Nosocomial Infections Surveillance Systaem

I. Introduction

The "nosocomial infection" is limited to describing infections that acquired in hospitals, while the "healthcare-associated infection" (HAI) generally refers to infections that patients acquire while receiving treatment for medical or surgical conditions. HAIs may 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. Purpose of surveillance system

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 and data analysis 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 300 hospitals are reporting during 2008, and more than 70 hospitals are working on bridging the connection between HIS and TNIS system to convey their data through interchange platform. 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 2008.
2. Distribution of HAI rates by type of location in the ICUs of medical centers and regional hospitals in 2008.
3. Distribution of device-associated infection rates in the ICUs of medical centers and regional hospitals in 2008.
4. Distribution of major sites of HAI in ICU patients from medical centers and regional hospitals in 2008.
5. Common pathogens of HAI for patients in the ICUs of medical centers in 2008.
6. Common pathogens of HAI for patients in the ICUs of regional hospitals in 2008.
7. Antimicrobial resistance proportions of selected pathogens of HAI in the ICUs of medical centers and regional hospitals in 2008.

V. Surveillance method and main results

In order to evaluate the general view of rates of HAIs and device-associated infections in Taiwan, the data source of rate distributions of HAIs and of device-associated infections in ICUs of medical centers and regional hospitals in 2008 were adopted by paper-based reports provided by all medical centers and regional hospitals, regardless it was in and not in TNIS system. Otherwise, all the analytical results in this report besides the aforesaid statement were derived from TNIS

database (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 819,556 patient-days with 9,936 person-times of HAI events occurred in the ICUs of 21 medical centers, the rate of infections was 12.1‰. However, in the ICUs of the 78 regional hospitals, there were 897,959 patient-days with 8,542 person-times of HAI events occurred, the rate of infections was 9.5‰. The HAI rates of ICUs were higher in medical centers than those in regional hospitals by corresponding types of location. The infection rate was highest in surgical ICU among all types of ICUs for medical centers and regional hospitals; the rate was 14.6‰ and 11.8‰, respectively. 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 rates of catheter-associated urinary tract infections (CAUTI) was 6.0‰ in medical centers and 4.5‰ in regional hospitals, and the central line-associated bloodstream infections (CLABSI) were 4.8‰ and 3.6‰ respectively, the rate of CAUTI and the rate of CLABSI in ICUs of medical centers are higher than those in regional hospitals; the rate of infection of ventilator-associated pneumonia in regional hospitals is higher than that in medical centers, which are 2.9‰ and 2.1‰ respectively.

There were 14 medical centers and 51 regional hospitals participated in reporting HAI cases to TNIS system in 2008. The distribution of site-specific HAIs in ICUs is shown in Table 13, with the urinary tract infections topped the list in both medical centers and regional hospitals (39.3% and 38.5% respectively), followed by bloodstream infections (31.7%), and respiratory tract infections (15.3%) in medical centers; while followed by respiratory tract infections (25.2%), and bloodstream infections(24.0%) in regional hospitals. The common pathogens for HAIs in ICUs are shown in Table 14 and Table 15, the top three pathogens in the ICUs of medical centers and regional hospitals were the same , but the order in medical centers is *Candida* species, *Acinetobacter baumannii* and *Pseudomonas aeruginosa*; whereas the order in regional hospitals is *A. baumannii*, *Candida* species and *P. aeruginosa*. 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 *S. aureus* isolates those were resistant to methicillin (MRSA) is 80.7%, the proportion of *A. baumannii* isolates those were resistant to carbapenem (CRAB) is 56.3%, the proportion of *P. aeruginosa* isolates those were resistant to carbapenem (CRPA) is 16.4%, the proportion of *enterococci* isolates those were resistant to vancomycin (VRE) is 13.0%, and the proportion of *Klebsiella pneumoniae* isolates those were resistant to carbapenem (CRKP) is 6.2%. Meanwhile, the antimicrobial resistance proportions of selected pathogens isolated from patients acquired HAIs in the ICUs of regional hospitals were 79.1%, 62.1%, 15.6%, 16.6% and 3.3% for MRSA, CRAB, CRPA, VRE and CRKP, respectively.

VI. Data analysis of healthcare-associated infections in medical centers and regional hospitals in 2008

Table 11. TNIS hospitals in the ICUs of medical centers and regional hospitals contributing data used in this report, 2008

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	14	1,448	14	1,396	14	1,445	12	1,452
Regional hospital	51	1,425	50	1,421	49	1,304	49	1,225

Note: Data updated to 2009/05/01

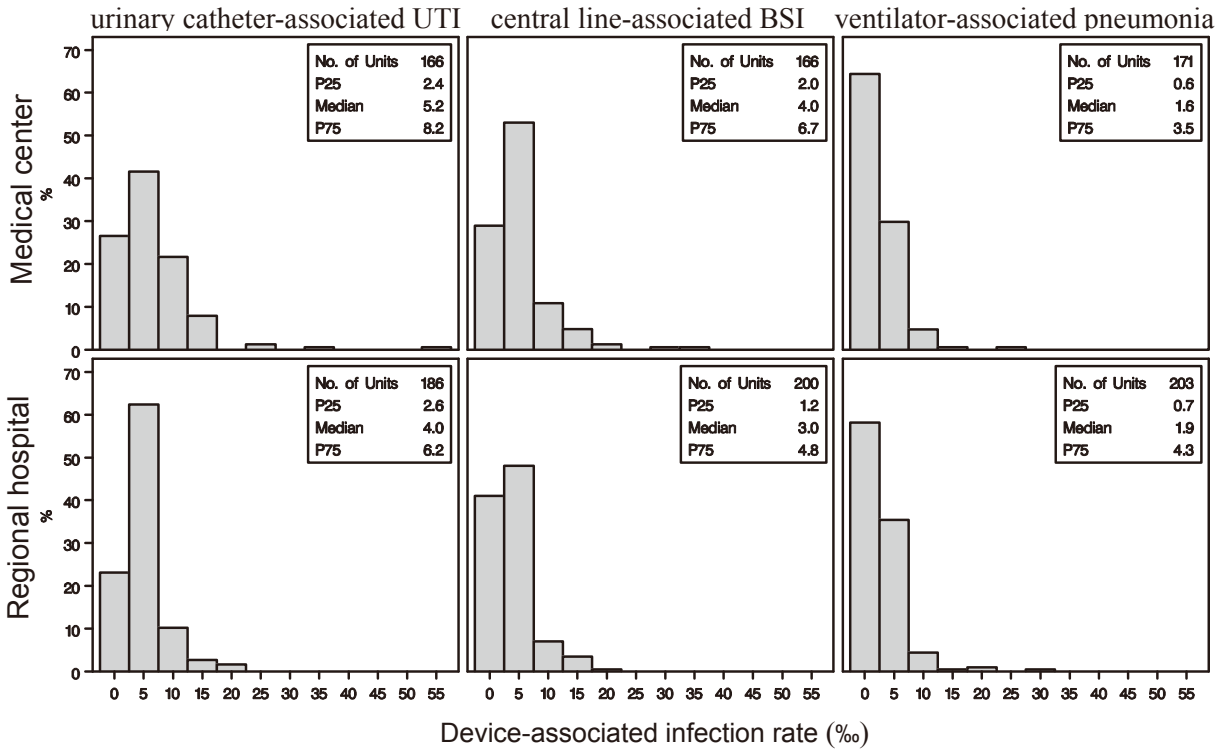
Table 12. Distribution of healthcare-associated infection rates by type of location in the ICUs of medical centers and regional hospitals, 2008

Hospital level	Type of locations	No. of units	No. of HAIs	Patient -days	Pooled mean*	Percentile		
						25%	50%	75%
Medical center	Medical ICU	50	3,279	232,393	14.1	10.1	13.2	16.7
	Surgical ICU	71	3,904	267,813	14.6	10.5	13.1	17.5
	Cardiology ICU	16	823	74,134	11.1	8.9	10.2	12.7
	Pediatric ICU	41	838	166,460	5.0	2.4	4.9	8.0
	Medical/surgical	19	1,092	78,756	13.9	9.6	12.2	17.5
	Total	197	9,936	819,556	12.1	8.0	11.6	15.3
Regional hospital	Medical ICU	56	2,349	247,723	9.5	5.5	8.5	13.2
	Surgical ICU	43	1,982	167,826	11.8	7.5	10.2	16.4
	Cardiology ICU	13	285	34,732	8.2	5.5	8.1	9.9
	Pediatric ICU	53	129	55,994	2.3	0.0	1.1	3.9
	Medical/surgical	89	3,797	391,684	9.7	6.8	9.1	11.7
	Total	256	903,697	8,542	9.5	4.9	8.0	11.7

Note:

1.Data sources were adopted by paper-based reports provided by medical centers and regional hospitals, regardless it was in not in TNIS system ;

2. healthcare-associated infection 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 did not report at least 50 device-days or reported 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, 2008

Table13. Distribution of major sites of healthcare-associated infection in the ICU patients from medical centers and regional hospitals, 2008

	Medical center		Regional hospital	
Infection site	No.	%	No.	%
Urinary tract	2,258	39.3	2,067	38.5
Bloodstream	1,822	31.7	1,292	24.0
Respiratory tract	878	15.3	1,354	25.2
Surgical site	290	5.1	216	4.0
Other	493	8.6	446	8.3
Total	5,741	100.0	5,375	100.0

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

Table 14. Common pathogens of healthcare-associated infections in the ICUs of medical centers, 2008

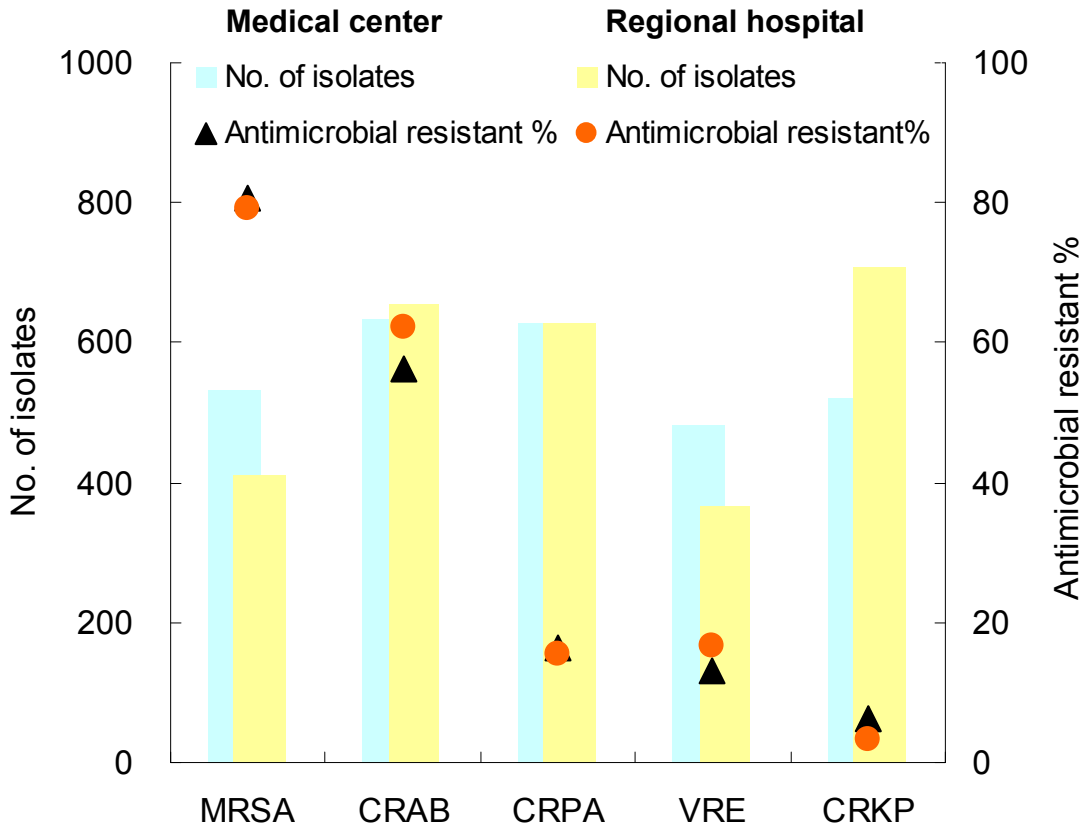
Pathogens	Total		Infection sites									
			Urinary tract		Bloodstream		Respiratory tract		Surgical site		Others	
	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.
Candida species	1		1		3		8		8		6	
C. albicans		639		462		121		17		13		26
Other *Candida* spp. or NOS		267		185		73		2		4		3
Acinetobacter baumannii	2	648	6	146	2	240	2	169	3	41	4	52
Pseudomonas aeruginosa	3	639	4	215	7	126	1	189	1	50	3	59
Escherichia coli	4	630	2	448	8	90	7	32	6	32	7	28
Staphylococcus aureus	5	546	10	28	1	253	3	116	2	42	1	107
Klebsiella pneumoniae	6	483	5	157	5	179	4	88	4	37	10	22
Yeast-like	7	367	3	279	11	43	11	11	11	7	9	27
Enterobacter species	8		7		6		6		5		8	
E. cloacae		283		74		122		35		30		22
Other *Enterobacter* spp. or NOS		62		20		20		10		7		5
Coagulase negative staphylococci	9	283	15	8	4	185	44	1	7	23	2	66
Stenotrophomonas maltophilia	10	170	13	12	9	66	5	70	9	11	12	11
Other	-	1,480	-	457	-	541	-	161	-	155	-	166
Total	-	6,497	-	2,491	-	2,059	-	901	-	452	-	594

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, 2008

Pathogens	Total		Infection sites									
			Urinary tract		Bloodstream		Respiratory tract		Surgical site		Others	
	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.
Acinetobacter baumannii	1	743	5	143	2	154	1	346	5	24	1	76
Candida species	2		1		5		9		4		6	
C. albicans		542		361		89		39		20		33
Other *Candida* spp. or NOS		191		120		56		5		6		4
Pseudomonas aeruginosa	3	715	4	213	8	67	2	336	2	38	3	61
Escherichia coli	4	667	2	453	7	81	6	70	1	39	7	24
Klebsiella pneumoniae	5	637	3	242	4	145	3	189	6	22	5	39
Staphylococcus aureus	6	495	9	38	1	204	4	155	3	30	2	68
Enterobacter species	7		8		6		8		7		8	
E. cloacae		200		66		70		36		16		12
Other *Enterobacter* spp. or NOS		63		27		14		14		2		6
Coagulase negative staphylococci	8	236	11	21	3	147	15	11	9	11	4	46
Yeast-like	9	214	6	128	9	48	13	18	15	3	9	17
Proteus species	10		7		13		11		8		11	
P. mirabilis		143		93		14		15		10		11
Other *Proteus* spp. or NOS		13		6		0		4		3		0
Other		- 1,256		- 388		- 341		- 333		- 95		- 99
Total		- 6,115		- 2,299		- 1,430		- 1,571		- 319		- 496

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. MRSA: methicillin resistant *Staphylococcus aureus*. CRAB: carbapenem (imipenem or meropenem) resistant *Acinetobacter baumannii*. CRPA: carbapenem (imipenem or meropenem) resistant *Pseudomonas aeruginosa.* VRE: vancomycin resistant enterococci *(Enterococcus faecalis, Enterococcus faecium...etc.)* . CRKP: carbapenem (imipenem, meropenem, or ertapenem) resistant *Klebsiella pneumoniae*

Figure 3. Antimicrobial resistances of selected pathogens of healthcare-associated infections in the ICUs of medical centers and regional hospitals, 2008