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 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 2010. 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 2010.
2. Distribution of HAI rates by type of location in the ICUs of medical centers and regional hospitals in 2010.
3. Distribution of device-associated infection rates in the ICUs of medical centers and regional hospitals in 2010.
4. Distribution of major sites of HAI in ICU patients from medical centers and regional hospitals in 2010.
5. Common pathogens of HAI for patients in the ICUs of medical centers in 2010.
6. Common pathogens of HAI for patients in the ICUs of regional hospitals in 2010.
7. Antimicrobial resistance proportions of selected pathogens of HAI in the ICUs of medical centers and regional hospitals in 2010.

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 2010 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 830,180 patient-days with 7,761 person-times of HAI events occurred in the ICUs of 21 medical centers, the rate of infections was 9.3‰. However, in the ICUs of the 84 regional hospitals, there were 987,746 patient-days with 7,156 person-times of HAI events occurred, the rate of infections was 7.2‰. 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 (11.1‰) and highest in surgical ICU for regional hospitals (8.8‰). 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 4.0‰ in medical centers and 2.7‰ in regional hospitals, and the median of central line-associated bloodstream infection (CLABSI) rates were 4.7‰ and 2.7‰ 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 1.2‰ and 0.9‰ respectively.

There were 20 medical centers and 84 regional hospitals participated in reporting HAI cases to TNIS system in 2010. The distribution of site-specific HAIs in ICUs is shown in Table 13, with the bloodstream infections infections topped the list in medical centers (37.7%), followed by urinary tract (36.8%), and pneumonia (12.1%). In regional hospitals, the urinary tract infections topped the list (35.3%), followed by bloodstream infections (29.3%), and pneumonia (21.5%). 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, *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 *A. baumannii* isolates those were resistant to carbapenem (CRAB) is 66.8%, the proportion of *Klebsiella pneumoniae* isolates those were resistant to carbapenem (CRKP) is 11.5%, the proportion of *P. aeruginosa* isolates those were resistant to carbapenem (CRPA) is 18.2%, the proportion of enterococci isolates those were resistant to vancomycin (VRE) is 23.6%, and the proportion of *S. aureus* isolates those were resistant to oxacillin (MRSA) is 76.7%. Meanwhile, the antimicrobial resistance proportions of selected pathogens isolated from patients acquired HAIs in the ICUs of regional hospitals were 73.1%, 6.9%, 19.7%, 15.5% and 76.5% for CRAB, CRKP, CRPA, VRE and MRSA, respectively.

VI. 2010 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, 2010

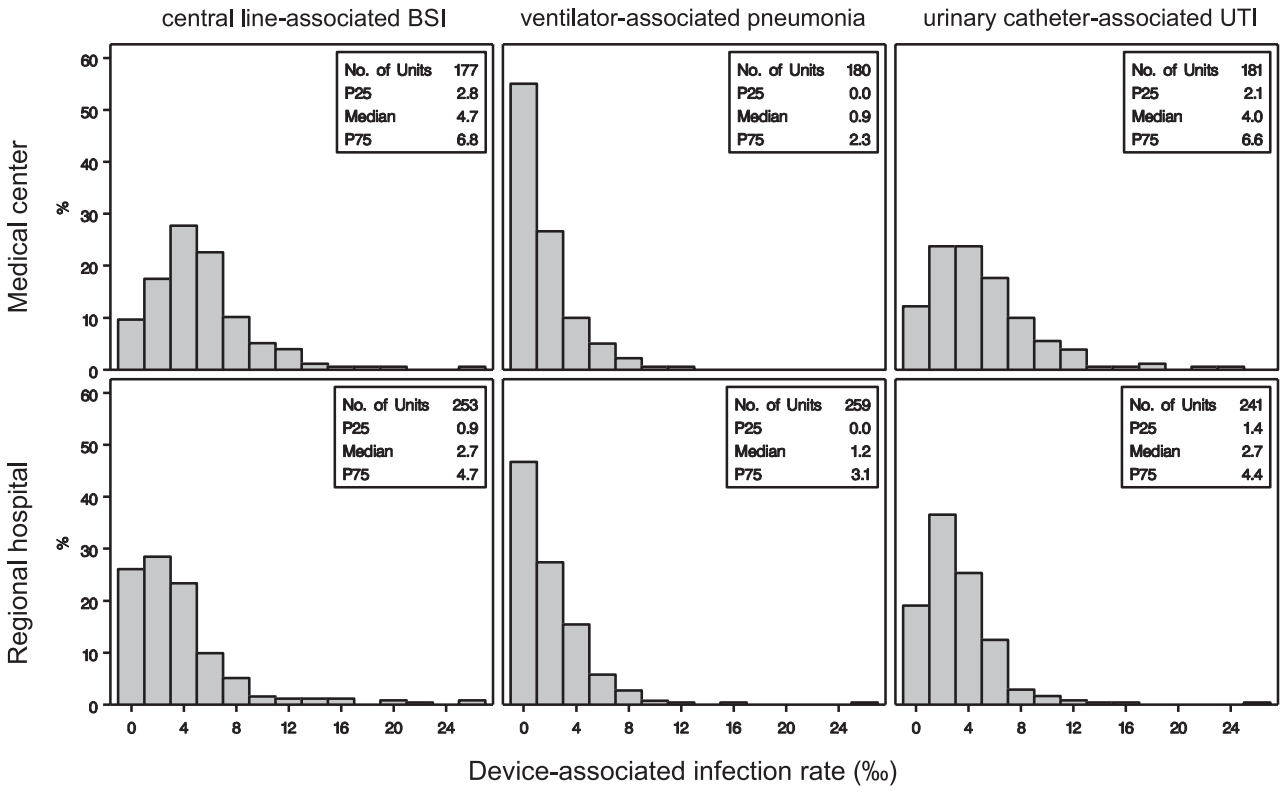
Hospital level	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs	No. of hospitals	No. of HAIs
Medical center	20	1,687	20	1,705	20	1,716	20	1,699
Regional hospital	81	1,636	83	1,676	81	1,656	82	1,752

Note: Data updated to 2011/05/24

Table 12 Distribution of healthcare-associated infection rates by type of locations in the ICUs of medical centers and regional hospitals, 2010

Hospital level	Type of locations	No. of units	No. of HAIs	Patient -days	HAI Rate* (‰)	Percentile		
						25	50	75
Medical center	Medical ICU	54	2,757	248,038	11.1	7.7	10.5	13.4
	Surgical ICU	73	3,046	282,354	10.8	7.4	9.5	14.0
	Cardiology ICU	15	510	64,806	7.9	5.8	7.5	10.1
	Pediatric ICU	44	675	161,965	4.2	2.7	4.0	5.9
	Medical/surgical ICU	16	773	73,017	10.6	7.5	9.4	15.2
	Total	202	7,761	830,180	9.3	5.8	8.6	12.3
Regional hospital	Medical ICU	71	2,348	320,827	7.3	4.9	7.4	10.1
	Surgical ICU	50	1,650	186,846	8.8	5.9	8.4	10.5
	Cardiology ICU	13	190	41,095	4.6	2.9	3.7	4.9
	Pediatric ICU	63	75	56,172	1.3	0.0	0.0	2.1
	Medical/surgical ICU	99	2,893	382,806	7.6	5.0	7.1	9.8
	Total	296	7,156	987,746	7.2	2.8	6.2	9.0

Note: 1. Data sources were adopted by paper-based reports provided by medical centers and regional hospitals;
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 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, 2010

Table13 Distribution of major types of healthcare-associated infection in the ICU patients from medical centers and regional hospitals, 2010

Types of infection	Medical center		Regional hospital	
	No.	%	No.	%
Urinary tract	2,505	36.8	2,370	35.3
Bloodstream	2,563	37.7	1,970	29.3
Pneumonia	823	12.1	1,446	21.5
Surgical site	342	5.0	309	4.6
Other	574	8.4	625	9.3
Total	6,807	100.0	6,720	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,2010

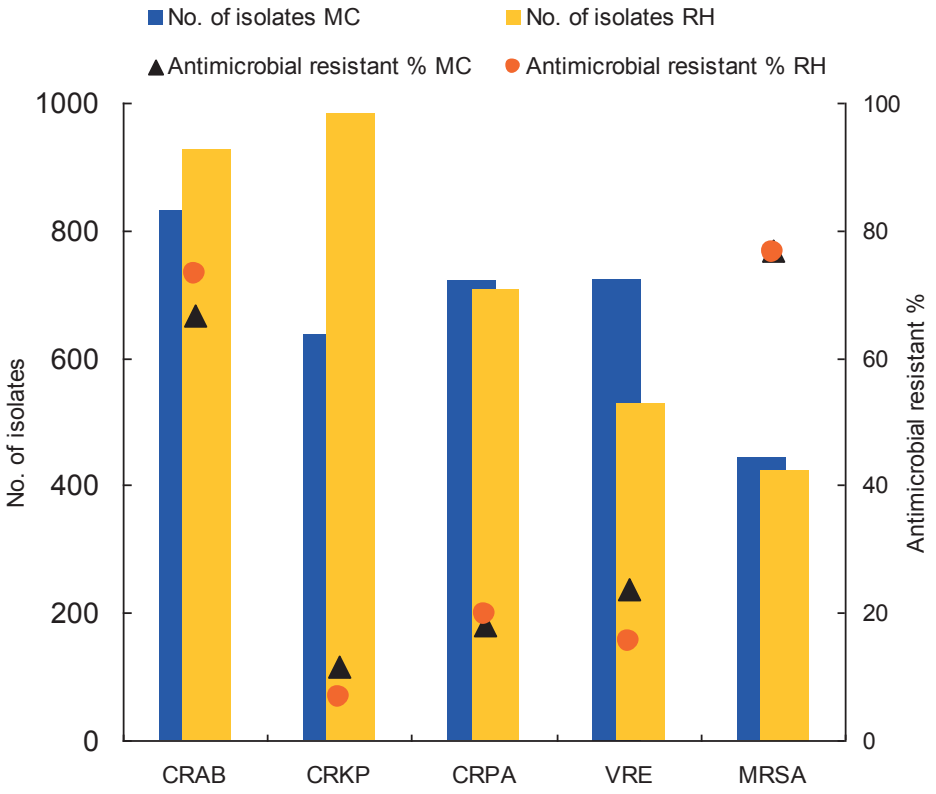
Pathogens	Total		Types of Infection									
			Urinary tract		Bloodstream		Pneumonia		Surgical site		Others	
	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.
Candida species	1		1		2		9		8		5	
C. albicans		701		466		165		18		19		33
Other Candida spp. or NOS		427		249		158		4		3		13
Acinetobacter baumannii	2	843	6	146	1	364	1	212	2	43	3	78
Pseudomonas aeruginosa	3	753	4	253	6	189	2	174	1	68	4	69
Escherichia coli	4	656	2	435	8	133	8	22	4	39	8	27
Klebsiella pneumoniae	5	537	5	169	4	214	3	89	6	32	6	33
Yeast-like	6	505	3	416	14	38	10	14	9	14	9	23
Staphylococcus aureus	7	469	9	30	3	239	4	87	7	28	2	85
Enterobacter species	8		7		5		6		5		10	
E. cloacae		292		62		153		33		28		16
Other Enterobacter spp. or NOS		87		20		41		12		10		4
Coagulase negative staphylococci	9	348	11	24	7	186	18	6	3	42	1	90
Stenotrophomonas maltophilia	10	227	14	13	9	110	5	78	11	12	11	14
Others	-	1,999	-	552	-	935	-	147	-	183	-	182
Total	-	7,844	-	2,835	-	2,925	-	896	-	521	-	667

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, 2010

Pathogens	Total		Types of Infection									
			Urinary tract		Bloodstream		Pneumonia		Surgical site		Others	
	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.	Rank	No.
Acinetobacter baumannii	1	1,003	5	178	1	263	1	392	3	46	1	124
Candida species	2		1		3		9		7		6	
C. albicans		648		421		129		31		29		38
Other *Candida* spp. or NOS		285		163		96		10		2		14
Klebsiella pneumoniae	3	793	3	272	5	201	3	220	5	32	4	68
Pseudomonas aeruginosa	4	757	4	239	6	131	2	264	1	51	3	72
Escherichia coli	5	741	2	493	7	119	7	55	2	50	8	24
Staphylococcus aureus	6	504	10	35	2	227	4	149	6	31	5	62
Coagulase negative staphylococci	7	354	9	39	4	210	15	9	9	17	2	79
Enterobacter species	8		8		8		5		4		9	
E. cloacae		220		58		76		38		31		17
Other *Enterobacter* spp. or NOS		77		17		19		24		11		6
Yeast-like	9	230	6	144	11	47	14	10	18	4	7	25
Stenotrophomonas maltophilia	10		7		13		12		8		10	
Proteus mirabilis		156		78		26		18		15		19
Other *Proteus* spp. or NOS		12		4		1		4		3		0
Others	-	1,649	-	460	-	632	-	286	-	144	-	127
Total	-	7,429	-	2,601	-	2,177	-	1,510	-	466	-	675

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, 2010