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Foreword

Antimicrobial resistance (AMR) is a threat to global public health, which involves the human, food chain, and environment sectors. The Global Action Plan on AMR (GAP-AMR) adopted by WHO Member States addresses the importance of a cross-sectoral "One Health" approach to contain this problem. One of the overarching requirements of the GAP-AMR is for all Member States to develop National Action Plans (NAPs) on AMR with due consideration to achieving five strategic objectives, including AMR surveillance systems grounded in the One Health approach.

AMR is a complex and challenging One Health issue. In order to establish a national programme on integrated surveillance, countries need key elements including holistic collaboration, involvement of key sectors and subsectors, laboratory capacity to culture, isolate, identify, and characterize the pathogens involved, and human and financial resources.

This protocol is a simple and feasible approach providing countries the opportunity to increase capacities to build national integrated surveillance systems for AMR starting with a simple indicator: frequency rates of extended-spectrum beta-lactamase producing *Escherichia coli* (ESBL-Ec). The stepwise approach adopted in the protocol allows countries to gradually include other cities and provinces, sectors and subsectors, and bacterial pathogens.

The AMR information collected through this protocol will enable monitoring of this indicator at the national, regional and global level. The data can also be combined with information on the use and consumption of antimicrobials in human and animal sectors that countries are collecting using WHO and OIE guidance. This will strengthen understandings of the magnitude of AMR, and facilitate the development of containment strategies. Importantly, this protocol will increase multisectoral collaboration for AMR surveillance, promoted and supported by the Tripartite Collaboration established by the Food and Agriculture Organization (FAO), World Organisation for Animal Health (OIE), and WHO.

Executive summary

Antimicrobial resistance (AMR) has emerged as a key public health challenge for the years ahead, with major economic consequences, particularly in low- and middle-income countries (LMICs). The United Nations (UN) advocates a global, holistic, "One Health" approach to the problem, involving its specialized agencies. The Tripartite plus agreement,[1] for example, links together the World Health Organization (WHO), World Organisation for Animal Health (OIE), Food and Agriculture Organization (FAO), and United Nations Environment Programme (UNEP) for action against AMR. An efficient, robust, and multisectoral surveillance system is a central tool to steer this action and assess its effectiveness. However, such a foundational surveillance system is still lacking.

For this reason, the Advisory Group on Integrated Surveillance of Antimicrobial Resistance (AGISAR) and the WHO Surveillance Prevention and Control of AMR have developed the Tricycle protocol for global surveillance on extended-spectrum beta-lactamase producing Escherichia coli (ESBL-Ec), which describes the implementation of a simplified, integrated, trans-sectoral surveillance system for bacterial resistance to antibiotics. This integrated surveillance protocol uses a One Health approach that is built upon principles of WHO surveillance tools, such as the AGISAR guidance on integrated surveillance of AMR in foodborne bacteria,[2] and the Global Antimicrobial Resistance Surveillance System (GLASS).[3] The surveillance focuses on the single key indicator that these two programmes recommended: the frequency rates of ESBL-Ec. ESBL-Ec is also used as an indicator for resistance development in gram-negative bacteria in hospitalized humans by the European Antimicrobial Resistance Surveillance Network (EARS-Net),[4] supported by the European Centre for Disease Prevention and Control (ECDC). The proposed name is "Tricycle", after its three-wheeled namesake, to demonstrate the idea that it will simultaneously address three aspects of bacterial resistance (human health, food chain (animals), and the environment) as a One Health approach, in a simple and feasible manner designed to provide robust and valid statistically-based surveillance outcomes using minimal resources.

In addition to addressing the three sectors impacted by AMR (humans, animals, and the environment), Tricycle is also a three-level process that includes:

(i) A core surveillance protocol, the Tricycle surveillance itself;

(ii) Links with other UN proposed surveillance systems in the field of AMR;[i] and

(iii) Opportunities to add satellite surveillance and research project protocols on AMR.