

# Development of Key Indicators for Appropriate Antibiotic Use in Republic of Korea: a Systematic Review followed by Delphi Procedure

Bongyoung Kim<sup>1</sup>, Myung Jin Lee<sup>2</sup>, Se Yoon Park<sup>3</sup>, Song Mi Moon<sup>4</sup>, Kyung Ho Song<sup>5</sup>, Tae Hyong Kim<sup>1</sup>, Eu Suk Kim<sup>5</sup>, Hong Bin Kim<sup>5</sup>, Korea Study Group for Antimicrobial Stewardship (KOSGAP)

<sup>1</sup>Department of Internal Medicine, Hanyang University College of Medicine, Seoul, Republic of Korea

<sup>2</sup>Department of Internal Medicine, Inje University Sanggye Paik Hospital, Seoul, Republic of Korea

<sup>3</sup>Division of Infectious Diseases, Department of Internal Medicine, Soonchunhyang University Seoul Hospital, Soonchunhyang University College of Medicine, Seoul, Republic of Korea

<sup>4</sup>Department of Internal Medicine, Hallym University Sacred Heart Hospital, Anyang, Republic of Korea

<sup>5</sup>Division of Infectious Diseases, Department of Internal Medicine, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Seoul, Republic of Korea

## Introduction

Increased use of broad-spectrum antibiotics is closed related to antimicrobial resistance [1]. Therefore, the need for measurement of appropriate antibiotic use has been emphasized [2]. There is various step in measurement of appropriate antibiotic use such as diagnosis, empiric therapy, dosing, de-escalation, and duration of therapy [3]. The result of appropriateness can be changed according to the definition of appropriate antibiotic use [4].

The aim of this study was select potential quality indicators (Qis) by systematic review of the literatures and to determine the key indicators thar are necessary and important in ROK through expert agreement.

## Materials and Methods

A systematic literature review was performed in order to retrieve a list of potential key QIs. We screened literature using database of PubMed, Embase, and Cochrane. Search strategy was shown in Figure 1.

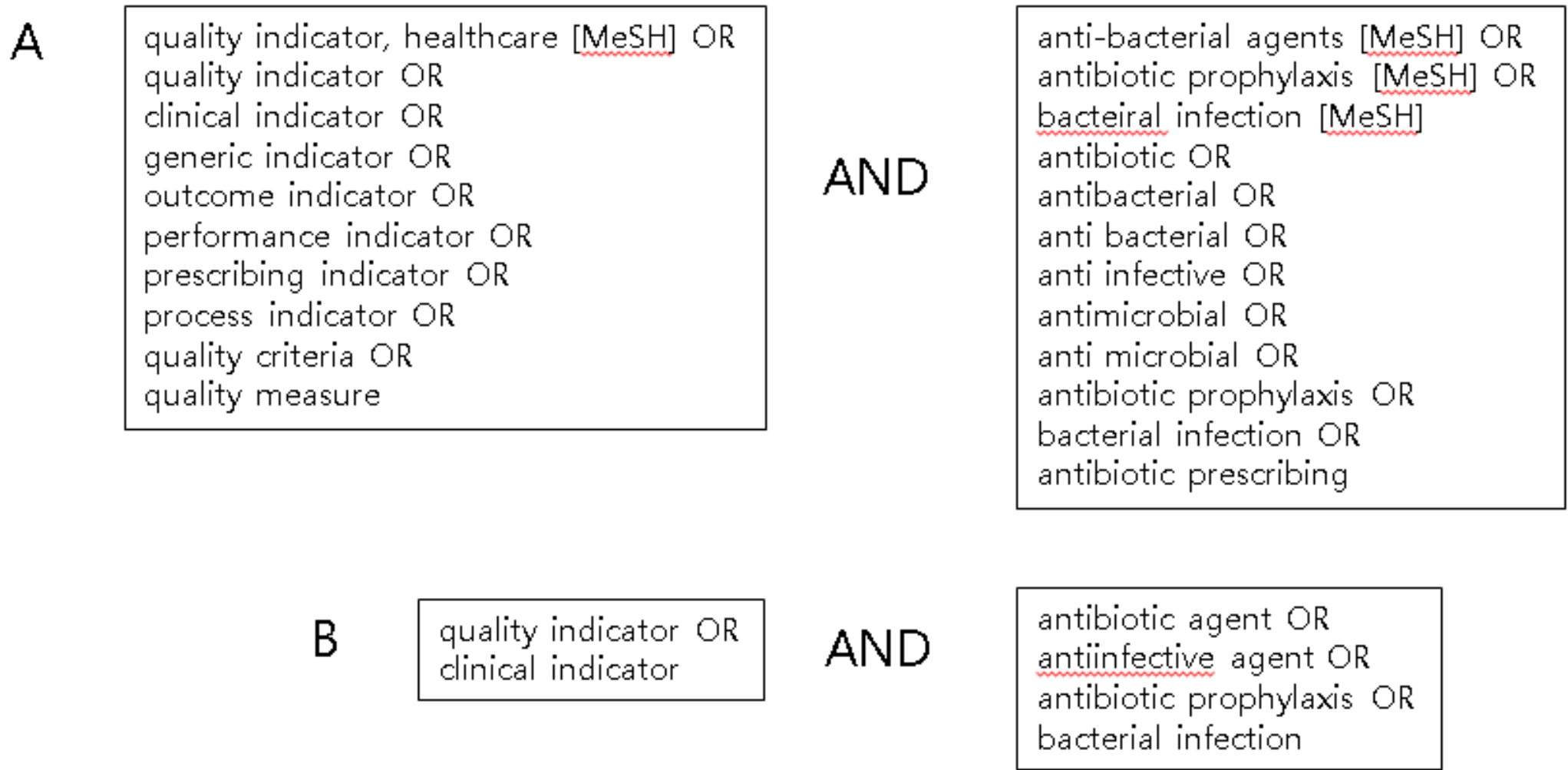


Figure 1 Search strategy

These candidates were evaluated by multidisciplinary expert panel using a RAND-modified Delphi procedure, using two online questionnaires and a face-to-face meeting between them. Twenty-five expert panels with diverse backgrounds (infectious diseases specialist, urologist, laboratory medicine doctors, pediatric infectious disease specialists, otorhinolaryngology doctors, gastrointestinal doctors, pulmonologist, general surgeon, and researcher in National Evidence-Based Healthcare Collaborating Agency) participated in the consensus procedure.

A Likert scale (ranging 1-7) was used for the evaluation of appropriateness of the potential key QIs and items with median score 6 or 7 were accepted if there was no disagreement. In addition, we grade each QI into admission, outward, or surgical prophylaxis using the Likert scale. If the score was 6 or 7, we considered it as appropriate application.

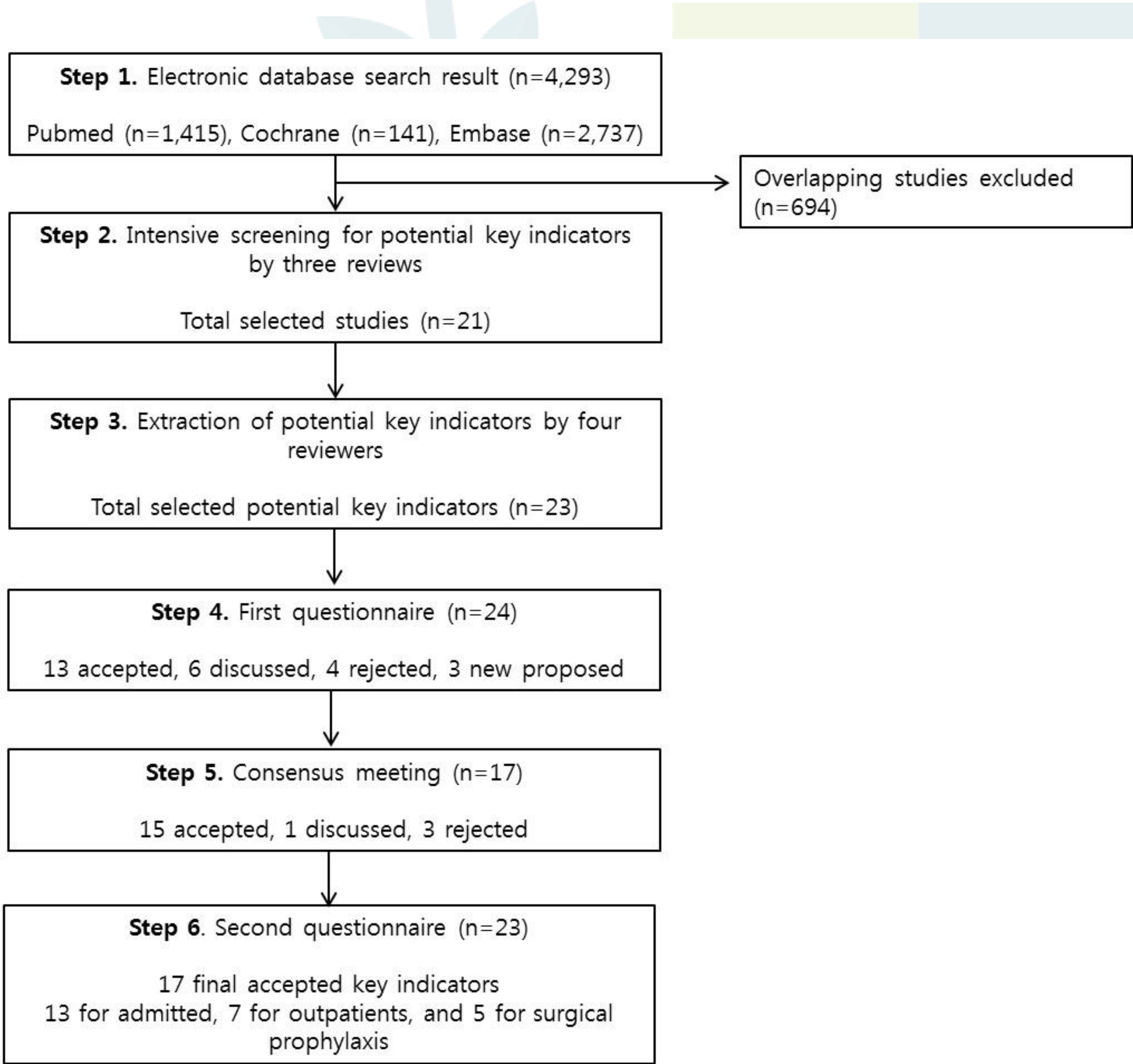


Figure 2 Flowchart of the study

## Results

The systematic literature review identified 23 potential QIs, from 21 studies. Ultimately, 17 key indicators were retained, with a high level of agreement (13 QIs for admitted patients, 7 for outward patients and 3 for surgical prophylaxis) (Figure 2).

Table 1. Ranking in key indicators for admitted and outpatients and applicability in point surveillance study.

Quality indicators	Inpatients			Outpatients		
	Ranking	Total score	Applicability	Ranking	Total score	Applicability
QI 1. Empirical systemic antibiotic therapy should be prescribed according to the institutional, national, or international guideline	1	114	Yes	1	114	Yes
QI 6. Empirical antibiotic therapy should be changed to pathogen-directed therapy if culture results become available	2	109	Yes	2	109	Yes
QI 3. When starting systematic antibiotic therapy, specimens for culture from suspected sites of infection should be taken as soon as possible, preferably before antibiotics are started	3	103	Yes			
QI 2. Before starting systemic antibiotic therapy, at least two sets of blood cultures should be taken	4	100	Yes			
QI 7. Dose and dosing interval of systemic antibiotic therapy should be adapted to renal function	5	96	Yes	3	96	Yes
QI 17. Antibiotics should be prescribed in appropriate duration	6	92	No	4	92	No
QI 4. An antibiotic plan should be documented in the case notes at the start of systemic antibiotic therapy	7	89	Yes			
QI 9. Empirical antibiotic therapy for presumed bacterial infection should be discontinued based on the lack of clinical and/or microbiological evidence of infection. The maximum duration of empirical systemic antibiotic treatment should be 7 days	8	88	No	5	88	No
QI 14. Contraindications (history of allergy, anaphylaxis, or toxicity) should be taken into account when prescribing antibiotics	9	87	No	6	87	No
QI 18. Antibiotics with anaerobic activity combination of two or more antimicrobials	10	84	No			
QI 5. Systemic antibiotic therapy should be switched from i.v. to oral antibiotic therapy within 48-72 hr on the basis of the clinical condition and when oral treatment is adequate	11	82	No			
QI 20. Follow up cultures 4-7 days after initial blood culture positivity (bloodstream infection due to Staphylococcus aureus and fungi)	12	69	No			
QI 8. Therapeutic drug monitoring should be performed when the therapy duration is >3 days for aminoglycosides and >5 days for vancomycin	13	52	No	7	84	No

After sum of importance score and applicability, 6 key QIs [6 QIs (1-6) for admitted patients and 3 (1, 2 and 5) for outward patients] were finally selected: (1) prescribe empirical antibiotic therapy according to guideline, (2) change empirical to pathogen-directed therapy, (3) take cultures from suspected sites of infection, (4) take 2 blood cultures, (5) adapt antibiotic dosage to renal function, and (6) document antibiotic plan (Table 1). In surgical prophylaxis, prescribe according to guideline and initiate antibiotics one hour before incision was finally selected (Table 2).

Table 2. Ranking in key indicators for surgical prophylaxis and applicability in point surveillance study.

Ranking	Quality indicators	Total score	Applicability
1	QI 10. Surgical prophylaxis antibiotic therapy should be prescribed according to guideline	113	Yes
2	QI 11. Surgical prophylaxis antibiotic therapy should be initiated within 1 hr before incision	109	Yes
3	QI 12. Surgical prophylaxis antibiotic therapy should be discontinued within 1 day	103	No
4	QI 17. Antibiotics should be prescribed in appropriate duration	92	No
5	QI 24. Dose of surgical prophylaxis antibiotics should be adjusted according to body weight	58	No

## Conclusions

We identified key QIs to measure the appropriateness of antibiotics. These QIs can be used to identify targets for improvement and to evaluate the effects of antibiotic stewardship intervention.

## References

- Kim B, Kim Y, Hwang H, et al. Trends and correlation between antibiotic usage and resistance pattern among hospitalized patients at university hospitals in Korea, 2004 to 2012: A nationwide multicenter study. Medicine (Baltimore) 2018;97:e13719.
- Barlam TF, Cosgrove SE, Abbo LM, et al. Implementing an Antibiotic Stewardship Program: Guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America. Clin Infect Dis 2016;62:e51-77.
- Spivak ES, Cosgrove SE, Srinivasan A. Measuring Appropriate Antimicrobial Use: Attempts at Opening the Black Box. Clin Infect Dis 2016;63:1639-44.
- DePestel DD, Eiland EH, 3rd, Lusardi K, et al. Assessing appropriateness of antimicrobial therapy: in the eye of the interpreter. Clin Infect Dis 2014;59 Suppl 3:S154-61.