

# Human use of antimicrobial agents

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## Summary

Antibiotics have increased life expectancy. Self-medication, even over the Internet, occurs in many countries where antibiotics are classified as prescription-only medicines. Collateral damage caused by antibiotic use includes resistance, which could be reduced if the inappropriate use of antibiotics that takes place globally, especially in low-income countries, could be prevented. Surveillance of antimicrobial resistance can recognise trends in resistance patterns and novel resistances. Surveillance of antimicrobial consumption can identify and target practice areas for quality improvement, both in the community and in healthcare institutions. Antimicrobial stewardship initiatives and infection control programmes play an important role in decreasing inappropriate use and halting dissemination of resistance. Education of professionals and the public should focus on changing behaviour rather than exclusively increasing knowledge, as the latter could have a paradoxical effect by increasing demand and prescription. Behaviour change should target all prescribers, including veterinarians, since microbes know no boundaries between animals and humans and are capable of exchanging resistance genes.

## Keywords

Antimicrobial resistance – Antimicrobial stewardship – Human antimicrobial consumption – Legal classification of antimicrobials – Self-medication – Surveillance – Veterinary antimicrobial consumption.

## Introduction

The introduction of antibiotics to the prescribers' armamentarium was a quantum leap in medicine and is often referred to as the 'antibiotic revolution' (59). Penicillin was affectionately referred to as the 'wonder drug' (14, 63, 96) and antimicrobials in general became known as 'miracle drugs' (49, 66). Antimicrobial treatment made many infections curable in the second half of the 20th Century. This led to a dramatic increase in life expectancy.

Antibiotic growth promoters, including bacitracin; the glycopeptide avoparcin; the macrolides spiramycin and tylosin; and the streptogramin virginiamycin were gradually withdrawn between 1995 and 1999 on the basis of the 'Precautionary Principle' in the European Union (EU) (72). In some countries, antimicrobials are still used in animal husbandry as growth promoters, but in Europe they have not been used for this purpose since 2006 (56, 57).

The United States has also concluded that using antimicrobials as growth promoters is not in the interest of public health. However, through its Center for Veterinary Medicine (part of the Department of Health and Human Services of the Food and Drug Administration) it is still accepting feedback on the proposed guidance on limiting the use of non-therapeutic/sub-therapeutic doses of medically important antimicrobial drugs in food-producing animals for growth-enhancement purposes (86).

Antibiotics should only be used in animals therapeutically if there are scientifically validated indications (48). This practice has always been advocated in humans. Antimicrobial use and resistance need to be tackled at both the 'micro level' as well as the 'macro level'. At the micro level, individual hospitals or communities (human) and farms (animal) can aim to ensure that the respective prescribers always use antibiotics appropriately. At the macro level this is a political issue. The complexity of dealing with the problem at macro level has been discussed

previously by Keulayan and Gould (51), but tackling antimicrobial resistance could be even more complex than they envisaged, as it can entail the involvement of two ministerial sectors (health and agriculture) at national level. The level of complexity escalates when aiming at European and global consensus.

Most literature about appropriate antibiotic prescribing refers to the acute hospital setting. Historically, it was always emphasised that appropriate samples for culture and sensitivity testing should be taken before the initiation of antibiotics. However, for patients with septic shock and severe sepsis, usually in the intensive care setting, each hour's delay in starting antibiotics increases the likelihood of in-hospital mortality by 7.6% (52). In this respect, probably the best guidelines for setting up a programme of antimicrobial stewardship in the acute care setting are those published in 2007 by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America (27). Key aspects for appropriate antimicrobial use are summarised in Box 1. It is important to use appropriate (high) doses of the right drug. This is referred to as 'hitting hard' and 'getting it right the first time round'. The latter also brings in the concept of de-escalation or 'streamlining therapy', i.e. upon laboratory confirmation of the infective pathogen, therapy should be narrowed down accordingly by the prescribing physician.

## Legal classification of antibiotics

In most parts of the world, including all the developed countries, antibiotics are classified as prescription-only medicine ('POM'). In the United Kingdom (UK) an Act was passed to this effect in 1947 upon the introduction of injectable penicillin, the first clinically available antibiotic

(59). However, the possibility of acquiring antibiotics without a prescription is still a reality, even in countries within the EU. This potential source of inappropriate antibiotic use has been documented in Greece where co-amoxiclav was dispensed without a prescription, from all 174 pharmacies assessed, when requested by the patient (73). This tendency was also documented in Spain, where the total reimbursement and total sales figures did not match (17, 58).

## The message is not always clear

There have been warnings about antimicrobial resistance and conflicting messages about the 'appropriate use' of antibiotics for more than half a century. This could be related to the fact that there is no consensus on the definition of 'appropriate' antimicrobial use.

In 1954, a conference of the Royal Society of Medicine in the UK warned doctors to save the penicillin 'umbrella' for 'real storms' and not 'impending showers', whilst in the same year a textbook was recommending antibiotics even in patients with mild symptoms (59).

In the past decade, despite our knowledge that resistance is a serious threat to the continued efficacy of antibiotics, many household products for surface cleaning have had 'antibacterials' added as a marketing strategy (25, 54). Such use may also contribute to the development of resistance as these antibacterials remain in the environment long after their use.

In the UK there is a drive for some antibiotics to be reclassified from 'POM' to 'pharmacy-medicines' (76). This appears to be in conflict with antimicrobial stewardship initiatives, both in the community and in hospital, aimed at restricting antimicrobial use. Furthermore, this reclassification might aggravate another global issue, that of self-medication. This is exemplified by the use of azithromycin, which in the UK can be dispensed without a prescription for the treatment of confirmed *Chlamydia* infections. Once again there are conflicting opinions on the validity of this new initiative. Shivasankar and colleagues concluded that both professionals and patients favoured patient-delivered partner medication (i.e. providing patients with medication to give to their sexual partners) (80, 81). The early diagnosis and treatment of the condition was a key factor in the decision of the Medicines and Healthcare products Regulatory Agency to change the classification of azithromycin (15, 85). According to Dryden and colleagues, this availability of treatment failed to address the fact that sexually transmitted diseases co-exist and that identification of one does not exclude another (29). The authors also noted that a reclassification

### Box 1

#### Key principles in appropriate prescribing

##### The right 3 Ds:

- Drug (right drug for the right patient and the right indication)
- Dose (including frequency and route of administration)
- Duration (clinical markers can help clinicians stop therapy before the target stop date)

##### The 4 Cs to avoid as much as possible

##### in order to minimise *Clostridium difficile* infection:

- Cephalosporins
- Clindamycin
- Co-amoxiclav
- Ciprofloxacin

of azithromycin would make it difficult for authorities to trace contacts, track antibiotic use or engage in health education to promote the concept of prevention rather than cure (29).

## Self-medication with antibiotics

Self-medication with antibiotics has been widely reported globally, including in the western world. It is a major problem, especially in developing countries, as discussed below.

In the Middle East, specifically Jordan, self-medication with antibiotics was very high (39.5%) and significantly associated with age, income, and level of education (2). A similarly high level of self-medication (40.7%) was confirmed in another Jordanian study (79). In northern Israel only 89.4% of antibiotics were reported to be used by prescription (i.e. 10.6% self-medication). Moreover, 18.7% of people interviewed admitted to be willing to use antibiotics without medical consultation, especially those left over from previous prescriptions (75).

The highest levels of self-medication were reported in two other continents. In a Chinese study, 59.4% of parents obtained antibiotics for their children without prescription (10). The highest level of self-medication with antibiotics and antimalarials was reported in Khartoum State, Sudan, where 73.9% of the study population obtained these medications without prescription (8).

### Self-medication with antibiotics and resistance levels in Europe

A survey of 'Self-Medication with Antibiotics and Resistance Levels in Europe' (SAR) was funded by a grant from the European Commission (EC) Directorate-General for Health and Consumers (DG SANCO) and participating institutions. The survey was carried out in 19 European countries and showed consistent associations between prescribed use and self-medication with 'left-over' antibiotics. The study could not conclude that self-medication from other sources (i.e. buying through the Internet or directly from a pharmacy without a prescription) was associated with earlier prescribed use (45). The SAR survey found that, across the 19 countries, the prevalence of actual self-medication among interviewees ranged from 1 to 210 per 1,000, and that the prevalence of intended self-medication was higher, ranging from 73 to 449 per 1,000 (46). These rates were higher in eastern and southern Europe and lower in northern and western Europe, with pharmacies and medication left over being the main sources of non-prescribed antibiotics (46). In some countries, the level of self-medication was relatively low, e.g. 0.3% in Sweden (84), 2% in Hungary

(64) and 3% in Denmark (69). This is in contrast with countries such as Spain, where one report claimed that 17.7% of antibiotic use was through self-medication (18). The figure quoted for Lithuania is even more alarming, with more than half of all antibiotic use being reported as over-the-counter use or self-medication (9). Respondents in some countries (the UK, Malta, Italy, the Czech Republic, Croatia, Israel and Lithuania) were less knowledgeable about antimicrobials than those in other countries (Sweden, the Netherlands, Austria and Belgium) (43). In addition, the survey concluded that people in wealthier countries had a lower likelihood of self-medication (44). A similar association was observed for countries where only the exact number of prescribed tablets were dispensed (44).

### Attitude and behaviour towards self-medication

Various factors determine a person's behaviour with respect to self-medication. The results of another survey carried out in Spain (a high self-medication country) are of utmost importance and interest. The survey found that 41% of the interviewees (Finnish nationals living in Spain) had used antibiotics as self-medication (87). The result is perhaps surprising, given that Finland is considered a low self-medication country. The availability of antibiotics without a prescription, possibly due to less strict law enforcement in Spain, influenced their behaviour even though they were not used to self-medication in their country of origin.

Reported figures for self-medication based on interviews or questionnaires could be biased, as respondents might deny practising self-medication, especially if aware that this is not appropriate behaviour. In a study carried out at a sexually transmitted disease clinic, 14% stated that they had used antibiotics without a prescription in the previous week. Thirty-six percent of these patients had negative urine samples for antibiotics but, more alarmingly, 60% of those with a positive urine test for antibiotics denied having used any (41).

### The modern phenomenon of the Internet and counterfeit drugs

Various publications have raised the issue of patients buying their choice of antibiotics over the Internet (25, 46, 62, 76). In western countries the majority of households have broadband Internet and there are also public places with Internet access, such as libraries and Internet cafes (76). This phenomenon jeopardises quality of care by promoting irresponsible self-medication (62). The framework of international trade in the 21st Century makes control of suppliers virtually impossible (76). These sellers deliver to countries where antibiotics are prescription-only medicine, even though such distribution

is forbidden by law (62). The modern media, including the Internet, also play a role in advertising antibiotics, which causes patient pressure on the prescriber (25). Direct-to-consumer advertising of prescription-only medicine is allowed in the United States and Canada and this leads to potential overuse (28).

Self-medication has been associated with development of resistance (40, 47, 78, 88, 91). Reports of resistance developing through self-medication date back half a century, when resistance in *Plasmodium falciparum* malaria was observed in Ghana following self-administration of pyrimethamine (19). Although indiscriminate prescription is frequently linked with resistance, both in the community and in healthcare facilities, another important contributing factor might well be self-medication (55).

## The consequences of antimicrobial use: antimicrobial resistance

Antimicrobial resistance is recognised as a major public health problem (5). This is because antimicrobial agents are unlike any other drug class. Their use has consequences both for the patient and for society at large. This applies to antibacterial agents as well as all other antimicrobial agents. This phenomenon was rightly referred to as ‘collateral damage’ in a recently published expert review (26) and previously by Paterson, who in 2004 referred to the collateral damage caused by the ‘usual suspects’ cephalosporins and fluoroquinolones (71). Such collateral damage is a legitimate price to pay when the antimicrobial agent is prescribed in an evidence-based manner. However, in the mid-1950s more than 80% of patients with acute bronchitis were treated with penicillin even though research now tells us that this treatment was not evidence based and was probably futile (59).

Another type of collateral damage is the development of asthma and atopic allergy in children who are exposed to antibiotics in the first six weeks of life: these children are more likely than non-exposed children to develop these conditions by the age of six (77). One more area in which the value of using antibiotics is questionable is in end-of-life situations. In many cases the patient under treatment will not benefit from antibiotics, thus causing potential harm to other patients in the same facility and possibly future patients, as this process promotes the harbouring of resistant strains (70). However, a major driver for development of resistance is the fact that in developing countries the drugs available may be of poor quality (47). However, the country where a resistance mechanism is first described is not necessarily the country of origin. The

novel New Delhi metallo-beta-lactamase (NDM-1) was first described in the Indian subcontinent but has also been identified in North America and Europe and to date there is no evidence of its exact origins (68, 95).

## Antibiotics in developing countries

Developing countries are often low-income countries with scanty resources for surveillance of antibiotic consumption. Thus, effective intervention in the form of antimicrobial stewardship is not possible due to both the lack of funds and resources as well as the lack of identification of major areas where interventions are most effective. Additionally, antibiotics can often be purchased without a prescription from licensed medicine stalls and drugstores, roadside stalls and hawkers even when this practice is forbidden by law (74).

The Mediterranean region has been identified as a geographic area having a problem of antibiotic resistance. Data from the European Antimicrobial Resistance Surveillance System (EARSS, [www.earss.rivm.nl](http://www.earss.rivm.nl)) showed that higher resistance rates were found in the Mediterranean EU participant countries than in northern EU countries. This information led to the inception of the Antibiotic Resistance in the Mediterranean Region project (ARMed) that gathered antimicrobial consumption and resistance data in the Mediterranean region between 2003 and 2005. Participating countries included North African and Middle Eastern countries, EU applicant countries, and Turkey (11). Antimicrobial consumption data from ARMed participants were only available from voluntarily participating hospitals and is not representative of the respective countries. However, data highlighted an overall high consumption in the southern Mediterranean region, with a median of 112 ‘defined daily doses (DDD) per 100 occupied beds’ (DBD) for the study period (2004–2005) (12). This was much higher than the European (2001) median of 49.6 DBD, with a southern European median of 72.2 DBD reported by the EC-funded study Antibiotic Resistance Prevention and Control (ARPAC) (60, 61). (Note: ARPAC is discussed later in this manuscript.)

## Examples of surveillance systems of antibiotic use in humans in developed countries

There is no single standardised uniform method to monitor antimicrobial consumption in humans. There are various

reasons for this, including the fact that certain methods apply exclusively to a specific setting. Thus, the number of packages consumed over a period of time (usually one year) would apply only to ambulatory care (AC) since hospital packs are bulk packs, often equivalent to more than a single prescription or patient. On the other hand 'Point Prevalence Surveys' (PPS) apply only to institutional care as this methodology would not be feasible in the community. Furthermore, not all countries have the resources and databases to extract certain levels of detail. For example, countries that do not have a reimbursement system would not have a national database providing the number of treated patients (or prescriptions) or the number of packages used, over a given period of time. Table I presents a summary of types of surveillance methods and their respective applicability.

### ABS International: antibiotic strategies for appropriate use of antibiotics in hospitals in member states of the European Union

A two-year (2006–2008) project entitled: Implementing antibiotic strategies for appropriate use of antibiotics in hospitals in member states of the EU (ABS International), co-financed by the EU through the Programme of Community Action in the Field of Public Health, looked into the effect of antibiotic stewardship in nine partner EU

countries. ABS International only focused on hospital care (HC) but recommended further studies dealing with stewardship in AC (3). It showed how different projects can be utilised in order to cover a large proportion of possible actions against antibiotic resistance. In fact, data generated by EARSS and the European Surveillance of Antimicrobial Consumption (ESAC) programme were considered an essential prerequisite for targeted interventions to cope with the problem of antibiotic resistance, the aim of ABS International (65). Sweden is one of the better-performing countries in regard to the containment of antibiotic resistance. Indeed, there is close multisectorial collaboration in human and veterinary medicine supported by the Swedish Government (83).

### Antibiotic resistance prevention and control: ARPAC

The ARPAC study was a Concerted Action project funded by the EC Directorate-General for Research and Innovation within the Fifth Framework Programme under the auspices of the European Society for Clinical Microbiology and Infectious Diseases (ESCMID). The project took a snapshot (year of study 2001) of various aspects including resistance, prescribing policies, and infection control practices in a number of European hospitals.

**Table I**  
**Methods used for measuring human antimicrobial consumption**

Type of survey	Population type	Preferred catchment	Numerator	Denominator	Comments	Study period
<b>Longitudinal surveys</b>						
Continuous – either retrospective and/or prospective	AC; HC; LTCF	Census data in all population types: – entire nation – entire region  HC and LTCF: – entire institution	All population types: – DDD – DOT – number of prescriptions  AC only – number of packages	AC, HC or LTCF: – per 1,000 inhabitant-days HC and LTCF: – per 100 patient-days (also known as 100 bed-days) – per 100 admissions	Suitable for identifying changing trends in classes/route of administration or overall consumption	In both AC and HC data collection can take place monthly, quarterly or annually
<b>Point prevalence surveys</b>						
Snapshot data which, if repeated periodically, can still analyse trends and impact of interventions	HC and LTCF	HC and LTCF: – entire institution or – previously identified units/wards requiring closer monitoring within the institution	HC and LTCF: – patients on treatment including multiple drugs	HC: – total in-patient population LTCF: – total residents	More appropriate for linking use with indication	This is meant to be a snapshot, so ideally it should be carried out on a single day or in the minimum number of days feasible depending on human resources

AC: ambulatory care  
DDD: defined daily doses

DOT: days of treatment  
HC: hospital care

LTCF: nursing homes and long-term care facilities

Pharmacists are key members of any antimicrobial stewardship programme. One of the major issues identified by ARPAC was the lack of clinical pharmacy services on antibiotics (61). Apart from quantifying use and identifying regional differences between participating hospitals, the final consensus conference of ARPAC issued a number of basic recommendations for hospitals, countries, and Europe as a whole, despite the fact that not all regions of Europe were included in the survey. These recommendations were classified as 'high-priority' or 'desirable' depending on their importance and feasibility (61). The high-priority recommendations for hospitals included participation in multinational surveillance projects. One such project is the European surveillance of antimicrobial consumption (ESAC) programme. This programme, which has been ongoing since 2001, collects retrospective data dating back to 1997.

### **European surveillance of antimicrobial consumption: ESAC**

The EU acknowledged antimicrobial resistance and healthcare-associated infections as public health concerns back in 1999 (31). The need for surveillance of antimicrobial consumption was recognised a year later (13). In 2001 the DG SANCO Health Monitoring Programme issued a Council Recommendation on the prudent use of antimicrobial agents in human medicine (32). This led to the development of ESAC, with the aim of collecting comparable and reliable European antimicrobial consumption data (89). The ESAC programme was initially launched as a pilot project (ESAC-1: 2001–2004), the main objectives of which included the harmonisation of data collection on antimicrobial use through an international network of national surveillance systems in participating countries. Thus, the Anatomical Therapeutic Chemical (ATC) classification and the DDD were selected as the numerator for national data sets, whilst the denominator chosen was the number of inhabitants (based on the mid-year population of the country). National antimicrobial consumption was therefore represented as DDD per 1,000 inhabitants per day (DID) (35).

Another three-year term was approved (ESAC-2: 2004–2007) by DG SANCO and the European Centre for Disease Prevention and Control (ECDC) provided funding for a further three months. The final phase of ESAC (ESAC-3: 2007–2010) was supported by the ECDC. The ESAC project collected data on AC and HC at a national level. Furthermore, in the second and third phases of ESAC four sub-projects (covering AC and HC in more detail and looking at socio-economic issues and nursing homes) provided more in-depth information (94). A final extension was granted by ECDC till June 2011.

Most consumption studies have been carried out in hospitals, but prior to ESAC, most of these studies did not use standardised numerator/denominator criteria. For example, a figure for total antimicrobial consumption quoted in DBD might include only systemic antibacterial (ATC code J01) or anti-infective agents (ATC code J), which would hamper the comparison of results between different studies (53). The main indication in Europe for oral and rectal metronidazole (ATC code P01AB01) is anaerobic bacterial infection (89, 90). Therefore, ESAC included this category in all antimicrobial data collection protocols. Initially ESAC used national data even for hospitals using 'DDD/1,000 inhabitant-days' (DID) rather than DBD or DDD/100 admissions (DAD) (90). The DID is the standard method for reporting outpatient use or population-based consumption data.

The data source may also have implications for study results. Indeed, in Spain the reimbursement data showed a 30% lower DID than the sales data (17). Furthermore, there were regional differences in the results in some countries. In the UK, for example, where there are four independent administrations, antimicrobial consumption was 37% lower in England than in Northern Ireland (24). This suggests that other countries might also have varying consumption patterns, especially larger countries where regional administrations have more executive power on health.

In ESAC-1, 21 countries delivered suitable AC data and 14 countries provided valid HC data for a number of years within the study period (1997–2001) making it possible to obtain a valid estimate of total exposure to antibiotics in 17 of the 31 participating countries (89). Corrections for various sources of bias and appropriateness of ATC/DDD assignment were needed during data mining (89). In ESAC-2 the HC sub-project analysed data from sample hospitals in 20 countries (one hospital in each country) in the PPS and 18 of these also participated in the detailed longitudinal study (6, 7, 93). Similar data were collected from more hospitals during ESAC-3 (4, 92).

The ESAC PPS methodology has been adapted for a project relating specifically to children: 'Antibiotic Resistance and Prescribing in European Children' (ARPEC) (50). The web-based method piloted for PPS in ESAC-2 offered a standardised platform that made it possible to undertake further detailed analysis of the PPS data collected in ESAC-3, which helped in the identification of targets for quality improvement (4, 92).

The ESAC project also identified 12 quality indicators for antibiotic use that are potentially applicable in AC. These could be used to better describe antibiotic use in AC and help assess the quality of antibiotic prescribing patterns in Europe (21). Correlations between high antimicrobial resistance and high-level prescribing (especially of wide-

spectrum antibiotics) and between high antimicrobial resistance and seasonal variation in AC were also identified (40). This possible correlation between high consumption and high levels of resistance was also identified in a joint ESAC/EARSS collaboration that recommended interventions designed to reduce antimicrobial drug consumption at a national level in Europe in order to halt the development of resistance (88).

The level of total AC antimicrobial use across Europe varied considerably (37, 67). Indeed, such differences were also observed for different drug classes, namely: antifungals (1); fluoroquinolones (38); cephalosporins (20); penicillins (36); and macrolides, lincosamides, streptogramins and ketolides (22). Differences were also observed for the level of outpatient parenteral antibiotic treatment (23). However, the overall antimicrobial use in Europe is lower than the average in the United States (25 DID) with only three of 27 European countries having a higher level of use (39). The European median for 1997 to 2002 was 20 DID (30).

## European surveillance of veterinary antimicrobial consumption: ESVAC

An adaptation of ESAC methodology for veterinary use of antimicrobials is currently in its infancy. This project, the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC), is being undertaken by the European Medicines Agency (EMA) (34). The ESVAC inclusion criteria and data collection protocol are available on the EMA website ([www.emea.europa.eu](http://www.emea.europa.eu)) (33). The need for a surveillance system like ESVAC is obvious since only ten EU countries have data on the type and amount of antibiotics used in Veterinary Services. A wide range of uses, not completely explained by animal-species demographics, has been identified in these ten countries, but the data are not comprehensive enough as they do not include details at the level of the animal species (42).

## Lack of novel drug classes

An alarming reality is that we have been facing a shortage of new drug classes for the past quarter of a century. The challenges to antibacterial discovery have kept the development and marketing of novel antibacterial drug classes to extraordinarily low levels even though research and development programmes have been in place within pharmaceutical companies as well as academic laboratories (82).

## Conclusions

The lack of drugs with novel mechanisms of action and the increased frequency of reports of multiple-drug-resistant microorganisms should be a cause for concern for all healthcare professionals involved in antimicrobial prescribing. Such microorganisms cannot be prevented from crossing political borders and they can be transmitted from species to species. Thus antimicrobial use and resistance in animal husbandry should be monitored in ways that are similar to those used in human medicine. For animal use the denominator would probably be 'tons of livestock', best separated into categories such as 'live' (e.g. dairy cattle or layers) and 'meat-products' (e.g. chicken, pork and beef, etc.). Once countries have national antimicrobial consumption data both for humans and for animals, it will be possible to determine the correlation between human use and animal use and to carry out a comparison of antibiotic consumption across countries. Consumption data will also help to ascertain the relationship between antibiotic pressure and resistance.



## Utilisation des agents antimicrobiens en médecine humaine

P. Zarb & H. Goossens

### Résumé

Grâce aux antibiotiques, l'espèce humaine a gagné en espérance de vie. Dans nombre de pays où les antibiotiques ne sont délivrés que sur ordonnance, cette contrainte est contournée par un recours à l'automédication, y compris via Internet. L'un des dommages collatéraux induits par l'utilisation des antibiotiques est l'apparition de résistances, phénomène qu'il serait possible de maîtriser en empêchant l'utilisation inappropriée d'antibiotiques telle qu'elle est pratiquée aujourd'hui dans le monde, en particulier dans les pays à faible revenu. La surveillance de l'antibiorésistance fait ressortir l'existence de tendances dans les structures de la résistance, ainsi qu'une émergence de résistances nouvelles. La surveillance de la consommation d'antibiotiques permet d'identifier et de cibler certaines pratiques particulières en vue d'améliorer la qualité du service rendu aussi bien en médecine courante que dans les structures hospitalières. Les initiatives de gestion des agents antimicrobiens et les programmes de lutte contre les infections jouent un rôle important pour réduire les utilisations inappropriées et mettre un terme à la dissémination des résistances. La sensibilisation des professionnels et de la société en général devrait être axée sur une modification des comportements plutôt que sur la seule diffusion des connaissances, dans la mesure où celles-ci ont souvent pour effet paradoxal d'accroître la demande et de multiplier les prescriptions. Ce changement de comportement doit s'adresser à toute personne délivrant des ordonnances, y compris les vétérinaires, puisque les microbes ne connaissent pas de frontières entre les animaux et l'être humain et que les gènes codant pour la résistance peuvent être transférés d'une bactérie à l'autre.

### Mots-clés

Antibiorésistance – Automédication – Classification légale des agents antimicrobiens – Consommation d'antibiotiques en médecine humaine – Consommation d'antibiotiques en médecine vétérinaire – Gestion des agents antimicrobiens.



## Uso de agentes antimicrobianos en el hombre

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### Resumen

Los antibióticos han acrecentado la esperanza de vida. La automedicación, incluso a través de internet, es moneda corriente en muchos países donde los antibióticos se venden únicamente con prescripción médica. Entre otros daños colaterales, el empleo de estos productos lleva a la aparición de resistencias, que sería posible reducir conteniendo el uso inadecuado de antibióticos que tiene lugar a escala mundial, sobre todo en países de renta baja. La vigilancia sirve para determinar tendencias en los patrones de resistencia y detectar la aparición de nuevos microorganismos resistentes. Con la vigilancia del consumo de agentes antimicrobianos se pueden acotar áreas de trabajo e incidir especialmente en ellas para mejorar la calidad tanto en los centros de ámbito

comunitario como en los establecimientos de salud. Las iniciativas de gestión de agentes antimicrobianos y los programas de lucha contra las infecciones cumplen una importante función para reducir el uso inadecuado de esos fármacos y atajar la diseminación de resistencias. La formación de profesionales y ciudadanos no debería apuntar exclusivamente a ofrecer mayores conocimientos, sino también a modificar una serie de hábitos, pues lo primero podría tener la paradójica consecuencia de incrementar los niveles de demanda y prescripción. Este cambio de comportamiento debería interesar a todos los prescriptores, incluidos los veterinarios, por cuanto los microbios no conocen fronteras entre el hombre y los animales y pueden intercambiar genes de resistencia.

#### Palabras clave

Automedicación – Clasificación legal de los agentes antimicrobianos – Consumo de agentes antimicrobianos en medicina veterinaria – Consumo humano de agentes antimicrobianos – Gestión de agentes antimicrobianos – Resistencia a los agentes antimicrobianos – Vigilancia.



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