Nosocomial Infections Surveillance System

I. Preface

The "nosocomial infection" is limited to describing infections that acquired after admission to the hospitals, while the "healthcare-associated infection" (HAI) generally refers to those infections that occur in all settings of care, including hospitals, long-term care facilities, homecare facilities, or outpatient departments. In order to respond to continuous evolving in the contents of medical services and the expansion of surveillance range, "healthcare-associated infection" instead of "nosocomial infection" was commonly used internationally as well as in the definition of infection surveillance in the acute care settings that published by the US CDC in 2008. To monitor the occurrence of HAIs effectively, to evaluate the epidemiologic trend of HAIs in Taiwan, and to set up internationally comparable surveillance indicators, therefore all the information could be made use of collectively to serve as important references for policy making, Taiwan CDC had revised and launched the Taiwan Nosocomial Infections Surveillance System (TNIS) in 2007. Moreover, strengthening in functions and the utility of the surveillance system is continuously going on. TNIS system not only helps to gather demographic data of HAI cases and patient-specific cultures and antimicrobial susceptibility results from reporting hospitals, but also provides a format report function, so that reporting hospitals can analyze their data locally as a reference in developing quality improvement initiatives.

II. Objectives

1. Establish the epidemiological database of HAI in Taiwan
2. Discovery of HAI trends
3. Facilitation of inter- and intra-hospital comparisons that can be used for quality improvement activities
4. Assistance for hospitals in developing the appropriate surveillance mechanism that permits timely recognition of infection control problems.

III. Reporting methods, data analysis, and feedback

TNIS adopts voluntary reporting, and each hospital may provide their data either through web-based entry or convey their data electronically through interchange platform. The web-based report mechanism mainly serves for the hospitals which lack HAI surveillance system of their own. Hospital staff enters the HAI data on the TNIS website directly. The other mechanism, conveying surveillance data electronically through interchange platform, serves for the hospitals which had built their own HAI surveillance system. However, to enable interoperability between

hospital information systems (HIS) and TNIS system, infection control practitioner has to work on vocabularies mapping from local to standard codes and hospital information technology staff has to bridge the connection between the two systems and make the electronic data pack in a standard format according to the working instruction issued by Taiwan CDC. Through this mechanism, surveillance data could be routinely transferred from hospital information systems to the TNIS system automatically. This can save the hospital staff a lot of time because they would not need to repeatedly enter the data to both of hospital surveillance system and TNIS system. At present, more than 400 hospitals are reporting during 2012. Hospitals may use TNIS system to manage HAI cases and generate individual hospital reports. Also, Taiwan CDC periodically feedback hospitals with analysis report as a reference for inter- and intra-hospital comparisons, hope to facilitate hospitals to improve their quality in controlling HAIs and to safeguard the wellbeing of healthcare workers and the general public.

IV. Healthcare-associated infection surveillance data analysis content

1. TNIS hospitals in the intensive care units (ICUs) of medical centers and regional hospitals contributing data used in this report in 2012.
2. Distribution of HAI rates by type of location in the ICUs of medical centers and regional hospitals in 2012.
3. Distribution of device-associated infection rates in the ICUs of medical centers and regional hospitals in 2012.
4. Distribution of major sites of HAI in ICU patients from medical centers and regional hospitals in 2012.
5. Common pathogens of HAI for patients in the ICUs of medical centers in 2012.
6. Common pathogens of HAI for patients in the ICUs of regional hospitals in 2012.
7. Antimicrobial resistance proportions of selected pathogens of HAI in the ICUs of medical centers and regional hospitals in 2012.

V. Surveillance method and main results

Data for analysis were downloaded from the TNIS system on October 17, 2013. There were 21 medical centers and 82 regional hospitals reporting HAI data to TNIS system in 2012, the number of hospitals participated at each quarter was shown in Table 11.

This report should be considered provisional. When more information is available in TNIS system, Taiwan CDC will provide the updated analysis report of comparison and trend of years on its website as a reference for the general public.

The distributions of HAI rate ((number of HAIs/number of patient-days)×1000‰) in ICUs of medical centers and regional hospitals are shown in Table 12. There were 791,133 patient-days

with 6,542 person-times of HAI events occurred in the ICUs of 20 medical centers, the rate of infections was 8.3‰. However, in the ICUs of the 82 regional hospitals, there were 902,112 patient-days with 5,763 person-times of HAI events occurred, the rate of infections was 6.4‰. The HAI rates of ICUs were higher in medical centers than those in regional hospitals by corresponding types of ICU. The infection rate was highest in surgical ICU for medical centers (10.1‰) and highest in surgical ICU for regional hospitals (8.1‰). The distributions of device-associated infection rate in ICUs ((number of device-associated infections/ number of device-days)×1000‰) are shown in Figure 2. The median of catheter-associated urinary tract infection (CAUTI) rates was 3.5‰ in medical centers and 2.0‰ in regional hospitals, and the median of central line-associated bloodstream infection (CLABSI) rates were 4.7‰ and 2.0‰ respectively, the rate of CAUTI and the rate of CLABSI in ICUs of medical centers are higher than those in regional hospitals; the median of ventilator-associated pneumonia (VAP) rates in medical centers is similar with in regional hospitals, which are 0.6‰ and 0.5‰ respectively.

The distribution of site-specific HAIs in ICUs is shown in Table 13, with the bloodstream infections topped the list in medical centers (41.4%), followed by urinary tract (35.4%), and pneumonia (10.4%). In regional hospitals, the urinary tract infections topped the list (34.4%), followed by bloodstream infections (31.5%), and pneumonia (21.9%). The common pathogens for HAIs in ICUs are shown in Table 14 and Table 15, the top three pathogens in the ICUs were *Candida* species, *Acinetobacter baumannii*, and *Escherichia coli* in medical centers and regional hospitals. The proportions of antimicrobial resistance among selected pathogens identified from patients in the ICUs with HAIs are shown in Figure 3. In the ICUs of medical centers, the proportion of *A. baumannii* isolates those were resistant to carbapenem (CRAB) is 71.2%, the proportion of *Klebsiella pneumoniae* isolates those were resistant to carbapenem (CRKP) is 15.7%, the proportion of *P. aeruginosa* isolates those were resistant to carbapenem (CRPA) is 16.1%, the proportion of enterococci isolates those were resistant to vancomycin (VRE) is 24.4%, and the proportion of *S. aureus* isolates those were resistant to oxacillin (MRSA) is 66.9%. Meanwhile, the antimicrobial resistance proportions of selected pathogens isolated from patients acquired HAIs in the ICUs of regional hospitals were 63.0%, 11.1%, 13.9%, 21.5% and 72.6% for CRAB, CRKP, CRPA, VRE and MRSA, respectively.

VI. 2012 Data analysis of HAI in the ICUs of medical centers and regional hospitals

Table 11 TNIS hospitals in the ICUs of medical centers and regional hospitals contributing data used in this report, 2012

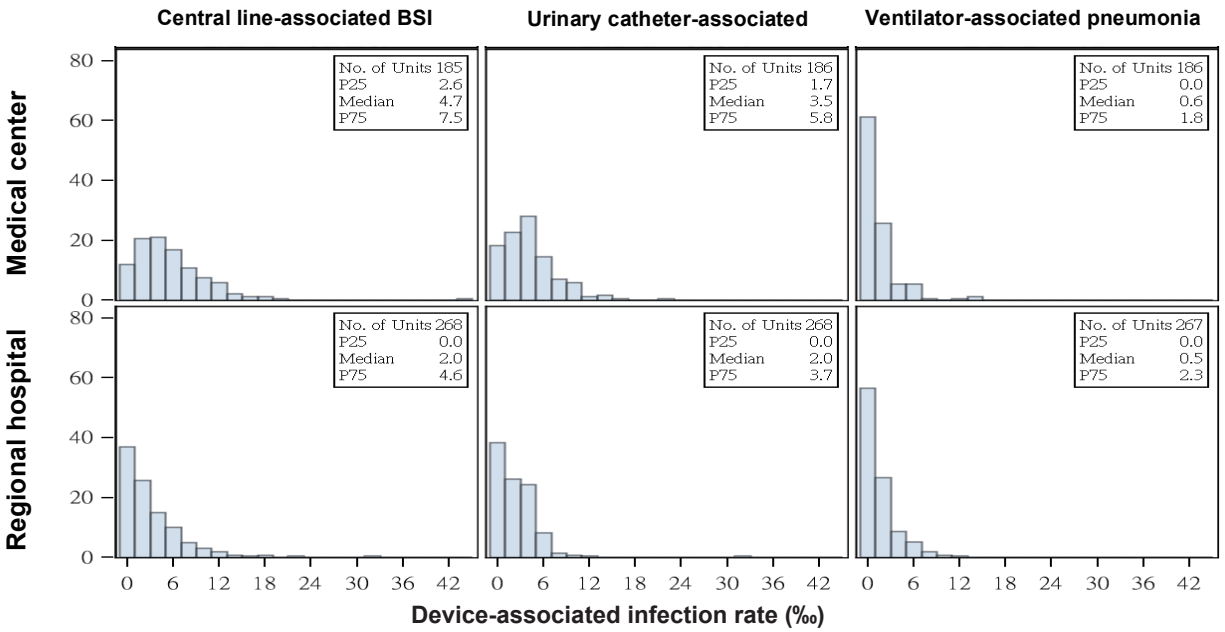
Hospital level	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs
Medical center	21	1,867	20	1,638	20	1,653	19	1,614
Regional hospital	81	1,621	81	1,458	80	1,363	81	1,406

Note: Data updated to 2013/10/17

Table 12 Distribution of healthcare-associated infection rates by type of locations in the ICUs of medical centers and regional hospitals, 2012

Hospital level	Type of locations	No. of units	No. of HAIs	Patient -days	HAI Rate* (‰)	Percentile		
						25th	50th	75th
Medical center	Medical ICU	53	2,268	240,519	9.4	6.0	8.2	12.6
	Surgical ICU	65	2,562	254,707	10.1	7.5	9.4	12.8
	Cardiology ICU	14	485	59,263	8.2	5.9	8.6	9.8
	Pediatric ICU	43	648	172,328	3.8	2.1	4.6	5.7
	Medical/surgical ICU	15	579	64,316	9.0	5.2	8.1	12.8
	Total	190	6,542	791,133	8.3			
Regional hospital	Medical ICU	59	1,514	258,649	5.9	4.3	5.9	7.7
	Surgical ICU	47	1,341	166,520	8.1	5.8	7.6	10.6
	Cardiology ICU	12	150	35,363	4.2	3.6	4.6	5.1
	Pediatric ICU	62	69	57,734	1.2	1.0	1.4	3.1
	Medical/surgical ICU	90	2,689	383,846	7.0	5.0	6.6	8.4
	Total	270	5,763	902,112	6.4			

Note: *HAI rate= (number of HAIs/number of patient-days) ×1000‰



Note:
1. device-associated infection rate= (number of HAIs/number of device-days) ×1000‰;
2. each analysis of ICU data excluded rates for units that reported more device-associated HAIs than total HAIs or more device-days than patient-days ;
3. UTI, urinary tract infection; BSI, bloodstream infection

Figure 2. Distribution of device-associated infection rates in the ICUs of medical centers and regional hospitals, 2012

Table13. Distribution of major types of healthcare-associated infection in the ICU patients from medical centers and regional hospitals, 2012

Types of infection	Medical center		Regional hospital	
	No.	%	No.	%
Urinary tract	2,397	35.4	2,014	34.4
Bloodstream	2,801	41.4	1,842	31.5
Pneumonia	706	10.4	1,279	21.9
Surgical site	338	5.0	256	4.4
Other	530	7.8	457	7.8
Total	6,772	100	5,848	100

Note: proportion of specific infection type= (number of specific infection type /number of overall infection)×100%

Table 14. Common pathogens of healthcare-associated infections in the ICUs of medical centers, 2012

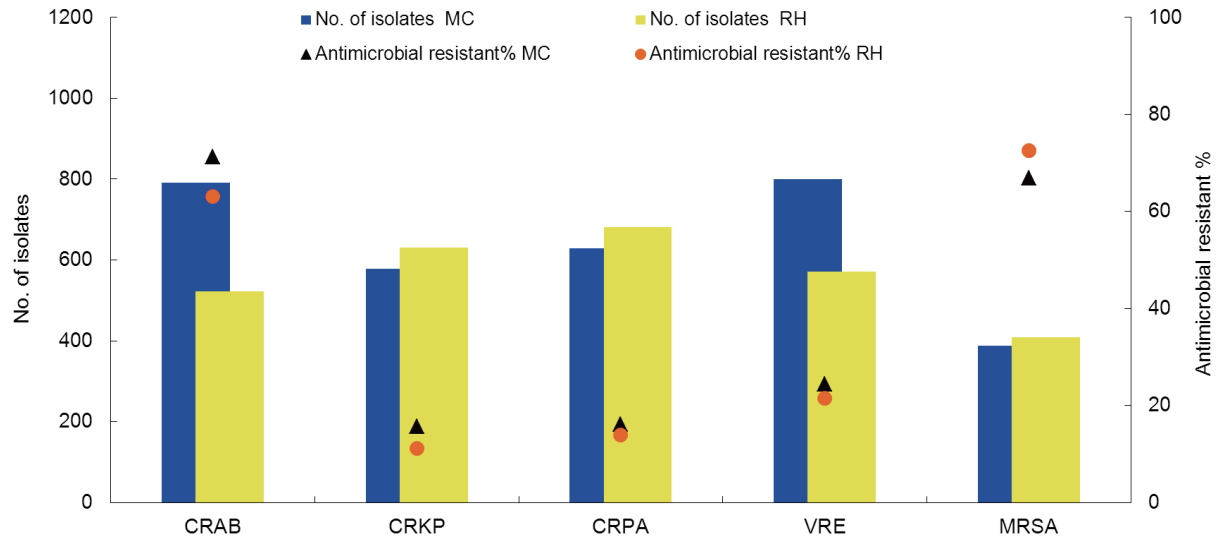
Pathogens	Total		Types of Infection									
			Urinary tract		Bloodstream		Pneumonia		Surgical site		Others	
	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.
Candida spp.	1		1		2		9		8		6	
C. albicans		620		405		157		12		14		32
Other *Candida* spp. or NOS		421		233		169		3		5		11
Acinetobacter baumannii	2	799	6	130	1	440	1	146	7	27	3	56
Escherichia coli	3	692	2	446	9	153	7	22	3	42	8	29
Pseudomonas aeruginosa	4	643	4	198	6	194	2	137	1	55	2	59
Klebsiella pneumoniae	5	608	5	183	3	267	3	91	6	32	7	35
Yeast-like	6	493	3	412	13	54	11	11	16	3	11	13
Staphylococcus aureus	7	391	10	19	4	228	4	62	5	33	4	49
Enterobacter spp.	8		7		5		6		2		9	
E. cloacae		277		48		151		29		32		17
Other *Enterobacter* spp. or NOS.		90		17		46		8		14		5
Coagulase negative staphylococci	9	313	9	21	7	174	28	1	4	40	1	77
Stenotrophomonas maltophilia	10	251	12	12	8	154	5	61	10	9	10	15
Others		1,918		504		962		116		150		186
Total	-	7,516	-	2,628	-	3,149	-	699	-	456	-	584

Note:
1. isolates of the same species of bacteria, regardless of antimicrobial susceptibility pattern, are counted only once per patient per infection. That is, no duplicate isolates are included;
2. NOS: not otherwise specified

Table 15. Common pathogens of healthcare-associated infections in the ICUs of regional hospitals, 2012

Pathogens	Total		Types of Infection									
			Urinary tract		Bloodstream		Pneumonia		Surgical site		Others	
	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.
Candida spp.	1		1		2		9		4		6	
C. albicans		622		400		123		34		28		37
Other *Candida* spp. or NOS		244		130		100		4		4		6
Acinetobacter baumannii	2	780	6	112	1	234	1	314	6	21	1	99
Escherichia coli	3	758	2	502	6	132	5	64	2	34	7	26
Pseudomonas aeruginosa	4	735	3	216	7	118	2	286	1	59	3	56
Klebsiella pneumoniae	5	710	4	187	3	222	3	216	3	32	4	53
Staphylococcus aureus	6	449	9	38	5	183	4	183	7	18	5	52
Coagulase negative staphylococci	7	299	11	18	4	191	30	2	8	17	2	71
Enterobacter spp.	8		8		8		7		5		8	
E. cloacae		205		50		86		30		20		19
Other *Enterobacter* spp. or NOS.		83		19		25		23		9		7
Yeast-like	9	199	5	113	10	57	12	15	10	7	12	7
Serratia marcescens	10	130	14	15	9	75	11	26	14	4	10	10
Others		1,597		507		560		237		129		139
Total	-	6,811	-	2,307	-	2,106	-	1,434	-	382	-	582

Note:
1. isolates of the same species of bacteria, regardless of antimicrobial susceptibility pattern, are counted only once per patient per infection. That is, no duplicate isolates are included;
2. NOS: not otherwise specified



Note:
1. Intermediate and resistant results of antibiotic susceptibility tests were categorized as antimicrobial resistant
2. CRAB: carbapenem (imipenem or meropenem)-resistant *Acinetobacter baumannii*; CRKP: carbapenem (imipenem, meropenem, or ertapenem)-resistant *Klebsiella pneumoniae*; CRPA: carbapenem (imipenem or meropenem)-resistant *Pseudomonas aeruginosa*; VRE: vancomycin-resistant enterococci (*Enterococcus faecalis*, *Enterococcus faecium*...etc.); MRSA: oxacillin-resistant *Staphylococcus aureus*.

Figure 3. Antimicrobial resistances of selected pathogens of healthcare-associated infections in the ICUs of medical centers and regional hospitals, 2012