449

Epidemiologic Characteristics of Healthcare-Associated Outbreaks and Lessons Learned from Multiple Outbreak Investigations

Hajime Kanamori[1,2] MD, PhD, MPH; David J. Weber[1,2] MD, MPH; Maria F. Gergen[1], MT (ASCP); Lauren M. DiBiase[1,2] MS; Emily E. Sickbert-Bennett[1,2] PhD; MS; William A. Rutala[1,2] PhD, MPH

1) Division of Infectious Diseases, Hospital Epidemiology, University of North Carolina Health Care; 2) Division of Infectious Diseases, University of North Carolina School of Medicine, Chapel Hill, North Carolina, USA

Hajime Kanamori, MD, PhD, MPH
Assistant Professor, Department of Infection Control and Laboratory Diagnostics, Tohoku University Graduate School of Medicine
Adjunct Assistant Professor, Division of Infectious Diseases, UNC School of Medicine
Email: kanamori@med.unc.edu

Background

- Single outbreaks due to a specific pathogen(s) and a reservoir have often been reported in healthcare settings.
- Healthcare-associated outbreaks not only may affect patients' morbidity and mortality but also may have severe repercussions in healthcare operations.
- Although there are many publications of outbreak investigations in a single hospital, they are likely to be substantially affected by publication bias with larger outbreaks (e.g., novel reservoirs or routes of transmission).
- However, the frequency of multiple outbreaks at an academic hospital over time and the value of routine molecular typing have not been analyzed.
- We examined epidemiologic features of healthcare-associated outbreak investigations with a focus on the usefulness of molecular analysis.

Methods

- Healthcare-associated outbreak investigations at an academic hospital during January 2012-December 2016 were retrospectively reviewed through institutional healthcare-associated infection (HAI) data.
- The data included comprehensive hospital-wide surveillance, monthly reports to the hospital infection control committee, and reports of pulsed-field gel electrophoresis (PFGE) analysis.
- Our outbreak investigations were triggered by an increase in number of infections or pathogens above baseline rate in a unit during a specified period of time.
- A healthcare-associated outbreak evaluated by molecular typing was defined as 1) cases overlapping in time and space and 2) identification of at least 2 isolates linked by PFGE.
- Contact tracing associated with exposure investigations of a single patient (e.g., varicella, tuberculosis) were excluded from analysis.

Figure 1. Annual trends in healthcare-associated outbreaks at an academic hospital, 2012-2016

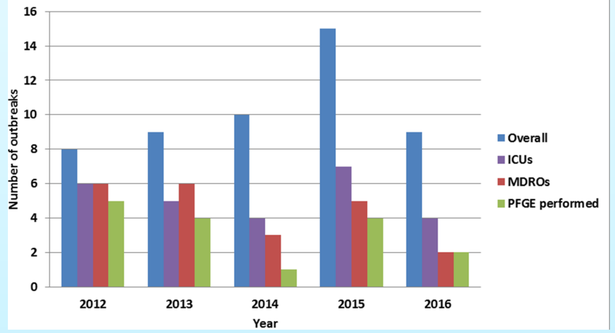


Figure 2. Frequency of pathogens involved in healthcare-associated outbreaks in ICUs (N=26)

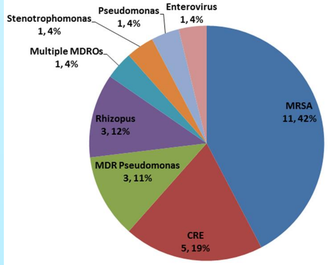
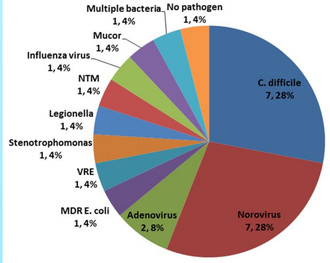


Figure 3. Frequency of pathogens involved in healthcare-associated outbreaks in non-ICUs (N=25)



Results

Table 1. Epidemiological characteristics of healthcare-associated outbreaks at an academic hospital, 2012-2016.

	Overall (N=51)		ICUs (N=26)		Non-ICUs (N=25)		ICUs vs Non-ICUs
	No.	%	No.	%	No.	%	p-value
Duration							
>2 months	21	41	19	73	2	8	<0.0001
Pathogen							
MDRO	22	43	20	77	2	8	<0.0001
C. difficile	7	14	0	0	7	28	0.0042
Norovirus	7	14	0	0	7	28	0.0042
Repeated pathogen at same location	32	63	23	88	9	36	0.0001
Infection type							
Any HAI	47	92	23	88	24	96	
Pneumonia	9	18	8	31	1	4	0.0238
Lower respiratory tract infection	6	12	6	23	0	0	0.0226
Bloodstream infection	8	16	7	27	1	4	0.0496
Urinary tract infection	3	6	2	8	1	4	
Surgical site infection	3	6	2	8	1	4	
Gastroenteritis	18	35	1	4	17	68	<0.0001
Skin and soft tissue infection	8	16	7	27	1	4	0.0496
Population							
>4 patients involved in an outbreak	29	57	16	62	13	52	
>2 staff involved in an outbreak	9	18	1	4	8	32	0.0109
Genotyping							
PFGE performed	16	31	14	54	2	8	0.0006
Control measure							
Isolation/cohorting	37	73	18	69	19	76	
Enhanced hand hygiene	20	39	12	46	8	32	
Enhanced cleaning/disinfection	29	57	11	42	18	72	0.0483
Modification of care/equipment	21	41	13	50	8	32	
Patient screening/surveillance	14	27	13	50	1	4	0.0003
Closure of affected location	7	14	0	0	7	28	0.0042
Restriction of work	7	14	0	0	7	28	0.0042

- Fifty-one healthcare-associated outbreaks (annual range 8-15), including 26 (51%) outbreaks in ICUs and 25 (49%) outbreaks in non-ICUs, and 263 infected/colonized patients (median 4, range 1-20) involved in these outbreaks were identified (Fig. 1, Table 1).
- The frequency of pathogens varied greatly by affected location, specifically multidrug-resistant organisms (MDROs) in ICUs and gastroenteritis in non-ICUs (*Clostridium difficile*, norovirus, adenovirus) (Fig. 2, 3).
- Outbreaks in ICUs significantly tended to reoccur more commonly than those in non-ICUs (P=0.0001, Table 1).
- All outbreaks were limited to approximately one-third of all units with some repeated instances of same pathogens.
- Of 16 outbreaks due to a bacterial pathogen (total 99 bacteria isolates, median 4.5, range 2-20) evaluated by PFGE, 12 (75%) included some indistinguishable strains, suggesting person-to-person transmission or a common source.
- PFGE were more frequently performed in ICU outbreaks than in non-ICU outbreaks (P=0.0006).
- A majority of outbreaks were terminated rapidly by enhanced control measures.
- Seven (14%) outbreak investigations (four caused by norovirus) led to closure of the affected location.

Conclusions

- We characterized epidemiologically multiple outbreaks over time at a single academic hospital.
- This study demonstrated significant differences in epidemiologic characteristics of multiple healthcare-associated outbreaks between ICUs and non-ICUs.
- Our analysis provided insight into the usefulness of routine molecular analysis in assessing the transmission of MDROs and understanding the epidemiology of outbreaks.
- Our findings are important to implement appropriate infection prevention against healthcare-associated outbreaks and avoid repeated cases.

October 4-8 • San Diego, CA • www.idweek.org