulifloxacin
J01MB06	cinoxacin	J01MA09	sparfloxacin	J01MA18	pazufloxacin
J01MB07	flumequine	J01MA10	rufloxacin	J01MA19	garenoxacin
		J01MA11	grepafloxacin		
		J01MA12	levofloxacin		

* Classification of quinolones is based on their chemical structure and antimicrobial activity. Adapted from [7].

Classification of antivirals into seven groups based on their main indication*

Substances used for the treatment of influenza: 'influenza antivirals'

J05AC02	rimantadine	J05AH01	zanamivir	J05AH02	oseltamivir

Substances used for the treatment of hepatitis C: 'hepatitis C antivirals'

J05AB04	ribavirin

Substances used for the treatment of herpetic infections: 'herpes antivirals'

J05AC03	tromantadine	J05AB03	vidarabine	J05AB12	cidofovir
J05AD01	foscarnet	J05AB06	ganciclovir	J05AB13	penciclovir
J05AB01	aciclovir	J05AB09	famciclovir	J05AB14	valganciclovir
J05AB02	idoxuridine	J05AB11	valaciclovir	J05AB15	brivudine

Substances used for the treatment of HIV/AIDS: 'HIV/AIDS antivirals'

J05AE01	saquinavir	J05AF01	zidovudine	J05AR01	zidovudine and lamivudine
J05AE02	indinavir	J05AF02	didanosine	J05AR02	lamivudine and abacavir
J05AE03	ritonavir	J05AF03	zalcitabine	J05AR03	tenofovir disoproxil and emtricitabine
J05AE04	nelfinavir	J05AF04	stavudine	J05AR04	zidovudine, lamivudine and abacavir
J05AE05	amprenavir	J05AF06	abacavir	J05AR05	zidovudine, lamivudine and nevirapine
J05AE06	lopinavir	J05AG01	nevirapine	J05AR06	emtricitabine, tenofovir disoproxil and efavirenz
J05AE07	fosamprenavir	J05AG02	delavirdine	J05AX07	enfuvirtide
J05AE08	atazanavir	J05AG03	efavirenz	J05AX08	raltegravir
J05AE09	tipranavir	J05AG04	etravirine	J05AX09	maraviroc
J05AE10	darunavir				

Substances used for the treatment of hepatitis B: 'hepatitis B antivirals'

J05AF08	adefovir dipivoxil	J05AF11	telbivudine
J05AF10	entecavir	J05AF12	clevudine

Substances used for both HIV and hepatitis B treatment: 'HIV/hepatitis B antivirals'

J05AF05	lamivudine	J05AF07	tenofovir disoproxil	J05AF09	emtricitabine

'Other antivirals'

J05AA01	metisazone	J05AX01	moroxydine	J05AX05	inosine pranobex
J05AD02	fosfonet	J05AX02	lysozyme	J05AX06	pleconaril

* Adapted from [4].

This classification is not part of that of the WHO Collaborating Centre for Drug Statistics Methodology.

Annex 2. Additional data

Table A1. Consumption of antibacterials for systemic use (ATC group J01) in the community, EU/EEA countries, 1997–2011, expressed as DDD per 1 000 inhabitants and per day

Country	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Austria		12.6	13.1	12.3	11.8	11.8	12.5	12.6	14.5	14.3	14.7	15.1	15.5	15.0	14.5
Belgium	25.4	26.4	26.2	25.3	23.7	23.8	23.8	22.8	24.3	24.2	25.4	27.8	27.5	28.4	29.0
Bulgaria			15.1*	20.2*	22.7*	17.3*	15.5*	16.4*	18.0*	17.7	19.4	20.3	18.3	18.2	19.5
Cyprus										31.9*	33.9*	32.9*	34.4*	31.0*	32.0*
Czech Republic		18.2	18.6				16.7	15.9	17.3	15.9	16.5	17.5	18.4	17.9	18.5
Denmark	12.2	12.7	12.1	12.3	12.8	13.2	13.5	14.1	14.6	15.2	15.9	15.6	15.6	16.5	17.4
Estonia					14.4*	11.7	11.1	10.4	11.7	11.4	12.2	11.9	11.1	11.1	12.1
Finland	19.4	18.4	18.4	19.1	19.8	17.9	18.7	17.3	18.1	17.4	18.3	17.8	17.9	18.5	20.1
France	33.1	33.6	34.1	33.3	33.2	32.2	28.9	27.1	28.9	27.9	28.6	28.1	29.6	28.2	28.7
Germany	13.0	13.3	13.6	13.7	12.8	12.7	13.9	13.0	14.6	13.6	14.5	14.6	14.9	14.5	14.1
Greece	25.1	24.9	28.5	29.5	29.6	30.6	31.3	33.1*	34.7*	41.0*	43.1*	45.3*	38.6	39.4*	35.1
Hungary		18.3	23.5	18.6	18.6	17.1	19.1	18.2	19.5	17.2	15.5	15.2	16.0	15.7	14.7
Iceland	22.2*	23.1*	21.7*	20.5*	20.0*	20.6*	20.3*	21.5*	23.2*	20.0	19.2	20.7	19.4	22.3*	22.3*
Ireland		16.5	18.0	17.6	18.7	18.7	20.1	20.3	20.5	21.2	22.9	22.5	20.8	20.3	22.6
Italy			24.5	24.0	25.5	24.3	25.6	24.8	26.2	26.7	27.6	28.5	28.7	27.3	27.6
Latvia						11.2		12.0	12.5	11.5	12.4	11.4	10.9	11.8	12.8
Lithuania										22.7*	24.1*	25.1*	19.5*	12.7	19.0*
Luxembourg (a)	27.2	26.9	28.2	27.2	27.6	27.5	28.6	25.0	26.3	25.1	27.2	27.1	28.2	28.6	27.6
Malta											17.9	20.9	21.6	21.3	23.4
Netherlands	10.1	9.9	10.0	9.8	9.9	9.8	9.8	9.8	10.5	10.8	11.0	11.2	11.4	11.2	11.4
Norway		15.3			15.6	15.7	15.6	15.7	16.8	14.8	15.5	15.6	15.2	15.8	16.5
Poland		20.7	22.2	22.7	24.8	21.4		19.1	19.6		22.2	20.7	23.6	21.0	21.9
Portugal	23.1	23.3	25.2	24.9	24.5	26.5	25.1	23.8	24.5	22.7		22.7	22.9	22.4	23.2
Romania (b)													10.2		13.0
Slovakia			25.7	27.7	29.1	26.7	27.6	22.6	25.1	22.5	24.8	23.2	23.8		23.8*
Slovenia	17.5	19.3	19.8	18.1	17.4	16.3	17.0	16.8	16.3	14.7	16.0	14.9	14.3	14.4	14.4
Spain (b)	21.3	20.6	20.0	19.0	18.0	18.0	18.9	18.6	19.3	18.7	19.9	19.8	19.7	20.3	20.9
Sweden	14.6	15.5	15.8	15.6	15.8	15.2	14.7	14.5	14.9	15.4	15.5	14.6	14.1	14.2	14.3
United Kingdom	17.0	16.2	14.8	14.3	14.8	14.8	15.1	15.0	15.4	15.3	16.5	17.0	17.3	18.6	18.8
EU Minimum	10.1	9.9	10.0	9.8	9.9	9.8	9.8	9.8	10.5	10.8	11.0	11.2	10.2	11.1	11.4
EU Median	20.4	18.4	20.0	19.9	18.7	17.3	18.7	17.3	18.1	17.5	18.3	20.0	18.4	18.5	19.5
EU Maximum	33.1	33.6	34.1	33.2	33.2	32.2	31.3	33.1	34.7	41.0	43.1	45.2	38.6	39.4	35.1

**Total care data; i.e. including the hospital sector.*
(a) Luxembourg updated all years with insured population data.
(b) Romania and Spain provided reimbursement data, i.e. not including consumption without a prescription and other non-reimbursed courses.

Table A2. Consumption of antibacterials for systemic use (ATC group J01) in the hospital care sector, EU/EEA countries, 1997–2011, expressed as DDD per 1 000 inhabitants and per day

Country	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Belgium	2.0	2.0	2.2	2.2	2.2	2.2	2.3	2.1	1.9	1.9	1.9	1.7		2.0	2.0
Bulgaria										1.4	1.4	1.5	1.6	1.4	1.4
Denmark	1.3	1.3	1.3	1.4	1.4	14	1.5	1.6	1.6	1.7	1.8	1.8	1.8	1.8	1.7
Estonia						2.1	2.4	2.3	2.5	1.9	1.8	2.0	1.6	1.8	1.8
Finland (a)	3.5	3.7	3.7	3.8	3.9	3.9	3.6	3.4	3.5	3.4	3.2	3.1	3.2	2.8	3.1
France	3.3	3.0	3.0	3.2	2.9	3.9	2.8	2.5	2.6	2.3	2.2	2.2	2.2	2.2	2.1
Greece	2.1	2.1	21	2.3	2.2	2.2	2.3						3.3		2.1
Hungary					1.2	1.2	1.5	1.3	1.4	1.4	1.2	1.2	1.3	1.3	
Ireland								0.7	0.7	1.9	1.1	1.6	1.4	1.8	1.8
Italy									0.2		1.5	2.3		2.1	2.5
Latvia						6.3		4.8	3.9	3.2	3.6	2.9	2.3	3.2	2.9
Lithuania														2.4	
Luxembourg	2.1	2.0	2.3	2.3	2.1	2.5	2.5	2.1	2.2	2.2	2.3	2.3		2.1	2.1
Malta	1.6	2.5	2.6	2.4	1.9	1.7	2.0	1.8	1.4	1.7	1.3	1.4	1.4	2.0	1.7
Netherlands	0.6	0.6	0.7	0.6	0.6	0.7								1.1	1.0
Norway		1.1			1.1	1.3	1.4	1.3	1.3	1.5	1.5	1.7	1.5	1.4	1.5
Poland		3.0	3.4	2.4	2.4	1.7									
Portugal (b)													1.4	1.4	1.5
Romania													2.6		3.2
Slovakia			1.3	1.2	1.4	1.5	1.4	1.6	1.9	1.7	1.9	1.8	1.9		
Slovenia	0.5	1.6	1.7	1.8	1.7	1.8	1.8	1.6	1.7	1.7	1.7	1.7	1.8	1.7	1.7
Sweden	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.3	1.5	1.5	1.5	1.6
EU Minimum	0.5	0.6	0.7	0.6	0.6	0.7	1.4	0.7	0.2	1.3	1.1	1.2	1.3	1.1	1.0
EU Median	1.8	2.0	2.2	2.3	1.8	1.8	2.1	1.7	1.7	1.7	1.7	1.7	1.7	1.8	1.8
EU Maximum	3.5	3.7	3.7	3.8	3.9	6.3	3.6	4.8	3.9	3.4	3.6	3.1	3.3	3.2	3.4

(a) Finland: data include consumption in remote primary health care centres and nursing homes.
(b) Portugal: data correspond to public hospitals only.