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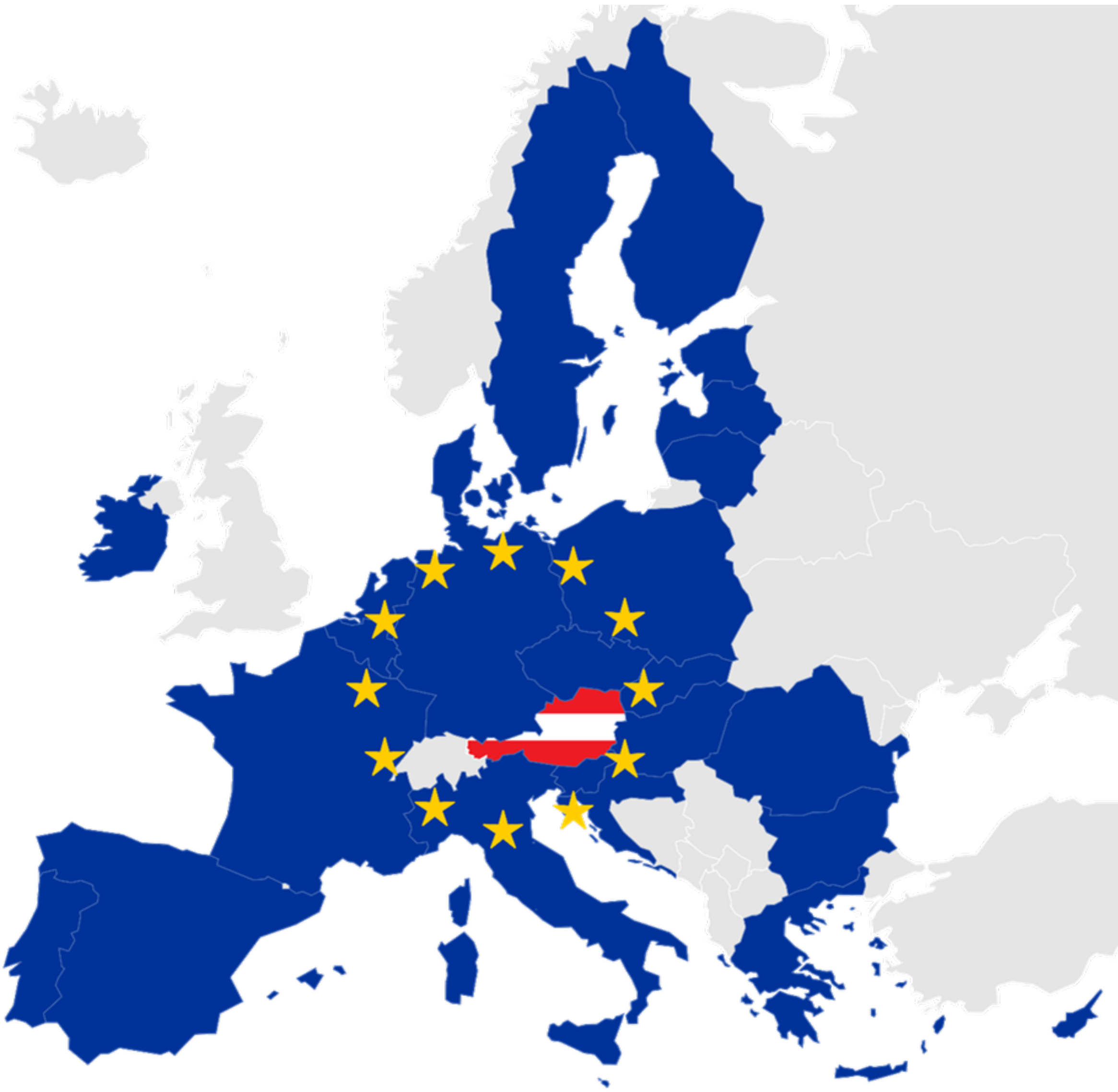
Republic of Austria
Social Affairs, Health, Care
and Consumer Protection

Resistance Report Austria
AURES 2018

Summary



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Introduction

The present summary of the AURES 2018 has resulted from the full version of the AURES 2018, an inter-departmental co-operation in the field of human and veterinary medicine as well as food technology. Like in the reports of the previous years, the aim of the AURES 2018 is the sustainable and comparative illustration of representative data on antimicrobial resistance and on the consumption of antimicrobial agents with special consideration of Austrian characteristics and development trends over time. The data provided by National Reference Centres, appointed by the Federal Ministry of Social Affairs, Health, Care and Consumer Protection, and the respective projects are illustrated in separate chapters. This method has been chosen in order to take into account the different approaches used in data collection. Direct comparison with data from veterinary medicine and human medicine is only possible to a limited extent at the present on account of the use of different test procedures and/or laboratory methods and antimicrobial limit values (epidemiological cut-offs and clinical limit values). The AURES provides data for a comprehensive professional discussion and will subsequently contribute to the optimization of the use of antimicrobial agents in Austria. The present short version is composed of the summaries of the individual chapters of the AURES. In this way, a first introduction to the subject of antimicrobial resistance and a brief survey on the situation in Austria will be made available. Details on the individual chapters may be found in the long version of the AURES 2018.

Initial Situation

For decades, antibiotics have been used for the treatment and prevention of infectious diseases and infections. Antimicrobial use has highly contributed to the improvement of health in humans and animals. Antibiotics are indispensable in modern medicine and procedures: transplantations, cancer treatment via chemotherapy or orthopaedic surgery, all of these could not be performed without antibiotics. Their wide application, however, is associated with a steady increase of resistant microorganisms. The Health Ministers of the European Union issued a declaration in 2012, emphasizing that the increasing antibiotic resistance in Europe and worldwide constitutes a growing health threat for humans and animals, leading to limited or inadequate treatment options and, therefore, diminishing the quality of life [1]. "Antimicrobial resistance: no action today, no cure tomorrow" was chosen as the primary issue by the World Health Organization at the World Health Day on April 7th, 2011 [2]. Since 2008, on the initiative of the European Parliament, the European Antibiotics Day has been held every year on November 18th with the aim of informing professionals and the public about the prudent use of antimicrobials. The problem of antimicrobial resistance has been furthermore set as a "Key Priority" in the 2015 working programme of the European Commission [3]. Antibiotic resistance was part of the agenda of the G7 Summit in 2015 in Schloss Elmau, Germany. The global action plan of the WHO is to be supported and promoted. The G7 member nations aim to follow a "One-Health"-approach [4].

The use of antibacterial agents for the treatment of viral infections, the unjustified use of wide spectrum agents, elongated "prophylactic" use of antibiotics in surgical interventions and the use of antibiotics in the case of mere colonization (and not infection) of the patient are considered the essential reasons and causes of antimicrobial resistance in human medicine. Patients, or in the case of children their parents, demanding therapy further contributes to the improper use of antibiotics. There is a clear causal relationship between the use of antibiotics and the development of bacterial resistance both for infections patients treated by local practitioners and nosocomial infections. [5]. In the Council Recommendation of November 15, 2001 for the prudent use of antimicrobial agents in human medicine, the member states were asked to ensure that specific strategies for the prudent use of antimicrobial agents are available and are implemented with the goal to limit the increase of microorganisms being resistant to these agents [6].

Attempts to reduce the development of resistance through a rational use of antibiotics by general practitioners have been found Europe-wide [7]. These efforts are mainly directed at the omission of antibiotic use in the treatment of viral infections. The fact that high-quality microbiological diagnostics are not available throughout Austria often hinders the physician to clearly identify infections which require antimicrobial therapies; in addition, it is frequently only possible to start with a very broad antimicrobial therapy. This results in unnecessary use of antibiotics and the preferred use of agents having a wide range of effect – both being factors that promote the development of antibiotic resistance due to innate selection pressure. Due to the improved treatability of viral diseases, drug-resistant viruses are also gaining increasing importance. The biggest hazard caused by drug-resistant viruses is currently posed by HIV infection. This may lead to limited or absent effectiveness of anti-retroviral therapy in patients already in treatment and in persons newly infected with these resistant viruses.

In hospitals, especially in intensive care units, multi-resistant hospital pathogens have been considered a daily occurring problem. The combination of “immunocompromised” patients, intensive and prolonged use of antibiotics as well as the transmission of pathogens between patients will lead to the occurrence of infections with multi-resistant pathogens, which are sometimes no longer responsive to antibiotic therapy. In the document “WHO Global Strategy for Containment of Antimicrobial Resistance”, the World Health Organization refers to hospitals as “a critical component of the antimicrobial resistance problem worldwide” [8].

Although it is still true that “most of the problems with resistance in human medicine are correlated to use of antimicrobials in humans“, it is currently in no way doubted that, regarding food of animal origin, the topic of antibiotic resistance is also of significance [9, 10]. As early as 2008, the Panel on Biological Hazards (BIOHAZ) of the European Food Safety Authority (EFSA) recommended the development and implementation of specific measures for the control of raw poultry, pork and beef, wherein measures to counter antibiotic resistance were classified as a priority [11]. Already since 2004, compulsory surveillance of the prevalence of zoonoses and selected zoonotic pathogens as well as their susceptibility to antimicrobial agents in the livestock population, has been carried out in the veterinary field in Austria (in the form of randomized sampling schemes in healthy slaughtered animals – cattle, pork, poultry) [12]. The OIE (World Organization for Animal Health) has developed recommendations for countering antimicrobial resistance in order to protect the health of animals and ensure food safety [13]. In regard to the surveillance of the antibiotic resistance and the ascertainment of antibiotics volume flows there have been existent guidelines for the harmonization of national programmes as well as recommendations on the prudent use of antibiotics in veterinary medicine and on the risk assessment of antibiotic resistance in the treatment of animals as well as for laboratory methods for the detection of antibiotic resistance.

The problem of increasing antibiotic resistance of human pathogens requires the willingness of all fields and sectors involved (human medicine, veterinary medicine, primary livestock production, food processing and food preparation, consumers) to assume responsibility in their respective areas of influence in order to impede the development and further distribution of antimicrobial resistance. In July 2019 the World Health Organization (WHO) presented the Global Action Plan to combat the distribution of multiresistant pathogens, which constitutes one of the “most pressing health risks of our time and a threat to medical advancements of a century”, according to WHO-Director General Tedros Adhanom Ghebreyesus [14].

In 2016 the conclusions of the Council regarding the next steps within the concept of “One Health” for combatting antimicrobial resistance were published [15]. On September 21, 2016, the problem of antimicrobial resistances was addressed at a General Assembly of the United Nations [16]. As a result a political declaration was published (“Political declaration of the high-level meeting of the General Assembly on antimicrobial resistance“) [17] as well as the establishment of a working group (Interagency Coordination Group on Antimicrobial Resistance – IACG), who’s report was published as “No Time to Wait: securing the future from drug-resistant infections” in April 2019 [18]. The European Commission published a new action plan against antimicrobial resistance in 2017 [19].

The European Commission published the “Council conclusions on the next steps towards making the EU a best practice region in combatting antimicrobial resistance” in 2019 [20] Co-ordinated measures for countering the distribution of antimicrobial resistance require the use of surveillance systems. Only then is it possible to assess how local and global resistance situations will react to an altered use of antibiotics and new measures for infection control. In the field of human medicine, many Austrian hospitals participate in the European system for the surveillance of resistance to antimicrobial agents (“European Antimicrobial Resistance Surveillance Network” [EARS-Net]) and in the “European Surveillance of Antibiotic Consumption Network“(ESAC-Net). EARS-Net and ESAC-Net are surveillance programmes initiated by the community and confirmed in their importance by the EU Council, wherein standardized, harmonized and comparative human medicine data on the resistance to bacterial pathogens and/or the use of antibiotics are sampled and collected [1]. The Resistance Report on hand makes the data acquired within the network of the Austria-wide resistance surveillance available to the public.

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Antimicrobial resistance in selected bacterial invasive pathegens

Data from the human sector

An activity by the National Reference Centre for nosocomial infections and antibiotic resistance within the scope of participation in the European Antimicrobial Resistance Surveillance Network (EARS-Net)

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European Antimicrobial Resistance Surveillance Network (EARS-Net)

The Austrian EARS-Net data represent the data of 129 acute care hospitals. The resistance rates of the invasive indicator pathogens, hence, constitute a reliably measured substitute value for the prevalence of the resistance of the respective pathogens in relation to the selected antibiotic substances. In 2011 Austrian laboratories, that offered microbiological services, switched from CLSI to EUCAST, a process that was finished in 2012. The Austrian results for 2018 may be summarized as follows:

Streptococcus pneumoniae: with regard to penicillin, the resistance rates are stable at a low level. According to EUCAST breakpoints differ with regard to to clinical indication and intended formulation of administration, isolates having a MHK of > 2 mg/l would be regarded as highly resistant. In 2018 two such isolates were detected in Austria. Based on the strict Meningitis breakpoints, 7 invasive isolates proved to be resistant to penicillin in the year 2018 (1.3 %). The resistance rateof macrolides slightly increased from 11.2 % to 11.6 % in the last year.

The **MRSA rate** continuously decreased for the last five years, with an actual rate of 6.4 % in 2018. No reduced susceptibility to (resistance against) vancomycin was detected and confirmed in the year 2018 in any invasive *S. aureus* isolate.

Escherichia coli: the resistance rate with regard to aminopenicillins (50.7 %) remained stably on a high level since 2014. In comparison to 2017, the resistance rate has increased with regard to fluoroquinolones (from 20.5% to 21.90 %), 3rd generation cephalosporins (from 9.6 % to 10.2 %) and aminoglycosides (from 7.7 % to 8.2 %), respectively.

In **enterococci**, the resistance rate of aminopenicillin was stable in comparison to the previous years. Aminoglykosidresistance rates in comparison to 2017, decreased for *Enterococcus faecalis* (from 33.1% to 28.3%) and for *Enterococcus faecium* (from 41.3 % to 30.8 %). In 2018, the **VRE** rate in Enterococcus faecalis was 0.4 % and 2.1 % in *Enterococcus faecium*.

The resistance rate of ***Klebsiella pneumoniae*** with regard to fluoroquinolones increased until 2017 and remained stable for 3rd generation cephalosporins and with aminoglycosides until 2017. In comparison to 2017, in 2018 the resistance rate in regard to fluoroquinolones has decreased (from 14.2 % to 13.2 %) as well as in regard to 3rd generation cephalosporins (from 8.6 % to 8.4 %). The resistance rate in regard to aminoglycosides remained stable with 4.8 %.

Carbapenemase producing isolates: In 2017, four invasive *Escherichia coli* isolate strains and 14 invasive strains of *Klebsiella pneumonia* were reported.

Pseudomonas aeruginosa**:** a decrease of the resistance rate to 12.8 % (-1.1 %) was shown in 2018 with regard to carbapenems. The resistance rates with regard to aminoglycosides, however, increased to 6.3 % (+1.3 %), with regard to fluoroquinolones to 14 % (-1.7 %), in regard to ceftazidime to 10.3 % (+1.6 %) and in regard to piperacillin/tazobactam to 13.6 % (+0.1 %).

On the basis of only 95 isolates in total, ***Acinetobacter*** **spp.** showed resistance rates in regard to aminoglycosides of 8.7 %, in regard to fluoroquinolones of 7.7 % and in regard to carbapenems of 4.4 %, respectively.

In total, comparing the last 5-years, there was a declining trend in resistance rates in Austria. focussing on nosocomial gram-positive pathogens like MRSAand VRE. Multidrug resistant gramnegative bacteria remain a rather problematic field with again a slight increase of fluoroquinolone resistance being detectable in 2018.

The full report can be found in the long version of the **AURES 2018** from page 27 to page 125 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Project report CARBA-NET

Data from the human sector

An activity by the National Reference Centre for nosocomial infections and antibiotic resistance

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Increasing numbers of carbapenemase producing gram-negative bacteria are reported worldwide[1]. Therefore, the surveillance project CARBA-Net was initiated in April 2015. In 2018 in 153 out of 226 *Enterobacterales* strains referred to the Austrian National Reference Laboratory due to decreased carbapenem susceptibility, a carbapenemase gene was confirmed. The enzymes could be assigned to Ambler classes A (*bla*KPC [n=16]), B (*bla*VIM [n=65] and *bla*NDM [n=34]) and D (*bla*OXA-48 like [n=32]) and one combination of *bla*NDM like und *bla*OXA-48 like). No *mcr*-1 plasmid encoded variant of Colistin resistance was detected. With regard to other gram-negative bacilli, 34 out of 88 suspected Pseudomonas aeruginosa isolates were positive for a metallo-beta-lactamase (blaVIM [n=26], *bla*FIM [n=1] *bla*IMP [n=6] and *bla*NDM [n=1]) and 42 out of 43 Acinetobacter baumannii complex isolates gave a positive result for at least one carbapenemase gene.

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Resistance report for selected non-invasive pathogens

Data from the human sector

An activity of the working group resistance reporting

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The resistance report on selected non-invasive pathogens supplements EARS-Net, which focuses on blood culture and cerebrospinal fluid, and therefore completes the assessment of the resistance situation in Austria with regard to important bacterial pathogens. The spectrum comprises key pathogens of infections of the respiratory and urinary tract but also *S. aureus* and ß-haemolysing group A streptococci from various clinical materials. For this reason, data supplied by the routine diagnostics of 12 Austrian laboratories operating on microbiological diagnostics have been summarized, evaluated and presented.

In the present AURES, the results are arranged in a colour-coded ranking system, which quickly offers an assessment of empirical therapy options and aims at facilitating the comparison with the EARS-Net numbers. In order to further provide a review over the last 5 years with the respective resistance developments, the separation between hospital and outpatient settings has been maintained, where appropriate. For the second time, however, resistance numbers were also presented cumulatively for both fields of practice.

Summary of the data of 2018:

1. **Respiratory tract:** ß-haemolytic group A streptococci (n=2,238) show a lower macrolide resistance than pneumococci (n=1,346) (7.3 % versus 16.3 %). The trend observed last year thus remains more or less unchanged. The macrolide resistance for pneumococci, hence, lies above that of the invasive pneumococci with 11.6 % (EARS-Net AT). The resistance rates with ***H. influenzae*** (n=3,033) are for aminopenicillins 18.0 %, for aminopenicillins with beta-lactamase inhibitor 6.6 % and for fluoroquinolones 1.0 %.
2. **Urinary tract:** The Ceph3-resistance rate for *E. coli* isolates (n=51,853) in total has been about the same with 7.8 % for the last two years. The fluoroquinolones and sulfamethoxazole/trimethoprim show the highest resistance rates with 16.4 % and 22.5 %, respectively.
   Klebsiella pneumoniae (n=10,833): The resistance with regard to 3rd generation cephalosporins was 7.7 % in 2018, the cabapenem resistance amounts to 1.0 %.
3. ***Staphylococcus aureus:*** MRSA (n=1,711): With no major changes compared to the year before, the MRSA rate was 6.9 %. No linezolid or vancomycin resistant strain was isolated.
4. ***Pseudomonas aeruginosa*****:** In tracheal secretion (n=966), a regressive tendency with regard to the resistance of all indicator substances, in particular with regard to piperacillin/tazobactam (18.8 %) is determined. The carbapenem resistance currently amounts to 15.2%, with the ceftazidime resistance being 17.4 %. With ear swabs (n=1,188), there is currently a resistance rate of 4.3 % with regard to aminoglycosides and 6.1 % with regard to ciprofloxacin.

In conclusion, resistance rates of non-invasive pathogens are stable in Austria, which, except for only a few exemptions (e.g., MRSA), indicates hardly any differences between hospital and outpatient setting. Empiric therapy options will further be existent for all pathogens, wherein with the gram-negative pathogens the importance of the antibiogram is steadily increasing due to the resistance rates: for many substances, the resistance rates determined range between 10 and 25 %. A resistance rate that lies within this range would imply that the respective antibiotic should only be used following antimicrobial susceptibility testing.

The full report can be found in the long version of the **AURES 2018** from page 140 to page 177 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Resistance report *Neisseria meningitidis*

An activity of the National Reference Centre for Meningococci

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The National Reference Centre for Meningococci received 55 culturable isolates in 2018. Of these, 15 isolates were from invasive infections. Twenty-six of the 55 isolates were polyagglutinable (PA) (47.3 %), 18 serogroup B (32.7 %), 7 serogroup Y (12.7 %), 2 serogroup C (3.6 %) and 2 were serogroup W (3.6 %).

According to EUCAST, 17 isolates showed reduced susceptibility to penicillin. Six non-invasive isolates were resistant to penicillin (MHK > 0.25 mg/L).

The full report can be found in the long version of the **AURES 2018** from page 178 to page 186 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Resistance report *Campylobacter*

Data from the human and food sector

An activity of the National Reference Centre for *Campylobacter*/the National Reference Laboratory for *Campylobacter* from food and feed products

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In 2018, a total of 7,981 cases of campylobacteriosis was reported in Austria (EMS as of February 12th 2019). Again, a high to very high tetracycline and fluoroquinolone resistance rate, respectively, were found in *C. jejuni* and *C. coli* isolates of human and food (broiler meat) origin. The fluoroquinolone resistance in human isolates increased to 75.6% in *C. jejuni*, in *C. coli* resistance rate was as high as 80.3 %. Resistance against erythromycin remained low and was primarily recorded in *C. coli*.

The full report can be found in the long version of the **AURES 2018** from page 187 to page 200 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Resistance report *Salmonella*

Data from the human, food and veterinary sector

An activity of the National Reference Centre for *Salmonella*

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In 2018, the number of primary human isolates sent to the National Reference Centre for *Salmonella* decreased by 9.6 % as compared to 2017.

Due to the decline of fully susceptible *S.* Enteritidis isolates, there has been a shift towards higher resistance rates in recent years in Austria. The highest resistance rates are found against ampicillin, sulphonamides and tetracycline (resistance pattern typical for multiresistant *S.* Typhimurium strains) and against nalidixic acid (low-level ciprofloxacin resistance), which is typical for *S.* Infantis, and several *S.* Enteritidis subtypes.

High-level resistances against ciprofloxacin and third generation cephalosporins (cefotaxime, ceftazidime) were still extremely rare. The resistance rates among non-human salmonella isolates are partly considerably higher than those among human strains.

The full report can be found in the long version of the **AURES 2018** from page 201 to page 227 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Resistance report *Shigella*

Data from the human sector

An activity of the National Reference Centre for *Shigella*

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In Austria 69 cases of shigellosis were reported to the health authorities in 2018. The incidence rate was 0.78 / 100,000. A total of 66 *Shigella* isolates were received by the National Reference Centre. The predominant species was *Shigella sonnei* accounting for 77.3 % of 66 initial isolates. Resistance testing revealed that four strains were sensitive against all substances tested. We detected resistance against ciprofloxacin in 26 strains and resistance to nalidixic acid in 35 isolates; ten *Shigella* strains were ESBL (extended spectrum ß-lactamase) producers (15.2 %).

The full report can be found in the long version of the **AURES 2018** from page 228 to page 241 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Resistance report *Yersinia*

Data from the human sector

An activity of the National Reference Centre for *Yersinia*

Author/contact person

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In 2018, the Austrian National Reference Centre for *Yersinia* examined 179 isolates of *Yersinia* spp. Of these isolates, 130 were pathogenic, 49 were non-pathogenic. Among the pathogenic isolates 129 belonged to Yersinia enterocolitica and one strain to *Y. pseudotuberculosis*. In 2018, the incidence rate for cases confirmed by the National Reference Centre was 1.48 per 100 000 inhabitants. In vitro susceptibility testing revealed no abnormalities – eighteen *Y. enterocolitica* isolates showed resistance to amoxicillin/clavulanic acid.

The full report can be found in the long version of the **AURES 2018** from page 242 to page 247 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Resistance report Tuberculosis

Data from the human sector

An activity of the National Reference Centre for tuberculosis

Authors/contact persons

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In 2018, 481 cases of tuberculosis (365 confirmed, 72 probable and 44 possible cases) were notified in Austria, which corresponds to an incidence of 5.5/100,000 population. Men were 1.6 times more affected than women were (6.7/100,000 versus 4.3/100,000 population). Among native Austrians, 158 cases (32.8 %) were detected, among Austrian residents born in the WHO region Europe 154 cases (32.1 %) and among residents born outside of the WHO region Europe 169 cases (35.1 %). The lowest incidence of tuberculosis was observed in the age group 5-14 years (1.9/100,000 population) and the highest among the 15-24 years old (7.4/100,000), the latter reflecting the age distribution of TB cases in Austrian residents born outside of Europe. The analysis of the TB incidence trend for the period between 2008 and 2018 yielded a significant decrease of four cases per 1 million native Austrians per year. In 2018, the national reference center for TB confirmed 15 cases of MDR-tuberculosis among non-native Austrians and three cases among the native Austrians. No case of XDR-tuberculosis was registered in 2018.

> The full report can be found in the long version of the **AURES 2018** from page 248 to page 266 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Resistance report *Neisseria gonorrhoeae*

Data from the human sector

An activity of the Nationale Reference Centre for gonococcal

Authors/contact persons

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Due to the rapid emergence of antimicrobial resistance mechanisms in *Neisseria gonorrhoeae* the continuous surveillance of antimicrobial resistance data of *Neisseria gonorrhoeae* is crucial for the control and management of gonorrhea. In 2016 the Institute for Medical Microbiology and Hygiene of AGES (IMED-WIEN) was mandated in collaboration with the Microbiology Laboratory Möst Innsbruck for the tasks of a national reference laboratory for *Neisseria gonorrhoeae*. In 2018, data of 268 *Neisseria gonorrhoeae* isolates were evaluated for their antimicrobial susceptibility. The isolates were provided by 14 Austrian laboratories via a sentinel-system. All isolates showed sensitivity to Ceftriaxone. Resistance rates for Cefixime, Azithromycin, Ciprofloxacin and Tetracycline were 3,4 %, 14,3 %, 56,8 % and 40,6 % respectively. A total of 11,9 % of isolates produced penicillinase (PPNG).

The full report can be found in the long version of the **AURES 2018** from page 267 to page 280 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Resistance report Yeasts

Data from the human sector

An activity of the National Reference Centre for Yeasts

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In 2018, 270 different Candida species from blood cultures were recorded by seven different centers in Austria. *C. albicans* remains the most common pathogen, followed by *C. glabrata*, *C. parapsilosis* and *C. tropicalis*. The majority of candidaemias were found in intensive care units and surgical wards (21 % each), followed by internal wards (14 %).

Thus, a low resistance rate in Candida and other yeasts from blood culture show a low rate of resistance. The highest resistance rate was found in *C. albicans* and itraconazole (26 %), whereby the minimal inhibitory concentration (MIC) values for all strains were only one to three dilutions above the clinical breakpoint.

Echinocandin resistance still is a rare phenomenon. In 2018 only a minor number has been identified as resistant. The highest resistance rate was found in micafungin with 4.5 %. When assessing the MIC distribution of the individual Candida species over the entire observation period, no particularly noticeable changes were observed.

The full report can be found in the long version of the **AURES 2018** from page 281 to page 330 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Resistance report Mould

Data from the human sector

An activity of the National Reference Centre for Mould

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371 moulds out of sterile body sites and bronchoalveolar lavages were collected from the Medical University Vienna, Department of Laboratory Medicine, the Medical University of Innsbruck, Division of Hygiene and Medical Microbiology, the Diagnostic and Research Institute of Hygiene, Microbiology and Environmental Health of the Medical University of Graz and the Hospital Rudolfstiftung Vienna in 2018. *Aspergillus* species, which were isolated in 75 % (280/371), are still the leading causative agents of invasive mould diseases; thereof 79 % (222/280) belong to the *Aspergillus fumigatus* complex.

Apart from *Aspergillus terreus* isolates, which exhibit intrinsic resistance to amphotericin B, 6 % (13/217) of *Aspergillus* isolates showed elevated minimal inhibitory concentrations (MIC > 1 mg/l) against amphotericin B (9 A. flavus-, 2 A. nidulans-isolates, 1 *A. sclerotiorum*- and 1 *A. ochraceus*-isolate); 5 % (11/221) represented elevated MICs (> 0.125 mg/l) against posaconazole (4 *A. flavus*-, 3 *A. niger*-isolates and 1 *A. fumigatus*-, 1 *A. ustus*-, 1 *A. clavatus*- and 1 *A. sclerotiorum*-isolate) and 7 % (5/71) against itraconazole (> 1 mg/l; 1 *A. fumigatus*-, 1 *A. niger*-, 1 *A. ustus*-, 1 *A. clavatus*- and 1 *A. sclerotiorum*-isolate), respectively. Out of 25 *Aspergillus*-isolates (16 *A. fumigatus*-, 3 *A. flavus*-, 2 *A. niger*-, 2 *A. terreus*-isolates, 1 *A. clavatus*- and 1 *A. glaucus*-isolate) tested against isavuconazole, all isolates showed MICs of ≤ 0.5 mg/l and can therefore be valued as susceptible.

Among the non-*Aspergillus* isolates (91/371) elevated MICs above 1 mg/l for amphotericin B, above 0.125 mg/l for posaconazole and above 1 mg/l for voriconazole were detected in 40 % (21/52), 78 % (39/50) and 50 % (24/46) respectively.

The full report can be found in the long version of the **AURES 2018** from page 331 to page 341 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Resistance report of the Austrian HIV cohort study part 1: transmission of drug-resistant HIV in Austria

An activity of the association "Austrian HIV Cohort Study"

Authors/contact persons

Mag.[a] Stefanie Strickner
Univ.-Prof. Dr. Robert Zangerle

Prevalence of Transmitted Drug Resistance is Stabilising at a Low Rate in Austria

Strickner S.[1], Rieger A.[2], Schmied B.[3], Sarcletti M.[4], Öllinger A.[5], Wallner E.[6], Egle A.[7], Kanatschnig M.[8], Zoufaly A.[9], Atzl M.[10], Zangerle R.[4], for the AHIVCOS Study Group

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Objective: To determine the prevalence of transmitted drug resistance (TDR), temporal trends in resistance, and predictors for TDR.

Method: Newly diagnosed patients from 2003 to December 2018 from nine centres were analyzed. Mutations were judged as resistant according to Bennett et al. (WHO 2009 mutation list). For patients with acute or recent infection the year of infection was obtained by the date of primary HIV infection or the median point in time between negative and positive HIV test. For patients with chronic infection the rate of resistance was plotted against the year of the HIV diagnosis.

Results: Overall 3.454 of 5.249 patients had an amplifiable resistance test. The overall prevalence of TDR was 7.2 % (248 of 3.454 patients; 95 % CI: 6.4 %-8.1 %). The prevalence of NRTI resistance was 3.0 % (2.5 %-3.7 %), the prevalence of NNRTI resistance was 2.8 % (2.3 %-3.4 %), and the prevalence of PI resistance was 1.8 % (1.4 %-2.3 %). The relative risk of TDR in men who have sex with men compared to heterosexual contacts was 1.8 (95 % CI: 1.3-2.3). The prevalence rate of TDR in the 1.014 patients with acute/recent infection was 8.1 % (63 of 776 patients; 6.4 %-10.3 %). One patient (0.1 %) showed TDR against 3 drug classes (K70R; K103N; L90M). The prevalence rate of TDR in the 4.212 patients with chronic infection was 6.9 % (185 of 2.678 patients; 6.0 %-7.9 %).

Conclusions: The prevalence of TDR among newly diagnosed patients was found to be stabilizing. No difficult to treat cases of TDR has been observed.

The full report can be found in the long version of the **AURES 2018** from page 342 to page 356 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Resistance report of the Austrian HIV cohort study part 2: resistance development under antiretroviral therapy

An activity of the association “Austrian HIV Cohort Study”

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University Clinic of Dermatology and Venereology

Prevalence of Development of Drug Resistance in HIV infected patients in Austria

Strickner S.[1], Rieger A.[2], Schmied B.[3], Sarcletti M.[4], Öllinger A.[5], Wallner E.[6], Egle A.[7], Kanatschnig M.[8], Zoufaly A.[9], Atzl M.[10], Zangerle R.[4], for the AHIVCOS Study Group

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Objective: To determine the prevalence of development of drug resistance, predictors and temporal trends in resistance.

Method: Patients currently in care in one of nine centres who have ever been on antiretroviral therapy (ART) were analyzed. Mutations were judged as resistant according

to “2017 Update of the Drug Resistance Mutations in HIV-1” from the International Antiviral-Society-USA.

Results: Overall 4.710 patients have ever received ART, 1.332 had a resistance test after ART (28.3 %). The overall prevalence of development of drug resistance was 68.8 % (917 of 1.332 patients), the prevalence of NRTI resistance was 33.0 %, the prevalence of NNRTI resistance was 26.4 %, and the prevalence of PI resistance was 62.2 %. The prevalence of 3-class-resistance was 16.4 % (218 of 1.332 patients). The risk factors for developing a 3-class-resistance were a CD4 nadir <50 (OR=3.5; 95 % CI: 2.3-5.3), a CD4 nadir between 50 and 200 (OR=2.3; 95 % CI: 1.6-3.4) and initial therapy before 1997 (OR=29.0; 95 % CI: 19.1-44.0) as well as from 1997 to 2003 (OR=9.2; 95 % CI: 6.0-14.1) and an age at ART-start <30 (OR=2.3; 95 % CI: 1.2-4.4). The risk to develop a 3-class-resistance was lower in patients with a low viral load (for <50 copies/ml OR=0.3; 95 % CI: 0.2-0.7.

Conclusions: The overall prevalence of development of drug resistance is at a rather high level, while the prevalence of 3-class-resistance was found to be stabilizing at a low level. The risk for developing resistance is small in those who initiated therapy in recent years.

The full report can be found in the long version of the **AURES 2018** from page 357 to page 378 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Occurrence of antimicrobial resistance in bacteria from food-producing animals and in fresh meat in Austria

Report of antibiotic resistance monitoring according to the commission implementing decision 2013/652/EU in Austria

Authors/contact persons

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Since 2014, the Federal Ministry of Social Affairs, Health, Care and Consumer Protection in cooperation with the Austrian Agency for Health and Food Safety (AGES) and officially designated veterinary practitioners in accordance with EU-Directive 2003/99/EC, has conducted annual programs in order to monitor the prevalence and the antimicrobial resistance of certain zoonotic and indicator bacteria in different Austrian farm animal species. Since 2014, based on the Commission Implementing Decision No. 2013/652/EU, the EU-Member States have to monitor and report antimicrobial resistance in zoonotic and commensal bacteria isolated from samples of food producing animals and from food originating from these animals. In 2018, slaughter batches of broilers and turkeys had to be examined for *Campylobacter* (*C.*) *jejuni*, commensal *E. coli*, ß-lactamase- or carbapenemase-producing *E. coli*, as well as fresh chicken meat samples at retail for ß-lactamase- or carbapenemase-producing *E. coli*. Compulsory, all or a maximum of 170 isolates of *Salmonella* obtained from each flocks of laying hens, broilers and turkeys in the course of the *Salmonella* control program but also *Salmonella* from carcases of broilers and turkeys sampled by food business operators at slaughterhouses in accordance with the process hygiene criteria had to be tested. In the respective national reference laboratories the isolates were specified or typed and tested for their antimicrobial susceptibility; on a voluntary basis, all *C. coli* that were identified in the course of *Campylobacter* speciation, were also tested and additionally all fresh chicken meat samples for methicillin resistant *Staphylococcus aureus*.

One *C. jejuni* isolate each from 177 broiler and 64 turkey flocks as well as one *C. coli* from 82 broiler flocks and 54 turkey flocks, isolated from 449 broiler and 204 turkey flocks was susceptibility tested. Full susceptibility against all six antimicrobials tested, was detected in 24.9 % of *C. jejuni* isolates from chicken and 15.6 % from turkeys as well as in 8.6 % of *C. coli* from chicken and 1.9% from turkeys. *C. jejuni*-isolates from both animal species showed similar resistance patterns with very high to extremely high resistance rates against nalidixic acid and ciprofloxacin, and high rates against tetracycline. No resistance was found against erythromycin and gentamicin, low or moderate resistance against streptomycin. In *C. coli* from broilers and turkeys, resistance rates were generally higher than in *C. jejuni*, presenting significant differences between *C. coli* and *C. jejuni* in isolates from turkeys against nalidixic acid and tetracycline (p-value = 0,002 and < 0,001).

Commensal *E. coli* from 174 broiler and 176 turkey flocks were susceptibility tested against 14 antimicrobial substances. Full susceptibility was found in 29.3 % of isolates from broilers and 43.2 % of isolates from turkeys. In *E. coli* from broilers, resistance rates were very high against ciprofloxacin and nalidixic acid (51 % and 54 %), high against tetracycline, sulphonamides and ampicillin (between 26 % and 33 %), and moderate against trimethoprim (19 %). Low resistance rates were found against azithromycin, gentamicin and chloramphenicol (2-5 %), and no resistance was detected against all other tested substances. In contrast, highest resistance rates in isolates from turkeys were identified against ampicillin and tetracycline (33.5 % and 43.8 %), significant lower rates against quinolones (nalidixic acid: 11.4 %; ciprofloxacin: 19.3 %), and moderate rates against trimethoprim and sulphonamides (10.2 % and 19.3 %). Against gentamicin and chloramphenicol the detected resistance rates were low (1.1 % and 6.8 %), very low against 3rd generation cephalosporines (one isolate) and also against azithromycin (another isolate). The single isolate against 3rd generation cephalosporines was confirmed as an ESBL-producing *E. coli*. Differing rates of resistance were found in isolates from broilers against the group of the highest priority critically important antimicrobials (HPCIA) that had been tested, very high resistance was detected against quinolones, low rates against macrolides, but no resistance against 3rd generation cephalosporines and polymyxins. In isolates from turkeys, moderate resistance was found against quinolones, very low rates against 3rd generation cephalosporines and azithromycin, and no resistances against polymyxins. Multidrug resistance, considered as the resistance to at least three antimicrobials of different antimicrobial classes, was observed in 28.7 % of isolates from broilers and 21.0 % of turkeys.

ß-lactamase-producing *E. coli* were found following selective enrichment in 36.0% of 314 tested broiler flocks, in 38.2% of 304 fresh chicken meat samples and 16.2% of 204 turkey flocks. Among the ß-lactamase-producing *E. coli*, the ones with extended spectrum (ESBL) were most commonly identified (68% of all positive samples in broiler flocks, 62% in chicken meat, and 94% in turkey flocks), AmpC-ß-lactamase-producing *E. coli* in 32% and 43% of isolates from broilers and chicken meat and in 6% of isolates from turkeys. In fresh chicken meat samples produced in Austria, the prevalence of ß-lactamase producing *E. coli* was significantly lower than in meat samples produced abroad (p-value < 0,001). Compared with 2016, the prevalence of ß-lactamase producing *E. coli* decreased significantly in samples of broiler flocks, chicken meat and turkey flocks (p-value < 0,001). Carbapenemase-producing *E. coli* could not be detected following selective enrichment in any broiler flock, chicken meat sample and turkey flock.

All commercially produced flocks of layers, broilers, and turkeys are controlled for *Salmonella*. For susceptibility testing, all 40 *Salmonella* isolates from layers, 242 from broilers, of which 170 were randomly chosen, and all 15 isolates from turkeys were available. At slaughterhouses, 55 Salmonella isolates were obtained from broiler carcases but none from turkey carcases. Of all isolates tested, 72.5 % *Salmonella* isolates from layers, 28.2 % from broilers, 46.7% from turkeys and 12.7 % from broiler carcases were fully susceptible against the 14 antimicrobial substances tested. The detection of resistance in all *Salmonella* isolates from poultry corresponds with the occurrence of certain serovars e. g. multidrug resistant

S. Infantis, *S*. Typhimurium including the monophasic variant, *S.* Mbandaka, *S.* Saintpaul, and *S.* Stanley and the decrease of fully sensitive serovars like most *S.* Enteritidis and *S.* Montevideo. Therefore, significant tendencies in resistance rates of *Salmonella* spp. are difficult to determine.

The full report can be found in the long version of the **AURES 2018** from page 379 to page 458 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

European surveillance of veterinary antimicrobial consumption (ESVAC)

An activity of AGES – Agency for Health and Food Safety
Department data, statistics and risk assessment

Authors/contact persons

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Agency for Health and Food Safety
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In 2018, the total sales of active ingredients of antimicrobial agents in Austria for livestock equal 49.85 tons (t) and increased by 5.23 tons (+11.7 %) compared to 2017.

The largest amount of veterinary antimicrobials is forseen for systemic use (more than 90 %), which may take the form of parenteral or oral administration. Within the group for systematic use more than half were tetracyclines, followed by penicillins with extended spectrum, sulfonamides and macrolides.

Oral preparations – this group includes oral powders, oral solutions, tablets and oral paste – are with more than 80% still the most sold application form. Parenteral preparations are on second place with roughly 12%, followed by premix with 3%.

Within the group, which, according to the WHO, are the “Highest Priority Critically Important Antimicrobials (HPCIA)“, there was an increase of 8 % to 5.79 tons. The share in total amount of sold antibiotics is relatively constant at round 12 % over the years.

The full report can be found in the long version of the **AURES 2018** from page 459 to page 471 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Antimicrobial consumption in human medicine in Austria

National Reference Centre for nosocomial infections and antibiotic resistance
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This AURES report presents the consumption of antibiotics in the field human medicine in the year 2018 and is based on prescription data, as provided by the "Hauptverband der österreichischen Sozialversicherungsträger" (The Organisation of Austrian Social Security), and on sales data, as provided by IQVIA™ (former IMS Health Marktforschung GmbH).

Based on sales data, the systemic overall consumption of antibiotics in Austria amounted in the year 2018 in the field of human medicine to 70.271 kg active ingredients, with 67% thereof accounting for registered practitioners.

The consumption density in Austria in 2018, considering the new defined daily doses for certain antibiotics by the WHO, was 15.53 DDD/1,000 inhabitants per day, based on sales data, compared with 10.36 DDD/1,000 inhabitants per day, based on the consumption data by the Sozialversicherungsträger. Compared with the year 2017, the prescriptions of antibiotics decreased from 17.3 to 15.2 per 10,000 inhabitants per day.

Penicillins (J01C) accounted with 42.2% (6.99 DDD/1.000 inhabitants per day) for the largest portion of overall consumption. In the sector of registered practitioners, the penicillins (J01C) were registered with the highest consumption (42.8%; 5.7 DDD/1.000 inhabitants per day), followed by the group of macrolides, lincosamides and streptogramins (J01F) (21%;

2.8 DDD/1.000 inhabitants per day). The same holds for the hospital sector, with a consumption of penicillins (J01C) of 15.3 DDD/100 bed days per year (38.3% of the overall consumption in this sector). The second mostly consumed group of antibiotics in this sector were the cephalosporines (J01D) with 10.6 DDD/100 bed days per year (portion of overall consumption in this sector: 26.4%).

The full report can be found in the long version of the **AURES 2018** from page 472 to page 511 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Resistance report *Erwinia amylovora*

An activity of AGES - Austrian Agency for Health and Food Safety
Sector food security
Institute of sustainable plant production

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Austrian Agency for Health and Food Safety
Sector food security
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Fire blight is one of the most destructive pome fruit diseases. It is caused by the plant pathogenic bacterium *Erwinia amylovora* and is highly infectious. In Austria fire blight can be controlled by the use of streptomycin as plant protection agent amongst other measures. Surveillance activities, implemented since 2006, are established to determine the prevalence of streptomycin resistant *E. amylovora* strains at an early stage. Timely detection of local changes in sensitivity to streptomycin are the bases for triggering adequate actions. Up to date, all *E. amylovora* isolates from treated orchards were susceptible to streptomycin. The comparison of the distribution of minimum inhibitory concentrations between wild-type strains and test-strains did not reveal any shifting of the sensitivity range of the tested isolates.

The full report can be found in the long version of the **AURES 2018** from page 512 to page 523 (https://www.sozialministerium.at/Themen/Gesundheit/Antimikrobielle-Resistenzen-und-Gesundheitssystem-assoziierte-Infektionen/Antimikrobielle-Resistenzen/AURES---der-%C3%B6sterreichische-Antibiotikaresistenz-Bericht.html).

Table 1: Overview contribution summary with authors and contact persons

contributions	authors and contact persons
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Resistance report for selected non-invasive pathogens	**Prim.[a] Univ.-Prof.[in] Dr.[in] Petra Apfalter** **Lucia Berning, MSc** Ordensklinikum Linz GmbH Elisabethinen Institute of Hygiene, Microbiology and Tropical Medicine National Reference Centre for nosocomial infections and antibiotic resistance Fadingerstr. 1 4020 Linz Email: petra.apfalter@analyse.eu
Resistance report *Neisseria meningitidis*	**Mag.[a] Claudia Mikula-Pratschke** Austrian Agency for Health and Food Safety Institute for Medical Microbiology and Hygiene Graz Centre for Foodborne Infectious Diseases Beethovenstr. 6 8010 Graz Email: claudia.mikula-pratschke@ages.at
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