



PERSPECTIVES

National action plan to combat antimicrobial resistance in Taiwan



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Antibiotic-resistant microorganisms continue to emerge and spread.^{1,2} Antimicrobial resistance is one of the three major challenges in patient safety. In 2011, the World Health Organization designated “Combat antimicrobial resistance” as the theme for World Health Day, stating “no action today, no cure tomorrow.”³ We need to actively confront the issue of antimicrobial resistance.

Antimicrobial resistance is both a threat and a challenge to the treatment of infectious diseases in Taiwan. Based on the national database on antimicrobial resistance from the Taiwan Nosocomial Infection Surveillance System during the period 2003–2012, the proportion of methicillin-resistant *Staphylococcus aureus* infections in intensive care units in medical centers and regional hospitals decreased from 89.2% to 69.9%; the proportion of vancomycin-resistant enterococci infections increased from 2.9% to 23.2%; the proportion of Enterobacteriaceae isolates resistant to carbapenems increased from 1.4% to 8.1%; and the proportion of *Acinetobacter baumannii* isolates resistant to imipenem or meropenem increased from 17.2% to 72.8%.⁴

In response to the emergence of antimicrobial resistance in pathogens encountered in hospitals and, more recently, in the community, the Centers for Disease

Control, Taiwan (Taiwan CDC) has implemented a national action plan to combat antimicrobial resistance⁵: the antimicrobial management project from 2013 to 2015 for preventing the emergence of resistant microorganisms and decreasing health care-associated infections (HAIs). The national action plan on antimicrobial resistance is a multifaceted, multidisciplinary approach which works through the implementation of antimicrobial stewardship by hospitals, coordination and supervision, regular review and allocation of resources, measuring performance, and benchmarking (Fig. 1). The phases of the national action plan—antimicrobial management project include a planning phase, an executive phase, and a policy evaluation phase.

Planning phase

The main intervention measures are the appropriate use of antibiotics and infection control. The former consists of a prospective audit with intervention and feedback, formulary restriction and preauthorization, surveillance of antimicrobial resistance and consumption, an effective health information system, and education.⁶ The latter includes hand hygiene, isolation and protection, audit and evaluation, regional labeling, and antimicrobial resistance analysis. The expected achievements are a reduction in the consumption of antimicrobial drugs, reduction in antimicrobial resistance, and a reduction in HAIs. The core

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elements of the national action plan on antimicrobial resistance include multidisciplinary professionals and coordination.⁷ The roles for the national action plan—antimicrobial management program are given in the following sections.

Role of the Taiwan CDC

The role of the Taiwan CDC is the coordination of policy planning, management, and inspection for the national action plan to combat antimicrobial resistance.

Role of the infectious diseases service

The role of the infectious diseases service is to coordinate the establishment of the hospital antimicrobial management mechanism and its strategic promotion in hospitals, monitoring HAIs, and implementing infection control measures.

Role of the pharmacy

The role of the pharmacy is the assessment of the appropriateness of prescriptions for antibiotic drugs, monitoring a checklist of adverse drug reactions, and monitoring of therapeutic drugs.

Role of the clinical microbiology service

The role of the clinical microbiology service is the assessment of standard operating procedures for examinations

and the proposal of definite improvement plans, such as a reduction in the defect rate and the rate of contamination of specimens, and the use of rapid test kits or equipment to provide fast and accurate test results.

Role of computer technology

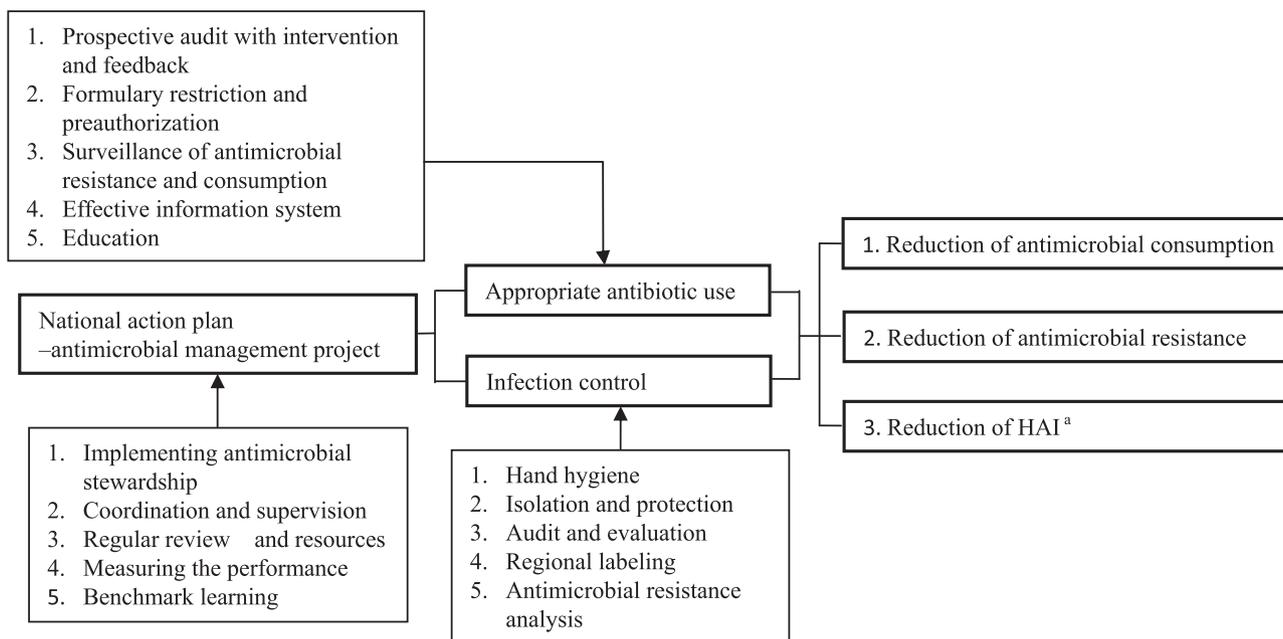
Computer technology has a role in strengthening and integrating the various information systems of consumption of antimicrobial drugs, antimicrobial resistance, HAIs, and clinical information of patients.

Executive phase

There are three levels for the implementation of the executive phase⁸: a project management center, the demonstration centers, and the participating hospitals.

Establishment of the project management center

Professional organizations are entrusted with developing the project management center. The duties of the center include the preparation of an antimicrobial management toolkit and the assessment of the antimicrobial management project, creating and analyzing the monitoring performance indicators periodically, implementing external audits and inspection, organizing the antibiotic management forum, and the promotion of benchmarking and performance competitions. Educating and training medical professionals and the public, developing digital learning



^a Healthcare-associated infections

Figure 1. Infrastructure of the national action plan—antimicrobial management project in Taiwan.

courses, and building up promotional tools are also included.

Regional development of demonstration center for management of antibiotic drugs

A total of seven demonstration centers have been selected for the antimicrobial drug management project. These are required to provide their own experience of antimicrobial management through the exchange of experience and resources and to help the project management center to develop national technical documents. The upgrade of the management capabilities of antibiotic drugs in each hospital are achieved by the evaluation and monitoring performance indicators of this project, observations and learning between hospitals, and the exchange of executive experience.

Regional assessment and screening of participating hospitals

A total of 55 hospitals have been selected for participation. The demonstration centers from each district are responsible for understanding the basic status of participation, assisting in defining the cause of problems, developing the program on the appropriate use of antibiotic drugs and infection control in accordance with the characteristics of each different hospital. For hospitals with poor performance on the execution of the program, on-site visits and consultations are provided by the demonstration centers.

Policy evaluation phase

The national action plan—antimicrobial management project was implemented in May 2013. The preliminary surveillance using the first half-year of data showed that the rate of antimicrobial resistance, antibiotics use, and the rate of HAIs decreased. For example, the rate of antimicrobial resistance declined by 6.6%, within which the proportion of *Acinetobacter baumannii* isolates resistant to imipenem or meropenem decreased from 60.5% to 56.5%. The total hospital antibiotic drug usage rates declined by 2.3%, from 1009 to 986 defined daily doses per 1,000 patient days, and the rate of HAIs declined by 12.0%, from 2.5 to 2.2 per 1,000 patient days, from May 2013 to December 2013.

In conclusion, The effectiveness of the national action plan on antimicrobial resistance could be achieved through the promotion of an antimicrobial management program and hospital implementation. The evidence database of this program will be provided for the national health insurance payment, review and monitoring strategy, the evaluation of hospital accreditation, the aggressive involvement of a guaranteed global budget in national health insurance, and the evaluation of standards in medical centers in the future. Together, these will encourage hospitals to focus on antimicrobial management and enhance patient safety.

Antimicrobial resistance significantly increases morbidity, mortality, and medical costs.⁹ Each year in the

USA, at least 2 million people acquire serious infections from resistant microorganisms. At least 23,000 people die each year as a direct result of these antibiotic-resistant infections. The estimated extra medical costs of antimicrobial resistance are as high as \$20 billion a year. The use of antibiotic drugs is the single most important factor leading to antibiotic resistance around the world. Up to 50% of all the antibiotic drugs prescribed are inappropriate as prescribed.¹⁰ The prevention of antimicrobial resistance is not impossible to achieve. However, a reduction in the spread of resistant microorganisms and an improvement in the quality of medical care can be only achieved by multiple strategies with the cooperation of governments, institutions, professionals, and the public.

Conflicts of interest

All contributing authors declare no conflicts of interest.

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References

1. Tseng SH, Lee CM, Lin TY, Chang SC, Chang FY. Emergence and spread of multi-drug resistant organisms: think globally and act locally. *J Microbiol Immunol Infect* 2011;44: 157–65.
2. Tseng SH, Lee CM, Lin TY, Chang SC, Chuang YC, Yen MY, et al. Combating antimicrobial resistance: antimicrobial stewardship program in Taiwan. *J Microbiol Immunol Infect* 2012;45: 79–89.
3. WHO. Antimicrobial resistance: no action today, no cure tomorrow. <http://www.who.int/world-health-day/2011/en/> [accessed 15.03.14].
4. Taiwan CDC. Nosocomial infections surveillance system statistical analysis, 2012. <http://www.cdc.gov.tw/professional/info.aspx?treeid=BEAC9C103DF952C4&nowtreeid=ECDDD4FB A932D996&tid=1FOAAD094B589625> [accessed 10.03.14].
5. Taiwan CDC. Antibiotic management plan. <http://www.cdc.gov.tw/professional/list.aspx?treeid=BEAC9C103DF952C4&nowtreeid=EFA547EB9C97BD72> [accessed 20.03.14].
6. Dellit TH, Owens RC, McGowan Jr JE, Gerding DN, Weinstein RA, Burke JP, et al. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Clin Infect Dis* 2007;44: 159–77.

7. The Australian Commission on Safety and Quality in Health Care. *Antimicrobial stewardship in Australian hospitals*. <http://www.theasm.org.au/assets/ASM/44471-Antimicrobial-Stewardship20111.pdf>; 2011 [accessed 20.03.14].
8. WHO. WHO global strategy for containment of antimicrobial resistance. http://www.who.int/drugresistance/WHO_Global_Strategy_English.pdf [accessed 02.03.14].
9. Roberts RR, Hota B, Ahmad I, Scott 2nd RD, Foster SD, Abbasi F, et al. Hospital and societal costs of antimicrobial-resistant infections in a Chicago teaching hospital: implications for antibiotic stewardship. *Clin Infect Dis* 2009;**49**:1175–84.
10. CDC. *Antibiotic resistance threats in the united states*. <http://www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf>; 2013 [accessed 15.03.14].