Nosocomial Infections Surveillance System

I. Preface

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. 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 300 hospitals are reporting during 2009. 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 2009.
2. Distribution of HAI rates by type of location in the ICUs of medical centers and regional hospitals in 2009.
3. Distribution of device-associated infection rates in the ICUs of medical centers and regional hospitals in 2009.
4. Distribution of major sites of HAI in ICU patients from medical centers and regional hospitals in 2009.
5. Common pathogens of HAI for patients in the ICUs of medical centers in 2009.
6. Common pathogens of HAI for patients in the ICUs of regional hospitals in 2009.
7. Antimicrobial resistance proportions of selected pathogens of HAI in the ICUs of medical centers and regional hospitals in 2009.

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 2009 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 830,405 patient-days with 9,359 person-times of HAI events occurred in the ICUs of 21 medical centers, the rate of infections was 11.3‰. However, in the ICUs of the 78 regional hospitals, there were 914,132 patient-days with 7,637 person-times of HAI events occurred, the rate of infections was 8.4‰. 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 medical ICU for medical centers (13.9‰) and highest in surgical ICU for regional hospitals (10.2‰). 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 5.3‰ in medical centers and 3.6‰ in regional hospitals, and the central line-associated bloodstream infections (CLABSI) were 4.6‰ and 3.1‰ 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 (VAP) in regional hospitals is higher than that in medical centers, which are 1.2‰ and 1.1‰ respectively.

There were 17 medical centers and 66 regional hospitals participated in reporting HAI cases to TNIS system in 2009. 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 (45.3% and 38.1% respectively), followed by bloodstream infections (31.1% and 28.0% respectively), and pneumonia (10.9% and 22.2% respectively). 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 *Pseudomonas aeruginosa* in medical centers; whereas there were *A. baumannii* , *Candida* species, and *Escherichia coli* in 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 *S. aureus* isolates those were resistant to methicillin (MRSA) is 77.4%, the proportion of *A. baumannii* isolates those were resistant to carbapenem (CRAB) is 59.7%, the proportion of *P. aeruginosa* isolates those were resistant to carbapenem (CRPA) is 14.9%, the proportion of *enterococci* isolates those were resistant to vancomycin (VRE) is 21.6%, and the proportion of *Klebsiella pneumoniae* isolates those were resistant to carbapenem (CRKP) is 5.8%. Meanwhile, the antimicrobial resistance proportions of selected pathogens isolated from patients acquired HAIs in the ICUs of regional hospitals were 77.9%, 69.6%, 16.7%, 16.0% and 5.8% for MRSA, CRAB, CRPA, VRE and CRKP, respectively.

VI. 2009 Data analysis of HAI in the ICUs of medical centers and regional hospitals

Table11. TNIS hospitals in the ICUs of medical centers and regional hospitals contributing data used in this report, 2009

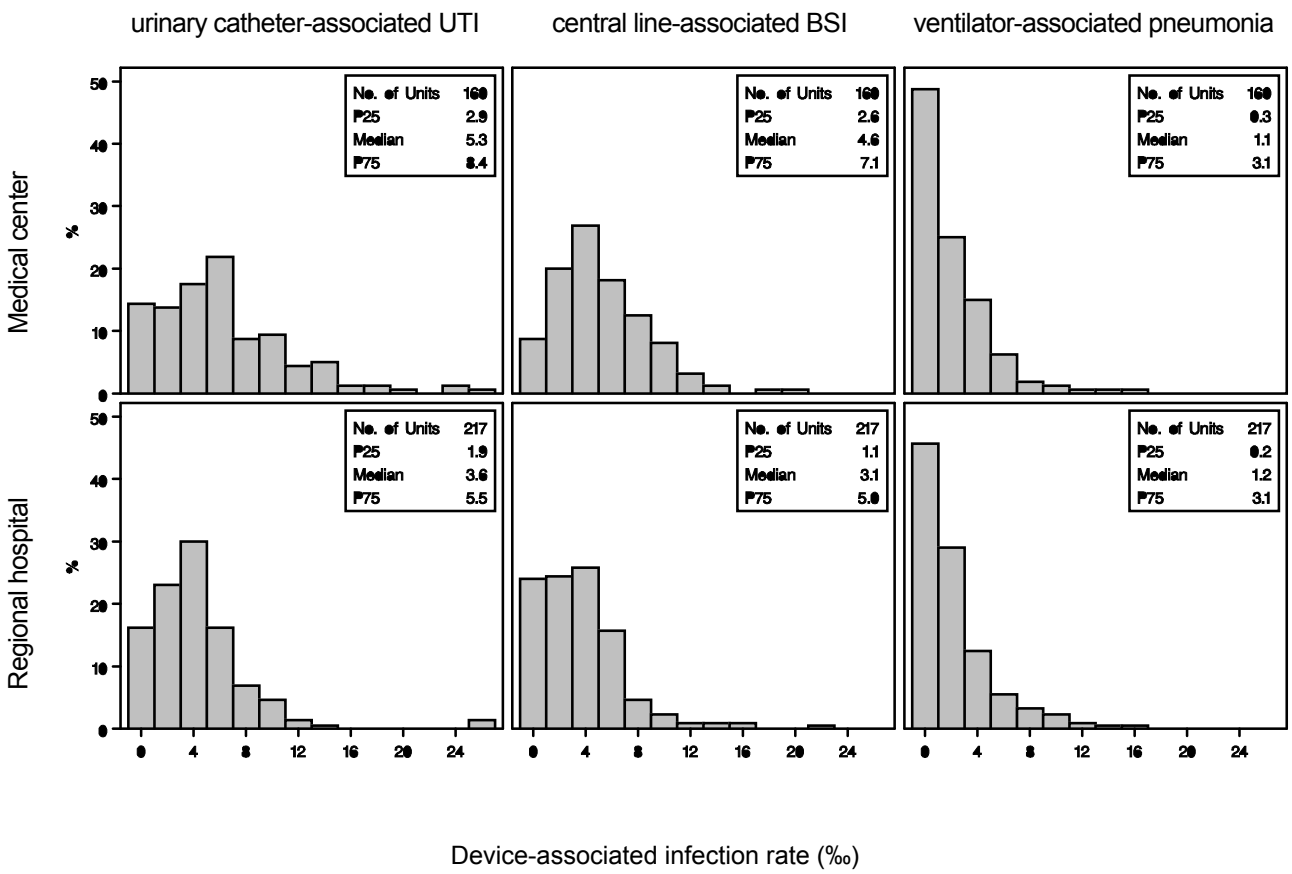
Hospital level	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs
Medical center	17	1,818	16	1,801	15	1,787	16	1,762
Regional hospital	58	1,412	57	1,315	60	1,244	60	1,254

Note: Data updated to 2010/05/01

Table 12. Distribution of healthcare-associated infection rates by type of locations in the ICUs of medical centers and regional hospitals, 2009

Hospital level	Type of locations	No. of units	No. of HAIs	Patient -days	HAI Rate*	Percentile		
						25th	50th	75th
Medical center	Medical ICU	54	3,518	253,344	13.9	10.8	13.8	16.9
	Surgical ICU	73	3,600	278,724	12.9	9.0	11.9	16.0
	Cardiology ICU	15	668	65,668	10.2	5.9	10.4	11.9
	Pediatric ICU	46	800	170,120	4.7	2.3	4.2	7.2
	Medical/surgical ICU	16	773	62,549	12.4	9.2	12.0	20.0
	Total	204	9,359	830,405	11.3	7.0	10.8	14.8
Regional hospital	Medical ICU	69	2,481	294,866	8.4	5.6	7.5	11.2
	Surgical ICU	47	1,867	183,063	10.2	6.7	9.8	12.7
	Cardiology ICU	14	237	36,849	6.4	3.6	4.9	8.4
	Pediatric ICU	61	128	65,593	2.0	0.0	0.7	2.9
	Medical/surgical ICU	81	2,924	333,761	8.8	6.2	8.1	10.2
	Total	272	7,637	914,132	8.4	3.7	7.1	10.4

Note:1.Data sources were adopted by paper-based reports provided by medical centers and regional hospitals;
2. *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, 2009

Table13. Distribution of major types of healthcare-associated infection in the ICU patients from medical centers and regional hospitals, 2009

Types of infection	Medical center		Regional hospital	
	No.	%	No.	%
Urinary tract	3,245	45.3	1,993	38.1
Bloodstream	2,230	31.1	1,461	28.0
Pneumonia	782	10.9	1,162	22.2
Surgical site	383	5.3	209	4.0
Other	528	7.4	400	7.7
Total	7,168	100.0	5,225	100.0

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, 2009

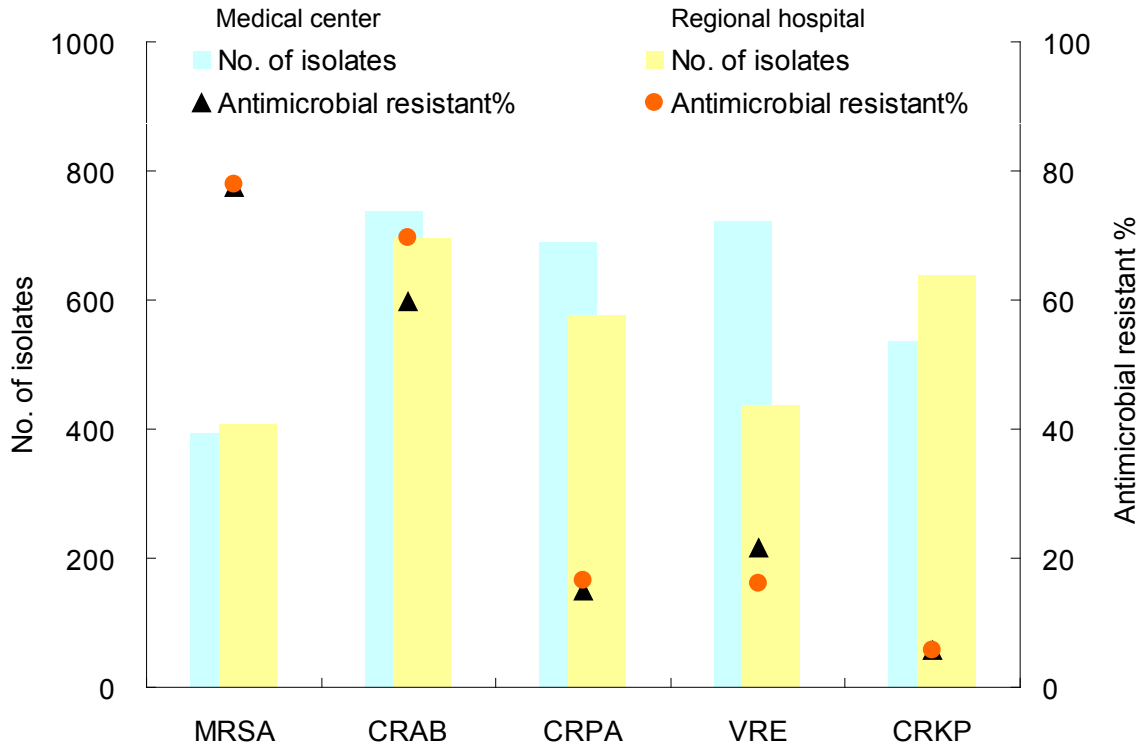
pathogens	Total		Types of Infection									
			Urinary tract		Bloodstream		Pneumonia		Surgical site		Other	
	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.
Candida species	1		1		2		9		6		8	
C. albicans		835		627		152		9		25		22
Other *Candida* spp. or NOS		463		311		134		3		6		9
Acinetobacter baumannii	2	795	6	205	1	339	2	150	8	28	3	73
Pseudomonas aeruginosa	3	764	4	303	7	159	1	164	1	77	4	61
Escherichia coli	4	761	2	541	8	108	6	30	2	51	7	31
Klebsiella pneumoniae	5	599	5	242	4	194	3	96	4	44	10	23
Yeast-like	6	481	3	408	13	28	11	8	11	13	9	24
Staphylococcus aureus	7	456	10	35	3	221	4	77	3	49	2	74
Enterobacter species	8		7		5		7		5		6	
E. cloacae		346		103		163		20		33		27
Other *Enterobacter* spp. or NOS		69		18		31		9		6		5
Coagulase negative staphylococci	9	296	12	23	6	165	26	2	7	29	1	77
Stenotrophomonas maltophilia	10	162	14	16	9	93	5	38	17	6	12	9
Others	-	2,241	-	828	-	735	-	197	-	259	-	222
Total	-	8,268	-	3,660	-	2,522	-	803	-	626	-	657

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, 2009

pathogens	Total		Types of Infection									
			Urinary tract		Bloodstream		Pneumonia		Surgical site		Other	
	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.
Acinetobacter baumannii	1	756	5	155	1	201	1	298	4	27	2	75
Candida species	2		2		2		10		7		6	
C. albicans		457		282		106		26		17		26
Other Candida spp. or NOS		205		115		74		5		1		10
Escherichia coli	3	644	1	441	8	95	7	48	1	44	8	16
Pseudomonas aeruginosa	4	630	4	218	6	107	2	217	2	35	3	53
Klebsiella pneumoniae	5	622	3	222	5	161	3	180	5	23	5	36
Staphylococcus aureus	6	450	10	22	3	171	4	155	6	22	1	80
Enterobacter species	7		8		7		6		3		7	
E. cloacae		208		49		80		44		16		19
Other *Enterobacter spp.* or NOS		58		13		17		13		12		3
Coagulase negative staphylococci	8	249	12	18	4	171	24	3	8	13	4	44
Yeast-like	9	210	6	153	11	41	23	3	16	3	10	10
Stenotrophomonas maltophilia	10	140	20	4	9	61	5	66	14	3	12	6
Others	-	1,307	-	486	-	389	-	240	-	97	-	95
Total	-	5,936	-	2,178	-	1,674	-	1,298	-	313	-	473

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, 2009