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Letter to the Editor

Gap analysis on antimicrobial stewardship program in central Thailand

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To the Editor—Implementation of an antimicrobial stewardship program (ASP) in an acute-care setting requires several important components: hospital administration support, an appropriate ASP team (eg, infectious disease physician(s) and pharmacist(s)), ASP program goals and carefully planned interventions, a structured reporting system, adequate hospital infrastructure, and mechanisms for education.[1] Examination of these components can provide a useful gap analysis for acute-care hospitals in various resource settings to fulfill the hospital ASP goals. To evaluate the feasibility of gap analysis based on previous ASP consensus in Asia,[1] we performed a survey of hospital components and analyzed the gaps to help inform the implementation of ASP in central Thailand.

From February 1, 2019 through May 31, 2019, investigators (A.A. and K.J.) interviewed key personnel in central Thailand hospitals to assess the implementations of ASPs in acute-care settings. All hospitals in central Thailand that had an intensive care unit (ICU) and at least 250 hospitals beds were invited to participate (n = 56). The list of hospitals was obtained from Thai Ministry of Public Health. The gap analysis survey instrument was modeled from a previous publication[1] and included assessment of several components including hospital administration support, ASP team membership and training, ASP program and interventions, structured reporting system, hospital infrastructure and education. Each component was subdivided into core gaps (C score comprised of of 12 components) and supplementary gaps (S score comprised of 27 components) (Supplement 1 online). Data collected also included general hospital characteristics, affiliation with a medical school, personnel, infection control program characteristics, and total full-time equivalent for all infection preventionists. The following hospital characteristics were considered: type of ownership, number of acute-care beds, affiliation with a medical school, and involvement in a collaborative network to reduce healthcare-associated infections. In-person interviews were administered by A.A. and K.J., who used the survey instrument to interview ASP leaders in each of the acute-care hospitals in central Thailand. Both interviewers were familiar with the gap analysis tool. Descriptive statistics were calculated for all relevant survey questions. Multivariable logistic regression was used to determine factors associated with hospitals that achieved all essential 12 C-score components.

Overall, 45 of 56 hospitals (80%) participated in our survey. Of these, 27 hospitals (27 of 45, 60%) fulfilled all C-score components (C score, 12), whereas none of the participated hospitals fulfilled all S-score components. Although a formal statement of ASP support from leadership was available from all hospitals, only 15 of 45 hospitals (33%) received financial support for their ASP activities. For core component assessment, microbiologist and pharmacist involvement in ASP, process and outcome measurements, regularly published antimicrobial resistant data were lacking for several hospitals (Table 1). For supplementary component assessment, lack of information and technology (IT) to support ASP, lack of available treatment and surgical prophylaxis antibiotic guidelines and unit-specific antibiograms, lack of a monitoring system for ASP process and outcomes were reported by several hospitals (Table 1). In multivariable regression analyses, participation in any collaborative network to reduce healthcare-associated infections (adjusted odds ratio [aOR], 19.9; 95% confidence interval [CI], 12.4–249.2; $P < .001$) and medical school affiliation (aOR, 36.6; 95% CI, 6.3–144.5; $P < .001$) were independent factors associated with fulfillment of all C-score components.

In this survey, we identification of several existing gaps and factors associated with fulfillment of core components among tertiary-care hospitals in central Thailand. To overcome those core gaps, hospitals need to provide hospital administrators with a possible business case to persuade funding for an ASP, prioritize identification of key ASP team members (eg, clinical pharmacist, microbiologist), and prioritize selection of a combination of process and outcome related measures for the ASP as well as mechanisms to monitor compliance (Supplement 2). Previous publications have suggested the role of participating in collaborative network to prevent HAIs as one of the predictors of successful reduction in nosocomial infections and multidrug-resistant organisms.[2–4] We expanded this association as one of the key prerequisites for hospitals to fulfill the core components gaps for ASP. Notably, all hospitals had not fulfilled supplementary gaps and need to prioritize acquiring adequate IT support. All hospitals also need to develop plans to provide regular feedback to prescribers, to monitor process and outcome related measures, and to report ASP performance to relevant stakeholders as well as hospital administrations (Supplement 2 online).

Our study had some limitations. First, because the response rate was <100%, our results may be susceptible to nonresponse bias. Second, because we relied on self-reported data from the

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Table 1. Hospital Characteristics and Gap Analysis

Variable	No. (%) (n = 45)
Type of ownership	
Private	18 (40)
Government	32 (71.1)
Military	5 (11.1)
Total number of beds	545.9 + 465.5
Total FTE for all infection preventionists	3.2 + 3.6
Affiliated with medical school	24 (53.3)
Participated in collaborative network to prevent HAIs	26 (56.5)
Hospital leadership support	
Formal statement of leadership support	45 (100)
Leadership had budgeted financial support for ASP	15 (33.3)
ASP team and ID training	
Physician lead ASP	45 (100)
Presence of pharmacist working on ASP	32 (71.1)
Presence of microbiologist working on ASP	26 (58)
Presence of IC team working on ASP	45 (100)
ASP program intervention	
Implement preauthorization with or without prospective audit and feedback	45 (100)
Available of computerized support system	14 (33.3)
Available of treatment and surgical prophylaxis guidelines	32 (71.1)
ASP monitoring and reporting	
Available of antibiotic consumption measurement (DDD or DOT)	22 (49)
Regularly published resistant data	24 (53.3)
Regularly published antibiogram	29 (64.4)
Regularly published unit-specific antibiogram	19 (42.2)
Hospital infrastructure	
Available of IT capacity to assist ASP program	14 (31.1)
Available of reliable and timely reporting microbiology data	36 (80)
Hospital with all core elements for ASP in place (C-score, 12)	27 (60)
Hospital with all supplementary elements for ASP in place (S-score, 27)	0 (0)

Note. FTE, full-time equivalent; HAIs, healthcare-associated infections; ASP, antimicrobial stewardship program; ID, infectious diseases; DDD, days on therapy; DOT, days on treatment; C-score, core component score; S-score, supplementary component score.

ASP leader at each facility to determine the frequency of the various gap analyses, our results may be susceptible to respondent bias. Finally, we did not have access to (and thus could not adjust for) hospital case-mix data. As such, our regression estimates could be biased because of unmeasured confounding, and our results can only be interpreted as providing evidence for associations rather than causal mechanisms. Despite these limitations, our study identified several gaps, and we have suggested mechanisms for overcoming such barriers. As part of ongoing efforts to build and maintain successful ASP in Thailand, national policy makers should regularly implement gap analyses for acute-care hospitals and provide adequate supports for those unmet need.

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.1017/ice.2019.185.

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Antibiotic prescribing behavioral assessment of physicians involved in surgical care

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To the Editor—Appropriate antibiotic use in surgical department is associated with reduction in morbidity and mortality.[1] Challenges exist in conducting behavior-based studies of antibiotic stewardship, given the multifactorial decision-making associated with prescribing practices. Two theory-based behavioral constructs associated with sustained behavioral change are the Transtheoretical Model of Health Behavior Change (TTM) and the Theory of Planned Behavior (TPB).[2,3] These behavioral theories were recently employed in successful implementation of a hand hygiene infection prevention campaign.[4] To potentially extend the application of these theories to medication prescribing practices, we performed an exploratory study to evaluate surgical care providers, categorized by TTM and by TPB, for association with appropriate antibiotic prescribing practice.

A prospective study was conducted at Thammasat University Hospital from January 1 to January 31, 2019. Surgical care prescribers of antibiotics were enrolled; de-identified data collection included demographics, indications, the rationale for antibiotic prescriptions, and prescribed drug modifications based on Tamma et al.[5] Appropriateness of antibiotic prescriptions was defined based on the criteria of Kunin et al.[6] The source data for assessment was the hospital's drug use evaluation (DUE) form. After DUE review, an in-depth interview using a standardized data collection tool was conducted with each prescriber by either a clinical pharmacist or infectious disease physician to explore antibiotic prescribing behavior based on the TTM and TPB. The interview with each prescriber focused on 1 antibiotic for treatment or 1 antibiotic for surgical prophylaxis. In TTM and TPB assessment, questions were modeled, and each domain was assessed based on previous publications (Supplement 1 online).[2–4,7]

All analyses were performed using SPSS, version 19 software. The χ^2 or Fisher exact test was used to compare categorical variables. Independent *t* tests were used for continuous data. All *P* values were 2-tailed; $P < .05$ was considered statistically significant. To determine factors associated with appropriate antibiotic prescriptions, variables that had a significance level of $P < .20$ in univariate analysis were entered into multivariate logistic regression models. Adjusted odd ratios (aORs) and 95% confidence intervals (CIs) were calculated. Correlation between TTM and TPB behavior score were measured using Pearson correlation.

There were 92 antibiotic prescriptions assessed from 64 prescribers. Most antibiotic prescriptions (62 of 92, 67%) were for treatment of infection (Table 1); 70 prescribed antibiotics (76%) were deemed appropriate. The 3 most common reasons for inappropriate antibiotic prescriptions were (1) antibiotics choice for either treatment or surgical prophylaxis (n = 11, 50%), (2) treatment duration (n = 8, 36%), and (3) prescribed combination antibiotics (eg, a third-generation cephalosporins and metronidazole) for surgical prophylaxis (n = 3, 14%). Prolonged antibiotic use for surgical prophylaxis (>48 hours) (8 of 22, 36.3%) was common, particularly in neurosurgical procedures. Physicians who de-escalated antibiotics had higher rate of appropriate antibiotic prescriptions, with an overall trend for inappropriate antibiotic prescriptions among physicians with higher levels of training. Notably, a higher proportion of inappropriate antibiotic prescriptions were identified among physicians who had no stated rationale for antibiotic selection.

For the behavioral assessments of prescribing practice, higher stages of TTM strongly correlated with appropriate antibiotic use. In contrast, there was no correlation between the total TPB score and appropriate antibiotic prescriptions (Supplement 1 online). Characteristics, antibiotic prescribing patterns, rationale for prescribing empirical antibiotics and modifying antibiotics, and behavior of prescribers are summarized in Table 1.

By multivariate analysis, TTM prescribers in Action plus Maintenance (aOR, 7.95; 95% CI, 2.08–30.30) and prescribers considering patients as first priority (aOR, 4.02; 95% CI, 1.05–15.32) were associated with appropriate antibiotic prescriptions. Neurosurgical procedures (aOR, 0.13; 95% CI, 0.02–0.89) and antibiotic prescriptions for surgical prophylaxis (aOR, 0.15; 95% CI, 0.004–0.53) were associated with inappropriate antibiotic prescriptions. Prescribers staged in TTM Action plus Maintenance were also associated with appropriate antibiotic prescriptions for treatment and for surgical prophylaxis.

The major finding of this study is the identification of the strong correlation between the TTM stages of surgical care prescribers and appropriate antibiotic prescriptions. To our knowledge, this is the first study to evaluate TTM stages with medication selection. Based on the TTM framework, early-stage prescribers (precontemplation, contemplation, and preparation) have the potential

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