

# ICU patients, more likely to be admitted from and discharged to surrounding hospitals/LTACs, may impact AMR burden in the region.

## Epidemiological interaction of MRSA, ESBL *E.coli* and *C. difficile* between ICU/Step-down Unit of University-affiliated Community Hospital and LTACs in Japan: Utility of Molecular Epidemiology Analysis by PCR-based ORF Typing (POT method)

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### BACKGROUND

- Epidemiological interaction of drug resistant organisms between ICU of a tertiary-care hospital, and surrounding health facilities including LTACs is of high interest in the era of antimicrobial resistance (AMR) and aging society.
- Conventional molecular epidemiology methods such as pulsed-field gel electrophoresis (PFGE), and multilocus sequence typing are time-consuming and difficult to perform in a standard microbiology laboratory.
- PCR-based open-reading frame (ORF) Typing (POT) method, originally developed in Japan, is a more resource-friendly and time-efficient technology.
- Infection control of surrounding hospitals/LTACs can potentially impact the AMR burden of the tertiary-care hospital but its status of these facilities remains unknown.

### METHODS

- Patients admitted to 450-bed, university-affiliated community hospital in Japan in 2018/2019 were recruited if their cultures that were collected clinically during hospitalization grew the following target pathogens: Methicillin-resistant *Staphylococcus aureus* (MRSA), Vancomycin Resistant *Enterococci* (VRE), extended spectrum beta-lactamase (ESBL) Gram negative rods (GNR), carbapenem-resistant Enterobacteriaceae (CRE), multi-drug resistant *Pseudomonas* (MDRP) and *Clostridioides difficile* (*C. diff*).
- For the isolates of MRSA, ESBL *E. coli*, and *C. diff* isolated from ICU/Step-down Unit, further molecular epidemiology analysis was made, using POT method.
- Surrounding hospitals/LTACs as source of admission and/or discharge location of patients on ICU/Step-down Unit were visited, and their status of infection control was assessed, using WHO Hand Hygiene Self-Assessment Framework (HHSAF), and Infection Prevention and Control Assessment Framework (IPCAF) as validated tools.

### RESULTS

Table 1. Type of pathogens, source of admission and locations after discharge

	Total N (%)	ICU / Step-down Unit n (%)	General wards n (%)	Risk Ratio (95% CI)	p-value
Total admission	9639	1605	7801		
Target pathogens	233 (2.4)	117 (7.2)	116 (1.4)	4.90 (3.81-6.30)	<0.001
MRSA	96	55	41	6.52 (4.37-9.73)	<0.001
ESBL GNR	93	45	48	4.56 (3.04-6.82)	<0.001
<i>C. diff</i>	21	11	10	5.35 (2.27-12.57)	<0.001
CRE	13	8	5	7.78 (2.55-23.74)	<0.001
MDRP	10	5	5	4.86 (1.41-16.77)	<0.001
VRE	0	0	0	n/a	n/a
Admitted from:					
Home	180 (77.3)	85 (72.6)	95 (81.9)	ref.	
Hospitals/LTACs	53 (22.7)	32 (27.4)	21 (18.1)	1.51 (0.93-2.46)	0.09
Discharged to:*					
Home	92 (39.5)	29 (24.8)	63 (54.3)	ref.	
Hospitals/LTACs	102 (43.8)	70 (59.8)	32 (27.6)	2.01 (1.54-2.86)	<0.001

\*total 39 discharged dead excluded

Table 2. Strains analyzed by POT method among patients on ICU / Step-down Unit

	Number of strains analyzed	Number of strains identified from multiple patients	Number of patients who shared the strains
MRSA	40	8	27
ESBL <i>E.coli</i>	35	6	17
<i>C. diff</i>	8	3	7

Table 3. Surrounding hospitals/LTACs linked with ICU / Step-down Unit and their assessment of infection control at facility level

	Number / Score
Number of other hospitals/LTACs as source of admission	29
Number of other hospitals/LTACs after discharge	51
Number of other hospitals/LTACs visited and assessed by HHSAF and IPCAF	4
Median HHSAF score of hospitals/LTACs assessed*	251
Median IPCAF score of hospitals/LTACs assessed*	375

\* full-scores of HHSAF and IPCAF are 500 and 800, respectively

### PECO of this research question

- P** (participants/populations): patients admitted to university affiliated community hospital in Japan with confirmed growth of target pathogens from clinical cultures: ie. MRSA, VRE, ESBL-GNR, CRE, MDRP and *C. diff*
- E** (exposure): Admitted to ICU / Step-down Unit
- C** (comparator): Admitted to other general wards
- O** (outcomes): Admission source, Locations after discharge, Epidemiological links by POT method, Characteristics of hospitals/LTACs where the patients were admitted from and/or discharged to.

### CONCLUSIONS

- Target pathogens were more commonly isolated among patients admitted to ICU/Step-down Unit at the tertiary-care hospital in Japan.
- The source of admission and location after discharge varied. Patients on ICU/Step-down Unit were more likely to be discharged to health facilities other than home, suggesting a potential risk posed on surrounding hospitals/LTACs.
- POT method revealed some strains of the target pathogens were shared among patients on ICU/Step-down Unit, though their exact transmission route and timing remains unknown.
- Compared to the tertiary-care hospital, the scores of HHSAF and IPCAF at surrounding hospitals/LTACs may be lower, suggesting a risk of transmission of target pathogens be high.
- Further research is required to determine the impact of hospital/ICU care, and facility-level infection control on the AMR burden across facilities in the region.

