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## Background

In 2019, the project about developing a system for measure and benchmark antibiotic usage in each hospital was launched. As the basic work for the project, we developed 'antibiotic classification for measuring antibiotic usage in Korean hospitals' using a modified Delphi method.

## Methods

### • Study design

- Two series of modified Delphi studies were performed from Jul to Aug 2019.
  - First series: classify antibiotics used in Korean hospitals
  - Second series: analyze antibiotic components according to antibiotic classes
- Each Delphi study included two rounds of surveys in order to gather opinions and refine the information related to each study.
  - The questions in the first round were adopted from the antibiotic classification of the NHSN and antibiotics not available in Korea were excluded.

### • Delphi panels

- Infectious diseases physicians (10), professor of preventive medicine (1), the researcher of Health Insurance Review & Assessment Service (1).

### • Evaluation of the appropriateness of each question

- Four-point Likert scale (1 = very inappropriate, 2 = inappropriate, 3 = appropriate, 4 = very appropriate)
- Item acceptance: Content validity ratios (CVRs)  $\geq 0.56$

## Results

- The response rates
  - First series: 7/12 (58.3%) and 9/12 (75.0%)
  - Second series: 7/12 (58.3%) and 8/12 (66.7%)

Table 1. Antibiotic classification in Korean hospitals according to a Delphi method

	CVR	Mean $\pm$ SD
<b>Broad-spectrum antibacterial agents predominantly used for hospital-onset infections in adults*</b>	1.000	3.78 $\pm$ 0.44
<b>Broad-spectrum antibacterial agents predominantly used for community-acquired infections in adults*</b>	1.000	3.78 $\pm$ 0.44
<b>Antibacterial agents predominantly used for resistant gram-positive infections in adults*</b>	1.000	3.89 $\pm$ 0.33
<b>Narrow-spectrum beta-lactam agents in adults*</b>	1.000	3.89 $\pm$ 0.33
<b>Antibacterial agents posing the highest risk for Clostridioides difficile infection in adults</b>	-1.000	1.78 $\pm$ 0.44
<b>Antibacterial agents predominantly used for extensive antibiotic resistant gram-negative bacteria in adults*</b>	1.000	3.89 $\pm$ 0.33
<b>Broad-spectrum antibacterial agents predominantly used for hospital-onset infections in children</b>	-0.111	2.67 $\pm$ 0.87
<b>Broad-spectrum antibacterial agents predominantly used for community-acquired infections in children</b>	-0.111	2.67 $\pm$ 0.87
<b>Antibacterial agents predominantly used for resistant gram-positive infections in children</b>	-0.556	2.22 $\pm$ 0.44
<b>Narrow-spectrum beta-lactam agents for children</b>	-0.111	2.67 $\pm$ 0.87
<b>Macrolides for children</b>	-0.556	2.00 $\pm$ 1.00
<b>Antibacterial agents posing the highest risk for Clostridioides difficile infection in children</b>	-0.778	1.78 $\pm$ 0.67
<b>Antifungal agents predominantly used for invasive candidiasis in Children</b>	-0.111	2.56 $\pm$ 0.73
<b>Antibacterial agents predominantly used for extensive antibiotic resistant bacteria in children</b>	-0.111	2.67 $\pm$ 0.87
<b>Agents predominantly used for surgical site infection prophylaxis</b>	0.333	3.11 $\pm$ 0.93
<b>Total antibacterial agent*</b>	1.000	4.00 $\pm$ 0.00

Table 2. Consensual definition of antibiotic components according to the antibiotic classification in Korean hospitals

	CVR	Mean $\pm$ SD
<b>Broad-spectrum antibacterial agents predominantly used for hospital-onset infections in adults</b>		
Amikacin (IV)	0.750	3.25 $\pm$ 0.71
Tobramycin (IV)	0.750	3.00 $\pm$ 0.53
Cefepime	1.000	4.00 $\pm$ 0.00
Ceftazidime	1.000	4.00 $\pm$ 0.00
Imipenem	1.000	4.00 $\pm$ 0.00
Meropenem	1.000	4.00 $\pm$ 0.00
Doripenem	1.000	4.00 $\pm$ 0.00
Piperacillin/tazobactam	1.000	4.00 $\pm$ 0.00
Other 4 <sup>th</sup> generation cephalosporins	1.000	3.75 $\pm$ 0.46
<b>Broad-spectrum antibacterial agents predominantly used for community-acquired infections in adults</b>		
Cefdinir	1.000	3.75 $\pm$ 0.46
Cefixime	0.750	3.75 $\pm$ 0.46
Cefotaxime	1.000	4.00 $\pm$ 0.00
Cefpodoxime	1.000	3.75 $\pm$ 0.46
Ceftriaxone	1.000	4.00 $\pm$ 0.00
Ertapenem	1.000	3.88 $\pm$ 0.35
Gemifloxacin	1.000	3.75 $\pm$ 0.46
Levofloxacin	1.000	3.88 $\pm$ 0.35
Moxifloxacin	1.000	3.88 $\pm$ 0.35
Ciprofloxacin	1.000	3.88 $\pm$ 0.35
Other fluoroquinolones	0.750	3.63 $\pm$ 0.74
Other 3 <sup>rd</sup> generation cephalosporins	0.750	3.13 $\pm$ 0.64
<b>Antibacterial agents predominantly used for resistant gram-positive infections in adults</b>		
Linezolid	1.000	4.00 $\pm$ 0.00
Vancomycin (IV)	1.000	4.00 $\pm$ 0.00
Teicoplanin	1.000	4.00 $\pm$ 0.00
<b>Narrow-spectrum beta-lactam agents in adults</b>		
Amoxicillin	1.000	4.00 $\pm$ 0.00
Amoxicillin/clavulanate	1.000	3.88 $\pm$ 0.35
Ampicillin	1.000	3.88 $\pm$ 0.35
Ampicillin/sulbactam	1.000	3.88 $\pm$ 0.35
Nafcillin	1.000	3.88 $\pm$ 0.35
Cefadroxil	1.000	3.75 $\pm$ 0.46
Cefazolin	1.000	3.88 $\pm$ 0.35
Cephalexin	1.000	3.75 $\pm$ 0.46
Cefotetan	1.000	3.62 $\pm$ 0.52
Cefoxitin	1.000	3.62 $\pm$ 0.52
Cefaclor	0.750	3.63 $\pm$ 0.74
Cefprozil	0.750	3.63 $\pm$ 0.74
Other 1 <sup>st</sup> generation cephalosporins	0.750	3.50 $\pm$ 0.76
Other 2 <sup>nd</sup> generation cephalosporins	0.500	3.38 $\pm$ 0.92
<b>Antibacterial agents predominantly used for extensive antibiotic resistant gram-negative bacteria in adults</b>		
Colistin (IV)	1.000	4.00 $\pm$ 0.00
Tigecycline	1.000	3.88 $\pm$ 0.35
Ceftolozane/tazobactam	1.000	3.75 $\pm$ 0.46

**Conclusions:** This study provides antibiotic classification for measuring antibiotic usage in Korean hospitals. This classification may guide to develop a system for measuring of antibiotic usage in each Korean hospital.