

USING ONE HEALTH APPROACH TO ADDRESS CHALLENGES OF ANTIMICROBIAL RESISTANCE AND INAPPROPRIATE USE OF ANTIBIOTICS THROUGH TRAINING OF FUTURE HEALTH WORKFORCES

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Antimicrobial resistance (AMR) is recognized over the past few decades as an important, serious and urgent health threat in Thailand. AMR is a complex problem associated with humans, animals and the environment. The common or important AMR bacteria causing infections in Thailand are carbapenem-resistant *Acinetobacter baumannii* (CRAB), *Pseudomonas aeruginosa* and Enterobacteriaceae (CRE), extended-spectrum β -lactamase (ESBL)-producing Enterobacteriaceae, methicillin-resistant *Staphylococcus aureus* (MRSA), and vancomycin-resistant enterococci (VRE). In addition, quinolone-resistant *Escherichia coli* (QREC) and penicillin-resistant *Streptococcus pneumoniae* are among the public health pathogens of concern. In addition, community-acquired infections, such as respiratory tract infections (RTIs) and infectious diarrhea, represent a major burden for every healthcare system, particularly when ineffective or inappropriate antibiotic treatment leads to clinical failure. About half of the antibiotics are prescribed in hospitals where a high prevalence of such antibiotics exists. Moreover, the consumption of antibiotics in Thailand dispensed over-the-counter by community drug stores and retail shops poses major problems of overuse and inappropriate choice of antibiotics for treatment of upper respiratory tract infections (URIs) and acute diarrhea (AD). These subsequently could lead to emergence of AMR in the community.

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One of the Thailand national strategies to control AMR is to strengthen health workforce. Health science students can play a major leadership role in the education of appropriate antibiotic use in primary care settings and community healthcare facilities. Training of future health workforce should aim at increasing awareness and knowledge of AMR and rational use of antibiotics in the treatment of common illnesses related to their future career.

Although, there was an initiative in establishing training modules on rational use of antibiotics (RUA), which in part included the topic of responsible use of antibiotics in treating common illnesses, the modules for health science programs have yet to be fully implemented. Thus, there is no specific course on AMR and rational use of antibiotics offered to health science students so far in Thailand. Hence, a short-course training program was held for health sciences students on One Health strategy to confront AMR challenges and to promote awareness and knowledge of responsible use of antibiotics in the treatment of common illnesses in the country.

We developed concepts and structure of a two-day training course based on (i) One Health core competencies, (ii) Thailand national policies to control AMR and promote RDU, and (iii) the Training Modules on Responsible Use of Antibiotics in targeted common illnesses developed by the RDU Education working group under the national committee on RDU policies. The training course was designed for 3rd-6th year students as a curriculum requirement before their first professional clerkship at community-level healthcare facilities. With training on AMR in ambulatory care settings, students will be able to identify and prescribe antibiotics for common illnesses in an appropriate manner. The short-course training program included brief guidelines for responsible use of antibiotics for four target diseases identified by the Antibiotic Smart Use Project (antibiotic prophylaxis in vaginal delivery of normal term labor (APL), AD, fresh traumatic wound (FTW), and URI), community-acquired antibiotic resistance, control and prevention of AMR using One Health strategy, roles of antibiotic stewardship, and role of multi-disciplinary team in limiting AMR and developing protocols for AMR research proposals (Table 1).

Building on the developed course structure, learning materials and case studies were reviewed by seven experts in health science education and One Health strategy based in the northern region of Thailand and produced for use in a "Short-course Training on Antimicrobial Resistance and Responsible Use of Antibiotics". The short-course

Table 1

Structure and topic content of the short-course training program on antimicrobial resistance (AMR) and rational use of antibiotics (RUA).

Knowledge and skill	Topic
Module 1: General concepts of AMR and RUA	Epidemiology of antimicrobial resistance in Thailand Concept and policy of rational drug use
Module 2: Responsible use of antibiotics in common illnesses in out-patient department (OPD)	Upper respiratory infection (URI) <ul style="list-style-type: none"> - Pharyngitis - Rhino sinusitis - Acute otitis media - Acute diarrhea - Fresh traumatic wound - Antibiotic prophylaxis in vaginal delivery of normal term labor
Module 3: Team building and communication	Communication skills needed to promote rational use of drugs
Module 4: Integrated care in OPD, in-patient department and the environment using case studies	Principles and importance of RUA in out-patient and in-patient services, and impact of antibiotic use on the environment, organized in five learning stations
Module 5: Health promotion	Alternative care in health promotion and reduction of infection risks

training program consists of five modules. The first module is designed to strengthen awareness of the One Health strategy among health science students from various professional areas, such as medical technology, nursing, pharmacy, and veterinary medicine. Communication and team building skills are developed using role-play and case studies. Students are encouraged to work as a team of different professions so as to obtain One Health core competencies through games and activities. Lectures together

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with case study examples help students to improve basic knowledge on responsible use of antibiotics dispensed to out-patients and in-patients. The second module is designed to increase basic knowledge and responsible use of antibiotics for common infectious diseases, such as AD, APL, FTW, and URI, in out-patient department (OPD). The main activities in this module are lectures, presentations of scientific evidence and guidelines of current standard treatment. The third module is designed to strengthen communication and team building skills. The activities include lectures, case studies and assignments. The fourth module is designed to increase knowledge of principles and importance of responsible use of antibiotics in out-patient and in-patient services and to understand the impact of antibiotic use on the environment. This module is organized into five learning stations using case-based learning activities. Awareness of antibiotic use on the environment is conveyed via internet search of evidences for AMR caused by antimicrobial overuse in animal food production and agriculture, along with discussions and debates. The fifth module is designed to increase understaffing of ways and means to promote health using alternative care and reduction in risk of infections. Staff of this short-course program composed of seven faculty members from the Faculties of Associated Medical Sciences, Medicine, Nursing, Pharmacy, and Veterinary Medicine.

A pilot short-course training on AMR and RUA in a primary care setting was held for 53 (35 undergraduate and 18 graduate) students in dentistry, medicine, nursing, and pharmacy from three universities in the northern region of Thailand, with 55% from the latter faculty. Students were exposed to applications of One Health concepts by working in a multi-disciplinary team (Fig 1) to manage AMR through development of (i) communication skills among health care professionals and the public, (ii) multi-disciplinary collaborations on solving problems of overuse of antibiotics and educating public on rational use of antibiotics, and (iii) antibiotic stewardship at every step of antibiotic use based on professional responsibility. The sets of knowledge and skills most likely to be applied in managing AMR and promoting rational use of antibiotics were (i) selection of antibiotics appropriate to the pathogens and corresponding to the standard treatment guidelines, (ii) public education that is simple and easy to understand, and (iii) public communication on AMR and its burden; (iv) dissemination of One Health concept, rational prescribing of antibiotics, (v) active listening, planning and managing AMR, and (vi) development of analytical skills in managing AMR, literature search, communication skills, and multi-disciplinary collaborations; and those requiring further training were (i) analysis of case studies, (ii) antimicrobial stewardship, (iii) skills and attitudes to promote

Feedbacks from 27 health science students attending the short-course training regarding impact of antibiotic use on the environment (station 1), communication skills needed to promote rational use of antibiotics (station 2), principles and importance of rational use of antibiotics in out-patient services (station 3), principles and importance of rational use of antibiotics in in-patient services (station 4), and overall rating of the training course are shown in Figs 2, 3, 4, 5 and 6, respectively.

Workshop: Station 1 Impact of antibiotic use on environment

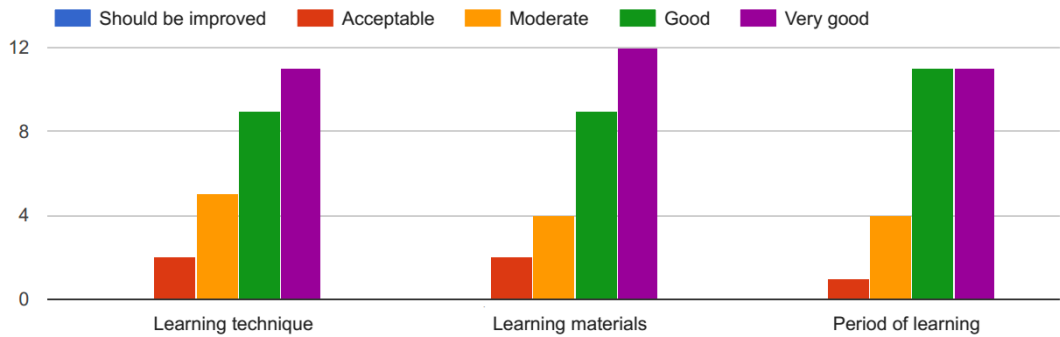


Fig 2 – Number of respondents to workshop station 1.

Workshop: Station 2 Communication skills needed to promote rational use of drugs

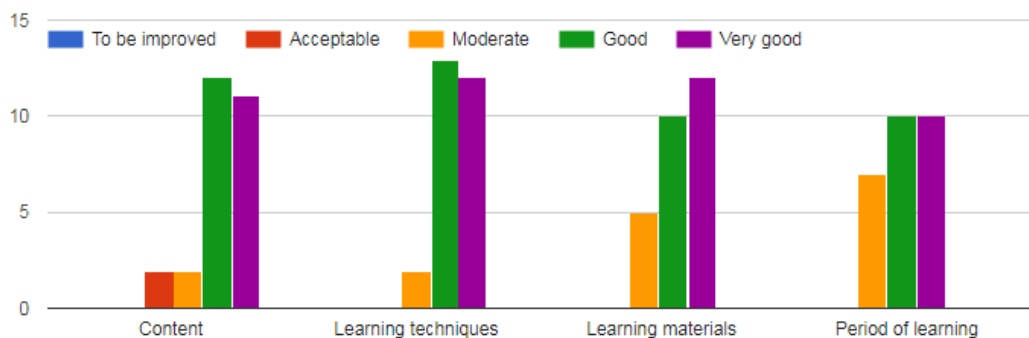


Fig 3 – Number of respondents to workshop station 2.

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Workshop: Station 3 Principles and importance of rational use of antibiotics in outpatient services

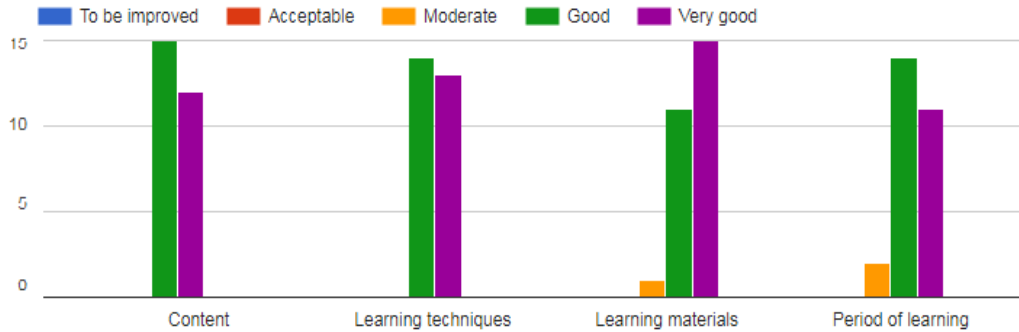


Fig 4 – Number of respondents to workshop station 3.

Workshop: Station 4 Principles and importance of rational use of antibiotics in inpatient service

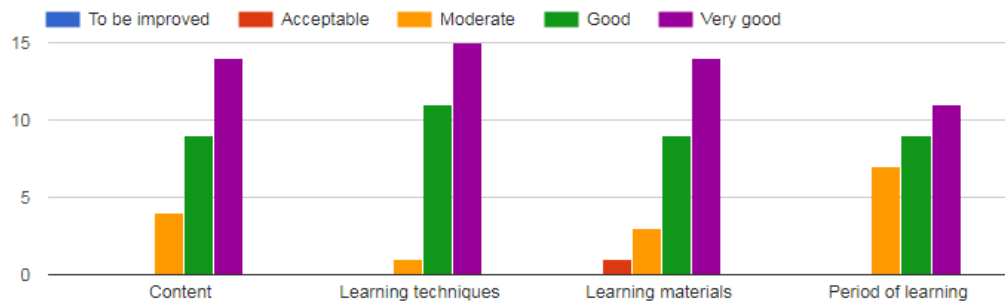


Fig 5 – Number of respondents to workshop station 4.

Health science students will play an important role in attacking AMR problems when they enter into their respective careers. With full understanding and awareness of AMR and responsible use of antibiotics for common illnesses, these trained health science students will have the potential to act in antibiotic stewardship, minimizing overuse of antibiotics in humans and animals, promoting health, and reducing risks of

Overall rating for the training course

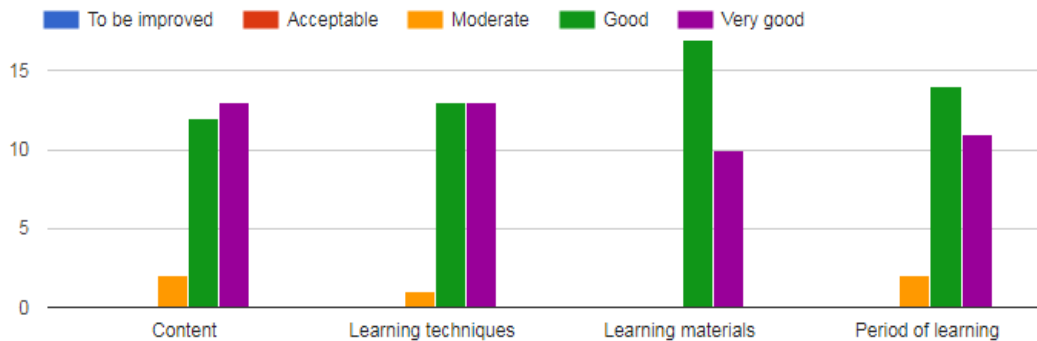


Fig 6 – Number of respondents to overall rating of the training course.

infection, leading to reduced problems related to AMR in the country. Inclusion of the whole short-course training program or some of its learning modules in health sciences curricula should enhance the preparation of future healthcare professions who are capable of contributing to the promotion of rational use of antibiotics and reduction of AMR-related problems.

The pilot short-course training program was conducted with a small number of students because it was arranged during a university break period. Although the participating students came from different health science fields, the majority of the students were from pharmacy. Further training employing in larger groups of students should be considered. Further development of the AMR training program will require consultation and partnership with major stakeholders, such as the Ministry of Public Health, the Ministry of Agriculture and Cooperatives, the Food and Agriculture Organization (FAO), and the World Organization for Animal Health (OIE), to ensure the knowledge and skills of future workforce are in-step with national policies and guidelines on AMR for Thailand and meet the country needs, as well as meeting international standards.

We suggest that short-course training on AMR and responsible use of antibiotics be included in the curriculum of health science degree programs in Thailand. We recommend (i) the training be organized as an inter-professional education course offered students from year 3 onwards to ensure that the students have adequate pre-clinical

and clinical knowledge, (ii) the course be approved by each health science program and a course credit be allocated, and (iii) training modules, manuals and learning materials of each institution be shared among the participating faculties. Attendance of the short-course training program before students enter their first professional clerkship at hospitals and community healthcare centers will enable application of their knowledge of AMR, responsible use of antibiotics for common illnesses and skill in communicating awareness of AMR to other health care professions in their workplace.