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 440 hospitals are reporting during 2014. 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 2014.
2. Distribution of HAI rates by type of location in the ICUs of medical centers and regional hospitals in 2014.
3. Distribution of device-associated infection rates in the ICUs of medical centers and regional hospitals in 2014.
4. Distribution of major sites of HAI in ICU patients from medical centers and regional hospitals in 2014.
5. Common pathogens of HAI for patients in the ICUs of medical centers in 2014.
6. Common pathogens of HAI for patients in the ICUs of regional hospitals in 2014.
7. Antimicrobial resistance proportions of selected pathogens of HAI in the ICUs of medical centers and regional hospitals in 2014.

V. Surveillance method and main results

All the analytical results in this report were derived from TNIS database. In 2014, there were 20 medical centers(199 ICU units) and 83 regional hospitals(273 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 2015/08/05). 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 5,332 episodes of HAI events occurred during 773,761 patient-days in the ICUs of 20 medical centers, the rate of infections was 6.9‰. However, in the ICUs of the 83 regional hospitals, there were 4,611 episodes of HAI events occurred during 875,884 patient-days, the rate of infections was 5.3‰. The HAI rates of ICUs were

higher in medical centers than those in regional hospitals by corresponding types of ICU. The infection rates were highest in surgical ICU for both medical centers (8.4‰) and 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 pooled mean of catheter-associated urinary tract infection (CAUTI) rates was 3.8‰ in medical centers and 2.8‰ in regional hospitals, and the pooled mean of central line-associated bloodstream infection (CLABSI) rates were 4.5‰ 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 pooled mean of ventilator-associated pneumonia (VAP) rates in regional hospitals is higher than that in medical centers, which are 1.2‰ and 0.9‰ respectively.

The distribution of site-specific HAIs in ICUs is shown in Table 13, with the bloodstream infections topped the list in medical centers (39.3%), followed by urinary tract (36.0%), and pneumonia (10.6 %). In regional hospitals, the urinary tract infections topped the list (40.0%), followed by bloodstream infections (32.1%), and pneumonia (17.5%). 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 *Klebsiella pneumoniae* 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 63.7%, the proportion of *K. pneumoniae* isolates those were resistant to carbapenem (CRKP) is 14.5%, the proportion of *P. aeruginosa* isolates those were resistant to carbapenem (CRPA) is 19.6%, the proportion of enterococci isolates those were resistant to vancomycin (VRE) is 31.6%, and the proportion of *S. aureus* isolates those were resistant to oxacillin (MRSA) is 72.4%. Meanwhile, the antimicrobial resistance proportions of selected pathogens isolated from patients acquired HAIs in the ICUs of regional hospitals were 74.3%, 22.3%, 15.7%, 28.5% and 76.4% for CRAB, CRKP, CRPA, VRE and MRSA, respectively.

VI. 2014 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, 2014

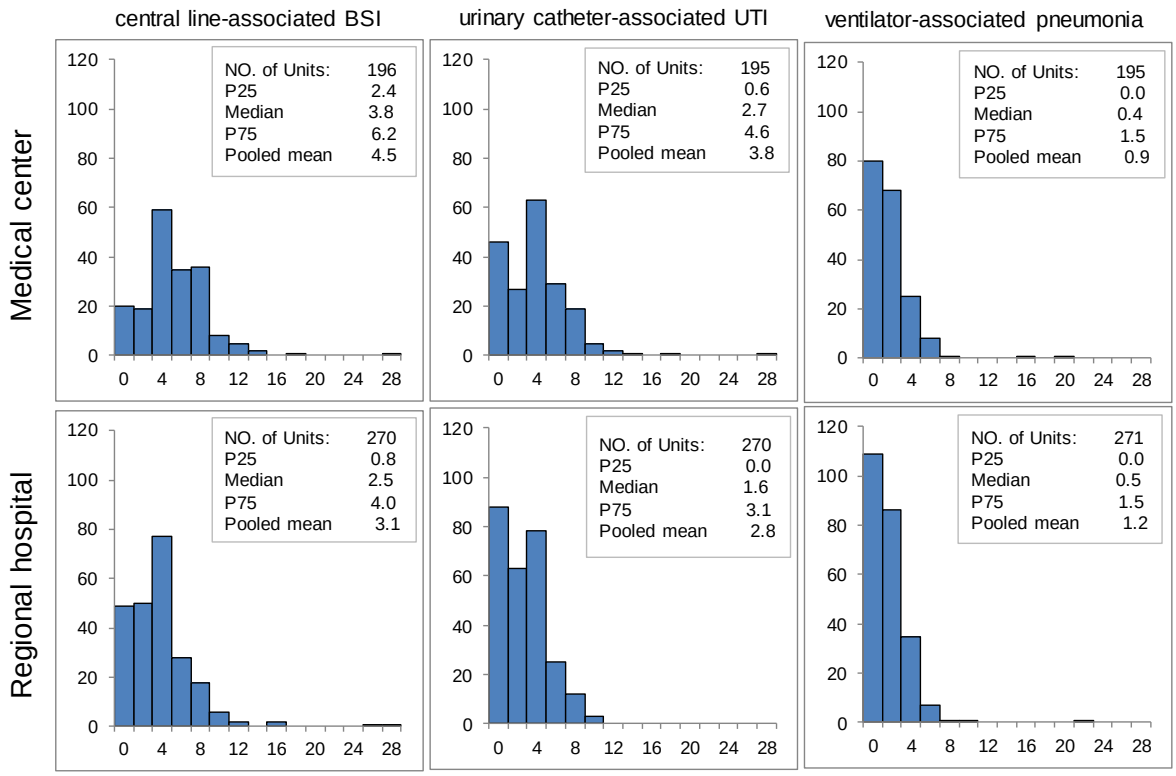
Hospital level	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs
Medical center	20	1,346	20	1,320	19	1,370	20	1,306
Regional hospital	83	1,244	82	1,181	82	1,130	83	1,120

Note: Data updated to 2015/08/05

Table 12 Distribution of healthcare-associated infection rates by type of locations in the ICUs of medical centers and regional hospitals, 2014

Hospital level	Type of locations	No. of units	No. of HAIs	Patient -days	HAI Rate* (‰)	Percentile		
						25th	50th	75th
Medical Medical center	Medical ICU	50	1,844	228,969	8.1	5.6	7.7	9.4
	Surgical ICU	60	2,176	258,682	8.4	6.6	8.4	9.7
	Cardiology ICU	14	318	58,261	5.5	3.5	4.8	7.0
	Pediatric ICU	48	535	151,855	3.5	0	2.9	4.5
	Medical/surgical ICU	27	459	75,994	6.0	3.7	6.7	8.8
	Total	199	5,332	773,761	6.9			
Regional hospital	Medical ICU	58	1,241	263,411	4.7	3.0	4.3	6.0
	Surgical ICU	45	1,211	175,787	6.9	5.3	6.1	8.1
	Cardiology ICU	13	187	44,617	4.2	2.6	3.8	4.9
	Pediatric ICU	64	68	51,102	1.3	0	0	1.1
	Medical/surgical ICU	93	1,904	340,967	5.6	2.8	4.6	6.6
	Total	273	4,611	875,884	5.3			

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



Note: 1. horizontal axis is device-associated infection rate, vertical axis is number of units; 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, 2014

Table13 Distribution of major types of healthcare-associated infection in the ICU patients from medical centers and regional hospitals, 2014

Types of infection	Medical center		Regional hospital	
	No.	%	No.	%
Urinary tract	1,921	36.0	1,872	40.0
Bloodstream	2,099	39.3	1,500	32.1
Pneumonia	567	10.6	818	17.5
Surgical site	330	6.2	220	4.7
Other	425	8.0	265	5.7
Total	5,342	100	4,675	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, 2014

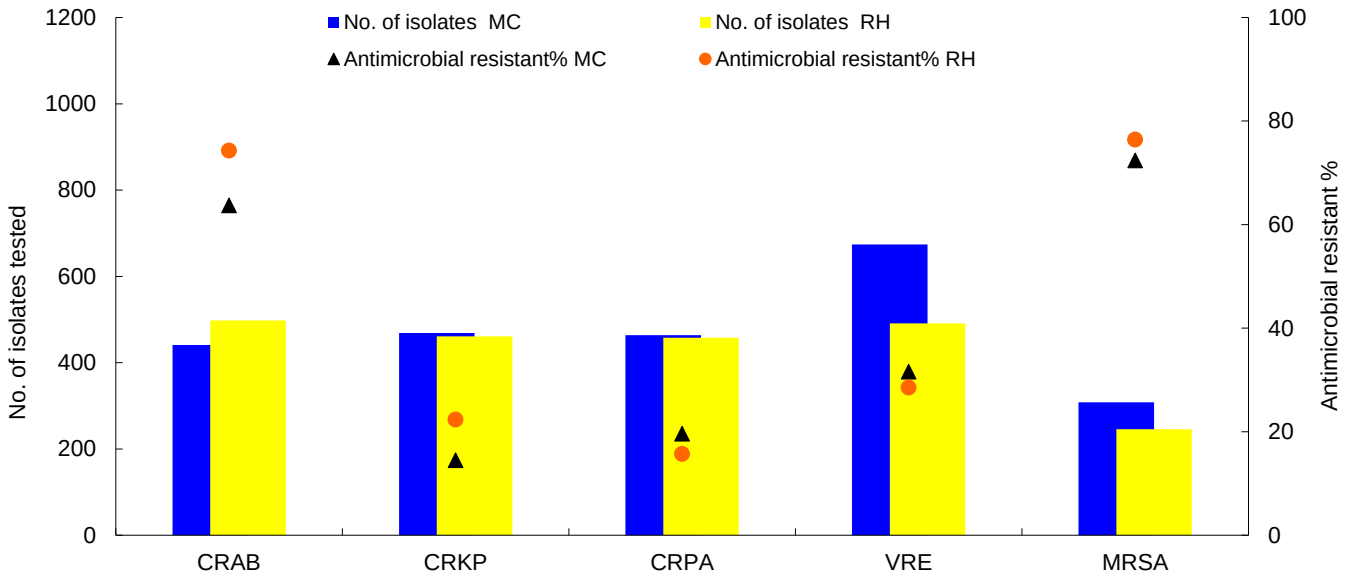
Pathogens	Total		Types of Infection									
			Urinary tract		Bloodstream		Pneumonia		Surgical site		Others	
	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.
Candida spp.	1	935	1	538	1	310	8	15	5	29	3	43
C. albicans		557		344		143		13		23		34
Other *Candida spp.* or NOS		378		194		167		2		6		9
Escherichia coli	2	611	2	420	9	102	7	17	2	52	8	20
Klebsiella pneumoniae	3	482	5	115	3	201	3	104	3	34	7	28
Pseudomonas aeruginosa	4	466	4	151	7	107	1	119	1	58	6	31
Acinetobacter baumannii	5	444	6	75	2	218	2	106	9	13	5	32
Yeast-like	6	414	3	324	13	60	13	5	13	5	8	20
Staphylococcus aureus	7	316	12	16	4	154	4	54	3	34	2	58
Enterobacter spp.	8	271	7	55	5	135	6	35	6	27	10	19
E. cloacae		199		42		103		21		19		14
Other *Enterobacter spp.* or NOS		72		13		32		14		8		5
Coagulase negative *staphylococci*	9	220	9	21	6	115			7	20	1	64
Stenotrophomonas maltophilia	10	166	14	10	8	103	5	40	11	9	12	4
Others		1,774		447		885		89		182		171
Total	-	6,099	-	2,172	-	2,390	-	584	-	463	-	490

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, 2014

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	839	1	575	1	182	7	32	6	23	4	27
C. albicans		591		424		100		28		19		20
Other *Candida spp.* or NOS		248		151		82		4		4		7
Escherichia coli	2	589	2	427	7	84	6	33	3	37	9	8
Acinetobacter baumannii	3	565	5	118	3	174	1	217	7	21	1	35
Klebsiella pneumoniae	4	546	4	179	2	175	3	135	4	35	7	22
Pseudomonas aeruginosa	5	512	3	184	6	100	2	163	2	39	5	26
Staphylococcus aureus	6	277	11	18	4	135	4	67	5	25	2	32
Enterobacter spp.	7	239	7	54	8	83	5	39	1	40	6	23
E. cloacae		175		38		66		28		27		16
Other *Enterobacter spp.* or NOS		64		16		17		11		13		7
Coagulase negative *staphylococci*	8	198	9	28	5	122	27	1	8	17	3	30
Yeast-like	9	152	6	98	11	37	15	4	11	4	8	9
Serratia marcescens	10	115	13	7	9	68	10	27	10	6	11	7
Others		1,313		445		537		150		109		72
Total	-	5,345	-	2,133	-	1,697	-	868	-	356	-	291

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, 2014