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Developing a situation analysis tool to assess containment of antimicrobial resistance in South East Asia

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Standfirst:

This article discusses the development of a tool to assess implementation of efforts to contain antimicrobial resistance (AMR) in South East Asia, where there are acknowledged gaps in the AMR containment programs.

Key Messages

1. The situation analysis tool allows us to assess and monitor the progress made in each of the Member States of the South East Asia Region over a period of time with respect to the implementation of the national action plan for AMR containment through a multisectoral, sustainable program.
2. The situation analysis process using the tool follows a unique multi-stakeholder review, conducted through guided discussions, table top exercises, and site visits as needed. Results are mapped as strengths and challenges; and this aids in identifying implementation gaps.
3. The tool builds on previous efforts, and addresses the lacunae therein; it is more relevant in the context of developing countries with rudimentary or non-existent AMR containment programs.
4. The tool recognizes the complexity of the AMR issue and addresses it through a multistakeholder approach, encouraging assimilation of One Health engagement as a major principle of AMR containment programs.

Text

The emergence of AMR is no longer a problem defined by national or political boundaries. For example, *Escherichia coli isolates* bearing mcr-1, was first identified in China, and shortly after, was also retrieved from clinical and animal samples in the United States (1,2). WHO and its partners have alerted on the concerning global rise of resistance against antibiotics, particularly those of "last resort" (3).

Evidence suggests that the main drivers of AMR are antibiotic selection pressure and transmission of resistant microbes (3). However, in addition to the biological basis, several drivers at the level of policies and systems operate in a complex web to contribute to the emergence of AMR (Chereau et al, BMJ current issue)

This complexity of multisectoral drivers indicates the need to establish a comprehensive, holistic, collaborative approach, to combat the issue effectively (Chereau et al). The 68th World Health Assembly (WHA) of 2015 endorsed the global action plan to contain AMR (GAP-AMR, text box 1), which is expected to translate into national action plans (NAP), by May 2017 (4). The NAP will develop a strategic action plan, based on a One-Health approach, bringing together multiple sectors to combat resistance in the local context.

To assist the Member States (MS), WHO, along with the Food and Agriculture Organization of the United Nations (FAO) and World Organisation for Animal Health (OIE), developed a manual and sample templates, as well as a library of existing NAPs (5). As underscored in the manual, a situation analysis is recommended prior to the development of the NAP. There exists a wide variation across countries in the capacity to respond to the call to develop a comprehensive, holistic NAP. Out of 133 surveyed countries in the worldwide situation analysis conducted by the WHO, very few reported to have a comprehensive, multisectoral NAP supported by sustainable financing (4). Consequently, to tailor a NAP to address the challenges in the setting of a particular MS, it is essential to conduct a comprehensive situation analysis, which would inform the subsequent steps of the process.

In response to the need to conduct such a situation analysis, the WHO South-East Asia Regional (SEAR) Office developed a tool to conduct a system-wide analysis of AMR containment programmes. We developed indicators based on existing evidence, to evaluate the progress made in each of the MS of SEAR over five years (2016-2020). In this article, we discuss the tool, which was developed to identify the vulnerabilities in the system, and to identify the stage of implementation of GAP-AMR related comprehensive activities and assess the progress made over time.

The situation analysis tool is being piloted in several countries of the region. We present here the tool and discuss its potential in helping to identify the programmatic lacunae from an implementation perspective, its shortcomings, and its relevance in comparison to other available tools. This will be instrumental for the WHO to fulfil its obligations, in accordance with the 68th WHA's Resolution to report on the development, implementation, monitoring and evaluation of the NAP developed by the MS (6).

Development and structure of the tool

The tool was developed based on a scoping literature review. A systematic search was undertaken to identify the major frameworks for monitoring AMR in different countries. This included documents associated with NAPs, monitoring and surveillance frameworks at the national and supranational levels, and policy frameworks dealing with the drivers of and plans for the mitigation of AMR.

The documents for the scoping review were drawn from available programs, at the national and supra-national levels, dealing with surveillance, prevention, control, and containment of AMR. Further documents were obtained from citations mentioned in the body/bibliography of the initially identified documents. This process was continued till no new documents were further elicited. During the initial phase, 12 documents were identified and a further 16 were identified in the second stage. In addition, 14 documents identified through hand searching the included texts.

The documents were reviewed to identify a list of indicators for system-wide evaluation. Following expert inputs, these were then classified into seven focus area indicators, each of which addressed one or more of the five strategic objectives outlined in the GAP-AMR (6). These seven focus areas were: 1. National AMR Action Plan; 2. Awareness raising; 3. National AMR surveillance; 4. Rational antimicrobial use & surveillance; 5. Antimicrobial Stewardship and Infection Prevention & Control ; 6. Research & innovation; and 7. One-Health engagement. Each of the focus area indicators was further classified into sub-category indicators based on the indicators identified in the review of the evidence (table 1).

Based on the extent of implementation, each of the sub-category indicators were further graded on an incremental scale consisting of five phases based on an adaptation of the Indicator Standards Assessment Tool developed by UNAIDS. (7)

The first phase, that of exploration and adoption, indicates that the process of designing an AMR containment program has been initiated. Once the decision to implement the program has been made, systems progress to the second phase, that of program installation. The third phase, of initial implementation, is one of the most challenging phases for programs in developing countries. Once the early implementation barrier is overcome and the program is scaled up, the fourth stage – full operation – is achieved. Once the program starts to function at the highest grade of operational efficiency, the fifth and final stage, that of sustainable operation, is attained.

Situation Analysis Process and Definitions

Based on the elements of the tool the situation analysis process is designed to be a multi-stakeholder review, to be performed jointly by national stakeholders and WHO team.

National stakeholders assess themselves and provide evidence and justification. WHO facilitates the process and helps reach a consensus regarding the grading through guided discussions. The guided discussion technique (8,9) is employed to elicit dialogue and exchanges between reviewers and stakeholders. Core questions triggered discussions on each focus area. We defined functional system as a system that shows sound procedures, interdepartmental interactions, leadership, governance and funding capacity, and outputs (reports, decisions translated into actions) (Vong S, 2017).

A thematic situation analysis would be conducted based on the outcome of the multi-stakeholder review. A combination of the review for capacity and that for functionality describe at which stage the AMR containment program is positioned for each focus area.

Results of the process would be summarized in the form of an analysis of strengths and challenges, mapped using the phases attained by the indicators for each strategic objective. Indicators in the first two phases of implementation are considered to contribute to challenges and vulnerability of the system while those in the three higher phases are considered to be the strengths of the system.

Existing tools

Two monitoring and evaluation frameworks have been widely implemented globally for assessment of national AMR containment programs – WHO rapid assessment tool for country situation analysis (CSA) and International Health Regulations (IHR) Joint External Evaluation (JEE) tool.

CSA was used to determine the extent to which effective practices and structures to address AMR were already in place and where gaps remained (4). A total of 133 of the 194 WHO MS provided information. CSA covered the six objectives of the 2011 WHO strategy as a questionnaire with largely close-ended questions; it was submitted to national health authorities for self-assessment and reporting, which may be biased be of limited credibility.

The CSA rapid assessment tool has a limited scope to provide insights on how an AMR containment program is operational. Furthermore, it does not adequately assess the One Health engagement and response, and related mechanisms as an important attribute of AMR prevention and control.

More recently AMR has been acknowledged as a threat to global economic stability and security (11). The Global Health Security Agenda (GHSA) – a partnership between countries to "*prevent, detect, and respond to biological threats*" - was launched in 2013 including AMR as one of the 11 priorities for global action (12,13).

Building on the GHSA experiences (12), and other assessments, WHO developed the JEE tool (13,14) to foster compliance with the IHR core capacity requirements. AMR is part of a larger set of public health issues concerning global health (15).

Despite having functional indicators that may assess improvements in program implementation over time, the tool fails to capture the complexity of AMR containment as detailed in the GAP-AMR. Many aspects of the strategic objectives of GAP are missing, including research & innovation or capacity strengthening. It did not capture the multisectoral essence and had minimal alignment with GAP-AMR. One Health approach is measured in a broad way so that multisectoral governance over AMR containment is diluted. Stewardship activities were bundled all together in one category. While the JEE tool captured key elements of system-wide functionality regarding AMR containment program, progress against the threat of AMR requires comprehensive and concrete metrics that can be monitored and measured efficiently.

SEAR tool: strengths and limitations

AMR is an on-going silent epidemic across the world, which many countries have limited capacity to detect. Given the limited resources, competing priorities and political challenges could derail the

implementation goals of the NAP. Enabling all countries to measure progress toward sustained operations of the AMR containment program is, therefore, essential.

The current tool is organized around the development and implementation of the NAP. Through an extensive set of indicators, the tool provides a window for comprehensive governance, policy and systems analysis that can be applied at the community level as well as the systems level. It provides a combination of functionality and capacity assessment, and can be deployed repeatedly over time to assess the progress. It focuses on areas where active participation, political will and stakeholder engagement is crucial to succeed, thereby giving a glimpse into the extent of involvement of the political and governance machinery in addressing AMR concerns. Additionally, it stresses on One-Health engagement in a trans-sectoral sense, at the policy implementation level, which is a critical strategy since antimicrobial use in the veterinary sector has been identified to be a major determinant of emergence of AMR.

The incremental phases through which the sub-indicators progress are also indicative of systems building over time in a positive way fostering ownership, collaboration and transparency. Compared to other assessment tools, the language used to describe the different stages of development encourages countries and allows them to benchmark as to whether they are on the right track to sustainable operation.

Moreover, we provide a clear direction to AMR containment in terms of best practices, best policies or system development. As indicated, the last phase of sustainable operations is defined as a phase where components of sustainability are clearly implemented i.e. secured funding, Monitoring & Evaluation (M&E) system that documents findings and subsequent changes made for improvement.

The tool, however, is limited by its inability to assess the quality of implementation of framed policies and programs since it only assesses the extent to which the programs are implemented. However, considering the context of SEAR in which it is being deployed, that of countries with no or rudimentary programs for AMR containment, it is more essential to assure implementation as the first step. Once most countries reach Phase 4 (phase of full operations), further steps could be added between Phase 4 and 5 to monitor quality by designing performance indicators.

Having piloted the tool in a few countries of the SEAR, we believe that countries appreciated the tailored tool and the one-to-one assistance provided to apply the tool; picking up the issues pertinent to the countries in the region, many of which have systems gaps and relatively rudimentary programs for containment of AMR that need extensive support and strengthening.

While we understand the need for a globally standardized M&E framework we believe our tool accounts for local MS context and is less about evaluating or comparing countries. Rather, this joint approach allowed countries to prioritize and formally document the most urgent needs to enhance the implementation of the NAP. WHO's regional and country offices for country liaison and provision of support to apply WHO-developed tools is of paramount importance.

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CONTRIBUTORISHIP STATEMENT

All the authors have participated in the development of the manuscript to merit authorship. SV conceptualized the article and in discussion with AS and MK, drew up the outline based on which the article was to be written. He is also the guarantor of the article. MK was responsible for conducting the review and development of the tool which is discussed in the article. He wrote the first draft of the article. AS and SV participated in review of the tool, including pilot testing it in certain areas, and provided inputs in subsequent drafts based on pilot experiences. All the authors have participated in revising the drafts and approve of the final version which has been submitted to the journal.

Text box 1: Five Strategic Objectives adopted for the Global Action Plan against AMR at the 68th World Health Assembly in May 2015

1. Improve awareness and understanding of antimicrobial resistance through effective communication, education and training
2. Strengthen the knowledge and evidence base through surveillance and research
3. Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures
4. Optimize the use of antimicrobial medicines in human and animal health
5. Develop the economic case for sustainable investment that takes account of the needs of all countries and to increase investment in new medicines, diagnostic tools, vaccines and other interventions.

Table 1: Indicators for situational analysis and monitoring of AMR (by WHO strategic objectives, focus area, and sub category indicators)

WHO Strategic Objective	Focus area Indicator	sub category-Indicator	Description – best practices
SO2	**National AMR Action Plan (NAP)**	NAP in line with GAP-AMR	Comprehensive and multisectoral NAP implemented with a coordination body, an operational plan, adequately funded and a monitoring system
SO2	**National AMR surveillance system**	Lab-based AMR surveillance system	National human AMR surveillance in place and functional to monitor AMR trends accurately and timely with national guidelines and regulations (minimum representative datasets, standards, definitions, methodology, standards of quality implemented)
		Lab capacity strengthening	A national network of quality assured laboratories developed that contributes quality and proper data to national AMR surveillance
		Early warning system – detection	Early warning systems, with integrated rapid response mechanisms, have been incorporated in the human AMR surveillance system
SO4	**Rational use and surveillance (community level)**	National Antimicrobials Containment Policy	A national AMR containment policy for control of human use of antimicrobials implemented and enforced. AMR containment policies include vaccination policies and high coverage where appropriate
		National regulatory authorities	Competent and functional NRA or DRA with capacity to ensuring/enforcing antibiotic quality standards and taking measures against substandard products and Inspecting pharmacies.
		Regulation of finished antibiotic products and active pharmaceutical ingredients (APIs) used to manufacture	Comprehensive, multisectoral Drug Act is implemented at the national level to regulate the production/manufacture (if it is a country that manufactures antibiotics of APIs) and import/export (if the country is involved in importing or exporting of antibiotics and APIs) of antibiotics and APIs.

		antibiotics for human use	
		Regulation of supply chain	A national policy/act is in place to regulate the supply chain management of antibiotics and APIs.
		Regulation of pharmacies	Presence of a regulatory system, with monitoring and evaluation framework, to prevent over the counter sale and inappropriate sale of antibiotics and APIs.
		Surveillance of use and sale of antimicrobials in human sector	Surveillance in place and functional to monitor use and sales in humans that produces representative and quality data
SO3	**Infection Prevention Control & AMR program in healthcare settings**	Surveillance of Healthcare associated infections and antimicrobial use	A National surveillance HAI and antibiotic guidelines and policy for healthcare facilities formulated. Hospitals are mandated to undertake surveillance and report healthcare associated infections as a part of continuous quality control in patient care services. Surveillance data to be analysed and centralized for actions for monitoring purposes
		AMR stewardship program	Training, education in-service & capacity building program. Protocols, SOPs and guidelines for IPC are available based on nature and type of healthcare facility.
		Policies – practices: governance, control program in healthcare setting	A National Infection Prevention and Control policy for healthcare facilities formulated. A AMR control program providing guidance and best practices for implementing antimicrobial stewardship and rational use of antimicrobials implemented in each health care facility
SO1	**Awareness raising**	Antibiotic awareness campaign	A national program on improving awareness of AMR and AMR containment interventions implemented and monitored
		Professional education & training pre-service	Policy on education and training strategies for professionals, para-professionals and other occupational groups implemented and progress monitored
SO5	**Research and**	Proper environment for research and	Investing in development of new drugs, diagnostics and interventions through increased research funding; National policy to promote and foster

	Innovation	innovation	innovation to combat AMR
		Horizon scanning	Latest updates on research agenda and advances
SO 1-5	**One-health engagement**	A national AMR containment policy and regulatory framework for control of animal use, and their registration for use	National policy & plan on use of antimicrobials & Regulatory framework for control of animal use, and their registration for use implemented, enforced and monitored
		Surveillance of use and sale of antimicrobials in veterinary sectors	The national policy & plan that identifies activities linked to use and sales of antimicrobials at national level in the veterinary sector and surveillance of AMR and AMU
		Infection prevention and control in the animal sector: Animal health & agricultural practices	Development and implementation of best practices on infection prevention in animal by species / commodity. Surveillance and policies developed to control contamination of food abiding by the Codex Alimentarius standards
		Vaccination in animals to prevent and reduce infection in food animals	Development of a vaccination policy for animals, including outlining implementation strategies through microplans developed at the local levels.
		Awareness in animal sector	Strategy to engage veterinary sector in AMR prevention and control through awareness generation & education in the animal health sector

Table 2: Interpretation of phase of AMR prevention and control program implementation (FUNCTIONALITY INDICATORS)

Phase of Program Implementation	What it means
Phase 1 **Phase of Exploration and Adoption**	There are no programs implemented in a systematic manner in order to conduct AMR prevention and control in the country. However, the process of designing a program has been initiated, and depending on the progress made (as seen through the indicators), it may be that one or more of the following activities are being undertaken: - Identification of needs, options and resources - Identification of potential barriers to implementation (funding, human resources, system responsiveness, etc.) - Investing in systems to augment their readiness to deploy the program and overcome the identified barriers in implementation - Identifying structures (both in policy making and implementation frameworks) to aid in the implementation of the program As the nation gets closer to the end of Phase 1, it is on the verge of implementing (at any scale, even a pilot project) an AMR surveillance program.
Phase 2 **Phase of Program Installation**	**The decision to implement a program** has been made and the initial set of activities have been undertaken in order to launch the program. These may include: - Capacity building - Resource allocation - Establishment of data transmission, security, and sharing protocols - Development of process indicators, standard operation protocols and other guidelines to be adhered to by institutions participating in the program In course of the second phase, there is more emphasis on development of infrastructure, and allocation of resources in order to implement a program in a defined context and then scale it up to the national context in the subsequent phases.
Phase 3 **Phase of Initial Implementation**	This is probably the most challenging phase in the stages of **early implementation** of any program within the context of developing nations. In this phase, there is a need to initiate a change or an intervention, which may have patchy uptake or maybe avoided altogether. - In course of this phase, a functional model of the program is identified - All protocols, SOPs, etc. undergo a real world challenge This is a very crucial phase and most programs are likely to find it difficult to come out of this phase.
Phase 4 **Phase of Full Operation**	This is the process of **scaling up a successful model** of the program that may have been trialled in the previous phase. - The program is part of accepted practice - There is a nation-wide (or a large scale) adoption of the program

	- The program is functional by generating outputs and outcomes on a regular basis (seek proof of evidence)
Phase 5 **Phase of Sustainable Operation**	This is the highest grade of **operational efficiency of the program** and indicates that the program can have long-term survival. - The program is resilient to changes in funding volume, partner agency support, etc. external factors which were essential for installation and initial implementation of the program. - Through a functional M&E mechanism, there is systematic improvement of capacity, especially in human resources and system capacity, to enable the program to function without extensive need to invest in continued capacity building

Table 3: **Instrument for In-Country Situation Analysis and Monitoring of Antimicrobial Resistance in South East Asia Region (see below in landscape format)**

Focus Areas	Indicators/Phases	Exploration and adoption	Program installation	Initial implementation	Full operation	Sustainable Operation
1. National AMR Action Plan	NAP In line with GAP-AMR	No Action Plan or No nat. multisectoral committee or AMR committee established but involving one ministry	AMR working group established and National action plan underway	GAP-aligned Action plan including operational plan with defined activities and respective budget available	Action plan includes operational plan being rolled out & scaled up with defined activities and respective budget	Action plan includes operational plan being rolled out & scaled up with defined activities and respective budget
2. Awareness raising	Awareness campaigns to the public	Government not involved in awareness-raising activities on antibiotic resistance	Some government-led activities in parts of the country to raise awareness about AMR and actions to address it	Nationwide, government-led antibiotic awareness campaign targeting the general public OR professionals	Nationwide, government-led antibiotic awareness campaign targeting public AND professionals	Impact of government led awareness campaigns assessed over behavior changes in public and professionals
	Education and training strategies for professionals	No policy or strategy	Relevant policies developed but ad-hoc training courses in some disciplines	AMR in some pre service training and/or some special courses OR Continuous professional development and regular audit of learning	AMR in some pre service training and/or some special courses AND Continuous professional development and regular audit of learning	AMR incorporated into pre service training for all relevant cadres. Regular continuing professional development
3. National AMR surveillance system	National human AMR surveillance	No capacity for AMR laboratory and/or limited reporting; or no surveillance guidelines	Guidelines developed but not fully implemented – limited quality data and analysis and/ representativeness	Standardized national AMR surveillance in place and representative of country but limited number of op. sites	Surveillance in place and functional to monitor AMR trends accurately and timely but no contributing data to GLASS*	National AMR surveillance regularly assessed and adjusted; and contributing to GLASS
	National	No national network	A national network with	Nat. Ref. Lab identified	A national network of	Lab network established,

	Laboratory Network strengthening	developed	testing according to the international standards is planned	and quality assured laboratory networks developed only at few surveillance sites	EQA health laboratories developed in most /ALL surveillance sites	EQA measures in place, and demonstrated capacity of reference lab for research
	Early warning systems	No system in place or planned	System planned, in keeping with international standards	System is implemented in pilot mode, or if implemented on a national scale either not fully functional (not sensitive to reportable events)	Demonstrated functional capacity: data centralized and analysed with reports	Demonstrated functional capacity and proof of response from detection
4. Rational use of antimicrobials and surveillance of Use/Sale (community-based)	A national AMR containment policy for control of human use of antimicrobials; AMR Stewardship (AMS)	No/weak national policy & plan, regulations for antimicrobial use and availability	National AMS Program (AMSP) planned and under development	National AMS Program (AMSP) is developed Including tools to implement and monitor AMS progress & impact	AMSP implemented by relevant institutions. Regulations for antimicrobial use and availability implemented in limited capacity	A national AMSP for control of human use of antimicrobials implemented and enforced >2 years
	National Regulatory Authorities (NRA) or Drug Regulatory Authorities (DRA)	No official NRA/DRA or existing with limited capacity	NRA/DRA with limited capacity but strategic planning in place for capacity building and appropriate budgeting	NRA/DRA system set up for oversight but not fully functional	Tools for quality assurance & registration of antibiotics in place and inspection implemented but limited capacity for enforcement of policies and regulation	Competent and functional NRA/DRA with capacity to ensuring/enforcing antibiotic quality standards and taking measures against substandard products and Inspecting pharmacies
	Surveillance of	No guidelines for	National policy & plan on	Monitoring sales of	On a regular basis (every	On a regular basis (every

	antimicrobial use (AMU) and sales in humans	surveillance of use and/or sales of antimicrobials	surveillance of use of antimicrobials under development or developed & approved but not implemented (surveillance in individual facilities and national level sales)	antimicrobials at national level not implemented. Monitoring of use limited to few facilities that are not representative and irregularly	year/two-years) sales data at national level are collected. Use data in individual healthcare facilities are collected from a small & not representative sample. No established analysis with national AMR lab-based surveillance	year/two-years) sales data at national level are collected and AMU surveys are conducted in a representative sample of facilities & translated into actions. And links with national AMR surveillance data analysed and reported
	Regulation of finished antibiotic products and active pharmaceutical ingredients (APIs)	No official regulation on import, export, production, distribution and use of finished antibiotic products and APIs or existing with limited capacity	Regulation with limited capacity but strategic planning in place for capacity building and appropriate budgeting	Regulatory authority and system set up for oversight with a limited functional capability	Regulatory authority and system in place and inspection implemented but limited capacity for enforcement of policies and regulation	Regulatory authority and system in place and are fully and effectively implemented
	Regulation of pharmacies on over the counter sale and inappropriate sale of antibiotics and APIs	No official regulation on over the counter sale and inappropriate sale of antibiotics and APIs	Regulation with limited capacity but strategic planning in place for capacity building and appropriate budgeting	Regulatory authority and system set up for oversight with a limited functional capability	Regulatory authority and system in place and inspection implemented but limited capacity for enforcement of regulation	Regulatory authority and system in place and are fully and effectively implemented
Prevention Control & AMR Stewardship	AMR stewardship program in Healthcare setting	No national AMR stewardship policy, or operational plan is available or approved	A national IPC/AMR policy, or operational plan, is available but weak SOPs, guidelines and	Nat. IPC/AMR plan-aligned IPC/AMR plans implemented in limited number of HCS	Nat. IPC/AMR plan-aligned IPC/AMR plans are implemented in about all HCS	IPC/AMR measures and the effectiveness is widely implemented and regularly evaluated and

			protocols not available to all hospitals (limited updates)			shared
	IPC program in healthcare setting (HCS)	No national IPC policy, guidelines or action plans to mandate IPC in HCS	A national capacity building program, or operational plan, is developed; SOPs, guidelines and protocols developed and available But not implemented	IPC program and capacity building plans implemented in selected HCS	IPC program and capacity building plans implemented nationwide	IPC Capacity building and program effectiveness are regularly evaluated and shared
	National HAI and related AMR surveillance	No policies, limited national plan and guidelines to mandate hospitals for HAI surveillance	Few public and private facilities have HAI surveillance but data not centralized at national level	Few public and private facilities have HAI surveillance and share data with national level	Centralized data on HAI from several hospitals but with limited data analysis and detection capacity	Monitoring and response frameworks established to identify critical HAI events, especially related to emergence of AMR indicator bacteria against critical drugs
	Sanitation & Hygiene and Vaccination	No formal campaign on sanitation & hygiene and vaccination	Formal campaign to enhance on sanitation & hygiene and vaccination being developed	Formal campaign to enhance on sanitation & hygiene and vaccination is implemented in small scale	Formal campaign to enhance on sanitation & hygiene and vaccination is implemented in large scale	Formal campaign to enhance on sanitation & hygiene and vaccination is implemented in large scale & associated with M&E system
6. Research and Innovation	R&D and innovation on AMR prevention and containment (+ Research funding)	No policies fostering research environment although capacity exists for research	Policies planned and existing structure has a plan to foster research and innovation on AMR	Presence of policies and investments to foster research and innovation on AMR	Research consortium, dynamic research programs are on-going thanks to government led agenda	Gov.-led research outputs related to AMR global research agenda

7. One Health engagement	A national AMR containment policy and regulatory framework for control of animal use, and their registration for use	No national policy & plan to reduce use of antibiotics	National policy & plan on use of antimicrobials developed & approved or Regulatory framework for control of animal use, and their registration for use developed but not implemented	Implementation of policy & plan but limited capacity for monitoring of use and quality of drugs	Policy & plan implemented with some capacity for monitoring but limited capacity for enforcement	Policy & plan implemented with proper capacity for monitoring capacity and increased capacity for enforcement
	National surveillance of AMR, and use and sales of antimicrobials at national level in the veterinary sector	No/weak national policy & guidelines	Limited capacity for surveillance in any of sales, AMR, AMU	Some capacity and data generated from sales, AMR or AMU	Some comparative analysis of surveillance data between AMR and AMU	Comprehensive approach of surveillance with coordinated analysis between humans and animals
	Infection prevention and control in the animal sector	No policy and national guidelines developed for biosecurity to reduce infection rates in food and both large producers and small holders	Policies and National guidelines in line with international standards planned including vaccination policy and *Codex Alimentarius* standards	Limited implementation particularly in large producers	Full implementation particularly in large producers	Fully implemented in multiple areas with a monitoring framework in place
	AMR awareness generation & education in the animal sector	No Policies or Strategies or only planned	Policies or Strategies developed	AMR in some pre service training and/or some special courses Or Continuous professional development and regular	AMR in some pre service training and/or some special courses AN D continuous professional development and regular	Impact of education program assessed over behaviour changes

				audit of learning	audit of learning	