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Addressing the threat of antibiotic resistance in Thailand: monitoring population knowledge and awareness

Viroj Tangcharoensathien¹, Angkana Sommanustweechai¹, Sunicha Chanvatik¹, Hatairat Kosiyaporn¹, Klara Tisocki²

¹International Health Policy Program, Ministry of Public Health, Nonthaburi, Thailand, ²World Health Organization Regional Office for South-East Asia, New Delhi, India

Correspondence to: Dr Viroj Tangcharoensathien (viroj@ihpp.thaigov.net)

Abstract

The 2015 *Global action plan on antimicrobial resistance* (GAP-AMR) highlights the key importance of improving awareness and understanding of antimicrobial resistance among consumers. While low levels of awareness are not exclusive to consumers in low- and middle-income countries, the challenges to improving understanding are compounded in these settings, by factors such as higher rates of antibiotic self-medication and availability through informal suppliers. In 2016, Thailand set an ambitious target to increase, by 2021, public knowledge of antibiotic resistance and awareness of appropriate use of antibiotic by 20%. This involved first establishing baseline data by incorporating a module on antibiotic awareness into the 2017 national Health and Welfare Survey conducted by the National Statistical Office. The benefit of this approach is that the data from the antibiotic module are collected in parallel with data on socioeconomic, demographic and geospatial parameters that can inform targeted public communications. The module was developed by review of existing tools that have been used to measure public awareness of antibiotics, namely those of the Eurobarometer project of the European Union and a questionnaire developed by the World Health Organization. The Thai module was constructed in such a way that results could be benchmarked against those of the other survey tools, to allow international comparison. The Thai experience showed that close collaboration between the relevant national authorities allowed smooth integration of a module on antibiotic awareness into the national household survey. To date, evidence from the module has informed the content and strategy of public communications on antibiotic use and misuse. Work is under way to select the most robust indicators to use in monitoring progress. The other Member States of the World Health Organization South-East Asia Region can benefit from Thailand's experiences in improvement of monitoring population knowledge and awareness.

Keywords: antibiotic resistance, dispensing competencies, health knowledge, health professionals, national action plan, prescribing competencies, public awareness, South-East Asia Region

Antibiotic resistance: a growing global threat

Antibiotic resistance is one of the greatest challenges to global public health today. The threat is increasing and is fuelled by a range of factors, including the excessive and inappropriate use of antibiotics. This, in addition to use of poor quality and substandard antibiotics, results in selective pressure, accelerating the emergence of antibiotic-resistant bacteria.^{1,2} Of all the reports to the WHO Global Surveillance and Monitoring System for Substandard and Falsified Medical Products during 2013–2017, antibiotics accounted for 16.9%, second only to anti-malarials at 19.6% of all reports.³ Substandard and falsified antibiotics are a significant problem, particularly in low- and lower-middle-income countries, such as those of the World Health Organization (WHO) South-East

Asia Region,⁴ where nonexistent or inadequate post-marketing quality surveillance of human and veterinary antibiotics allows the market in these substandard medicines to flourish.

Inadequate prevention and control of infection in health facilities transmits pathogens such as methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant *Enterococcus* and multidrug-resistant *Acinetobacter* from patients with these resistant strains to other patients.⁵ Massive international travel facilitates global spread of antibiotic resistance pathogens.⁶ These include the lactam-resistant *Enterobacteriaceae* and *Klebsiella pneumoniae* strains isolated from travellers who have visited countries in South Asia.^{7,8} In addition, South-East Asia is a hub for production of animal-source foods and major use of pharmaceuticals; both can increase the threat of antibiotic resistance in the region, for example via excessive use of antibiotics as growth promoters or as prophylactic agents

for livestock.⁹ In addition, untreated wastewater containing antibiotics is sometimes released from hospitals, livestock, poultry and aquaculture farms, and human dwellings.⁹

The prevalence of antibiotic resistance is higher in communities where there is high-level use of non-prescription antibiotics.¹⁰ In low- and middle-income countries, the prevalence of self-medication of antibiotics is high, ranging from 19% to 82% in countries of the Middle East;¹¹ an average of 39% in 34 studies in low- and middle-income countries;¹² and 7% to 86%, with an overall average of 43% in 19 studies in the WHO South-East Asia Region.¹³ Penicillins are the most common self-medication drug class, mostly sourced from leftover medicines, from pharmacies and drug shops. Self-medication has been reported mainly for upper respiratory tract problems,¹⁰ or for fever or respiratory or gastrointestinal conditions.^{13,14} Inappropriate use includes wrong indications, such as use for viral infections, inflammation, influenza or the common cold, and inappropriate duration of treatment.

Use of subtherapeutic doses not only results in treatment failure but also raises the serious threat of emergence of antibiotic-resistance pathogens. Sales of antibiotics in drug stores offered by non-qualified lay persons exacerbate the inappropriate use.¹² In the WHO South-East Asia Region, the majority of self-medicated antibiotics are obtained from a range of sources, such as pharmacies, leftover drugs, hospitals, or friends and family.

In May 2015, in response to health security threats posed by antimicrobial resistance, the World Health Assembly adopted the *Global action plan on antimicrobial resistance* (GAP-AMR),¹⁵ and called on WHO Member States to develop national action plans. In September 2015, at the regional committee meeting of the WHO South-East Asia Region, Member States committed to implementing national action plans in accordance with the GAP-AMR and regional priorities.¹⁶ The GAP-AMR underscored the need for an effective “one health” approach involving coordination among numerous sectors and actors, including human and veterinary medicine, agriculture, finance, environment, and well-informed consumers. The GAP-AMR has five overarching objectives, the first of which is to “improve awareness and understanding of antimicrobial resistance through effective communication, education and training”.

Responses by Member States in the WHO South-East Asia Region

As of April 2018, all 11 Member States of the WHO South-East Asia Region had developed a national action plan on antimicrobial resistance.¹⁷ These national action plans were developed in response to country situation analysis, using a tool developed by the WHO Regional Office for South-East Asia. The indicator on awareness-raising in this tool covers two sub-indicators: education and training strategies for professionals; and awareness campaigns for the public.¹⁵

With respect to professionals, all countries have proposed strategies to strengthen antibiotic-prescribing competencies among pharmacists, veterinarians and physicians, through pre-service training and in-service continued professional development. These professionals who prescribe and dispense antibiotics are key stakeholders; with improved prescribing

and dispensing competencies, they can be the change agents for ensuring appropriate use of antibiotics in the population.¹⁸

With respect to the public, the national action plans also propose mechanisms to increase levels of knowledge about proper use of antibiotics and awareness of antibiotic resistance. However, countries also need to document the baseline and gaps in awareness of antibiotic resistance, knowledge of antibiotics, and the level of inappropriate use in populations that often self-medicate, as well as among health professionals. These baseline data are needed to inform effective interventions and allow regular monitoring of progress, which in turn will inform any need to reformulate strategies. Other than Thailand, none of the Member States of the WHO South-East Asia Region have set a target for an improved level of awareness in the population. Thailand has set an ambitious 5-year target to increase, by 2021, public knowledge of antibiotic resistance and awareness of appropriate use of antibiotics by 20% against the 2017 baseline.¹⁹

This perspective paper provides an overview of how Thailand successfully incorporated a standard tool for measuring and monitoring public knowledge and awareness of antibiotic resistance into its national household survey, and discusses the lessons learnt.

Monitoring in the population: analysis of the content of the tools

Tools that have been used to measure public awareness of antibiotics include the European Commission Special Eurobarometers 338 and 445;^{20,21} the Flash Eurobarometer 444;²² and the WHO *Antibiotic resistance: multi-country public awareness survey* tool (hereafter called “the WHO tool”) used in 12 countries globally.²³ Box 1 summarizes the common content of these tools.

Box 1. Summary of common content used by the Eurobarometer and WHO tools

- Use of antibiotics: the prevalence of self-medicated antibiotics, source of antibiotics and indication
- Knowledge of antibiotics
- Information about the use of antibiotics: source of information, impact of information on self-medication behaviour
- Knowledge and awareness of antibiotic resistance
- Use of antibiotics in agriculture and the environment

The Eurobarometer tool

The general Eurobarometer surveys are used to monitor public opinion in all 28 European Union (EU) Member States. Special Eurobarometer surveys are used for in-depth thematic studies and are integrated into the standard Eurobarometer. For the Special Eurobarometer tool on antibiotics, a four-section questionnaire was added to the standard Eurobarometer tool.^{20–22}

1. *use of antibiotics in the last 12 months*: this includes questions on the source of antibiotics (with or without prescription) and symptoms or indications leading to antibiotic use;

2. *knowledge of antibiotics*: participants' knowledge is probed using four true/false statements, namely "antibiotics kills viruses" (FALSE); "antibiotics are effective against colds and flu" (FALSE); "unnecessary use of antibiotics makes them become ineffective" (TRUE); and "taking antibiotics often has side-effects such as diarrhoea" (TRUE); and one question on the timing of stopping a course of antibiotics;
3. *information about the use of antibiotics*: participants are asked whether they have received information about the correct use of antibiotics in the last 12 months; this section includes questions on the sources of information; the impact of information on future use of antibiotics; what additional information respondents require; and what respondents believe are trustworthy sources of information;
4. *use of antibiotics in agriculture and the environment*: in this section, respondents are asked whether sick animals should have the right to be treated with antibiotics, and also asked whether they know about the EU ban on the use of antibiotics to stimulate growth in farm animals.
 - d. level of awareness and knowledge of how to address the challenges of antibiotic resistance, such as knowing that people should use antibiotics only when they are prescribed by a doctor or nurse; farmers should give fewer antibiotics to food-producing animals; people should not keep antibiotics and use them later for other illnesses; parents should make sure all of their children's vaccinations are up to date; and people should wash their hands regularly;
 - e. respondents' opinion on the scale of antibiotic-resistance challenges and whether they are local or global, individual or a common problem for everyone that requires collective effort;
 - f. level of awareness of antibiotic use in the agriculture sector.

The WHO tool

The questionnaire developed by WHO, which has been used in 12 countries, contains three sections:²³

1. *use of antibiotics*: the question asks when the last use of antibiotic was (last month, last 6 months, last year, or more than a year); and about sources of self-medicated antibiotics and counselling if they are delivered by doctors and nurses;
2. *knowledge of antibiotics*: this section covers two true/false statements, namely, "use of antibiotics that were given to a friend or family member for the same illness is acceptable" (FALSE); and "buying the same antibiotic or requesting it from a doctor for symptoms that are similar to a previous episode is acceptable" (FALSE); and asks about when to stop taking antibiotics, and knowledge about what conditions can be treated by antibiotics (e.g. HIV/AIDS, gonorrhoea, urinary tract infection, diarrhoea, cold and flu, fever, measles, malaria, skin and wound infection, sore throat, body aches, headaches).
3. *knowledge and awareness of antibiotic resistance, sources of information and the use of antibiotics in the agriculture sector*: this section is quite lengthy and covers the following subsections:
 - a. having heard of key terms (such as antibiotic resistance, drug resistance, antibiotic-resistant bacteria, superbugs, antimicrobial resistance);
 - b. where did people get this information (health-care workers versus other sources);
 - c. level of understanding of the issues of antibiotic resistance, using a few true/false statements, such as "antibiotic resistance occurs when the body becomes resistant to antibiotics and they no longer work as well" (FALSE); "many infections become resistant to treatment by antibiotics" (TRUE); "if bacteria are resistant to antibiotics, it can be very difficult or impossible to treat the infections they cause" (TRUE); "antibiotic resistance is an issue that could affect me or my family" (TRUE); "antibiotic resistance is

an issue in other countries but not here" (FALSE); "antibiotic resistance is only a problem for people who take antibiotics regularly" (FALSE); "bacteria that are resistant to antibiotics can be spread from person to person" (TRUE);

- d. level of awareness and knowledge of how to address the challenges of antibiotic resistance, such as knowing that people should use antibiotics only when they are prescribed by a doctor or nurse; farmers should give fewer antibiotics to food-producing animals; people should not keep antibiotics and use them later for other illnesses; parents should make sure all of their children's vaccinations are up to date; and people should wash their hands regularly;
- e. respondents' opinion on the scale of antibiotic-resistance challenges and whether they are local or global, individual or a common problem for everyone that requires collective effort;
- f. level of awareness of antibiotic use in the agriculture sector.

Monitoring in the population: lessons learnt from Thailand's application of the tools

In 2016, Thailand established a working group on health policy and systems research on antimicrobial resistance (HPSR-AMR),²⁴ to develop a monitoring tool to assess knowledge and awareness of antibiotic use and antibiotic resistance in the population, as well as other monitoring infrastructures such as establishment of surveillance of antimicrobial consumption.²⁵ A scoping review of the existing tools available was done to inform the construction of a module for application in the Thai population. This module was then integrated into the 2017 Health and Welfare Survey conducted biannually by the National Statistical Office (NSO). The benefit of this approach is that the data from the antibiotic module are collected in parallel with data on socioeconomic, demographic and geospatial parameters that can inform targeted public communications. Three main areas of focus were identified in the key lessons learnt: tools, methods and policy utilities.

Tools

The finding of the scoping review was that the Eurobarometer and WHO tools provide detail on knowledge of antibiotics and the level of awareness of antibiotic resistance. The WHO tool is very useful, as it probes true/false statements on the level of understanding of the challenges of antibiotic resistance, and the findings can support the design of effective public communication. The module for use in Thailand was constructed in such a way that the findings could be benchmarked against the results of surveys using the Eurobarometer tool. Review of and learning from international experiences contributed to the design of the module.

There are four sections in the Thai questionnaire, which include (i) antibiotic use and use profiles during the last month; (ii) antibiotic literacy; (iii) public information on proper use of antibiotics and on antibiotic resistance, and the source and impact of this information on future use of antibiotics; and (iv) awareness of the use of antibiotics in farm animals.

The challenge of household surveys in this area is that respondents frequently cannot distinguish antibiotics from other medicines. Thus, the prevalence of antibiotic use they report will be invalid if not all medicines are antibiotics. In small-scale research, investigators can conduct on-site verification of whether medicines are antibiotics; however, for the national household surveys, time does not allow interviewers to conduct such verification, owing to the large number of questions in other sections, such as those on health-care utilization, payment for health, and other risk behaviour. Also, medicines provided by stalls, hawkers or groceries do not provide proper package labelling. In this regard, we suggest that in the next household survey in 2019, the interviewers should be provided with a set of photos of common antibiotics and a guide on how to present these to participants with explanations.

It is important to estimate the prevalence of antibiotic use, such as the percentage of the population that uses antibiotics over a certain time period, which could be the last 12 months, 6 months or 1 month. For the 2017 survey, the HPSR-AMR decided to apply a 1-month period for valid recall.²⁶ Literature reviews suggest that a 15-day recall is appropriate for acute health problems in linking use of medicines, including self-medication of antibiotics.^{27,28} For chronic health conditions, a longer recall period ranging from the previous month to the past 12 months is more appropriate.^{27,28}

The true/false statements used to assess participants' knowledge of antibiotics should be developed from prior small-scale qualitative studies, which can be country and context specific. Each country has specific gaps of knowledge of antibiotics; it is advisable to identify these gaps in a small-scale qualitative study and to use the findings to inform the design of national survey questionnaires. However, the true/false statements can be standardized in the same way as those used by the Eurobarometer and WHO tools, in order to facilitate cross-country comparisons. The HPSR-AMR did not conduct such a small-scale qualitative study, but decided for the 2017 survey to apply the standard questions used by the Eurobarometer tool, in order to enable future cross-country comparisons. This may be seen as similar to the approach taken in the 1990s, when the AIDS Indicator Survey was applied via the Demographic and Health Survey Programme questionnaire to provide countries with a standardized set of questions. These questions probed, for example, knowledge on HIV/AIDS and on HIV prevention; misconceptions; attitudes; stigma; and higher-risk sexual behaviour, for effective monitoring of national HIV/AIDS programmes. The data collected contributed to comparable cross-country monitoring of the improvement of population knowledge and was regularly reported by the Joint United Nations Programme on HIV/AIDS (UNAIDS).^{29,30}

Methods

The module was introduced into the biannual Health and Welfare Survey conducted by the NSO, and the survey was conducted in 2017.²⁴ With strong institutional relationships, mutual recognition and mutual respect between the NSO and the International Health Policy Program of the Ministry of Public Health, integration of this special module into the survey went smoothly. The NSO has committed to integrating the module on antibiotic resistance into future Health and Welfare Surveys for biannual national monitoring.

As part of the Health and Welfare Survey, the module on antibiotic resistance involves a face-to-face interview conducted by NSO field staff, which does not allow proxy respondents in cases where the eligible respondents are absent. The respondents are adult members of the sample household who are more than 15 years old. A total 27 960 households and 27 762 adults were enumerated in the 2017 Health and Welfare Survey. The sample households were selected using a two-stage stratified sampling method. In the first stage, urban and rural enumeration areas were selected using probability proportional to size in all 77 provinces. In the second stage, samples of 10 and 15 households in each of the rural and urban enumeration areas were selected using a systematic random sampling method. In comparison, the WHO tool applies either face-to-face street interviews or online electronic surveys,²³ while the Eurobarometer tool uses face-to-face interviews in the respondent's house,²¹ and the Flash Eurobarometer tool applies telephone interviews.²²

Policy utilities

Evidence generated from the module on antibiotic resistance has contributed to the design of public communications in both content and strategies. For example, the survey indicated that the public communication in Thailand for proper use of antibiotics should include the following messages: (i) antibiotics should not be used for symptoms such as headache, backache, diarrhoea, cough, cold, flu and fever; (ii) people with conditions such as pneumonia, bronchitis, rhino-pharyngitis and urinary tract infection should seek medical attention instead of self-medicating with antibiotics; and (iii) completing a full course of antibiotics and adhering to treatment regimens are essential for successful outcomes and to prevent antibiotic resistance. Public communication can be prioritized, based on the knowledge gaps identified from the survey and transmitted through the trustworthy sources identified by the respondents.

Baseline knowledge of antibiotics can be measured by various indicators; for example, the percentage of participants who responded correctly to three out of five statements, or four out of five statements, or all five statements. By 2021, Thailand should achieve a 20% increase in each of these three possible knowledge indicators, as well as the percentage of the population who are aware of antibiotic resistance. On the other hand, negative indicators can be measured; for example, the percentage of the adult population who respond incorrectly to all five statements should be significantly reduced. A series of consultations with stakeholders to finalize these indicators is planned in 2018. Evidence from monitoring knowledge and awareness will be communicated to the National Steering Committee on Antimicrobial Resistance chaired by the deputy prime minister, for further policy actions.

Remaining challenges

This section identifies a few remaining monitoring gaps that warrant policy attention.

Monitoring gaps in the animal and food safety sector

There are limited surveys with special focus on the farmers and veterinarians who use antibiotics in animals reared for food.³¹ In 2016, The European Food Safety Authority (EFSA) conducted

a survey among three stakeholder groups: the farmers who produce and the consumers who use animal products and the veterinarians who prescribe antibiotics on farms. The EFSA questionnaire covered four sections: (i) understanding the relationship between antibiotic use and antibiotic resistance in animals and human health; (ii) risk perceptions of developing antibiotic resistance in animal farming; (iii) reasons and rationales underpinning risk perceptions; and (iv) channels that influence respondents' perceptions and practices.³¹

The EFSA suggested that, for farmers, the level of knowledge about, and practice of, the antibiotic-withdrawal period (the minimum duration from administration until harvesting of food from an animal) should guide specific messages for practice modifications.³¹ We suggest that countries that have more resources and capacity should introduce surveys in the animal and food safety sector to generate evidence for precise and effective messages. In the area of food safety, there is an urgent need to monitor knowledge and awareness of antibiotic resistance and hygienic practice among food-handling personnel – from farms to tables, as unsafe food handling is one of the major transmission pathways, which is often overlooked and an unknown area.

Monitoring gaps in health professionals' practice

There are no global standardized survey tools to assess the prescribing and dispensing practices and competencies among health professionals who are the change agents: the physicians, veterinarians and pharmacists, particularly in low- and middle-income countries that often legally dispense antibiotics without prescription.³² Monitoring knowledge and practice, awareness and incentives for prescribing antibiotics among physicians and veterinarians is more sporadic; most information is acquired from research projects and, less frequently, small-scale surveys.^{33,34} Yet, there is an urgent need to monitor professional prescribing competency, practice and knowledge, as well as awareness of local antibiotic-resistance profiles. Gaps in prescribing and dispensing competency will guide the design of in-service continued professional education.

Conclusion

Increasing societal literacy on antibiotics and awareness of antibiotic resistance can be an efficient strategy to improve proper use of antibiotics and address antibiotic resistance. Setting national targets creates demand for evidence; it is an entry point to establish a baseline, through the review of existing tools, and to develop a national monitoring tool. Application of the Eurobarometer and WHO tools is useful, as the findings can be benchmarked with international peers. Integration of the survey module into the existing national household survey is more cost effective than using a stand-alone survey. The HPSR-AMR plans for further research work that concentrates on understanding in the animal and food safety sector, and on three cadres of health professionals – physicians, veterinarians and pharmacists. A survey of antibiotic dispensing competencies among community pharmacists in Thailand will be conducted in 2018; this will contribute to proper design of in-service continued professional development.

Thailand is the only Member State in the WHO South-East Asia Region to have set a target for an improved level

of knowledge of antibiotic use and awareness of antibiotic resistance. The other Member States would also benefit from Thailand's lessons for improvement in these areas. They could introduce a similar module into their respective national household health surveys, such as demographic and health surveys. The strength of such integration is the availability of independent data such as socioeconomic, demographic and geospatial parameters, which support the design of specific public communications.

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