MISSION REPORT

ECDC country visit to Belgium to discuss antimicrobial resistance issues

20-24 November 2017

www.ecdc.europa.eu

ECDC MISSION REPORT

ECDC country visit to Belgium to discuss antimicrobial resistance issues

20–24 November 2017

This report of the European Centre for Disease Prevention and Control (ECDC) was coordinated by Alessandro Cassini, Expert, Antimicrobial Resistance and Healthcare-Associated Infections, ECDC.

Contributing authors
Alessandro Cassini (ECDC), Dominique L. Monnet (ECDC), Andrea Nilsson (ECDC), Catherine Dumartin (France), Cliodna A. M. McNulty (United Kingdom) and Michael Borg (Malta).

This report was sent for consultation to the Belgian Federal Public Service Health, Food Chain Safety and Environment.

Acknowledgements
The ECDC team would like to thank Anne Ingenbleek (Belgian Antibiotic Policy Coordination Commission (BAPCOC) and Lieven De Raedt (Belgian Federal Public Service Health, Food Chain Safety and Environment) for arranging the visit.

Suggested citation: European Centre for Disease Prevention and Control. ECDC country visit to Belgium to discuss antimicrobial resistance issues. Stockholm: ECDC; 2018

Stockholm, July 2018

ISBN 978-92-9498-186-8
doi: 10.2900/065952
Catalogue number TQ-01-18-554-EN-N

Contents

Abbreviations

AMR	antimicrobial resistance
ARHAI	Antimicrobial Resistance and Healthcare-Associated Infections Disease Programme
BAPCOC	Belgian Antibiotic Policy Coordination Committee
CLSI	Clinical and Laboratory Standards Institute
CPE	carbapenemase-producing Enterobacteriaceae
CRP	C-reactive protein
DDD	defined daily doses
EARS-Net	European Antimicrobial Resistance Surveillance Network
ESBL	extended spectrum beta-lactamase
EUCAST	European Committee on Antimicrobial Susceptibility Testing
EuSCAPE	European Survey on Carbapenemase-Producing Enterobacteriaceae
EU/EEA	European Union/European Economic Area
FPS Health	Federal Public Service Health, Food Chain Safety & Environment Belgium
GGA/ABTBG	Groupe de Gestion de l'Antibiothrapie/Anttiibiiottiicattherapiiebelleiidsgroepen (hospital multidisciplinary antibiotic management groups in Belgium)
GP	general practitioner
HAI	healthcare-associated infection
ICM	Intersectoral Coordinating Mechanism
ICU	intensive care units
IPC	infection prevention and control
LA-MRSA	livestock-associated MRSA
LTCF	long-term care facilities
MDRO	multidrug-resistant organisms
MRSA	meticilin-resistant *Staphylococcus aureus*
NDM	New Delhi Metallo-beta-lactamase
NIHDI	National Institute for Health and Disability Insurance, Belgium
NRC	national reference centre
OST	outbreak support team
PPS	point prevalence survey
SSI	surgical site infections
VAP	ventilator-associated pneumonia
VRE	vancomycin-resistant *Enterococcus faecium*
WIV-ISP	Scientific Institute of Public Health, Belgium

Executive summary

Rationale and purpose of the country visit

Council Recommendation of 15 November 2001 on the prudent use of antimicrobial agents in human medicine (2002/77/EC) outlines the threat that AMR poses to human health and advocates for a range of actions to be taken for its prevention and control. Council Conclusions on antimicrobial resistance (AMR) of 10 June 2008 reiterated this call for action.

To assist Member States in implementing the Council Recommendation, ECDC has developed a process for and is carrying out, upon invitation from national authorities, country visits to specifically discuss and assess the situation of the country regarding prevention and control of AMR through prudent use of antibiotics and infection control. These country visits also help document how Member States have approached this implementation and deployed national activities and support the European Commission in evaluating this implementation.

The main output of the visit is a report from the ECDC Team provided to the inviting national authority. To help the ECDC Team ensure consistency of the visits and follow-up of progress of countries, an assessment tool has been developed. The assessment tool includes ten topics. These topics are regarded as core areas for successful prevention and control of AMR and are based on Council Recommendation 2002/77/EC and on Council Conclusions of 10 June 2008. The assessment tool is used as a guide for discussions during the visit.

Following the official invitation by Mr. Tom Auwers, President of the Executive Committee, Belgian Federal Public Service Health, Food Chain Safety and Environment (FPS Health) (23 August 2017), an ECDC country visit team conducted an assessment mission on 20-24 November 2017 to discuss antimicrobial resistance (AMR) issues in Belgium with the overall objective to provide an observation-based assessment of the situation in Belgium regarding prevention and control of AMR through prudent use of antibiotics and infection control. This country visit was conducted as a joint One Health AMR country visit together with a team from the European Commission's Directorate General for Health and Food Safety Unit F5.

Conclusions

Although the percentage of meticillin-resistant *Staphylococcus aureus* (MRSA) isolates over all *S. aureus* tested has been declining since 2003, particularly within healthcare-associated infections, Belgium now faces challenges in preventing and controlling infections with multidrug-resistant Gram-negative bacteria. For example, the percentages of ESBL-producing *E. coli* and *K. pneumoniae* have been increasing since 2007. Moreover, the latest data from EARS-Net show a substantial increase in the percentage of carbapenem-resistant isolates among *K. pneumoniae* from bloodstream infections. Between 2012 and 2015, active surveillance of carbapenem-producing carbapenem-resistant Enterobacteriaceae (CRE) from the National Reference Centre (NRC) demonstrated a three-fold increase in the number of reported isolates. Of greater concern is the emergence of New Delhi metallo-beta-lactamase (NDM)-producing CRE, which increased from 0.5% in 2012 to 8% of reported carbapenemase-producing CRE in 2015. Between 2012 and 2015, the NRC provided services to all Belgian hospitals and private laboratories for carbapenemase detection. In 2015, CPE was added to the mandatory surveillance of multidrug-resistant gram-negative bacteria. Nevertheless, reporting of CPE is *de facto* optional, because not all hospital laboratories have the capacity to detect carbapenemase production. Reporting of CRE (without information on carbapenemase production) is compulsory for six months per year; most hospitals provide data for the full year on a voluntary basis.

Belgium was one of the first European countries to implement a national antibiotic policy coordinating commission, the Belgian Antibiotic Policy Coordination Commission (BAPCOC). The work and dedication demonstrated so far are impressive, with outstanding professionals who contribute to the ambitious targets set by the Steering Committee ('Bureau') and the Working Groups. BAPCOC efforts to produce evidence-based, independent guidelines on appropriate antibiotic use, in both the community and hospital settings are laudable. Moreover, BAPCOC promotes activities conducted to foster education groups, among GP circles and among hospital networks, and has also been promoting awareness campaigns for the general public for many years. These campaigns were initially successful in reducing antibiotic consumption, by reducing the demand for antibiotics, and contributed to reducing AMR in *S. pneumoniae* in Belgium.

Despite all these activities, human antibiotic use in Belgium remains above EU/EEA average in the community if expressed in DDD per 1 000 inhabitants per day, but falls below the EU/EEA average when expressed in packages per 1 000 inhabitants per day. In addition, a heavy emphasis is placed on prescription of broad-spectrum antibiotics both in the community and in hospitals, bestowing a higher risk that AMR will develop and ultimately increase the costs of healthcare. In addition, a significant proportion of hospitals report not having a policy to restrict the use of last-resort antibiotics. Moreover, antibiotic susceptibility is not reported selectively on laboratory results and often decisions on which antibiotics to prescribe are not supported by infectious disease specialist advice (which is particularly important in hospital settings).

National surveillance of healthcare-associated infections (HAIs) due to antimicrobial-resistant bacteria, and HAIs in general, performed by the Scientific Institute of Public Health (WIV-ISP), was considered to be one of the most

extensive national systems seen during the ECDC country visits on AMR. This impressive surveillance system has contributed to documenting the successful reduction of MRSA in the country. However, surveillance is now highlighting an even bigger patient safety challenge - the increasing impact of CRE on healthcare. We believe that Belgium is at a cross-roads: the situation can still be controlled to ensure that the CRE epidemic does not reach the endemic situation similar to that in a number of southern EU countries where deaths from untreatable CRE infections are, unfortunately, a daily reality.

Belgium will need to establish its own ranking priorities. Ultimately, however, the success of AMR control will depend on increasing the level of urgency for change among all prescribers, stakeholders and the general public. In turn, this will require strong leadership and a considerable top-down direction.

Recommendations

Update the national intersectoral coordinating commission. BAPCOC is almost 20 years old and the current AMR epidemiological situation is different to that at its inception in 1999. A priority for BAPCOC would be to review and update its composition, mandate, tasks and lines of reporting. The respective remits of BAPCOC and the Scientific Institute of Public Health need to be complementary and not overlap. For example, BAPCOC could play an enhanced role as a policy advisory body on IPC and AMR, including MDRO outbreaks. In fact, it has been demonstrated that a holistic approach is essential to effectively curb AMR. A national Intersectoral Coordinating Mechanism (ICM) should be multi-disciplinary (the veterinary side and animal health activities within BAPCOC are limited). It should include a strong IPC component and a tangible presence from the relevant ministries. Therefore, BAPCOC should not limit its activities to antibiotic policy alone; this rearrangement could even be reflected in a change of name and acronym.

In addition, the organisational aspects should be updated in order to face the administrative difficulties and procurement issues which in the past have resulted in inefficiencies and difficulties in executing budget. Adequate resources should be made available, such as ministerial staff and support from relevant ministries for handling the administration, procurement, coordination and secretarial tasks of BAPCOC. Finally, composition of BAPCOC should include complementary key actors, such as representatives of long-term care facilities (LTCFs), nurses, patients and consumer groups.

Develop a national action plan based on the BAPCOC policy paper. The current policy paper from BAPCOC should be transformed into a comprehensive national action plan following the One Health approach, in line with the Council Conclusions of 17 June 2016, and incorporating specific activities, a core compulsory set of AMR and HAI indicators, targets (including IPC targets that are now absent from the document), times and responsible entities (to increase the executive role of the relevant ministries). The national action plan should cover human medicine (ambulatory/general practice, hospital and nursing homes sectors) and animal medicine, including vaccination policy. This action plan, once approved, will need to be supported and provided with the necessary resources for its implementation, preferably earmarked for each activity.

Implement a national CRE control strategy. We believe that Belgium must urgently review its current actions on CRE surveillance and control, and develop and implement a consistent and sustainable national CRE control strategy for all Belgian hospitals and other healthcare settings. This will rely on mandatory surveillance and notification of CRE cases (throughout the whole year), reducing antibiotic prescription in hospitals and other stewardship measures aimed at prudent use of antibiotics; sufficient numbers of IPC nurses and doctors to support strengthened IPC practices, such as upscaling at admission and regular CRE screening practices with rapid turnaround time to inform patient placement decisions; effective patient isolation procedures (which will need complementary resources even when cohorting CRE patients and the staff caring for them), contact precautions and contact tracing; access to molecular typing for confirmed carbapenemase-producing CRE. When suspected cross-transmission of CRE is recognised, this should be subject to root-cause analysis, the most relevant risk factors identified and improvements to processes explored and implemented.

As a service to clinical microbiology services in the country, the national reference laboratory should be able to provide assistance with the analysis of CRE isolates, confirmation of carbapenemase-production and should be funded accordingly.

Commitment of healthcare frontline and administrative staff, as well as ownership and accountability for CRE prevention and control are key factors. Having full recognition of infectious disease consultation for the purposes of reimbursement would also help achieve these goals. Promoting a culture of transparency for reporting hospital outbreaks of MDROs, without fear of possible repercussions on staff and the hospital/healthcare setting, is also vital.

In addition, surveillance of *Clostridium difficile* and of VRE should also be reinforced, in the light of the numerous outbreaks experienced throughout the country and designated as mandatory rather than optional as is currently the case.

Strengthen infection prevention and control policies. Based on our observations, the number (full time equivalents - FTEs) of dedicated IPC nurses and doctors in hospitals appeared low compared to accepted standards, particularly given the evolving CRE situation. IPC staffing in hospitals should be reviewed and increased accordingly to ensure that all necessary tasks are performed. The number of IPC staff required by law in Belgium is

based on staff ratios that were drafted prior to the current threat represented by CRE and other healthcare-associated MDROs. This number should therefore be reviewed and adapted to the current AMR epidemiology in Belgium.

Belgium has conducted biennial hand hygiene campaigns, which have shown a consistent and encouraging increase in hand hygiene compliance. However, our observations show that more effort and initiatives are needed – throughout the year and in all types of healthcare settings starting with hospitals – to embed a culture of hand hygiene across the spectrum of healthcare settings. It seems that focus on hand hygiene is primarily restricted to the period of the campaign and to performing the minimal number of observations. Moreover, the ECDC team identified few obvious hand washing posters/visuals for patients or staff around hospitals, LTCF or GP practices. Simple visual poster reminders are needed in bathrooms, waiting areas, consulting rooms, and inside and outside wards. To reduce transmission of MDROs in hospitals and in the community, and to improve patient safety, mandatory hand hygiene audits could be extended to all healthcare settings.

Finally, increasing vaccination coverage of staff (and patients, in particular residents in long-term care facilities) should be part of the antimicrobial stewardship and IPC programmes in Belgian hospitals, healthcare facilities, and GP and specialist practices.

Promote compliance with evidence-based prescription guidelines. From June 2018, a mandatory electronic prescribing system will be in place. This represents an important opportunity for faster feedback of prescribing practices to clinicians and GPs, benchmarking and self-improvement of these prescribing practices through, for example, visits from peers to the highest prescribers of antibiotics. Similar experiences from other EU/EEA countries showed how successful peer-reviews are. However, information on the indication (type of infection) for each antibiotic prescription would need to be reported in order for the monitoring and evaluation of e-prescriptions to be really effective.

In addition, the development of the e-health system represents an opportunity to include decision-making tools in accordance with national guidance or warning in the event of inappropriate prescription. E-prescribing can easily be linked to national guidelines. For example, through pop-up windows reminding the clinician what the favoured antibiotic is and why, when information is included on the indication for prescription of a particular antibiotic. As a minimum, a pop-up window would appear when prescribing specific antibiotics, such as broad-spectrum antibiotics. To preserve last-line antibiotics, we recommend that a national, harmonised policy be implemented for a restricted list of some antibiotics and that this should be mandatory. For example, prescription of certain broad-spectrum antibiotics could be restricted to specialists.

Introducing targets, increasing access to narrow-spectrum antibiotics (e.g. authorities ensuring that pharmaceutical companies market penicillin V) and making antibiotic stewardship a mandatory discussion theme in GP circles are potential and achievable interventions to effectively curb antibiotic use. Moreover, the results of clinical audits, which are rarely reported back to clinicians, could become part of a quality label for GPs, LTCFs and hospitals. Audit templates for particular conditions could be further produced and evaluated by BAPCOC. To make these audits more effective and to improve prescription habits in general, providing information on the indication for each antibiotic prescription should also be mandatory as this would enable the quality of antibiotic prescriptions to be monitored, rather than just the quantity of prescribed antibiotics.

Although it is important to assess compliance with guidelines, this could include tailored advice and the guidelines themselves could be made more readily available. For example, they could provide evidence that broad-spectrum antibiotics are not more effective than narrow-spectrum antibiotics.

Other possible effective interventions would be to create a network of pharmacists with training in antibiotic use, as well as promoting delayed/back up antibiotic prescription (especially useful when confronted with demanding patients), in parallel with safety netting. Finally, limited and conditional reimbursement, as has been proposed, among others, by FPS Health, BAPCOC and the National Institute for Health and Disability Insurance (NIHDI) for quinolones, would help limit usage and promote antibiotic stewardship and adherence to guidelines.

Mandatory audits of antibiotic use, dose, duration and reason for prescribing as part of the accreditation process would help GPs and specialists understand and change their prescribing practices. In hospitals, coupling the audits with input and help by medical microbiologists and infectious disease specialists would increase prescribing appropriateness.

Targets on antibiotic use could also be included in the 'pay-for-performance' system and would contribute to promoting behaviour change via financial incentives. However, in order for these interventions to be effective, the government will have to encourage pharmaceutical companies to market narrow-spectrum antibiotics and address the current lack of supply of penicillin V (oral) and amoxicillin for intravenous injections.

As a minimum, specific challenges concerning over-prescription for certain conditions, such as inappropriate prophylaxis, antibiotic treatment of asymptomatic UTI or overuse of fluoroquinolones, should be the focus of tailored antibiotic stewardship interventions. We recommend that the results of these audits continue to be fed back through written reports with interpretation and advice in hospital and community settings. GP-dedicated peer-review groups or GP circles would be encouraged to discuss the results and challenges and to look at how antibiotic use could be improved.

The management of patients' expectations requires time for coaching and convincing patients and parents of young children that antibiotics may not be necessary. This time is not always available or a priority for private GPs. Dedicated topics on antibiotic stewardship and patient communication as part of GP circle discussions could help GPs to tackle this issue.

Reinforcement of infectious disease clinicians' status and activity. Clinicians with appropriate knowledge and training about antibiotics and AMR, such as ID specialists or medical microbiologists, are essential to ensuring appropriate treatment of infections, appropriate use of antibiotics and support for antibiotic stewardship programmes. Infectious disease specialisation and consulting should be formally acknowledged and consultations should be eligible for financial compensation.

Medical microbiology. Increased daily input by clinical microbiologists would improve the management of infections. This could be supported by automated comments, automated pop-up antibiotic guidance when receiving microbiology reports, and restrictive reporting of antibiotic susceptibility tests to encourage clinicians to use the correct antibiotic.

Guidelines for antimicrobial susceptibility testing of *Streptococcus pneumoniae* isolates implemented in Belgian laboratories should be based on breakpoints published by the European Committee on Antimicrobial Susceptibility Testing (EUCAST), in order to compare the proportion of antibiotic-resistant *Streptococcus pneumoniae* with that in other EU/EEA countries.

Awareness campaigns. National public awareness campaigns on the prudent use of antibiotics should be continued and should target both the general public and healthcare professionals. The campaigns should engage national and regional media with well-crafted stories, multiplying the messages around prudent use of antibiotics and the issues posed by AMR. The use of limited funds should be systematically monitored and evaluated for cost-effectiveness. Finally, traditional and social media should be monitored (the use of tools such as the EC Joint Research Centre NewsDesk could facilitate this task).

Tailored campaigns including patient leaflets or posters, in multiple languages if necessary, at GP facilities and hospital wards, could increase awareness among patients, GPs, hospital prescribers and nurses.

Possible solutions for low-budget campaigns include the engagement of national and regional media to tell personal stories and the engagement of well-known, national and regional figures as sponsors. These would help boost the messages on AMR and the need for a more prudent use of antibiotics. Moreover, evaluation of the cost-effectiveness of the successive campaigns would help gather evidence for further action.

Compulsory education on AMR and antibiotic stewardship. Education on issues posed by AMR and the prudent use of antibiotics in the undergraduate and postgraduate curriculum should be compulsory. AMR topics, antibiotic stewardship and IPC should also be part of the continuous professional training for medical doctors and nurses, with a minimum biannual required attendance.

Strengthen the role of the coordinating physician in nursing homes. Each LTCF should have and implement clear antibiotic guidance, preferably placing emphasis on specific issues such as treatment of UTIs, asymptomatic bacteriuria and respiratory infections. Clear, short tables targeting the management of residents with dementia who have suspected infections or are carriers of MDRO would help to increase appropriate use of antibiotics.

1 Background

1.1 Rationale for country visits to discuss antimicrobial resistance (AMR) issues

After the introduction of antibiotics in the 1940s, it soon became clear that antibiotic usage promoted the rise of antibiotic-resistant bacterial strains in common bacteria such as *Staphylococcus aureus* and *Mycobacterium tuberculosis* (TB). In the decades which followed, the increasing number of antibiotic-resistant strains could be managed thanks to the continuous availability of new antibiotics providing new means of treating patients infected with resistant bacteria. However, from the 1990s onwards, development of new antibiotics decreased and at the same time, the emergence of bacteria resistant to multiple antibiotics became an ever-increasing problem in clinical medicine. Treatment guidelines had to be rewritten and the need to take bacteriological samples for antibiotic susceptibility testing became essential.

Once a resistant bacterium has developed, it will spread from a colonised person to another person if appropriate hygienic precautions (e.g. hand hygiene, isolation) are not taken. The risk of resistant bacteria spreading is higher in crowded environments and even greater when people in the surrounding area are receiving antibiotics - a common situation in hospitals and other healthcare facilities.

Today, bacteria that are totally (or almost totally) resistant to antibiotics (i.e. untreatable with antibiotics) are spreading in Europe. This represents a patient safety issue.

In 1998, the Chief Medical Officers of the EU Member States recognised this evolving problem and took the initiative to arrange the first major conference on AMR, which resulted in the Copenhagen Recommendations (Report from the Invitational EU Conference on the Microbial Threat, Copenhagen, Denmark, 9–10 September 1998).

In November 2001, the EU Health Ministers adopted a **Council Recommendation on the prudent use of antimicrobial agents in human medicine (2002/77/EC)**, which covers most topics of importance for the prevention and control of AMR. The Commission has to report back to the Council on progress in implementing the Council Recommendation.

In 2005, the European Commission reported to the Council on progress in Member States in the Report from the Commission to the Council on the basis of Member States reports on the implementation of the Council recommendation (2002/77/EC) on the prudent use of antimicrobial agents in human medicine (COM (2005) 0684). This states that 'ECDC should be able to assist the Commission in the future preparation of implementation reports and of recommendation proposals.'

In June 2008, EU Health Ministers adopted Council Conclusions on antimicrobial resistance (AMR) that reiterated the call for action to contain antimicrobial resistance and called upon Member States 'to ensure that structures and resources for the implementation of the Council recommendation on the prudent use of antimicrobial agents in human medicine are in place and to continue with the implementation of specific strategies targeted towards the containment of the antimicrobial resistance'.

In June 2009, EU Health Ministers adopted a **Council Recommendation on patient safety, including the prevention and control of healthcare-associated infections (2009/C 151/01)**, which further stresses the importance of combating AMR as a patient safety issue.

In April 2010, the European Commission published its second report from the Commission to the Council on the basis of Member States' reports on the implementation of the Council Recommendation (2002/77/EC) on the prudent use of antimicrobial agents in human medicine. While acknowledging that Member States have made significant progress since 2003, this report highlights many areas where implementation is not optimal and identifies directions for future work.

In November 2011, the European Commission published a new five-year **action plan against the rising threats from antimicrobial resistance** with the aim of addressing AMR by implementing a coordinated approach in all those sectors concerned (public health, animal health, food safety, environment, etc.) and strengthening and further developing EU initiatives against AMR and HAI at EU and international levels.

The new cross-sectorial approach has been further strengthened with the adoption of the **Council Conclusions on antimicrobial resistance of 22 June 2012** and the **Council conclusions on the next steps under a One Health approach to combat antimicrobial resistance of 17 June 2016**.

On 29 June 2017, the European Commission published a new **European one health action plan against antimicrobial resistance (AMR)**[*] with concrete actions with EU added value that the European Commission will develop and strengthen as appropriate for a more integrated, comprehensive and effective approach to combating AMR.

[*] https://ec.europa.eu/health/amr/sites/amr/files/amr_action_plan_2017_en.pdf

ECDC's mission, as part of its **Founding Regulation No 851/2004**, is (i) to identify, assess and communicate current and emerging threats to human health from communicable diseases; (ii) in the case of other outbreaks of illness of unknown origin which may spread within or to the Community, the Centre shall act on its own initiative until the source of the outbreak is known; and (iii) in the case of an outbreak which clearly is not caused by a communicable disease, the Centre shall act only in cooperation with the competent authority upon request from that authority. As part of this mission, ECDC may be requested, by the European Commission, a Member State, or another country to provide scientific or technical assistance in any field within its mission.

1.2 Purpose

Council Recommendation of 15 November 2001 on the prudent use of antimicrobial agents in human medicine (2002/77/EC) outlines the threat posed by AMR to human health and advocates for a range of actions to be taken for its prevention and control. Council Conclusions on antimicrobial resistance (AMR) of 10 June 2008 reiterated this call for action.

To assist Member States in implementing the Council Recommendation, ECDC has developed a process for country visits. At the invitation of the national authorities, these visits are undertaken to specifically discuss and assess the national situation regarding prevention and control of AMR through prudent use of antibiotics and infection control. The country visits also help document how Member States have approached implementation and deployed national activities and they support the European Commission in evaluating implementation.

The main output of the visit is a report from the ECDC Team provided to the inviting national authority. To help the ECDC Team ensure consistency of the visits and follow-up of progress of countries, **an assessment tool** has been developed (see Annex 5.2 of this Report). The assessment tool includes ten topics. These topics are regarded as core areas for successful prevention and control of AMR and are based on Council Recommendation 2002/77/EC and on Council Conclusions of 10 June 2008. The assessment tool is used as a guide for discussions during the visit.

The country visit to Belgium was conducted as a joint One Health AMR country visit together with a team from the Directorate-General for Health and Food Safety, Unit F5. The ECDC country visit team consisted of Dominique L. Monnet, Head of ECDC's Antimicrobial Resistance and Healthcare-associated infections (ARHAI) Disease Programme, Alessandro Cassini, ECDC ARHAI expert, and three experts from EU/EEA countries: Michael Borg (Malta), Catherine Dumartin (France) and Cliodna McNulty (United Kingdom), as well as Andrea Nilsson (ECDC communication expert, only 14 November 2017). At national level, the visit was organised and coordinated by Anne Ingenbleek (Belgian Antibiotic Policy Coordination Commission (BAPCOC) and FPS Health) and Lieven De Raedt (International Relations, FPS Health). For the full list of national experts met during the ECDC country visit, please refer to Annex 5.1 of this Report.

2 Overview of the situation in Belgium*

2.1 Antimicrobial resistance (AMR)

Data on AMR in invasive bacterial isolates - mainly from bloodstream infections - are available from the European Antimicrobial Resistance Surveillance Network (EARS-Net) which Belgium has participated in since 2000. Overall, in 2016 the proportions of AMR for the microorganisms under surveillance by EARS-Net were consistently under or around the EU/EEA average.

According to data reported to EARS-Net, the proportions of some resistant infections have declined. Proportions of meticillin-resistant *Staphylococcus aureus* (MRSA) in bloodstream infections have decreased significantly, from 20.9% in 2001 to 12.2% in 2016. Since 2015, the proportion of penicillin-resistant, combined penicillin/macrolide-resistant *Streptococcus pneumoniae* and vancomycin-resistant *Enterococcus faecium* (VRE) have decreased to under 1% in 2015, although the proportion of VRE increased to 1.7% in 2016. Even though the proportion of macrolide-resistant *Streptococcus pneumoniae* remains high at 15.9% in 2016, it has decreased from 31.5% in 2005. However, clinical guidelines used by Belgian laboratories for testing *Streptococcus pneumoniae* isolates are reported to all be based on the Clinical and Laboratory Standards Institute (CLSI) breakpoints and not the European Committee on Antimicrobial Susceptibility Testing (EUCAST) breakpoints. Therefore, it is not possible to compare the proportion of resistant *Streptococcus pneumoniae* with those of other EU/EEA countries.

A European study showed that, in 2014, about 10% of MRSA infections in Belgium were from livestock-associated MRSA (LA-MRSA) clones. Although small, this percentage is among the highest of all EU/EEA countries. More recent data are not available.

EARS-Net data for Belgium indicate that the previously observed decline in the proportion of carbapenem-resistant *Pseudomonas aeruginosa* (from 9% in 2009 to 3.9% in 2015) has reversed, with a proportion of 9.6% being reported in 2016. The proportion of third-generation cephalosporin-resistant *Escherichia coli*, as well as the proportion of *E. coli* with combined resistance to fluoroquinolones, third-generation cephalosporins and aminoglycosides, continued to increase from 1.8% and <1% respectively in 2001, to 10.5% and 3.8% respectively in 2016. A similar pattern was observed for *Klebsiella pneumoniae,* from 14.8% and 3.4% respectively in 2009, to 22.9% and 9.3% respectively in 2016.

In 2015, a report from the European Survey on Carbapenemase-Producing Enterobacteriaceae (EuSCAPE) project published in Eurosurveillance stated about Belgium that 'the situation of carbapenemase-producing Enterobacteriaceae (CPE) has seriously worsened with a rapid spread of CPE since 2012 - i.e. a doubling in prevalence and incidence in acute care hospitals between 2012 and 2015 and more than 80% of the reported cases being confirmed as autochthonous acquisition. In addition, there has been an increase in the number of documented regional and inter-regional transmissions of epidemiologically related clusters and/or outbreaks, especially for OXA-48-producing Enterobacteriaceae and to a lesser extent for KPC-producing Enterobacteriaceae. There has also been an increase in the number of outbreaks with one third of the country's hospitals reporting outbreaks of CPE [between 2012 and 2015]. Another major change in Belgium in 2015 was the marked increase, compared with 2013, in the number of non-travel-related New Delhi Metallo-beta-lactamase (NDM) cases with inter-institution regional spread and multiple large difficult-to-control outbreaks occurring in several hospitals.'

This increase in carbapenem-resistant Enterobacteriaceae (CRE) in Belgium is new and was not apparent from data reported to EARS-Net in 2016, when Belgium reported an increase in carbapenem-resistant *Escherichia coli* (from 0% across almost all years to 0.1%) and in carbapenem-resistant *Klebsiella pneumoniae* (from <1% in previous years to 2.4%). This suggests that the situation is evolving and that CRE may have already spread widely across Belgium.

An increase in CRE was also reported in the national 2017 Surveillance of Bloodstream Infections in Belgian Hospitals (SEP) report compiled by the Healthcare-Associated Infections & Antimicrobial Resistance (NSIH) department of the Scientific Institute of Public Health (WIV-ISP, part of Sciensano since 1st April 2018). Carbapenem-resistant *Escherichia coli* increased from 0.3% in 2013 to 0.5% in 2016, with a peak of 0.9% in 2015. Similarly, carbapenem-resistant *Klebsiella pneumoniae* increased from 2.4% in 2013 to 6.4% in 2016. Also of note is the higher proportion of carbapenem-resistant *Pseudomonas aeruginosa* compared to EARS-Net data, which remained stable between 14.7% in 2013 and 17.3% in 2016.

Finally, Belgium started reporting *Acinetobacter* spp. invasive isolates to EARS-Net in 2015. In 2016, the proportion of carbapenem-resistant *Acinetobacter* spp. in EARS-Net (2.6%) was low compared to the EU/EEA average (35.1%). According to national surveillance (SEP report) it reached a peak in 2014 at 7.9%.

* Chapter 2 is completed in preparation of the country visit and based on available data sources at EU/EEA level.

2.2 Healthcare-associated infections

In September–November 2011, Belgium participated in the first ECDC point prevalence survey (PPS) of healthcare-associated infections (HAIs) and antimicrobial use in European acute care hospitals. A total of 70 hospitals performed the PPS, 52 of which were selected for the EU sample. The representativeness of the data was considered good. The percentage of patients with at least one HAI (7.1%) on a given day in Belgian hospitals was above the EU/EEA average (5.7%). Under the coordination of WIV-ISP, Belgium also participated in the second ECDC PPS in September–November 2017. A total of 43 hospitals and 11 800 patients participated resulting in an overall good data representativeness. Belgium will participate in the second ECDC-PPS validation study.

During the same period, another 66 hospitals, including 16 329 patients, participated in the Global-PPS on antimicrobial use and resistance (www.global-pps.com). In 2015, 100 hospital sites in Belgium participated in the Global-PPS showing that in 2015, 7.9% of all admitted inpatients had at least one HAI on the day of the PPS.[*] However, the HAI definitions of the Global-PPS are different of that of the ECDC PPS.

Belgium has participated in all editions of the EU/EEA-wide point prevalence survey on healthcare-associated infections and antimicrobial use in long-term care facilities (HALT); as project collaborator in HALT-1 (2010) and notably, as project lead in the subsequent HALT-2 (2013) and HALT-3 (2016-2017). The crude antimicrobial use prevalence was 4.3% in HALT-1 and 5.1% in HALT-2 for Belgium, which was comparable to the overall survey rates of 4.3% and 4.4% in HALT-1 and 2 respectively. Preliminary results indicate that Belgium recruited 16 855 eligible residents in 165 long-term care facilities (LTCFs) for HALT-3, an increase from 8 756 residents in 87 LTFCs included in HALT-2 and 12 041 residents in 108 LTCFs for HALT-1.

Belgium does not contribute to the ECDC-coordinated surveillance of surgical site infections (HAI-Net SSI), but Belgian hospitals have the possibility of participating in the national surveillance of SSI organised by WIV-ISP. However, Belgium contributes to the ECDC-coordinated surveillance of HAIs in intensive care units (ICUs) (HAI-Net ICU) via national surveillance of healthcare-associated infections in intensive care units (NSIH-ICU), which is coordinated by the Scientific Institute of Public Health (WIV-ISP). In 2015, Belgium reported data from 12 ICUs with 1 370 patients. The incidence density of ventilator-associated pneumonia (VAP) was 12.7 episodes per 1 000 intubation days (close to the average incidence for participating countries of 10.0). The incidence density of central line-associated bloodstream infections was 1.5 episodes per 1 000 catheter-days (lower than the average incidence for participating countries of 3.2). In 2017, Belgium also contributed data to the ECDC-coordinated surveillance of *C. difficile* infections (HAI-Net CDI), with 2016 data from 129 hospitals participating in the national surveillance of CDI (NSIH-CDI) via the Scientific Institute of Public Health (WIV-ISP) (ECDC report will be available in 2018, national report available from http://www.nsih.be/download/CDIF/CDIF_Report_EN_v8.pdf).

2.3 Antimicrobial consumption

Data from the latest Eurobarometer survey on AMR (April 2016) showed that the proportion of the general population in Belgium who reported having taken antibiotics during the past year (32%) was at about the EU/EEA average (34%) and had decreased since 2013 (38%). Most other indicators reported by the Eurobarometer placed the Belgian population sample as being more knowledgeable on antibiotics than the average EU/EEA population. Compared to the EU/EEA, most respondents claimed that they had received information on unnecessary antibiotic treatment from TV advertisements, the radio and leaflets/posters.

In 2016, antimicrobial consumption in the community in Belgium was 27.5 defined daily doses (DDD) per 1 000 inhabitants per day, which is higher than the EU/EEA average of 21.9 DDD per 1 000 inhabitants per day, having decreased from 29.8 DDD per 1 000 inhabitants per day in 2012.

Packages of antibiotics available on the Belgian market are often larger than what is needed for one prescribed treatment. This increases the risk of keeping leftovers at home and of subsequent self-medication. For this reason, Belgium also uses packages per 1 000 inhabitants per day as a metric for antimicrobial consumption in the community. The ranking of antibiotic consumption in Belgium measured in packages per 1 000 inhabitants in the community is lower than the EU/EEA average.

In the hospital sector, Belgium reported a decreasing trend in antibiotic consumption, from 1.71 in 2012 to 1.63 DDD per 1 000 inhabitants per day in 2016, which is lower than the EU/EEA average of 2.06 DDD per 1 000 inhabitants per day. With 0.063 DDD per 1 000 inhabitants per day, consumption of carbapenems remained stable in 2016, but above the EU/EEA average of 0.052 DDD per 1 000 inhabitants per day. However, consumption of polymyxins increased slightly from 0.006 in 2012 to 0.008 DDD per 1 000 inhabitants per day in 2016, although it remained below the EU/EEA average of 0.016 DDD per 1 000 inhabitants per day.

In conclusion, between 2015nd 2016, there was a decrease in the consumption of antibiotics for systemic use (ATC J01), both in the community (-1.8 DDD per 1 000 inhabitants per day, -6.1%) and the hospital sector (-0.04 DDD per 1 000 inhabitants per day, -2.4%). This was mainly caused by a decrease in consumption of beta-lactam

[*] http://overlegorganen.gezondheid.belgie.be/sites/default/files/documents/18nov2015_k.magerman-pps.pdf

antibacterials, penicillins (ATC group J01C). Within the penicillins group, the ratio of penicillins with extended spectrum (J01CA) to combinations of penicillins, including beta-lactamase inhibitors (J01CR) in the community improved from 40/60 to 50.5/49.5 between 2009 and 2016. This means that, although antibiotic consumption in the ambulatory sector remains high, there was a small improvement in the type of penicillins that were used according to Belgian guidelines produced by the Belgian Antibiotic Policy Coordination Commission (BAPCOC).* Nevertheless, consumption of combinations of penicillins, including beta-lactamase inhibitors (J01CR) in the community, such as amoxicillin-clavulanic acid, remains high in Belgium compared to other countries.

Similarly, the consumption of fluoroquinolones in the community remains high. However, there was a decline in the consumption of other antibacterial agents in the community (compared to 2015), especially for fluoroquinolones (ATC group J01MA, -0.20 DDD per 1 000 inhabitants per day, -7.6%), second-generation cephalosporins (J01DC, -0.11 DDD per 1 000 inhabitants per day, -8.1%) and macrolides (J01FA, -0.07 DDD per 1 000 inhabitants per day, -2.1%). Although there was an overall decrease in the use of macrolides, mainly due to a decrease in the use of clarithromycin (-0.12 DDD per 1 000 inhabitants per day, -7.8%), the consumption of azithromycin (+0.08 DDD per 1 000 inhabitants per day, +4.7%) is still increasing, in line with the previous years.

Consumption of nitrofuran derivatives (ATC J01XE) for the treatment of urinary tract infections remained stable (-0.03 DDD per 1 000 inhabitants per day, -1.1%). With regard to the consumption of antimycotics for systemic use (ATC J02), there was a slight decrease in the ambulatory (-0.04 DDD per 1 000 inhabitants per day, -3.1%) and the hospital sector (-0.003 DDD per 1 000 inhabitants per day, -3.9%).

* Available at: https://upb-avb.be/assets/antibioticagids-NL-d96b19ad.pdf

3 Observations

3.1 Development of an Intersectoral Coordinating Mechanism (ICM)

A Royal Decree dated 26 April 1999 sets out the legislative framework for a Commission on the coordination of antibiotic policies with the aim of (a) collecting and publishing relevant data on antibiotic consumption and resistance, (b) initiating information dissemination and awareness raising with regard to AMR issues, and (c) formulating recommendations and guidelines for diagnosis, consumption and prescription of antibiotics. This Commission was established as the Belgian Antibiotic Policy Coordination Commission (BAPCOC) with the declared aim of promoting the rational consumption of antibiotics and fighting the increase of AMR in the country. BAPCOC was one of the first examples of an ICM in Europe.

The Royal Decree foresaw a Steering Committee ('Bureau') composed of a president (Director General of Health services), a secretary (a medical doctor from the Federal Public Service Health, Food Chain Safety and Environment [FPS Health]), and four members (two medical doctors and two veterinarians designated by the respective ministers in charge of health and agriculture) who would take turns as vice-president every 18 months. Moreover, the Royal Decree indicated that BAPCOC should be composed of 27 members from national institutions (ministries and research institutions working on health, agriculture and pharmaceuticals, as well as the national insurance scheme) and academia covering multiple disciplines: epidemiology, microbiology, pharmacology, human health and animal health. Finally, the Royal Decree allowed for involvement of other ad-hoc experts and the creation of specific thematic working groups. The secretariat approves all published reports and guidelines/recommendations, and is responsible for the appointment of the working groups. The Commission determines its terms of reference.

However, the Royal Decree did not explicitly address healthcare infection prevention and control (IPC), general practitioners (GPs) or behavioural sciences. Moreover, it did not address the allocation of financial resources to different institutions or projects, meeting frequency or targets (including its own monitoring and evaluation).

The current governance of BAPCOC is composed of a Steering Committee, Working Groups and the General Assembly. The Steering Committee ('Bureau') includes the BAPCOC President and Vice-President (not employed by FPS Health), chairs and vice-chairs of the working groups, experts from other partner institutions (public health institute, national insurance) and a support team (mainly coordination, responsible for Patient Safety Division at FPS Health). The working groups cover ambulatory practice, veterinary medicine, awareness raising, hospital medicine and the federal hospital hygiene platform (responsible for hospital IPC). The Steering Committee regularly meets in person (exceptionally by conference call) and minutes are taken and circulated. In 2016, the BAPCOC budget was more than EUR 21.8 million and financed the following activities: awareness campaigns on the prudent use of antibiotics in the community, hand hygiene campaigns, hospital antimicrobial stewardship and IPC teams, regional IPC platforms, nosocomial information and guidelines. Most of the financial resources are allocated to actions in the hospital sector. The awareness campaigns (approximately EUR 400 000 in 2016) are developed by BAPCOC but, similar to other national campaigns, they are implemented by the Offices of the Prime Minister.

BAPCOC was responsible for the development of the 2014–2019 policy paper outlining policies to improve antibiotic consumption and appropriateness of antibiotic prescriptions. It includes a One-Health approach (i.e. integrated programmes and datasets on antimicrobial use and antimicrobial resistance in humans and in animals), targets for outpatient and inpatient antibiotic use, quality measures and audits, education and training, a better integration and coordination with relevant stakeholders (MDRO Working group, National Reference Centres, National Institute for Health and Disability Insurance [NIHDI, INAMI-RIZIV], WIV-ISP), methods to monitor effects of antimicrobial stewardship strategies and policy and guidance interventions. However, a number of gaps exist, such as the inclusion of IPC in the targets (IPC is acknowledged as being an important factor in the spread of AMR). Moreover, actions are somewhat generic and often lack milestones, deliverables and timelines; executive players (beyond Working Group members who are voluntary experts) and resources for each activity are not clearly identified and earmarked.

At present, FPS Health does not seem to be directly involved in BAPCOC's formulation of policies aimed at preventing and controlling AMR. It is unclear how BAPCOC's advice is being translated into regulatory action at the national and regional levels. The remit of FPS Health's responsibilities linked to BAPCOC's' recommendations is also unclear. BAPCOC activities seem to lack accountability and it is unclear how BAPCOC and the National Public Health Institute (WIV-ISP) interact and define their roles in surveillance and scientific advice on AMR.

Furthermore, the presence and role of the veterinary sector within BAPCOC seems limited, although the 2020 Strategy Plan of the Center of Expertise on Antimicrobial Consumption and Resistance in Animals (AMCRA) is directly included in the BAPCOC 2014–2019 Policy Paper.

The constitution of a task force to develop a national strategic plan 'to fight multidrug-resistant organisms (MDRO)' through an agreement protocol (21/11/2013) between the Federal State and the federated entities is a laudable ad-hoc initiative. This Task Force was created to respond to the increase in detected CPE cases. The plan is based on four pillars: enhanced coordination i.e. creation within BAPCOC of a National Commission to fight MDRO (CNL-MDRO), creation within the WIV-ISP of a Technical Cell (TC-MDRO) and an Outbreak Support Team (OST), link between experts, especially those from the concerned NRC, from the Superior Health Council and from BAPCOC; improved microbiological and epidemiological surveillance; increase IPC capabilities; promotion of antibiotic stewardship.

3.2 Organised multi-disciplinary and multi-sectoral collaboration at local level

All hospitals are required by Royal Decree (26/04/2007) to have a Hospital Hygiene Committee and a Hospital Hygiene Team (one or more medical doctors, or pharmacists/biologists, and nurses who have undergone specific IPC training). Hospital hygiene and IPC are the responsibilities of the team, the committee, the medical director and the head nurse.

The Hospital Hygiene Team has some operational independence, but reports to and depends on the medical director and the head nurse, who are ultimately responsible. The team ensures that standard hygiene measures are in place and enforced, that infected patients are isolated and that surveillance of HAIs is implemented. Moreover, the team develops the strategy for controlling and preventing HAI outbreaks, and exchanges information/experiences with other healthcare facilities. Each year, the team is responsible for the development of a strategic action plan and reporting on past activities.

The Hospital Hygiene Committee is a larger group including the hospital director, the hospital hygiene team, microbiologists, pharmacists and appointed doctors and nurses (other advisors can be called in where necessary). The committee discusses and approves the strategic action plan and the report on past activities and the annual budget. The committee is also responsible for coordinating all other services in the area of IPC. The committee is supposed to meet four times a year and minutes are taken at the meetings. Hospitals participate in regional IPC platforms, and each regional IPC platform is represented at the federal IPC platform (BAPCOC working group).

Another Royal Decree (12/02/2008) tasks hospitals and their medical directors with setting up a multidisciplinary antibiotic management group (GGA/ABTBG). These groups should include at least one hygiene doctor from the hospital hygiene team, a hospital pharmacist and the delegate responsible for the group. The latter should be a medical specialist in clinical infectious diseases or clinical microbiology, although consultations by such specialists are often not formally acknowledged or eligible for financial compensation Consequently the delegate is usually a pneumologist, an internal medicine specialist, an ICU specialist, a paediatrician, a clinical biologist or sometimes even a hospital pharmacist. The group is responsible for keeping pharmaceutical registries for all anti-infectious drugs up-to-date; disseminating national guidelines to hospital prescribers and monitoring their compliance; developing and executing antibiotic stewardship initiatives; training staff on all aspects of infectious disease diagnostics and treatment; monitoring individual prescribers' patterns and reporting them (and their cost) to the prescribers and the medical manager; participating in surveillances of antimicrobial consumption and reporting data to WIV-ISP.ISP In addition, each antibiotic management group needs to report to BAPCOC via an online system on the composition of the teams, number of meetings, and number and type of courses and audits.

In the hospitals that we visited, members of the GGA/ABTBG had implemented a number of activities: dissemination of local guidelines, local policy for restricted prescription or dispensation of some antibiotics, systematic review of prescription in some wards via weekly multidisciplinary meetings, face-to-face meetings, educational activities, surveillance of antimicrobial use, practice audits. They work in coordination with the Hospital Hygiene Team.

We were impressed that the medical director of one hospital was very aware of the problem of AMR organisms, its effect on patient safety and hospital costs, and was a member of the GGA/ABTBG. It was evident that AMR control was a priority in that hospital. However, this state of affairs was not encountered in all the healthcare facilities that we visited. As a key part of the patient safety policy, we would encourage such top-down approaches in other hospitals, to increase the commitment of hospital managers to understand and provide the resources needed to combat AMR and promote prudent use of antibiotics.

Advice on antimicrobials is provided to clinicians depending on the availability of doctors with the appropriate competence in the area of infectious diseases or clinical microbiology. However, these doctors feel that their role is not acknowledged, as their verbal or written advice to other doctors is not recorded as a consultation and does not count for the purposes of reimbursement. This is probably related to the fact that, unlike the vast majority of EU countries, medical specialisations in infectious diseases and medical microbiology are not yet legally recognised in Belgium.

In long-term care facilities (LTCFs), each resident has the choice of being cared by their own GP, which may result in an inconsistent approach to the diagnosis and management of infections, with an overuse of antibiotics in general and a tendency to overuse broad-spectrum antibiotics in particular. In each LTCF, the coordinating physician – also a GP – has an educational role to raise awareness regarding AMR/IPC practices and vaccination among nurses and other healthcare workers. Coordinating physicians do not have any real possibility to train other GPs or to harmonise their diagnostic and prescription practices. For example, implementation, monitoring and evaluation of evidence-based guidelines for the treatment of urinary tract infections would represent a significant step forward in terms of antibiotic stewardship for GPs working in LCTFs.

A number of GPs work in joint practices where exchange of ideas and collaboration is easier. Generally, GPs participate in 'peer review groups' and 'GP circles' where they can share experiences and receive training. However, antimicrobial resistance or antibiotic use are not mandatory review topics and can be completely overlooked for the

purposes of this type of self-improvement initiative. Moreover, there are few instruments in place for the monitoring and evaluation of GP antibiotic prescription appropriateness and quantity which reduces the accountability of GPs.

3.3 Laboratory capacity

Medical (or clinical) microbiology is not an available or recognised medical specialty in Belgium, therefore non-medical clinical biologists are sometimes responsible for laboratories. In the larger hospitals, we met clinical biologists whose time was mostly allocated to microbiology activities relating to infectious diseases. This enabled them to optimise laboratory testing and reporting and which meant that they were key players in antimicrobial stewardship and AMR control at these hospitals. However, in a smaller laboratory the clinical biologist was responsible for many different laboratory specialities, limiting the time available for microbiological specimens and patients with resistant organisms.

The centrally-driven active and detailed surveillance of carbapenem-resistant Enterobacteriaceae (CRE) between 2013 and 2015 represents a laudable example of enhanced diagnosis, prevention and control of the spread of a serious AMR infection. This was crucial to improving understanding of the epidemiological profiles of CRE outbreaks and helped to highlight the increasing trends in NDM-producing CRE strains. Data collected up to 2015 showed a significantly increasing trend which could very well continue (as EARS-Net data suggests), with a possible increase in the proportion of NDM-producing CRE strains (as suggested from anecdotal comments during the visit).

Information on the time required to obtain laboratory test results and the mode of communication to hospital clinicians or GPs was not provided to the ECDC team during the visit. In primary care, rapid diagnostic tests are not often used as they are not reimbursed by the national insurance scheme.

Microbiological results were reported without any comment on the clinical significance of the cultures, and the results of antimicrobial susceptibility tests were reported to clinicians for a broad range of antimicrobials, in alphabetical order per antimicrobial (instead of in order of narrow-spectrum to broad-spectrum antibiotics), without reporting restrictions (no selective reporting). This probably contributes to the prescription of broad-spectrum antibiotics such as amoxicillin and amoxicillin-clavulanic acid.

3.4 Monitoring of antibiotic resistance

The national surveillance of AMR and HAIs coordinated by the NSIH at WIV-ISP is one of the most extensive national systems seen during our country visits to date. In addition to EARS-Net and the ECDC-coordinated surveillance systems, additional national sources of information are available on the WIV-ISP website (www.nsih.be)..

In October 2011, the WIV-ISP and the National Reference Center for Gram-negative bacteria alerted the health authorities about a worrying increase of CPE cases. A risk-assessment process was activated, actions were implemented, including an active surveillance system (microbiology and epidemiology, since 2012), an MDRO Task Force, guidance on standard precautions well as specific precautions for CPE-positive patients were published by the Superior Health Council and communicated to all hospitals. In 2015, CPE was added to the mandatory surveillance of multidrug-resistant gram-negative bacteria. Nevertheless, reporting of CPE is optional, because not all hospital laboratories have the capacity to detect carbapenemase production. Reporting of CRE (without information on carbapenemase production) is compulsory for six months per year; most hospitals provide data for the full year on a voluntary basis. .

Unfortunately, surveillance of VRE and *Clostridium difficile* is included as an optional module, despite the regular occurrence of VRE outbreaks in Belgian hospitals. This may foster the perception that some antibiotic-resistant organisms or types of HAIs are less important than others, and is a major obstacle to benchmarking. It makes it difficult to properly evaluate the extent of the problem across Belgium for these critical antibiotic-resistant organisms. Another issue is that hospitals seem to rely completely on the national systems for analysis and evaluation of their own data. This could hamper local ownership of the problem, and hinder the implementation of effective and timely local responses, especially when it seems that feedback from the national systems to participating hospitals and healthcare facilities is relatively slow.

Information on LTCFs is provided by repeated point prevalence surveys on MDRO carriage, their risk factors and recent antibiotic treatments. As seen for the hospital sector, 2015 data showed a decrease in the proportion of MRSA and a major increase in the proportion of extended-spectrum beta-lactamase (ESBL)-producing Enterobacteriaceae, particularly for *K. pneumoniae*.

3.5 Monitoring of antibiotic usage

A comprehensive antimicrobial consumption surveillance system is in place, providing an accurate picture of consumption in Belgium and enabling trends to be monitored in order to assess the impact of public awareness campaigns and other activities aiming to improve the appropriateness of antibiotic prescriptions.

Consumption of antibiotics in the community is monitored using data gathered from all private insurance companies at InterMutual Funds Agency and then sent to the National Institute for Health and Disability Insurance

(NIHDI, INAMI-RIZIV). NIHDI publishes annual reports on the percentage of patients with at least one antibiotic prescription per year, on the number of DDD per inhabitant per year, and on the proportion of amoxicillin and second-line antibacterial agents prescribed. Penicillin V (oral use) was rarely prescribed.

In primary care, GPs and other physicians receive feedback on their own prescriptions with a two-year delay or sometimes more; this gap is not conducive to timely corrective action. To ensure effective correlation between individual monitoring, evaluation and stewardship, data should be analysed and feedback provided much more rapidly and frequently. All the GPs that we met pointed out that increased feedback, coupled with benchmarking (e.g. including data detailed by age groups and gender) and tailored messages from guidelines to improve prescription appropriateness would help develop a higher sensibility among GPs towards the importance of antibiotic use and its impact on AMR.

In hospitals, surveillances of antibiotic consumption is moving from a passive system, where pharmacists have to enter data in an NSIH website, to a new system managed by the WIV-ISP, based on NIHDI data (Belgian Hospitals – Surveillance of Antibiotic Consumption, BeH-SAC). In this new system, data already reported to the NIHDI for reimbursement purposes will be fed back to hospitals and will be available for analysis of antibiotic prescriptions. This will expand the scope of data monitored (i.e. automatically for all in-patient wards), decrease the workload for pharmacists, and improve the availability of data at the national level for faster feedback. The last available report on antibiotic use in hospitals was issued in 2015 based on 2013 data (http://www.nsih.be/download/GM/BeH-SAC_Report-2015_EN.docx). However, hospitals can still use the NSIH web system to compare themselves with other hospitals via the immediate feedback offered by the system.

In addition to quantitative use of antibiotics, quality indicators on hospital use have been proposed by the IPC Federal Platform (BAPCOC working group) to support the implementation of IPC programmes in all acute hospitals, with the surveillance part of this project being coordinated by the WIV-ISP. These quality indicators of antibiotic-prescription were assessed in 2015 for 100 hospital sites through the conducting of a Global-PPS (see above www.global-pps.com) and at 66 hospitals in September-November 2017. The hospitals received a year's feedback report or a longitudinal feedback report (if they participated twice) on a set of quality indicators, including the reasoning written in notes, post-prescription review, guideline compliance, prolonged surgical prophylaxis, and targeted prescribing. This further represents an opportunity to develop a monitoring and evaluation method through the automated e-prescribing software tool, for example, to assess compliance of prescriptions with local and national guidelines by linking prescription data (that must include an indication for the prescription) with electronic patient records.

3.6 Antibiotic utilisation and treatment guidance

Antibiotic stewardship initiatives have largely focused on evidence-based guidelines issued by BAPCOC. These guidelines were well known by all the prescribers that we met, both in primary and hospital care. On the other hand, GPs and hospital prescribers reported to the ECDC team that many GPs and other clinicians lack knowledge on the mode of action of different antibiotics, their indication and use. For example, we collected anecdotal evidence that doctors overprescribe quinolones for acute, uncomplicated urinary tract infections; amoxicillin-clavulanic acid for simple skin infections; amoxicillin rather than penicillin V for tonsillitis, or combinations of oral and topical antibiotics simultaneously. No information on the situation in dental practices was collected during the visit.

Less emphasis has been placed on other methods aimed at changing behaviour, such as those focusing on motivation/social norms. The positive impact of effective behaviour change interventions, especially system change in reimbursement entitlements, was demonstrated in the area of perioperative antibiotic prophylaxis and this could be replicated in other areas. An audit on perioperative antibiotic prophylaxis was being performed at the time of the visit. However, according to the ECDC point prevalence survey 2011–2012 and a national survey from 2013, perioperative antibiotic prophylaxis practices vary significantly across the country.

All the hospitals reported that they had a rigorous process for producing evidence based antibiotic guidelines. In each of the three visited hospitals, the antimicrobial guidance committee (GGA/ABTBG) had a wide membership that felt independent of prescribers and of the pharmaceutical industry. However, an online survey evaluating the policy of restrictive use of antibiotics in Belgium, conducted by BAPCOC in 2016, revealed that 20% of the participating hospitals did not have a policy restricting selected antibiotics such as carbapenems. Finally, compliance with guidelines varied among hospitals, with a mean of 80% and not reaching 90% as defined by the BAPCOC policy paper 2014–-2019.

During the visit, it seemed clear that implementation of the national evidence-based guidelines was difficult for several reasons related to structures and processes. Hospitals (especially small ones) lack doctors specialised in infectious diseases (as already mentioned, this medical specialisation does not exist in Belgium) who can provide tailored advice on treatment. Interdisciplinary activities, such as providing advice in several different wards, are not acknowledged. Clinicians often do not have the knowledge or the motivation to monitor and assess their antibiotic prescriptions (indication, dose and duration). Similar issues affect LTCFs where the coordinating physician (responsible for the GPs working with LTCF residents) does not even have access to other clinicians' patient files and prescription records because of privacy rules. Other structural limitations include the limited availability of

narrow-spectrum antibiotics, such as penicillin V, and lack of reimbursement of point-of-care testing such as C-reactive protein (CRP) rapid tests. In primary care, many GPs work independently, in single GP practices.

3.7 Infection control

A working group on hospital infection prevention and control (IPC) exists within BAPCOC. It was not clear if and how the Technical Committee on multidrug-resistant organisms (MDROs) interacts with the BAPCOC working group on hospital IPC. By Royal Decree, all hospitals are required to have a hospital hygiene committee and a hospital hygiene team. HHT However, the number of IPC nurses and, in at least one of the hospitals visited, the number of doctors dedicated solely to IPC is low. We consistently noted that most IPC nurses are part-time employees. This results in gaps in coverage, with days when an IPC nurse is not even be working. In addition, it was noted that IPC staffing levels were unlikely to support the comprehensive and proactive programme of activities needed to address the challenges mentioned. This will become increasingly important as CRE increases, as seen from the experience of CRE endemic countries which suggests that CRE is more difficult to control than MRSA and requires more intensive IPC programmes.

National hand hygiene campaigns are run biennially with positive results. However, the required number of hand hygiene observations is only 150 per ward (mandatory in ICUs). In addition, hand hygiene auditing between the campaigns was unclear and – at best – did not appear to be substantial. An active culture of hand hygiene and IPC did not seem to be present in most of the healthcare facilities visited – for example, some healthcare professionals were wearing watches or rings. There were few visual reminders and, where present (mainly outside single rooms with barrier nursing), these were too small and unlikely to be effective. Hospitals are also required to report on consumption of hand hygiene products and other quality indicators, although during our visits we did not see data on these process indicators and were not informed of any use of such data for self-improvement initiatives. Alcohol-based hand rub solutions seemed widely available, but not always well located (for example, no dispensers at the end of beds or in close proximity to patient care). One well signposted hand rub dispenser was empty.

The national Outbreak Support Team (OST, part of WIV-ISP) is deployed to hospitals requesting help in controlling outbreaks (mainly VRE and CRE outbreaks.) The OST provides scientific advice on HAI surveillance and guidelines on IPC, situation assessment and sampling, and consultation on measures that need to be prioritised and the best way to mediate between actors of response. The OST has had an effective impact on the management of recent outbreaks, although platforms and active sharing of experience and best practices with all hospitals and reporting to all relevant health authorities would be useful to boost awareness and improve IPC practices. For example, the lack of knowledge and awareness from hospital staff on the impact of CRE on patient safety and its propensity to spread more easily than MRSA, was reported to be a problem.

One hospital that we visited had a great deal of spare equipment stored in the corridors of several wards (including the ICU), and open shelving and racking were used to store medical devices and drugs. Multidrug-resistant organisms (MDROs) can settle on these surfaces and they therefore represent a patient safety issue. By way of example, ESBL-producing *E. coli*, VRE and CRE can spread indirectly via environmental contamination when hand hygiene practices are sub-optimal. Moreover, isolation of patients infected with CRE, VRE or MRSA was not always consistent with recognised good-practice standards. Signage requiring contact precautions was not sufficiently clear and evident enough for staff and visiting relatives. As a result, we noted instances of persons accessing and leaving an isolation room without correct precautions, proper use of personal protective equipment (PPE) or hand hygiene.

The level of IPC in the primary care group practice visited was found to be relatively good. We could not gauge whether a similar standard of care was also predominant in practices manned by a single GP. Similarly, several IPC-related initiatives were also observed in the LTCF visited, especially in relation to prevention of catheter-associated urinary tract infections. Nevertheless, emphasis on hand hygiene was not immediately apparent, with few posters or visual signs prominent, suggesting that a pro-active hand hygiene culture was unlikely to be embedded.

3.8 Educational programmes on AMR

No specific course on AMR is available for undergraduate medical students.

No compulsory education on antimicrobial stewardship is in place for GPs and other prescribers. There was also no indication that GPs were using tools provided by BAPCOC. Within the framework of compulsory continuous professional development (CPD) for all medical doctors, BAPCOC provided e-learning modules on antimicrobial stewardship for GPs since October 2017.

3.9 Public information related to AMR

According to the surveys performed each year to evaluate the impact of the winter antibiotic public campaign, the majority of respondents wish to be informed about antibiotics by their doctor (in 2017: 75% by their GP; 47% by the television; 45% by their pharmacist).

Since 2000, Belgium has implemented annual public awareness campaigns focusing on prudent use of antibiotics that have partly served as a basis for the development of European Antibiotic Awareness Day (EAAD), in which Belgium has been participating every year since 2008. Campaigns start in November following the influenza season, with a peak in January.

These national public awareness campaigns on the prudent use of antibiotics target the general public or healthcare professionals and Eurobarometer results show that knowledge of AMR issues in Belgium rates around the European average, or better. Campaigns include different communication strategies such as posters, advertising in media, brochures, TV spots (last broadcast during the winter 2013–14), bags for pharmacies, and direct mailing. Social media are used to some extent, depending on the target audience, messages and/or documents to convey or events taking place. Monitoring of social media use could be improved by using tools such as NewsDesk, developed by the European Commission's Joint Research Centre. However, media coverage is imbalanced between the French, Flemish and German languages. Free broadcasting on national television is not possible and funds are limited to around EUR 400 000 each year (budget not managed by BAPCOC).

During the visit, the ECDC team gathered anecdotal reports that despite the public awareness campaigns targeting the general population, a significant number of patients still expect to be prescribed antibiotics even when this is not appropriate for their condition. Patient pressure was cited as an important reason why some clinicians may overprescribe antibiotics for acute uncomplicated infections, despite guidelines stating the contrary. Some patient groups, for example those who do not watch Belgian television channels where the adverts are hosted, seem to be more vocal in their demands for antibiotics. In a GP medical house that we visited, the amount of time dedicated to each patient was said to be critical to providing better explanations as to why antibiotics were not required for simple viral infections. The GP medical house also organises a number of meetings - dedicated to antibiotic prescribing - that the GPs have to attend. These have led to a documented reduction in antibiotic prescribing and a greater emphasis on patient education and communication.

BAPCOC has translated the United Kingdom's Antibiotic Guardians initiative into the two main national languages. For children and teenagers, BAPCOC proposes the e-Bug programme in the two main national languages, so it can be used in schools throughout the country.

In November 2017, BAPCOC made available national public awareness material to all Belgian hospitals during the EAAD. This material aimed at raising awareness of prescribers, nurses and the public visiting the hospitals, about prudent use of antibiotics.

3.10 Marketing related issues

Belgium has a code of ethics for healthcare professionals and a system of transparency for ensuring ethical sponsoring of professional meetings. Yet pharmaceutical companies are allowed to sponsor symposia for continuous education. This represents a potential significant conflict of interest although it was reported that representatives of the pharmaceutical industry did not directly advertise their products during these symposia and that several companies could sponsor the same meeting.

Nevertheless, the influence of pharmaceutical companies on prescribing behaviour seemed to be significant. One reason for the high prescription rates of moxifloxacin in Belgium compared to other countries seems to be the significant influence of pharmaceutical companies on prescribers' practices in the past. Prescribers did not report recent promotional activities on antibiotics.

Prescribers experience difficulties regarding the availability of some narrow-spectrum antibiotics, such as oral penicillin V; these are less expensive and could replace broad-spectrum antibiotics for several conditions, such as tonsillitis.

4 Conclusion and recommendations

4.1 Conclusions

Although the percentage of meticillin-resistant *Staphylococcus aureus* (MRSA) isolates over all *S. aureus* tested has been declining since 2003, particularly within healthcare-associated infections, Belgium now faces challenges in preventing and controlling infections with multidrug-resistant Gram-negative bacteria. For example, the percentages of ESBL-producing *E. coli* and *K. pneumoniae* have been increasing since 2007. Moreover, the latest data from EARS-Net show a substantial increase in the percentage of carbapenem-resistant isolates among *K. pneumoniae* from bloodstream infections. Between 2012 and 2015, active surveillance of carbapenem-producing carbapenem-resistant Enterobacteriaceae (CRE) from the National Reference Centre (NRC) demonstrated a three-fold increase in the number of reported isolates. Of greater concern is the emergence of New Delhi metallo-beta-lactamase (NDM)-producing CRE, which increased from 0.5% in 2012 to 8% of reported carbapenemase-producing CRE in 2015. Between 2012 and 2015, the NRC provided services to all Belgian hospitals and private laboratories for carbapenemase detection. In 2015, CPE was added to the mandatory surveillance of multidrug-resistant gram-negative bacteria. Nevertheless, reporting of CPE is *de facto* optional, because not all hospital laboratories have the capacity to detect carbapenemase production. Reporting of CRE (without information on carbapenemase production) is compulsory for six months per year; most hospitals provide data for the full year on a voluntary basis.

Belgium was one of the first European countries to implement a national antibiotic policy coordinating commission, the Belgian Antibiotic Policy Coordination Commission (BAPCOC). The work and dedication demonstrated so far are impressive, with outstanding professionals who contribute to the ambitious targets set by the Steering Committee ('Bureau') and the Working Groups. BAPCOC efforts to produce evidence-based, independent guidelines on appropriate antibiotic use, in both the community and hospital settings are laudable. Moreover, BAPCOC promotes activities conducted to foster education groups, among GP circles and among hospital networks, and has also been promoting awareness campaigns for the general public for many years. These campaigns were initially successful in reducing antibiotic consumption, by reducing the demand for antibiotics, and contributed to reducing AMR in *S. pneumoniae* in Belgium.

Despite all these activities, human antibiotic use in Belgium remains above EU/EEA average in the community if expressed in DDD per 1 000 inhabitants per day, but falls below the EU/EEA average when expressed in packages per 1 000 inhabitants per day. In addition, a heavy emphasis is placed on prescription of broad-spectrum antibiotics both in the community and in hospitals, bestowing a higher risk that AMR will develop and ultimately increase the costs of healthcare. In addition, a significant proportion of hospitals report not having a policy to restrict the use of last-resort antibiotics. Moreover, antibiotic susceptibility is not reported selectively on laboratory results and often decisions on which antibiotics to prescribe are not supported by infectious disease specialist advice (which is particularly important in hospital settings).

National surveillance of healthcare-associated infections (HAIs) due to antimicrobial-resistant bacteria, and HAIs in general, performed by the Scientific Institute of Public Health (WIV-ISP), was considered to be one of the most extensive national systems seen during the ECDC country visits on AMR. This impressive surveillance system has contributed to documenting the successful reduction of MRSA in the country. However, surveillance is now highlighting an even bigger patient safety challenge - the increasing impact of CRE on healthcare. We believe that Belgium is at a cross-roads: the situation can still be controlled to ensure that the CRE epidemic does not reach the endemic situation similar to that in a number of southern EU countries where deaths from untreatable CRE infections are, unfortunately, a daily reality.

Belgium will need to establish its own ranking priorities. Ultimately, however, the success of AMR control will depend on increasing the level of urgency for change among all prescribers, stakeholders and the general public. In turn, this will require strong leadership and a considerable top-down direction.

4.2 Recommendations

Update the national intersectoral coordinating commission. BAPCOC is almost 20 years old and the current AMR epidemiological situation is different to that at its inception in 1999. A priority for BAPCOC would be to review and update its composition, mandate, tasks and lines of reporting. The respective remits of BAPCOC and the Scientific Institute of Public Health need to be complementary and not overlap. For example, BAPCOC could play an enhanced role as a policy advisory body on IPC and AMR, including MDRO outbreaks. In fact, it has been demonstrated that a holistic approach is essential to effectively curb AMR. A national Intersectoral Coordinating Mechanism (ICM) should be multi-disciplinary (the veterinary side and animal health activities within BAPCOC are limited). It should include a strong IPC component and a tangible presence from the relevant ministries. Therefore, BAPCOC should not limit its activities to antibiotic policy alone; this rearrangement could even be reflected in a change of name and acronym.

In addition, the organisational aspects should be updated in order to face the administrative difficulties and procurement issues which in the past have resulted in inefficiencies and difficulties in executing budget. Adequate

resources should be made available, such as ministerial staff and support from relevant ministries for handling the administration, procurement, coordination and secretarial tasks of BAPCOC. Finally, composition of BAPCOC should include complementary key actors, such as representatives of long-term care facilities (LTCFs), nurses, patients and consumer groups.

Develop a national action plan based on the BAPCOC policy paper. The current policy paper from BAPCOC should be transformed into a comprehensive national action plan following the One Health approach, in line with the Council Conclusions of 17 June 2016, and incorporating specific activities, a core compulsory set of AMR and HAI indicators, targets (including IPC targets that are now absent from the document), times and responsible entities (to increase the executive role of the relevant ministries). The national action plan should cover human medicine (ambulatory/general practice, hospital and nursing homes sectors) and animal medicine, including vaccination policy. This action plan, once approved, will need to be supported and provided with the necessary resources for its implementation, preferably earmarked for each activity.

Implement a national CRE control strategy. We believe that Belgium must urgently review its current actions on CRE surveillance and control, and develop and implement a consistent and sustainable national CRE control strategy for all Belgian hospitals and other healthcare settings. This will rely on mandatory surveillance and notification of CRE cases (throughout the whole year), reducing antibiotic prescription in hospitals and other stewardship measures aimed at prudent use of antibiotics; sufficient numbers of IPC nurses and doctors to support strengthened IPC practices, such as upscaling at admission and regular CRE screening practices with rapid turnaround time to inform patient placement decisions; effective patient isolation procedures (which will need complementary resources even when cohorting CRE patients and the staff caring for them), contact precautions and contact tracing; access to molecular typing for confirmed carbapenemase-producing CRE. When suspected cross-transmission of CRE is recognised, this should be subject to root-cause analysis, the most relevant risk factors identified and improvements to processes explored and implemented.

As a service to clinical microbiology services in the country, the national reference laboratory should be able to provide assistance with the analysis of CRE isolates, confirmation of carbapenemase-production and should be funded accordingly.

Commitment of healthcare frontline and administrative staff, as well as ownership and accountability for CRE prevention and control are key factors. Having full recognition of infectious disease consultation for the purposes of reimbursement would also help achieve these goals. Promoting a culture of transparency for reporting hospital outbreaks of MDROs, without fear of possible repercussions on staff and the hospital/healthcare setting, is also vital.

In addition, surveillance of *Clostridium difficile* and of VRE should also be reinforced, in the light of the numerous outbreaks experienced throughout the country and designated as mandatory rather than optional as is currently the case.

Strengthen infection prevention and control policies. Based on our observations, the number (full time equivalents - FTEs) of dedicated IPC nurses and doctors in hospitals appeared low compared to accepted standards, particularly given the evolving CRE situation. IPC staffing in hospitals should be reviewed and increased accordingly to ensure that all necessary tasks are performed. The number of IPC staff required by law in Belgium is based on staff ratios that were drafted prior to the current threat represented by CRE and other healthcare-associated MDROs. This number should therefore be reviewed and adapted to the current AMR epidemiology in Belgium.

Belgium has conducted biennial hand hygiene campaigns, which have shown a consistent and encouraging increase in hand hygiene compliance. However, our observations show that more effort and initiatives are needed – throughout the year and in all types of healthcare settings starting with hospitals – to embed a culture of hand hygiene across the spectrum of healthcare settings. It seems that focus on hand hygiene is primarily restricted to the period of the campaign and to performing the minimal number of observations. Moreover, the ECDC team identified few obvious hand washing posters/visuals for patients or staff around hospitals, LTCF or GP practices. Simple visual poster reminders are needed in bathrooms, waiting areas, consulting rooms, and inside and outside wards. To reduce transmission of MDROs in hospitals and in the community, and to improve patient safety, mandatory hand hygiene audits could be extended to all healthcare settings.

Finally, increasing vaccination coverage of staff (and patients, in particular residents in long-term care facilities) should be part of the antimicrobial stewardship and IPC programmes in Belgian hospitals, healthcare facilities, and GP and specialist practices.

Promote compliance with evidence-based prescription guidelines. From June 2018, a mandatory electronic prescribing system will be in place. This represents an important opportunity for faster feedback of prescribing practices to clinicians and GPs, benchmarking and self-improvement of these prescribing practices through, for example, visits from peers to the highest prescribers of antibiotics. Similar experiences from other EU/EEA countries showed how successful peer-reviews are. However, information on the indication (type of infection) for each antibiotic prescription would need to be reported in order for the monitoring and evaluation of e-prescriptions to be really effective.

In addition, the development of the e-health system represents an opportunity to include decision-making tools in accordance with national guidance or warning in the event of inappropriate prescription. E-prescribing can easily be linked to national guidelines. For example, through pop-up windows reminding the clinician what the favoured antibiotic is and why, when information is included on the indication for prescription of a particular antibiotic. As a minimum, a pop-up window would appear when prescribing specific antibiotics, such as broad-spectrum antibiotics. To preserve last-line antibiotics, we recommend that a national, harmonised policy be implemented for a restricted list of some antibiotics and that this should be mandatory. For example, prescription of certain broad-spectrum antibiotics could be restricted to specialists.

Introducing targets, increasing access to narrow-spectrum antibiotics (e.g. authorities ensuring that pharmaceutical companies market penicillin V) and making antibiotic stewardship a mandatory discussion theme in GP circles are potential and achievable interventions to effectively curb antibiotic use. Moreover, the results of clinical audits, which are rarely reported back to clinicians, could become part of a quality label for GPs, LTCFs and hospitals. Audit templates for particular conditions could be further produced and evaluated by BAPCOC. To make these audits more effective and to improve prescription habits in general, providing information on the indication for each antibiotic prescription should also be mandatory as this would enable the quality of antibiotic prescriptions to be monitored, rather than just the quantity of prescribed antibiotics.

Although it is important to assess compliance with guidelines, this could include tailored advice and the guidelines themselves could be made more readily available. For example, they could provide evidence that broad-spectrum antibiotics are not more effective than narrow-spectrum antibiotics.

Other possible effective interventions would be to create a network of pharmacists with training in antibiotic use, as well as promoting delayed/back up antibiotic prescription (especially useful when confronted with demanding patients), in parallel with safety netting. Finally, limited and conditional reimbursement, as has been proposed, among others, by FPS Health, BAPCOC and NIHDI for quinolones, would help limit usage and promote antibiotic stewardship and adherence to guidelines.

Mandatory audits of antibiotic use, dose, duration and reason for prescribing as part of the accreditation process would help GPs and specialists understand and change their prescribing practices. In hospitals, coupling the audits with input and help by medical microbiologists and infectious disease specialists would increase prescribing appropriateness.

Targets on antibiotic use could also be included in the 'pay-for-performance' system and would contribute to promoting behaviour change via financial incentives. However, in order for these interventions to be effective, the government will have to encourage pharmaceutical companies to market narrow-spectrum antibiotics and address the current lack of supply of penicillin V (oral) and amoxicillin for intravenous injections.

As a minimum, specific challenges concerning over-prescription for certain conditions, such as inappropriate prophylaxis, antibiotic treatment of asymptomatic UTI or overuse of fluoroquinolones, should be the focus of tailored antibiotic stewardship interventions. We recommend that the results of these audits continue to be fed back through written reports with interpretation and advice in hospital and community settings. GP-dedicated peer-review groups or GP circles would be encouraged to discuss the results and challenges and to look at how antibiotic use could be improved.

The management of patients' expectations requires time for coaching and convincing patients and parents of young children that antibiotics may not be necessary. This time is not always available or a priority for private GPs. Dedicated topics on antibiotic stewardship and patient communication as part of GP circle discussions could help GPs to tackle this issue.

Reinforcement of infectious disease clinicians' status and activity. Clinicians with appropriate knowledge and training about antibiotics and AMR, such as ID specialists or medical microbiologists, are essential to ensuring appropriate treatment of infections, appropriate use of antibiotics and support for antibiotic stewardship programmes. Infectious disease specialisation and consulting should be formally acknowledged and consultations should be eligible for financial compensation.

Medical microbiology. Increased daily input by clinical microbiologists would improve the management of infections. This could be supported by automated comments, automated pop-up antibiotic guidance when receiving microbiology reports, and restrictive reporting of antibiotic susceptibility tests to encourage clinicians to use the correct antibiotic.

Guidelines for antimicrobial susceptibility testing of *Streptococcus pneumoniae* isolates implemented in Belgian laboratories should be based on breakpoints published by the European Committee on Antimicrobial Susceptibility Testing (EUCAST), in order to compare the proportion of antibiotic-resistant *Streptococcus pneumoniae* with that in other EU/EEA countries.

Awareness campaigns. National public awareness campaigns on the prudent use of antibiotics should be continued and should target both the general public and healthcare professionals. The campaigns should engage national and regional media with well-crafted stories, multiplying the messages around prudent use of antibiotics and the issues posed by AMR. The use of limited funds should be systematically monitored and evaluated for cost-

effectiveness. Finally, traditional and social media should be monitored (the use of tools such as the EC Joint Research Centre NewsDesk could facilitate this task).

Tailored campaigns including patient leaflets or posters, in multiple languages if necessary, at GP facilities and hospital wards, could increase awareness among patients, GPs, hospital prescribers and nurses.

Possible solutions for low-budget campaigns include the engagement of national and regional media to tell personal stories and the engagement of well-known, national and regional figures as sponsors. These would help boost the messages on AMR and the need for a more prudent use of antibiotics. Moreover, evaluation of the cost-effectiveness of the successive campaigns would help gather evidence for further action.

Compulsory education on AMR and antibiotic stewardship. Education on issues posed by AMR and the prudent use of antibiotics in the undergraduate and postgraduate curriculum should be compulsory. AMR topics, antibiotic stewardship and IPC should also be part of the continuous professional training for medical doctors and nurses, with a minimum biannual required attendance.

Strengthen the role of the coordinating physician in nursing homes. Each LTCF should have and implement clear antibiotic guidance, preferably placing emphasis on specific issues such as treatment of UTIs, asymptomatic bacteriuria and respiratory infections. Clear, short tables targeting the management of residents with dementia who have suspected infections or are carriers of MDRO would help to increase appropriate use of antibiotics.

5 Annexes

5.1 Country visit team and people met during the ECDC country visit to Belgium to discuss AMR issues

ECDC Team

- Dominique L. Monnet, Head of Antimicrobial Resistance and Healthcare-associated Infections (ARHAI) Programme, ECDC, Stockholm, Sweden
- Alessandro Cassini, Expert for Antimicrobial Resistance and Healthcare-associated Infections, ECDC, Stockholm, Sweden
- Michael Borg, National Focal Point for AMR, National Focal Point for Antimicrobial consumption, National Focal Point for Healthcare-Associated Infections, Malta
- Catherine Dumartin, Regional Centre for Prevention of Healthcare-Associated Infections, Bordeaux, France
- Cliodna A. M. McNulty, Head of Public Health England Primary Care Unit, Gloucester, UK
- Andrea Nilsson, Communication Specialist, Press and Media, Communication Support, ECDC, Stockholm, Sweden (only 14 November 2017)

Persons met*

Monday 20 November 2017

Meeting with national authorities: Federal Public Service Health, Food Chain Safety and Environment (FOD VVVL-SPF SPSCAE, FPS Health), Belgian Antibiotic Policy Coordination Commission (BAPCOC), National Institute for Health and Disability Insurance (INAMI-RIZIV, NIHDI), Federal Agency for Medicines and Health Products (FAGG-AFMPS, FAMHP), Federal Agency for the Safety of the Food Chain (FAVV-AFSCA, FASFC), Centre of Expertise Antimicrobial Consumption and Resistance in Animals (AMCRA), Scientific Institute of Public Health (WIV-ISP), Veterinary and Agrochemical Research Centre (CERVA-CODA), Regional Office for Health & Well-being, Wallonia (AViQ)

FPS Health, Brussels

- Myriam Boreux, Surveillance of Infectious Diseases, AViQ
- Diederica Claeys, Assessor, Clinical human cell, FAMHP
- Fabiana Dal Pozzo, Coordinator, AMCRA
- Lieven De Raedt, Attaché, International Relations, FPS Health
- Katelijne Dierick, Operational Director, Infectious Diseases, WIV-ISP
- Jan Eyckmans, Head of Communication, FPS Health
- Pedro Facon, General Director Healthcare, FPS Health
- Herman Goossens, Professor of Clinical Pathology, University of Antwerp; Chair, BAPCOC
- Margareta Haelterman, Head, Cell Quality of Care & Patient Safety, FPS Health
- Germaine Hanquet, Medical Expert, KCE
- Jean-François Heymans, Director, Animal Health & Safety of Animal Products, FASFC
- Bart Hoet, Assessor, Medicines for Veterinary Use, FAMHP
- Mathieu Hubaux, Attaché, Veterinary & Animal Health, FPS Health
- Hein Imberechts, Programme Management & Biosafety Officer, CERVA-CODA; BAPCOC
- Anne Ingenbleek, BAPCOC Coordinator, FPS Health
- Gerard Lamsens, Head, Service Health Policy Animal & Plants, FPS Health
- Roos Leroy, Expert, Clinical and Health Services Research, KCE
- Jacques Mainil, BAPCOC; Professor of Veterinary Medicine, Infectious Diseases, University of Liège
- Sarah Panuccio, Attaché, Healthcare, FPS Health
- Daniel Reynders, Head of International Relations, FPS Health
- Nathalie Shodu, Inspector, Surveillance – Infectious Diseases, AViQ
- Katie Vermeersch, Veterinary Expert, One Health Contact Point, FASFC
- Ann Versporten, Scientific Researcher, University of Antwerp; BAPCOC

Meeting to discuss health systems and antibiotic policies with Federal Public Service Health, Food Chain Safety and Environment (FPS Health), Belgian Antibiotic Policy Coordination Commission (BAPCOC), Federal Agency for Medicines and Health Products (FAMHP), Centre for Health Economics (KCE), Scientific Institute of Public Health (WIV-ISP), Regional Office for Health & Well-Being, Wallonia (AviQ), Regional Office for Health & Well-Being, Brussels (CCC-GGC), Regional Office for Health & Well-Being, Flanders (Zorg en Gezondheid)

* Names are cited in alphabetical order

FPS Health, Brussels

- Myriam Boreux, Surveillance of Infectious Diseases, AviQ
- Diederica Claeys, Assessor, Clinical Human Cell, FAMHP
- Lieven De Raedt, Attaché, International Relations, FPS Health
- Wouter Dhaeze, Healthcare Inspector, Zorg en Gezondheid
- Margareta Haelterman, Head, Cell Quality of Care & Patient Safety, FPS Health
- Germaine Hanquet, Medical Expert, KCE
- Cécile Huard, Communicable Diseases, CCC-GGC
- Anne Ingenbleek, BAPCOC Coordinator, FPS Health
- Barbara Legiest, Medical Expert, Outbreak Support Team, WIV-ISP
- Roos Leroy, Expert Clinical and Health Services Research, KCE
- Romain Mahieu, Medical Expert Communicable Diseases, CCC-GGC
- Sarah Panuccio, Attaché Healthcare, FPS Health
- Patricia Roman, Communicable Diseases, CCC-GGC
- Nathalie Shodu, Inspector, Surveillance of Infectious Diseases, AViQ
- Elias Staes, Attaché, International Relations, FPS Health
- Ann Versporten, Scientific Researcher, University of Antwerp; BAPCOC

University hospital in Brussels: six persons met (associate chief medical officer and healthcare professionals: infectious disease specialists, microbiologist, infection control physician, hospital pharmacist)*

Tuesday 21 November 2017

Meeting to discuss the Belgian Antibiotic Policy Coordination Commission (BAPCOC) with Federal Public Service Health, Food Chain Safety and Environment (FPS Health), Belgian Antibiotic Policy Coordination Commission (BAPCOC), Centre for Health Economics (KCE), Veterinary and Agrochemical Research Centre (CERVA-CODA)

FPS Health, Brussels

- Vinciane Charlier, Attaché, Communication, FPS Health
- Lieven De Raedt, Attaché, International Relations, FPS Health
- Margareta Haelterman, Head, Cell Quality of Care & Patient Safety, FPS Health
- Hein Imberechts, Programme Management & Biosafety Officer, CERVA-CODA; BAPCOC
- Anne Ingenbleek, BAPCOC Coordinator, FPS Health
- Roos Leroy, Expert Clinical and Health Services Research, KCE
- Koen Magerman, Clinical Biologist, Hasselt Jessa Hospital; BAPCOC
- Sarah Panuccio, Attaché, Healthcare, FPS Health
- Ann Versporten, Scientific Researcher, University of Antwerp; BAPCOC

Meeting to discuss national surveillance on healthcare-associated infections with the Federal Public Service Health, Food Chain Safety and Environment (FPS Health), Belgian Antibiotic Policy Coordination Commission (BAPCOC), Scientific Institute of Public Health (WIV-ISP), Centre for Health Economics (KCE), Regional Office for Health & Well-being, Wallonia (AViQ), National Institute for Health and Disability (NIHDI), Veterinary and Agrochemical Research Centre (CERVA-CODA)

FPS Health, Brussels

- Myriam Boreux, Surveillance of Infectious Diseases, AViQ
- Boudewijn Catry, Head of HAI & AMR, WIV-ISP
- Hélène De Pauw, Scientific Collaborator, HAI & AMR, WIV-ISP
- Lieven De Raedt, Attaché, International Relations, FPS Health
- Els Duysburgh, Scientific Collaborator, HAI & AMR, WIV-ISP
- Lies Grypdonck, Medical Advisor, Medical Evaluation and Control, NIHDI
- Hein Imberechts, Programme Management & Biosafety Officer, CERVA-CODA; BAPCOC
- Anne Ingenbleek, BAPCOC Coordinator, FPS Health
- Beatrice Jans, HCAI & AMR Expert, WIV-ISP
- Roos Leroy, Expert, Clinical and Health Services Research, KCE
- Koen Magerman, Clinical Biologist, Hasselt Jessa Hospital; BAPCOC
- Karl Mertens, Scientific Collaborator, HAI & AMR, WIV-ISP
- Laure Mortgat, Scientific Collaborator, HAI & AMR, WIV-ISP
- Sarah Panuccio, Attaché, Healthcare, FPS Health
- Nathalie Shodu, Inspector, Surveillance of Infectious Diseases, AViQ
- Thomas Struyf, Scientific Collaborator, HAI & AMR, WIV-ISP
- Eline Vandael, Scientific Collaborator, HAI & AMR, WIV-ISP
- Ann Versporten, Scientific Researcher, University of Antwerp; BAPCOC

* At the request of the Belgian authorities, the name of the site visited and persons met are not specified in this report.

Meeting to discuss national antibiotic policies with the Federal Public Service Health, Food Chain Safety and Environment (FPS Health), Belgian Antibiotic Policy Coordination Commission (BAPCOC), National Institute for Health and Disability Insurance (NIHDI), Scientific Institute of Public Health (WIV-ISP), Centre for Health Economics (KCE), Regional Office for Health & Well-being, Wallonia (AViQ), Regional Office for Health & Well-Being, Brussels (CCC-GGC), Federal Agency for Medicines and Health Products (FAMHP)

FPS Health, Brussels

- Myriam Boreux, Surveillance of Infectious Diseases, AViQ
- Diederica Claeys, Assessor, Clinical human cell, FAMHP
- Lieven De Raedt, Attaché, International Relations, FPS Health
- Lies Grypdonck, WIV-ISP
- Margareta Haelterman, Head, Cell Quality of Care & Patient Safety, FPS Health
- Germaine Hanquet, Medical Expert, KCE
- Anne Ingenbleek, BAPCOC Coordinator, FPS Health
- Roos Leroy, Expert, Clinical and Health Services Research, KCE
- Romain Mahieu, Medical Expert Communicable Diseases, CCC-GGC
- Wesley Mattheus, Scientific Collaborator, Reference Laboratories, WIV-ISP
- Pascal Meeus, General Advisor, NIHDI
- Gaetan Muyldermans, Scientific Collaborator, Infectious Diseases, WIV-ISP
- Sarah Panuccio, Attaché, Healthcare, FPS Health
- Patricia Roman, Communicable Diseases, CCC-GGC
- Nathalie Shodu, Inspector, Surveillance – Infectious Diseases, AViQ
- Eline Vandael, Scientific Collaborator, HAI & AMR, WIV-ISP
- Ann Versporten, Scientific Researcher, University of Antwerp; BAPCOC

Long-term care facility in Brussels: met with the Medical coordinator*

General practitioners in Brussels: met two GPs†

Wednesday 22 November 2017

Hospital in the Region of Flanders: six persons met (medical director and healthcare professionals: pneumologist, microbiologist, hospital pharmacists)‡

Primary care facility in Ghent: six persons met§

Dinner with Chief of Staff, Federal Public Service Health, Food Chain Safety and Environment (FPS Health), Radisson Hotel, Atrium, Brussels

- Lieven De Raedt, Attaché, International Relations, FPS Health
- Margareta Haelterman, Head, Cell Quality of Care & Patient Safety, FPS Health
- Anne Ingenbleek, BAPCOC Coordinator, FPS Health
- Bert Winnen, Chief of Staff, Minister De Block's staff.

Thursday 23 November 2017

Hospital in the Region of Wallonia: 13 persons met (healthcare professionals: infectious disease specialists, microbiologists, infection prevention and control specialist and nurses, intensive care specialist, hospital pharmacist)**

* At the request of the Belgian authorities, the name of the site visited and persons met are not specified in this report.
† At the request of the Belgian authorities, the name of the site visited and persons met are not specified in this report.
‡ At the request of the Belgian authorities, the name of the site visited and persons met are not specified in this report.
§ At the request of the Belgian authorities, the name of the site visited and persons met are not specified in this report.
** At the request of the Belgian authorities, the name of the site visited and persons met are not specified in this report.

Friday 24 November 2017

Preliminary report debriefing from the ECDC Team to the Federal Public Service Health, Food Chain Safety and Environment (FPS Health), Belgian Antibiotic Policy Coordination Commission (BAPCOC), Federal Agency for the Safety of the Food Chain (FASFC), Federal Agency for Medicines and Health Products (FAMHP), Centre of Expertise Antimicrobial Consumption and Resistance in Animals (AMCRA), Scientific Institute of Public Health (WIV-ISP), Veterinary and Agrochemical Research Centre (CERVA-CODA), Belgian Health Care Knowledge Centre (KCE)

Location: FASFC, Brussels

- Tom Auwers, President of the Executive Committee, FPS Health
- Boudewijn Catry, Head HAI & AMR, WIV-ISP
- Diederica Claeys, Assessor, Clinical Human Cell, FAMHP
- Samuel Coenen, Clinical Epidemiology & Social Medicine, University of Antwerp; BAPCOC
- Anina Colin, Inspector, FASFC
- Fabiana Dal Pozzo, Coordinator, AMCRA
- Maggie De Block, Minister of Social Affairs and Public Health
- Lieven De Raedt, Attaché, International Relations, FPS Health
- Thierry Detobel, Minister Ducarme's staff
- Katelijne Dierick, Operational Director a.i., Infectious Diseases, WIV-ISP, representing Myriam Sneyers, General Director a.i., WIV-ISP.
- Herman Diricks, Chief Executive Officer, FASFC
- Fanny Di Silvestro, Attaché, FASFC
- Jan Eyckmans, Head Communication, FPS Health
- Herman Goossens, Professor Clinical Pathology, University of Antwerp; Chair, BAPCOC
- Margareta Haelterman, Head, Cell Quality of Care & Patient Safety, FPS Health
- Germaine Hanquet, Medical Expert, KCE
- Jean-François Heymans, Director Animal Health & Safety of Animal Products, FASFC
- Bart Hoet, Assessor, Medicines for Veterinary Use, FAMHP
- Mathieu Hubaux, Attaché, Veterinary & Animal Health, FPS Health
- Hein Imberechts, Programme Management & Biosafety Officer, CERVA-CODA; BAPCOC
- Wim Impens, Inspector, FAMHP
- Anne Ingenbleek, BAPCOC Coordinator, FPS Health
- Pierre Kerkhofs, General Director, CERVA-CODA
- Tessa Latrez, Minister De Block's staff
- Vicky Lefèvre, General Director, Control Policy, FASFC
- Roos Leroy, Expert, Clinical and Health Services Research, KCE
- Dries Minne, Head of Veterinary Division, FAMHP
- Lode Potte, Inspector, FASFC
- Daniel Reynders, Head of International Relations, FPS Health
- David Saeys, Expert, FASFC
- Anne Simon, Professor of Clinical Microbiology, University Saint-Luc; Vice-Chair, BAPCOC
- Valerie Van Merris, International Affairs, FAMHP
- Katie Vermeersch, Veterinary Expert, One Health Contact Point, FASFC
- Ann Versporten, Scientific Researcher, University of Antwerp; BAPCOC
- Julie Wits, Expert, FASFC.

5.2 Assessment tool for ECDC country visits to discuss antimicrobial resistance (AMR) issues

The mechanisms behind emerging antimicrobial resistance (AMR) are complex. However, two main issues that stand out offering opportunity for control efforts are: the use of antibiotics and the epidemiological spread of resistant microbes.

The complexity of the problem makes it difficult to grade which interventions are most successful. Where interventions have been introduced few of them have been evaluated. This may partly be because few systematic interventions have been used.

The Council Recommendation on the prudent use of antimicrobial agents in human medicine (2002/77/EC) lists a number of areas that have an impact on controlling AMR. Most of the following tentative indicators are based on the Council Recommendation. Some are based on experience from different countries. These indicators are either structure- or process-related. Outcome indicators are collected by dedicated surveillance networks.

1. Development of an Intersectoral Coordinating Mechanism (ICM)

Due to the complexity of the issue there is a need for coordination to make an interventional strategy work. There is also a need for close cooperation from fields such as epidemiology, microbiology clinical medicine, infection control, veterinary medicine, pharmacology and behavioural sciences. It also requires cooperation from practitioners working in different medical specialities as well as government departments and healthcare providers.

In the Council Recommendation on the prudent use of antimicrobial agents in human medicine (2002/77/EC) and the World Health Organization (WHO) Global Strategy for Containment of Antimicrobial Resistance (WHO/CDS/CSR/DRS/2001.2) the establishment of a coordinating group is regarded as essential.

Member States have different administrative organisations. There should be a group at the highest administrative level where representatives from regulatory bodies and professionals from the different sectors coordinate.

Tentative indicators for 1

Structures

- Multidisciplinary composition
- Regular meetings
- Minutes from meetings
- National strategy plan available
- Defined governmental mandate
- Financially supported by government.

Functions

- Coordinates analysis of consumption and plans and supports interventions
- Proposes national objectives and policies
- Proposes, plans and supports interventions
- Provides policymakers, media and public with continues updated and structured data
- Provides support to local working groups.

2. Organised multidisciplinary and multisectoral collaboration at local level

One of the main elements for control strategies is to lower the selective pressure of antibiotics by restricting usage to appropriate indications. There is much evidence showing that antibiotics are overused. Prescribers need to be well acquainted with the AMR problem and the rational of using antibiotics appropriately.

A non-regulatory intervention that has had some influence on prescribing habits is a local activity whereby practising physicians discuss local data on consumption and bacterial resistance patterns, supported by epidemiologists, pharmacists and infection control. This proves to be an appropriate opportunity to revise local usage patterns, develop local guidelines (based on national guidelines) and organise local meetings with prescribers to promote rational use of antibiotics. In addition, topical issues can be discussed, such as problems related to MRSA or *Clostridium difficile* 027.

Practising doctors have limited time available. It is essential that there is a good collaboration with and support from the national/regional group to provide background data and help with scientific updates.

Tentative indicators for 2

General

Structures

- Are there local activities in some places?
- Are there nationally disseminated local activities?
- Are activities in hospitals and primary healthcare coordinated at the local level?

Primary health care

Structures

- Are there local activities in primary health care?
  - If yes:
  - Mostly multidisciplinary
  - Private practitioners are taking part
  - Have access to local surveillance data on AMR
  - Have access to local antibiotic consumption data
  - Have public funding
  - Meet regularly.

Functions

Primary areas of work are:

- Infection control
- Diagnostic practices/habits
- Analysis of local consumption and resistance data
- Educational activities
- Coordination of interventions
- Provide local guidelines
- Convene local meetings with prescribers at least once a year.

Hospitals

Structures

- Are there local activities in hospital health care?
  - If yes:
  - Mostly multidisciplinary
  - Have access to local surveillance data on AMR
  - Have access to local antibiotic consumption data
  - Have public funding
  - Meet regularly.

Functions

Primary areas of work are:

- Infection control
- Diagnostic practices/habits
- Analysis of local consumption and resistance data
- Educational activities
- Coordination of interventions
- Provide local guidelines
- Convene local meetings with prescribers at least once a year.

3. Laboratory capacity

Laboratory capacity is essential for many reasons:

- To be able to follow trends in antimicrobial resistance;
- To discover newly emergent resistant strains;
- To enable prescribers to make informed antibiotic choices. For this there is a need for timely feedback to clinicians.

It is important to characterise isolates that may have clinical importance. Often this cannot be done in all laboratories so a referral system to specialised laboratories should exist.

All laboratory work should be quality assessed regularly.

Tentative indicators for 3

General

Structures

- How many diagnostic laboratories are appropriately equipped for microbiological diagnostic work (minimum requirement: performance of gram-stain, aerobe culture and antimicrobial susceptibility testing)?
- What proportion of microbiological laboratories have at least one specialist clinical/medical microbiologist?
- Is there a formal referral structure to reference laboratories supported by public (alternatively through insurance system or equivalent) funding?
- Does a national external quality assessment scheme exist?
- Does an accreditation system exist for microbiological laboratories that requires regular QC and EQA?

Hospitals

Functions

- What proportion of microbiological laboratories provide preliminary and individual feedback (gram stain, rapid tests, culture results) via telephone or clinical rounds to the submitting clinician within the first 12 hours of receiving a diagnostic specimen?
- What proportion of microbiological laboratories provide preliminary and individual feedback (gram stain, rapid tests, culture results) via telephone or clinical rounds to the submitting clinician within the first 24 hours of receiving a diagnostic specimen?
- What proportion of microbiological laboratories provides susceptibility test results to the submitting clinician within 48 hours of receiving a diagnostic specimen?
- What proportion of microbiological laboratories provides species identification of blood culture isolates to the submitting clinician?
- Who pays for the analysis of samples sent in?

Out patients

Functions

- What proportion of general practitioners can submit clinical specimen for microbiological investigation to an appropriately equipped microbiological laboratory within 12 hours?
- What proportion of microbiological laboratories provide preliminary and individual feedback (gram stain, rapid tests, culture results) to the submitting clinician within the first 24 hours of receiving diagnostic specimen?
- What proportion of microbiological laboratories provides susceptibility test results to the submitting clinician within 48 hours of receiving a diagnostic specimen?
- Who pays for sent in sample analysis?

4. Monitoring of antibiotic resistance

Resistance patterns should regularly be followed. This should be done using a standardised method. The method should be quality assessed on a regular basis.

To be able to guide prescribers in prudent usage of antibiotics, surveys of different clinical conditions should be carried out to define which pathogens and their susceptibility profiles for antibiotics. The resistance pattern may vary from area to area so local monitoring may be needed.

Data should be gathered nationally and internationally to follow long term trends.

Tentative indicators for 4

- Local, time limited studies have been performed
- Local continuous, monitoring is done in a few laboratories
- Are duplicates excluded?
- National monitoring with standardised methodology on clinically and epidemiologically relevant bacterial pathogens is on-going
- Country wide local monitoring with standardized methodology in communities and hospital unites is on-going
- Data from hospitals and out-patient settings are treated separately
- Data collection is financially supported by government
- Regular surveys of resistance patterns for pathogens in population based syndromes are performed
- Regular feedback of resistance patterns to prescribers and local groups is given.

5. Monitoring of antibiotic usage

As antibiotic usage is the driving force for emerging resistance it is important to monitor usage. Therefore, reliable surveillance systems of antibiotic consumption are essential to complement antibiotic resistance data and develop instruments for assessing effective strategies to foster appropriate antibiotic use in all European countries.

Current antibiotic use surveillance systems are mostly monitoring trends and shifts in usage patterns. However, to deepen our understanding of antibiotic prescribing, more detailed information is needed on patients' age and gender, the prescriber, the indication and pathogen. Although prescriber data are felt as sensitive, this kind of data can be used for the self-assessment. Aggregated data may be used for local group discussions.

Tentative indicators for 5

- Are valid national data on outpatient antibiotic use available?
- Are valid national (or at least representative sample) data on hospital antibiotic use available?
- Is collection of data on antibiotic use legally supported?
- Is data collection financially supported by the government?
- Are data available per prescriber/ clinical diagnosis/micro-organism?
- Is there regular feedback of prescription patterns to prescribers?
- Are anonymous data fed back to local groups?

6. Antibiotic utilisation and treatment guidance

Antibiotics should be used properly. 'Proper use' is a difficult term both in human and veterinary medicine. There is still a need to find some common view on what is 'proper'. Guidelines are a way of agreeing locally or nationally.

Antibiotics allow treatment of serious bacterial infections. The largest volume of antibiotics is prescribed in ambulatory care. This use is increasingly recognised as the major selective pressure driving resistance, which in turn makes them ineffective. Therefore antibiotics should be used appropriately - i.e. (no) antibiotics for those who will (not) benefit from the treatment. In addition, unnecessary use of antibiotics requires more resources, motivates patients to re-consult and exposes them to the additional risk of side effects, whereas under-prescribing could be associated with higher risk of complications of untreated infections.

A 'proper' level of usage is difficult to define. The levels are mostly for following trends and shifts in usage patterns. With these data related to other data there might be a way of defining a 'proper' range of usage. One benchmark value at European level cannot be given, because for different countries the demographical characteristics and epidemiological situation can influence this indicator. Individual countries should position themselves and define their own benchmark, This should be based on the epidemiology of infectious diseases and national guidelines. A range of acceptable antibiotic use should be defined rather than one threshold value. If the use is outside the limits of the range, more detailed assessment is recommended in order to define the action required. For any action planned explicit targets should be set.

Most guidelines define treatment for specific diagnosis. This means that the diagnosis has to be made correctly before guidelines are applicable.

That also means that antibiotic usage must be directed by medical diagnosis and decisions. This is why systemic antibiotics are prescription-only medicines in the European Union.

Tentative indicators for 6

- Availability of OTC (over-the-counter) antibiotics
- Availability of national treatment guidelines
- Availability of locally adapted treatment guidelines
- Has the compliance to guidelines been assessed?
- Defined standardised criteria for clinical diagnosis
- What is the rate of laboratory diagnostics use before deciding on use of antibiotics for sore throat (% of patients)?
- What is the rate of blood cultures before use of antibiotics for perceived bacteremia with sepsis (% of patients)?

7. Infection control

Healthcare and hospitals in particular have historically been a major source of spread for epidemics. This has been shown for a wide variety of microbes – for example smallpox and early outbreaks of Lassa fever. A recent well-known example is SARS. Another very well-known bacterium that spreads in healthcare settings is MRSA.

All hospitals have defined procedures and hygienic principles although these may not always be based on the latest scientific knowledge. Implementation of guidelines and adherence to procedures is another problem. Surveys have shown that adherence to infection control guidelines many times is poor.

More and more people with complicated medical conditions are given home-based care. Many of them are elderly. Such patients may have indwelling catheters, a lower immunity and often use antibiotics. Infection control guidelines are difficult to follow in a home setting and many of the care staff have little or no training in infection control. Increasingly MRSA is reported to also be a problem in these settings.

Tentative indicators for 7

General

- Is there a national committee on issues related to infection control?

Hospitals

- Alcohol-based hand disinfection recommended for non-diarrhoeal disease
- Guidelines for hygienic procedures including standardized barrier precautions in >90% of hospitals
- Specific guidelines for MRSA in >90% of hospitals
- At least one infection control nurse/doctor per hospital
- Time allocated for infection control?
- What numbers of hospitals do surveillance of healthcare acquired infections (HAI) regularly in ICUs? (% of hospitals)
- What numbers of hospitals do surveillance of healthcare acquired infections (HAI) regularly in surgical wards? (% of hospitals)
- What numbers of hospitals do surveillance of healthcare acquired infections (HAI) regularly in internal medicine wards? (% of hospitals)
- Are there legal requirements for infection control system in hospitals?
- Is implementation of infection control practice regularly evaluated?

Health care settings outside hospitals

- Alcohol-based hand disinfection recommended for non-diarrhoeal disease
- Alcohol-based hand disinfection available in >90% of outpatient clinics
- Alcohol-based hand disinfection available in >90% of health care settings for elderly
- Guidelines for infection control are available for elderly and long term care staff
- Implementation of infection control practice in elderly and long term care is regularly evaluated.

8. Educational programmes on AMR

Understanding the problem with AMR is the basis for having an impact with interventional programmes. This can partially be achieved with educational programmes. Educational programmes should be an integrated part of undergraduate studies. All healthcare-related professionals need to have an understanding of the AMR problem.

'Education' in the context of AMR is more than just pharmacology of antibiotics or resistance patterns in microbes. It encompasses the relationship between microbes, antibiotics and the epidemiology of resistant strains. It describes the complex interrelation between all aspects brought up in this document.

Regular, repetitive, independent educational material best provided by locally-based colleagues in discussion groups seems to be one of the better success factors.

Tentative indicators for 8

- Doctors have in their curriculum AMR as undergraduate course
- Hospital health care workers have some education on AMR
- Community health care workers have some education on AMR
- Specific post-graduate courses for doctors in antibiotic resistance are provided
- Regular educational programmes in antibiotic resistance are provided for health staff
- It is compulsory for all prescribers to take part regularly in a session on AMR
- <60% of information on AMR is industry sponsored.

9. Public information related to AMR

Many prescribers blame patients for demanding antibiotics irrespective of their condition. This can only be changed if the public is well informed about what antibiotics can and cannot do. Hence, educational activities for the wider public are important.

Tentative indicators for 9

- No information provided
- Topic sometimes covered in media
- Some material for media and/or internet from official sources
- Occasional national campaigns
- Repeated, structured national campaigns
- Regular, structured information provided by professional bodies
- Public perception assessed.

10. Marketing related issues

Economics also have an impact on prescribing habits, irrespective of diagnosis or best practice. This should be discouraged.

Tentative indicators for 10

- Independent (not industry supported) drug information is available
- Ethical guidelines for interrelation between physicians and industry are in place
- Physician's prescriptions do not influence on physician's salary
- Personal gifts from industry to physicians are illegal.

European Centre for Disease Prevention and Control (ECDC)

Address:
Gustav III:s boulevard 40, SE-169 73 Solna, Sweden

Tel. +46 858601000
Fax +46 858601001
www.ecdc.europa.eu

An agency of the European Union
www.europa.eu

Subscribe to our publications
www.ecdc.europa.eu/en/publications

Contact us
publications@ecdc.europa.eu

Follow us on Twitter
@ECDC_EU

Like our Facebook page
www.facebook.com/ECDC.EU

ECDC is committed to ensuring the transparency and independence of its work

In accordance with the Staff Regulations for Officials and Conditions of Employment of Other Servants of the European Union and the ECDC Independence Policy, ECDC staff members shall not, in the performance of their duties, deal with a matter in which, directly or indirectly, they have any personal interest such as to impair their independence. Declarations of interest must be received from any prospective contractor(s) before any contract can be awarded.
www.ecdc.europa.eu/en/aboutus/transparency

HOW TO OBTAIN EU PUBLICATIONS

Free publications:

- one copy:
  via EU Bookshop (http://bookshop.europa.eu);
- more than one copy or posters/maps:
  from the European Union's representations (http://ec.europa.eu/represent_en.htm);
  from the delegations in non-EU countries (http://eeas.europa.eu/delegations/index_en.htm);
  by contacting the Europe Direct service (http://europa.eu/europedirect/index_en.htm) or calling 00 800 6 7 8 9 10 11 (freephone number from anywhere in the EU) (*).

  (*) The information given is free, as are most calls (though some operators, phone boxes or hotels may charge you).

Priced publications:

- via EU Bookshop (http://bookshop.europa.eu).

Publications Office