

# Healthcare- associated Infections

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# Nosocomial Infections

**What?**

***Nosocomial* comes from the Greek word *nosokomeion* meaning hospital (*nosos* = disease, *komeo* = to take care of ).**

*From Wikipedia, the free encyclopedia*

# **Nosocomial Infection= Hospital- acquired Infection**

**refers to an infection that develops in a patient 48 hours or more after admission to a hospital.**

## **Healthcare- associated infection (HCAI)**

**refers to infections that occur as a result of contact with the healthcare system in its widest sense - from care provided in your own home, to general practice, nursing home care and care in acute hospitals.**



**Why we should pay an  
attention to nosocomial  
infections?**



**Nosocomial Infections:**

**How much?**

# Retrospective Analysis of Nosocomial Infections Songklanagarind Hospital

Authors: Jamulitrat S. et al

Year : 1985

No. of admissions : 12,469

Sample - size : 3,319 statistically -  
representative charts

Criteria : Modified SENIC criteria

Nosocomial infections , Songklanagarind Hospital (1986)

= 11.06/100 admissions

(Jamulitrat S et al: J Infect Dis Antimicrob. agents (Thai)  
1987 ; 4 : 10-24)

## Nosocomial Infection Rate

Hospital	Year	Rate
U.S. Hospitals	1975 - 76	5.7
Songklanagarind	1987	10.5
Ramathibodi	1982 - 85	10.3
Siriraj	1986	14

## Nosocomial Infection Rate 1985-1986, Thailand

<b>Hospital beds</b>	<b>Rate (%)</b>
<b>&gt;700</b>	<b>15.2</b>
<b>400 – 700</b>	<b>4.1</b>
<b>&lt;400</b>	<b>2.8</b>

**Ref.: Pinyowiwat W *et al.* Dept. of Epidemiology**

**Ministry of Public Health**

# **Prevalence and Impacts of Nosocomial Infection in Thailand 2001**

Somwang Danchaivijitr MD\*, Chertsak Dhiraputra MD\*\*,  
Somporn Santiprasitkul MSc\*\*\*, Tepnimitr Judaeng MNS\*\*\*

*J Med Assoc Thai 2005; 88 (Suppl 10): S1-9*

**42 hospitals**

**Point prevalence survey**

**March 2001**

**18,456 patients.**

**Patients on antibiotics = 48.5%**

Table 1. Demographic data and the point prevalence rate of N.I.

Data	Categories of hospitals				Average
	U(1)	R(2)	P(3)	O(4)	
Average(%)	7.3	6.5	4.9	6.9	6.4

# NI point prevalence survey

<b>Country</b>	<b>Year</b>	<b>Rate</b>
<b>China</b>	<b>2001</b>	<b>5.2%</b>
<b>Latvia</b>	<b>2002</b>	<b>5.75</b>
<b>Norway</b>	<b>2002</b>	<b>5.3%</b>



# Nosocomial Infections

Mortality-How much?

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**Table 14. Mortality in patients with N.I.**

	Categories of hospitals				Average
	U	R	P	O	
No. patients with NI	392	449	222	290	1,353
Mortality(%)					
Due to NI	4.1	7.6	10.4	6.2	6.7
Due to NI and other causes	3.1	2.0	1.4	5.5	3.0
Due to other causes	4.3	3.8	5.4	3.1	4.1
Total	11.5	13.4	17.2	14.8	14.3

# The Hazards of Hospitalization

ELIHU M. SCHIMMEL, M.D., *West Haven, Connecticut*

# Nosocomial Infections

Morbidity-How much?

**Table 12.** Prolongation of hospitalization in patients with N.I. (days)

Sites of NI	Categories of hospitals				Average
	U	R	P	O	
Low respiratory	13.1	12.7	11.7	12.1	12.4
Urinary	10.4	9.5	9.6	10.4	10.0
Surgical	12.2	12.2	13.2	12.9	12.6
Skin and soft tissue	11.1	10.5	7.5	13.9	10.8
Primary bacteremia	15.4	11.8	7.1	12.8	11.8

Patients with single nosocomial infection  
remained in hospital on average

19.67 days longer

and incurred hospital charge of average

7,254 bahts more

than control patients

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attention to nosocomial  
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**The number of admissions in Thailand is ~6.2 million. With a prevalence rate of 6.4%, the estimated number of nosocomial cases was 396,800 cases with 26,586 deaths attributable to these infections in Year 2001.**

# Thailand Health Profile 2001-2004

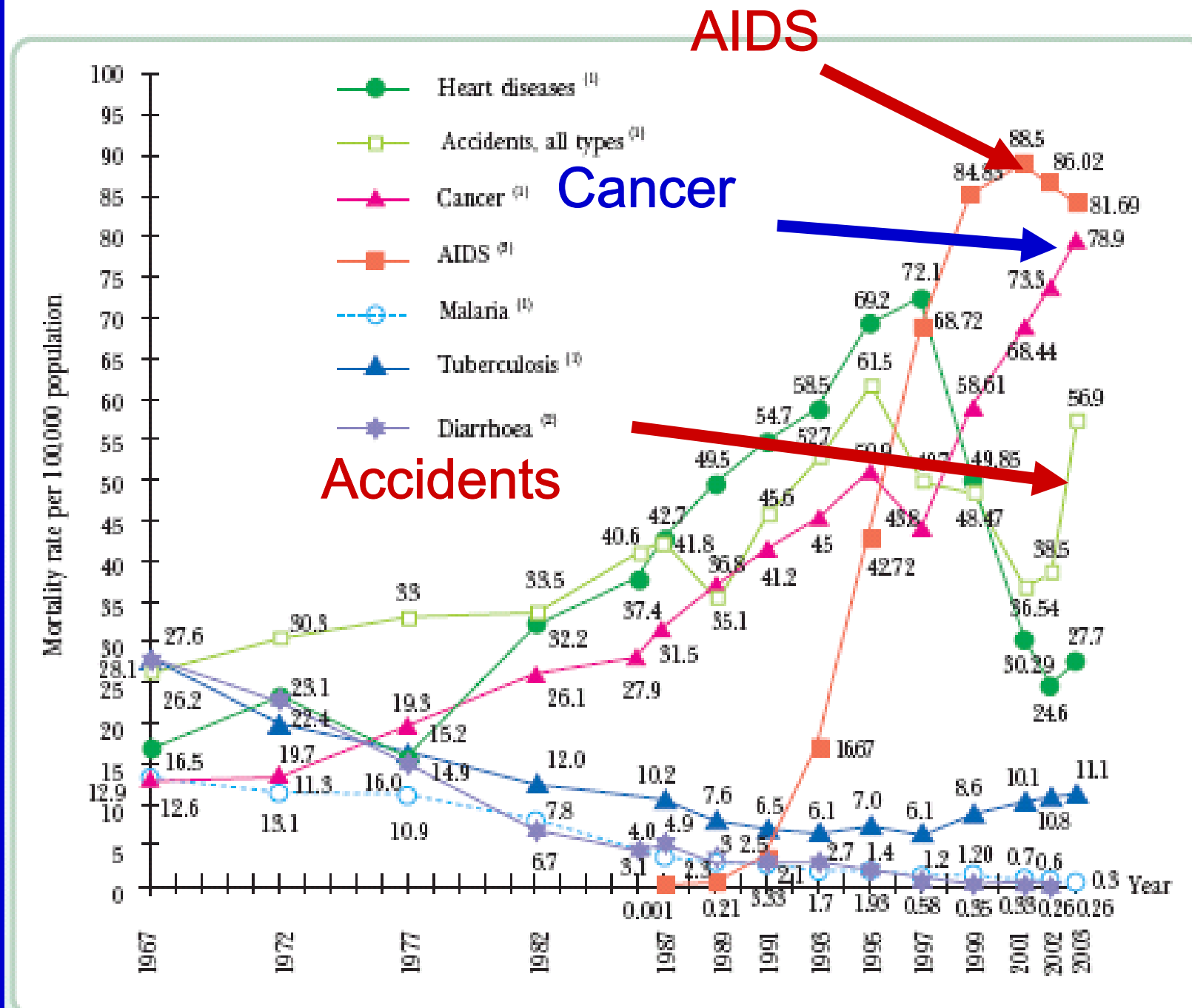
**Editor**

**Dr.Suwit**

**Wibulpolprasert**

[http://www.moph.go.th/ops/thp/index.php?option=com\\_content&task=view&id=7&Itemid=2](http://www.moph.go.th/ops/thp/index.php?option=com_content&task=view&id=7&Itemid=2)

Figure 5.7 Mortality Rates due to Major Causes of Death, Thailand, 1967-2003



**Table 5.19** Numbers and Rates of Accidental Deaths and Injuries a

Year	Population	No. of accidents (cases)	Deaths	
			No. (persons)	Rate per 100,000 pop.
2000	61,770,259	73,737	11,988	19.41
2001	62,093,855	77,616	11,652	18.76
2002	62,554,482	91,623	13,116	20.97

**The number of admissions in Thailand is ~6.2 million. With a prevalence rate of 6.4%, the estimated number of nosocomial cases was 396,800 cases with 26,586 deaths attributable to these infections in Year 2001.**

## Top ten morbidity rate of diseases under surveillance Thailand, 2001 (2544)

Rank	Diseases	Cases	Deaths	Morbidity Rate
				(Per 100,000 Pop.)
1	Acute diarrhoea	1020377	176	1643.3
2	Pyrexia of unknown origin	269740	54	434.4
3	Dengue haemorrhagic fever	139355	245	224.4
4	Food poisoning	138795	2	223.5
5	Pneumonia	135768	1057	218.6
6	Haemorrhagic conjunctivitis	107929	0	173.8
7	Influenza Chickenpox	42371	1	68.2
8	Dysentery	37601	2	60.6
9	Malaria	34925	81	56.2
10	Chickenpox	31707	1	51.1

*Ref.: Annual Epidemiological Surveillance Report 2001, MOPH*



## Top ten mortality rate of diseases under surveillance Thailand, 2002 (2545)

Rank	Diseases	Cases	Deaths	Mortality Rate
				(Per 100,000 Pop.)
1	Pneumonia	135768	1057	1.7
2	Tuberculosis	30033	287	0.46
3	Dengue haemorrhagic fever	139355	245	0.39
4	Suicide by liquid substance	5241	224	0.36
5	Acute diarrhoea	1020377	176	0.28
6	Leptospirosis	10217	171	0.28
7	Malaria	34925	81	0.13
8	Pyrexia of unknown origin	269740	54	0.09
9	Rabies	37	37	0.06
10	Encephalitis - total	430	30	0.05

***Ref.: Annual Epidemiological Surveillance Report 2001, MOPH***

# Causes of Death of Thai Physicians (1992-2001)

No.=262

1= Cancers (35.1%)

1.1 Hepatoma (7.6%)

2= Heart Diseases (28.2%)

3=Accidents (12.6%)

4=Sepsis (3.4%)

5=Suicides (3.4%)

*Source: Sithisarankul P et al. Intern Med J Thai 2004;20:188-191*



AMERICAN  
Journal of Epidemiology

*Formerly* AMERICAN JOURNAL OF HYGIENE

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VOL. 121

FEBRUARY 1985

NO. 2


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**Original Contributions**

**THE NATIONWIDE NOSOCOMIAL INFECTION RATE**

**A NEW NEED FOR VITAL STATISTICS**

ROBERT W. HALEY,<sup>1,2</sup> DAVID H. CULVER,<sup>1</sup> JOHN W. WHITE,<sup>1</sup> W. MEADE MORGAN<sup>1</sup> AND  
T. GRACE EMORI<sup>1</sup>



**TABLE 3**  
*Overall estimates of the numbers and rates of nosocomial infections among the 6,449 acute-care US hospitals, 1975-1976*

	No. of infections	%	Infection ratio*
Urinary tract infection	902,732	42.0	2.39
Surgical wound infection	510,402	23.8	1.35†
Pneumonia	226,968	10.5	0.60
Bacteremia	102,950	4.8	0.27
Subtotal, SENIC sites	1,743,052	81.1	4.62
Non-SENIC sites	405,433	18.9	1.07
<b>Total</b>	<b>2,148,485</b>	<b>100.0</b>	<b>5.69</b>

\* Number of nosocomial infections per 100 admissions.

† The ratio of surgical wound infections to total operations was 2.79 per 100 operations.

**“ There are substantially more nosocomial infections each year than hospital admissions for either cancer or accidents and at least four times more than admissions for acute myocardial infarction.”**

*F. Daschner, H. Nadjem, H. Langmaack, W. Sandritter*

## Surveillance, Prevention and Control of Hospital-Acquired Infections

III. Nosocomial Infections as Cause of Death: Retrospective Analysis of 1000 Autopsy Reports

Infection 6 (1978) Nr. 6 261

**1000 post-mortem reports between 1975-1976  
were analysed retrospectively.**

**In 6.3% of the patients, nosocomial infection  
was a contributory factor leading to death.**

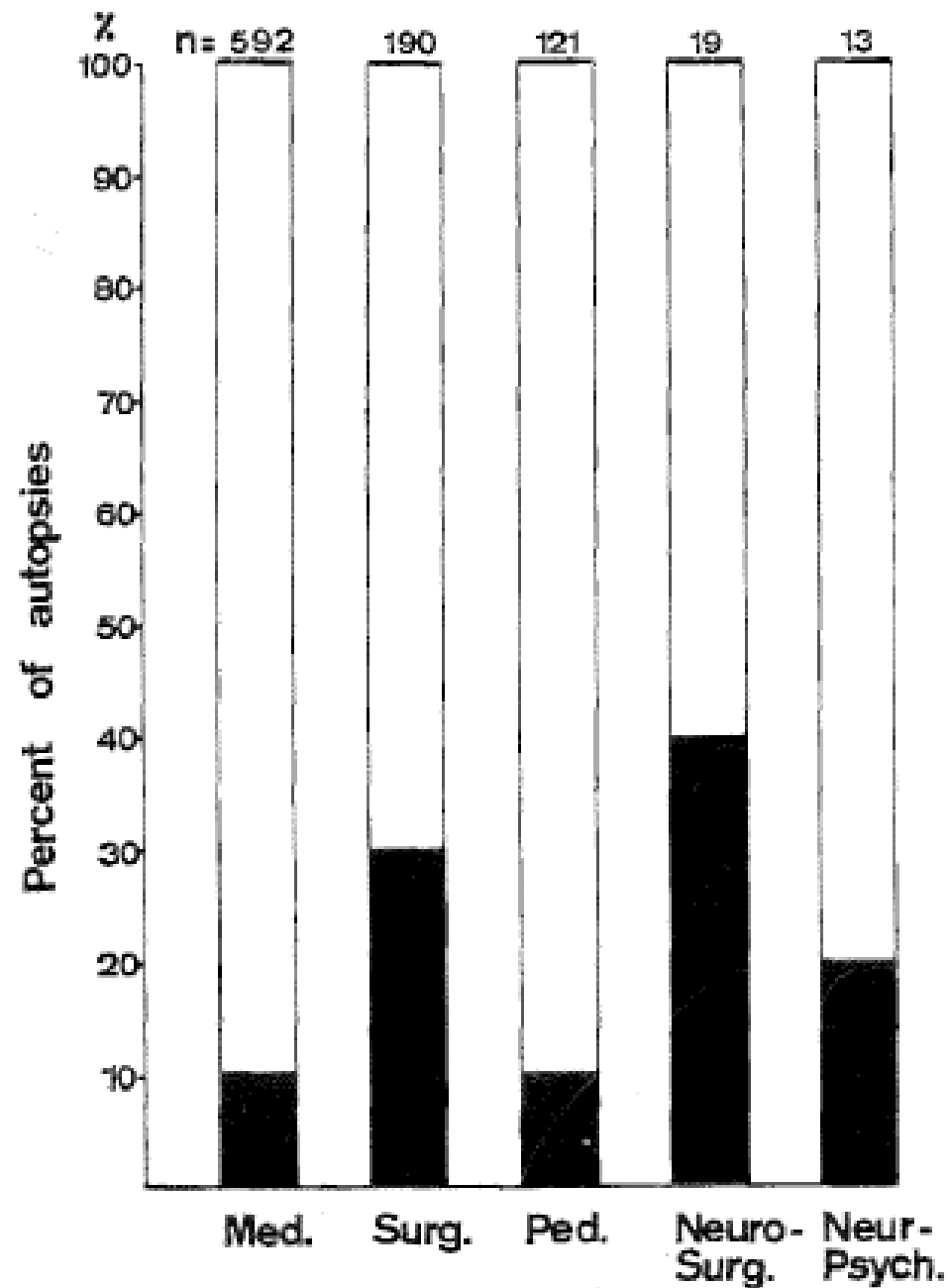


Figure 1: Nosocomial infections (black bars) as cause of death or contributing to death (% of autopsies). N = number of autopsies.

**Nosocomial infection led to death in none of the 10 autopsied patients from the EENT Department and in none of 52 autopsied patients from the Department of Gynecology.**



**In none of the 137 patients who died of nosocomial infection was a urinary tract infection the contributing factor to the death of the patient.**

**This can be explained with reference to the findings of *Stamm et al.* that the mortality in patients with nosocomial urinary tract infection is only about 1%**

## Year 2006, Admission Diagnoses, PSU Hospital

Rank	Diseases	Number of patients
1	Senile cataract	1,123
2	Malignant neoplasm of bronchus and lung	734
3	Malignant neoplasm of breast	576
4	Malignant neoplasm of ovary	483
5	Intracranial injury	445
6	Malignant neoplasm of liver and intrahepatic bile ducts	442
7	Malignant neoplasm of rectum	415
8	Malignant neoplasm of cervix uteri	415
9	Maternal care for known or suspected abnormality of pelvic organs	385
10	Lymphoid leukaemia	331

## Year 2006, Causes of Deaths, In-Patients, PSU Hospital

Rank	Causes of Deaths	No. of Patients
1	Malignant neoplasm of bronchus and lung	56
2	Acute myocardial infarction	51
3	Other septicaemia	38
4	Intracerebral haemorrhage	25
5	Malignant neoplasm of liver and intrahepatic bile ducts	22
6	Diffuse non-Hodgkin's lymphoma	20
7	Aortic aneurysm and dissection	18
8	Chronic renal failure	18
9	Chronic ischaemic heart disease	17
10	Malignant neoplasm of cervix uteri	16
11	[HIV] disease resulting in infectious and parasitic diseases	15

# Nosocomial Infections

Economical Impacts-How much?

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Average(%)	7.3	6.5	4.9	6.9	6.4

**Table 13. Costs of antimicrobials for one episode of N.I. (baht) (1)**

Sites of NI	Categories of hospitals				Average
	U	R	P	O	
Low respiratory	13,000	8,571	6,432	11,750	9,938.25
Urinary	4,629	3,377	3,648	6,737	4,597.75
Surgical site	6,107	3,758	2,453	6,584	4,725.5
Skin and soft tissue	4,987	1,538	2,094	8,964	4,395.75
Primary bacteremia	5,132	3,295	812	16,297	6,384.0

**The number of admissions in Thailand is ~6.2 million. With a prevalence rate of 6.4%, the annual hospital costs for management of N.I. was about 7 billion baht (175 million U.S. dollars).**

## Health Expenditure 1980-2002 (Million baht)

<b>Year</b>	<b>MoPH</b>
2000	63,001
2001	61,563
2002	70,923

*Wibulpolprasert S et al. Thailand Health Profile 2001-2004 MOPH  
Bangkok, Thailand 2005 (ISBN: 974-465-889-4)*



# Allocation of Government Health Budget by Service Category, 1993-2004

Health budget	2001	
	Amount	%
1. Hospitals	38,949.0	60.0
2. Outpatient services (at health centres)	14,943.4	23.0
3. Public health services	2,765.7	4.3
4. Health research	718.9	1.1
5. Other health activities	7,550.5	11.6
<b>Total</b>	<b>64,927.5</b>	<b>100</b>

*Wibulpolprasert S et al. Thailand Health Profile 2001-2004 MOPH Bangkok, Thailand 2005 (ISBN: 974-465-889-4)*

**Why rising cost of antibiotics???**

# Antibiotic Resistance: PSU

## MRSA

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	1986	1987	1988	1989
PSU	5%	15%	25%	30%
Siriraj	14%	14%	23%	-

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## PSU Antibiotic Resistance : MRSA

Year	Resistance
1990	38%
1991	20%
1992	25%
1993	27%
1994	26%
1995	31%
1996	29%
1997	35%
1998	35%
1999	34%
2000	33%

## PSU Antibiotic Resistance - E. coli

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1991 1992 1993 1994 1995 1996 1997 1998 1999 2000

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<b>Ciprofloxacin</b>	7%	6%	8%	16%	18%	18%	25%	24%	25%	25%
<b>Amikacin</b>	9%	6%	6%	4%	6%	7%	5%	5%	4%	5%

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# PSU Antibiotic Resistance : *Ps. aeruginosa*

## Imipenem Resistance

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	1992	1993	1994	1995	1996	1997	1998	1999	2000
% resistance	4%	9%	12%	8%	8%	10%	7%	11%	16%

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## PSU Antibiotics: Cost/Day

Amikacin	15 mg./kg q d.	262 bht.
Sulperazone	2 g. q 12 hr.	1578 bht
Imipenem	500 mg. q 6 hr.	3213 bht.
Meropenem	0.5 g. q 6 hr.	3780 bht.
Meropenem	1 g. q 8 hr.	4200 bht.
Ertapenem	1g. q d.	1498 bht.
Cefipeme	2 g. q 12 hr.	2088 bht.
Tazocin	4.5 q 8 hr.	1890 bht.



## ตาราง สรุปจำนวนการสั่งใช้ยาในกลุ่ม ID restrict drug (5 ชนิด)

ยา	1 ตุลาคม 2546 - 31 มีนาคม 2547 ( ช่วงก่อนการสั่งใช้โดย Computer )			1 ตุลาคม 2547 - 31 มีนาคม 2548 ( ช่วงหลังการสั่งใช้โดย Computer )		
	จำนวนผู้ป่วย ( คน )	จำนวนยา ( vial )	Cost ( บาท )	จำนวน ผู้ป่วย	จำนวนยา ( vial )	Cost ( บาท )
Cefoperazone + Sulbactam 1 g	776	5,159	1,906,354	1,760	12,163	4,798,304
Fosmicin 2 g	453	1,462	427,606	681	2,315	727,488
Meropenem 500 mg	27	94	87,841	107	416	392,903
Meropenem 1 g	55	281	390,073	391	1,617	2,260,105
Tienem 500 mg	784	4,111	3,261,010	982	6,079	4,882,896
Vancomycin 500 mg	526	2,282	1,016,776	1,147	5,075	1,952,707

# PSU Antibiotic Resistance : Acinetobacter

## Imipenem Resistance

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1997	1998	1999	2000	2001	2002	2003	2004	2005
3%	2%	4%	3%	3%	2%	<u>9%</u>	<u>31%</u>	<u>39%</u>

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# NARST



<http://narst.dmsc.moph.go.th/>

National Antimicrobial Resistance Surveillance Center , Thailand

## Percentage of susceptible *Acinetobacter baumannii* , Jan - Dec 2005

Organism	CEFTOXIME	CEFTRIAZONE	CEFTAZIDIME	CEFOPERAZONE/ SULBACTAM	IMIPENEM	PIPERACILLIN/TAZOBACTAM	CIPROFLOXACIN	AMIKACIN	GENTAMICIN
<i>Acinetobacter calcoaceticus-baumannii</i> complex	4 (6633)	6 (3790)	30 (14110)	56 (11693)	27 (12564)	18 (2114)	31 (13022)	38 (14877)	30 (14723)

# PSU IC. :Objectives

- 1 Reduce Infections - in patients  
- in personnels
- 2 Cost reduction
- 3 Research & Development
- 4 Teaching
- 5 Income generating

Table 2. Ward specific nosocomial infections

Ward	Admission	Infection	Rate (/100 admissions)
NICU	49	41	83.67
ICU	83	32	38.55
Traumatic	112	24	21.43
Surgery (male)	275	49	17.82
Medicine (female)	280	46	16.43
Medicine (male)	327	49	14.98
Surgery (female)	255	34	13.33
Orthopedic (female)	88	10	11.36
Private	240	21	8.75
Pediatric	530	33	6.23
Gynecology	337	19	5.64
Orthopedic	112	6	5.36
Obstetric	264	5	1.89
ENT	219	4	1.83
Ophthalmic	151	2	1.32
Psychiatric	53	0	0.00

# **PSU ลดการติดเชื้อในผู้ป่วย**

- 1. Surgical wound infections.**
- 2. Ventilator-associated pneumonia.**
- 3. Bloodstream infection.**
- 4. Urinary tract infection.**

# Objectives

1 Reduce Infections - in patients

Goals = ???

# US.National Nosocomial Infections Surveillance (NNIS) System:

**Established in 1970**

**>300 hospitals currently participating**

**Standardized surveillance protocols,  
( intensive care unit (ICU), high-risk nursery  
(HRN), and surgical patients.)**



**AJIC** Special Articles

**National Nosocomial Infections  
Surveillance (NNIS) System  
Report, data summary from  
January 1992 to June 2002, issued  
August 2002**

**Table 1.** Pooled means and percentiles of the distribution of device-associated infection rates by type of ICU, ICU component, January 1995 to June 2002\*

Type of ICU	No. of units	Urinary catheter-days	Pooled mean	Percentile				
				10%	25%	50% (median)	75%	90%
Medical-surgical								
Major teaching	127	1,145,790	5.6	1.9	3.2	5.3	7	9.6

Table 5 SSI rates, by operative procedure and risk index category, Surgical Patient component, January 1992 to June 2007

Operative procedure category	Duration cut point (h)	Risk index category	N	Rate
HER Herniorrhaphy	2	0	10,243	0.8
MAST Mastectomy	3	0	13,623	1.86
CRAN Craniotomy	4	0	3964	0.91
VSHN Ventricular shunt	2	0	3331	4.17
CSEC Cesarean section	1	0	127,324	2.83

# Reduction of Nosocomial Infections among Patients:

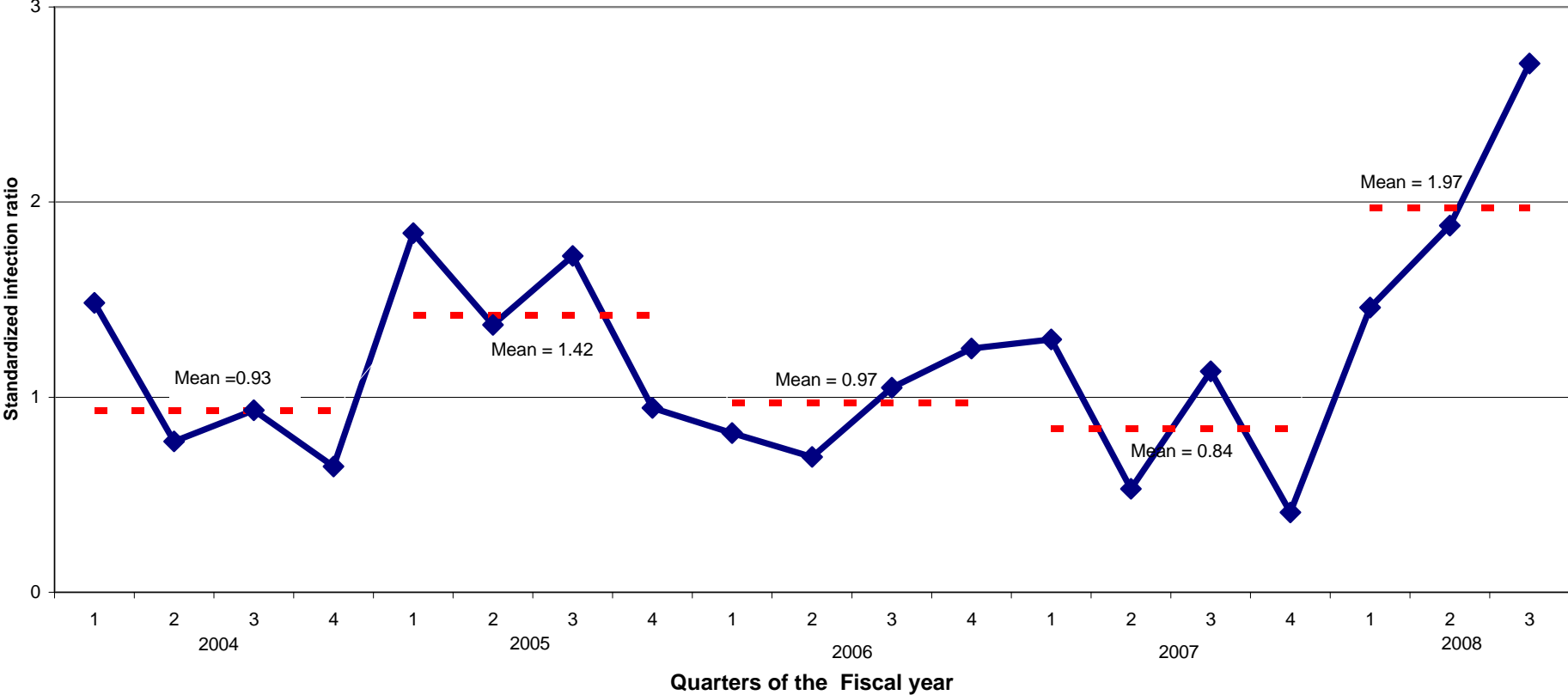
GOALS : NOT MORE

THAN

50 PERCENTILE *NNIS* RATE

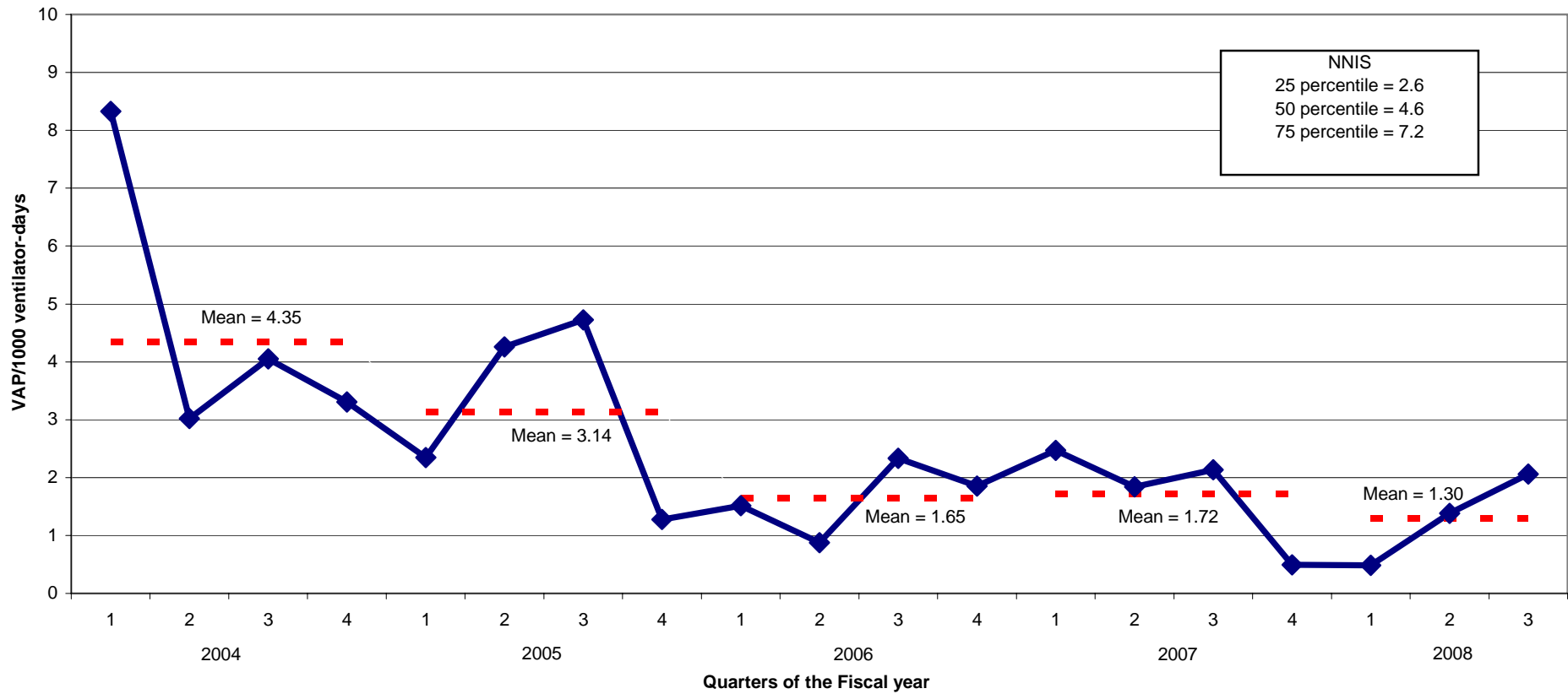
WITHIN TWO YEARS.

# Standardized infection ratio of overall surgical site infection

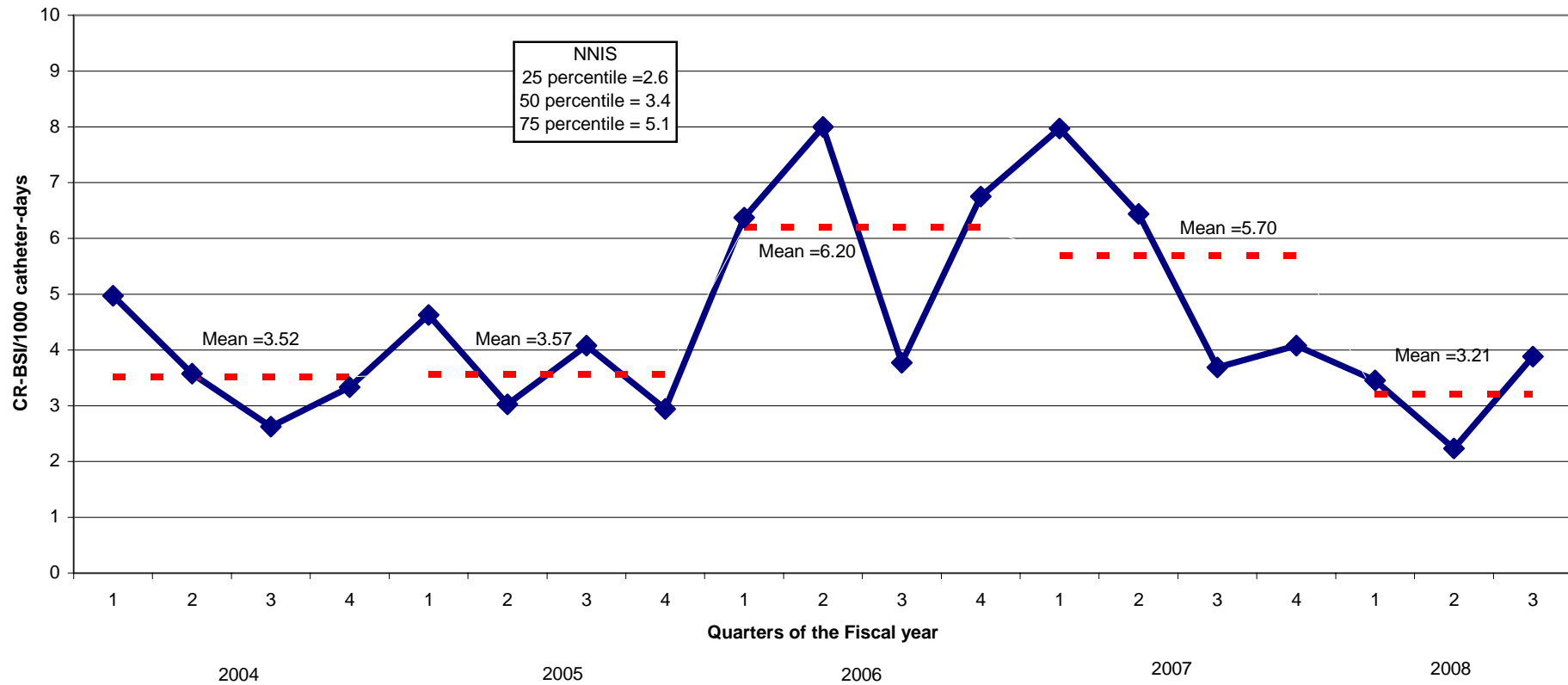


<b>Procedure</b>	<b>ปีงบฯ 2550 SIR(เท่า)</b>	<b>ปีงบฯ 2551 SIR(เท่า)</b>
<b>Open Heart surgery</b>	#	0.84
<b>Appendectomy</b>	0.66	#
<b>Cholecystectomy</b>	1.86	5.99
<b>Colectomy</b>	0.79	0.84
<b>Craniotomy</b>	1.44	5.52
<b>Herniorrhaphy</b>	0.56	#
<b>Mastectomy</b>	0.33	0.54
<b>Total</b>	<b>0.84</b>	<b>1.97</b>

### Overall rate of ventilator-associated pneumonia



### Overall catheter-related bloodstream infection rate





หอผู้ป่วย	UTI ปีงบฯ 2550	UTI ปีงบฯ 2551
ศัลยกรรมหญิง	14.84	18.94
ICU2	10.76	10.31
ศัลยกรรมประสาท	11.27	29.13
ICU1	5.78	5.06
ศัลยกรรมชาย 2	10.43	9.20
ศัลยกรรมชาย 1	7.77	11.06
PICU	2.77	9.60
RCU	20.34	8.40
อายุรกรรมชาย1	13.22	5.76
อายุรกรรมหญิง	12.17	11.31
อุบัติเหตุ	5.46	12.38
อายุรกรรมชาย2	0.00	0.00
Total	9.41	10.81
Total ICU	7.77	7.10