IPC and ASP

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Disclosure

- 3M
- Aesculup Academy
- MSD

Objectives of antimicrobial stewardship program (ASP)

- Achieve best clinical outcomes related to antibiotic use while minimizing toxicity and limiting the selective pressure on bacterial populations that drive the emergence of AMR

- Primarily
  - Optimising antimicrobial use
  - Cost-effective interventions

- AMR prevention and control
  - IPC and ASP

Impact on cost

- Reduction in cost after the implementation of ASPs
  - range, 9.7% – 58.1% reduction in cost in the intervention period/arm

Study	Country or Region	Type of Costs	Cost Changes Between Intervention vs Control or Prior to Intervention (% Change)	Statistical Significance
Two-group comparative study				
Cai, 2016 [30]	Singapore	Cost of total antimicrobial use	Reduced SGD 90 045 after intervention (details NA)	ND
Taniguchi, 2015 [59]	Japan	Cost of total antimicrobial use	JPY 5 409 051 vs JPY 12 894 159 (58.1% reduction)	ND
Shen, 2011 [18]	China	Cost of individual antimicrobial use (mean ± SD) and individual hospital hospitalization (mean ± SD)	Antimicrobial use: USD 832.0 ± 373.0 vs 943.9 ± 412.0 (13.3% reduction) Hospitalization: USD 1442.3 ± 684.9 vs $1729.6 ± 773.7 (16.6% reduction)	$P = .01$ $P < .001$
Before–after trial				
Fukuda, 2014 [25]	Japan	Cost of antimicrobial therapy per 1000 patient-days (mean)	USD 4555.0 vs 6133.5 per 1000 patient-days (25.8% reduction)	$P = .005$
Lin, 2013 [45]	Taiwan	Cost of antimicrobial therapy per 1000 patient-days (mean)	USD 12 146 vs 21 464 per 1000 patient-days (43.4% reduction)	$P = .02$ in trend analysis
Teo, 2012 [21]	Singapore	Cost of total and audited antimicrobial use in 12-mo periods	Total antimicrobials: reduced USD 141 554 in (7.1% reduction) after intervention Audited antimicrobials: reduced USD 198 575 (13.2% reduction) after intervention	$P = .15$ $P = .01$
Ikeda, 2012 [37]	Japan	Cost of total antimicrobial use in 14-mo periods	USD 2.73 million vs 3.49 million (21.7% reduction)	ND
Niwa, 2012 [20]	Japan	Annual cost of total antimicrobial use	USD 1.86 million vs 2.02 million (11.7% reduction)	ND
Miyawaki, 2010 [43]	Japan	Annual cost of total antimicrobial use	JPY 262 528 000 vs 290 596 000 (9.7% reduction)	ND
Cheng, 2009 [16]	Hong Kong	Annual cost of total antimicrobial use	USD 1.32 million vs 1.50 million (12.0% reduction)	ND
Ng, 2008 [48]	Hong Kong	Annual cost of total antimicrobial use Monthly cost of restricted antimicrobial use per 1000 patient-days Monthly cost of nonrestricted antimicrobial use per 1000 patient-days	USD 1.65 million vs 1.96 million (15.8% reduction) USD 3906 vs 7293 (46.4% reduction) USD 3946 vs 4414 (11.9% increase)	ND $P < .001$ $P = .003$
Apisarnthanarak, 2007 [53]	Thailand	Mean cost of antibiotics and hospitalization for treatment of VAP per patient	Antibiotics: USD 2378 vs 4769 (45%–50% reduction) Hospitalization: USD 254 vs 466 (37%–45% reduction)	$P < .001$ $P < .001$
Apisarnthanarak, 2006 [41]	Thailand	Total cost saving from the reduction in antimicrobial use	USD 52 219 vs 84 450 (38.2% reduction)	$P < .001$

Incidence of Microorganisms or Infections	Range, Absolute Risk Difference After ASP Implementation	Studies, First Author
Clostridium diffcile infection		Liew, 2015 (Singapore, [29]); Lew, 2015 (Singapore, [26])
Incidence	−3.2% to −1.2%	
MRSA		Chen, 2015 (Taiwan, [28]); Fukuda, 2014 (Japan, [25]); Yeo, 2012 (Singapore, [22]); Niwa, 2012 (Japan, [20]); Miyawaki, 2010 (Japan, [43]), Buising, 2008 (Australia, [34]); Apisarnthanarak, 2006 (Thailand, [41])
Overall incidence density	−1.4 to −0.9 per 1000 patient-days	
Resistance rate	−14.5% to 0%	
ESBL-producing Enterobacteriaceae		Chan, 2011 (Taiwan, [36]); Fukuda, 2014 (Japan, [25]); Kim, 2008 (Korea, [35]); Apisarnthanarak, 2006 (Thailand, [41])
Overall incidence density	−0.1 per 1000 patient-days	
Proportion of ESBL-producing Enterobacteriaceae	−12.0% to +12.5%	
MDR or carbapenem-resistant *Pseudomonas* spp		Fukuda, 2014 (Japan, [25]); Zou, 2015 (China, [51]); Chen, 2015 (Taiwan, [28]); Yeo, 2012 (Singapore, [22]); Niwa, 2012 (Japan, [20]); Ikeda, 2012 (Japan, [37]); Yong, 2010 (Australia, [61]), Kim, 2008 (Korea, [35])
Overall incidence density	−0.5 per 1000 patient-days	
Proportion of carbapenem-resistant *Pseudomonas* spp	−22.2% to +1.5%	
MDR or carbapenem-resistant *Acinetobacter* spp		Cheon, 2016 (Korea, [31]); Chen, 2015 (Taiwan, [28]), Lew, 2015 (Singapore, [26]); Yeo, 2012 (Singapore, [22]); Kim, 2008 (Korea, [35])
Overall incidence density	−20.14 to −0.1 per 1000 patient-days −40.0 per person-years per 100 000 admissions	
Proportion of MDR or carbapenem-resistant *Acinetobacter* spp	−7.1% to +37.5%	

Box 1
Effective antibiotic stewardship program

ASP leadership team

- ID clinician ASP team leader
- Clinical ID-trained PharmDs
- Tracks and reports antibiotic use
- Conduct prospective audits to assess effectiveness of ASP interventions

Antibiotic education

- Medical staff education on optimal antibiotic therapy
- Medical staff education on antibiotic resistance
- Medical staff education on antibiotic-related *C difficile*

Administration support

- ASP personnel funding
- Dedicated IT personnel funding

Liaison relationships

- Medical microbiology laboratory on resistance
- Infection control and hospital epidemiology on containment of resistance and control of *C difficile*

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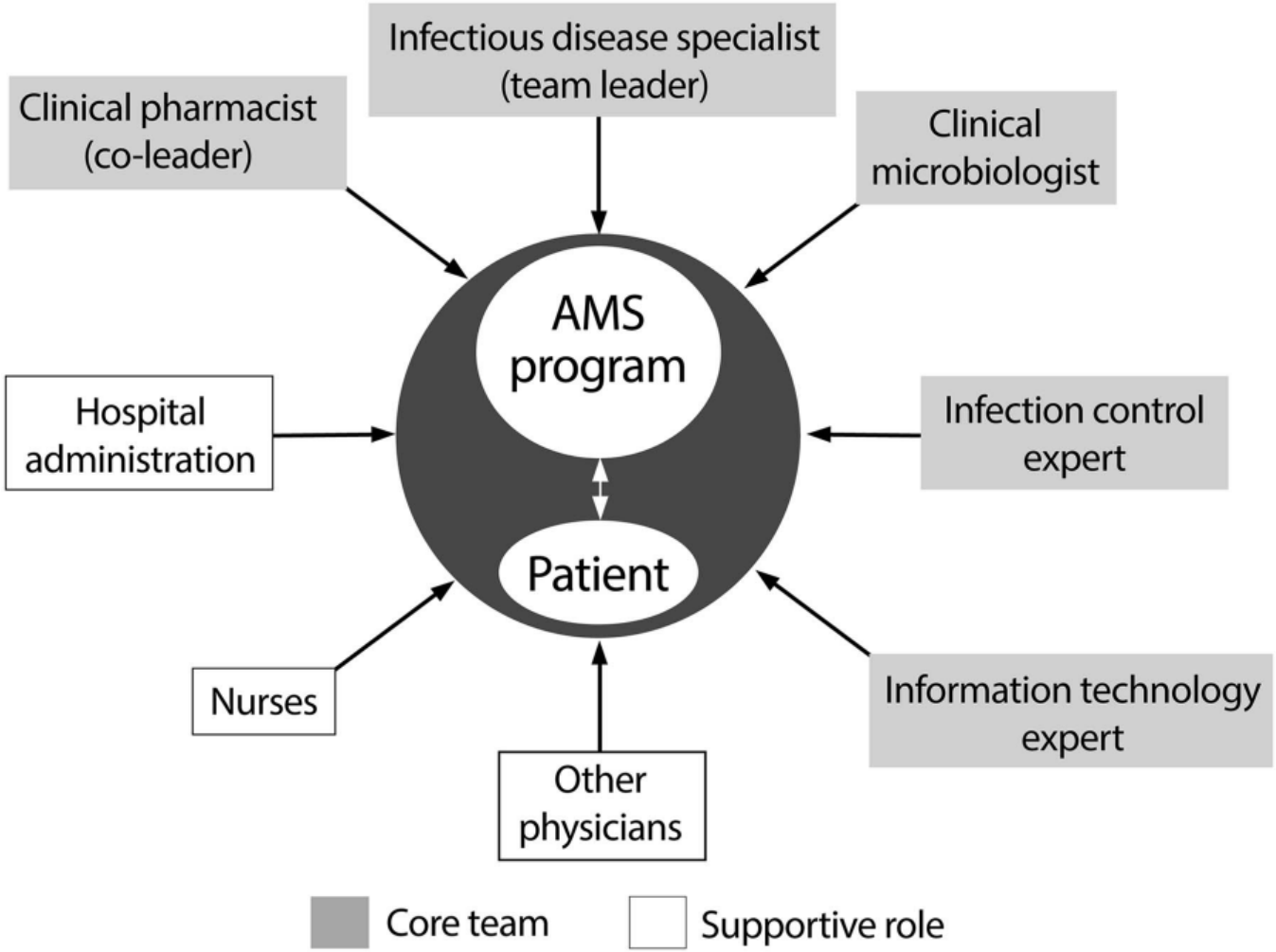
IPC is part of core team in ASP



Infection Control & Hospital Epidemiology (2018), **39**, 1237–1245

Common Gaps and Challenges in Implementing Hospital AMS Programs in Asia[a]	Potential Solutions to Overcoming Gaps in Hospital AMS Programs[b]
Lack of epidemiological data and surveillance systems	• Prioritize obtaining support for microbiology laboratory services for reliable culture-guided therapy, AMR surveillance and provision of hospital antibiograms
Lack of awareness of AMR	• Provide regular report of AMR data and AMS program performance to relevant hospital departments and hospital administration
Weak infrastructure	• If there is no infrastructure to set up IT systems to support a hospital AMS program, a paper-based system can be used in conjunction with syndrome-specific guidelines.
Insufficient education and training of hospital staff	• Obtain formal support from hospital administration for infectious disease and AMS training, and appropriate time commitment and remuneration for AMS providers based on the size of the hospital • Consider obtaining external infectious disease specialist advice and training from a more well-resourced hospital
Limited funding	• Provide hospital administrators with credible business case to persuade them that funding of an AMS program is beneficial to the hospital • Start small and build capacity over time; gradually introduce AMS interventions by hospital unit or ward
Prescriber resistance to AMS	• Provide regular feedback and education to prescribers in an easily interpreted format • Make efforts to understand the reasons for noncompliance to AMS recommendations and rectify the problems.
Poor infection control	• Include an infection control personnel in the AMS core team • AMS and infection control teams work together under the same leadership to achieve the goal of reducing the rate of multidrug-resistant infections.

Barriers	n (%)
Deficiencies in antimicrobial stewardship knowledge	10 (42)
IP	4 (16)
Pharmacist	3 (13)
Physician	3 (13)
Political/social tensions in the hospital	9 (38)
IP	3 (13)
Pharmacist	1 (4)
Physician	5 (21)
Time constraints	13 (54)
IP	5 (21)
Pharmacist	5 (21)
Physician	3 (13)
AMS is a lower priority relative to competing activities or demands	14 (58)
IP	4 (17)
Pharmacist	4 (17)
Physician	6 (25)
IP staffing levels	11 (46)
IP	4 (17)
Pharmacist	4 (17)
Physician	3 (13)
Communication difficulties between concerned groups	11 (46)
IP	3 (13)
Pharmacist	3 (13)
Physician	5 (21)
Outside of IP role definition "It's not my job"	8 (33)
IP	2 (8)
Pharmacist	2 (8)
Physician	4 (17)
No barriers exist	5 (21)
IP	2 (8)
Pharmacist	2 (8)
Physician	1 (4)

- 42% participants indicated that IPs have deficiencies in antimicrobial stewardship knowledge
- When asked whether political/ social tensions hindered IP involvement
  - 38% indicated yes and were mostly physicians (21%)
- Most common barriers
  - ASP as a lower priority (58%)
  - Time constraints (54%)
  - IP staffing levels (46%)
  - Communication difficulties (46%)
- ASP is not part of the IP role (33%)

Table 2
Antimicrobial consumption metrics

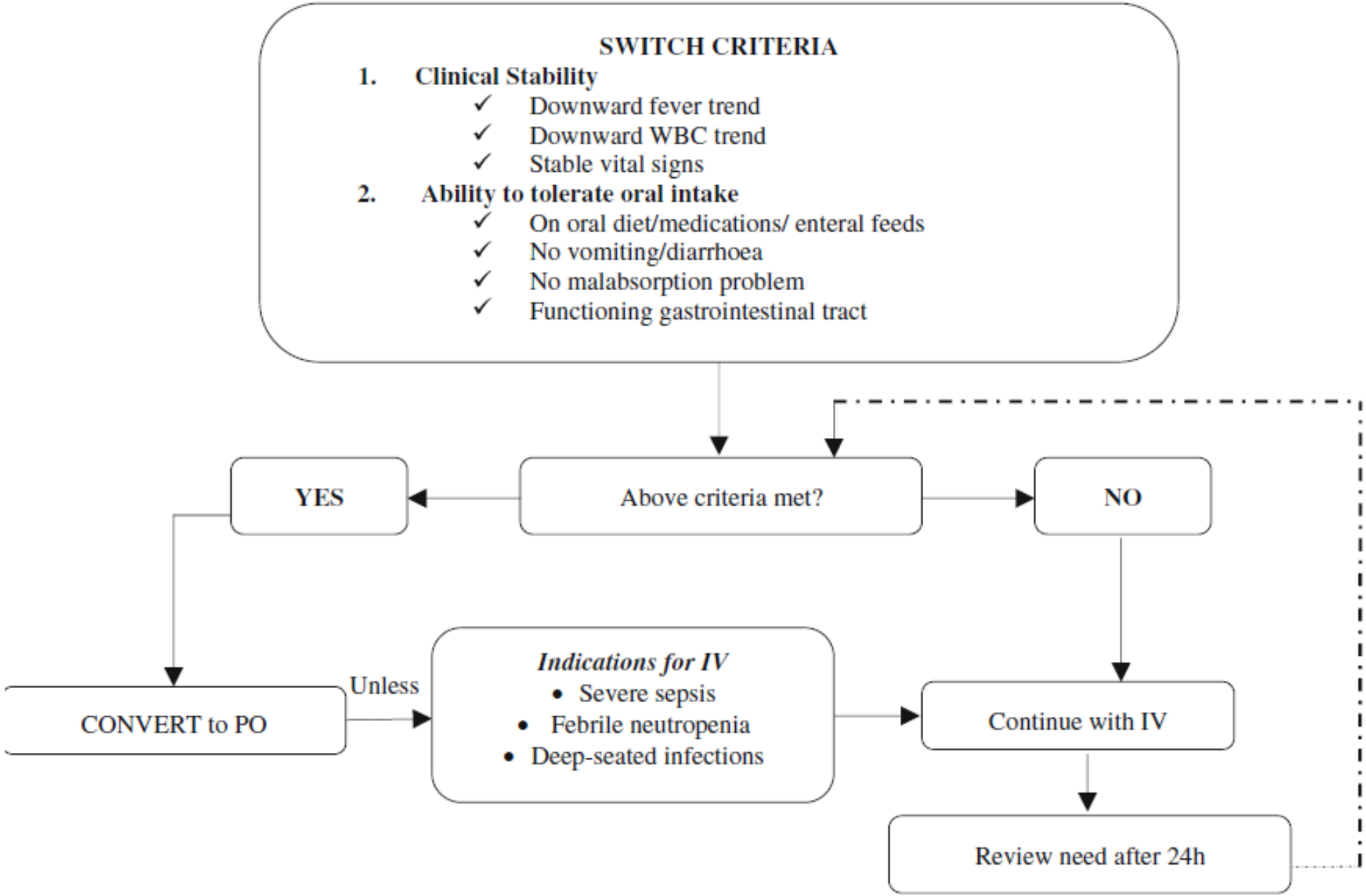
Metric	Definition	Advantages	Disadvantages
Numerator (consumption metric)			
Defined daily dose (DDD)	• Average maintenance dose per day for a drug used for its main indication in adults • Grams of antibiotic administered, purchased, or dispensed divided by WHO-assigned DDD (found on WHO Web site)	• Can be used for international benchmarking as other countries use DDD • Does not require administration data • Facilitates cost analyses	• Discrepancies between WHO-assigned DDD and dose used in practice leads to inaccurate assessment of use • Not appropriate for use in pediatric patients • Not an accurate reflection of use in renal impairment
Days of therapy (DOT)	• Aggregate sum of calendar days during which a patient received any amount of an antibiotic as documented in the eMAR and or BCMA data	• Recommended metric by IDSA/SHEA ASP guidelines • Required for participation in CDCs NHSN AU module (referred to as "antimicrobial days") • Appropriate for use in pediatric patients • Not affected by discrepancies between WHO-assigned DDD and dose used in practice	• Not as useful for international bench-marking as other countries use DDD • Not an accurate reflection of use in renal impairment • Requires administration data, which may not be obtainable in all institutions
Denominator (patient time at risk)			
Patient days	• Manual or electronic count of the number of patients in a location measured at the same time each day (ie, a daily census count at 12 AM)	• Information is readily available from infection control data • Historically the gold standard, ASPs and infection control are familiar with the metric	• May miss a partial patient day on the day of admission or discharge depending on time of daily count • Not used in CDCs NHSN module for reporting AU • Underestimates person time
Days present	• Electronic count of calendar day when a patient is present in a location for any portion of the calendar d based on ADT data	• Used in CDCs NHSN module for reporting AU • Better fit for capturing partial days	• Requires electronic capture of continuous ADT data • overestimates person time especially in units with short stays • Novel metric, ASPs and infection control are less familiar with metric

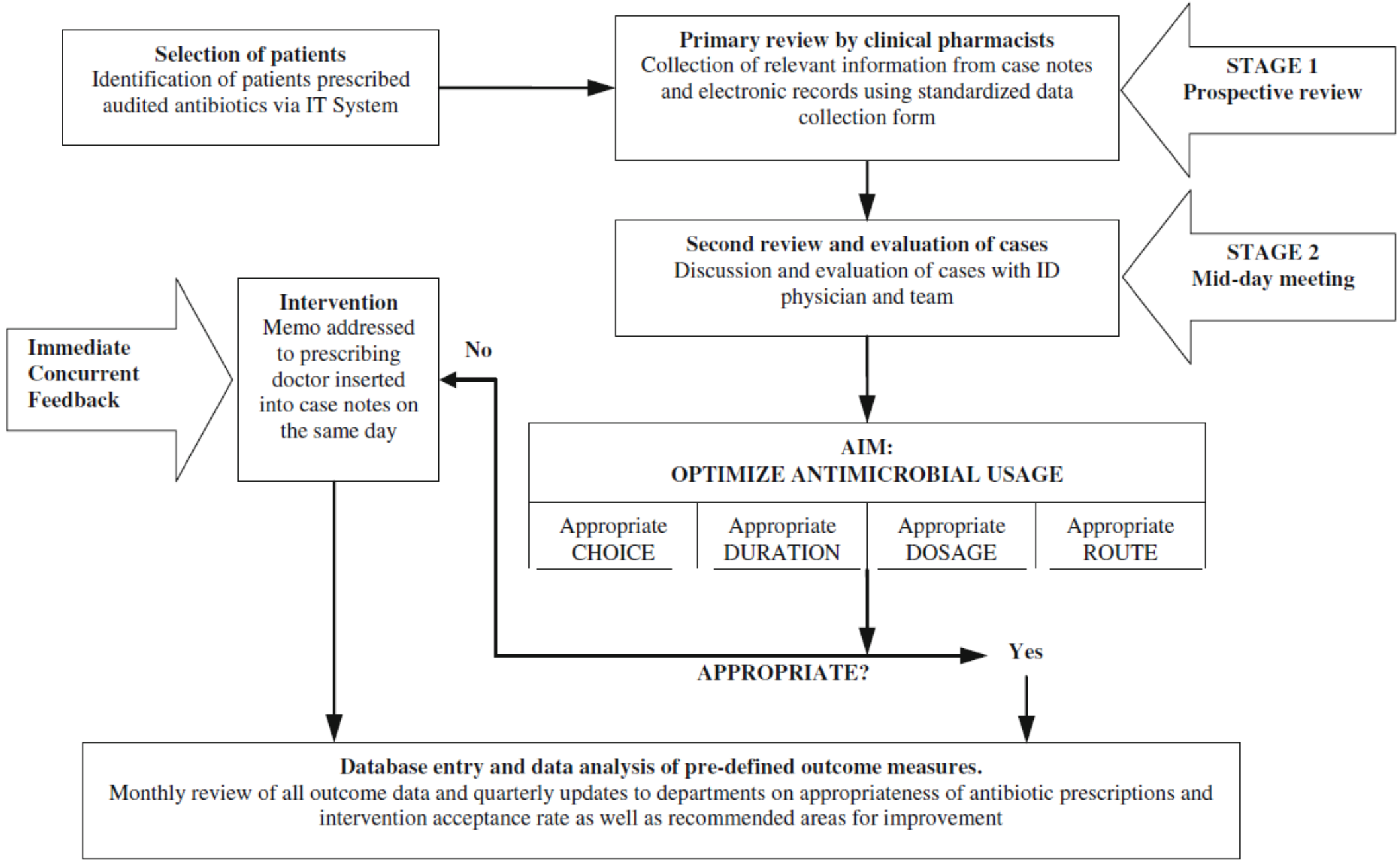
Table 3
Potential metrics for outpatient antibiotic stewardship programs

Measures	Metrics
Antimicrobial consumption	Antimicrobial prescribing rates by drug, diagnosis, and prescriber
Quality/Process	Local or national guideline compliance Unnecessary prescribing for syndromes that do not require antibiotics (eg, asymptomatic bacteriuria, viral illnesses, acute bronchitis, nonsuppurative otitis media) Vaccination rates
Clinical outcomes	Clinical and microbiologic cure Treatment failure Rate of CA-CDI Rate of drug-resistant pathogens
Unintended consequences	Adverse drug events/toxicities Rates of hospital admission, emergency department visits, or return office visits

Baby steps

- ASP program at 1600 bedded acute tertiary care hospital launched in 2008
  - One-page antibiotic guidelines for infections of major organs
  - Intravenous-to-oral (IV-to-PO) conversion algorithm to guide direct conversion or de-escalation
  - A two-stage prospective audit of selected antibiotics with immediate concurrent feedback


SWITCH CRITERIA
1. Clinical Stability
✓ Downward fever trend
✓ Downward WBC trend
✓ Stable vital signs
2. Ability to tolerate oral intake
✓ On oral diet/medications/ enteral feeds
✓ No vomiting/diarrhoea
✓ No malabsorption problem
✓ Functioning gastrointestinal tract
Above criteria met?
YES
NO
CONVERT to PO
Unless
Indications for IV
• Severe sepsis
• Febrile neutropenia
• Deep-seated infections
Continue with IV
Review need after 24h


Selection of patients
Identification of patients prescribed audited antibiotics via IT System
Primary review by clinical pharmacists
Collection of relevant information from case notes and electronic records using standardized data collection form
STAGE 1
Prospective review
Second review and evaluation of cases
Discussion and evaluation of cases with ID physician and team
STAGE 2
Mid-day meeting
Immediate
Concurrent
Feedback
Intervention
Memo addressed to prescribing doctor inserted into case notes on the same day
No
AIM:
OPTIMIZE ANTIMICROBIAL USAGE
Appropriate CHOICE
Appropriate DURATION
Appropriate DOSAGE
Appropriate ROUTE
APPROPRIATE?
Yes
Database entry and data analysis of pre-defined outcome measures.
Monthly review of all outcome data and quarterly updates to departments on appropriateness of antibiotic prescriptions and intervention acceptance rate as well as recommended areas for improvement

Cost effectiveness:

Review October 2008 – September 2010

- Overall acceptance = 77.8%
- Shorter LOS (10.2 ± 18.6 days vs 16.6 ± 21.6 days(P = 0.009)
- Daily savings of SGD 106.54 (direct savings on antibiotic cost)
- Reduction of 6.4 days in hospital stay led to a savings of SGD 6683.33 per patient

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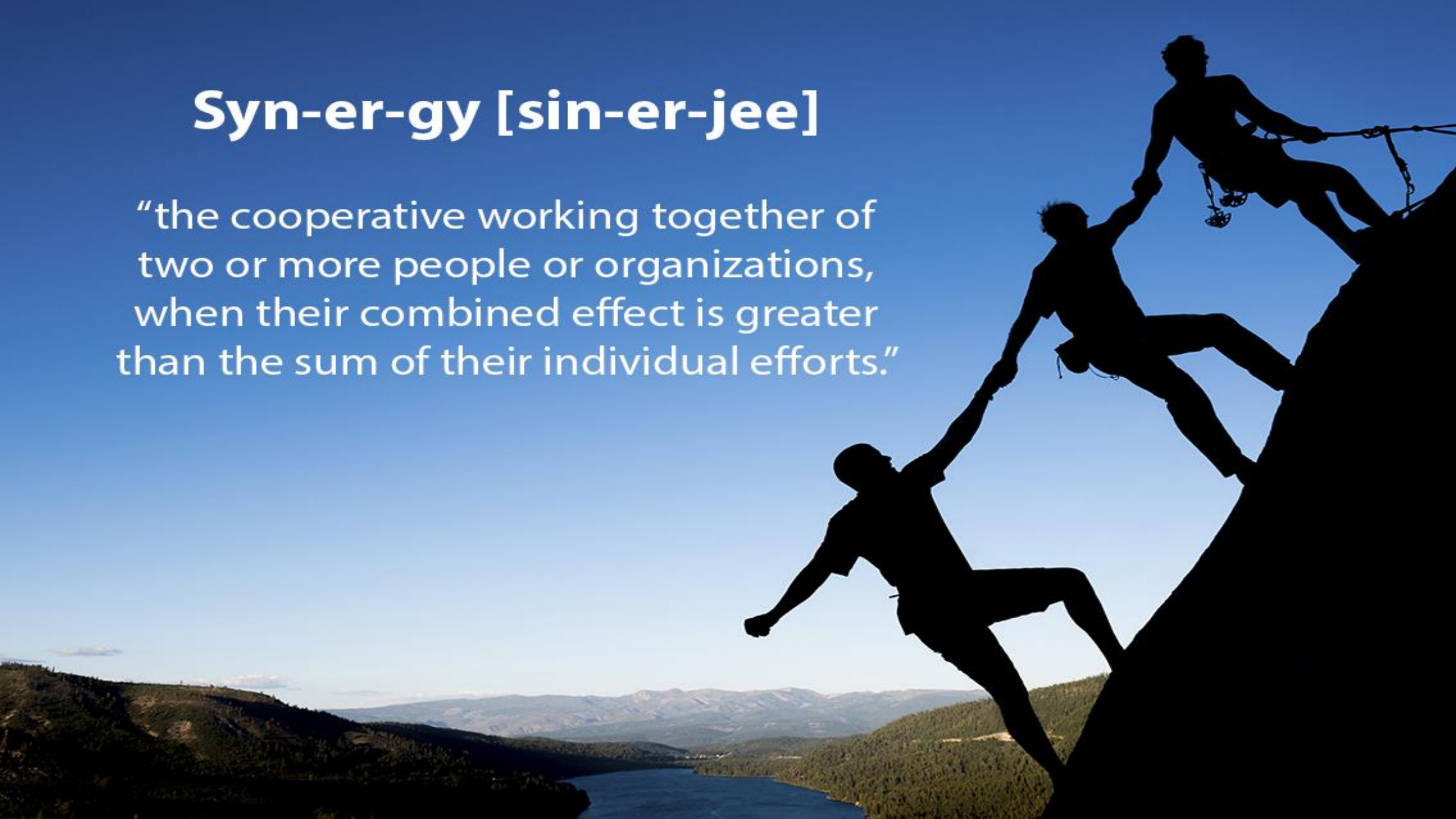
Benefits of de-escalation therapy

- Carbapenem de-escalation at a 1500-bedded hospital
  - Review from day 3 of carbapenem use

- Sep 2011 – Dec 2012
  - 68% acceptance
  - Shorter duration of carbapenem therapy (6 days vs 8 days, $p<0.001$)
  - Lower adverse drug reactions (4% vs 12.5%, $p=0.037$)
  - Lower incidence of carbapenem-resistant *Acinetobacter baumannii* acquisition (2.0% vs 7.3%, $p=0.042$)
  - Lower incidence of CDAD (1.0% vs 4.2%, $p=0.081$)

J Antimicrob Chemother 2015; 70: 1219–1225


Syn-er-gy [sin-er-jee]
"the cooperative working together of two or more people or organizations, when their combined effect is greater than the sum of their individual efforts."

Organised by:

INFECTION CONTROL ASSOCIATION (SINGAPORE)

ASIA PACIFIC SOCIETY OF INFECTION CONTROL

In collaboration with:

INFECTION CONTROL CHAPTER SINGAPORE

SOCIETY OF INFECTIOUS DISEASE (SINGAPORE)