Report of the 2nd meeting of the WHO AMR Surveillance and Quality Assessment Collaborating Centres Network
12–14 March 2018
Geneva, Switzerland

I. Opening of the meeting
The meeting was opened by Dr Laetitia Gahimbare, WHO Regional Office for Africa, who commented that the next three days would give participants from collaborating centres (CCs) and WHO Regional Offices the opportunity to confer on ways in which the work plan should be updated.

Dr Carmem Pessoa-Silva, Acting Coordinator, AMR Surveillance (WHO AMR Secretariat), said that antimicrobial resistance (AMR) has assumed growing importance within WHO under the new Director-General, who had made it a “flagship” issue in the 13th General Programme of Work (GPW) for 2019–2023. She introduced the objectives of the meeting which were 1) to review and revise the master plan for CCs for 2017–2019, 2) discuss the target products, 3) establish priorities and 4) how to meet the defined support requested by WHO Regional Offices. The organization of the meeting involved three break-out groups and the expected outputs included a common understanding of the development of GLASS, support to WHO Regional Offices for AMR surveillance in countries, a revised plan of activities for the target products and definition of the steps required to address challenges to AMR surveillance.

Dr L. Alansari, Assistant Director-General, welcomed the commitment of WHO Regional Offices to coordinating AMR surveillance and ensuring dialogue among countries. She noted that AMR was the topic of two of the 44 targets and indicators in the impact framework of the 13th GPW: improving treatment of multidrug-resistant tuberculosis and decreasing bloodstream infection caused by resistant pathogens. The new Health Metrics and Measurement cluster calls on the expertise in each WHO department in order to concert efforts and avoid duplication, which will result in a flow of clear, transparent, validated data for statistical analysis that can be used throughout WHO to produce health data for policy-making.

II. Update on GLASS and challenges
Dr Sergey Eremin provided overview of the GLASS roadmap and methodology. He said that, since its launch in 2015, 53 countries have joined GLASS. The major achievement was publication in January 2018 of the first GLASS report with submissions by 42 countries and data on AMR from 22 countries. Five countries submitted data on the total sampled population, which allowed calculation of the incidence of resistance in tested populations and stratification by gender, age and origin of infection. The first GLASS report indicated that the system is valuable and feasible for monitoring AMR.

An emerging AMR reporting module (GLASS EAR) has been developed with support from several CCs to facilitate timely sharing of information on the detection and confirmatory investigation of emerging
AMR and to stimulate technical discussion. “One health” AMR surveillance is being piloted with ESBL-producing Escherichia coli as the selected common indicator in the “Tricycle” project led by Food Safety and Zoonoses Department. Consumption of antimicrobial agents is being monitored by the Essential Medicines Department; a report will be issued in September 2018 on data from 31 countries, and the information will be integrated into the GLASS web platform. The WHO protocol for point prevalence surveys on antibiotic use in hospitals and a WHO protocol for surveys of antibiotic use in the community will also be published.

The next steps will be to continue supporting countries in strengthening their AMR surveillance systems, improve the participation of countries, ensure the quality of data, and strengthen collaboration with partners such as FAO and OIE and with regional AMR surveillance networks. Future work will include also developing and testing protocols to estimate the impact on health and burden of disease associated with AMR.

III. Challenges and needs expressed by WHO Regional Offices

1. WHO Regional Office for Africa

Dr Gahimbare reported that current activities include encouraging enrolment in GLASS, training in integrated surveillance of AMR and strengthening laboratory and surveillance capacity; surveys on antimicrobial consumption and use. The challenges and needs include:

• There is a need to improve representativeness of data on AMR: 11 countries have completed enrolment in GLASS, of which four submitted data in 2016. The CCs are asked to help countries to enrol in GLASS and build capacities to implement national surveillance. The latter could be done through assisting with assessing their needs and capabilities, providing or translate tools and train focal points, and support countries in establishing and using AMR surveillance systems.
• the small number of CCs in Africa and language barriers: the CCs are asked to help identify technical institutions that could support work in French or Portuguese.
• insufficient capacity of laboratories and national surveillance systems: support is required to assess the needs and capabilities of laboratories, training in microbiology and use of reporting tools, development of tools and standard operating procedures, re-establishment of external quality assurance.
• uncertain sustainability in some countries: support is required to identify and collaborate with partners institutions, perhaps by twinning or mentorships.
• training is needed in laboratory diagnosis of enteric and meningitis bacteria, identification and antimicrobial susceptibility testing, and in preparing the annual report on AMR surveillance of both GLASS and non-GLASS pathogens.
• insufficient capacity for surveillance of Neisseria gonorrhoeae: support is required to implement or reinforce diagnostics and surveillance in some countries.
• little surveillance of the consumption and use of medicines: support is needed to establish antimicrobial stewardship programmes.

2. WHO Regional Office for the Americas

Dr Nienke Bruinsma reported that the regional plan of action on AMR will be presented at the G20 meeting in Buenos Aires, Argentina, in December 2018. Country support activities include a train-the-trainers workshop to improve capacity for detection and surveillance of AMR in the Caribbean;
laboratory assessments, including for mycotic diseases; finalization and implementation of national action plans; and training in antimicrobial stewardship.

A number of challenges and opportunities have been identified. Implementation of national action plans requires operational plans, monitoring and evaluation, allocation or dedication of funds (as part of the national health budget), sustainable structural changes to the health system (programmes, legislation and enforcement) and prioritizing and maintaining government commitment to human resources. For national AMR surveillance, the methodology of the Latin American Antimicrobial Resistance Surveillance Network (ReLAVRA) is being adjusted to enable countries to report to GLASS and to support the Caribbean region in setting up national AMR surveillance. Integrated surveillance is planned, including use of antibiotics and AMR in food and animal samples.

The Regional Office is currently working with CCs on surveillance of AMR in N. gonorrhoeae and other sexually transmitted infections; the surveillance, epidemiology and control of Salmonella and other causes of foodborne disease; and training in surveillance. The Regional Office takes into account language and culture in providing support, through experts and consultants, manuals, online training and problem-solving on WHONET. It is also developing methods for economic studies based on country experience, for the purpose of convincing finance ministers to invest in AMR. It provides expertise in operational planning and implementation of NAPs, including budgets, human resources, legal issues and health systems for sustainable programmes.

3. WHO Regional Office for the Eastern Mediterranean

Dr Maha Taalat and Dr Frank Konings described the current activities, which include supporting countries in preparing and implementing their national AMR plans; assessment of sentinel sites; linkage between national programmes for surveillance of AMR and for health care-associated infections; and supporting countries in reporting high-quality laboratory, clinical and epidemiological data to GLASS. They are requesting countries to conduct studies on the consumption and use of antimicrobials and to strengthen their capacity in the use of information technology (IT) methods. The Regional Office has a strategic framework for strengthening health laboratory services (2016–2020), which includes capacity to meet the requirements of the International Health Regulations (2005), and national laboratory working groups, laboratory policies and strategic plans exist or are being established in some countries. The regional external quality assessment scheme has been in operation for more than 10 years, with capacity-building in laboratory quality management and biosafety/biosecurity.

The challenges faced are:

- the need to strengthen governance for AMR in ministries of health;
- lack of expertise in designing national AMR surveillance plans and use of data for prevention;
- lack of expertise in data management (entry, cleaning, analysis and interpretation);
- uneven laboratory services and lack of well-coordinated laboratory referral networks;
- fragmented implementation of laboratory quality management systems, external quality assessment, accreditation and shipping of infectious substances;
- no designated WHO CC for AMR in the region;
- lack of equipment (and lack of capacity to maintain it), reagents, controls and standards.

The Regional Office needs support from WHO CCs in:
- preparing national AMR surveillance plans, data analysis and use of data for prevention;
- assessing the quality of epidemiological and laboratory data before they are submitted to
GLASS, especially from countries that have no national action plan;
• setting up diagnostic stewardship training programmes and tools to ensure that samples are taken according to a standard protocol;
• a protocol for identifying AMR in community-acquired infections;
• reviewing and assessing institutions for potential designation as WHO CCs;
• extending external quality assessment to antimicrobial susceptibility testing and improving or establishing national external quality assessment;
• reviewing the large number of standard operating procedures and improving them;
• on-site and off-site technical support when required;
• technical training and training trainers, e.g. for WHONET;
• molecular testing;
• developing a protocol and training for surveillance of candidaemia; and
• simple IT solutions.

4. Regional Office for Europe

Dr Danilo Lo Fo Wong said that the Regional Office is providing policy support for national stakeholder meetings, national AMR action plans, evidence-informed briefs to ensure that data are translated into policy, and FAO, OIE and WHO “one health” policy meetings. With its protocols, templates, tools and videos, consultants and experts provide training and capacity-building, analysis of data on antimicrobial consumption, standardized laboratory methods, data management and analysis, antimicrobial stewardship, behaviour change campaigns, research, projects and surveillance network activities. CAESAR strengthens national AMR reference laboratories by providing training and quality control, introducing EUCAST methods and WHONET, supporting the national laboratory network and giving feedback on submitted data. It also provides external quality assessment and training in data management,

The challenges for surveillance are:
• a low sampling frequency, often only after repeated treatment failure;
• limited laboratory capacity;
• lack of standard methods;
• limited access to high-quality reagents, often because producers are not interested in the small markets represented by some European countries;
• recording of data on paper; and
• limited communication and data-sharing between clinicians and microbiologists.

For training in surveillance, the Regional Office needs access to culturally sensitive microbiologists, data managers and epidemiologists, who represent WHO. Other needs are routine diagnostics for antimicrobial susceptibility testing to improve patient treatment, reference testing and troubleshooting and more types of specimens, with focused projects.

5. WHO Regional Office for South East Asia

Dr Aparna Singh Shah and Dr Sirenda Vong said that all Member States are in the process of designation of national reference labs (NRLs) for AMR. Most of the members have identified NRLs but it may not be a formal decision (on paper). Assessment of NRLs (designated/ proposed designation) by
SEARO is ongoing using a simple questionnaire. This will help us in identifying gaps in NRL capacity and NRL will support forging AMR lab network in the country. NRL will also provide technical support to the labs participating in the national AMR lab network. SEARO is working on formulating regional lab strategy for AMR. Most of the SEAR Member States either have their National Laboratory Policies/Strategies or they are in the process of developing one. SEARO is recommending Member States to formulate National AMR lab strategy as a part of overall National Health Laboratory Strategy to improve its implementation. Regional external quality assurance has been established for NRLs.

The challenges include inadequate funding and technical expertise; a rapid turnover of laboratory staff, which requires continuous training; and lack of sensitization of policy-makers to the integrated approach or to investing in laboratories.

WHO CCs could provide:

- more on-site hands-on training, including in testing resistance to antifungal products;
- support for drafting and reviewing regional/national AMR laboratory strategies and guidance documents in line with GAP;
- technical support in establishing national EQA;
- development and evaluation of rapid diagnostic tests for use at community level.
- technical assistance to strengthen IT and data management, including visits from epidemiologists, assistance in setting up a system and recommendations for further development, training of IT support team and programmers and a regional network to support WHONET users.

6. WHO Regional Office for the Western Pacific

Dr Raynal Squires reported that AMR was on the agenda at several regional meetings, and governments and other stakeholders will sign an AMR stewardship and accountability framework in November 2018. The Asia–Pacific Strategy for Emerging Diseases and Public Health Emergencies guides Member States in advancing implementation of the International Health Regulations (2005), including laboratory strengthening, optimizing the use of antimicrobials in human and animal health and reducing AMR in health care and in the food chain.

The challenges include:

- implementation of national action plans, especially by low-income countries;
- sustained technical and financial resources for establishing systems such as surveillance, stewardship and monitoring antimicrobial consumption;
- integration of surveillance and interventions in all countries;
- robust research evidence on AMR, especially its emergence in the environment and food; coordination of support to countries across technical areas and development partners; and
- integration of work in the human, animal and environment sectors.

CCs could therefore support research and generate evidence on AMR, help to establish a regional network of technical and research institutions to monitor AMR in the food chain, provide technical support to building systems in countries and conduct advocacy and behaviour change activities.

IV. Updates on 2017-2019 CC Network master plan target products (TPs)

Professor Neil Woodford took the Chair.
In December 2016, at the establishment of the CC Network, a master plan was agreed to cover activities from January 2017 to December 2019 (Annex: 2017-2019 CC Network master plan). Twelve target products (TP) with respective 26 activities were included in this plan.

In order to review this master plan according to current needs, the meeting had a session to update on each TP, followed by breakout sessions to review the current needs and possible next steps for the TPs and respective activities. The breakout groups were divided as follows:

Breakout Group 1
Area of work: Capacity building/technical support: microbiology laboratory (TPs 1-5)

Breakout Group 1
Area of work: Capacity building/technical support: Surveillance system (TPs 6-10)

Breakout Group 3
Area of work: GLASS Development (TP 11)

The updates and proposed next steps are described below.

TP1. Technical assistance to low-income countries
TP2. Network supranational laboratories to provide reference testing of unusual AMR

Update
An assessment tool and a questionnaire have been developed to assess the laboratories that request assistance. Fifty-two NRLs participating in GLASS were requested to respond to the questionnaire and 28 countries responded, including LMIC. The results of this survey and combining with previous recent surveys conducted by RO will inform the map of needs for support.

GLASS Secretariat conducted a mapping of the existing supra-national reference laboratories (SRL) already providing support to other WHO programmes, being the TB SRL network a major network willing to help in filling the gaps. Once the map of needs for lab support is concluded (see under TP1 above), the identified SRL could be considered to help address these needs.

Discussion
Professor Perovic reported that the group had agreed that TP2 should be subsumed into TP1. Country needs would first be assessed with WHO headquarters and Regional Offices on the basis of previous assessments and the survey conducted under TP1; on-site assessments would be conducted if requested or considered necessary.

Professor Woodford reminded CCs that countries within regions should be categorized by the relevant Regional Offices by priority, as it would be difficult to meet the needs of an entire region. Dr Pessoa-Silva raised the problem of ad-hoc requests, which the department and Regional Offices receive almost daily. The group commented that they should be assessed in the context of the overall work plan and as per CC availability.

Action points

- Feedback is requested from CCs and WHO by end of June 2018
- Country and laboratory visits are expected to be conducted to laboratories with unknown capacity in mid-2019.
- Countries that are in the process of enrolling in GLASS could be included in the assessment of gaps.
TP3. Minimal requirements for national reference laboratories in limited-resource settings

**Update**

GLASS Secretariat identified an initial list of laboratory supplies and equipment considered essential for the NRL operation. This list is going through final review and will be included in the WHO Catalogue by June 2018. This list will require continuous update and the CC could contribute to its periodic review.

**Discussion**

Professor Perovic said the group had changed the title of the TP to “Requirements for national reference laboratories to participate in GLASS”. The activities and inputs would be (i) to tabulate guidelines on best practices for identification and susceptibility testing of GLASS priority organisms and (ii) assist WHO in updating the inventory of the equipment and supplies necessary. Dr PessoaSilva commented that the WHO catalogue support WHO procurement to support build infrastructure in countries with limited resources.

The TP should also address the functions of NRLs required to support clinical laboratories. Dr Patel suggested that, in addition to the tabulated guidelines, a document be developed on the roles of NRLs and best practices to support national AMR surveillance.

**Action points**

The first version of the inventory is already available, and the draft tabulated guidelines will be sent by Dr Jean Patel to the group for comments before the end of May 2018.

- CC to assist WHO in updating the inventory of the equipment and supplies for inclusion in the WHO Catalogue.
- CC to tabulate guidelines on best practices for identification and susceptibility testing of GLASS priority organisms.
- CC to assist in developing guidance on the roles of NRLs and best practices to support national AMR surveillance.

TP4. Guidance on detection of and reporting on colistin resistance

**Update**

The guidance has been peer reviewed and is in final stages of development. The review will be sent to Dr Patel for finalization within 6 weeks.

**Discussion**

A representative of PAHO said that an easy test that shows good correlation with other tests has been assessed in the Region and could be shared with all CCs. Professor Woodford suggested that WHO should not recommend tests that are not recognized by the European Committee on Antimicrobial Susceptibility Testing (EUCAST) and the Clinical and Laboratory Standards Institute (CLSI). While the CC could assist in evaluating sensitivity/specificity of new/alternative tests being proposed, colistin is a difficult compound to test and any deviation from EUCAST or CLSI should have strong scientific support. It was also suggested that guidance documents will need regular updates.
**Action points**

- CC to finalize the review by May 2018
- WHO to publish the guidance by June 2018.
- WHO to plan with the CC the regular (e.g., annual) guidance update
- CC to assist with evaluation of new/alternative tests for colistin resistance detection.

TP5. Guidance on use of molecular methods to foster surveillance

**Update**

Professor Neil Woodford reported that a draft document on the use of molecular methods for AMR surveillance has been developed, it is currently under review by WHO RO, and will undergo external peer review in May 2018.

**Discussion**

Professor Perovic reported that draft document provides a very good review of the costs, benefits and drawbacks of existing molecular methods in AMR surveillance. The document is expected to be finalized by June 2018.

The group discussed that a document on molecular targets for inclusion in AMR surveillance could be useful and proposed its development in 2018.

A separate document on whole genome sequencing was discussed: participants agreed the document will need to be developed but no specific activity was proposed, pending WHO advice.

**Action points**

- WHO to facilitate peer review process
- CC to assist in compiling/incorporating the suggestions by reviewers
- WHO to issue the guidance in Summer 2018
- CC to outline the development of a document on molecular targets for inclusion in AMR surveillance.
- WHO and CCs begin planning the possibility of initiating a document on document on whole genome sequencing to support AMR surveillance.

TP6. Technical assistance to low income countries

**Update**

Dr Jonas Fuks mentioned that some webinars were developed and attended by 20 low- and middle-income countries and a training package including webinars is under development. The topics proposed are the GLASS concept and implementation, data management and IT tools, data analysis, reporting and interpretation and laboratory methods and quality assurance. These will be revised after feedback and will also include training in compiling surveillance reports that lead to action.

**Discussion**

Dr Sonja Löfmark said that the group had tabulated the needs of the Regional Offices and matched them with activities. The group highlighted the need for training in data analysis and interpretation, also in languages other than English. The group also concluded that webinars should be better targeted to specific needs and capacity.
The challenges include that training and training materials reach the intended audience with regard to both content and language.

Dr Pessoa-Silva suggested that a desk review be conducted of the available tools, with short descriptions, constituting a library for use at different levels for different purposes. Any member of the network should inform GLASS of useful tools.

**Action points**

- Extending the webinar series and recording them for reuse.
- Conduct desk review of available tools to support AMR surveillance in line with GLASS standards. All CCs to contribute to the lead CC in gathering these tools.
- Coordinate webinars execution.

TP7. Operational research protocols to inform sustainable implementation of AMR surveillance in limited resource settings

**Update**

The CC USA-281 is aware of work being done to review resource needs for implementation of AMR national action plans, and it expected that some information on resource use for AMR surveillance implementation would derive from this work.

The CC CHN-120 has developed slides to support training on diagnostic stewardship.

**Discussion**

Dr Löfmark reported that the group had agreed to provide technical support for diagnostic stewardship programmes, and technical support on linking surveillance of AMR and nosocomial infections surveillance.

**Action points**

- Share the ongoing work on assessment of resource use for AMR surveillance implementation with CC and RO.
- CC to support training on diagnostic stewardship.
- CC to technical support on linking surveillance of AMR and nosocomial infections surveillance.

TP8. Development of IT and data management tools

TP9. Data management, epidemiological analysis and development of reports

**Update**

Substantial support was provided by CC for to GLASS Secretariat in management and analysis of surveillance data published in the 1st GLASS report.

**Discussion**

The group suggested that TP 8 and T9 should be merged to become: “IT and data management GLASS development and country capacity building”.

It was also suggested that under this TP the use of the JANIS program could be pilot-tested in a country other than Japan. Country needs for IT should be carefully categorized, and all reporting should be integrated. Dr Pessoa-Silva commented that the aim of new Health Metrics and Measurement cluster
at WHO is to increase the connectivity of all WHO data; integration is also being sought with FAO and OIE data on drug use. It is also important that assistance is provided to countries with epi design, avoiding biases, designing modes of interaction between the national and local levels to improve data quality and relevance of data, and establishment of surveillance sites capable of producing and analysing quality epidemiological data, including two main streams of work:

(i) development of IT tools to and training materials to support data analysis and reporting, and
(ii) support national IT and data management solutions for AMR surveillance.

Action points
- Development curricula and training materials for IT capacity data management:
- Assess JANIS flexibility/applicability for data analysis/reports.

TP11. Guidance on detection and reporting of antifungal resistance in selected invasive fungal diseases

Update
Ms. Kaitlin Forsberg informed that a framework for surveillance of AMR in invasive Candida infections is being developed, and a global face-to-face meeting will be held during the European Congress of Clinical Microbiology and Infectious Diseases (ECCMID) in April in Madrid, Spain to discuss the framework and plan the pilot testing of the fungal surveillance framework. Four CC (IND-99, NET-89, USA-417, SOA-43) and three ROs will attend this technical consultation.

Discussion
The group indicated that the focus of the initial phase of fungal AMR surveillance will be on invasive Candida spp (i.e., candidemia).

Action points
- Hold the technical consultation on April 24, 2018.

TP12. Protocols for assessing the economic and health impact of AMR to be used at sentinel sites in all regions

Update
A technical consultation was held in January to discuss the findings of a literature review and potential protocols for epidemiological studies on the health burden due to AMR. It was decided to focus on health impact (burden of disease).

Discussion
Dr Pessoa-Silva updated work on TP12 with the objective to generate estimates of the global burden of AMR in humans in accordance with the WHO Global Burden of Disease methodology, by developing and testing protocols for standardized collection of the data for estimating disability-adjusted life-years (DALYs) due to AMR. The TP name should reflect the focus on health impact.

Action points
- The next steps are to develop and test protocols for estimating the incidence of AMR infections, attributable mortality and the duration of associated health states. The methods must be adapted to global scale and included in the GLASS framework.
Other requests from Regional Offices

Dr Löfmark said that the group had also considered requests that do not fit into the existing TPs. These include data harmonization from “one health” projects, production of regional annual reports and regional research on AMR. The representative of the African Regional Office said they will work on the terms of reference for the regional report, specifying the data to be included that would represent the African Region comprehensively. They will then request inputs on the Terms of Reference to the CCs supporting the development of the report.

The review of the work plan should take into consideration special projects such as surveillance of AMR in N. gonorrhoeae and consider the creation of a new target product related to One Health AMR surveillance.

V. Revised Collaborating Centre Network work plan

The draft work plan, revised according to the above comments and suggestions, was presented and discussed. It was proposed the plan will be reviewed and commented on in the coming weeks and that the lead for each TP proposes actions that are “SMART” (i.e. specific, measurable, attainable, realistic and timely).

The group discussed also the need for inter-CC assistance and agreed that it should not be the topic of a TP but, rather, the terms of reference of the CC network should be revised to accommodate this.

The revised work plan is described in Annex 1.

VI. Capturing the future

Several specific challenges faced by GLASS were discussed, including the periodicity, timeline and format of reports on GLASS; whether point prevalence surveys should be added to GLASS and what they should measure; how AMR surveillance data can be translated into policy; how to ensure surveillance of AMR in communities; and the potential use of artificial intelligence tools.

VII. Modus operandi of the Collaborating Centre Network

Dr Löfmark said that more CCs are needed to lead target products; greater use of the SharePoint would reduce the large number of e-mail chains and communication with the Regional Offices should be improved.

The need for direct communication with focal points in CCs in order to meet immediate requests was identified. Regional Offices should also communicate directly among themselves to share issues.

Professor Woodford said that requests to make country visits should be made well in advance. The expectations of the Network must be aligned with Regional Office priorities and work plans.

Communication among CCs, country offices, responsible officers in Regional Offices and the GLASS secretariat must be assured, with all those concerned kept informed. For example, knowledge of the language capability in a CC would be useful. CCs that have bilateral agreements with countries should ensure that the Regional Office is aware of their activities.

The next meeting of representatives of the CCs and the Regional Offices was agreed to be held in February 2019, for one week and include side meetings to discuss specific TPs. Virtual meetings, side meetings at international events and conference calls should also be organized to discuss TPs.
Dr Löfmark reported that some financing is available for meetings, but external sources of funding must be found. Dr Pessoa-Silva suggested that a position paper be issued by the Network, and Dr Löfmark and Professor Monica Lahra agreed to prepare a first draft by June 2018. The objective of publishing the position paper is to raise the visibility of the CC Network and hopefully attract governmental funding.

Action points

- All CCs to send Dr Löfmark information on their ongoing work and their language capacity.
- Develop a position paper to describe the CC Network and its role in supporting GLASS.

VIII. Closing remarks

Dr Pessoa-Silva welcomed the representatives of the two new CCs (Dr Hanan Balkhy and Dr Arunaloke Chakrabarti) to the Network and congratulated all CCs on completing 13 of the 26 activities on the previous master plan. The revised work plan will more clearly reflect the real needs identified by Regional Offices through their country representatives.

Annex 1

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<tr>
<th>Area of work</th>
<th>Target Product (TP)</th>
<th>Activities</th>
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| Capacity building/technical support: microbiology laboratory | TP1: Technical assistance to countries | • Support detection of emerging AMR  
• Support strengthening quality management system  
• Provide external quality assurance support for AMR  
• Provide reference testing for AMR  
• Develop web-based training opportunities  
• Address ad hoc requests and issues in implementing GLASS |
| | TP2: Tools for strengthening national reference laboratory (NRL) to support AMR surveillance | • Assist WHO in the development of a tabulated guidance on best practices for GLASS organisms  
• Assist WHO in the development of an inventory of equipment and supplies for bacteriological identification and AST at NRL  
• Assist WHO in the development of guidance on NRL best practices to support AMR surveillance |
| | TP3: Detection and reporting of colistin resistance | • Develop guidance including review of current methods for detection of colistin resistance  
• Assessment of alternative methods for colistin resistance detection |
| | TP4: Guidance on use of molecular methods to foster surveillance implementation | • Provide a review of benefits, costs and drawbacks of existing molecular methods application to support AMR surveillance  
• Define molecular targets which can and should be reported |

1 *Please note that the target products have been renumbered (as compared to the numeration in the work plan agreed in December 2016, at http://www.who.int/antimicrobial-resistance/AMR-Surveillance-QA-CCs-network-meeting/en/) to align with the discussions in March 2018.
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<th>Target Product (TP)</th>
<th>Activities</th>
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| Capacity building/technical support: Surveillance system | TP 5: Technical assistance to Countries (Lab and Epi combined) | • Map and collect available training materials for capacity building for AMR data analysis, interpretation, and utilization  
• Develop AMR surveillance curricula. Review existing and develop new materials and tools for data analysis, interpretation, and utilization: guidelines/manuals/case studies/tutorials; translation as needed  
• Direct training (workshops, webinars, online material): data analysis, utilization (data for action) and reporting  
• Toolbox to be made public via the GLASS website  
• Collect and review available needs and capacity assessment tools (modules to be integrated with the lab assessment part)  
• Country capacity building or assessment missions upon request  
• Assist with the development of regional AMR surveillance reports upon request |
| TP6: Strategies and operational research to inform sustainable implementation of AMR surveillance in limited resource settings |                                                                                       | • Review existing documents and tools on diagnostic stewardship, and consolidate a training package  
• Collect available tools on surveillance strategies (e.g. CDC tool), pilot in countries and provide feedback  
• Develop method for linking AMR surveillance, data on antimicrobial consumption/use and health care associated infection surveillance data  
• Assess inclusion of additional sources of AMR data into GLASS  
• Assess resource use needs for national AMR surveillance implementation  
• Support enhanced surveillance of AMR in *Neisseria gonorrhoea* |
| GLASS development                                | TP7: One Health AMR surveillance                                                     | • Develop guidance for data harmonization (standards, comparisons and interpretations)  
• Support development and implementation of surveillance of one AMR indicator (extended-spectrum beta-lactamase (ESBL)-producing *Escherichia coli*) across human, animal, food and environmental sectors |
| TP8: development of IT and data management tools |                                                                                       | • Development of curricula, training materials and tools for IT capacity and data management: guidelines/manuals/case studies/tutorials; translation as needed  
• Training (including webinars) on IT capacity and data management: data acquisitions, entry, storage, data security  
• JANIS for data analysis/reports: assess JANIS flexibility/applicability. Pilot in one country other than Japan  
• Support to assessment needs and provide recommendations on national IT solutions and capacity (national situation analysis, development of IT system strategy) |
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<tr>
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<th>Target Product (TP)</th>
<th>Activities</th>
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<tr>
<td>GLASS development</td>
<td>TP 9:</td>
<td>• Develop the risk assessment approach for emerging AMR</td>
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<td>Framework for early detection and information sharing of emerging types of AMR</td>
<td>• Promote implementation of the GLASS Emerging AMR Reporting (GLASS-EAR)</td>
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<td>TP 10:</td>
<td>• Development of a framework to guide the surveillance of antimicrobial resistance in invasive fungal disease</td>
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<td>Guidance on detection and reporting of antifungal resistance in selected invasive fungal disease</td>
<td>• Support country capacity building for detection and reporting of antimicrobial resistance in invasive fungal disease</td>
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<tr>
<td>Increase understanding of impact of AMR</td>
<td>TP 12</td>
<td>• Assessment of health impact of AMR and estimation of AMR burden of disease</td>
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