MISSION REPORT

ECDC country visit to Malta to discuss antimicrobial resistance issues

3-7 July 2017

www.ecdc.europa.eu

ECDC MISSION REPORT

ECDC country visit to Malta to discuss antimicrobial resistance issues

3–7 July 2017

This report of the European Centre for Disease Prevention and Control (ECDC) was coordinated by Alessandro Cassini.

Contributing authors
Alessandro Cassini (ECDC), Dominique L. Monnet (ECDC), Andrea Nilsson (ECDC), Karen Burns (Ireland), Elpida-Niki Paphitou (Cyprus) and Gunnar Skov Simonsen (Norway)

Acknowledgements [Optional]
The ECDC team would like to thank Dr Charmaine Gauci at the Ministry of Health, Malta for the invitation for the country visit and Professor Michael Borg, Chair of the National Antibiotic Committee, Malta for arranging the visit.

Suggested citation: European Centre for Disease Prevention and Control. ECDC country visit to Malta to discuss antimicrobial resistance issues. Stockholm: ECDC; 2017.

Stockholm, December 2017

ISBN 978-92-9498-166-0 doi: 10.2900/854035 TQ-07-17-138-EN-N

© European Centre for Disease Prevention and Control, 2017

Reproduction is authorised, provided the source is acknowledged.
For any use or reproduction of photos or other material that is not under the EU copyright, permission must be sought directly from the copyright holders.

Contents

Abbreviations

AMR	Antimicrobial resistance
ARHAI	Antimicrobial Resistance and Healthcare-Associated Infections Disease Programme
CME	Continuing medical education
CRE	Carbapenem-resistant *Enterobacteriaceae*
DDD	Defined daily dose
EARS-Net	European Antimicrobial Resistance Surveillance Network
ESAC-Net	European Surveillance of Antimicrobial Consumption Network
GP	General practitioner
HAI	Healthcare-associated infection
ICM	Intersectoral Coordinating Mechanism
ICU	Intensive care unit
IPC	Infection prevention and control
MRSA	Meticillin-resistant *Staphylococcus aureus*
PPS	Point prevalence survey

Executive summary

Rationale and purpose of the country visit

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

To assist Member States in implementing the Council Recommendation, ECDC has developed a process for country visits, which are carried out at the invitation of national authorities. These visits are designed 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 ECDC provided to the inviting national authority. To help ECDC 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.

Conclusions

Progress was observed in some areas since the first ECDC country visit on the same topic in November 2009, but for several areas, we noted little difference in the situation in 2017 compared with 2009.

Several good developments have been documented such as a decrease of meticillin-resistant *Staphylococcus aureus* (MRSA) bacteraemia cases at Mater Dei Hospital. Nevertheless, prevalence of MRSA remains high in other types of *S. aureus* infections and MRSA community infections have been reported in young adults. Moreover, new threats such as carbapenem-resistant *Enterobacteriaceae* (CRE), including New Delhi metallo-beta-lactamase (NDM)-producing CRE, have emerged in Malta since 2007. The fact that it is not mandatory to notify CRE cases to national public health authorities raises concerns in terms of the future capacity of the country to identify, report and control CRE. Antimicrobial consumption in hospitals is increasing, particularly for last-resort antibiotics.

There have also been a few positive changes in the community where a large fraction of the population now acknowledges that the incorrect use of antibiotics contributes to AMR and oral antibiotics are now more difficult to obtain at a pharmacy without a medical prescription.

Despite these, based on Eurobarometer findings, a very large proportion of the Maltese population lacks insight as to when to use antibiotics and there is low awareness about the fact that antibiotics do not work on viral infections such as common cold and influenza. During consultations with doctors, this may result in high patient demand for antibiotics when they are not needed.

In addition, the use of broad-spectrum antibiotics is particularly high in the community. A primary reason may be that first-line narrow-spectrum antibiotics, as recommended in the national guidelines, cannot be obtained at pharmacies in Malta. Another reason may be that the pharmaceutical industry influences doctors' prescriptions. For example, continuing medical education in Malta, including those related to antibiotics, are almost always sponsored by the pharmaceutical industry. The fact that there is relatively little detailed information on – and accountability for – antibiotic prescribing, (e.g. for each individual prescriber and by indication, as electronic prescription is not yet implemented), is an obvious limitation for better understanding prescription patterns and for the monitoring and evaluation of interventions.

The creation of new hospitals and wards, the reorganisation of long-term care facilities, the ageing population of the country, frequent patient transfers, the high volume of tourists during the holiday season and the issue of migrants are obvious challenges for the prevention and control of AMR in the country. Nevertheless, the same re-organisation process at some of the hospitals/facilities, the high-level of awareness of the Maltese population that incorrect use of antibiotics contribute to AMR and the momentum created by the new national action plan on AMR, represent opportunities for change.

Recommendations

Based on the observations made during the visit and the above conclusions, ECDC proposes the following actions:

National Antibiotic Committee

- Malta is developing a strategy and action plan in a One Health perspective, which has required a broadening of the remit of the National Antibiotic Committee, from advisory to implementation and the inclusion of representation from the veterinary and agricultural sectors. In this context, the terms of reference of the National Antibiotic Committee should be reviewed, along with its membership, to ensure that they reflect the evolution of the role of the National Antibiotic Committee. In particular, composition of the National Antibiotic Committee should include appropriate representation of stakeholders from the veterinary sector (more than one representative), and representation from several stakeholders from human health (e.g. Malta Medicines Authority, Gozo General Hospital), that are not currently part of the Committee.
- Malta will need to make the decision on whether healthcare-associated infections (HAIs) and infection prevention and control issues are included under the National Antibiotic Committee or whether these issues should be the remit of a different committee as per Council Recommendation 2009/C 151/01. If the latter, then there should be good interaction between the National Antibiotic Committee and the other committee.
- The revised terms of reference of the National Antibiotic Committee may require a new legal notice. It was suggested during the visit that subcommittees or ad hoc committees could be introduced in the short term to address the shortcoming regarding representation on the National Antibiotic Committee. However, this will not, in the long-term, guarantee the intersectoral work of the Committee.
- The National Antibiotic Committee will require specific resources and budget to deliver over the national strategy and action plan. The National Antibiotic Committee may need to increase the frequency of meetings during the period of implementation of the national strategy and action plan (see below).

National strategy and action plan

- Malta should be commended for developing a comprehensive and ambitious draft AMR strategy and action plan for the period 2017–2025.
- It is a matter of urgency to further consult with those stakeholders who were not or little consulted during the development of the document. In particular, it is necessary to consult with the veterinary sector. While doing this, it would make sense to add the following elements to the document: a CRE control programme as national priority (see below), more detailed infection prevention and control (IPC) actions (especially if Malta decides that IPC actions will not be covered by another plan) (see below) and actions related to antibiotics and AMR in the environment.
- After taking into consideration the report of this country visit, it is strongly recommended that the Maltese Government formally adopts the finalised national strategy and action plan on AMR. Subsequently, Malta should develop a specific roadmap, with a ring-fenced budget and resources for implementation, sufficient administrative support, nominations of named responsible owners and deadlines for the goals mentioned in the roadmap. The addition of specific targets or key performance indicators with regard to AMR and AMC should be considered in the various sectors.

Make prevention and control of CRE a national priority

- Malta needs to make prevention and control of CRE a national priority and implement a specific programme for this purpose. Depending on resources, the focus could be on all CRE carriers, or on carriers of specific types of CRE.
- CRE cases – both infections and colonisations/carriers – should be made notifiable to public health authorities and be included in the list of reportable diseases.
- The programme will require:
  - A renewed organisational CRE control strategy with commitment from front line staff to ownership of and accountability for the control of CRE in their hospital/facility and in Malta
  - The expansion of CRE screening capacity in the country to include screening of the contacts of known CRE patients, of patients admitted from long-term care facilities, acute admissions with a history of previous hospitalisation, and inter-hospital transfers
  - Increased laboratory capacity. Malta should consider introducing screening methods with rapid turnaround time to inform patient placement decisions, such as direct molecular testing of screening samples, as well as molecular typing of confirmed carbapenemase-producing CRE, as part of the function of a national reference laboratory for AMR (see below);
  - Increased contact tracing, increased resources for the isolation of CRE carriers, enforcement of contact precautions for CRE carriers patients and education of all hospital staff.
- Electronic systems in hospitals, such as the one already in place at the tertiary care hospital, and in the community (e.g MyHealth) would provide an opportunity for flagging patients who are known CRE carriers.

Strengthen laboratory capacity of the country

- All acute care hospitals providing emergency services should have the capacity to undertake a limited repertoire of urgent microbiological services on-site, considering distance from the tertiary care hospital laboratory. For example, incubation and Gram stain of positive blood cultures, cell count and Gram stain of cerebrospinal fluid samples, urinary antigen testing.
- Direct molecular detection of AMR from clinical or screening specimens is not yet available and could positively impact on the turnaround times of laboratory results and on patient placement decisions in acute care hospitals, in particular in an outbreak or endemic situation, provided that there is a 24/7 system for patient placement decisions.
- Increase laboratory capacity for processing screening samples for detection of carriage of CRE and MRSA.
- Provide a formal service level agreement with the Ministry of Health and budget to ensure a formal reference laboratory service (national reference laboratory for AMR) for all citizens of Malta.
- Create a system for accreditation of laboratories for clinical microbiology services based on quality standards.
- In primary care, equitable access to the required repertoire of standard microbiological investigations (e.g., urine, throat swabs, swabs from infected wounds) and equitable turnaround time to support prudent use of antimicrobials and safe patient care.

Improve AMR surveillance

- Malta needs to formalise responsibilities for AMR surveillance including funding for performing this task.
- An annual national AMR report for Malta should be produced and disseminated. Production of the annual report will provide critical data to follow the impact of the implementation of the national AMR strategy and action plan.
- Within acute care hospitals and long-term care facilities, improved local AMR surveillance with timely feedback and trend analysis is recommended.
- In the community, a sentinel AMR surveillance system in primary care should be established, with timely feedback and trend analysis, pending provision of resources for more equitable access to microbiological diagnostic services in primary care, could provide valuable insight into AMR trends in the community.

Improve antimicrobial consumption surveillance

- Malta needs to formalise responsibilities for surveillance of antimicrobial consumption at the national level and in particular for the community, including funding for performing this task.
- An annual national antimicrobial consumption and expenditure report for Malta should be produced and disseminated. Production of this annual report will provide critical data to follow the impact of the implementation of the national AMR strategy and action plan.
- Within acute care hospitals and LTCFs, improve local antimicrobial consumption surveillance with timely feedback and trend analysis.
- In primary care, an electronic surveillance system should be established, with information about diagnostic / specific indication for prescriptions, timely feedback to prescribers, trend analysis and peer-review visits to prescribers. This may be achieved with electronic databases on drug dispensing at pharmacy level combined with the national electronic prescribing system (see below).

Antibiotic prescribing

- The national electronic prescribing system, when implemented, will provide the necessary data on antibiotic prescribing. There are essential features that this system should include to support the monitoring and effective improvement of antimicrobial prescribing practices such as registration of the indication for each antimicrobial prescription (this must be more precise than just "infection"), decision support tools to help prescribers with their prescriptions with suggested antibiotics based on national guidelines, access to laboratory results and automatic checks for previous prescriptions and drug interactions. Once implemented the electronic system should allow for reviews of prescription patterns to identify high prescribers of antimicrobials and trigger peer-review visits of these precribers to discuss their prescription patterns.
- Make available, by law, those narrow-spectrum antimicrobials that are recommended by the national guidelines, but are currently not available at private community pharmacies in the country. The same applies to some antimicrobials (e.g. fosfomycin) that are not available at the pharmacies of public hospitals, although this may require a different course of action.
- Review pack sizes for antimicrobials available in Malta and review rules around splitting antimicrobial packs in a legal and safe manner to reduce the risk of antibiotic left-overs at home.
- The introduction of electronic prescribing in acute care hospitals would greatly enhance the capacity for real time audit and feedback of prescriber level data, along with optimising dosing, route choice and therapeutic drug monitoring decisions.

- In hospitals, prescriptions of critically important antimicrobials for human medicine (e.g., carbapenems, colistin) should be discussed with and approved by an infection specialist before dispensation by the pharmacy.

Better networking

- Consider solutions to strengthen and formalise the relationships and collaboration on AMR and antibiotics between acute care hospitals. One solution could be collaborative agreements between hospitals and nominated contact points in each hospital.
- Establish local networks, in each catchment area, between the acute care hospital, long-term care facilities and primary care actors.
- Within each hospital, produce and make better use of local surveillance data, including trends on AMR and antimicrobial consumption as information for action.

Infection prevention and control

- Develop minimum/core infection prevention and control standards, including on the number of infection prevention and control doctors and nurses, for accreditation of hospitals and long-term care facilities. These would be accompanied by monitoring and evaluation plans to measure effectiveness.
- Encourage hospital administrator to increase resources for infection prevention and control teams.
- Consider dedicated, increased resources for renewing strategies aiming at improving hand hygiene compliance.

Training

- Implement e-Bug: designate a national focal point for e-Bug, and ensure that Malta participates in e-Bug meetings and teleconferences, takes part in e-Bug initiatives and ensure liaison between the National Antibiotic Committee and the Ministry of Education for e-Bug implementation in the country.
- Mandatory inclusion of AMR, prudent antibiotic use and infection prevention and control as a defined portion of undergraduate courses for healthcare professionals, of post-graduate training schemes and continuing professional development of specialists.
- Ensure the availability of continuing medical education activities on AMR and prudent use of antibiotics that are not sponsored by pharmaceutical industry and limit pharmaceutical industry-sponsored attendance to professional conferences.

Communication

- Develop a long-term communication strategy on prudent use of antibiotics and AMR that includes the National Antibiotic Committee, the Ministry of Health, medical and other professional organisations.
- Strengthen collaboration on antibiotic awareness activities between the National Antibiotic Committee and the Ministry of Health, and ensure that communication experts (and not only subject experts) are part of the NAC and involved in campaign activities. This could help increase the flux of ideas around the campaign and give the National Antibiotic Committee access to social media channels and other possibilities for communication.
- Make sure that communication efforts are consistent and sustained over a number of years.It is important that the most relevant messages, according to cultural needs, are repeated over several years to obtain tangible results. Potential topics for the campaign could be unnecessary use of topical antimicrobials and safe disposal of leftover antimicrobials.
- Step-up awareness-raising efforts to increase knowledge of the Maltese population about when antibiotics are unnecessary. This will likely result in decreasing the number of consultations and the level of patient expectation for an antibiotic prescription when they consult a doctor. At the same time, campaigns should also address antibiotic prescribers, starting with general practitioners, to make sure they are aware that frequent antibiotic prescribing results in higher antibiotic resistance levels. It is also important to provide them with information, strategies and tools (e.g. delayed prescription) to reassure them that for certain defined clinical situations, not prescribing antibiotics or prescribing older, narrow-spectrum antibiotics, is safe.
- In addition to longer term and more expensive initiatives, Malta should consider low-cost initiatives that could rapidly be implemented such as use of social media, websites (the website of the National Antibiotic Committee should be the main entry point for this topic), media outreach (including workshops for journalists and professionals in other media to educate themselves about antibiotics and AMR) and the use of letters to various types of healthcare professionals, and make use of existing toolkits and materials developed by ECDC that are available in English and in Maltese.

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 promotes the rise of antibiotic-resistant bacterial strains in common bacteria such as *Staphylococcus aureus* and *Mycobacterium tuberculosis* (TB). During the following decades, the increasing number of antibiotic-resistant strains could be handled with the continuous availability of new antibiotics that provided new means of treating patients infected with resistant bacteria. However, from the 1990s, 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 there is a resistant bacterium, it will spread from a colonised person to another person if appropriate hygienic precautions (e.g., hand hygiene, isolation) are not taken. The risk for spread of resistant bacteria is higher in crowded environment and even higher when people in the surroundings 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. not treatable with antibiotics, are spreading in Europe. This represents a patient safety issue.

In 1998, the Chief Medical Officers of EU Member States recognized this evolving problem and took the initiative to 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 prevention and control of AMR. The Commission must report back to the Council on progress with implementation of the Council Recommendation.

In 2005, the European Commission reported to the Council on this 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: "*The 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. Although acknowledging significant progress of Member States 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 (AMR) with the aim to address AMR through the implementation of a coordinated approach in all concerned sectors (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.

The mission of ECDC, 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.

Following the official invitation by Dr. Charmaine Gauci, Designate Superintendent of Public Health, Ministry of Health (15 October 2016), an ECDC country visit team conducted an assessment mission on 3-7 July 2017 to discuss AMR issues in Malta with the overall objective to provide an evidence-based assessment of the situation in Malta regarding prevention and control of AMR through prudent use of antibiotics and infection control.

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 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 ECDC provided to the inviting national authority. To help ECDC ensure consistency of the visits and follow-up of progress of countries, an assessment tool has been developed (see the annex). 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 Malta 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: Karen Burns (Ireland), Elpida-Niki Paphitou (Cyprus) and Gunnar Skov Simonsen (Norway), as well as Andrea Nilsson (ECDC communication expert, only 3-4 July 2017). At national level, the visit was organised and coordinated by Dr. Michael Borg (National Focal Point for AMR, National Focal Point for Antimicrobial consumption, National Focal Point for Healthcare-Associated Infections).

2. Overview of the situation in Malta

2.1 Antimicrobial resistance

Data on antimicrobial resistance (AMR) in invasive bacterial isolates - mainly from bloodstream infections - are available from the European Antimicrobial Resistance Surveillance Network (EARS-Net) in which Malta has participated since 2000.

Since 2000, Malta consistently reports a high percentage of meticillin-resistant *Staphylococcus aureus* (MRSA), with almost 50% of *S. aureus* invasive isolates being MRSA in 2015. This is one of the highest percentages of MRSA in the EU/EEA.

Moreover, since 2010 the proportion of carbapenem-resistant *Klebsiella pneumoniae* invasive isolates significantly increased to 9.9% in 2014 from, 0% in 2010, followed by a small decrease to 5.4% in 2015. The European Survey on Carbapenemase-Producing Enterobacteriaceae (EuSCAPE) project also reported that OXA-48-like carbapenemases were frequently found in Malta and that despite initial control of the outbreak, carbapenem-resistant *Enterobacteriaceae* (CRE) such as carbapenem-resistant *K. pneumoniae* had rapidly spread from the tertiary care hospital to other hospitals and residential care facilities. This was confirmed by the expert self-assessments conducted as part of the EuSCAPE project, for which Malta was reported as having an endemic situation regarding (CRE).

As reported to EARS-Net for 2015, the percentage of *Streptococcus pneumoniae* – a bacterium responsible for community-acquired infections – that were resistant/non-susceptible to penicillin and with combined resistance/non-susceptibility to penicillin and macrolides were among the highest in the EU/EEA.

For other bacterium-antibiotic combinations reported to EARS-Net, the percentages of resistance reported by Malta are close to the EU/EEA average.

2.2 Healthcare-associated infections

In May-June 2012, Malta participated in the first ECDC point prevalence survey (PPS) of healthcare-associated infections (HAIs) and antimicrobial use in European acute care hospitals. Three hospitals performed the PPS, considered as optimal representativeness. The percentage of patients with at least one HAI (4.4%) on a given day in Maltese hospitals was below the EU/EEA average (5.7%).

Malta contributes to the ECDC-coordinated surveillance of surgical site infections (HAI-Net SSI) with data from two hospitals: the 1 134-bed tertiary care Mater Dei Hospital and the 142-bed secondary level Gozo General Hospital hospital. Malta also contributes to the ECDC-coordinated surveillance of HAIs in intensive care units (HAI-Net ICU) with 55 ICU beds, mostly at the tertiary care Mater Dei Hospital.

2.3 Antimicrobial consumption

In 2015, antimicrobial consumption in the community in Malta was 22.2 defined daily doses (DDD) per 1 000 inhabitants per day (which is similar to the EU/EEA average of 22.4 DDD per 1 000 inhabitants per day) and has been stable since 2011.

However, data from the latest Eurobarometer survey on AMR (April 2016) showed that the proportion of the general population in Malta who reported having taken antibiotics during the past year was the highest of the whole EU/EEA (48% versus 34% EU/EEA average), and had been amongst the highest since 2009 (Eurobarometer 2009, Eurobarometer 2013). The vast majority of respondents reported having obtained their last course of antibiotics from a medical prescription. The reasons for the discrepancy between surveillance data as reported to ESAC-Net and self-reported data to the Eurobarometer survey are not known.

As indicated in the 2016 Eurobarometer survey, most of these antibiotics were taken for sore throat (22% versus 14% EU/EEA average), although this had improved since 2013 (30%). The 2016 Eurobarometer survey also found that only 27% of respondents from Malta knew that antibiotics do not kill viruses (43% EU/EEA average) and that only 39% knew that antibiotics are ineffective against flu and colds (56% EU/EEA average). On the other hand, 95% of respondents from Malta knew that the unnecessary use of antibiotics makes them become ineffective, which is higher than the EU/EEA average (84%).

In the hospital sector, Malta reported that, in 2012, 38% of patients hospitalised on the day of the ECDC point prevalence survey were receiving at least one antimicrobial which was slightly above the average EU/EEA average of 33%. Recent data from ESAC-Net show that hospitals in Malta have a high consumption of carbapenems (proportion of carbapenems over total hospital antibiotic consumption in 2015 was 3.7% compared to an EU/EEA average of 2.6%).

3. Observations

3.1 Development of an Intersectoral Coordinating Mechanism (ICM)

There is a Maltese National Antibiotic Committee that was established under Legal Notice (2008), as per public health act legal notice 122/2008. While multi-disciplinary, this National Antibiotic Committee does not include proportional representation in a One Health perspective; for example, there is only one veterinarian among its members. In addition, the membership of the National Antibiotic Committee is heavily weighted towards the country's tertiary hospital. Moreover, the members of the National Antibiotic Committee represent themselves and not the organisations by which they are employed. Because of the above-mentioned points and in the context of One Health in 2017, the Maltese National Antibiotic Committee does not have the characteristics of an Intersectoral Coordinating Mechanism (ICM).

On review of the draft national AMR strategy and action plan (see below), it appears that the National Antibiotic Committee will need to transition from its longstanding advisory role to one which involves implementation of the national AMR strategy and action plan.

Currently, the National Antibiotic Committee meets up to four times per year. One of the members of the National Antibiotic Committee acts as a nominated Secretary. However, the Committee does not have designated clerical support and does not have an annual budget. In addition, members of the Committee do not have protected time for contributing to its activities.

During the past year, the National Antibiotic Committee has been working at developing a draft AMR strategy and action plan for Malta (2017–2025). This document consists of six strategic areas and 15 actions. It is well-written and contains a comprehensive set of specific actions, with general indication of timelines for implementation. In its appendix, the draft strategy and action plan proposes an implementation grid with, for each action, a lead partner, other involved stakeholders, indicators and the level of urgency. It is unclear whether the lead partner is the responsible organisation, whether the indicators correspond to specific milestones and whether the level of urgency is associated with specific years for delivery.

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

Owing to the small size of Malta, this topic may be less relevant than for other Member States. Nevertheless, we observed well-established and evidently good multi-disciplinary collaboration with regard to ongoing surveillance and audit on prevention of AMR and HAIs at the local level, within the country's tertiary care hospital and within the country's largest long-term care facility.

In a second acute hospital that we visited, it was evident that the local multi-disciplinary collaborative process was at an earlier stage of development. Additionally, while microbiology laboratory services are provided by the tertiary care hospital for other acute care hospitals, the demand for and use of local surveillance data as information for action was not apparent in the second hospital that we visited.

There is frequent exchange of patients between acute care hospitals. However, collaboration between the acute care hospitals, in particular for exchanging information on patient status regarding carriage of multidrug-resistant bacteria, does not yet seem to be part of routine practice.

We observed good multi-disciplinary collaboration between the tertiary care hospital and a large long-term care facility, with established networks of communication, sharing of policies, procedures and guidelines, educational processes and surveillance data.

In Malta, the majority of primary care is delivered by private general practitioners who predominantly work as solo practitioners with limited administrative support. In the government health centre that we visited, general practitioners appeared busy and their schedules precluded convening regular discussion on medical practices. The only opportunity for general practitioners to exchange views and share knowledge appears to be via the forum of regular continuing medical education (CME) activities organised by the Malta College of Family Practice, which are generally sponsored by the pharmaceutical industry. Antimicrobial stewardship and antimicrobial agents are sometimes discussed during CME sessions and there is evidence that these sessions on antimicrobial agents are popular among general practitioners.

3.3 Laboratory capacity

One large and busy public clinical microbiology laboratory located in the tertiary care hospital provides the laboratory service to public acute care hospitals, government long-term care facilities and primary health centres, with an extremely limited service of urine culture and antimicrobial susceptibility testing available to the private general practitioners. Within each hospital and in general practice offices, whether public or private, designated managing healthcare personnel have access, after patient consent, to the tertiary care hospital's electronic database of the history of laboratory and radiology test results for their patients.

Malta does not have a formal national reference laboratory for AMR. The above mentioned public clinical microbiology laboratory performs a limited repertoire of reference laboratory tests, but neither has a specified service level agreement with the Ministry of Health, nor a designated budget to act as the national reference laboratory service.

Additionally, in the context of high incidences of MRSA and CRE, there is no molecular typing facility available in Malta, and isolates that require molecular typing are sent abroad for further testing at significant cost for the taxpayer and lengthy turnaround times, which hampers effective control measures.

The public clinical microbiology laboratory has reported an increased demand for active screening cultures for meticillin-resistant *S. aureus* (MRSA) and carbapenem resistant *Enterobacteriaceae* (CRE) in response to the increased incidence of both MRSA and CRE in the tertiary care hospital. While molecular confirmation on suspected isolates is available, the direct molecular detection of resistance from clinical or screening specimens is not yet available but could, if available, shorten result turnaround times and allow for more rapid patient placement decisions in the current endemic situation in acute care hospitals.

While the CRE detected in Malta to date is predominantly of the OXA-48 type, CRE isolates of the New Delhi metallo-beta-lactamase (NDM) type have also been reported.

Colistin-resistant CRE have been reported. Limitations in local susceptibility testing for colistin have been identified and the microbiology laboratory is working to improve its testing methodology for colistin resistance.

There is no on-site acute microbiology laboratory service at Gozo General Hospital where major plans for expansion are anticipated, although a microbiology laboratory is not foreseen as part of this expansion.

While microbiology specimens submitted from government primary health centres are processed routinely, private general practitioners do not have the same level of access to the clinical microbiology laboratory at the tertiary care hospital and must send samples to private laboratories at a cost to the patient.

3.4 Monitoring of antibiotic resistance

Malta reports national data on AMR in invasive bacterial isolates from public healthcare facilities to EARS-Net. Malta reports a 95% country coverage for EARS-Net surveillance. However, because of the small size of the country, EARS-Net data from Malta are based on a limited number of isolates and this must be taken into account when reviewing the data and in particular trends.

A national annual report on AMR in Malta was not presented.

Within the tertiary hospital, quality and timely data on local AMR surveillance led by the hospital's infection prevention and control (IPC) department were presented (e.g., MRSA bloodstream infections, new clinical isolates of MRSA, admission and acquired new isolates of MRSA, VRE and CRE). There was evidence that these AMR surveillance data were shared with staff.

Data on AMR trends in non-invasive isolates are available from the database at the tertiary care hospital.

3.5 Monitoring of antibiotic usage

National data on antimicrobial prescriptions in the community are not available. However, a proxy indicator of antimicrobial consumption in the community from wholesalers is reported. Trends on antimicrobial consumption in the community were not presented. Prescriber-level data are not available.

Malta reports national data to ESAC-Net on antimicrobial consumption from public healthcare facilities. Malta is an active participant in the ECDC point prevalence surveys of HAIs and antimicrobial use, including indicators of antimicrobial stewardship, both in acute care hospitals and in long-term care facilities.

A national annual report on antimicrobial consumption in human medicine in Malta was not presented. Similarly, and with the exception of the tertiary care hospital, data and trends on antimicrobial consumption in hospitals and in long-term care facilities were not presented.

Within the tertiary care hospital, evidence of periodic audit of antimicrobial prescribing activities (e.g., aspects of surgical antimicrobial prophylaxis) was presented. However, the hospital relied on *ad hoc* student, voluntary research projects to provide valuable audit data on antimicrobial prescribing.

3.6 Antibiotic utilization and treatment guidance

Within the tertiary care hospital, guidelines for empiric antimicrobial treatment of infections have been developed and policies to restrict the use of certain antimicrobials have been implemented, with renewed and recent focus on the restriction of certain antimicrobial agents (e.g., carbapenem and piperacillin-tazobactam) along with audit of their use.

A new interactive diagnostic and treatment algorithm to support antimicrobial prescribing decisions and provide guidance in the format of a smartphone app is being developed within the tertiary care hospital.

It appeared that the local guidelines of the tertiary care hospital have been adapted for use in other healthcare facilities. However, implementation of these guidelines outside of the tertiary care hospital was not evident. Moreover, involvement of stakeholders from other healthcare facilities in the development of guidelines was not evident.

The use of electronic prescribing systems was not evident in the hospitals that we visited.

There are national guidelines for empiric antimicrobial treatment in primary care that were developed under the auspices of the National Antibiotic Committee with input from general practitioners. However, the first-line antimicrobial agents recommended in these guidelines (e.g., penicillin, flucloxacillin and syrup formulations of cefalexin and amoxicillin) are unavailable from private pharmacies.

In primary care, the use of information technology systems is not widespread and where available, these systems did not provide options for electronic prescribing or prescriber decision support (e.g., direct access to treatment guidelines, drug interaction information).

Rapid near-patient diagnostic tests to influence antimicrobial prescribing decisions e.g. group A Step test for acute sore throat, does not appear to be in use in primary care in Malta, with cost and time cited as barriers to use.

The use of broad-spectrum antimicrobial agents, both in acute care hospitals (e.g., fluoroquinolones and carbapenems) and in the community (e.g., amoxicillin-clavulanic acid) for empiric treatment of common infections for which their routine use may not be indicated, was widespread. In the tertiary care hospital, there was evidence of good stewardship practices such as selective reporting of antimicrobial susceptibility test results from the microbiology laboratory, de-escalation therapy upon receipt of microbiology results, clinical liaison with high use areas (e.g., intensive care and vascular surgery), infectious disease consultations and clinical pharmacy referral to the antimicrobial pharmacists.

In primary care, there was a unified perception by healthcare professionals of a reduced patient demand for antimicrobial prescriptions at consultation. Community pharmacists also reported a significant reduction in patients presenting to pharmacy requesting oral antimicrobials without prescription. However, requests for topical antimicrobials without prescription remain common. An increased patient awareness of the issues of AMR and potential side effects of using antimicrobials was reported.

The issue of leftover antimicrobials is assessed by the Eurobarometer surveys. While there are a limited number of authorised leftover medication disposal sites on Malta, access to these sites may prove an issue for some residents. In one community pharmacy, the pharmacist undertook a local initiative to provide an on-site disposal bin for patients to dispose of leftover medicines safely.

On patient discharge from acute care hospitals, a limited supply of medicines is usually provided to patients. Patients requiring a few additional days of treatment after discharge to complete their course; are dispensed enough doses for 48 hours, by the hospital pharmacy. However, if more than two days of treatment have been prescribed, and need to be bought from a private pharmacy, an anomalous situation develops. The pharmacist must either split a pack (which is not legal) or provides a complete pack (i.e. too many doses), thus increasing the likelihood of leftover antibiotics and misuse of these leftovers.

3.7 Infection control

The mandate of the National Antibiotic Committee does not include infection prevention and control (IPC) issues and IPC nurses are not represented on the Committee. There is currently no specific national IPC committee in Malta.

Malta is an active participant in the ECDC point prevalence surveys of HAIs and antimicrobial use, both in acute care hospitals and long-term care facilities.

Within the tertiary care hospital, there is a well-established, stand-alone IPC department, with multi-disciplinary membership. The IPC nursing team within the tertiary care hospital provide a seven-day service and the IPC department also provides advice and support to colleagues in other public acute care hospitals and in long-term care facilities. It was evident that hospital staff in the tertiary care hospital heavily depend on the IPC department for many routine IPC issues which could be handled at ward or division level. For this reason, the IPC department cannot focus its expertise on other priority tasks and cannot ensure more efficient use of a valuable IPC service.

Although obviously busy with the above mentioned routine IPC issues, the IPC department also provides some occupational health services related to infectious diseases (e.g. staff vaccination and needlestick injury management), screening of patients for multidrug-resistant bacteria (pre-operatively and prior to treatment abroad), oversight of sterile services and procurement. Regular and periodic shortages of critical consumables (including hand hygiene products, personal protective equipment and other items essential for effective IPC) are reported to the IPC department resulting in time wasted in urgent resolution of the by the IPC team. These would require a specific, systematic intervention rather than repeated *ad hoc* procurement procedures.

Within the tertiary care hospital, the IPC department oversees an extensive, award-winning hand hygiene educational and promotional campaign. Hand hygiene products are available at the point-of-care. Hand hygiene promotional posters and materials are widely distributed, and regular hand hygiene compliance audit activities with anonymised feedback to wards. Despite the educational and promotional campaign, the hand hygiene compliance audits that use non-disclosure methods showed compliance levels that could be improved, in particular in the context of ongoing issues with transmission of multidrug-resistant bacteria such as CRE.

The IPC department at the tertiary care hospital conducts surveillance of *Clostridium difficile* infections. This monitoring, combined with specific interventions has resulted in a decrease in *C. difficile* infections. The IPC department also conducts surveillance of bloodstream infections acquired in the intensive care unit.

The IPC department at the tertiary care hospital has demonstrated a sustained reduction in MRSA bloodstream infections in the context of a continued high prevalence of MRSA patient clinical isolates, both in hospitals and in the community. This has been achieved through an active sustained educational programme (e.g. hand hygiene and device insertion and maintenance), regular audit, introduction of root-cause analysis, surveillance and feedback and, more recently, a universal admission programme.

On the other hand, the tertiary care hospital has been managing patients with CRE since the early 2010s, with an increasing number of cases despite increased patient screening and specific control measures. The prevalence of CRE is high, which results in high demand for single patient rooms to isolate patients with CRE. Electronic flagging and chart notification of patients with positive CRE results are communicated to ward staff and to receiving facilities. An information leaflet on CRE, along with trend analysis of CRE incidence and feedback of data to wards was produced and there is an education programme for nursing staff. Enhanced environmental disinfection including hydrogen peroxide vapour is utilised on discharge of known CRE carriers.

While patient screening for CRE has increased, there remain gaps that may promote unrecognised dissemination of CRE in the tertiary care hospital. Regular audits have demonstrated suboptimal compliance of staff with personal protective equipment and transmission-based precautions for the care of patients with CRE.

Point prevalence screening studies and the tertiary care hospital have shown that around 20% of patients in medical and surgical wards are unrecognized CRE carriers. In addition, CRE carriers have also been identified in a prevalence screening study conducted in a local long-term care facility, which may represent a reservoir for importation of CRE into the tertiary care hospital.

In another acute care hospital, there was no on-site access to a consultant microbiologist or IPC department and only one staff member provides the IPC services. Unlike the tertiary care hospital, there was no visibility of a hand hygiene educational or promotional campaign, while there was evidence that alcohol hand rub was available at point of care. There was limited evidence of ongoing prospective surveillance of HAIs, AMR or an audit programme of hand hygiene compliance. This other acute care hospital is embarking on a journey to accreditation and has established an IPC committee, an antimicrobial stewardship committee and a quality agenda with plans to seek accreditation. IPC has been identified as a priority for this hospital.

During a visit to a large long-term care facility, there was evidence of an ongoing programme of staff education and hand hygiene audits. The long-term care facility is staffed by resident medical staff who follow the empiric prescribing guidelines of the tertiary care hospital. The long-term care facility has an on-site IPC nurse who receives support from the IPC department at the tertiary care hospital. This long-term care facility is managing residents who are known to be CRE carriers, but there is only one single isolation room. A programme of phased refurbishment of an old building with complex infrastructure is being implemented. However, increasing the number of single-bed rooms of the facility, thus providing the infrastructure for the isolation of, e.g. CRE-positive, patients has not been addressed as part of this refurbishment.

In primary care, the government health centres have access to an IPC nurse who advises on policy and procedures, and IPC support is also available from the IPC department at the tertiary care hospital. Management of patients with MRSA in the primary care setting was directed by policy in government health centres. There is no organised system to provide private general practitioners with the same advice and support.

3.8 Educational programmes on AMR

Implementation of the E-bug educational programme for schools has not yet happened in Malta.

Within the university and undergraduate/postgraduate courses, education on infection, AMR and IPC issues is provided.

Within the tertiary care hospital, staff members receive training on AMR and local surveillance activities. New doctors are reportedly receptive to education activities and some have actively participated in research projects on AMR and HAI surveillance within the hospital setting.

At the long-term care facility that we visited, staff members receive training on AMR, IPC and local surveillance activities.

In primary care, general practitioners attend CME sessions organised by the Malta College of Family Practice throughout the year, with invited speakers on topics related to AMR. Webinars related to specific infection issues are communicated through a pharmaceutical industry-sponsored medical newsletter reaching several thousand healthcare professionals.

In general, CME activities seem to be sponsored by pharmaceutical industry in all healthcare settings.

There is an information website for general practitioners – ‚the Synapse' - that presents e-learning videos and other news, which sometimes focus on antibiotics. The Synapse's website also includes videos sponsored by pharmaceutical industry.

3.9 Public information related to AMR

Malta has participated in the European Antibiotic Awareness Day several times, with planned and implemented activities promoting prudent use of antibiotics, without a specific budget being provided for these activities. Most of these efforts take place on or around 18 November. Some of the materials produced by ECDC have been adapted and used.

Through materials such as posters, leaflets, billboards, fact sheets, patient brochures, articles in newspapers, and activities such as conferences and experts' participation in TV shows, the country has targeted mostly the general public. However, according to the results of the latest Eurobarometer on antimicrobial resistance, the public knowledge about antibiotics remains low compared with other EU/EEA countries - only 27% of respondents knew that antibiotics do not kill viruses (EU/EE average: 43%) and only 39% knew that antibiotics are ineffective against flu and colds (EU/EEA average: 56%).

Healthcare professionals have been targeted through education-related materials and activities, but not by using communication strategies. In addition, the current health system's limitations to reach professionals in private practices makes it even more difficult to target this specific group.

Media is one of the main multipliers of information in any country. In Malta, journalists tend to use the word virus when talking about antibiotic-resistant bacteria. This might explain why the country performs less well than other Member States for Eurobarometer questions such as ‚Do antibiotic kill viruses?'.

Other obstacles to undertaking a full national campaign flagged during the discussions, remain the lack human resources, low institutional support and absence of dedicated funding.

3.10 Marketing related issues

Advertising of prescription pharmaceutical agents to the general public is not permitted.

Implementation of the EU Pharmaceutical Directive on interaction between the pharmaceutical industry and healthcare professionals is being monitored by the Malta Medicines Authority.

Pharmaceutical sales representatives regularly visit prescribers in the acute care hospital. Pharmaceutical sales representatives also visit general practitioners, possibly less in primary health centres than in private general practice settings. Pharmaceutical sales representatives also regularly visit community pharmacies where private general practitioners may utilise on-site consultation rooms.

A lack of transparency of disclosure of gifts or benefits provided to healthcare professionals was noted. Moreover, there is no requirement for pharmaceutical companies to disclose a list of donations/gifts/sponsorships/support to attend meetings overseas and research grants provided to healthcare professionals.

4. Conclusion and recommendations

4.1 Conclusions

Progress was observed in some areas since the first ECDC country visit on the same topic in November 2009, but for several areas, we noted little difference in the situation in 2017 compared with 2009.

Several good developments have been documented such as a decrease of meticillin-resistant *Staphylococcus aureus* (MRSA) bacteraemia cases at Mater Dei Hospital. Nevertheless, prevalence of MRSA remains high in other types of *S. aureus* infections and MRSA community infections have been reported in young adults. Moreover, new threats such as carbapenem-resistant *Enterobacteriaceae* (CRE), including New Delhi metallo-beta-lactamase (NDM)-producing CRE, have emerged in Malta since 2007. The fact that it is not mandatory to notify CRE cases to national public health authorities raises concerns in terms of the future capacity of the country to identify, report and control CRE. Antimicrobial consumption in hospitals is increasing, particularly for last-resort antibiotics.

There have also been a few positive changes in the community where a large fraction of the population now acknowledges that the incorrect use of antibiotics contributes to AMR and oral antibiotics are now more difficult to obtain at a pharmacy without a medical prescription.

Despite these, based on Eurobarometer findings, a very large proportion of the Maltese population lacks insight as to when to use antibiotics and there is low awareness about the fact that antibiotics do not work on viral infections such as common cold and influenza. During consultations with doctors, this may result in high patient demand for antibiotics when they are not needed.

In addition, the use of broad-spectrum antibiotics is particularly high in the community. A primary reason may be that first-line narrow-spectrum antibiotics, as recommended in the national guidelines, cannot be obtained at pharmacies in Malta. Another reason may be that the pharmaceutical industry influences doctors' prescriptions. For example, continuing medical education in Malta, including those related to antibiotics, are almost always sponsored by the pharmaceutical industry. The fact that there is relatively little detailed information on – and accountability for – antibiotic prescribing, (e.g. for each individual prescriber and by indication, as electronic prescription is not yet implemented), is an obvious limitation for better understanding prescription patterns and for the monitoring and evaluation of interventions.

The creation of new hospitals and wards, the reorganisation of long-term care facilities, the ageing population of the country, frequent patient transfers, the high volume of tourists during the holiday season and the issue of migrants are obvious challenges for the prevention and control of AMR in the country. Nevertheless, the same re-organisation process at some of the hospitals/facilities, the high-level of awareness of the Maltese population that incorrect use of antibiotics contribute to AMR and the momentum created by the new national action plan on AMR, represent opportunities for change.

4.2 Recommendations

Based on the observations made during the visit and the above conclusions, ECDC proposes the following actions:

National Antibiotic Committee

- Malta is developing a strategy and action plan in a One Health perspective, which has required a broadening of the remit of the National Antibiotic Committee, from advisory to implementation and the inclusion of representation from the veterinary and agricultural sectors. In this context, the terms of reference of the National Antibiotic Committee should be reviewed, along with its membership, to ensure that they reflect the evolution of the role of the National Antibiotic Committee. In particular, composition of the National Antibiotic Committee should include appropriate representation of stakeholders from the veterinary sector (more than one representative), and representation from several stakeholders from human health (e.g. Malta Medicines Authority, Gozo General Hospital), that are not currently part of the Committee.
- Malta will need to make the decision on whether healthcare-associated infections (HAIs) and infection prevention and control issues are included under the National Antibiotic Committee or whether these issues should be the remit of a different committee as per Council Recommendation 2009/C 151/01. If the latter, then there should be good interaction between the National Antibiotic Committee and the other committee.
- The revised terms of reference of the National Antibiotic Committee may require a new legal notice. It was suggested during the visit that subcommittees or ad hoc committees could be introduced in the short term to address the shortcoming regarding representation on the National Antibiotic Committee. However, this will not, in the long-term, guarantee the intersectoral work of the Committee.

- The National Antibiotic Committee will require specific resources and budget to deliver over the national strategy and action plan. The National Antibiotic Committee may need to increase the frequency of meetings during the period of implementation of the national strategy and action plan (see below).

National strategy and action plan

- Malta should be commended for developing a comprehensive and ambitious draft AMR strategy and action plan for the period 2017–2025.
- It is a matter of urgency to further consult with those stakeholders who were not or little consulted during the development of the document. In particular, it is necessary to consult with the veterinary sector. While doing this, it would make sense to add the following elements to the document: a CRE control programme as national priority (see below), more detailed infection prevention and control (IPC) actions (especially if Malta decides that IPC actions will not be covered by another plan) (see below) and actions related to antibiotics and AMR in the environment.
- After taking into consideration the report of this country visit, it is strongly recommended that the Maltese Government formally adopts the finalised national strategy and action plan on AMR. Subsequently, Malta should develop a specific roadmap, with a ring-fenced budget and resources for implementation, sufficient administrative support, nominations of named responsible owners and deadlines for the goals mentioned in the roadmap. The addition of specific targets or key performance indicators with regard to AMR and AMC should be considered in the various sectors.

Make prevention and control of CRE a national priority

- Malta needs to make prevention and control of CRE a national priority and implement a specific programme for this purpose. Depending on resources, the focus could be on all CRE carriers, or on carriers of specific types of CRE.
- CRE cases – both infections and colonisations/carriers – should be made notifiable to public health authorities and be included in the list of reportable diseases.
- The programme will require:
  - A renewed organisational CRE control strategy with commitment from front line staff to ownership of and accountability for the control of CRE in their hospital/facility and in Malta
  - The expansion of CRE screening capacity in the country to include screening of the contacts of known CRE patients, of patients admitted from long-term care facilities, acute admissions with a history of previous hospitalisation, and inter-hospital transfers
  - Increased laboratory capacity. Malta should consider introducing screening methods with rapid turnaround time to inform patient placement decisions, such as direct molecular testing of screening samples, as well as molecular typing of confirmed carbapenemase-producing CRE, as part of the function of a national reference laboratory for AMR (see below);
  - Increased contact tracing, increased resources for the isolation of CRE carriers, enforcement of contact precautions for CRE carriers patients and education of all hospital staff.
- Electronic systems in hospitals, such as the one already in place at the tertiary care hospital, and in the community (e.g MyHealth) would provide an opportunity for flagging patients who are known CRE carriers.

Strengthen laboratory capacity of the country

- All acute care hospitals providing emergency services should have the capacity to undertake a limited repertoire of urgent microbiological services on-site, considering distance from the tertiary care hospital laboratory. For example, incubation and Gram stain of positive blood cultures, cell count and Gram stain of cerebrospinal fluid samples, urinary antigen testing.
- Direct molecular detection of AMR from clinical or screening specimens is not yet available and could positively impact on the turnaround times of laboratory results and on patient placement decisions in acute care hospitals, in particular in an outbreak or endemic situation, provided that there is a 24/7 system for patient placement decisions.
- Increase laboratory capacity for processing screening samples for detection of carriage of CRE and MRSA.
- Provide a formal service level agreement with the Ministry of Health and budget to ensure a formal reference laboratory service (national reference laboratory for AMR) for all citizens of Malta.
- Create a system for accreditation of laboratories for clinical microbiology services based on quality standards.
- In primary care, equitable access to the required repertoire of standard microbiological investigations (e.g., urine, throat swabs, swabs from infected wounds) and equitable turnaround time to support prudent use of antimicrobials and safe patient care.

Improve AMR surveillance

- Malta needs to formalise responsibilities for AMR surveillance including funding for performing this task.
- An annual national AMR report for Malta should be produced and disseminated. Production of the annual report will provide critical data to follow the impact of the implementation of the national AMR strategy and action plan.
- Within acute care hospitals and long-term care facilities, improved local AMR surveillance with timely feedback and trend analysis is recommended.
- In the community, a sentinel AMR surveillance system in primary care should be established, with timely feedback and trend analysis, pending provision of resources for more equitable access to microbiological diagnostic services in primary care, could provide valuable insight into AMR trends in the community.

Improve antimicrobial consumption surveillance

- Malta needs to formalise responsibilities for surveillance of antimicrobial consumption at the national level and in particular for the community, including funding for performing this task.
- An annual national antimicrobial consumption and expenditure report for Malta should be produced and disseminated. Production of this annual report will provide critical data to follow the impact of the implementation of the national AMR strategy and action plan.
- Within acute care hospitals and LTCFs, improve local antimicrobial consumption surveillance with timely feedback and trend analysis.
- In primary care, an electronic surveillance system should be established, with information about diagnostic / specific indication for prescriptions, timely feedback to prescribers, trend analysis and peer-review visits to prescribers. This may be achieved with electronic databases on drug dispensing at pharmacy level combined with the national electronic prescribing system (see below).

Antibiotic prescribing

- The national electronic prescribing system, when implemented, will provide the necessary data on antibiotic prescribing. There are essential features that this system should include to support the monitoring and effective improvement of antimicrobial prescribing practices such as registration of the indication for each antimicrobial prescription (this must be more precise than just "infection"), decision support tools to help prescribers with their prescriptions with suggested antibiotics based on national guidelines, access to laboratory results and automatic checks for previous prescriptions and drug interactions. Once implemented the electronic system should allow for reviews of prescription patterns to identify high prescribers of antimicrobials and trigger peer-review visits of these precribers to discuss their prescription patterns.
- Make available, by law, those narrow-spectrum antimicrobials that are recommended by the national guidelines, but are currently not available at private community pharmacies in the country. The same applies to some antimicrobials (e.g. fosfomycin) that are not available at the pharmacies of public hospitals, although this may require a different course of action.
- Review pack sizes for antimicrobials available in Malta and review rules around splitting antimicrobial packs in a legal and safe manner to reduce the risk of antibiotic left-overs at home.
- The introduction of electronic prescribing in acute care hospitals would greatly enhance the capacity for real time audit and feedback of prescriber level data, along with optimising dosing, route choice and therapeutic drug monitoring decisions.
- In hospitals, prescriptions of critically important antimicrobials for human medicine (e.g., carbapenems, colistin) should be discussed with and approved by an infection specialist before dispensation by the pharmacy.

Better networking

- Consider solutions to strengthen and formalise the relationships and collaboration on AMR and antibiotics between acute care hospitals. One solution could be collaborative agreements between hospitals and nominated contact points in each hospital.
- Establish local networks, in each catchment area, between the acute care hospital, long-term care facilities and primary care actors.
- Within each hospital, produce and make better use of local surveillance data, including trends on AMR and antimicrobial consumption as information for action.

Infection prevention and control

- Develop minimum/core infection prevention and control standards, including on the number of infection prevention and control doctors and nurses, for accreditation of hospitals and long-term care facilities. These would be accompanied by monitoring and evaluation plans to measure effectiveness.
- Encourage hospital administrator to increase resources for infection prevention and control teams.

- Consider dedicated, increased resources for renewing strategies aiming at improving hand hygiene compliance.

Training

- Implement e-Bug: designate a national focal point for e-Bug, and ensure that Malta participates in e-Bug meetings and teleconferences, takes part in e-Bug initiatives and ensure liaison between the National Antibiotic Committee and the Ministry of Education for e-Bug implementation in the country.
- Mandatory inclusion of AMR, prudent antibiotic use and infection prevention and control as a defined portion of undergraduate courses for healthcare professionals, of post-graduate training schemes and continuing professional development of specialists.
- Ensure the availability of continuing medical education activities on AMR and prudent use of antibiotics that are not sponsored by pharmaceutical industry and limit pharmaceutical industry-sponsored attendance to professional conferences.

Communication

- Develop a long-term communication strategy on prudent use of antibiotics and AMR that includes the National Antibiotic Committee, the Ministry of Health, medical and other professional organisations.
- Strengthen collaboration on antibiotic awareness activities between the National Antibiotic Committee and the Ministry of Health, and ensure that communication experts (and not only subject experts) are part of the NAC and involved in campaign activities. This could help increase the flux of ideas around the campaign and give the National Antibiotic Committee access to social media channels and other possibilities for communication.
- Make sure that communication efforts are consistent and sustained over a number of years.It is important that the most relevant messages, according to cultural needs, are repeated over several years to obtain tangible results. Potential topics for the campaign could be unnecessary use of topical antimicrobials and safe disposal of leftover antimicrobials.
- Step-up awareness-raising efforts to increase knowledge of the Maltese population about when antibiotics are unnecessary. This will likely result in decreasing the number of consultations and the level of patient expectation for an antibiotic prescription when they consult a doctor. At the same time, campaigns should also address antibiotic prescribers, starting with general practitioners, to make sure they are aware that frequent antibiotic prescribing results in higher antibiotic resistance levels. It is also important to provide them with information, strategies and tools (e.g. delayed prescription) to reassure them that for certain defined clinical situations, not prescribing antibiotics or prescribing older, narrow-spectrum antibiotics, is safe.
- In addition to longer term and more expensive initiatives, Malta should consider low-cost initiatives that could rapidly be implemented such as use of social media, websites (the website of the National Antibiotic Committee should be the main entry point for this topic), media outreach (including workshops for journalists and professionals in other media to educate themselves about antibiotics and AMR) and the use of letters to various types of healthcare professionals, and make use of existing toolkits and materials developed by ECDC that are available in English and in Maltese.

5. Annex

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

The mechanisms behind emerging 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)

Postal address:
Granits väg 8, SE-171 65 Solna, Sweden

Visiting address:
Tomtebodavägen 11A, SE-171 65 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