SEMIANNUAL REPORT

Aggregated Data from the National Nosocomial Infections Surveillance (NNIS) System
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NNIS SAR
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INTRODUCTION

The data in the SEMIANNUAL REPORT (SAR) are collected by hospitals that voluntarily participate in the National Nosocomial Infections Surveillance (NNIS) system and routinely report their data to the Centers for Disease Control and Prevention. The hospitals use the NNIS surveillance components, which are protocols that target specific patient groups with similar infection risks, to collect the data.

In January of 1999, the Hospital-wide component was eliminated from the NNIS system. This was done for several reasons. The Hospital-wide component required considerable time and resources in most hospitals, particularly those that have a large and high-risk patient population, resulting in inaccurate and inadequate case-finding. More importantly, the Hospital-wide component did not yield rates that were meaningful for national comparison purposes since they were not risk-adjusted.

Tables 1 and 2 update the device-associated rates and device utilization ratios from the ICU component reported in the last SAR, issued in June 1999. In the December 1998 SAR we separated for the first time combined Medical/Surgical ICUs into two groups by type of hospital: Major Teaching and All Other. The combined Medical/Surgical ICUs from major teaching hospitals had significantly higher infection rates and device utilization ratios than combined medical/surgical ICUs from all of the other hospitals. Major Teaching status is defined as a hospital that is an important part of the teaching program of a medical school and a major unit in the clinical clerkship program. Teaching affiliation was not an important factor for any other type of ICU.

We require a minimum of 50 device-days in the denominator of an ICU to calculate a device-associated infection rate. Similarly, device utilization ratios are calculated for ICUs that reported at least 50 patient-days. The distribution of device utilization ratios can be useful as a guide for assessing the appropriateness of device use in your hospital's ICU. The percentile distributions that display the infection rates and device utilization ratios require data from at least 20 different units. The number of units reporting data from the burn and respiratory ICUs is still insufficient to provide percentile distributions for these types of ICUs.

Figure 1 summarizes antimicrobial resistance among common pathogens identified from ICU patients with nosocomial infections. We first provide the pooled mean rate of resistance for each pathogen for January-December 1999. Second, we graph this rate next to the average rate of resistance (± 1 standard deviation) over the previous 5 years, for each pathogen. Finally, we calculate the percentage increase in the resistance rate in 1999 compared to the previous 5 years. This number provides a general estimate of the relative increase or decrease in this year's resistance rate compared to the historical data. These data display the changes in antimicrobial resistance in U.S. hospitals. Compared to the previous six month period reported in the June 1999 SAR, the rate of increase in resistance rates for MRSA and VRE has diminished slightly. Although these data are limited to patients in ICUs, these data are not risk-adjusted and comparisons of these rates between hospitals should be made with caution. Furthermore, these prevalence rates are derived from susceptibility patterns reported from bacteria associated with nosocomial infections in patients in the ICU and may not be comparable to resistance rates from routine hospital-wide antibiograms which may also include colonizing isolates.

Tables 3 and 4 show updated data from the HRN component.

The data in tables 5-8 are unchanged from the previous SAR. Table 5 displays SSI rates by operative procedure and NNIS risk index category. When the SSI rates for adjacent risk categories for a particular operation were not statistically different, we combined them into a single risk category. For example, because the SSI rates for herniorrhaphy operations with 2 or 3 risk factors were similar, we collapsed the data for these two categories into one category designated as '2,3'. Thus, the number of risk index categories in the tables will differ depending upon the operation.

Table 6 contains the percentile distributions for each operative procedure and SSI risk index category. For a hospital to be represented in this distribution, it must have reported sufficient data, which means it reported at least 30 operations in a given SSI risk category. Note that percentile distributions are not available for every operative procedure-risk category since percentile distributions of the procedure-specific and risk-index specific rates required sufficient data from at least 20 hospitals.

Table 7 lists four operations in which the use of a laparoscope has been incorporated into the SSI risk index. Laparoscopes and endoscopes (SCOPE) are being used with increasing frequency to perform operations. The SCOPE was used most frequently on the following procedures: Cholecystectomy (64%), Appendectomy (19%), Vaginal Hysterectomy (15%), Other Ear, Nose, or Throat (14%), Other Genitourinary (10%), Gastric Surgery (8%), Exploratory Laparotomy (7%), Other Musculoskeletal (7%), Thoracic (7%), Herniorrhaphy (4%), and Colon Surgery (3%). SCOPE was used to perform the other remaining operative procedures less than 2% of the time. For four operations, the SSI rate was significantly different when SCOPE was used. When other risk factors were controlled, Cholecystectomy, Colon Surgery, Gastric Surgery, and Appendectomy had lower SSI rates when a SCOPE was used. However, there were some differences among these operations. For Cholecystectomy and Colon Surgery, the influence of SCOPE was captured by subtracting one from the number of risk factors (ASA score of 3,4, or 5; duration of surgery > 75^{th} percentile; or contaminated or dirty wound class) whenever the procedure was done laparoscopically; M indicates minus 1 (-1) in the modified risk category where no risk factors were present and the procedure was performed with a laparoscope. For Appendectomy and Gastric Surgery, the use of a SCOPE was only important if the patient had no other risk factors. Therefore, we split the index value of zero risk factors into 0-No and 0-Yes. The percentile distributions of the four operative procedures with modified SSI risk index categories have not been developed at this time.

Table 8 displays SSI rates by specific site following coronary artery bypass graft (CBGB) operations where incisions are made at both the chest and the donor sites.

Tables 9 and 10 are new and show data from Phases 2 and 3 (January 1996-November 1999) of the Integrated Care Antimicrobial Resistance Epidemiology, formerly called Intensive Care Antimicrobial Resistance Epidemiology, (ICARE) Project and update previously published reports. These tables are similar in structure to the device-associated nosocomial infection rates in the SAR. For the purpose of analysis, grams of antimicrobial agents were converted into number of defined daily doses (DDDs) used each month in each hospital area. A DDD is the average daily dose in grams of a specific antimicrobial agent given to an average adult patient (Appendix A). Table 9 shows use of selected oral and parenteral antimicrobial agents in DDD. Antimicrobial use was stratified by route of administration and hospital area. Because outpatient antimicrobial use could not be estimated reliably from hospital pharmacy records, we did not collect data on

outpatient antimicrobial use. Finally, antimicrobial agents with similar spectrum or clinical indications were grouped in Appendix A. Based on detailed analysis, antimicrobial use rates were found to vary by type of ICU, so use rates and percentiles are calculated for each type of ICU. The number of burn, respiratory, trauma, and neurosurgical ICUs reporting data is still insufficient to provide percentile distributions for these types of ICUs. Table 10 shows ICARE resistance data for selected antimicrobial-resistant bacteria based on reported antimicrobial susceptibility test results on all nonduplicate clinical isolates processed by the laboratory during each study month. A duplicate isolate was defined as an isolate of the same species of bacteria with the same antimicrobial susceptibility pattern in the same patient in the same month, regardless of the site of isolation. All isolates, whether responsible for hospital-acquired or community-acquired infection or for colonization, were reported to ICARE by participating hospitals. Hospitals used National Committee for Clinical Laboratory Standards interpretive standards for minimum inhibitory concentration, or zone diameter testing standards to report numbers of susceptible, intermediate, or resistant organisms. We require a minimum of 10 isolates to be tested in a hospital area for resistance rates to be calculated for that area. We have combined resistance data among all ICU types because detailed analysis demonstrated that, in general, resistance rates (% prevalence) did not differ between ICU types. Also, these data show that for most antimicrobial resistant bacteria, resistance rates are highest in the ICU areas, followed by non-ICU inpatient areas, with lowest rates in the outpatient areas.

Appendix A is new and shows the defined daily dose for antimicrobial agents that are used in Table 9.

Appendix B and C provide instructions on how to calculate the rates and ratios found in the SAR and how to interpret the data. All individuals who analyze and use surveillance data must remember that a high rate or ratio (>90th percentile) does NOT define a problem, it only suggests an area for further investigation. Appendix D shows NNIS personnel how to use the NNIS surveillance software, IDEAS, to calculate SSI rates on data collected through the Surgical Patient surveillance component.

Table 1. Intensive care unit surveillance component. Pooled means and percentiles of the distribution of device-associated infection rates, by type of ICU, NNIS system, January 1992-October 1999

Urinary catheter-associated UTI rate*				Percentile				
Type of ICU	No. of Units	Urinary Catheter-Days	Pooled Mean	10%	25%	50% (median)	75%	90%
Coronary	112	413,686	6.5	1.0	3.1	5.5	9.8	13.4
Cardiothoracic	59	446,226	3.4	0.5	1.5	2.4	4.2	5.4
Medical	135	914,016	7.3	1.9	3.6	6.4	8.8	11.6
Medical/Surgical Major teaching	111	680,181	6.6	1.9	4.0	5.9	8.3	10.7
Medical/Surgical All others	174	1,317,599	4.2	1.0	2.0	4.0	5.8	7.7
Neurosurgical	49	233,277	8.6	2.0	4.9	8.3	10.1	14.1
Pediatric	70	212,765	5.1	0.0	2.0	4.8	7.0	9.8
Surgical	157	1,215,152	5.5	1.2	3.3	4.6	7.6	9.4
Trauma	25	157,139	7.4	0.0	4.0	6.4	8.7	10.5
Burn	17	41,717	10.0	.	.	.	.	.
Respiratory	7	28,699	6.4	.	.	.	.	.

Central line-associated BSI rate**				Percentile				
Type of ICU	No. of Units	Central Line-Days	Pooled Mean	10%	25%	50% (median)	75%	90%
Coronary	112	257,793	4.8	0.0	1.7	4.0	6.3	8.6
Cardiothoracic	59	406,358	2.8	0.4	1.4	2.4	3.5	4.9
Medical	136	651,238	6.1	1.6	3.6	5.3	7.1	9.9
Medical/Surgical Major teaching	114	468,689	5.6	1.7	3.3	5.1	7.3	9.8
Medical/Surgical All others	174	797,876	4.0	0.3	2.1	3.6	5.7	7.1
Neurosurgical	49	124,590	5.4	0.9	2.6	4.6	7.5	8.4
Pediatric	73	297,494	7.9	1.0	4.1	6.9	9.3	12.6
Surgical	157	974,157	5.6	1.3	2.6	5.1	7.0	9.2
Trauma	25	114,820	7.5	0.8	4.2	6.3	7.7	9.8
Burn	17	33,963	11.1	.	.	.	.	.
Respiratory	8	20,111	4.0	.	.	.	.	.

Ventilator-associated pneumonia rate***				Percentile				
Type of ICU	No. of Units	Ventilator-Days	Pooled Mean	10%	25%	50% (median)	75%	90%
Coronary	108	174,688	9.2	0.3	3.9	7.1	12.2	16.4
Cardiothoracic	59	242,815	11.0	3.1	5.5	10.8	14.0	17.6
Medical	133	619,173	7.8	1.9	4.1	6.8	9.9	14.8
Medical/Surgical Major teaching	112	395,292	11.7	3.1	5.5	10.2	14.2	17.8
Medical/Surgical All others	174	629,921	9.9	3.0	5.7	8.9	12.4	15.6
Neurosurgical	48	109,579	16.7	2.7	8.3	11.9	18.1	23.5
Pediatric	73	304,255	5.4	0.0	1.2	4.0	7.6	10.9
Surgical	157	678,520	14.4	5.5	8.4	12.5	16.0	24.0
Trauma	25	102,816	16.9	6.2	10.8	14.7	22.6	28.8
Burn	17	24,674	17.8	.	.	.	.	.
Respiratory	7	22,913	5.3	.	.	.	.	.

* $\frac{\text{Number of urinary catheter-associated UTIs}}{\text{Number of urinary catheter-days}} \times 1000$

** $\frac{\text{Number of central line-associated BSIs}}{\text{Number of central line-days}} \times 1000$

*** $\frac{\text{Number of ventilator-associated pneumonias}}{\text{Number of ventilator-days}} \times 1000$

Table 2. Intensive care unit surveillance component. Pooled means and percentiles of the distribution of device utilization ratios, by type of ICU, NNIS system, January 1992-October 1999

Urinary catheter utilization*

Type of ICU	No. of Units	Patient-Days	Pooled Mean	Percentile 10%	25%	50% (median)	75%	90%
Coronary	114	898,305	0.46	0.24	0.36	0.47	0.58	0.68
Cardiothoracic	59	516,088	0.86	0.73	0.82	0.89	0.95	0.96
Medical	138	1,276,794	0.72	0.45	0.61	0.72	0.81	0.88
Medical/Surgical Major teaching	114	857,705	0.79	0.49	0.71	0.80	0.85	0.90
Medical/Surgical All others	175	1,782,482	0.74	0.54	0.63	0.74	0.82	0.87
Neurosurgical	49	291,917	0.80	0.53	0.73	0.82	0.90	0.94
Pediatric	77	658,404	0.32	0.12	0.19	0.28	0.39	0.47
Surgical	157	1,451,793	0.84	0.66	0.77	0.85	0.91	0.95
Trauma	25	180,049	0.87	0.66	0.79	0.90	0.94	0.98
Burn	17	74,805	0.56	.	.	.	.	.
Respiratory	7	45,886	0.63	.	.	.	.	.

Central line utilization**

Type of ICU	No. of Units	Patient-Days	Pooled Mean	Percentile 10%	25%	50% (median)	75%	90%
Coronary	115	898,305	0.29	0.12	0.19	0.27	0.37	0.50
Cardiothoracic	59	516,088	0.79	0.62	0.73	0.80	0.88	0.95
Medical	138	1,276,794	0.51	0.29	0.35	0.48	0.61	0.72
Medical/Surgical Major teaching	114	857,705	0.55	0.34	0.45	0.54	0.64	0.73
Medical/Surgical All others	176	1,782,482	0.45	0.22	0.32	0.45	0.55	0.63
Neurosurgical	49	291,917	0.43	0.26	0.36	0.45	0.54	0.61
Pediatric	77	658,404	0.45	0.24	0.31	0.43	0.55	0.63
Surgical	157	1,451,793	0.67	0.47	0.56	0.68	0.77	0.87
Trauma	25	180,049	0.64	0.42	0.51	0.64	0.76	0.88
Burn	17	74,805	0.45	.	.	.	.	.
Respiratory	7	45,886	0.34	.	.	.	.	.

Ventilator utilization***

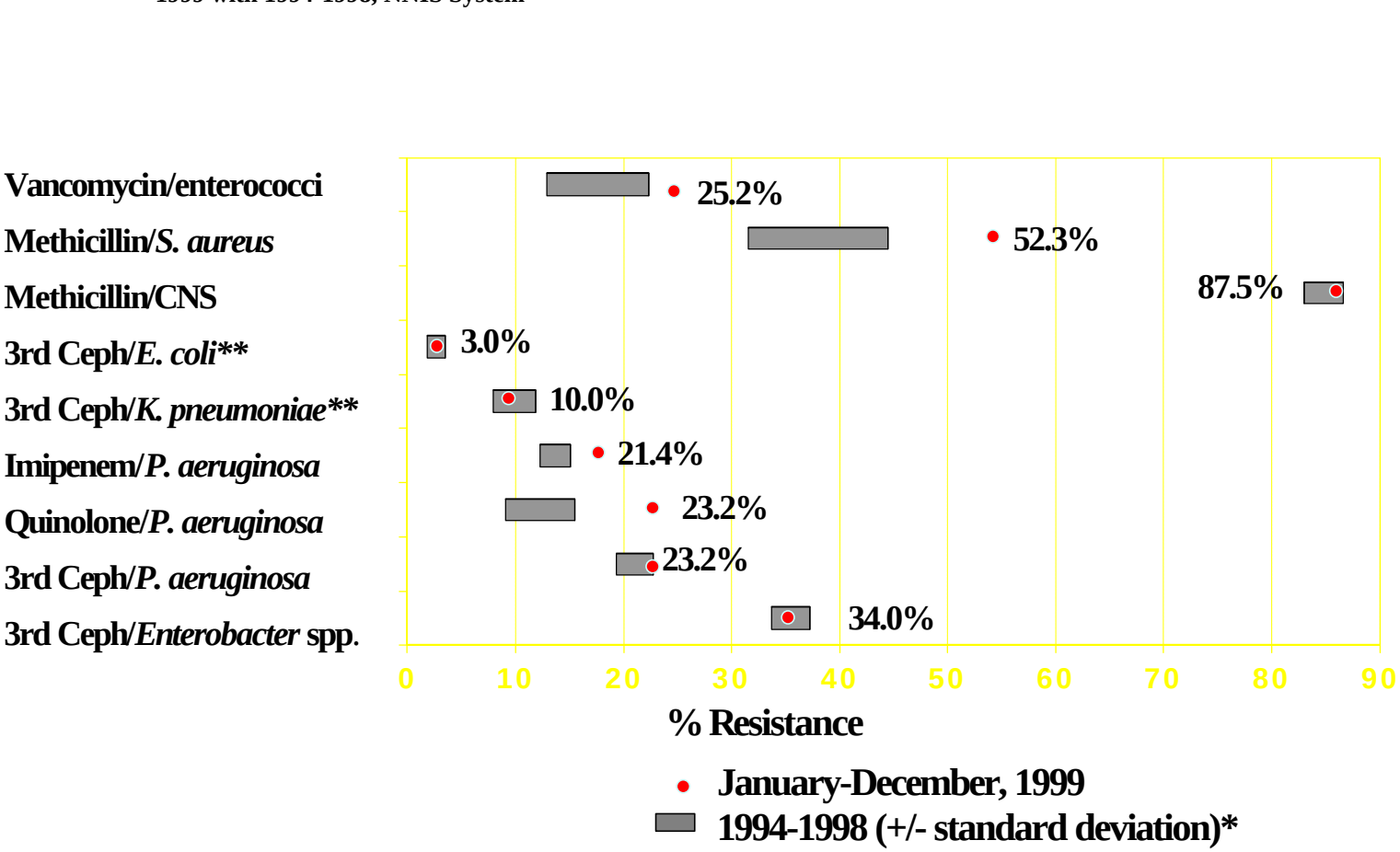
Type of ICU	No. of Units	Patient-Days	Pooled Mean	Percentile 10%	25%	50% (median)	75%	90%
Coronary	113	898,305	0.19	0.08	0.11	0.18	0.29	0.34
Cardiothoracic	59	516,088	0.47	0.33	0.38	0.48	0.54	0.61
Medical	138	1,276,794	0.48	0.20	0.32	0.45	0.59	0.68
Medical/Surgical Major teaching	114	857,705	0.46	0.27	0.35	0.43	0.54	0.64
Medical/Surgical All others	176	1,782,482	0.35	0.19	0.26	0.34	0.42	0.51
Neurosurgical	49	291,917	0.38	0.21	0.27	0.37	0.46	0.58
Pediatric	77	658,404	0.46	0.19	0.33	0.43	0.51	0.59
Surgical	157	1,451,793	0.47	0.24	0.35	0.46	0.55	0.65
Trauma	25	180,049	0.57	0.36	0.50	0.61	0.70	0.74
Burn	17	74,805	0.33	.	.	.	.	.
Respiratory	7	45,886	0.50	.	.	.	.	.

* $\frac{\text{Number of urinary catheter-days}}{\text{Number of patient-days}}$

** $\frac{\text{Number of central line-days}}{\text{Number of patient-days}}$

*** $\frac{\text{Number of ventilator-days}}{\text{Number of patient-days}}$

Figure 1. Selected antimicrobial resistant pathogens associated with nosocomial infections in ICU patients, comparison of resistance rates from January-December 1999 with 1994-1998, NNIS System



	January-December no. isolates tested	% increase in resistance (99 vs 94-98)*
Vancomycin/enterococci	1579	43%
Methicillin/*S. aureus*	2106	37%
Methicillin/CNS	3358	2%
3rd Ceph/*E. coli***	1425	8%
3rd Ceph/*K. pneumoniae***	773	- 3%
Imipenem/*P. aeruginosa*	1119	56%
Quinolone/*P. aeruginosa*	1639	50%
3rd Ceph/*P. aeruginosa*	1763	10%
3rd Ceph/*Enterobacter* spp.	1426	- 4%

Note: CNS=coagulase-negative staphylococci, 3rd Ceph = resistance to $1 of the following: ceftriaxone, cefotaxime, or ceftazidime, quinolone=resistance to either ciprofloxacin or ofloxacin.

* Percentage (%) increase in resistance rate of current year (January-December1999) compared to mean rate of resistance over previous 5 years (1994 through 1998): [(1999 rate - previous 5 year mean rate)/previous 5 year mean rate]*100.

** "Resistance" for *E. coli* or *K. pneumoniae* is the rate of non-susceptibility of these organisms to either 3rd Ceph group or aztreonam.

Table 3. High risk nursery surveillance component. Pooled means and percentiles of the distribution of device-associated infection rates, by birthweight category, NNIS system, January 1990 - October 1999

Umbilical and central line-associated BSI rate*				Percentile				
Birthweight Category	**No. of HRNs**	**Central-Line Days**	**Pooled Mean**	**10%**	**25%**	**50% (median)**	**75%**	**90%**
#1000 grams	130	422,608	12.0	5.1	7.9	11.8	15.8	18.6
1001-1500 grams	128	202,095	7.3	0.6	3.9	6.5	10.3	15.0
1501-2500 grams	131	169,846	4.7	0.0	1.7	4.0	6.9	10.8
> 2500 grams	133	245,072	4.5	0.0	1.3	3.4	5.9	8.7

Ventilator-associated pneumonia rate**				Percentile				
Birthweight Category	**No. of HRNs**	**Ventilator-Days**	**Pooled Mean**	**10%**	**25%**	**50% (median)**	**75%**	**90%**
#1000 grams	130	444,180	4.9	0.1	1.5	4.4	7.7	11.3
1001-1500 grams	124	139,554	3.9	0.0	0.0	2.7	6.1	9.1
1501-2500 grams	126	109,259	3.2	0.0	0.0	1.6	3.9	7.5
> 2500 grams	127	163,689	2.8	0.0	0.0	1.2	3.9	7.2

* $\frac{\text{Number of umbilical and central line-associated BSIs}}{\text{Number of umbilical and central line-days}} \times 1000$

** $\frac{\text{Number of ventilator-associated Pneumonias}}{\text{Number of ventilator-days}} \times 1000$

Table 4. High risk nursery surveillance component. Pooled means and percentiles of the distribution of device utilization ratios, by birthweight category, NNIS system, January 1990-October 1999

Umbilical and central line utilization ratio*

Birthweight Category	No. of HRNs	Patient-Days	Pooled Mean	Percentile 10%	25%	50% (median)	75%	90%
#1000 grams	132	1,046,562	0.40	0.19	0.28	0.39	0.53	0.65
1001-1500 grams	133	740,471	0.27	0.09	0.14	0.24	0.39	0.52
1501-2500 grams	139	823,475	0.21	0.05	0.09	0.16	0.30	0.45
> 2500 grams	138	784,878	0.31	0.07	0.14	0.22	0.38	0.54

Ventilator utilization ratio**

Birthweight Category	No. of HRNs	Patient-Days	Pooled Mean	Percentile 10%	25%	50% (median)	75%	90%
#1000 grams	132	1,046,562	0.42	0.25	0.33	0.40	0.52	0.64
1001-1500 grams	133	740,471	0.19	0.07	0.11	0.16	0.26	0.40
1501-2500 grams	139	823,475	0.13	0.03	0.05	0.09	0.17	0.32
> 2500 grams	138	784,878	0.21	0.04	0.08	0.13	0.24	0.37

*$\frac{\text{Number of umbilical and central line-days}}{\text{Number of patient-days}}$

**$\frac{\text{Number of ventilator-days}}{\text{Number of patient-days}}$

Table 5. Surgical patient surveillance component. Surgical site infection rates[‡], by operative procedure and risk index category, NNIS system, 1992-1998

Operative Procedure Category	Duration Cutpoint (hrs)	Risk Index Category	N	Rate	Risk Index Category	N	Rate	Risk Index Category	N	Rate	Risk Index Category	N	Rate
CARD Cardiac Surgery	5	0	1021	0.59	1	13285	1.69	2,3	4010	2.84	.	.	.
CBGB* CABG-Chest & Leg	5	0	1098	0.73	1	113169	3.46	2	22942	5.82	3	57	17.54
CBGC** CABG-Chest Only	4	0,1	6210	2.62	2,3	2420	4.05		.	.	.	.	.
OCVS Other Cardiovascular Surg	2	0,1	5313	0.77	2	1660	1.69	3	69	5.80	.	.	.
ORES Other Respiratory System	2	0,1,2,3	1352	2.74		.	.		.	.	.	.	.
THOR Thoracic Surgery	3	0	936	0.43	1	2876	1.29	2,3	1048	3.24	.	.	.
BILI Liver/Pancreas	4	0	309	3.24	1,2,3	1094	7.04		.	.	.	.	.
OGIT Other Digestive Surgery	3	0,1	2290	3.23	2,3	432	8.10		.	.	.	.	.
SB Small Bowel Surgery	3	0	823	5.59	1	1876	7.52	2	1010	9.80	3	183	14.75
XLAP Laparotomy	2	0	3733	1.69	1	4125	3.15	2	2181	5.36	3	363	7.99
NEPH Nephrectomy	4	0,1,2,3	2046	1.22		.	.		.	.	.	.	.
OGU Other Genitourinary Surgery	2	0	8946	0.44	1	4016	1.17	2,3	983	2.95	.	.	.
PRST Prostatectomy	4	0	1648	0.91	1,2,3	1306	2.68		.	.	.	.	.
HN Head and Neck	7	0	442	2.94	1	595	5.71	2,3	280	13.93	.	.	.
OENT Other ENT	2	0,1	2474	0.24	2,3	272	2.94		.	.	.	.	.
HER Herniorrhaphy	2	0	7251	0.79	1	3982	1.86	2,3	901	3.44	.	.	.
MAST Mastectomy	3	0,1	11178	2.07	2,3	403	3.97		.	.	.	.	.
CRAN Craniotomy	4	0	2054	0.58	1,2,3	8112	1.75		.	.	.	.	.
ONS Other Nervous System	4	0,1,2,3	1648	1.76		.	.		.	.	.	.	.
VSHN Ventricular Shunt	2	0	1549	3.68	1,2,3	3573	5.12		.	.	.	.	.
CSEC Cesarean Section	1	0	59921	3.27	1	19920	4.74	2,3	1641	8.65	.	.	.

Table 5 - continued

Operative Procedure Category	Duration Cutpoint (hrs)	Risk Index Category	N	Rate	Risk Index Category	N	Rate	Risk Index Category	N	Rate	Risk Index Category	N	Rate
HYST Abdominal Hysterectomy	2	0	17590	1.50	1	9504	2.47	2,3	2012	6.11	.	.	.
OOB Other Obstetric Procedures	1	0,1,2,3	793	0.50		.	.		.	.	.	.	.
VHYS Vaginal Hysterectomy	2	0	7959	1.08	1,2,3	3937	1.47		.	.	.	.	.
AMP Limb Amputation	1	0,1,2,3	5991	4.29		.	.		.	.	.	.	.
FUSN Spinal Fusion	4	0	12306	1.23	1	7206	3.07	2,3	1979	7.23	.	.	.
FX Open Reduction Fracture	2	0	8474	0.64	1	12709	1.33	2,3	2931	2.59	.	.	.
HPRO Hip Prosthesis	2	0	9841	0.78	1	17638	1.55	2,3	5120	2.07	.	.	.
KPRO Knee Prosthesis	2	0	13721	0.87	1	17101	1.22	2,3	4928	2.03	.	.	.
LAM Laminectomy	2	0	18951	0.85	1	14064	1.38	2,3	4122	2.57	.	.	.
OMS Other Musculoskeletal	3	0	9493	0.65	1	6680	0.93	2,3	1788	2.07	.	.	.
OPRO Other Prosthesis	3	0,1,2,3	1396	0.64		.	.		.	.	.	.	.
OBL Other Hem/Lymph System	3	0,1,2,3	844	2.01		.	.		.	.	.	.	.
OES Other Endocrine System	3	0	1364	0.15	1,2,3	1046	0.96		.	.	.	.	.
OEYE Other Eye	2	0,1,2,3	437	0.69		.	.		.	.	.	.	.
OSKN Other Integumentary System	2	0,1,2,3	5501	1.38		.	.		.	.	.	.	.
SKGR Skin Graft	3	0,1	1872	1.44	2,3	806	4.47		.	.	.	.	.
SPLE Splenectomy	3	0,1,2,3	1016	2.85		.	.		.	.	.	.	.
TP Organ Transplant	7	0,1	2077	5.39	2,3	5711	6.99		.	.	.	.	.
VS Vascular Surgery	3	0	3579	0.98	1	30595	1.79	2,3	12515	5.05	.	.	.

‡per 100 operations

*CBGB (chest and leg) = Coronary artery bypass graft, chest and leg (donor) incisions

**CBGC (chest only) = Coronary artery bypass graft, chest incision only (example: internal mammary artery)

Table 6. Surgical patient surveillance component. Percentiles of the distribution of surgical site infection rates[‡], by operative procedure and risk index category[§], NNIS system, 1992 - 1998

Operative Procedure Category	Risk Index Category	No. Hospitals	Pooled Mean Rate	Percentile				
				10%	25%	50% (median)	75%	90%
CARD Cardiac Surgery	1	71	1.69	0.00	0.00	1.28	2.06	3.46
CARD Cardiac Surgery	2,3	45	2.84	0.00	0.00	2.01	3.96	6.57
CBGB* CABG-Chest & Leg	1	123	3.46	1.09	1.92	2.95	4.29	6.70
CBGB* CABG-Chest & Leg	2	107	5.82	1.30	3.09	5.43	7.80	10.82
CBGC** CABG-Chest Only	0,1	52	2.62	0.00	0.00	1.33	3.38	4.43
CBGC** CABG-Chest Only	2,3	29	4.05	0.00	0.00	1.81	3.61	6.16
OCVS Other Cardiovascular Surgery	0,1	27	0.77	0.00	0.00	0.00	1.38	2.97
THOR Thoracic Surgery	1	31	1.29	0.00	0.00	0.00	2.01	2.77
OGIT Other Digestive Tract Surgery	0,1	21	3.23	0.00	1.41	2.38	5.05	7.36
SB Small Bowel Surgery	1	24	7.52	2.49	4.17	6.38	10.42	16.80
XLAP Laparotomy	0	30	1.69	0.00	0.00	1.43	2.40	4.55
XLAP Laparotomy	1	37	3.15	0.00	0.23	2.60	3.98	6.69
XLAP Laparotomy	2	25	5.36	0.00	1.25	4.04	7.84	9.80
NEPH Nephrectomy	0,1,2,3	24	1.22	0.00	0.00	0.00	1.92	4.01
OGU Other Genitourinary	0	28	0.44	0.00	0.00	0.25	1.04	1.45
OGU Other Genitourinary	1	25	1.17	0.00	0.11	0.64	2.08	3.30
PRST Prostatectomy	0	23	0.91	0.00	0.00	0.00	1.05	3.09
HER Herniorrhaphy	0	40	0.79	0.00	0.00	0.24	1.45	2.33
HER Herniorrhaphy	1	39	1.86	0.00	0.00	1.10	2.94	3.85
MAST Mastectomy	0,1	48	2.07	0.00	0.00	0.86	2.42	3.42
CRAN Craniotomy	0	26	0.58	0.00	0.00	0.00	1.34	2.38
CRAN Craniotomy	1,2,3	51	1.75	0.00	0.00	0.92	2.36	3.23
VSHN Ventricular Shunt	1,2,3	30	5.12	0.00	1.15	3.84	6.16	9.76
CSEC Cesarean Section	0	96	3.27	0.00	1.21	2.59	5.69	9.12
CSEC Cesarean Section	1	87	4.74	0.00	1.56	3.38	7.16	9.77
CSEC Cesarean Section	2,3	22	8.65	0.00	4.27	6.60	13.07	18.08
HYST Abdominal Hysterectomy	0	66	1.50	0.00	0.00	1.16	2.33	4.23
HYST Abdominal Hysterectomy	1	63	2.47	0.00	0.00	1.55	2.79	4.71
HYST Abdominal Hysterectomy	2,3	29	6.11	0.00	2.74	4.71	9.42	11.61

Table 6 - continued

Operative Procedure Category	Risk Index Category	No. Hospitals	Pooled Mean Rate	Percentile				
				10%	25%	50% (median)	75%	90%
VHYS Vaginal Hysterectomy	0	33	1.08	0.00	0.00	0.52	1.62	3.93
VHYS Vaginal Hysterectomy	1,2,3	34	1.47	0.00	0.00	1.15	1.95	4.23
AMP Limb Amputation	0,1,2,3	36	4.29	0.00	1.57	3.25	5.37	8.39
FUSN Spinal Fusion	0	57	1.23	0.00	0.00	0.47	1.45	2.56
FUSN Spinal Fusion	1	55	3.07	0.00	0.00	2.08	4.02	6.36
FUSN Spinal Fusion	2,3	26	7.23	0.00	4.67	7.02	9.60	13.46
FX Open Reduction Fracture	1	60	1.33	0.00	0.00	0.90	1.64	2.37
HPRO Hip Prosthesis	0	91	0.78	0.00	0.00	0.00	1.09	2.81
HPRO Hip Prosthesis	1	119	1.55	0.00	0.00	1.04	2.35	3.85
HPRO Hip Prosthesis	2,3	73	2.07	0.00	0.00	1.06	3.80	6.29
KPRO Knee Prosthesis	0	91	0.87	0.00	0.00	0.31	1.59	2.80
KPRO Knee Prosthesis	1	111	1.22	0.00	0.00	0.93	1.91	3.24
KPRO Knee Prosthesis	2,3	68	2.03	0.00	0.00	1.47	3.45	5.56
LAM Laminectomy	0	83	0.85	0.00	0.00	0.47	1.13	2.66
LAM Laminectomy	1	77	1.38	0.00	0.00	1.01	2.37	3.38
LAM Laminectomy	2,3	51	2.57	0.00	0.00	2.41	3.57	6.90
OMS Other Musculoskeletal	0	34	0.65	0.00	0.00	0.45	0.83	0.96
OMS Other Musculoskeletal	1	32	0.93	0.00	0.00	0.00	1.23	1.88
OSKN Other Integumentary System	0,1,2,3	26	1.38	0.00	0.00	0.95	1.49	2.39
VS Vascular Surgery	0	47	0.98	0.00	0.00	0.00	1.68	3.94
VS Vascular Surgery	1	83	1.79	0.00	0.71	1.38	2.25	3.50
VS Vascular Surgery	2,3	77	5.05	0.00	2.87	4.65	7.2	9.18
FX Open Reduction Fracture	2,3	35	2.59	0.00	0.00	2.80	4.40	7.5

‡ per 100 operations

§Includes only those procedure-risk categories for which at least 20 hospitals have reported at least 30 operations.

*CABG-Chest and Leg = Coronary artery bypass graft, chest and leg (donor) incisions

**CABG-Chest Only = Coronary artery bypass graft, chest incision only (example: internal mammary artery)

Table 7. Surgical patient component. Surgical site infection rates*, by selected operative procedure and modified risk index category incorporating laparoscope use, 1992-1998**

Operative Procedure Category	Duration Cutpoint (hrs)	Risk Index Category	N	Rate	Risk Index Category	N	Rate	Risk Index Category	N	Rate	Risk Index Category	N	Rate	Risk Index Category	N	Rate
CHOL Cholecystectomy	2	M	17,095	0.49	0	15,471	0.69	1	7,417	2.04	2	2,492	3.49	3	318	6.60
COLO Colon Surgery	3	M	288	0.69	0	6,812	4.32	1	11,856	6.24	2	5,267	9.55	3	718	12.95
APPY Appendectomy	1	0-Yes	893	0.56	0-No	3,866	1.37	1	4,957	3.17	2,3	2,121	5.85	.	.	.
GAST Gastric Surgery	3	0-Yes	203	0.49	0-No	1,144	2.71	1	2,416	5.13	2,3	1,184	10.73	.	.	.

* per 100 operations

** This table uses a new modified risk index that incorporates the influence of laparoscope or endoscope (SCOPE) on SSI rates. The influence of SCOPE on SSI rates was different across the four procedures:

< For Cholecystectomy and Colon Surgery, when the operation was done laparoscopically, 1 was subtracted from the number of risk factors (ASA score of 3,4, or 5; duration of surgery >75th percentile; or contaminated or dirty wound class) in the NNIS risk index. For example, when two risk factors were present and the procedure was done laparoscopically, the new modified risk index category is 1 (i.e., 2-1=1). When no risk factors were present and the procedure was performed with a laparoscope, i.e., 0-1=-1, we designated this new modified risk category as minus 1 or "M".

< For Appendectomy and Gastric Surgery, the use of a SCOPE was important only if the patient had no other risk factors. We split patients with no other risk factors into two groups: '0-Yes' which means laparoscope was used and '0-No' when laparoscope was not used. Since there was no difference in the rates when 2 or 3 risk factors were present, the rates for categories 2 and 3 were combined into a single category.

Table 8. Surgical patient surveillance component. Surgical site infection rates* following coronary artery bypass graft (CBGB) procedure, by risk index category and specific site, NNIS system, January 1992 - December 1997

Infection Site	Risk Index Category 0		1		2		3	
	No. SSIs	Rate	No. SSIs	Rate	No. SSIs	Rate	No. SSIs	Rate
Leg (donor site)	**4**	**0.36**	**1798**	**1.59**	**644**	**2.81**	**2**	**3.51**
Superficial incisional	*4*	*0.36*	*1453*	*1.28*	*504*	*2.20*	*2*	*3.51*
Deep incisional	*0*	*0.00*	*345*	*0.30*	*140*	*0.61*	*0*	*0.00*
Chest	**4**	**0.36**	**2120**	**1.87**	**692**	**3.02**	**8**	**14.04**
Superficial incisional	*3*	*0.27*	*892*	*0.79*	*285*	*1.24*	*2*	*3.51*
Deep incisional	*0*	*0.00*	*560*	*0.49*	*185*	*0.81*	*3*	*5.26*
Organ/space	*1*	*0.09*	*668*	*0.59*	*222*	*0.97*	*3*	*5.26*
Total	**8**	**0.73**	**3918**	**3.46**	**1336**	**5.82**	**10**	**17.54**

*per 100 operations.

Denominators for the risk categories are as follows:

Category 0 = 1, 098
Category 1 = 113, 169
Category 2 = 22, 942
Category 3 = 57

Table 9. ICARE Project. Pooled means and percentiles of the distribution of antimicrobial usage rates (Defined Daily Dose [DDD]*/1000 patient-days), by non-ICU inpatient areas and various types of ICU, January 1996 - November 1999**

Non-ICU Inpatient Areas (n=59)			Percentile				
Antimicrobial Agent	No. DDD	Pooled Mean	10%	25%	50% (median)	75%	90%
Penicillin group	76,481	9.7	2.0	3.4	6.3	9.8	16.2
Ampicillin group	513,252	65.0	36.7	50.0	62.3	78.0	102.4
Antipseudomonal penicillins	129,243	16.4	2.3	7.6	16.0	23.2	35.1
Antistaphylococcal penicillins	114,608	14.5	2.9	4.4	11.7	17.1	24.5
First-generation cephalosporins	611,281	77.4	45.6	58.7	75.5	102.8	129.3
Second-generation cephalosporins	343,290	43.5	12.3	24.4	35.7	58.9	75.7
Third-generation cephalosporins	658,150	83.3	29.6	49.0	76.8	117.5	140.7
Carbapenem group	43,283	5.5	0.3	1.5	3.8	7.1	14.7
Aztreonam	20,528	2.6	0.1	0.7	1.6	3.7	6.8
Fluoroquinolones	436,962	55.3	21.2	36.3	54.8	77.6	114.4
Trimethoprim/sulfamethoxazole	304,687	38.6	1.3	19.1	27.5	44.5	80.1
Vancomycin (oral)	18,164	2.3	0.0	0.6	1.3	2.2	4.2
Vancomycin (parenteral)	219,697	27.8	12.1	16.3	22.3	34.7	60.9

* DDD of an antimicrobial agent is calculated by dividing the total grams of the antimicrobial agent used in a hospital area by the number of grams in an average daily dose of the agent given to an adult patient.

** DDD per 1,000 patient days = $\frac{\text{DDD of specific agent used}}{\text{Total number of patient-days}} \times 1000$

Table 9. - continued

Coronary Care Unit (n=29)			Percentile				
Antimicrobial Agent	**No. DDD**	**Pooled Mean**	**10%**	**25%**	**50% (median)**	**75%**	**90%**
Penicillin group	516	5.0	0.0	0.4	1.9	5.9	17.6
Ampicillin group	4,020	38.8	4.2	17.9	37.1	72.3	97.9
Antipseudomonal penicillins	2,911	28.1	0.0	3.9	15.9	46.2	78.5
Antistaphylococcal penicillins	1,965	19.0	0.0	2.7	11.7	31.7	55.8
First-generation cephalosporins	4,075	39.3	7.5	28.1	35.5	49.9	104.9
Second-generation cephalosporins	3,604	34.8	0.5	9.2	18.9	34.4	48.0
Third-generation cephalosporins	12,652	122.0	19.5	46.2	120.3	143.8	263.1
Carbapenem group	879	8.6	0.0	0.5	4.7	10.1	30.1
Aztreonam	694	6.7	0.0	0.0	2.0	9.2	15.4
Fluoroquinolones	7,163	69.1	6.1	16.3	39.9	74.5	167.6
Trimethoprim/sulfamethoxazole	3,406	32.9	0.0	7.4	19.9	34.1	106.4
Vancomycin (oral)	441	4.3	0.0	0.0	0.0	1.0	8.1
Vancomycin (parenteral)	4,799	46.3	9.9	19.0	32.1	75.3	107.0

Table 9. - Continued

Cardiothoracic ICU (n=19)			Percentile				
Antimicrobial Agent	No. DDD	Pooled Mean	10%	25%	50% (median)	75%	90%
Penicillin group	423	4.3	0.0	0.0	1.4	5.4	16.8
Ampicillin group	2,547	26.0	0.6	8.0	27.6	37.5	65.2
Antipseudomonal penicillins	1,955	19.9	0.0	2.6	16.0	36.1	48.6
Antistaphylococcal penicillins	1,226	12.5	0.0	0.0	6.4	19.9	29.9
First-generation cephalosporins	25,129	256.0	41.4	120.6	258.7	501.6	720.2
Second-generation cephalosporins	5,678	57.9	1.9	3.9	25.4	81.2	625.3
Third-generation cephalosporins	9,362	95.5	15.0	28.2	84.8	132.2	201.5
Carbapenem group	1,345	13.7	0.0	0.5	5.2	16.3	49.4
Aztreonam	669	6.8	0.0	0.1	1.2	5.3	26.7
Fluoroquinolones	4,110	41.9	3.5	11.6	43.3	67.3	165.4
Trimethoprim/sulfamethoxazole	1,018	10.4	0.0	0.0	6.3	13.9	100.9
Vancomycin (oral)	453	4.6	0.0	0.0	0.0	0.8	19.2
Vancomycin (parenteral)	10,180	104.0	17.3	29.3	97.0	190.0	355.9

Table 9. - Continued

Hematology/Oncology/Transplant Wards (n=17)			Percentile				
Antimicrobial Agent	**No. DDD**	**Pooled Mean**	**10%**	**25%**	**50% (median)**	**75%**	**90%**
Penicillin group	436	5.0	0.0	0.1	3.1	6.0	9.3
Ampicillin group	4,774	54.3	1.1	21.3	42.5	61.0	105.4
Antipseudomonal penicillins	2,868	32.6	5.8	11.5	22.2	45.6	86.7
Antistaphylococcal penicillins	1,171	13.3	1.2	2.7	7.4	23.2	51.7
First-generation cephalosporins	3,894	44.3	8.6	25.7	34.8	41.4	90.3
Second-generation cephalosporins	2,491	28.3	3.4	6.0	14.3	30.2	48.5
Third-generation cephalosporins	27,854	317.0	104.0	180.2	233.8	341.3	410.1
Carbapenem group	1,238	14.1	0.1	5.1	16.8	23.4	40.3
Aztreonam	778	8.8	0.0	2.6	5.8	14.4	38.3
Fluoroquinolones	13,231	151.0	29.1	75.7	142.5	229.7	310.5
Trimethoprim/sulfamethoxazole	3,381	38.5	0.0	23.8	29.4	56.2	101.4
Vancomycin (oral)	383	4.4	0.0	0.0	1.7	4.9	12.3
Vancomycin (parenteral)	7,605	86.5	32.1	65.1	98.7	133.4	253.0

Table 9. - Continued

Medical ICU (n=31)			Percentile				
Antimicrobial Agent	No. DDD	Pooled Mean	10%	25%	50% (median)	75%	90%
Penicillin group	1,065	6.6	0.1	1.9	5.3	9.0	14.4
Ampicillin group	12,346	76.3	32.6	56.2	79.2	98.0	177.0
Antipseudomonal penicillins	10,285	63.5	4.6	24.4	71.6	112.9	119.9
Antistaphylococcal penicillins	4,214	26.0	1.5	6.0	22.3	48.6	66.1
First-generation cephalosporins	3,861	23.8	8.8	15.0	28.1	40.5	62.1
Second-generation cephalosporins	5,424	33.5	3.6	11.5	27.7	59.2	69.0
Third-generation cephalosporins	36,911	228.0	83.5	120.7	194.1	362.1	413.6
Carbapenem group	3,925	24.2	0.0	5.1	21.7	54.5	83.0
Aztreonam	1,065	6.6	0.0	1.9	6.6	13.4	18.1
Fluoroquinolones	13,940	86.1	22.6	45.6	86.5	128.1	217.1
Trimethoprim/sulfamethoxazole	7,479	46.2	1.9	17.6	39.1	59.3	95.7
Vancomycin (oral)	238	1.5	0.0	0.0	0.7	2.7	4.4
Vancomycin (parenteral)	12,305	76.0	36.0	55.5	74.9	133.3	172.1

Table 9. - Continued

Medical-Surgical ICU (n=45)			Percentile				
Antimicrobial Agent	**No. DDD**	**Pooled Mean**	**10%**	**25%**	**50% (median)**	**75%**	**90%**
Penicillin group	1,853	7.7	0.0	0.5	2.5	8.6	28.8
Ampicillin group	21,104	87.4	28.9	50.9	75.1	128.6	143.2
Antipseudomonal penicillins	17,059	70.6	17.0	29.3	50.1	90.2	120.0
Antistaphylococcal penicillins	5,531	22.9	1.3	4.5	11.5	22.7	51.6
First-generation cephalosporins	30,951	128.0	19.5	61.4	85.1	145.3	257.4
Second-generation cephalosporins	14,555	60.3	4.5	14.7	36.9	73.2	105.5
Third-generation cephalosporins	49,333	204.0	80.0	106.9	181.5	259.9	305.1
Carbapenem group	7,232	30.0	1.3	5.8	21.3	40.2	56.7
Aztreonam	2,767	11.5	0.0	1.7	7.0	15.1	25.3
Fluoroquinolones	31,734	131.0	33.3	53.6	104.1	162.0	285.7
Trimethoprim/sulfamethoxazole	9,961	41.3	0.0	11.4	21.7	35.9	100.7
Vancomycin (oral)	1,228	5.1	0.0	0.0	1.9	4.2	11.7
Vancomycin (parenteral)	16,754	69.4	27.0	44.7	54.5	81.1	137.4

Table 9. - Continued

Neurosurgical ICU (n=10)			Percentile				
Antimicrobial Agent	No. DDD	Pooled Mean	10%	25%	50% (median)	75%	90%
Penicillin group	346	8.0	0.0	2.2	6.5	14.9	27.0
Ampicillin group	2,120	48.8	7.4	33.2	51.0	62.3	73.5
Antipseudomonal penicillins	1,873	43.2	9.0	21.6	34.5	44.3	68.0
Antistaphylococcal penicillins	2,594	59.8	2.7	5.0	26.8	70.6	164.3
First-generation cephalosporins	5,376	124.0	38.3	83.8	107.0	173.4	314.4
Second-generation cephalosporins	981	22.6	1.3	5.5	8.5	29.2	34.9
Third-generation cephalosporins	9,542	220.0	41.6	124.7	206.8	314.7	366.5
Carbapenem group	1,154	26.6	0.0	0.0	7.4	44.4	53.3
Aztreonam	77	1.8	0.0	0.0	1.6	4.2	8.4
Fluoroquinolones	2,930	67.5	21.6	36.6	69.1	141.4	196.6
Trimethoprim/sulfamethoxazole	1,095	25.2	0.8	12.7	26.7	41.5	66.0
Vancomycin (oral)	54	1.2	0.0	0.0	0.0	0.2	4.1
Vancomycin (parenteral)	4,062	93.6	48.3	62.8	100.3	124.9	146.0

Table 9. - Continued

Surgical ICU (n=28)			Percentile				
Antimicrobial Agent	**No. DDD**	**Pooled Mean**	**10%**	**25%**	**50% (median)**	**75%**	**90%**
Penicillin group	1,307	7.6	0.0	0.8	3.7	11.9	20.7
Ampicillin group	13,249	76.8	12.6	53.2	85.3	145.4	207.6
Antipseudomonal penicillins	7,054	40.9	1.4	24.9	47.6	76.7	124.0
Antistaphylococcal penicillins	3,513	20.4	0.7	2.5	14.8	38.7	55.3
First-generation cephalosporins	23,208	135.0	24.8	92.9	154.2	312.9	490.2
Second-generation cephalosporins	7,092	41.1	3.7	22.1	51.2	68.9	136.2
Third-generation cephalosporins	20,846	121.0	41.8	86.4	145.5	184.4	222.8
Carbapenem group	5,463	31.7	0.0	4.9	19.2	53.2	71.5
Aztreonam	1,148	6.7	0.1	5.2	8.1	12.5	19.3
Fluoroquinolones	11,270	65.3	12.0	41.9	83.5	112.6	208.8
Trimethoprim/sulfamethoxazole	4,524	26.2	4.0	12.7	24.4	46.7	92.3
Vancomycin (oral)	262	1.5	0.0	0.0	1.2	3.0	11.9
Vancomycin (parenteral)	14,029	81.3	36.0	64.7	104.1	155.9	169.6

Table 9. - Continued

Pediatric ICU (n=15)			Percentile				
Antimicrobial Agent	**No. DDD**	**Pooled Mean**	**10%**	**25%**	**50% (median)**	**75%**	**90%**
Penicillin group	280	2.2	0.0	0.5	2.1	8.8	12.7
Ampicillin group	1,683	13.3	7.5	25.3	51.0	62.9	68.3
Antipseudomonal penicillins	561	4.4	0.0	1.2	7.5	24.0	34.6
Antistaphylococcal penicillins	1,102	8.7	1.6	12.1	22.4	32.0	52.6
First-generation cephalosporins	1,898	15.0	3.6	23.4	34.7	75.6	113.9
Second-generation cephalosporins	1,473	11.7	2.9	17.3	26.6	53.1	83.0
Third-generation cephalosporins	7,378	58.5	22.5	71.9	152.3	314.1	386.0
Carbapenem	215	1.7	0.0	0.0	1.0	10.6	14.1
Aztreonam	80	0.6	0.0	0.0	0.0	0.5	3.6
Fluoroquinolones	334	2.6	0.0	0.0	1.7	11.5	17.8
Trimethoprim/sulfamethoxazole	596	4.7	0.0	0.0	7.2	12.8	38.7
Vancomycin (oral)	151	1.2	0.0	0.0	0.0	2.7	15.7
Vancomycin (parenteral)	2,434	19.3	3.5	14.8	60.9	70.8	106.6

Table 10. ICARE Project. Pooled means and percentiles of the distribution of antimicrobial resistance rates*, by all ICUs combined, non-ICU inpatient units, and outpatients, January 1996 - November 1999

All ICUs Combined

Antimicrobial-resistant pathogen	No. Units	No. Tested	Pooled Mean	Percentile				
				10%	25%	50% (median)	75%	90%
MRSA	170	11,370	39.4	14.8	23.1	40.2	56.1	66.7
Methicillin-resistant CNS	161	9,952	74.2	54.5	65.8	75.4	81.8	87.4
Vancomycin-resistant *Enterococcus*	147	7,220	16.7	0.0	2.4	10.0	18.2	29.0
Ciprofloxacin/ofloxacin-resistant *Pseudomonas aeruginosa*	149	9,135	24.7	4.2	10.1	21.1	34.1	58.8
Levofloxacin-resistant *P aeruginosa*	33	1,275	35.5	8.0	15.4	26.7	38.1	52.5
Imipenem-resistant *P aeruginosa*	133	7,232	17.0	0.0	5.6	10.7	21.2	32.3
Ceftazidime-resistant *P aeruginosa*	140	8,192	11.1	0.0	3.0	8.8	15.1	25.0
Piperacillin-resistant *P aeruginosa*	127	6,917	14.4	0.0	4.3	11.8	19.2	31.7
Cef3-resistant *Enterobacter* spp	119	4,122	25.5	8.8	17.6	26.8	38.0	50.0
Carbapenem-resistant *Enterobacter* spp	67	1,568	1.2	0.0	0.0	0.0	0.0	4.8
Cef3-resistant *Klebsiella pneumoniae*	125	4,294	6.5	0.0	0.0	0.0	6.7	17.9
Cef3-resistant *Escherichia coli*	145	6,339	1.4	0.0	0.0	0.0	2.2	6.4
Quinolone-resistant *E coli*	142	6,047	2.5	0.0	0.0	0.0	4.5	10.0
Penicillin-resistant pneumococcus	47	999	14.5	0.0	0.0	6.7	23.1	50.0
Cefotaxime/ceftriaxone-resistant pneumococcus	14	243	2.5	0.0	0.0	0.0	2.9	8.3

MRSA=Methicillin-resistant *Staphylococcus aureus*; CNS=coagulase-negative *Staphylococcus*; Cef3=ceftazidime, cefotaxime, or ceftriaxone; Quinolone=ciprofloxacin, ofloxacin, or levofloxacin; Carbapenem = imipenem or meropenem

* $\frac{\text{Number of resistant antimicrobial-pathogen isolates}}{\text{Total number of antimicrobial-pathogen isolates that were tested for susceptibility}} \times 100$

Table 10. - Continued

Non-ICU Inpatient Areas

Antimicrobial-resistant pathogen	No. Units	No. Tested	Pooled Mean	Percentiles 10%	25%	50% (median)	75%	90%
MRSA	59	33,674	35.7	17.4	26.9	35.0	47.2	53.5
Methicillin-resistant CNS	59	23,740	61.8	48.4	57.1	60.9	67.2	72.1
Vancomycin-resistant *Enterococcus*	58	29,811	11.7	0.9	2.1	4.8	9.8	19.1
Ciprofloxacin/ofloxacin-resistant *Pseudomonas aeruginosa*	59	21,752	22.2	11.8	17.8	28.8	40.1	66.8
Levofloxacin-resistant *P aeruginosa*	15	2,433	26.3	12.9	20.0	23.9	32.3	35.2
Imipenem-resistant *P aeruginosa*	55	16,728	11.3	3.4	6.3	9.4	13.2	16.7
Ceftazidime-resistant *P aeruginosa*	57	20,146	7.2	1.4	3.8	6.3	11.2	14.4
Piperacillin-resistant *P aeruginosa*	56	16,897	9.5	2.7	4.9	8.1	12.6	18.6
Cef3-resistant *Enterobacter* spp	59	7,929	21.6	8.9	13.6	20.4	26.3	34.9
Carbapenum-resistant Enterobacter spp	35	2,552	1.4	0.0	0.0	0.0	1.1	4.9
Cef3-resistant *Klebsiella pneumoniae*	59	13,772	4.7	0.0	0.4	2.0	4.4	9.5
Cef3-resistant *Escherichia coli*	59	37,526	0.8	0.0	0.0	0.5	1.3	2.3
Quinolone-resistant *E coli*	58	36,105	2.3	0.0	0.5	1.2	2.9	5.3
Penicillin-resistant pneumococcus	51	3,531	14.1	1.6	5.5	10.0	20.0	31.8
Cefotaxime/ceftriaxone-resistant pneumococcus	23	947	8.0	0.0	2.6	7.1	13.3	20.0

Table 10 (corrected page) Antimicrobial resistance rates and key percentiles for ICUs, non-ICU inpatient units, and outpatients at NNIS/ICARE hospitals, January 1996 through November 1999

Outpatient Areas

Antimicrobial-resistant pathogen	No. Units	No. Tested	Pooled Mean	Percentile				
				10%	25%	50% (median)	75%	90%
MRSA	54	26,648	20.5	9.5	13.4	21.5	26.9	34.1
Methicillin-resistant CNS	53	16,253	44.7	33.3	40.5	45.3	50.4	58.4
Vancomycin-resistant *Enterococcus*	52	18,413	3.6	0.0	1.0	2.9	4.9	8.1
Ciprofloxacin/ofloxacin-resistant *Pseudomonas aeruginosa*	54	13,156	22.1	14.4	19.5	27.0	39.4	57.0
Levofloxacin-resistant *P aeruginosa*	14	1,548	25.0	14.0	15.8	21.3	28.0	37.0
Imipenem-resistant *P aeruginosa*	50	9,257	7.0	1.5	3.4	6.4	9.6	13.0
Ceftazidime-resistant *P aeruginosa*	53	11,600	4.5	0.0	1.8	4.1	6.3	12.2
Piperacillin-resistant *P aeruginosa*	49	10,034	5.4	0.0	2.0	4.2	6.4	15.7
Cef3-resistant *Enterobacter* spp	49	4,741	9.6	0.0	5.5	7.5	14.3	19.0
Carbapenem-resistant *Enterobacter* spp	31	1,348	1.2	0.0	0.0	0.0	0.0	2.4
Cef3-resistant *Klebsiella pneumoniae*	53	12,065	1.4	0.0	0.0	1.0	2.5	6.4
Cef3-resistant *Escherichia coli*	54	71,168	0.2	0.0	0.0	0.1	0.6	1.1
Quinolone-resistant *E coli*	52	63,179	1.2	0.0	0.4	1.2	2.2	3.7
Penicillin-resistant pneumococcus	44	3,806	14.1	3.1	4.7	10.6	18.3	30.8
Cefotaxime/ceftriaxone-resistant pneumococcus	28	1,276	5.3	0.0	0.0	3.4	10.3	28.8

Appendix A. ICARE Project. Defined Daily Dose (DDD) of antimicrobial agents, by class and group[1]

Class	Group	Antimicrobial Agent	DDD
$-Lactams	Penicillin group	Penicillin G	12 x 10^6 U
		Procaine Pen. G	2.4 x 10^6 U
		Pen. G benzathine	1.2 x 10^6 U
		Penicillin V	1 g
	Ampicillin group	Ampicillin (parenteral)	4 g
		Ampicillin (oral)	2 g
		Ampicillin/sulbactam	6 g
		Amoxicillin (oral)	1.5 g
		Amoxicillin/clav. acid (oral)	1.5 g
	Antistaphylococcal penicillins (Methicillin group)	Nafcillin	4 g
		Oxacillin	4 g
		Dicloxacillin (oral)	2 g
	Antipseudomonal penicillins	Piperacillin	18g
		Piperacillin/tazobactam	13.5 g
		Ticarcillin	18 g
		Ticarcillin/clav. acid	12.4 g
	1st-Generation cephalosporins	Cefazolin	3 g
		Cephalothin	4 g
		Cefadroxil (oral)	2 g
		Cephalexin (oral)	2 g
	2nd-Generation cephalosporins	Cefotetan	2 g
		Cefmetazole	4 g
		Cefoxitin	4 g
		Cefuroxime	3 g
		Cefuroxime axetil (oral)	1 g
		Cefaclor (oral)	1 g
		Cefprozil (oral)	1 g
	3rd-Generation cephalosporins	Cefotaxime	3 g
		Ceftazidime	3 g
		Ceftizoxime	3 g
		Ceftriaxone	1 g
		Cefixime (oral)	0.4 g
		Cefipime	4 g
	Carbapenems	Meropenem	3 g
		Imipenem cilastatin	2 g

[1] Adapted from Amsden GW, Schentag JJ. Tables of antimicrobial agent pharmacology. In: Mandell GL, Bennett JE, Dolin R, eds. Principles and practice of infectious diseases, 4th edition. New York: Churchill Livingstone, 1995:492-528.

Appendix A. - Continued

Class	Group	Antimicrobial Agent	DDD
Other $-lactams		Aztreonam	4 g
Glycopepetides		Vancomycin (parenteral)	2 g
		Vancomycin (oral)	1 g
Fluoroquinolones		Ciprofloxacin (parenteral)	0.8 g
		Ciprofloxacin (oral)	1.5 g
		Ofloxacin (parenteral)	0.8 g
		Ofloxacin (oral)	0.8 g
		Levofloxacin (parenteral)	0.5 g
		Levofloxacin (oral)	0.2 g
		Trovafloxacin (parenteral)	0.2 g
		Trovafloxacin (oral)	0.2 g
		Sparfloxacin (oral)	0.2 g
		Norfloxacin (oral)	0.8 g
		Lomefloxacin	0.4 g
Trimethoprim/sulfamethoxazole		Trimethoprim component (oral)	0.32 g
		Trimethoprim component (parenteral)	0.84 g

Appendix B. How to calculate device-associated infection rates and device utilization ratios using ICU and HRN surveillance component data

Calculation of Device-associated Infection Rate

Step 1: Decide upon the time period for your analysis. It may be a month, a quarter, 6 months, a year, or some

Step 2: Select the patient population for analysis, i.e., the type of ICU or a birthweight category in the HRN.

Step 3: Select the infections to be used in the numerator. They must be site-specific and must have occurred i patient population. Their date of onset must be during the selected time period.

Step 4: Determine the number of device-days which is used as the denominator of the rate. Device-days are th days of exposure to the device (central line, ventilator, or urinary catheter) by all of the patients in the population during the selected time period.

Example 1: Five patients on the first day of the month had one or more central lines in place; five on d day 3; five on day 4; three on day 5; four on day 6; and four on day 7. Adding the number of patients on days 1 through 7, we would have 5+5+2+5+3+4+4=28 central line-days for the first week. If we co entire month, the number of central line-days for the month is simply the sum of the daily counts.

Step 5: Calculate the device-associated infection rate (per 1000 device-days) using the following formula:

Device-associated Infection Rate =

$$\frac{\text{Number of device-associated infections for a specific site} \times 1000}{\text{Number of device-days}}$$

Example 2: **Central line-associated BSI rate per 1000 central line-days =**

$$\frac{\text{Number of central line-associated BSI} \times 1000}{\text{Number of central line-days}}$$

Calculation of Device Utilization (DU) Ratio

Steps 1,2,4: Same as device-associated infection rates plus determine the number of patient-days which is use denominator of the DU ratio. Patient-days are the total number of days that patients are in the IC during the selected time period (sum of the '#patients' column on the monthly ICU and HRN dat forms)..

Example 3: Ten patients were in the unit on the first day of the month; 12 on day 2; 11 on day 3; 10 on day 5; 6 on day 6; and 10 on day 7; and so on. If we counted the patients in the unit from 7, we would add 10 + 12 + 11 + 13 + 10 + 6 + 10 for a total of 72 patient-days for the first week we continued for the entire month, the number of patient-days for the month is simply the sum of counts.

Step 5: Calculate the DU ratio using the following formula:

$$\text{Device Utilization (DU) Ratio} = \frac{\text{Number of device-days}}{\text{Number of patient-days}}$$

With the number of device-days and patient-days from Examples 1 and 3 above,
DU = 28/72 = 0.39 or 39% of patient-days were also central line-days for the first week of the m

Step 6: Examine the size of the denominator for your hospital's rate or ratio. Rates or ratios may not be good "true" rate or ratio for your hospital if the denominator is small, i.e., <50 device-days or patient-days.

Step 7: Compare your hospital's ICU/HRN rates or ratios with those found in the tables of this report. Refer interpretation of the percentiles of the rates/ratios.

To calculate the device-associated infection rates and device utilization ratios for your ICU or HRN in IDEAS, first select the time period of interest in Option 10 of the OPM. Then select either OPM Option 21 or 22 to include infections based on date of infection onset. Next, select OPM Option 32 for ICU or Option 33 for HRN. From these data analysis menus, device-associated infection rates and device utilization ratios can be automatically calculated using Options 31 or 32.

Appendix C. How to interpret percentiles of infection rates or device utilization ratios

Step 1: Evaluate the rate (ratio) you have calculated for your hospital and confirm that the variables in the rate (both numerator and denominator) are identical to the rates (ratios) in the table.

Step 2: Examine the percentiles in each of the tables and look for the 50th percentile (or median). At the 50th percentile, 50% of the hospitals have lower rates (ratios) than the median and 50% have higher rates (ratios).

Step 3: Determine if your hospital's rate (ratio) is above or below this median.

Determining if your hospital's rate or ratio is a HIGH outlier

Step 4: If it is above the median, determine whether the rate (ratio) is above the 75th percentile. At the 75th percentile, 75% of the hospitals had **lower** rates (ratio) and 25% of the hospital had higher rates (ratio).

Step 5: If the rate (ratio) is above the 75th percentile, determine whether it is above the 90th percentile. If it is, then the rate (or ratio) is a high outlier which **may** indicate a problem.

Determining if your hospital's rate or ratio is a LOW outlier

Step 6: If it is below the median, determine whether the rate (ratio) is below the 25th percentile. At the 25th percentile, 25% of the hospitals had **lower** rates (ratios) and 75% of the hospitals had higher rates (ratios).

Step 7: If the rate (ratio) is below the 25th percentile, determine whether it is below the 10th percentile. If the rate is, then it is a low outlier which **may** indicate a problem with underreporting of infections. If the ratio is below the 10th percentile, it is a low outlier and indicates infrequent and/or short duration of device use.

Note: Device-associated infection rates and device utilization ratios should be examined together so that preventive measures may be appropriately targeted. For example, you find that the ventilator-associated pneumonia rate for a certain type of ICU is consistently above the 90th percentile and the ventilator utilization ratio is routinely between the 75th and 90th percentile. Since the ventilator is a significant risk factor for pneumonia, you may want to target your efforts on reducing the use of ventilators or limiting the duration with which they are used on patients in order to lower the pneumonia rate in the unit.

Appendix D. How to use IDEAS to calculate SSI rates from the surgical patient surveillance component

If you have been following the surgical patient surveillance component and wish to calculate SSI rates in IDEAS, first select the time period of interest using Option 10 of the OPM. Then select either OPM Option 23 or 24 to include infections based on date of surgery. Next, select OPM Option 34 to go to the SP Component Data Analysis Menu. Select Option 35 for the SP Rates Menu #1. Here, modify the SP filter (Option 60) to include only SSI and specify operative procedures and/or surgeons, if desired. For example:

majsite = ssi
and srgoper = cbgb or cbgc
and surgeon = 12345

Select SP Rates Menu #1 Option 1 to calculate SSI rates by operative procedure and risk index category. Select Option 5 to calculate SSI rates by operative procedure and risk index category by surgeon.