SEMIANNUAL REPORT

Aggregated Data from the National Nosocomial Infections Surveillance (NNIS) System
June 2000

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*Data unchanged from December 1999 NNIS SAR

NNIS SAR
June 2000

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service

CDC
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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 December 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 is an updated surveillance report summarizing the rates of antimicrobial resistance among pathogens identified from ICU patients with nosocomial infections. The figure summarizes several important points for the more common pathogens reported to NNIS. First, we provide the pooled mean rate of resistance 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. These data display the concerning and continuing increase in antimicrobial resistance in U.S. hospitals. However the rate of increase has diminished for several pathogens, including VRE (reported as +55% in 1998 compared to +40% in 1999), *K. pneumoniae* not susceptible to cephalosporins (reported as +7% in 1998 compared to 0% in 1999). Although these data are limited to patients in ICUs, they are not risk-adjusted and comparisons of these rates between hospitals should be made with caution.

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

Table 5 displays updated 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 cardiac surgery 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 20 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. 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 >75th 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.

The data in Tables 9 and 10 are unchanged from those previously reported in the December 1999 SAR. The data are from Phases 2 and 3 (January 1996-November 1999) of the 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 (DDD) 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 shows the defined daily dose for antimicrobial agents that are shown 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.

The mid-year issue of the NNIS Semiannual Report is published in the American Journal of Infection Control and is posted on the CDC web page. The address is www.cdc.gov/ncidod/hip/SURVEILL/NNIS.HTM.

Erratum in the December 1999 *NNIS Semiannual Report*
On Table 2, page 6, the data for central line utilization ratio in the Burn ICU should read, No. of Units 17; Patient-Days 74,805; and Pooled Mean 0.45. No percentile distribution is available since fewer than 20 Burn ICUs have reported data.

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 1995-April 2000

Urinary catheter-associated UTI rate*

Type of ICU	No. of Units	Urinary Catheter-Days	Pooled Mean	Percentile 10%	25%	50% (median)	75%	90%
Coronary	96	326,839	5.8	0.7	2.6	5.0	8.5	11.4
Cardiothoracic	60	371,875	3.1	0.3	1.3	2.3	3.8	4.9
Medical	125	776,197	6.8	2.4	3.9	5.9	8.2	10.5
Medical-Surgical								
Major teaching	103	661,035	6.1	1.7	3.2	5.4	7.5	10.3
All others	160	1,137,848	3.9	0.9	2.1	3.8	5.5	7.3
Neurosurgical	46	190,839	8.1	1.4	4.1	7.1	9.4	12.0
Pediatric	67	166,299	5.1	0.0	2.3	4.8	7.3	9.5
Surgical	144	963,902	5.2	1.5	3.1	4.3	7.3	9.3
Trauma	24	120,919	6.9	3.5	4.7	6.6	8.0	10.0
Burn	16	38,212	10.2	.	.	.	.	.
Respiratory	6	28,975	5.7	.	.	.	.	.

Central line-associated BSI rate**

Type of ICU	No. of Units	Central Line-Days	Pooled Mean	Percentile 10%	25%	50% (median)	75%	90%
Coronary	95	203,909	4.6	0.0	1.8	4.0	5.9	7.9
Cardiothoracic	60	332,992	2.8	0.4	1.4	2.4	3.6	4.9
Medical	126	548,124	6.1	2.0	3.5	5.3	6.9	9.8
Medical-Surgical								
Major teaching	104	447,618	5.3	1.6	3.1	5.0	6.9	8.7
All others	162	698,225	4.1	0.4	2.0	3.6	5.3	7.0
Neurosurgical	46	101,409	4.9	0.0	2.2	4.4	5.9	8.3
Pediatric	70	234,100	7.7	0.0	3.9	7.0	9.4	11.9
Surgical	144	756,718	5.3	1.2	2.6	4.9	6.7	9.1
Trauma	24	87,031	7.8	0.0	3.0	7.0	9.3	10.9
Burn	16	32,390	10.0	.	.	.	.	.
Respiratory	6	18,373	3.6	.	.	.	.	.

Table 1 - continued

Ventilator-associated pneumonia rate***				Percentile				
Type of ICU	No. of Units	Ventilator-Days	Pooled Mean	10%	25%	50% (median)	75%	90%
Coronary	93	140,269	8.9	0.7	4.4	7.3	11.5	16.0
Cardiothoracic	60	199,857	10.4	3.0	5.5	9.1	13.5	16.9
Medical	124	522,137	7.5	1.9	3.8	6.4	9.0	13.6
Medical-Surgical								
Major teaching	103	383,726	11.1	1.6	4.9	9.5	12.6	16.4
All others	161	548,905	9.1	2.8	5.5	8.3	11.2	13.7
Neurosurgical	45	89,851	15.2	2.6	7.9	11.3	17.3	22.4
Pediatric	70	233,886	5.2	0.0	1.4	3.7	7.2	10.9
Surgical	144	535,349	13.6	5.9	7.8	12.1	15.4	23.1
Trauma	24	79,197	15.9	6.5	10.2	15.1	20.9	26.5
Burn	16	22,591	14.9	.	.	.	.	.
Respiratory	6	21,044	4.1	.	.	.	.	.

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

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

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

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 1995-April 2000

Urinary catheter utilization*				Percentile				
Type of ICU	No. of Units	Patient-Days	Pooled Mean	10%	25%	50% (median)	75%	90%
Coronary	96	671,593	0.49	0.23	0.36	0.49	0.62	0.71
Cardiothoracic	60	421,954	0.88	0.72	0.80	0.91	0.95	0.97
Medical	125	1,062,909	0.73	0.54	0.65	0.75	0.82	0.87
Medical-Surgical								
Major teaching	105	825,019	0.80	0.54	0.72	0.81	0.86	0.91
All others	160	1,517,754	0.75	0.56	0.66	0.75	0.83	0.88
Neurosurgical	46	236,066	0.81	0.53	0.74	0.84	0.92	0.94
Pediatric	74	516,550	0.32	0.12	0.18	0.28	0.39	0.46
Surgical	144	1,138,346	0.85	0.72	0.79	0.85	0.91	0.96
Trauma	24	138,313	0.87	0.68	0.87	0.92	0.95	0.98
Burn	16	67,330	0.57	.	.	.	.	.
Respiratory	6	40,897	0.71	.	.	.	.	.

Central line utilization**				Percentile				
Type of ICU	No. of Units	Patient-Days	Pooled Mean	10%	25%	50% (median)	75%	90%
Coronary	97	671,593	0.30	0.13	0.21	0.28	0.38	0.54
Cardiothoracic	60	421,954	0.79	0.56	0.72	0.80	0.89	0.95
Medical	126	1,062,909	0.52	0.31	0.36	0.51	0.63	0.73
Medical-Surgical								
Major teaching	105	825,019	0.54	0.32	0.44	0.54	0.64	0.73
All others	162	1,517,754	0.46	0.25	0.34	0.46	0.56	0.63
Neurosurgical	46	236,066	0.43	0.26	0.34	0.46	0.54	0.64
Pediatric	74	516,550	0.45	0.24	0.30	0.43	0.55	0.59
Surgical	144	1,138,346	0.66	0.47	0.56	0.68	0.76	0.87
Trauma	24	138,313	0.63	0.47	0.54	0.63	0.78	0.84
Burn	16	67,330	0.48	.	.	.	.	.
Respiratory	6	40,897	0.45	.	.	.	.	.

Table 2 - continued

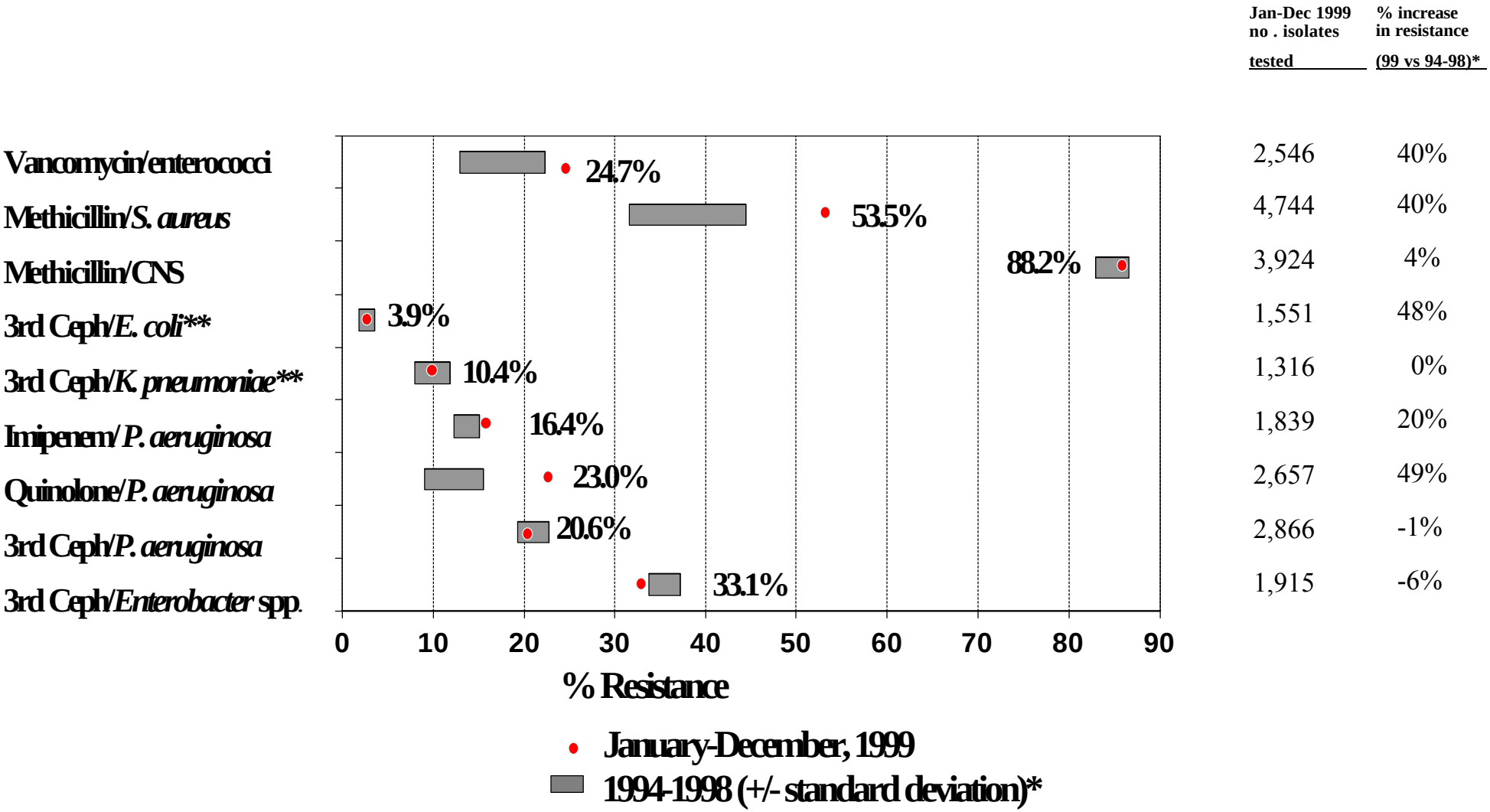
Ventilator utilization***				Percentile				
Type of ICU	No. of Units	Patient-Days	Pooled Mean	10%	25%	50% (median)	75%	90%
Coronary	97	671,593	0.21	0.08	0.11	0.20	0.27	0.35
Cardiothoracic	60	421,954	0.47	0.32	0.37	0.48	0.54	0.66
Medical	126	1,062,909	0.49	0.24	0.34	0.47	0.59	0.66
Medical-Surgical								
Major teaching	105	825,019	0.47	0.26	0.35	0.42	0.52	0.64
All others	162	1,517,754	0.36	0.20	0.27	0.35	0.43	0.49
Neurosurgical	46	236,066	0.38	0.19	0.27	0.38	0.46	0.56
Pediatric	74	516,550	0.45	0.17	0.31	0.43	0.50	0.59
Surgical	144	1,138,346	0.47	0.27	0.35	0.46	0.55	0.65
Trauma	24	138,313	0.57	0.44	0.56	0.62	0.70	0.73
Burn	16	67,330	0.34	.	.	.	.	.
Respiratory	6	40,897	0.51	.	.	.	.	.

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

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

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

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



Note: CNS=coagulase-negative staphylococci, 3rd Ceph = resistance to 3rd generation cephalosporins (either ceftriaxone, cefotaxime, or ceftazidime), Quinolone=resistance to either ciprofloxacin or ofloxacin.

* Percentage (%) increase in resistance rate of current period (January-December 1999) 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 1995-April 2000

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	128	350,560	11.6	4.2	7.2	11.0	15.6	18.7
1001-1500 grams	123	168,423	7.0	1.3	4.4	6.7	10.6	15.1
1501-2500 grams	120	127,958	4.0	0.0	1.3	3.4	6.3	8.9
> 2500 grams	125	184,212	4.0	0.0	0.8	2.9	5.6	7.9

Ventilator-associated pneumonia rate**				Percentile				
Birthweight Category	**No. of HRNs**	**Ventilator-Days**	**Pooled Mean**	**10%**	**25%**	**50% (median)**	**75%**	**90%**
#1000 grams	127	351,622	4.9	0.0	1.1	4.2	7.7	11.5
1001-1500 grams	122	106,186	3.6	0.0	0.0	2.6	6.0	9.7
1501-2500 grams	116	78,150	2.8	0.0	0.0	1.0	3.6	5.7
> 2500 grams	117	119,577	2.5	0.0	0.0	0.9	3.4	6.4

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

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

Table 4. High risk nursery surveillance component. Pooled means and percentiles of the distribution of device utilization ratios, by birthweight category, NNIS system, January 1995-April 2000

Umbilical and central line utilization ratio*				Percentile				
Birthweight Category	**No. of HRNs**	**Patient-Days**	**Pooled Mean**	10%	25%	50% (median)	75%	90%
#1000 grams	133	846,660	0.41	0.19	0.28	0.39	0.54	0.64
1001-1500 grams	132	592,713	0.28	0.09	0.14	0.24	0.40	0.54
1501-2500 grams	135	636,126	0.20	0.05	0.08	0.15	0.30	0.45
> 2500 grams	133	598,268	0.31	0.07	0.13	0.22	0.38	0.53

Ventilator utilization ratio**				Percentile				
Birthweight Category	**No. of HRNs**	**Patient-Days**	**Pooled Mean**	**10%**	**25%**	**50% (median)**	**75%**	**90%**
#1000 grams	133	846,660	0.42	0.23	0.30	0.41	0.50	0.63
1001-1500 grams	132	592,713	0.18	0.07	0.11	0.15	0.24	0.37
1501-2500 grams	135	636,126	0.12	0.03	0.05	0.09	0.17	0.32
> 2500 grams	133	598,268	0.20	0.04	0.07	0.13	0.24	0.34

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

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

Table 5. Surgical patient surveillance component. Surgical site infection rates‡, by operative procedure and risk index category, NNIS system, January 1992-April 2000

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	1393	0.65	1	23731	1.62	2,3	7243	2.53		.	.
CBGB*	CABG-Chest & Leg	5	0	1573	1.14	1	199807	3.56	2	39302	5.65	3	108	10.19
CBGC**	CABG-Chest Only	4	0,1	9756	2.18	2,3	3947	3.72		.	.		.	.
OCVS	Other Cardiovascular Surgery	2	0,1	7360	0.65	2	2566	1.48	3	112	4.46		.	.
ORES	Other Respiratory System	2	0,1,2,3	1502	2.73		.	.		.	.		.	.
THOR	Thoracic Surgery	3	0	1120	0.36	1	3700	1.22	2,3	1264	3.16		.	.
BILI	Liver/Pancreas	4	0	360	3.06	1,2,3	1304	7.36		.	.		.	.
OGIT	Other Digestive Surgery	3	0,1	2834	3.00	2,3	518	7.14		.	.		.	.
SB	Small Bowel Surgery	3	0	1210	5.04	1	2722	7.09	2,3	1670	9.58		.	.
XLAP	Laparotomy	2	0	4884	1.72	1	5678	3.15	2	2999	5.24	3	501	8.78
NEPH	Nephrectomy	4	0,1,2,3	2563	1.17		.	.		.	.		.	.
OGU	Other Genitourinary Surgery	2	0	10718	0.37	1	5360	1.06	2,3	1295	3.09		.	.
PRST	Prostatectomy	4	0	2109	0.90	1	1461	2.12	2,3	250	4.80		.	.
HN	Head and Neck	7	0	512	2.54	1	717	5.16	2,3	335	14.03		.	.
OENT	Other ENT	2	0,1	3086	0.23	2,3	325	2.77		.	.		.	.
HER	Herniorrhaphy	2	0	8806	0.73	1	5120	1.87	2	1141	3.68	3	36	11.11
MAST	Mastectomy	3	0	10512	1.89	1	6527	2.50	2,3	630	3.97		.	.
CRAN	Craniotomy	4	0	3065	0.82	1,2,3	11665	1.66		.	.		.	.
ONS	Other Nervous System	4	0,1,2,3	1953	1.59		.	.		.	.		.	.
VSHN	Ventricular Shunt	2	0	2346	3.92	1,2,3	5562	5.16		.	.		.	.

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
CSEC	Cesarean Section	1	0	96139	3.35	1	29897	5.06	2,3	2996	8.11		.	.
HYST	Abdominal Hysterectomy	2	0	27763	1.46	1	14267	2.36	2,3	3040	5.69		.	.
OOB	Other Obstetrical Procedures	1	0,1,2,3	974	0.41		.	.		.	.		.	.
VHYS	Vaginal Hysterectomy	2	0,1,2,3	17844	1.27		.	.		.	.		.	.
AMP	Limb Amputation	1	0,1,2,3	7814	3.80		.	.		.	.		.	.
FUSN	Spinal Fusion	4	0	22437	1.23	1	12112	2.86	2,3	3134	6.64		.	.
FX	Open Reduction Fracture	2	0	11045	0.68	1	17525	1.34	2	3476	2.30	3	394	4.82
HPRO	Hip Prosthesis	2	0	18660	0.86	1	31844	1.48	2,3	9033	2.20		.	.
KPRO	Knee Prosthesis	2	0	26852	0.80	1	31308	1.17	2,3	8252	2.16		.	.
LAM	Laminectomy	2	0	37578	0.90	1	26343	1.39	2,3	7911	2.53		.	.
OMS	Other Musculoskeletal	3	0	12991	0.63	1	8936	0.87	2,3	2517	1.71		.	.
OPRO	Other Prosthesis	3	0,1,2,3	2010	0.70		.	.		.	.		.	.
OBL	Other Hem/Lymph System	3	0,1,2,3	921	1.95		.	.		.	.		.	.
OES	Other Endocrine System	3	0	1755	0.11	1,2,3	1313	0.99		.	.		.	.
OEYE	Other Eye	2	0,1,2,3	493	0.81		.	.		.	.		.	.
OSKN	Other Integumentary System	2	0,1,2,3	6665	1.28		.	.		.	.		.	.
SKGR	Skin Graft	3	0	881	0.91	1	1542	2.08	2,3	1110	5.14		.	.
SPLE	Splenectomy	2	0	312	0.96	1,2,3	951	3.36		.	.		.	.
TP	Organ Transplant	6	0,1	2645	4.65	2	1065	15.12	3	32	28.13		.	.
VS	Vascular Surgery	3	0	5392	0.82	1	44398	1.76	2,3	18172	4.60		.	.

‡ per 100 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 6. Surgical patient surveillance component. Percentiles of the distribution of surgical site infection rates[‡], by operative procedure and risk index category[§], NNIS system, January 1992 - April 2000

Operative Procedure Category	Risk Index Category	No. Hospitals	Pooled Mean Rate	Percentile				
				10%	25%	50% (median)	75%	90%
CARD Cardiac Surgery	1	90	1.62	0.00	0.20	1.25	1.93	2.78
CARD Cardiac Surgery	2,3	64	2.53	0.00	0.00	1.75	3.45	5.54
CBGB* CABG-Chest & Leg	1	157	3.56	1.32	2.14	3.18	4.51	6.50
CBGB* CABG-Chest & Leg	2	142	5.65	2.00	3.41	5.45	7.57	9.63
CBGC** CABG-Chest Only	0,1	81	2.18	0.00	0.00	1.39	3.29	4.98
CBGC** CABG-Chest Only	2,3	45	3.72	0.00	0.00	2.80	4.35	7.32
OCVS Oth Cardiovascular Surg.	0,1	29	0.65	0.00	0.00	0.00	0.89	2.29
THOR Thoracic Surgery	1	32	1.22	0.00	0.00	0.54	1.99	3.06
THOR Thoracic Surgery	2,3	20	3.16	0.00	0.00	1.67	3.77	6.12
APPY Appendectomy	0-No	41	1.40	0.00	0.00	0.96	2.35	3.03
APPY Appendectomy	1	48	2.95	0.00	1.32	2.56	3.96	5.62
APPY Appendectomy	2	29	4.94	0.00	0.30	3.00	6.48	7.99
CHOL Cholecystectomy	M	80	0.46	0.00	0.00	0.00	0.56	1.16
CHOL Cholecystectomy	0	84	0.68	0.00	0.00	0.32	1.11	1.96
CHOL Cholecystectomy	1	70	1.81	0.00	0.00	1.39	3.64	5.00
CHOL Cholecystectomy	2	45	3.17	0.00	0.83	2.89	4.55	8.58
COLO Colon Surgery	0	78	4.13	0.00	2.17	3.85	5.47	7.72
COLO Colon Surgery	1	89	5.83	1.13	3.28	5.35	7.14	8.79
COLO Colon Surgery	2	68	9.08	3.84	5.32	8.71	13.4	18.72
GAST Gastric Surgery	0-No	21	2.66	0.00	0.00	2.03	4.20	6.59
GAST Gastric Surgery	1	31	4.98	1.45	2.21	4.08	6.47	9.00
OGIT Other Digestive Surgery	0,1	21	3.00	0.00	1.50	2.63	4.19	7.36

Table 6 - continued

Operative Procedure Category	Risk Index Category	No. Hospitals	Pooled Mean Rate	Percentile				
				10%	25%	50% (median)	75%	90%
SB Small Bowel Surgery	0	21	5.04	0.00	1.69	4.50	6.14	11.66
SB Small Bowel Surgery	1	31	7.09	0.00	3.85	5.53	10.10	14.03
SB Small Bowel Surgery	2,3	23	9.58	5.21	6.44	8.11	13.23	15.50
XLAP Laparotomy	0	33	1.72	0.00	0.00	1.53	2.65	3.45
XLAP Laparotomy	1	40	3.15	0.00	1.10	2.36	4.27	7.03
XLAP Laparotomy	2	31	5.24	0.00	1.06	3.52	7.06	10.41
NEPH Nephrectomy	0,1,2,3	26	1.17	0.00	0.00	0.85	2.25	5.13
OGU Other Genitourinary Surgery	0	29	0.37	0.00	0.00	0.16	0.68	1.38
OGU Other Genitourinary Surgery	1	26	1.06	0.00	0.21	0.81	1.94	3.11
PRST Prostatectomy	0	25	0.90	0.00	0.00	0.00	1.05	2.47
HER Herniorrhaphy	0	43	0.73	0.00	0.00	0.29	1.48	2.31
HER Herniorrhaphy	1	44	1.87	0.00	0.00	1.42	3.08	4.57
MAST Mastectomy	0	47	1.89	0.00	0.00	0.75	1.73	3.20
MAST Mastectomy	1	43	2.50	0.00	0.42	1.89	4.09	6.39
CRAN Craniotomy	0	34	0.82	0.00	0.00	0.00	2.11	2.60
CRAN Craniotomy	1,2,3	58	1.66	0.00	0.00	1.38	2.25	3.60
VSHN Ventricular Shunt	0	23	3.92	0.00	0.00	3.15	4.93	6.71
VSHN Ventricular Shunt	1,2,3	37	5.16	0.00	0.22	3.59	6.05	9.05
CSEC Cesarean Section	0	116	3.35	0.28	1.18	2.30	4.94	8.53
CSEC Cesarean Section	1	107	5.06	0.00	1.36	3.35	6.26	9.04
CSEC Cesarean Section	2,3	36	8.11	0.00	4.46	7.32	11.11	13.95
HYST Abdominal Hysterectomy	0	81	1.46	0.00	0.44	1.18	2.58	4.11
HYST Abdominal Hysterectomy	1	78	2.36	0.00	0.00	1.64	2.70	5.32
HYST Abdominal Hysterectomy	2,3	42	5.69	0.00	2.60	4.76	9.15	12.00
VHYS Vaginal Hysterectomy	0,1,2,3	56	1.27	0.00	0.11	1.05	2.02	3.41
AMP Limb Amputation	0,1,2,3	36	3.80	0.00	1.50	3.01	5.30	7.40

Table 6 - continued

Operative Procedure Category	Risk Index Category	No. Hospitals	Pooled Mean Rate	Percentile				
				10%	25%	50% (median)	75%	90%
FUSN Spinal Fusion	0	74	1.23	0.00	0.00	0.71	1.53	2.49
FUSN Spinal Fusion	1	73	2.86	0.00	0.11	2.24	3.95	6.43
FUSN Spinal Fusion	2,3	39	6.64	0.00	2.93	5.38	7.32	10.84
FX Open Reduction Fracture	0	60	0.68	0.00	0.00	0.00	1.06	1.92
FX Open Reduction Fracture	1	67	1.34	0.00	0.00	0.98	1.67	2.08
FX Open Reduction Fracture	2	41	2.30	0.00	0.00	2.29	3.59	6.32
HPRO Hip Prosthesis	0	125	0.86	0.00	0.00	0.17	1.18	2.72
HPRO Hip Prosthesis	1	152	1.48	0.00	0.00	1.01	2.08	3.30
HPRO Hip Prosthesis	2,3	110	2.20	0.00	0.00	1.72	3.70	5.41
KPRO Knee Prosthesis	0	120	0.80	0.00	0.00	0.47	1.24	2.04
KPRO Knee Prosthesis	1	142	1.17	0.00	0.00	0.98	1.80	3.05
KPRO Knee Prosthesis	2,3	97	2.16	0.00	0.00	1.98	3.64	5.17
LAM Laminectomy	0	104	0.90	0.00	0.00	0.58	1.23	2.38
LAM Laminectomy	1	100	1.39	0.00	0.33	1.22	2.03	2.99
LAM Laminectomy	2,3	80	2.53	0.00	0.52	2.20	3.57	6.90
OMS Other Musculoskeletal	0	36	0.63	0.00	0.00	0.34	0.81	1.21
OMS Other Musculoskeletal	1	35	0.87	0.00	0.00	0.52	1.38	2.06
OPRO Other Prosthesis	0,1,2,3	26	0.70	0.00	0.00	0.00	1.05	1.89
OSKN Other Integumentary	0,1,2,3	26	1.28	0.00	0.20	0.79	1.57	2.38
VS Vascular Surgery	0	58	0.82	0.00	0.00	0.00	1.37	2.69
VS Vascular Surgery	1	97	1.76	0.00	0.52	1.41	2.33	3.67
VS Vascular Surgery	2,3	89	4.60	0.00	2.62	4.56	6.65	9.14

‡ per 100 operations
§ Includes only those procedure-risk categories for which at least 20 hospitals have reported at least 20 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, January 1992-April 2000**

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	23913	0.46	0	20192	0.68	1	9654	1.81	2	3406	3.17	3	398	6.03
COLO Colon Surgery	3	M	384	1.30	0	10751	4.13	1	18856	5.83	2	8165	9.08	3	1126	11.37
APPY Appendectomy	1	0-Yes	1342	0.89	0-No	5343	1.40	1	6808	2.95	2	2569	4.94	3	295	9.49
GAST Gastric Surgery	3	0-Yes	251	0.40	0-No	1542	2.66	1	3151	4.98	2,3	1544	10.30	.	.	

* per 100 operations

** This table uses a 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. For Gastric Surgery, 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) operation, by risk index category and specific site, NNIS system, January 1992-April 2000

	Risk Index Category							
	0		1		2		3	
Infection Site	**No. SSIs**	**Rate**	**No. SSIs**	**Rate**	**No. SSIs**	**Rate**	**No. SSIs**	**Rate**
Leg (donor site)	**12**	**0.76**	**3194**	**1.60**	**1040**	**2.65**	**2**	**1.85**
Superficial incisional	*9*	*0.57*	*2500*	*1.25*	*818*	*2.08*	*2*	*1.85*
Deep incisional	*3*	*0.19*	*694*	*0.35*	*222*	*0.56*	*0*	*0.00*
Chest	**6**	**0.38**	**3913**	**1.96**	**1180**	**3.00**	**9**	**8.33**
Superficial incisional	*4*	*0.25*	*1517*	*0.76*	*454*	*1.16*	*2*	*1.85*
Deep incisional	*0*	*0.00*	*1077*	*0.54*	*313*	*0.80*	*3*	*2.78*
Organ/space	*2*	*0.13*	*1319*	*0.66*	*413*	*1.05*	*4*	*3.70*
Total	**18**	**1.14**	**7107**	**3.56**	**2220**	**5.65**	**11**	**10.19**

*per 100 operations

Denominators for the risk categories are as follows:

Category 0 = 1,573
Category 1 = 199,807
Category 2 = 39,302
Category 3 = 108

Table 9. ICARE Project. Pooled means and percentiles of the distribution of antimicrobial usage rates (DDD* rates), 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

*Defined daily dose (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)

Antimicrobial Agent	No. DDD*	Pooled Mean	Percentile				
			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

*Defined daily dose (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

Cardiothoracic ICU (n=19)

Antimicrobial Agent	No. DDD*	Pooled Mean	Percentile				
			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

*Defined daily dose (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

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

*Defined daily dose (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

Medical ICU (n=31)

Antimicrobial Agent	No. DDD*	Pooled Mean	Percentile				
			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

*Defined daily dose (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

Medical-Surgical ICU (n=45)

Antimicrobial Agent	No. DDD*	Pooled Mean	Percentile				
			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

*Defined daily dose (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

Neurosurgical ICU (n=10)

Antimicrobial Agent	No. DDD*	Pooled Mean	Percentile				
			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

*Defined daily dose (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

Surgical ICU (n=28)

Antimicrobial Agent	No. DDD*	Pooled Mean	Percentile				
			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

*Defined daily dose (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

Pediatric ICU (n=15)

Antimicrobial Agent	No. DDD*	Pooled Mean	Percentile				
			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

*Defined daily dose (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 10 **ICARE Project. Pooled means and percentiles of the distribution of antimicrobial resistance rates*, by all ICUs combined, non-ICU inpatient units and by 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

*For each antimicrobial agent and pathogen combination, resistance rates were calculated as:

$$\frac{\text{Number of resistant isolates}}{\text{Number of isolates tested}} \times 100$$

Table 10-continued

Non-ICU Inpatient Areas

Antimicrobial-resistant Pathogen	No. Units	No. Tested	Pooled Mean	Percentile				
				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 - continued

Outpatient Areas

Antimicrobial-resistant Pathogen	No. Units	No. Tested	Pooled Mean	Percentile				
				10%	25%	50% (median)	75%	90%
Methicillin-resistant *S. aureus*	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

*For each antimicrobial agent and pathogen combination, resistance rates were calculated as:

$$\frac{\text{Number of resistant isolates}}{\text{Number of isolates tested}} \times 100$$

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 Penicillin G	2.4 x 10^6 U
		Penicillin G benzathine	1.2 x 10^6 U
		Penicillin V	1 g
	Ampicillin group	Ampicillin (parenteral)	4g
		Ampicillin (oral)	2g
		Ampicillin/sulbactam	6g
		Amoxicillin (oral)	1.5g
		Amoxicillin/Clavulanic Acid (oral)	1.5g
	Antistaphylococcal penicillins (Methicillin group)	Nafcillin	4g
		Oxacillin	4g
		Dicloxacillin (oral)	2g
	Antipseudomonal penicillins	Piperacillin	18g
		Piperacillin/Tazobactam	13.5g
		Ticarcillin	18g
		Ticarcillin/Clavulanic Acid	12.4g
	1st-Generation cephalosporins	Cefazolin	3g
		Cephalothin	4g
		Cefadroxil (oral)	2g
		Cephalexin (oral)	2g
	2nd-Generation cephalosporins	Cefotetan	2g
		Cefmetazole	4g
		Cefoxitin	4g
		Cefuroxime	3g
		Cefuroxime axetil (oral)	1g
		Cefaclor (oral)	1g
		Cefprozil (oral)	1g
	3rd-Generation cephalosporins	Cefotaxime	3g
		Ceftazidime	3g
		Ceftizoxime	3g
		Ceftriaxone	1g
		Cefixime (oral)	0.4g
		Cefipime	4g
	Carbapenems	Meropenem	3g
		Imipenem cilastatin	2g

[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.

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

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 other period.

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 in the selected 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 the total number of days of exposure to the device (central line, ventilator, or urinary catheter) by all of the patients in the selected 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 day 2; two on day 3; five on day 4; three on day 5; four on day 6; and four on day 7. Adding the number of patients with central lines 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 continued for the 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:

$$\textbf{Device-associated Infection Rate} = \frac{\text{Number of device-associated infections for a specific site}}{\text{Number of device-days}} \times 1000$$

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

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

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 used as the denominator of the DU ratio. Patient-days are the total number of days that patients are in the ICU (or HRN) during the selected time period (sum of the '# patients' column on the monthly ICU and HRN data collection forms).

Example 3: Ten patients were in the unit on the first day of the month; 12 on day 2; 11 on day 3; 13 on day 4; 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 days 1 through 7, we would add 10 + 12 + 11 + 13 + 10 + 6 + 10 for a total of 72 patient-days for the first week of the month. If we continued for the entire month, the number of patient-days for the month is simply the sum of the daily counts.

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

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

Using 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 month.

Step 6: Examine the size of the denominator for your hospital's rate or ratio. Rates or ratios may not be good estimates of the "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 to Appendix C for 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 enter 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 enter the time period of interest in 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.