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 simple ananlytical function, so that reporting hospitals can analyze their own data on line 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 420 hospitals are reporting during 2013. Hospitals may use TNIS system to manage HAI cases and generate individual hospital reports. Also, Taiwan CDC periodically feedback hospitals with national 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 2013.
2. Distribution of HAI rates by type of location in the ICUs of medical centers and regional hospitals in 2013.
3. Distribution of device-associated infection rates in the ICUs of medical centers and regional hospitals in 2013.
4. Distribution of major sites of HAI in ICU patients from medical centers and regional hospitals in 2013.
5. Common pathogens of HAI for patients in the ICUs of medical centers in 2013.
6. Common pathogens of HAI for patients in the ICUs of regional hospitals in 2013.
7. Antimicrobial resistance proportions of selected pathogens of HAI in the ICUs of medical centers and regional hospitals in 2013.

V. Surveillance method and main results

All the analytical results in this report were derived from TNIS database. In 2013, there were 20 medical centers(192 ICU units) and 82 regional hospitals(267 ICU units) reported both HAI cases and the number of patient-days to TNIS system for at least one calendar month. (Table 11, data updated to 2014/06/16). 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 5,524 episodes of HAI events occurred during 732,607 patient-days in the ICUs of 20 medical centers, the rate of infections was 7.5‰. However, in the ICUs of the 82 regional hospitals, there were 4,878 episodes of HAI events occurred during 888,244 patient-days, the rate of infections was 5.5‰. 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 (9.0‰) and highest in surgical ICU for regional hospitals (6.9‰). 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 0.5‰ in medical centers and 0.3‰ in regional hospitals, and the median of central line-associated bloodstream infection (CLABSI) rates were 4.0‰ and 2.1‰ 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 regional hospitals is higher than that in medical centers, which are 0.5‰ and 0.3‰ respectively.

The distribution of site-specific HAIs in ICUs is shown in Table 13, with the bloodstream infections topped the list in medical centers (40.3%), followed by urinary tract (37.6%), and pneumonia (9.4%). In regional hospitals, the urinary tract infections topped the list (37.2%), followed by bloodstream infections (30.5%), and pneumonia (19.7%). 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, *Escherichia coli* and *Pseudomonas aeruginosa* in medical centers; Meanwhile, the top three pathogens in the ICUs were *Candida* species*, Escherichia coli*, *Acinetobacter baumannii* 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 *A. baumannii* isolates those were resistant to carbapenem (CRAB) is 72.9%, the proportion of *Klebsiella pneumoniae* isolates those were resistant to carbapenem (CRKP) is 15.2%, the proportion of *P. aeruginosa* isolates those were resistant to carbapenem (CRPA) is 17.6%, the proportion of enterococci isolates those were resistant to vancomycin (VRE) is 28.7%, and the proportion of *S. aureus* isolates those were resistant to oxacillin (MRSA) is 70.8%. Meanwhile, the antimicrobial resistance proportions of selected pathogens isolated from patients acquired HAIs in the ICUs of regional hospitals were 76.5%, 12.8%, 14.8%, 22.3 % and 73.3% for CRAB, CRKP, CRPA, VRE and MRSA, respectively.

VI. 2013 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, 2013

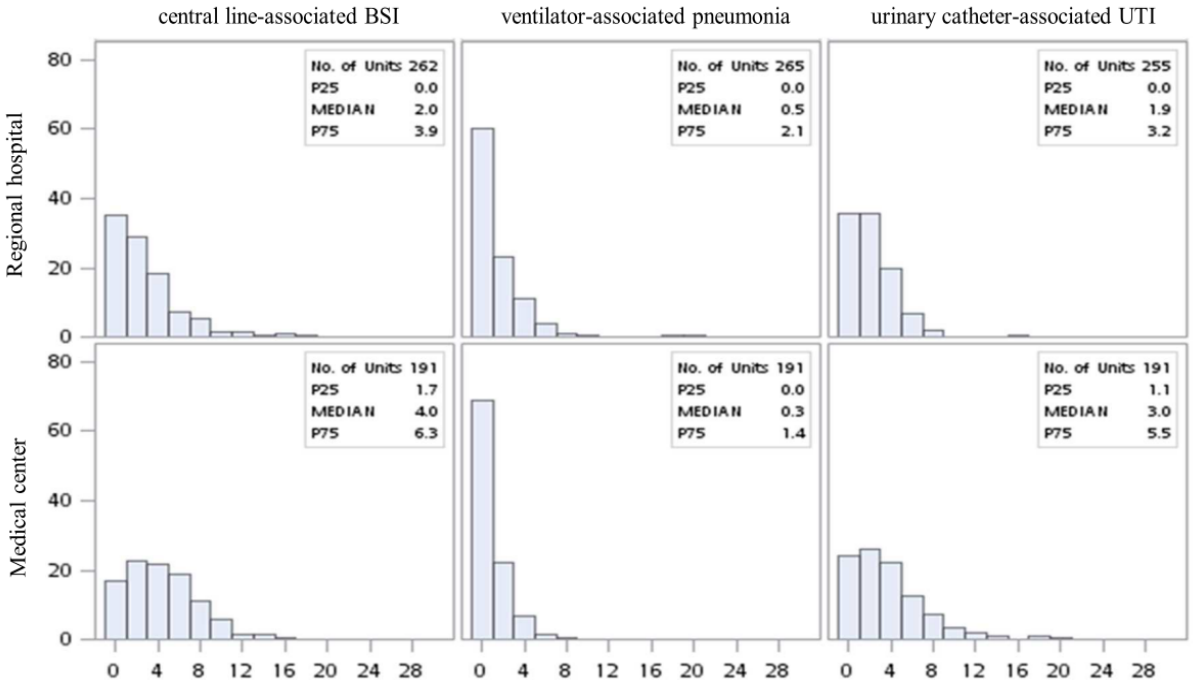
Hospital level	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs
Medical center	20	1,550	20	1,486	20	1,375	20	1,395
Regional hospital	82	1,314	82	1,257	82	1,194	82	1,201

Note: Data updated to 2014/06/16

Table 12 Distribution of healthcare-associated infection rates by type of locations in the ICUs of medical centers and regional hospitals, 2013

Hospital level	Type of locations	No. of units	No. of HAIs	Patient -days	HAI Rate* (‰)	Percentile		
						25th	50th	75th
Medical center	Medical ICU	48	1,907	211,800	9	6.6	8.6	10.8
	Surgical ICU	62	2,296	258,098	8.9	6.1	9.0	11.0
	Cardiology ICU	14	400	57,455	6.96	4.4	5.5	8.9
	Pediatric ICU	41	394	126,467	3.12	1.6	2.3	4.4
	Medical/surgical	27	527	78,787	6.69	4.1	6.6	11.1
	Total	192	5,524	732,607	7.54	4.3	7.0	10.1
Regional hospital	Medical ICU	65	1,385	283,368	4.89	2.8	4.6	6.4
	Surgical ICU	44	1,163	169,131	6.88	4.6	6.3	8.5
	Cardiology ICU	13	175	45,895	3.81	3.3	3.7	4.2
	Pediatric ICU	61	79	50,989	1.55	1.5	2.5	3.7
	Medical/surgical	84	2,076	338,861	6.13	3.9	5.3	7.6
	Total	267	4,878	888,244	5.49	3.1	4.7	7.0

Note: *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 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, 2013

Table13 Distribution of major types of healthcare-associated infection in the ICU patients from medical centers and regional hospitals, 2013

Types of infection	Medical center		Regional hospital	
	No.	%	No.	%
Urinary tract	2,183	37.6	1,847	37.2
Bloodstream	2,337	40.3	1,516	30.5
Pneumonia	547	9.4	979	19.7
Surgical site	321	5.5	242	4.9
Other	418	7.2	382	7.7
Total	5,806	100.0	4,966	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, 2013

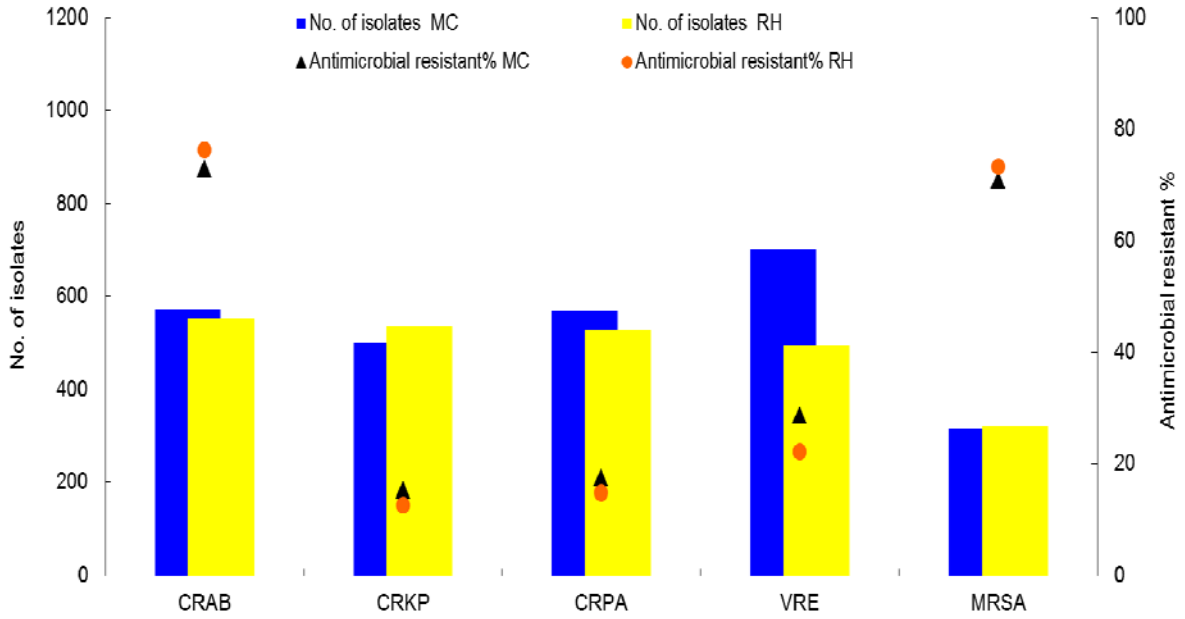
Pathogens	Total		Types of Infection									
			Urinary tract		Bloodstream		Pneumonia		Surgical site		Others	
	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.
Candida spp.	1	985	1	610	2	302	11	8	3	35	6	30
C. albicans		607		396		153		7		29		22
Other *Candida* spp. or NOS		378		214		149		1		6		8
Escherichia coli	2	630	2	444	9	108	8	16	2	36	7	26
Pseudomonas aeruginosa	3	589	4	203	5	149	1	121	1	62	1	54
Acinetobacter baumannii	4	581	6	100	1	308	2	113	6	29	5	31
Klebsiella pneumoniae	5	518	5	154	3	232	3	79	3	35	9	18
Yeast-like	6	395	3	320	14	40	9	9	11	11	10	15
Staphylococcus aureus	7	328	10	17	4	184	4	52	7	26	2	49
Enterobacter spp.	8	318	7	88	7	138	6	39	5	32	8	21
E. cloacae		251		76		107		30		24		14
Other *Enterobacter* spp. or NOS		67		12		31		9		8		7
Coagulase negative *staphylococci*	9	230	9	20	8	136	26	1	7	26	3	47
Stenotrophomonas maltophilia	10	222	16	7	6	148	5	40	9	13	14	10
Others		1,838		508		912		94		169		155
Total	-	6,634	-	2,471	-	2,657	-	572	-	474	-	460

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, 2013

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	771	1	499	2	184	9	29	6	23	6	36
C. albicans		538		365		95		28		21		29
Other *Candida* spp. or NOS		233		134		89		1		2		7
Escherichia coli	2	645	2	433	6	104	7	40	1	40	7	28
Acinetobacter baumannii	3	611	6	102	1	202	1	217	5	24	1	66
Klebsiella pneumoniae	4	600	3	194	4	155	3	184	4	29	5	38
Pseudomonas aeruginosa	5	587	4	192	7	98	2	214	1	40	3	43
Staphylococcus aureus	6	360	9	29	3	172	4	93	6	23	3	43
Enterobacter spp.	7	241	8	61	8	81	6	48	3	34	8	17
E. cloacae		166		45		58		27		25		11
Other *Enterobacter* spp. or NOS		75		16		23		21		9		6
Coagulase negative *staphylococci*	8	213	10	26	5	113	21	3	8	21	2	50
Yeast-like	9	174	5	109	11	46	14	6	13	3	9	10
Stenotrophomonas maltophilia	10	130	14	7	9	62	5	52	11	5	13	4
Others		1,307		433		502		168		107		97
Total	-	5,639	-	2,085	-	1,719	-	1,054	-	349	-	432

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. “Antimicrobial resistant %” indicates the % of Isolates with susceptibility tested to be intermediate or resistant to the antimicrobial specified.
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, 2013