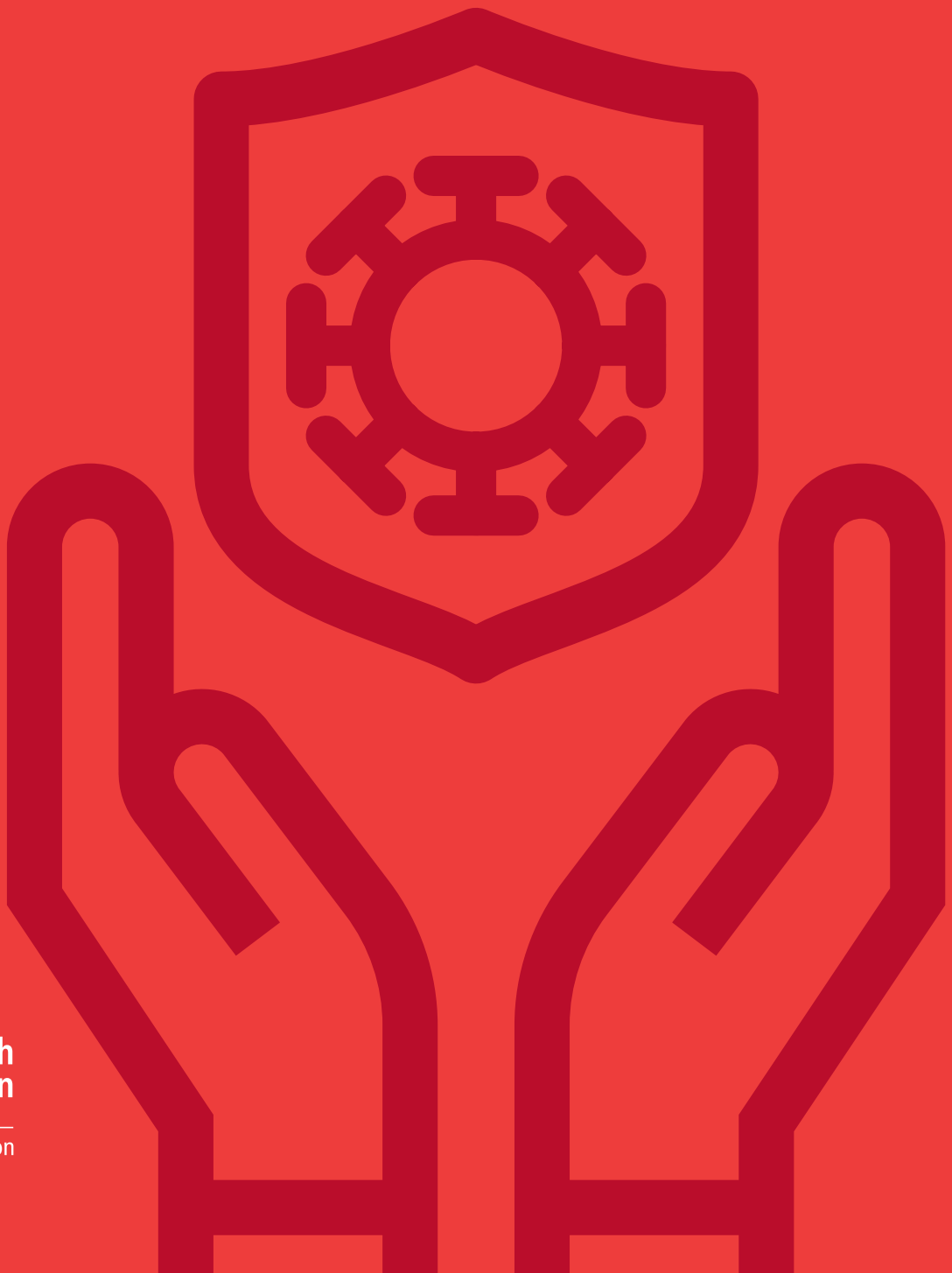
Prevention and control of antimicrobial resistance in the Eastern Mediterranean Region – a progress report, 2024



World Health Organization
Eastern Mediterranean Region

Prevention and control of antimicrobial resistance in the Eastern Mediterranean Region – a progress report, 2024

World Health Organization
Eastern Mediterranean Region

WHO Library Cataloguing in Publication Data

Names: World Health Organization. Eastern Mediterranean Region

Title: Prevention and control of antimicrobial resistance in the Eastern Mediterranean Region: a progress report, 2024 / World Health Organization. Eastern Mediterranean Region

Description: Cairo: World Health Organization. Eastern Mediterranean Region, 2024

Identifier: ISBN 978-92-9274-521-9 (pbk.) | ISBN 978-92-9274-522-6 (online)

Subjects: Drug Resistance, Microbial - drug effects | Anti-Bacterial Agents - therapeutic use | Anti-Infective Agents | Public Health Surveillance | Eastern Mediterranean Region

Classification: NLM QW 45

This publication was originally published under ISBN: 978-92-9274-365-9, 978-92-9274-366-6

Contents

Tables

Figures

Acknowledgements

The development of this report by the World Health Organization (WHO) Regional Office for the Eastern Mediterranean was led by Shaffi Fazaludeen Koya, Medical Officer, Antimicrobial Resistance and Infection Prevention and Control (AMR/IPC) Unit, supervised by Elizabeth Taylor (Acting Regional Adviser for AMR until December 2023), Hala Amer (Regional Adviser for AMR, beginning January 2024), Yvan Hutin (Director, Department of Communicable Diseases Control, until January 2024), Rana Hajjeh (Director of Programme Management, and Acting Director, Department of Communicable Diseases Control until August 2024), and Nevin Wilson (Acting Director, Department of Communicable Diseases Control, September 2024–March 2025).

The following AMR/IPC Unit staff, consultants and United Nations Volunteers from the WHO Regional Office for the Eastern Mediterranean contributed to this report: Iman Heweidy, Miriam Holm, Aalaa Moghith, Basma M. Saleh, and Mohamed Sarhan. Azza Mohamed Awad Tag El Din provided overall administrative support.

We also acknowledge the contribution of the following colleagues: Samira Al Eryani, Adi Al-Nuseirat, Lina Azkoul, Kenza Bennani, Engy Hamed, Quamrul Hasan, Joumana George Hermez, Muhammad Shahid Jamil, Shakiwa Fausta Mosha, Martin Van Den Boom and Ghasem Zamani.

We gratefully acknowledge the support of Mohsen Naghavi and his team at the Institute for Health Metrics and Evaluation, School of Medicine, University of Washington, for kindly providing us with antibiotic consumption estimates for the WHO regions.

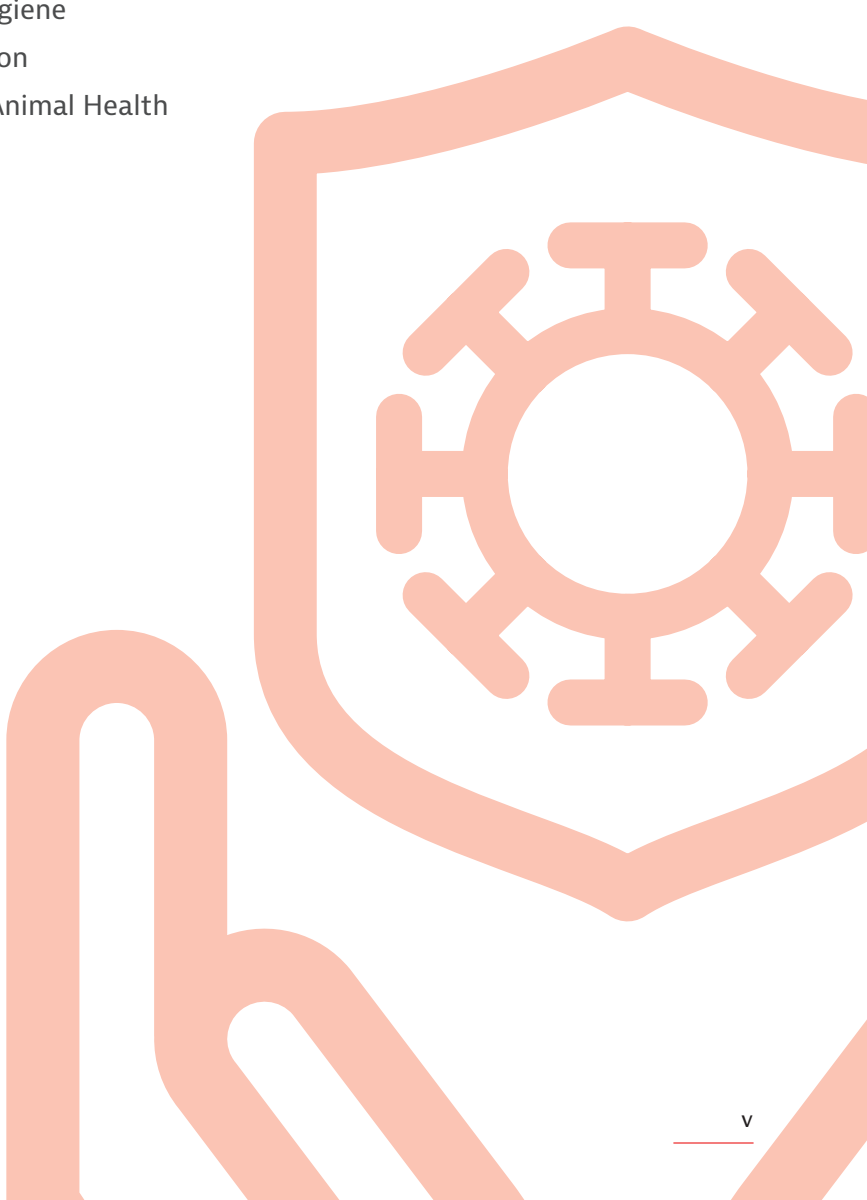
We are thankful to all the AMR and infection prevention and control (IPC) national programme heads, the AMR and IPC staff of ministries of health in all the 22 countries/territories of the Region, and our WHO colleagues in country offices and headquarters.

We would also like to acknowledge the clinicians across the Region for their contributions to addressing AMR. We remember and acknowledge all patients affected by AMR, directly or indirectly, as we dedicate this report to them.

The following governments and contributors provided funding for this report: Germany (Federal Ministry of Health); the Republic of Korea (Korea International Cooperation Agency and Ministry of Health and Welfare); Saudi Arabia; the United Kingdom of Great Britain and Northern Ireland (through the Fleming Fund); and the United States of America (Centers for Disease Control and Prevention).

Abbreviations

AMR	antimicrobial resistance
AWaRe	Access, Watch and Reserve classification of antibiotics
DID	defined daily doses per 1000 inhabitants per day
EML	essential medicines list
FAO	Food and Agriculture Organization of the United Nations
FCV	fragile, conflict-affected and vulnerable
GLASS	Global Antimicrobial Resistance and Use Surveillance System
GRAM	Global Research on Antimicrobial Resistance project
HIC	high-income country
IPC	infection prevention and control
MIC	middle-income country
NAP	national action plan
SDGs	Sustainable Development Goals
TB	tuberculosis
TrACSS	Tracking AMR Country Self-Assessment Survey
WASH	water, sanitation and hygiene
WHO	World Health Organization
WOAH	World Organisation for Animal Health



Glossary

- **Antibiotic resistance:** A subset of antimicrobial resistance that specifically refers to bacteria becoming resistant to antibiotics (medicines that act against bacteria).
- **Antimicrobial resistance:** The ability of bacteria, viruses, fungi and parasites to resist the effects of antimicrobial medicines that kill susceptible organisms or keep them from growing. Antimicrobial resistance predates the use of antimicrobials in human medicine, and many bacteria, viruses, fungi and parasites are intrinsically resistant to some antimicrobials. Microorganisms can also acquire resistance by being exposed to antimicrobials. Infection with antimicrobial-resistant pathogens makes infections harder to treat and increases the risk of disease spread, severe illness and death.
- **AWaRe classification:** WHO classification of antibiotics introduced as part of the 2017 Model Essential Medicines List (EML).
  - **Access group antibiotics:** Antibiotics that have a narrow spectrum of activity and a good safety profile in terms of side-effects.
  - **Watch group antibiotics:** Broader-spectrum antibiotics recommended as first-choice options for patients with more severe clinical presentations or for infections where the causative pathogens are more likely to be resistant to Access antibiotics.
  - **Reserve group antibiotics:** Last-choice antibiotics used to treat multidrug-resistant infections.
- **Defined daily dose (DDD):** The assumed average dose of a medicine used for the most common adult indications.
- **Defined daily doses per 1000 inhabitants per day (DID):** The number of defined daily doses consumed per day per 1000 population.

Executive summary

Antimicrobial resistance (AMR) is a global public health crisis that resulted in 1.14 million deaths in 2021. According to the Institute for Health Metrics and Evaluation estimates, 96 416 of these deaths occurred in the World Health Organization (WHO) Eastern Mediterranean Region.

All 22 countries/territories in the Eastern Mediterranean Region are enrolled in the global AMR surveillance system, and 17 countries/territories reported data in 2024 (for the year 2023). The total number of isolates reported to the system increased sixfold between 2017 and 2022, but the proportion of blood isolates is relatively very low. Most of the data come from public sector laboratories or hospitals, although the private sector has increased its participation in some countries/territories recently. Three pathogens account for three quarters of all the reported pathogens – *Escherichia coli* (26%), *Klebsiella pneumoniae* (23%), and *Staphylococcus aureus* (22%).

Data from the Global Research on Antimicrobial Resistance (GRAM) project from 2000 to 2018 indicate that the Eastern Mediterranean Region consumes more antibiotics than any other WHO region. The consumption is greatest among high-income countries (HICs), with middle-income countries (MICs) reporting the greatest increase in consumption between 2000 and 2018. Out of 10 countries/territories in the Region submitting Global Antimicrobial Resistance and Use Surveillance System (GLASS) data on antimicrobial use for 2021 and 2022, four reported a more than 60% share of Access group antibiotics. Point prevalence surveys on antibiotic use in seven countries/territories showed that just over one third of all antibiotics prescribed belong to the Access group. Indications were documented in three fifths of the prescriptions, and one fifth of the total prescriptions were targeted based on culture results.

All countries/territories in the Region have developed their first national action plans (NAPs) for AMR mostly in collaboration with the animal and agriculture sectors, reflecting a One Health approach to AMR, and all have been endorsed except in Djibouti and Somalia. Many countries/territories are also in the process of revising their NAPs. However, very few are funded, and the level of implementation varies greatly among countries. National medicine policies exist in several countries/territories, but only a few have an implementation plan. Most countries/territories have national essential medicines lists (EMLs), but only Iran (Islamic Republic of), Iraq, Jordan, Lebanon, Oman, Pakistan, Saudi Arabia, Tunisia and Yemen have adopted the AWaRe classification in their EML.

Support for infection prevention and control (IPC) showed profound progress as a result of the COVID-19 pandemic. In 2024, there were 19 countries/territories in the Eastern Mediterranean Region that had a functioning IPC programme and IPC guidelines and 13 that had adopted multimodel intervention strategies for implementing IPC. Antimicrobial stewardship activities are better implemented in HICs, where national guidelines for antibiotic use exist, mostly in the hospital sector. Stewardship in primary care is neglected in most countries/territories, even though most antibiotic use happens in primary care. A few MICs have developed policies for antibiotic use, but these are not legally enforced. Most countries/territories in the Region undertake annual targeted public awareness campaigns at the national and subnational levels for World AMR Awareness Week.

A people-centred collaborative approach, which underpins the resolution adopted by Member States at the 71st session of the WHO Regional Committee for the Eastern Mediterranean in October 2024, calls for strong systems to prevent, diagnose and manage infections with more appropriate use of antibiotics, while addressing the social and structural determinants of AMR and integrating gender and equity dimensions into NAPs. However, given the profound differences between health systems across the Region, priorities should be tailored to country contexts. HICs need to scale-up actions across the public and private sectors and throughout the health and food production systems. In MICs, the focus should be on appropriate antibiotic use through stewardship programmes supported by behavioural and social science research and better use of antibiotic consumption data. For fragile, conflict-affected and vulnerable (FCV) states, the emphasis needs to be on the basics of prevention – water, sanitation and hygiene (WASH), immunization and IPC – in combination with ensuring access to quality assured antibiotics and measures to encourage their appropriate use.

Introduction

Antimicrobial resistance (AMR) is among the most important global health security threats. It is a threat to health, health outcomes and sustainable food production throughout the World Health Organization (WHO) Eastern Mediterranean Region and needs to be addressed everywhere. Global Burden of Disease study estimates show that globally, in 2021, 4.71 million deaths (95% uncertainty interval (UI), 4.23–5.19 million) were associated with bacterial AMR, including 1.14 million (95% UI, 1.00–1.28 million) deaths attributable to bacterial AMR *(1)*. The World Bank estimates the global gross domestic product shortfall due to AMR could exceed US$ 1 trillion annually after 2030, widening economic inequality *(2)*. Addressing AMR is critical to achieving several Sustainable Development Goals (SDGs) related to poverty (SDG 1), hunger (SDG 2), good health (SDG 3), water, sanitation and hygiene (WASH) (SDG 6), economic growth (SDG 8), sustainable production and consumption (SDG 12), and partnerships (SDG 17) *(3)*.

In 2015, the Sixty-eighth World Health Assembly endorsed the *Global action plan on antimicrobial resistance*, with the following five objectives:

- improving AMR awareness and understanding;
- strengthening the knowledge and evidence base through surveillance and research;
- reducing the incidence of infection through effective infection prevention and control (IPC) measures;
- optimizing antimicrobial use; and
- developing the economic case for sustainable investment in AMR, new medicines, diagnostic tools, vaccines and other interventions.

The Sixty-eighth World Health Assembly also called on all Member States to develop national action plans (NAPs) that align with the global action plan. The Food and Agriculture Organization of the United Nations (FAO) and the World Organisation for Animal Health (WOAH) also endorsed the plan, to support an effective multisectoral, or One Health, response to AMR.

WHO developed the Access, Watch and Reserve (AWaRe) classification of antibiotics in 2017 as a tool to support antibiotic stewardship. Antibiotics are classified into Access, Watch and Reserve groups, based on the potential for the emergence of resistance to them. The Access group includes narrow-spectrum antibiotics recommended as first-line drugs for most infections, the Watch group includes broad-spectrum antibiotics with a higher chance of resistance and the Reserve group includes antibiotics to be used only as a last resort.

During the Seventy-seventh World Health Assembly in May 2024, Member States endorsed WHO's strategic and operational priorities to accelerate the programmatic response to AMR in the human health sector. Following this, at the United Nations General Assembly High-Level Meeting on AMR in September 2024, countries endorsed a comprehensive political declaration to strengthen the global, regional and country-level response to AMR. At the regional level, in October 2024 Member States adopted a resolution on promoting collaborative action to accelerate the regional response to AMR in the Eastern Mediterranean Region.

The countries/territories of the WHO Eastern Mediterranean Region are very diverse in their socioeconomic characteristics. The Region includes the six high-income countries (HICs) of the Gulf Cooperation Council (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates), 11 middle-income countries (MICs) (Djibouti, Egypt, Iran (Islamic Republic of), Iraq, Jordan, Lebanon, Libya, Morocco, occupied Palestinian territory, Pakistan and Tunisia) and five low-income countries (Afghanistan, Somalia, Sudan, Syrian Arab Republic and Yemen). Among these, nine are classified as fragile, conflict affected and vulnerable (FCV) countries/territories: Afghanistan, Iraq, Lebanon, Libya, occupied Palestinian territory, Somalia, Sudan, Syrian Arab Republic and Yemen.

These countries/territories face complex humanitarian challenges that put them at particular risk regarding AMR.

Between 2015 and 2024, all countries/territories in the Region laid foundations to address AMR by developing AMR NAPs. There was much progress in the areas of IPC, medicines, immunization and WASH, with several examples of excellence.

This report provides a brief account of the status of AMR in the Eastern Mediterranean Region as of the end of 2024. It summarizes the key attributes of various dimensions of AMR – including resistance in tuberculosis (TB), HIV and malaria; outcome measures on resistance and antibiotic use; processes and outputs linked to NAP implementation; improving access to antibiotics; antimicrobial stewardship; public awareness and training; and One Health – before concluding and proposing next steps.

This report utilizes data from several sources, including the Tracking AMR Country Self-Assessment Survey (TrACSS), the Global Antimicrobial Resistance and Use Surveillance System (GLASS), the Global Research on Antimicrobial Resistance (GRAM) project, WHO global surveys on minimum requirements for IPC programmes at the national level, WHO/UNICEF estimates of national immunization coverage and Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (WASH), point prevalence surveys conducted in the Region and published research studies from the countries/territories of the Region.

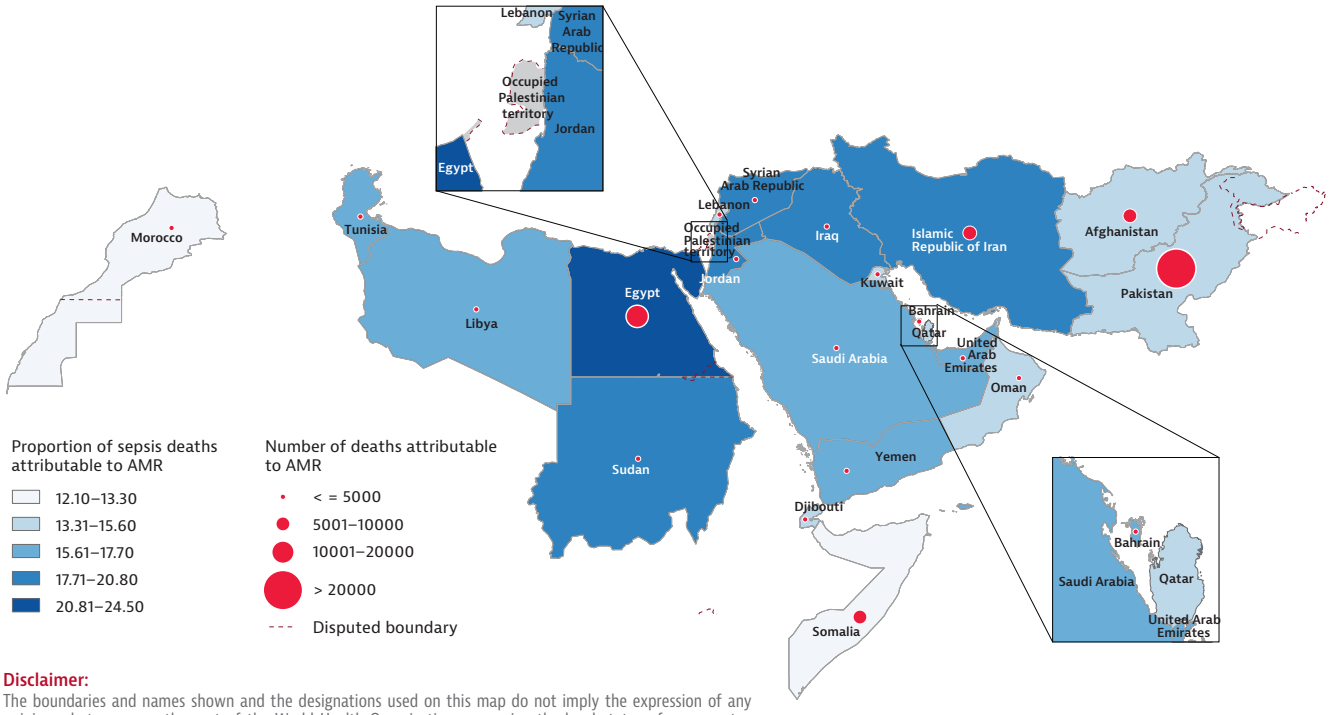
Findings

Antibiotic resistance

GRAM project data *(4)* estimate that in 2021, 96 416 people died because of bacterial AMR in Eastern Mediterranean Region countries/territories. This accounts for 16.6% of all deaths due to bacterial sepsis in the Region in 2021 (Fig. 1). Children were more affected by AMR: 29 461 (30.56%) of all the AMR attributable deaths were of children under the age of 5. The proportion of deaths among children under 5 was higher in FCV countries/territories: Somalia (52%), Pakistan (44%), Afghanistan (39%) and Sudan (35%). Methicillin-resistant *Staphylococcus aureus* was the drug–bug combination with the greatest attributable mortality among 13 out of 21 reporting countries. Carbapenem-resistant *Streptococcus pneumoniae* had the greatest attributable mortality in Afghanistan, Egypt, Jordan, Lebanon and Tunisia, while carbapenem-resistant *Acinetobacter baumannii* was associated with the greatest attributable mortality in Morocco and Sudan.

Children under 5 account for 30.56% of all AMR-attributable deaths

Fig 1. Number and proportion of bacterial sepsis deaths attributable to AMR, Eastern Mediterranean Region, 2021



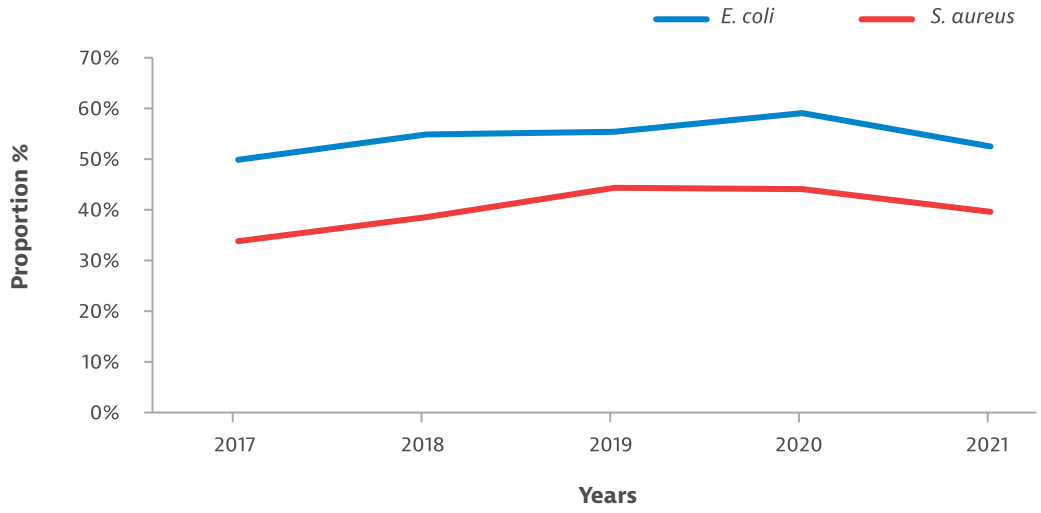
Disclaimer:
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Source: (4).

WHO GLASS data *(5)* suggest that the median proportion of drug resistance in the Region has been increasing over the years (Fig. 2). Between 2018 and 2021, more than half of all the blood isolates with *Escherichia coli* were resistant to third-generation cephalosporin.

Among six priority resistant blood stream infection pathogens for which GLASS data were available, carbapenem-resistant *Acinetobacter* spp. had the highest proportion of resistance, followed by *K. pneumonia* and *E. coli* resistant to third-generation cephalosporins. The proportion of resistance was higher for nosocomial infection than for those of community origin, except in methicillin-resistant *S. aureus*, for which the proportions were similar.

Fig 2. Proportion of patients with blood stream infections caused by methicillin-resistant *S. aureus* and extended spectrum beta-lactamase *E. coli*, core SDG AMR indicators, Eastern Mediterranean Region, 2017–2021



Note: From 2020 onwards, the proportion is only shown for countries, territories and areas reporting at least 10 bacteriologically confirmed blood stream infections with antimicrobial susceptibility test results in one calendar year.

Source: (5).

During the 2015–2022 period, 8.4% of previously treated TB patients and 2.7% of new TB patients in the Region had multidrug-resistant TB.

In 2019, around 9% of patients on antiretroviral treatment in 10 countries/territories received second- or third-line regimens *(6)*. The proportion on third-line regimens increased from 0.7% in 2015 to 1.9% in 2019, which may indicate a failure of the first-line regimen or acquired drug resistance.

Resistance to sulfadoxine-pyrimethamine led to malaria treatment failure in Somalia and Sudan. Studies have shown unexplained antibiotic prescription for malaria patients (ranging from 24% to 87% of patients), which has been shown to reduce with the use of point-of-care c-reactive protein tests among malaria test-negative patients *(7, 8)*.

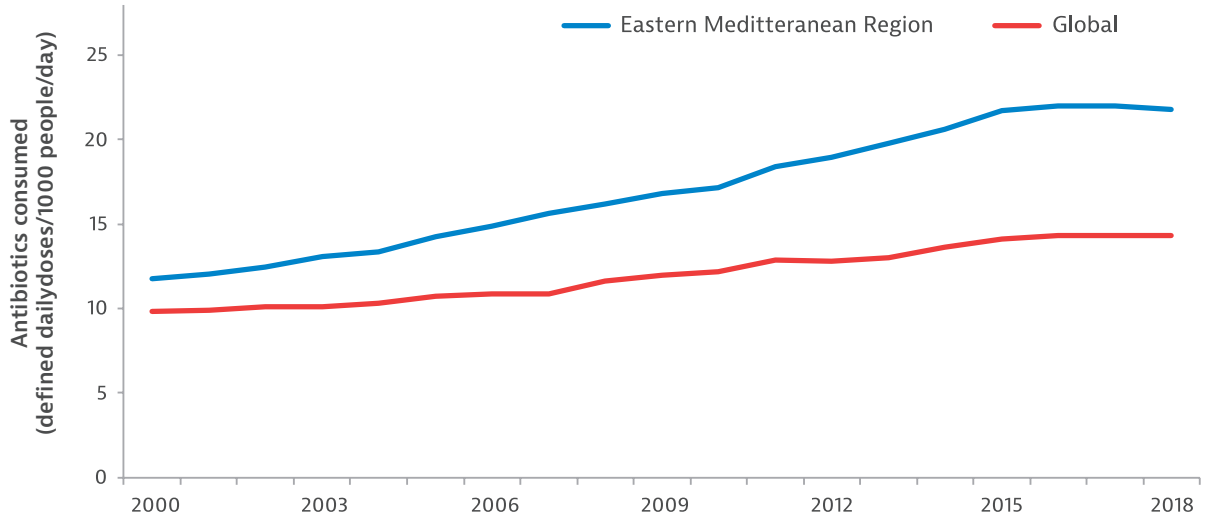
Antibiotic consumption

GRAM data *(4)* on antimicrobial consumption – which are largely limited to data on antibiotics – indicate that in 2018, Eastern Mediterranean Region countries/territories consumed antibiotics at higher rates per capita than the global average (21.8 defined daily doses per 1000 inhabitants per day (DID) versus 16.2 DID) and the averages of all the other WHO regions. This had been the trend since 2015 (Fig. 3).

Antibiotic consumption rates in the Region have exceeded the global average since 2015

GRAM data also suggest that between 2011 and 2018 the Region had the highest absolute increase in consumption rate: the Region's increase was 10 DID, whereas the global average was 4.9 DID. The annual mean consumption in the Eastern Mediterranean Region during the period 2011–2018 was 17.0 DID, only slightly lower than the European Region (18.7 DID) and the Region of the Americas (18.6 DID).

Fig 3. Mean estimated per capita antibiotic consumption, global and Eastern Mediterranean Region, 2000–2018

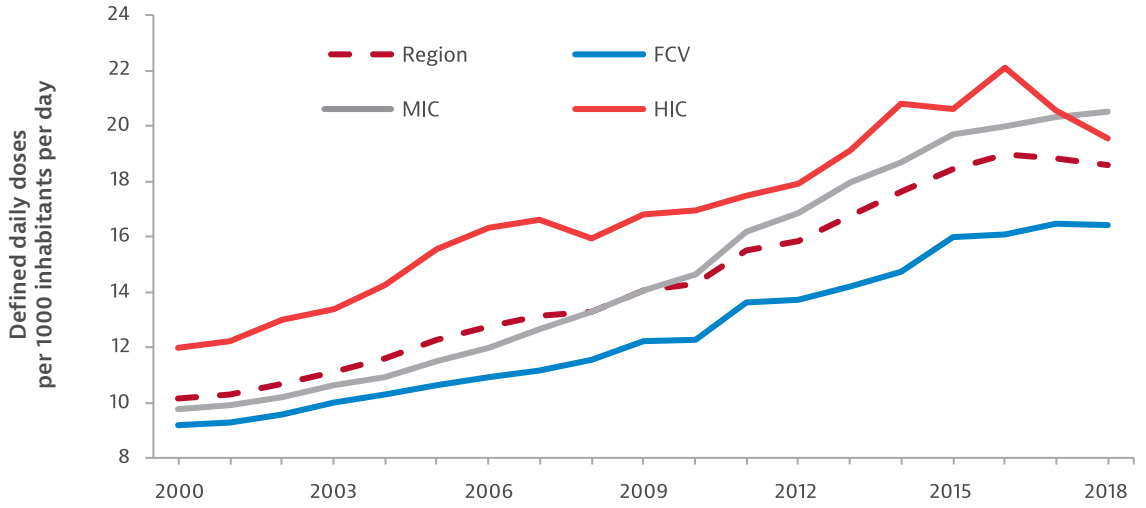


Source: (4).

The median consumption during 2000–2018 varied among FCV countries/territories, MICs and HICs (Fig. 4). The increase in the median DID between 2000 and 2018 was higher among MICs (114%) than in FCV countries/territories (62%) and HICs (42%). The GRAM data provide the Access, Watch and Reserve group composition for the period 2000–2018 for nine countries/territories. Among them, Egypt, Morocco and Tunisia maintained the 60% Access target in most years, and Lebanon had achieved the 60% target by 2015. Pakistan, Saudi Arabia and the United Arab Emirates showed a decrease in the Access share during 2000–2018. Data from GLASS indicate that the occupied Palestinian territory, Oman, Qatar and Saudi Arabia met the 60% Access target in 2022.[1]

A seven-country point prevalence survey in 2019 reported the prevalence of antimicrobial use as the proportion of patients prescribed at least one antimicrobial drug at the time of the survey *(9)*.

Fig 4. Mean estimated per capita antibiotic consumption, across HICs, MICs and FCV countries/territories, Eastern Mediterranean Region, 2000–2018



Source: (4).

[1] The 60% Access target was previously endorsed by Member States in the Muscat Manifesto. Since the endorsement of the United Nations General Assembly political declaration on AMR in September 2024, the target has been raised to 70%.

The overall prevalence was 57%, and Access antibiotics were used in only 34% of prescriptions. Patients admitted to private hospitals were more likely to receive antimicrobials (61%) than those admitted to public (57%) and teaching hospitals (55%). Only 61% of prescriptions documented a reason for antibiotic use, and only 21% of the instances of antibiotic use were based on culture results.

Access to antibiotics and regulations

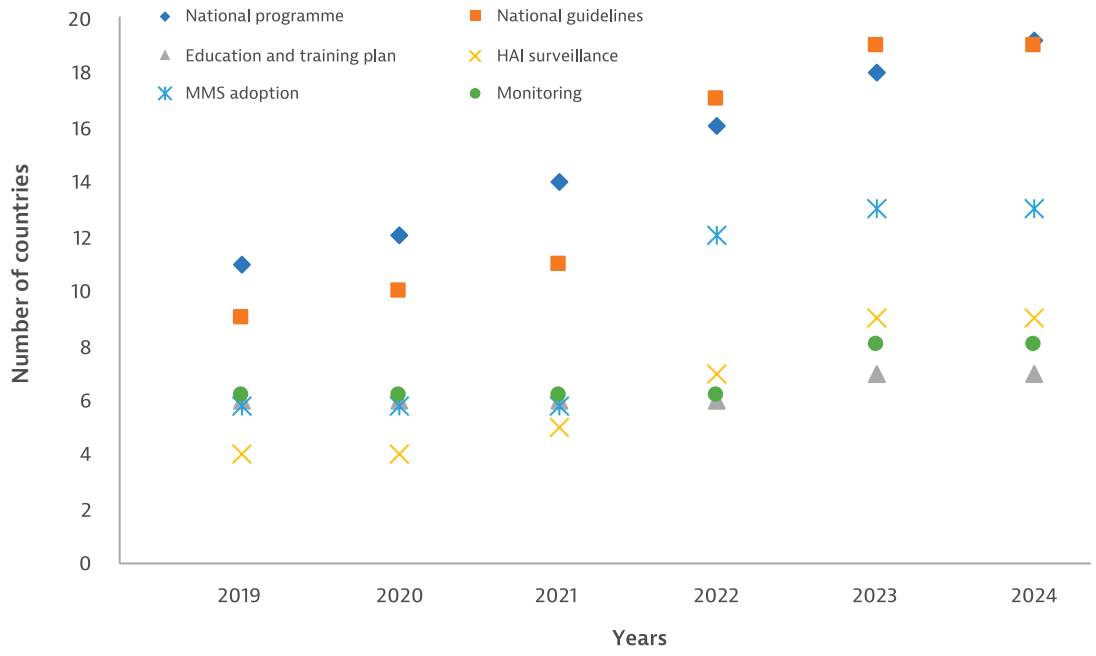
Most countries/territories have national EMLs, but only nine countries, including Egypt, Iran (Islamic Republic of), Iraq, Jordan, Lebanon, Oman, Pakistan, Tunisia and Yemen, have identified the AWaRe groups in their list. Most countries/territories have a medicines policy and legislation restricting over-the-counter sales, but enforcement is weak in most countries/territories. Seven countries (Egypt, Morocco, Oman, Saudi Arabia, Syrian Arab Republic, Tunisia and Yemen) have their standard treatment guidelines aligned with their national essential medicines list (EML). However, adherence to standard treatment guidelines is patchy. Access to antibiotics is still a challenge in many countries/territories of the Region, in part because of weak supply chains and funding issues but increasingly because of failures in global supply chains that are resulting in shortages of specific antibiotics.

IPC

Proper IPC measures reduce antibiotic consumption and prevent the spread of resistant organisms. Between 2019 and 2024, the number of countries/territories in the Eastern Mediterranean Region with a national IPC programme with dedicated trained staff and/or a national IPC advisory committee increased from 11 to 19 (Fig. 5). Similarly, 10 new countries/territories developed national IPC guidelines between 2019 and 2024. However, several countries/territories are yet to formulate plans for education/training, hospital-acquired infection surveillance and monitoring.

Read the Global action plan and monitoring framework on infection prevention and control (IPC), 2024–2030

Fig 5. Progress in implementing country/territory IPC programmes, Eastern Mediterranean Region, 2019–2024



Note: HAI – hospital-acquired infection; MMS – multi-modal strategy.

Source: AMR/IPC Unit, WHO Regional Office for the Eastern Mediterranean.

Vaccination and improved WASH as critical preventive measures

Pneumococcal vaccination coverage is suboptimal in several countries of the Region – for example, Afghanistan (67%), Djibouti (59%) and Yemen (74%) *(10)*. Moreover, Egypt, Iran (Islamic Republic of), Somalia and Syrian Arab Republic are yet to introduce the vaccine into their national programme. Typhoid conjugate vaccine played an important role in reducing the proportion of extensively drug-resistant typhoid cases from 65% (2016–2019) to 44% (2023) in Pakistan.

The proportion of the population using safely managed sanitation services (defined as an improved sanitation facility that is not shared with other households and where excreta are safely disposed of in situ or treated off site) was 54.9% in 2022 (rural: 47.2%, urban: 61.9%) *(11)*. The proportion varied widely between countries/territories – from less than 30% in Djibouti, Lebanon and Yemen to more than 90% in Bahrain, Qatar and United Arab Emirates. The situation of WASH services in health care facilities is more worrying. While 73% of facilities have basic water services, only 59% have basic hygiene services, 36% have basic environmental cleaning services, 29% have basic sanitation services, and 23% have basic health care waste management facilities.

© WHO/Zakarya Safari.

AMR is therefore an important reason for countries/territories to expand immunization programmes and improve their WASH facilities because there is substantial evidence on the impact of improved vaccination coverage and WASH facilities on reducing antibiotic use and the development and spread of AMR *(12)*.

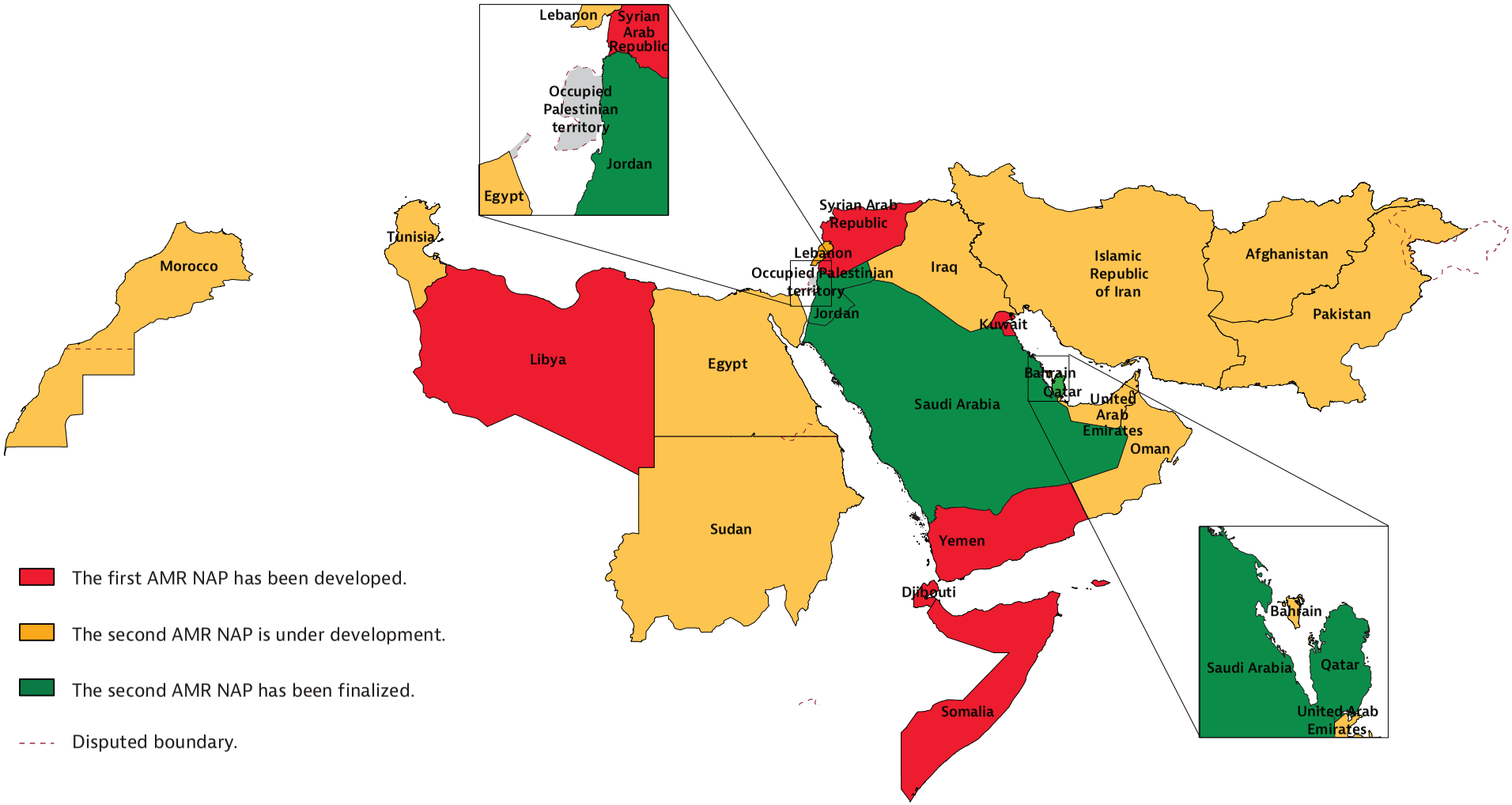
See resources on AMR and cross-cutting programmes, including WASH and vaccination

NAPs for AMR

By 2022, all 22 countries and territories of the Region had developed their first AMR NAPs.[1] All national plans were developed in alignment with WHO's *Global action plan on antimicrobial resistance* and reflect the political commitment to the issue. Most NAPs were developed in the period 2016–2019, and by 2024 they had expired or were about to expire. As of December 2024, Jordan, Qatar and Saudi Arabia were the only countries that had developed and endorsed an updated NAP, although several countries were in the process of updating their NAPs (Fig. 6).

[1] Two countries are yet to formally endorse their first national action plan on AMR.

Fig.6. Status of AMR NAP development, Eastern Mediterranean Region, 2024



Disclaimer:
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Source: (13).

Surveillance

The surveillance systems for assessing AMR among common pathogens and monitoring antimicrobial consumption vary across countries/territories (Fig. 7, Fig. 8). For AMR surveillance, the availability of microbiology laboratories, human resources and sample transportation systems vary between countries/territories, which limits the availability of representative, good-quality resistance data. Of the 21 countries/territories that responded to the TrACSS 2024, 14 countries – Bahrain, Egypt, Iran (Islamic Republic of), Iraq, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Tunisia and United Arab Emirates – reported that they use AMR surveillance data to inform operational decision-making and amend policies. Antibiotic use/consumption monitoring is still largely based on national procurement data in most countries/territories, which limits the use of such data in steering stewardship activities and in identifying subnational differences in consumption. Saudi Arabia and the Islamic Republic of Iran reported having an established system for surveillance of antimicrobial use to monitor national sales or consumption/use of antibiotics in health services to inform operational decision-making and amend policies. Eleven countries – Bahrain, Egypt, Iraq, Jordan, Lebanon, Morocco, Oman, Qatar, Sudan, Tunisia and United Arab Emirates – reported that they use some antimicrobial consumption/use data to inform operational decision-making and amend policies.

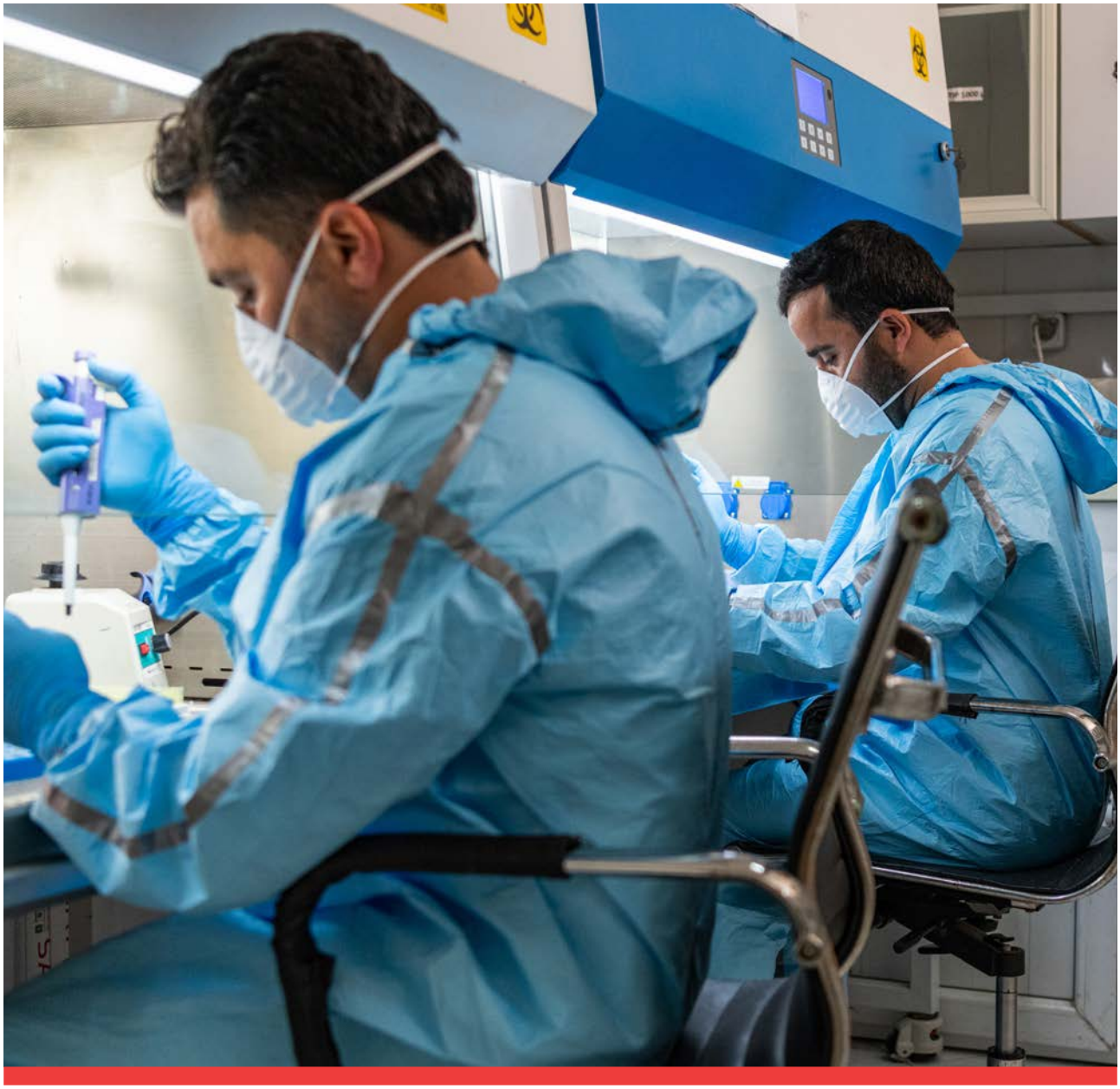
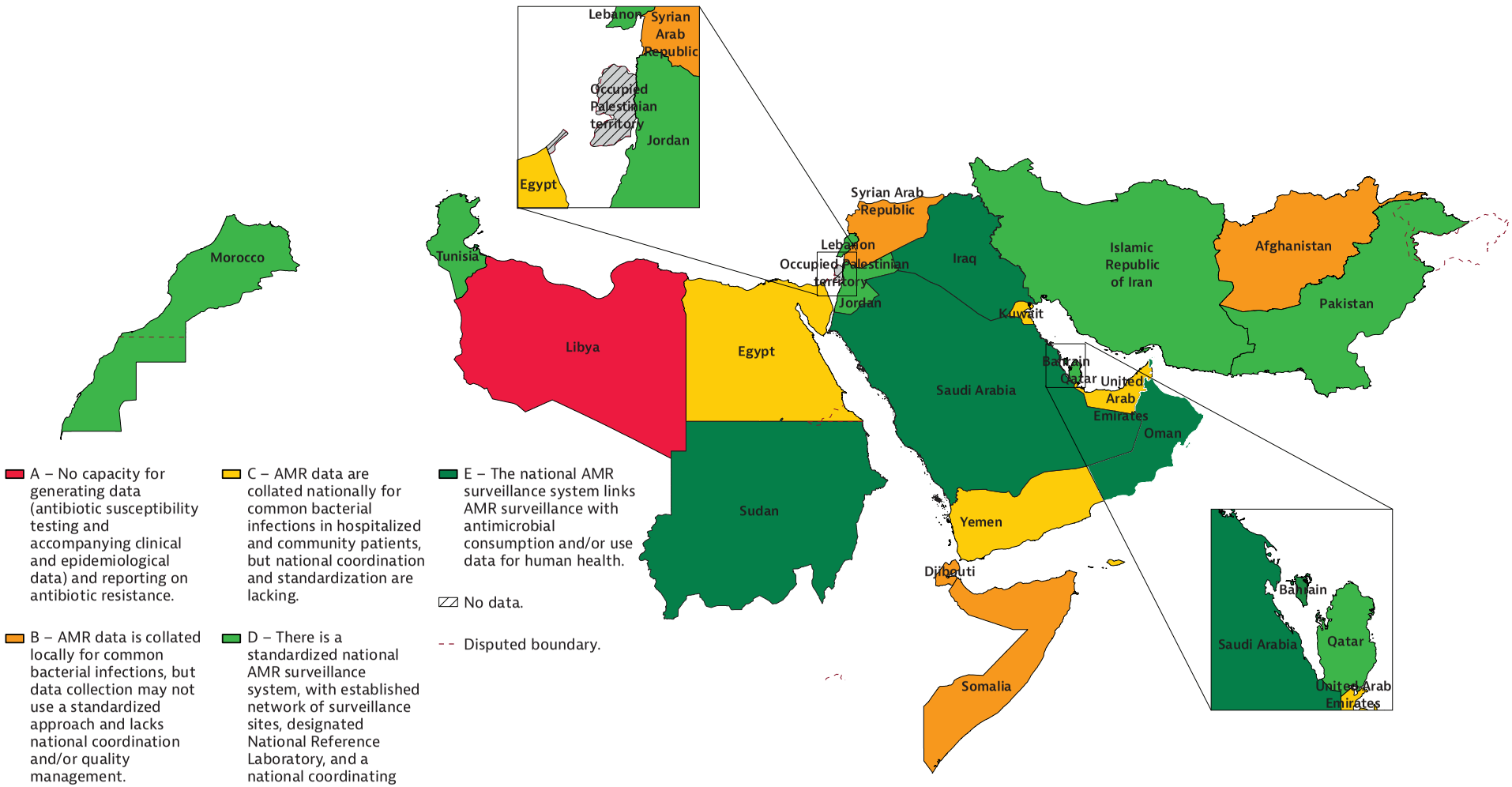


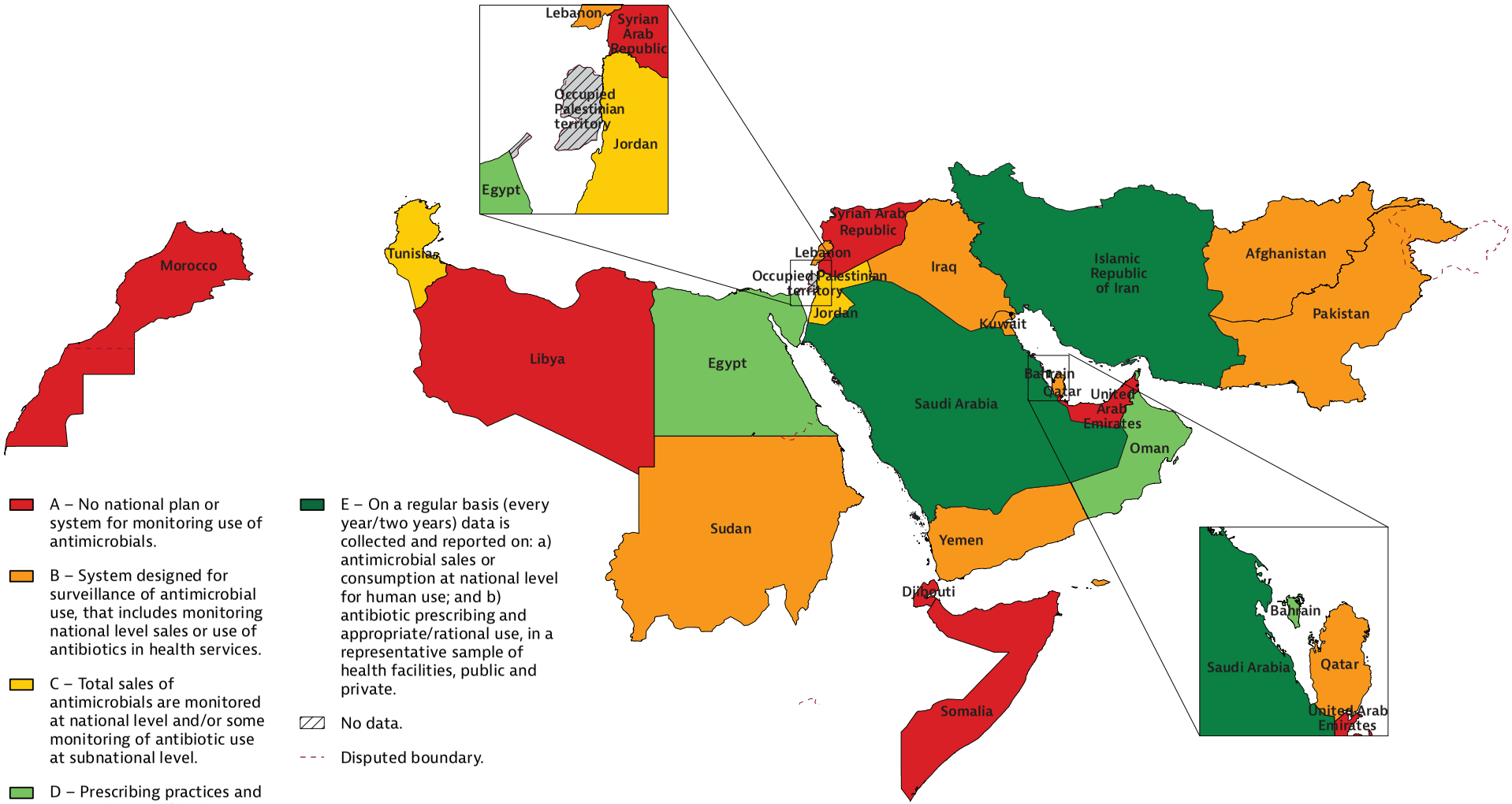
Fig.7. National surveillance systems for AMR in humans, Eastern Mediterranean Region, 2024



Disclaimer:
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Source: (13).

Fig. 8. National monitoring systems for consumption and use of antimicrobials in human health, Eastern Mediterranean Region, 2024



Disclaimer:
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Source: (13).

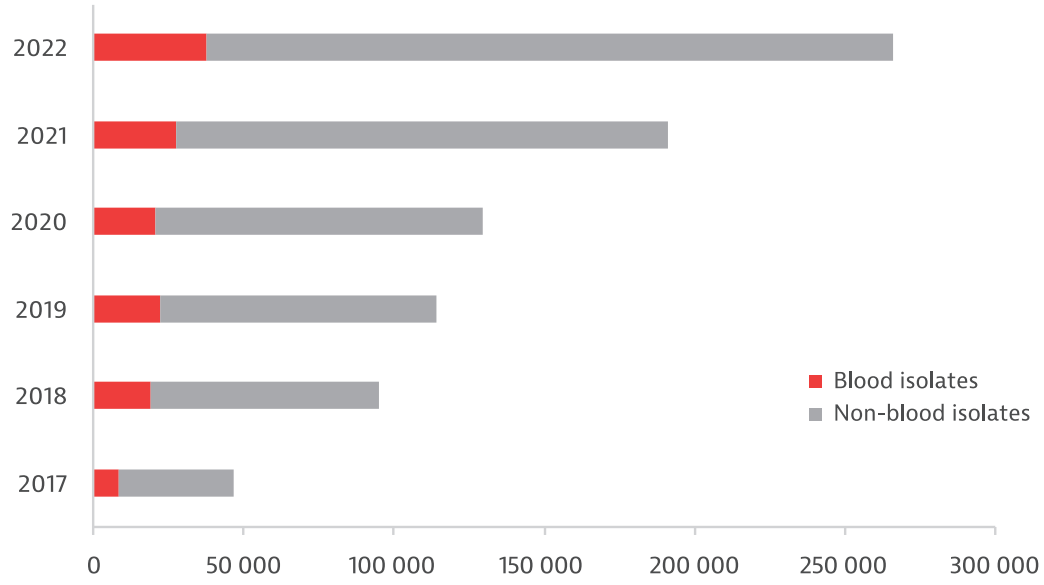
GLASS surveillance

All 22 countries/territories of the Region are enrolled in GLASS AMR surveillance, and 17 reported data in 2024. However, the relatively low proportion of blood samples among all isolates tested in the period 2017–2022 is a concern (Fig. 9). The most common pathogens were *E. coli, K. pneumoniae,* and *S. aureus* (Fig. 10).

In all, 20 countries/territories have enrolled in GLASS antimicrobial use surveillance as of December 2024, and 12 reported data in 2024. The countries that are yet to enroll are Djibouti and Lebanon.

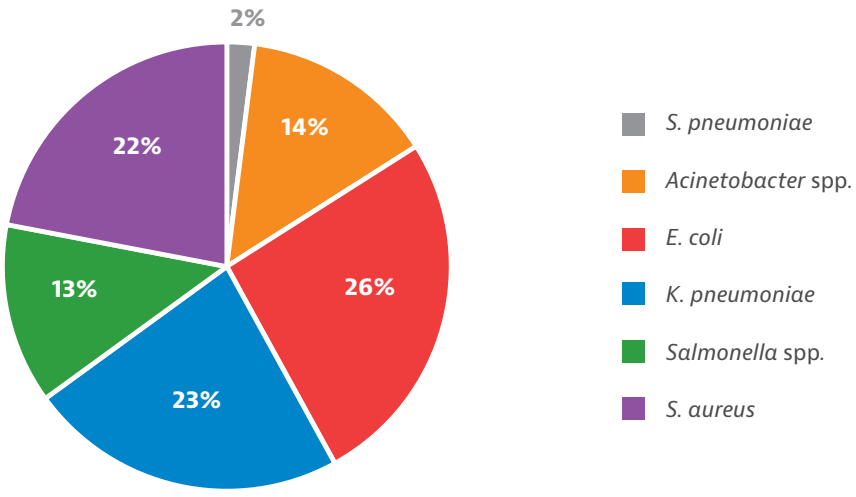
See the GLASS dashboard for data

Fig 9. Number of specimens reported to AMR GLASS platform, by year, 2017–2022, Eastern Mediterranean Region



Source: (5).

Fig 10. Proportion of reported GLASS pathogens among bloodstream infections in the Eastern Mediterranean Region between 2016 and 2022



Source: (5).

© WHO/NOOR/Sebastian Liste.

Antimicrobial stewardship

In general, MICs and FCV countries/territories lag in stewardship programmes (Table 1). TrACSS data show that national guidelines for the appropriate use of antimicrobials are available and implemented nationwide in Bahrain, Jordan, Qatar and Saudi Arabia, whereas implementation is limited to certain facilities in Iraq, Kuwait, Morocco, Oman, Pakistan, Sudan, Tunisia and the United Arab Emirates.

Table 1. **Status of appropriate antimicrobial use policy and stewardship programmes, Eastern Mediterranean Region, 2024**

Stewardship policy/programme status	Countries/territories
No/weak national policies for appropriate antimicrobial use including availability, quality and disposal of antimicrobials.	Afghanistan, Djibouti, Libya, Somalia, Syrian Arab Republic
National policies promoting appropriate antimicrobial use/antimicrobial stewardship activities developed for the community and health care settings.	Egypt, Iran (Islamic Republic of), Lebanon, Yemen
National guidelines for appropriate use of antimicrobials are available, and antimicrobial stewardship programmes are being implemented in some health care facilities.	Iraq, Kuwait, Morocco, Oman, Pakistan, Sudan, Tunisia, United Arab Emirates
National guidelines for appropriate use of antimicrobials are available, and antimicrobial stewardship programmes are being implemented in most health care facilities nationwide. Monitoring and surveillance results are used to inform action and to update treatment guidelines and EMLs.	Bahrain, Jordan, Qatar, Saudi Arabia

Source: (13).

Training, education and public awareness

Most countries/territories in the Region undertake annual targeted public awareness campaigns at the national and subnational levels during World AMR Awareness Week. Of the 21 countries/territories who responded to the TrACSS 2024, only six countries – Bahrain, Iran (Islamic Republic of), Morocco, Qatar, Saudi Arabia and Tunisia – reported having a nationwide, government-supported campaign targeting majority stakeholders, using targeted messaging. In Djibouti and the Syrian Arab Republic, only ad hoc training in some human health disciplines is available, whereas in Kuwait, Qatar and Saudi Arabia, AMR is covered in pre-service training for all relevant cadres and in-service training or other continuing professional development covering AMR is available for all types of human health workers nationwide.

One Health initiatives

Read the Muscat Ministerial Manifesto

The Muscat Ministerial Manifesto was endorsed by 47 countries/territories, including 17 from the Region, during the Third Global High-level Ministerial Conference in Oman in November 2022. With endorsement, countries/territories committed to implementing NAPs with adequate financial resources, milestones and national targets, taking into consideration the One Health approach. Of the 21 countries/territories that responded to the TrACSS 2024, 19 have some formal multisectoral governance or coordination mechanism on AMR, with the exceptions being Djibouti and Libya. However, most countries/territories' multisectoral coordination mechanisms on AMR are not meeting regularly, and their technical working groups have no clear terms of reference, funding or accountability/reporting mechanisms. Only two countries (Qatar and Saudi Arabia) reported formalized, fully operational multisectoral coordination mechanisms on AMR in which integrated approaches are used to implement the AMR NAP, with relevant data and lessons learned from all sectors used to adapt the implementation of the action plan. The Fourth Global High-level Ministerial Conference on Antimicrobial Resistance, held in Jeddah in November 2024, endorsed the establishment of an AMR One Health learning hub and regional AMR access and logistics hub within Saudi Arabia, and formalized the Global High-Level Ministerial Conference on AMR, to be held every two years, with the next conference to be held in 2026.

Summary of strengths, opportunities, barriers and challenges across thematic areas

Table 2 summarizes the key strengths, weaknesses, opportunities and challenges in the thematic areas of IPC, surveillance, stewardship, education and public awareness, and One Health.

Table 2. Summary of strengths, weaknesses, opportunities and challenges across thematic areas

Thematic area	Strengths and opportunities	Barriers and challenges
IPC	• Countries/territories now recognize IPC as an intervention that strengthens health systems. • National IPC guidelines and standards are available; they need to be effectively implemented. • IPC learning opportunities and capacity-building exist, although they are not standardized or coordinated. • The global IPC strategy will support a wider implementation of the WHO core components for IPC and WASH.	• Political instability and regional conflicts threaten the sustainability of gains. • National funding is limited. • The limited capacity of microbiology laboratories hinders surveillance of hospital-acquired infections. • Supplies and infrastructure are inadequate, including for WASH. • National and subnational integration of IPC into other programmes (WASH, AMR, quality, patient safety, etc.) is limited. • There is a lack of career pathways and development opportunities for IPC professionals. • There are no accredited national IPC curricula (pre- and postgraduate, in-service).
Surveillance	• Several countries/territories regularly submit AMR and antimicrobial consumption data. • An increased number of laboratories are enrolled in several countries/territories. • Several hospitals use these data to create local antibiograms.	• The diversity in the laboratory information systems used necessitates extensive technical support to generate appropriate files. • National surveillance systems lack representativeness. • The proportion of blood isolates can be improved through better diagnostic stewardship.
Stewardship	• NAPs have at least one component for appropriate antibiotic use in most countries/territories. • Regulations are in place for over-the-counter antibiotic restrictions in many countries/territories. • Multiple pieces of antimicrobial stewardship training are available, and international organizations, such as the International Centre for Antimicrobial Resistance Solutions and the British Society for Antimicrobial Chemotherapy, are willing to support MICs. • Antimicrobial stewardship tools and resources are available. • National professional organizations are keen to contribute to stewardship through regular training and workshops. • Some countries/territories have dedicated AMR champions who are raising awareness on AMR at the community level and advocating for a stronger response to AMR at a political level.	• Legislation on antibiotic use is poorly enforced in most countries/territories. • Primary health care facilities are not part of antimicrobial stewardship in most countries/territories. • Antimicrobial consumption governance at the hospital level is limited. • Good-quality data on antimicrobial consumption/use are limited, and use of data is poor. • Funding is insufficient.

Thematic area	Strengths and opportunities	Barriers and challenges
Education and public awareness	• Young people are drivers of change; strengthening engagement with regional and national student/young health professional networks can yield long-lasting results. • Systematic and participatory research has the potential to inform approaches to behaviour-change interventions among prescribers and the general population. • Incorporating AMR into the medical curricula for undergraduate and postgraduate medical training, including residency training, will educate health professionals more systematically on AMR.	• Most awareness activities are limited to World AMR Awareness Week, without sustained regular programming of awareness messaging throughout the year. • There is limited engagement of other sectors that are critical to the AMR response.
One Health	• Ministries of Agriculture are engaged in many of the countries/territories. • AMR focal points in the ministries of health are engaging with the ministries of agriculture. • Interest in One Health initiatives is growing in some countries/territories.	• There are sensitivities around the economic impact of the animal sector's antibiotic use. • The regional offices of the Quadripartite organizations are not covering the same countries/territories (i.e. the countries/territories covered by the WHO Regional Office for the Eastern Mediterranean are covered by two regional or subregional offices of the United Nations Environment Programme (UNEP), WOAH and FAO), which makes communication and collaboration incredibly complex. • One Health dedicated staff and capacity are limited across organizations and ministries, so collaboration can only take place for limited, selected activities.

Discussion

As of December 2024, 12 countries in the Region were in the process of reviewing their AMR NAPs, identifying best practices and challenges in order to update them through an evidence-based, multisectoral process. Only Jordan, Qatar and Saudi Arabia have endorsed their NAP 2.0 so far. These plans need to be embedded within health system plans and budgets to make them more likely to be implemented. Most countries/territories have developed their plans in collaboration with the animal health and agriculture sectors, reflecting a One Health approach to AMR. However, the level of implementation of these plans varies greatly among countries/territories. A lack of funding, human resources and technical capacity, as well as the challenges of coordinating and scaling up action across fragmented health sectors, are among the key challenges in turning plans into action.

See the Global Database for Tracking AMR Country Self-Assessment Survey (TrACSS)

One of the key challenges in the Region is the absence of good-quality reliable data, particularly in countries/territories with weak health systems and poor governance. This applies equally to data on AMR and antibiotic consumption. Even in HICs, the AMR data are often nonrepresentative and are prone to bias due to poor diagnostic stewardship, in addition to having quality issues related to sample collection and laboratory processes. For data on antibiotic use, countries/territories mostly have data only at the national level, without the scope to understand subnational patterns and differences. Very rarely are data available at the selected institutions needed to drive stewardship programmes.

Antibiotic use accelerates the development of AMR. Monitoring consumption provides an understanding of AMR that guides management. Systems to reliably monitor consumption and use in the Region are still being developed, and in many instances data are only partial. Low consumption patterns may in fact reflect incomplete reporting or problems in accessing antibiotics. Challenges to improving access range from inadequate investment in research and development to weak procurement and supply chain management, high prices, inappropriate prescribing and irrational use of antibiotics. The greatest proportion of antibiotics are used in primary care, and while some countries/territories have implemented pilot programmes, primary care systems must be strengthened for more appropriate use. *The WHO AWaRe (Access, Watch, Reserve) antibiotic book* provides a useful resource.[1]

Almost all countries (except Djibouti, Somalia, Sudan and Yemen) have legal restrictions on over-the-counter sales, but their implementation is weak in most. Nine countries have successfully adopted the AWaRe classification of antibiotics in their national EMLs. Although several countries/territories have national medicine policies, only a few have implemented these policies, particularly their regulatory procedures. In addition, the supply chains in many countries/territories are not yet fully established, which creates access issues in many areas, particularly in emergency contexts.

In the short term, there are strong incentives to use antibiotics. Many countries/territories manufacture them, and pharmaceutical companies and pharmacies profit from their sales. For health systems, they are often a substitute for good hygiene practices and IPC, and for busy clinicians providing an antibiotic just in case often results in a satisfied patient and reduces the risk of missing an underlying infection. Changing these behaviours and strengthening systems to encourage more appropriate use is therefore complex. The stewardship programmes – using training and regular audit and feedback – that do occur in isolated hospitals across the Region need to be taken to scale.

The COVID-19 response accelerated the development of IPC systems and capacities in several countries of the Region. WHO continuously works with countries to evaluate the status of IPC programmes and activities, formulate action plans and assess the impact and sustainability of these programmes. This

[1] This publication can be accessed at https://www.who.int/publications/i/item/9789240062382.

approach has resulted in clear engagement and progress in implementing the core components and the minimum requirements for IPC programmes at the national and health care facility levels across the Region.

Systematic and sustainable One Health engagement on AMR is challenging due to limited human and technical capacity. There is also a challenging logistic hurdle related to differences in the way countries/territories are organized across the Quadripartite organizations:[1] countries/territories covered by the WHO Regional Office for the Eastern Mediterranean Region are spread across two regional or subregional offices of the other three organizations.

Read a factsheet on addressing AMR in emergencies

FCV countries/territories face a substantial burden of drug resistance due to dysfunctional health systems, disrupted supply chains, poor adherence to infection prevention practices, breakdowns in water and sanitation infrastructure, and limited diagnostic capabilities. Weak enforcement of regulations to curb over-the-counter sales of antibiotics exacerbates the problem. However, the presence of several humanitarian response partners and the possibility of resources available through new global funding mechanisms may open up opportunities to overcome these challenges amid varying competing priorities.

© WHO/Arete/Ismail Taxta.

[1] These being FAO, UNEP, WHO and WOAH.

Way forward

Systems to prevent, diagnose and manage infections with more appropriate use of antibiotics need to be strengthened and taken to scale. What the priority actions are and how this is done will depend on the context of each country. There needs to be action at scale across the public and private sectors and throughout the health and food production systems. But AMR affects people, and in going to scale, more focus must be placed on how people experience health care, how the system responds, and what needs to change to better prevent infections and reduce the inappropriate use of antibiotics. Social and structural determinants of AMR need to be addressed and gender and equity dimensions need to be considered while designing and implementing programmes.

Read about the regional people-centred approach to promoting collaborative action to accelerate the response to AMR

In September 2024, AMR took centre stage again at the United Nations General Assembly during a dedicated high-level meeting resulting in countries endorsing a political declaration and committing to measurable targets across the relevant sectors. The fourth Ministerial Conference on AMR in Jeddah in November 2024 further discussed how to turn the political declaration into tangible actions at the country level and countries endorsed the Jeddah Commitments. In the Eastern Mediterranean Region, the need to strengthen cross-programmatic efforts to tackle AMR within the human health sector through a collaborative people-centred approach was discussed by countries during the 71st session of the WHO Regional Committee for the Eastern Mediterranean in Doha, Qatar, in October 2024. To build on this momentum, NAPs on AMR need to be updated in line with this approach in order to meet the targets set by the United Nations General Assembly political declaration. Countries need to operationalize their NAPs, underpinned by a functional multisectoral coordination mechanism, with resources and clear lines of accountability. The progress in IPC and its benefits must be sustained and built upon. Preventing infections – through immunization, WASH and IPC – is better for the patient and for the health system, and these programmes must achieve full coverage in all countries/territories. At the 77th World Health Assembly, WHO Member States adopted the first global strategy, action plan and monitoring framework on IPC, and established an accountability mechanism to track progress towards agreed targets up to 2030.

Read the Jeddah Commitments

The risk of emergence of resistance to antibiotics needs to be addressed with proper stewardship throughout their value chain. Development of and access to new drugs are needed, but far more needs to be done to preserve the drugs already available and to ensure that there are medicines of appropriate quality and cost available, when required, through systems to reduce inappropriate use. Given the rising rates of antibiotic consumption, stewardship in most contexts needs to focus on both the appropriateness of use – using the AWaRe classification – and reducing inappropriate use – that is, reducing total consumption. This will require the following actions throughout the value chain:

- the production of quality Access antibiotics without environmental contamination;
- the procurement and supply of appropriate quality medicines in line with the AWaRe classification;
- regulation of over-the-counter sales, advertising and promotion; and
- appropriate use in hospitals, primary health care and the community, in line with the WHO AWaRe antibiotic book.

Investing in the health workforce – to ensure appropriate staffing levels, skill mix and training – is vital to preserve antibiotics in the health system. The cultural and systemic shifts that are required to reduce inappropriate use and the overreliance on antibiotics are yet to occur. Rapid, accurate, point-of-care diagnostics that can detect bacteria and resistance patterns need to be available to help clinicians to take appropriate decisions on antibiotic use.

Systems for the surveillance of resistance need to ensure the quality and representativeness of the data. Data on the consumption and use of antibiotics provide an understanding of the main drivers of resistance and guide the response. Systems for data collection, analysis and use need to reflect the prevailing information technology and systems for the management of medicines, to ensure that they are as effective, efficient and sustainable as possible.

In countries with resources and an excellent workforce and health infrastructure, a comprehensive response to preventing, diagnosing and managing infections needs to be taken to scale. Actions to address AMR need to be incorporated within the evolving health systems. The countries with resources are potential leaders globally and will have much to share with others. Countries that are grappling with complex emergencies and severe financial and human resource constraints should not ignore the risks of AMR.

Primary health care and emergency programmes should incorporate infection prevention and the appropriate use of antibiotics. Addressing the threats of resistant bacteria should be a part of pandemic preparedness and health security planning. In MICs – which have the highest burden of resistance, high rates of antibiotic use and health systems that lack resilience to deal with health emergencies and severe disease outbreaks – WHO will work with national governments and other stakeholders to build replicable and sustainable systems to manage the risks of infection and AMR more effectively.

A One Health response – with a focus on preventing infection, reducing the inappropriate use of antibiotics and generating enough data to understand and manage the problem across sectors – is therefore needed.

Conclusion

The focus of the response to AMR has too often been on bugs (pathogens) and drugs (antibiotics) – on what is happening to the bacteria and the medicines used to treat them. But addressing AMR is beyond bugs and drugs. We need to strengthen IPC programmes, expand the coverage and scope of national vaccination programmes, ensure that diagnostics are available and affordable, and improve the use of data for action.

All countries/territories in the Eastern Mediterranean Region have developed a NAP reflecting their overall political commitment, but most of these plans are not costed and budgeted. MICs in the Region have the highest burden of AMR and per capita antibiotic use, and their health systems need to be resilient to deal with an increasing burden of untreatable infections. FCVs require special attention – the priorities should be on improving IPC, WASH and access to essential antibiotics at the primary care level.

The COVID-19 pandemic was a catalyst in many countries for the establishment and roll-out of IPC programmes; however, hospital-acquired infection surveillance and the education and training of health care workers lag in many countries. It is health workers who deliver care. When they are overstretched or lack capacity or confidence in managing infections, they may use antibiotics as a substitute for good prevention and care. We need better diagnostic facilities to support their clinical decision-making.

All countries/territories in the Region have reported data on resistance and 13 have reported data on antimicrobial consumption at least once to GLASS, but the data are rarely used at the country and facility levels. In-country teams need to be built with data analysis capacity to support AMR programmes.

Finally, this report has focused on the human health response. However, antibiotics are also used and abused in animal health and food production (livestock, poultry, fish and plants). This results in resistance that impacts human health through the environment, the food chain and a complex web of interaction at the human–animal interface. A One Health approach with the involvement of all key sectors is imperative to addressing AMR.

References [1]

1. GBD 2021 Antimicrobial Resistance Collaborators. Global burden of bacterial antimicrobial resistance 1990–2021: a systematic analysis with forecasts to 2050. Lancet. 2024 Sep 28;404(10459):1199–1226. doi:10.1016/S0140-6736(24)01867-1.
2. Drug-resistant infections a threat to our economic future. Washington DC: World Bank; 2017 (https://documents.worldbank.org/en/publication/documents-reports/documentdetail/323311493396993758/final-report.pdf). Licence: CC BY 3.0 IGO.
3. World Health Organization, Food and Agriculture Organization of the United Nations and World Organisation for Animal Health. Antimicrobial resistance and the United Nations Sustainable Development Cooperation Framework: guidance for United Nations country teams. Geneva: World Health Organization; 2021 (https://www.who.int/publications/i/item/9789240036024).
4. GRAM Project [online database]. University of Oxford; 2024 (https://www.tropicalmedicine.ox.ac.uk/gram/research).
5. GLASS dashboard [online database]. World Health Organization; 2024 (https://worldhealthorg.shinyapps.io/glass-dashboard/).
6. Mugisa B, Sabry A, Hutin Y, Hermez J. HIV epidemiology in the WHO Eastern Mediterranean region: a multicountry programme review. Lancet HIV. 2022;9(2);e112–e119 (https://doi.org/10.1016/s2352-3018(21)00320-9).
7. Bilal JA, Gasim GI, Abdien MT, Elmardi KA, Malik EM, Adam I. Poor adherence to the malaria management protocol among health workers attending under-five year old febrile children at Omdurman Hospital, Sudan. Malar. 2015;14(34) (https://doi.org/10.1186/s12936-015-0575-9).
8. Dickinson S, Yi Chong H, Leslie T, Rowland M, Schultz Hansen K, Boyers D. Cost-effectiveness of point-of-care C-Reactive Protein test compared to current clinical practice as an intervention to improve antibiotic prescription in malaria-negative patients in Afghanistan. PLoS One. 2021;16(11);e0258299 (https://doi.org/10.1371/journal.pone.0258299).
9. Talaat M, Tolba S, Abdou E, Sarhan M, Gomaa M, Hutin YJ-F. Over-prescription and overuse of antimicrobials in the Eastern Mediterranean Region: the urgent need for antimicrobial stewardship programs with Access, Watch, and Reserve adoption. Antibiotics. 2022;11(12);1773 (https://doi.org/10.3390/antibiotics11121773).
10. Estimates of national immunization coverage [online database]. World Health Organization; 2024 (https://www.who.int/teams/immunization-vaccines-and-biologicals/immunization-analysis-and-insights/global-monitoring/immunization-coverage/who-unicef-estimates-of-national-immunization-coverage).
11. Drinking water, sanitation and hygiene (WASH) estimates [online database]. UNICEF; 2024 (https://data.unicef.org/topic/water-and-sanitation/).
12. Lewnard JA, Charani E, Gleason A, Hsu LY, Khan WA, Karkey A et al. Burden of bacterial antimicrobial resistance in low-income and middle-income countries avertible by existing interventions: an evidence review and modelling analysis. Lancet. 2024;403(10442);2439–54 (https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(24)00862-6/).
13. Global database for tracking antimicrobial resistance (AMR) country self-assessment survey (TrACSS) [online database]. World Health Organization; 2024 (https://amrcountryprogress.org).

[1] All references were accessed on 10 December 2024.


9 789292 745226