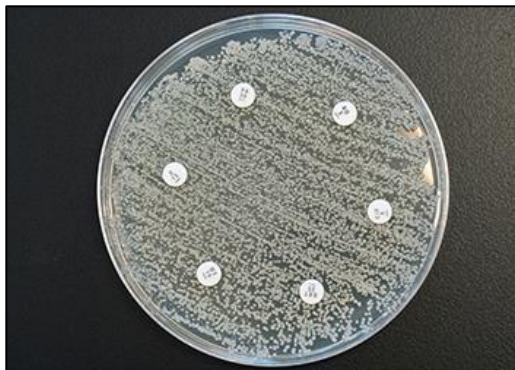# Antimicrobial Stewardship Strategy:

Identification of inappropriate pathogen/ antimicrobial combination ("bug-drug mismatch")

Identification and modification of therapy in patients with positive cultures who are receiving ineffective therapy.

@istock.com/zmeel

Priority Level: **B**

Difficulty Level: **3**

Program Stage:

- Early
- Intermediate
- ✓ Advanced

For more information on these criteria and how they were developed, please see the Antimicrobial Stewardship Strategy Criteria Reference Guide.

Description

> **This is an overview and not intended to be an all-inclusive summary. As a general principle, patients must be monitored by the health care team after changes to therapy resulting from recommendations made by the antimicrobial stewardship team.**

"Bug-drug mismatch" refers to a situation in which the antimicrobial(s) a patient is receiving do(es) not provide adequate therapy (e.g., is resistant) for the microbiologically identified organism presumed to be causing the clinical infection. For example, culture and susceptibility results of drainage from an intra-abdominal abscess may isolate *Klebsiella sp.* resistant to piperacillin/tazobactam in a patient empirically started on piperacillin/tazobactam for an intra-abdominal infection. Or a patient may be receiving intravenous ciprofloxacin for pyelonephritis, with *Escherichia coli* resistant to ciprofloxacin cultured from the blood and urine. An extreme example could include the identification of a significant organism in a clinical culture from a patient who is not receiving therapy. It is important, of course, to consider whether the organism cultured by the microbiology laboratory is of clinical significance (i.e., not colonization or contamination) when assessing therapy.

Although identification of bug-drug mismatch is part of a comprehensive assessment of a patient's therapy, it may also be performed as a standalone antimicrobial stewardship strategy.

Implementation

- Stewardship team/individual must establish a process for identifying and targeting patients with potential bug-drug mismatch. This can be facilitated by a computer program with pharmacy and microbiology interfaces. An alternative but more labour-intensive approach would be for the antimicrobial stewardship team to obtain a list of patients with positive culture results (could begin with blood cultures, and then expand to additional cultures as resources allow) and manually review current antimicrobial therapies.
- Certain commercial clinical decision support systems can facilitate the identification of bug-drug mismatch.

Bug-drug mismatch has the potential to significantly compromise patient outcomes, so communication (preferably verbal) with the prescriber is required. Messages left in the chart may not be noticed in a timely fashion.

Advantages

- Identifies patients at highest risk of therapeutic failure and subsequent morbidity and mortality.
- Because the incidence of bug-drug mismatch is generally not high, this may be an appealing strategy for a program wishing to initiate a prospective intervention, and/or for programs with fewer resources, providing the process for patient identification is not too onerous.
- Can improve the appropriateness of therapy in patients whose culture results were inadvertently overlooked, and can expedite changes to more appropriate therapy.
- Provides an opportunity to reinforce with prescribers the importance of checking final culture and susceptibility results, and using microbiologic data to modify/optimize antimicrobial prescribing.

Disadvantages

- May be labour-intensive if manual review of culture results and patient therapy is required.
- Chart review is still required for proper interpretation and assessment of the clinical issue.
- Requires ongoing resources of the antimicrobial stewardship team.
- Because the incidence of bug-drug mismatch is generally not high, the time spent identifying potential mismatches may not justify the benefits.

Requirements

- Access to microbiology results:
  - Microbiology laboratory system capable of providing a list of patients with new, positive microbiology results.
  - An integrated information technology system to identify patients with potential mismatch.
- Availability of a clinician (usually pharmacist or physician) able to assess the clinical significance of culture results and make recommendations for patients' therapy.

Associated Metrics

- Number of patients identified with bug-drug mismatch.
- Rating of potential consequences if not detected (patient safety perspective).

Useful References

Select articles to provide supplemental information and insight into the strategy described and/or examples of how the strategy was applied; not a comprehensive reference list. URLs are provided when materials are freely available on the Internet.

- Griffith M, Postelnick M, Scheetz M. Antimicrobial stewardship programs: methods of operation and suggested outcomes. Expert Rev Anti Infect Ther. 2012;10(1):63–73.

    Discusses identification of bug-drug mismatch as a stewardship intervention.

Samples/Examples

- [Example 1: Grey Bruce Health Services - Microbiology Condensed Line Listing Report](#)
- [Example 2: Royal Victoria Regional Health Centre - Pharmacy/Microbiology Report](#)
- [Example 3: The Scarborough Hospital - ICNet System Sample Automated Alerts](#)

These documents have been generously shared by various health care institutions to help others develop and build their antimicrobial stewardship programs. We recommend crediting an institution when adopting a specific tool/form/pathway in its original form.

Examples that contain clinical or therapeutic recommendations may not necessarily be consistent with published guidelines, or be appropriate or directly applicable to other institutions. All examples should be considered in the context of the institution's population, setting and local antibiogram.

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Links with Other Strategies

- [Clinical decision support systems/computerized physician order entry](#)
- [Prospective audit with intervention and feedback](#)
- [Targeted review of patients with bacteremia/fungemia](#)

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Citation

For further information

Antimicrobial Stewardship Program, Infection Prevention and Control, Public Health Ontario.

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Example 1: Grey Bruce Health Services - Microbiology Condensed Line Listing Report

```
Date: 09/23/15 06:35:15          Microbiology Condensed Line Listing Report          Id: Operations
Sequence: OS Pos Suscep Condensed Line Listing          GBRHC          Page:   1


Filter:                                                 Sort(s):
1: Date/Time - Complete - 09/22/15 00:00  -  09/23/15 23:59     1: Client [A]
2: Positive Indicator - Positive:                       2: Acsn# [A]
3: Service Resource - Owen Sound Lab, Saugeen Lab, Meaford Lab,     3: Orderable [A]
               Markdale Lab, Wiarton Lab, Lions Head Lab
4: Task Result - Susceptibility Interp Result - I, MS, NA, NS, R,
                          S

=====================================================================================================
Name:          MRN:      Receive Date:  Procedure:  Accession:        Source:      Final Isolate:
-----------------------------------------------------------------------------------------------------
               09/18/15 13:12 Culture-Wou                 Wound        MRSA,*,*,*
               09/20/15 09:07 Culture-Uri                 Urine        EC
               09/20/15 16:57 Culture-Uri                 Urine        EC
               09/20/15 09:07 Culture-Uri                 Urine        urpred1,EC
               09/20/15 09:07 Culture-Uri                 U Cath       MRSA,*
               09/19/15 17:13 Culture-Uri                 Urine        EC
               09/20/15 16:57 Culture-Uri                 Urine        EC,*
               09/20/15 16:57 Culture-Uri                 Urine        urpred1,EC
=====================================================================================================
Total accession selected:          8

********** END OF REPORT **********
```

Disclaimer

Example 2: Royal Victoria Regional Health Centre - Pharmacy/Microbiology Report

RVH
Royal Victoria
Regional Health Centre

```
DATE: 20/10/15 @ 1615        Royal Victoria Pharmacy **LIVE**               PAGE 9
USER: MCAL                   Microbiology Report
```

```
Patient [REDACTED]                    Responsible Doctor [REDACTED]
Account Number [REDACTED]    Location          Unit Number [REDACTED]
Age/Sex        [REDACTED]    Room              Registered Date
Status         ADM IN        Bed               Discharged Date
```

Rx Data

Rx Number	Medications	Dose	Directions	Start	Stop	Status
	0.9% sodium chloride	250 mL	Q12 IV	18/10	25/10	
	vancomycin	1,000 mg				
	piperacillin/tazo 3.375 g	100 mL	Q6 IV	19/10	26/10	

Microbiology Specimens

```
Specimen:                  Collected: 17/10/15-2336   Status:   RES     Req#:
                           Received:  17/10/15-2348   Source:   BLOOD   Sp Desc:

> [Blood culture]  Preliminary
      No growth after 2 days incubation
```

```
Specimen:                  Collected: 17/10/15-2336   Status:   RES     Req#:
                           Received:  17/10/15-2348   Source:   BLOOD   Sp Desc:

> [Blood culture]  Preliminary
      No growth after 2 days incubation
```

```
Specimen: [REDACTED]       Collected: 18/10/15-0145   Status:   RES     Req#:
                           Received:  18/10/15-0152   Source:   BLOOD   Sp Desc:
```

```
Specimen:                  Collected: 18/10/15-UNK    Status:   COMP    Req#:
                           Received:  18/10/15-1159   Source:   FINGER  Sp Desc: Unknown
```

	S aureus		P rettgeri	
	M.I.C.	RX	M.I.C.	RX
TRIMETH/SULFA	<=10	S	<=20	S
AMPICILLIN			<=2	R
CEFAZOLIN			<=4	R
CEFTAZIDIME			<=1	S
CEFTRIAXONE			<=1	S
CIPROFLOXACIN			<=0.25	S
CLINDAMYCIN	<=0.25	S		
ERYTHROMYCIN	<=0.25	S		
GENTAMICIN			<=1	S
ERTAPENEM			<=0.5	S
OXACILLIN	<=0.25	S		
PENICILLIN G	>=0.5	R		
TOBRAMYCIN			<=1	S
VANCOMYCIN	<=0.5	S		
PIPERA/TAZOBACT			<=4	S

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```
DATE: 20/10/15 @ 1615          Royal Victoria Pharmacy **LIVE**          PAGE 10
USER: MCAL                         Microbiology Report

Patient                           Responsible Doctor
Account Number              Location            Unit Number
Age/Sex                     Room                Registered Date
Status                      Bed                 Discharged Date
```

Wound culture Final (continued)
   Providencia rettgeri: AST-N219
   This organism may develop resistance during therapy with
   B-lactam agents. Retesting in 3-4 days is recommended.

1. Staphylococcus aureus

	Target Route Dose	RX	AB	Cost	M.I.C.	IQ
TRIMETH/SULFA		S			<=10	
CLINDAMYCIN		S			<=0.25	
ERYTHROMYCIN		S			<=0.25	
OXACILLIN		S			<=0.25	
PENICILLIN G		R			>=0.5	
VANCOMYCIN		S			<=0.5	

2. Providencia rettgeri

	Target Route Dose	RX	AB	Cost	M.I.C.	IQ
TRIMETH/SULFA		S			<=20	
AMPICILLIN		R			<=2	
CEFAZOLIN		R			<=4	
CEFTAZIDIME		S			<=1	
CEFTRIAXONE		S			<=1	
CIPROFLOXACIN		S			<=0.25	
GENTAMICIN		S			<=1	
ERTAPENEM		S			<=0.5	
TOBRAMYCIN		S			<=1	
PIPERA/TAZOBACT		S			<=4	

   This organism may develop resistance during therapy with
   B-lactam agents. Retesting in 3-4 days is recommended.

```
Specimen:           Collected: 18/10/15-UNK  Status:  COMP    Req#:
                    Received:  18/10/15-1353  Source:  NARES   Sp Desc: BOTH NARES
```

> MRSA screen Final
      NOT isolated.

```
Specimen:           Collected: 18/10/15-UNK  Status:  COMP    Req#:
                    Received:  18/10/15-1216  Source:  RECTUM  Sp Desc:
```

> MRSA screen Final
      NOT isolated.

> VRE screen Final
      NOT isolated.
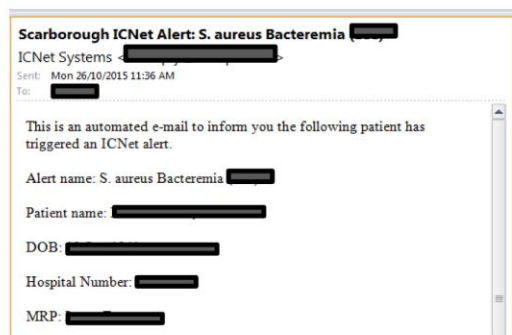
> ESBL screen Final
      NOT isolated.

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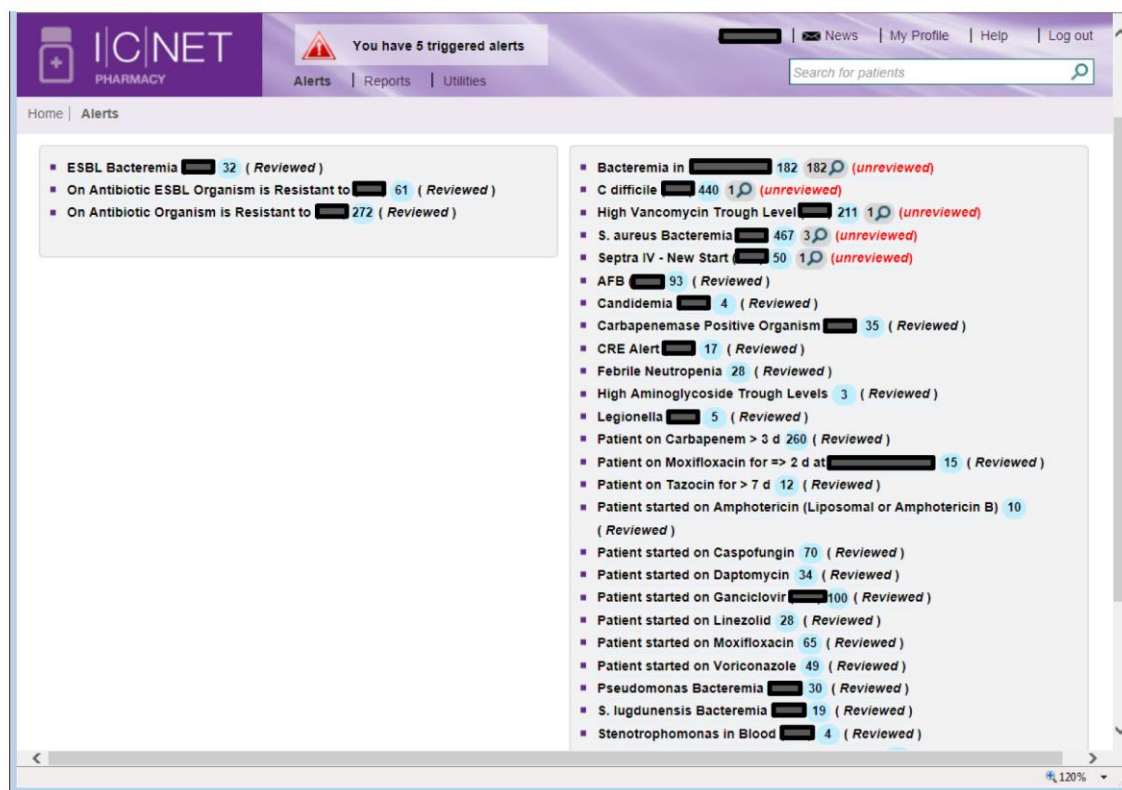
Example 3: The Scarborough Hospital - ICNet System Sample Automated Alerts

Sample Automated Email Alert for +ve cultures

Scarborough ICNet Alert: S. aureus Bacteremia ▮▮▮
ICNet Systems ◄▮▮▮▮▮▮▮▮▮►
Sent: Mon 26/10/2015 11:36 AM
To: ▮▮▮

This is an automated e-mail to inform you the following patient has triggered an ICNet alert.

Alert name: S. aureus Bacteremia ▮▮▮

Patient name: ▮▮▮▮▮

DOB: ▮▮▮▮

Hospital Number: ▮▮▮

MRP: ▮▮▮

Other alerts (browser view)

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