VICNISS
Hospital Acquired Infection Project

Year 5 report–September 2007

A Victorian Government initiative

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Foreword

This report describes data from the Victorian Hospital-Acquired Infection Surveillance (VICNISS) project between February 2006 and February 2007, and developments in hospital infection surveillance activities in large hospitals (Type 1 surveillance) and in smaller, usually rural, Victorian public hospitals (Type 2 surveillance).

The surveillance program for large hospitals is based on the United States NNIS program. Key stakeholders continue to have input and give feedback through hospital visits and contacts, the VICNISS Advisory Committee, and user groups. We remain in contact with similar overseas programs, including the US National Health and Safety Network, and aim to ensure our data in most areas is collected with methods that allow us to make international comparisons. However, the most important and meaningful comparisons are between our individual hospitals and state 'average' data. This year, we have responded to hospitals' requests to release non-identified hospital-level data so hospitals can see how they compare with similar institutions.

No clear trend in the aggregate surgical site infections (SSI) or intensive care unit device-associated infection rates over time has yet been identified in the VICNISS program. Coronary artery bypass graft surgery, major joint prosthetic surgery, Caesarean sections, cholecystectomies, and colon surgery remain the favoured surgical procedures for post-operative surveillance of surgical site infections. In each quarterly reporting period, hospitals with higher than expected infection rates are notified, and letters are sent to the infection prevention team and the chief executive officer. In future, we will also ask for a reply to these letters that outline the hospitals' planned response to attempt to lower these rates.

There has been improvement in the appropriateness of choice of antibiotic for surgical antibiotic prophylaxis for some surgical procedures. This year, for the first time, hospitals received hospital-level reports on their own surgical antibiotic prophylaxis data for individual surgical procedure groups over time to identify those areas where improvement has or has not been achieved. Both clinical practice and data collection for surgical antibiotic prophylaxis needs further improvement, particularly in the areas of timing and duration of prophylaxis.

Influenza vaccination of healthcare workers is an important aspect of patient safety. The 2006 data in this report showed a slight improvement of healthcare worker vaccination uptake from the previous year. It is anticipated we will continue to see improvements in uptake of this vaccine in the future.

The development of surveillance software for the VICNISS hospitals has been another exciting initiative. After a thorough review of existing hospital-infection surveillance software locally and internationally, we are proceeding, in collaboration with the Victorian Partnership for Advanced Computing, with developing a software program that will integrate with hospital information systems. This software will reduce the amount of time required to collect surveillance data and allow hospitals to focus more on infection prevention. The software has been called SHIINe (Safer Hospitals Integrated Information Network) and is currently being piloted at two hospitals.

Data quality has been an important focus in this period. The validation study in large hospitals for coronary artery graft surveillance proved very informative. Together with the Australasian Society of Cardiothoracic Surgeons, we have undertaken a collaborative study seeking to improve risk adjustment methods. This prompted the VICNISS Coordinating Centre to suggest modifications in surveillance methods and reporting for this surgical group. Findings from this study have been presented at national and international conferences. Recommendations from these findings are now being examined and tested on a large US database to see if they are more generally applicable.

We have appreciated the input of consumer representatives in considerations as to how VICNISS data can be usefully presented to the general public. This will be an increasingly important activity in preparation for the release of hospital-level data.

The smaller hospital program (Type 2 surveillance) is approaching maturity. We have learnt a lot about the hospital infection prevention needs in these (usually) rural hospitals. Some of these surveillance modules continue to identify problems that need to be addressed; for example, there is room for improvement in surgical antibiotic prophylaxis and staff immunisation. We continue to see very low rates of serious surgical infections, bloodstream infections after haemodialysis, and methicillin-resistant *Staphylococcus aureus* infections in these hospitals. These modules are constantly being reviewed to identify the most useful surveillance activities in the smaller hospitals.

Again this year, VICNISS staff have made many scientific presentations at local, national and international conferences, and have had papers accepted for publication in the medical literature. Through these activities, we hope to develop improved surveillance activities locally as well as contribute significantly to international progress in this area.

Each year there are major developments in our understanding of hospital-acquired infections and their prevention. We must acknowledge the hard work of the infection control staff at each of the hospitals. Their dedication to undertaking surveillance activities provides the opportunity for this program to be a vigorous, responsive and useful element in Victoria's response to the challenge of reducing the burden of hospital-acquired infections in the increasingly complex environment of modern medicine.

Associate Professor Mike Richards
Director, VICNISS Coordinating Centre

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Acknowledgements

The Quality and Safety Branch, Department of Human Services, produced this report in collaboration with the VICNISS Hospital-Acquired Infection Surveillance Coordinating Centre.

A special acknowledgment is extended to all of the infection control nurses and staff who participated in this project. Their ongoing support and commitment made this project achievable, and this fourth report possible.

Abbreviations

AEP	Appropriateness evaluation protocol
ASCTS	Australasian Society of Cardiac and Thoracic Surgeons
CABGS	Coronary artery bypass graft surgery
CLABSI	Central line-associated bloodstream infection
DHS	Department of Human Services, Victoria
HAI	Hospital-acquired infection
ICC	Infection control consultant
ICU	Intensive care unit
LC-BSI	Laboratory-confirmed bloodstream infection
LOS	Length of stay
MRO	Multi-resistant organism
MRSA	Methicillin-resistant *Staphylococcus aureus*
NHMRC	National Health and Medical Research Council
NICU	Neonatal intensive care unit
NNIS	National Nosocomial Infection Surveillance (United States)
NNL	Neonatal unit surveillance
OBD	Occupied bed days
PVC	Peripheral venous catheter
RC	Risk category
SSI	Surgical site infection
VAP	Ventilator-associated pneumonia
VICNISS	Victorian Hospital-Acquired Infection Surveillance System

Developments over the last 12 months

Validation activities

The aims of validating surveillance systems are to ensure scientific credibility, identify problems, ensure the use of standardised methodology and application of definitions, and to increase compliance and participation.

While surveillance programs are traditionally validated through retrospective analyses, we believe that although these analyses are useful, they have important limitations in that they can be invalidated by staff turnover and other disruptions to the surveillance program. The VICNISS Coordinating Centre has begun formal validation activities in addition to continuing more informal forms of validation, such as ongoing education and hospital visits.

A validation study of coronary artery bypass graft data was completed during 2006 and the results were widely disseminated. The objective of the study was to measure the accuracy of data submitted for identifying surgical site infection (SSI) following coronary artery bypass graft (CABG) surgery through a retrospective review of hospital medical records, comparing SSI data with surveillance data submitted. We found there was broad agreement on the number of infected patients, and on patients with a sternal SSI. However, discordance was frequent in the depth of sternal SSI and the identification of donor site SSI. We recommended modifications to NNIS-based surveillance for SSI following CABG surgery. This study has provided important insights in to how we analyse and report the data.

A similar study to measure the accuracy of intensive care unit central line-associated bloodstream infection data is planned for 2007.

As previously mentioned, we believe that ongoing communication and education are the most important methods to ensure valid data collection and we intend to continue with a strong focus on these activities. Both Type 1 and Type 2 hospitals are encouraged to contact the VICNISS Coordinating Centre with any queries, either by phone or email, and many hospitals take advantage of this. A significant proportion of Type 1 and Type 2 infection control coordinators' time is spent responding to queries about surveillance definitions, methodology and report interpretation. This regular communication helps to ensure the centre is receiving and reporting high-quality data.

Risk adjustment

One of the many challenges VICNISS surveillance faces is to ensure fair comparisons are made when looking at infection rates from different hospitals. VICNISS uses the NNIS Risk Index to risk adjust the surgical site infection rates. For some time now, it has been acknowledged that while the NNIS Risk Index works well for many surgical procedures, this is not the case for coronary artery bypass graft surgery. To address this concern, we analysed the risk factors for surgical site infection (SSI) complicating coronary artery bypass graft surgery (CABG) in an effort to create an alternative SSI risk score based on the results of multivariate analysis. The analysis identified that diabetes and obesity were independent risk factors for SSI. Based on these findings, a new risk index was created using these factors. When tested using appropriate statistical measures, it was found that our new risk index performed better than the NNIS Risk Index for this procedure. Importantly, the new risk index is made up of risk factors that are modifiable so it is possible that a patient's risk may be able to be reduced before having surgery.

These findings have been presented at an international conference, and tested and supported by researchers in the USA.

Software

The development of new surveillance software is well under way. The application called the Safer Hospitals Integrated Information Network (SHIINe) is being developed in collaboration with the Victorian Partnerships for Advanced Computing (VPAC).

There are two major advantages of the SHIINE software. First, the software is designed to retrieve data from existing hospital information systems and so largely eliminates the need for manual data input (some manual input will be required for certain SSI details). Second, hospitals will be able to write their own reports and will no longer be reliant on the VCC to generate reports and make comparisons with aggregate data.

The development process has experienced some delays; however, VICNISS and VPAC have tested each key component and gained feedback from infection control stakeholders as an iterative development strategy to gain user support and enhance the quality of the final software solution. This has taken time, but has significantly benefited both the infection control users and VICNISS data quality.

To retrieve data from existing hospital systems, the software needs to be ‘integrated’ into each hospital. This is a major undertaking as the integration needs to be ‘tailored’ at each hospital to ensure the correct data are retrieved.

SHIINe is being piloted at St Vincent’s and Geelong hospitals. Following the pilot, it will be integrated into all Type 1 participating hospitals.

For Type 2 hospitals, the development of web pages for data entry has been completed for one of the surveillance modules. In time, further web pages will be developed for direct data entry.

Results

This section presents the type of data collected from Type 1 and Type 2 hospitals.

Type 1 data refers to:

a) intensive care unit – annual data:

   i) central line-associated bloodstream infections and causative organisms.

b) surgical site infection rates – annual data:

   i) coronary artery bypass grafts – all infections

   ii) coronary artery bypass grafts – deep and organ space infections

   iii) colon surgery

   iv) caesarean section

   v) hip arthroplasty

   vi) knee arthroplasty.

c) neonatal intensive care unit – cumulative data:

   i) central line-associated bloodstream infections and causative organisms

   ii) peripheral line-associated bloodstream infections and causative organisms.

Type 2 data refers to:

a) compliance with surgical antibiotic prophylaxis

b) compliance with measles vaccination guidelines

c) compliance with hepatitis B vaccination guidelines

d) peripheral venous catheter compliance

e) multi-resistant organism infection rate

f) laboratory-confirmed bloodstream infections

g) outpatient haemodialysis event rate

h) occupational exposures

i) surgical infection report.

The influenza vaccination report includes healthcare worker influenza vaccination uptake from both Type 1 and Type 2 hospitals.

Surgical antibiotic prophylaxis includes surgical antibiotic prophylaxis data for both Type 1 and Type 2 hospitals.

Type 1 data

Intensive care unit data

Figure 1. Annual intensive care unit central line-associated bloodstream infection rates for A1 hospitals

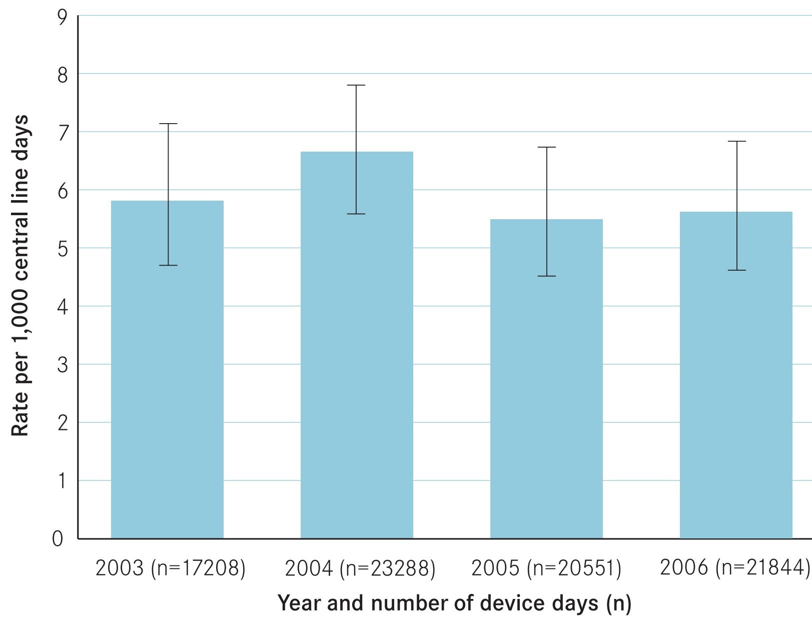


Figure 1 displays the annual central line-associated bloodstream infection rate in the Group A1 hospitals since the beginning of the VICNISS program. A slight variation on an annual basis can be observed. Six hospitals submitted data for this procedure.

Figure 2. Annual intensive care unit central line-associated bloodstream infection rates for other hospitals

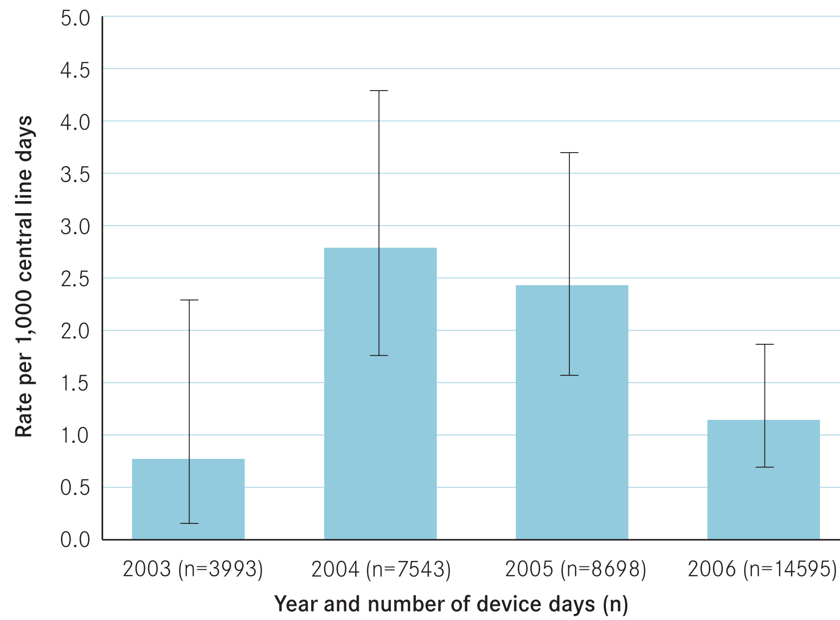


Figure 2 displays the annual central line-associated bloodstream infection rate in the other hospitals since the beginning of the VICNISS program. The rate has been decreasing since 2004. Twelve hospitals submitted data for this procedure.

Figure 3. Frequency of causative organisms in intensive care unit central line-associated bloodstream infections – A1 hospitals

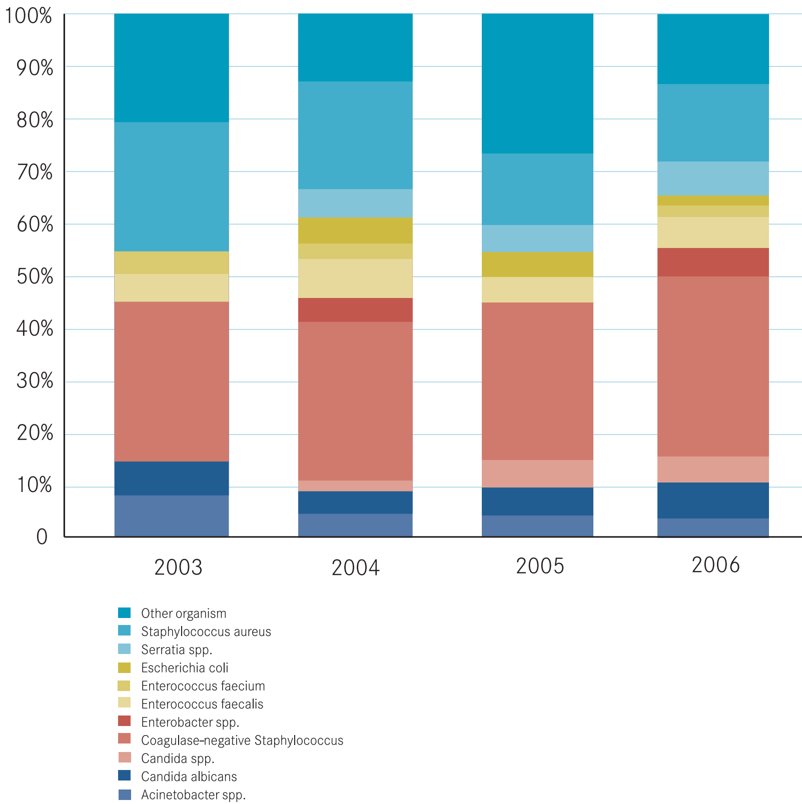


Figure 3 represents the annual frequency of causative organisms in A1 ICU central line-associated bloodstream infections. The frequency of the most common organism, coagulase-negative Staphylococcus has not varied on an annual basis.

Figure 4. Frequency of causative organisms in intensive care unit central line-associated bloodstream infections – other hospitals

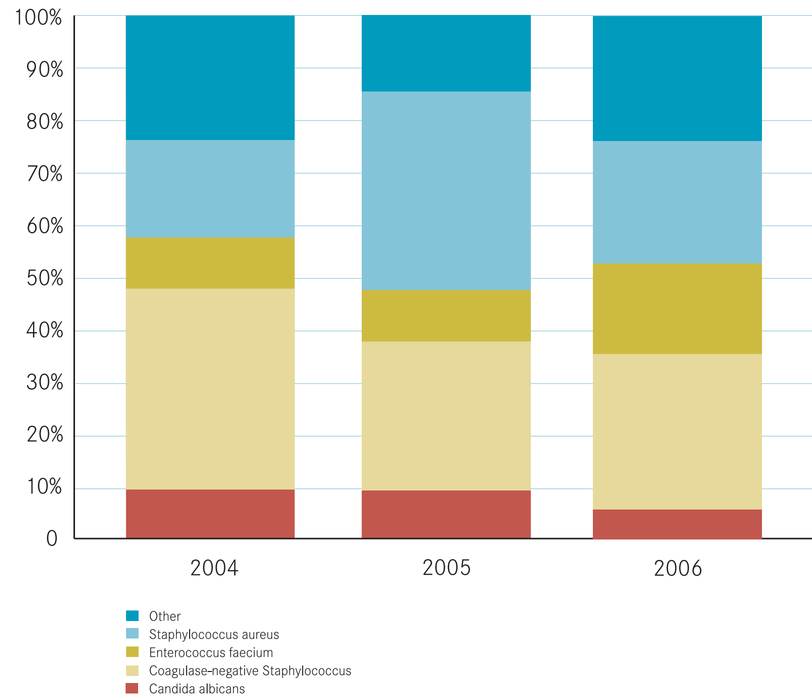


Figure 4 represents the annual frequency of causative organisms in other ICU central line-associated bloodstream infections. The frequency of the most common organism, coagulase-negative Staphylococcus, has decreased slightly since 2004, and the frequency of *Staphylococcus aureus* appears to have decreased since 2005.

Surgical site infection data

Figure 5. Annual coronary artery bypass grafts surgical site infection rates by risk category

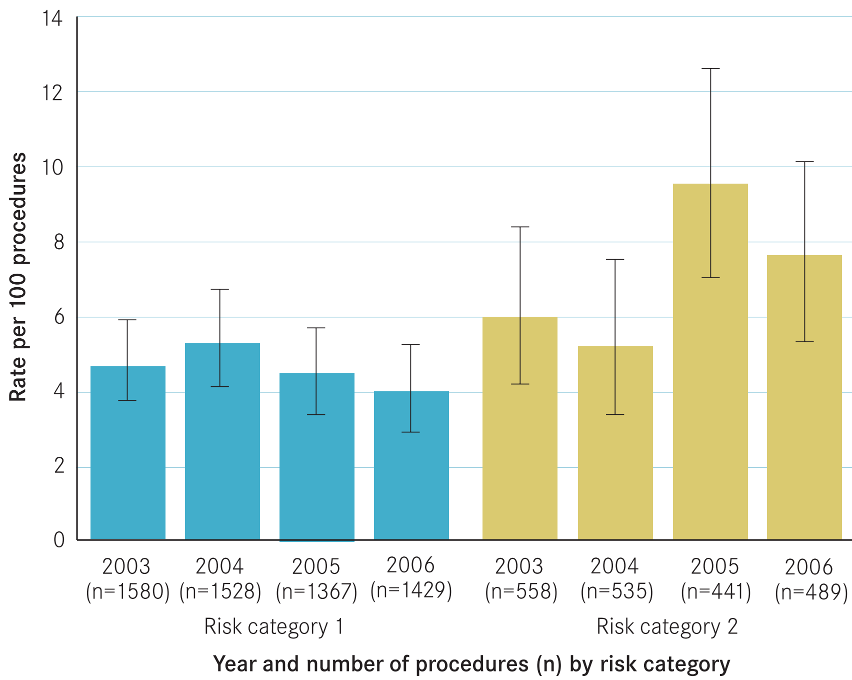
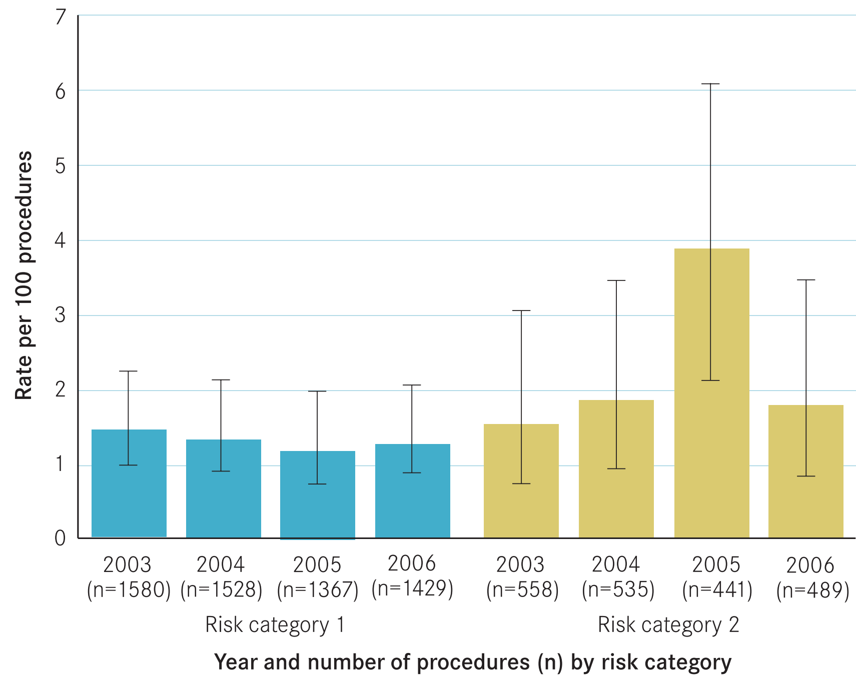


Figure 6. Annual coronary artery bypass grafts, deep and organ space surgical site infection rates by risk category



Figures 5 and 6 display the annual coronary artery bypass graft SSI rates since 2003. The difference between Figure 5 and Figure 6 is that Figure 5 data include all types of SSI (that is, deep, organ space and superficial). Figure 6 only includes *deep and organ space*, which are considered more serious infections. Following a validation of the data from coronary artery bypass graft procedures, VICNISS identified that, sometimes, superficial infections are not detected. Therefore, there may be some underreporting of infection rates (as shown in Figure 5). Deep and organ space infections were almost always identified; hence, these data are likely to be more accurate. When comparing data in Figures 5 and 6, note the difference in the scale. Six hospitals submitted data for this procedure.

Figure 7. Annual colon surgery surgical site infection rates by risk category

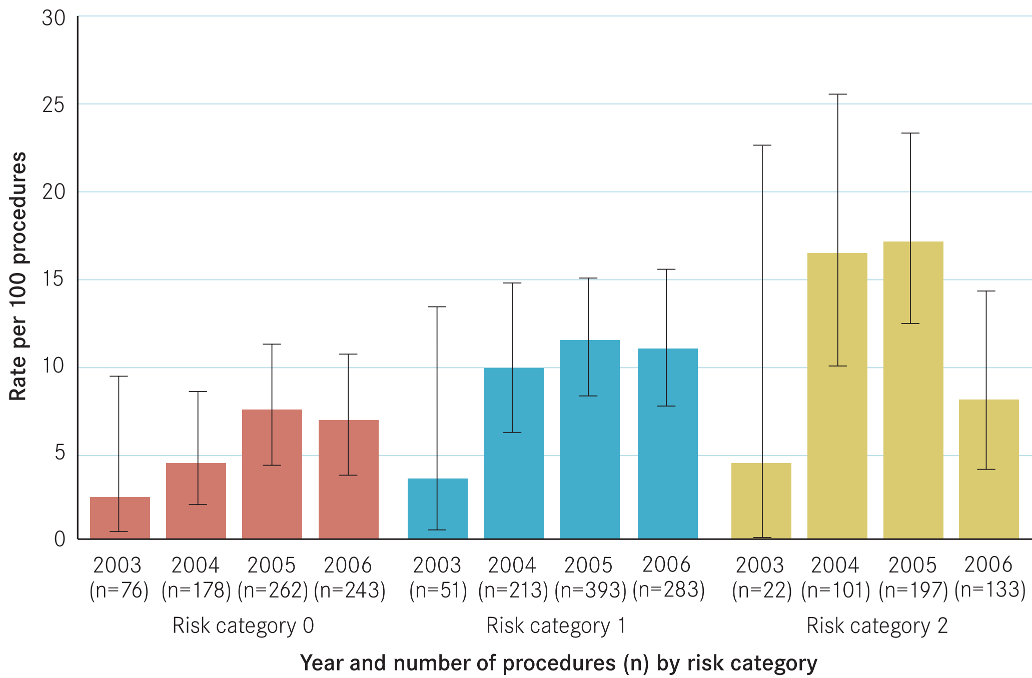


Figure 7 displays the colon surgery SSI rates since 2003. This procedure is classified as 'dirty' surgery, and it is expected that higher rates of infection will be seen than for 'clean' procedures (such as knee arthroplasty). In all risk categories, the rates for 2006 have decreased slightly from 2005. Nine hospitals submitted data for this procedure.

Figure 8. Annual Caesarean section surgical site infection rates by risk category

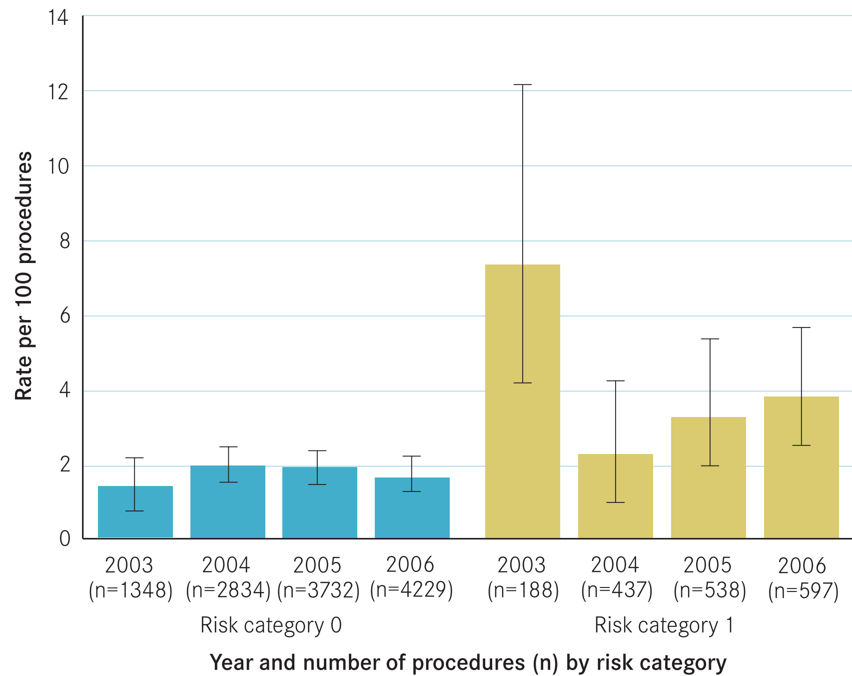


Figure 8 displays the Caesarean section surgery SSI rates since 2003. The rates for risk category 0 remained quite stable. Following a high rate in 2003, rates for risk category 1 dropped dramatically and now appear to be slowly increasing. Twenty-three hospitals submitted data for this procedure.

Figure 9. Annual hip arthroplasty surgical site infection rates by risk category

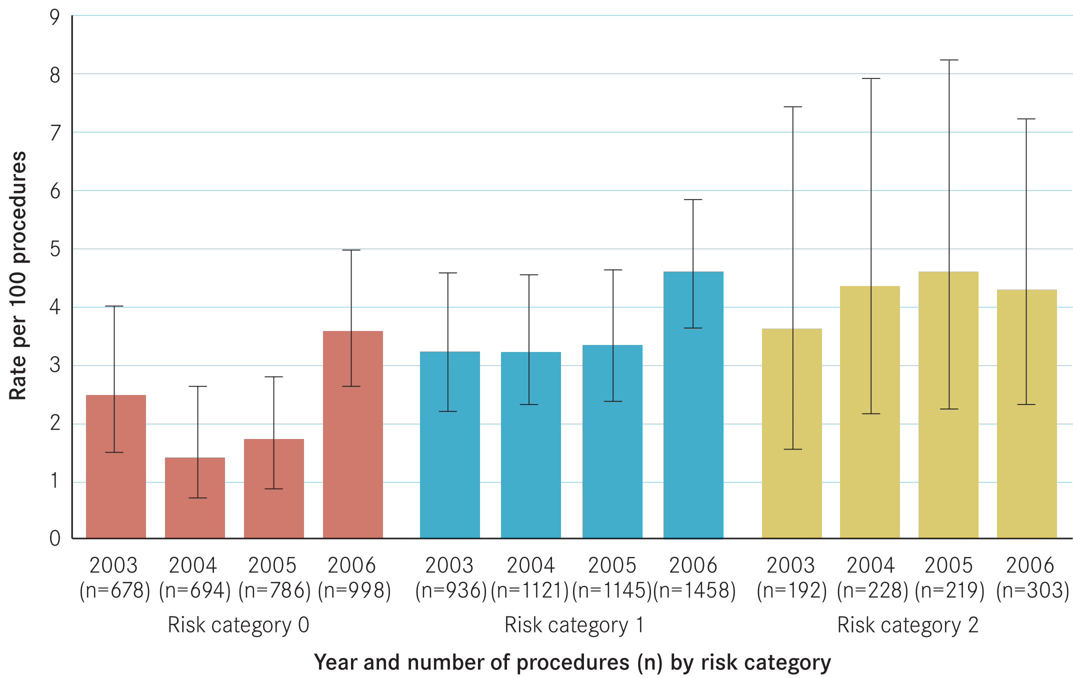


Figure 9 displays the knee arthroplasty surgery SSI rates since 2003. Increases in risk category 0 and 1 can be seen, while a slight decrease is shown for risk category 2. Nineteen hospitals submitted data for this procedure.

Figure 10. Annual knee arthroplasty surgical site infection rates by risk category

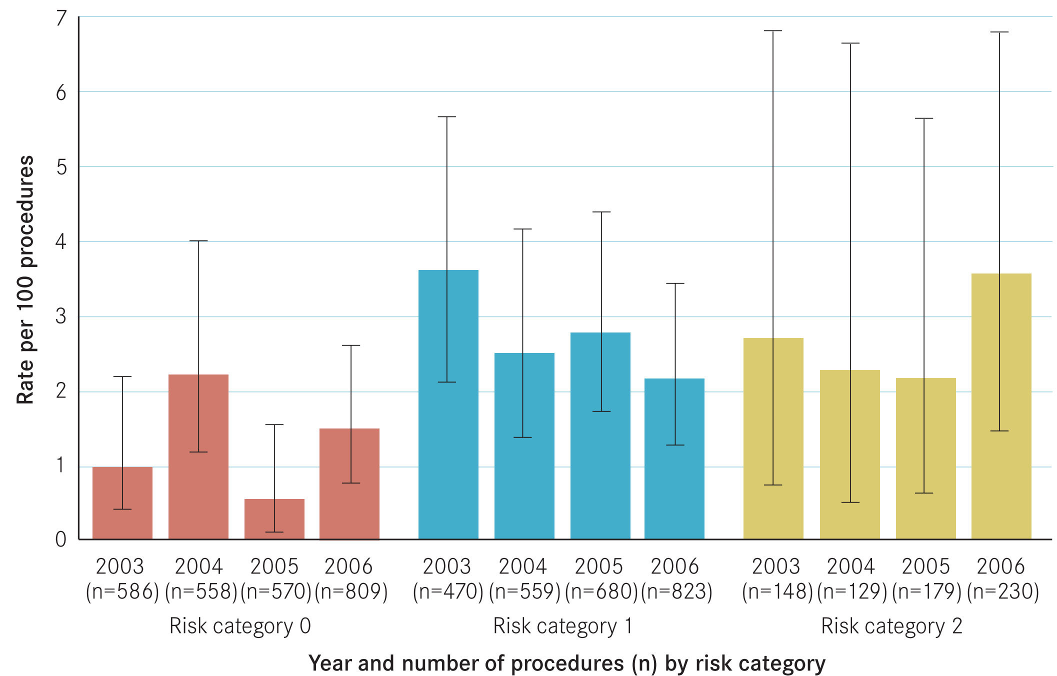


Figure 10 displays the knee arthroplasty surgery SSI rates since 2003. As can be seen and represented by 'n', most patients having knee arthroplasty fall into risk category 0 or risk category 1. The 2006 rate for risk category 0 has increased since 2005, but decreased in risk category 1. The more volatile rates in risk category 2 may be influenced by the smaller number of patients in this category, which is supported by the wider confidence intervals. Seventeen hospitals submitted data for this procedure.

Surgical site infection pathogens

Figure 11. Annual frequency of causative organisms following coronary artery bypass grafts

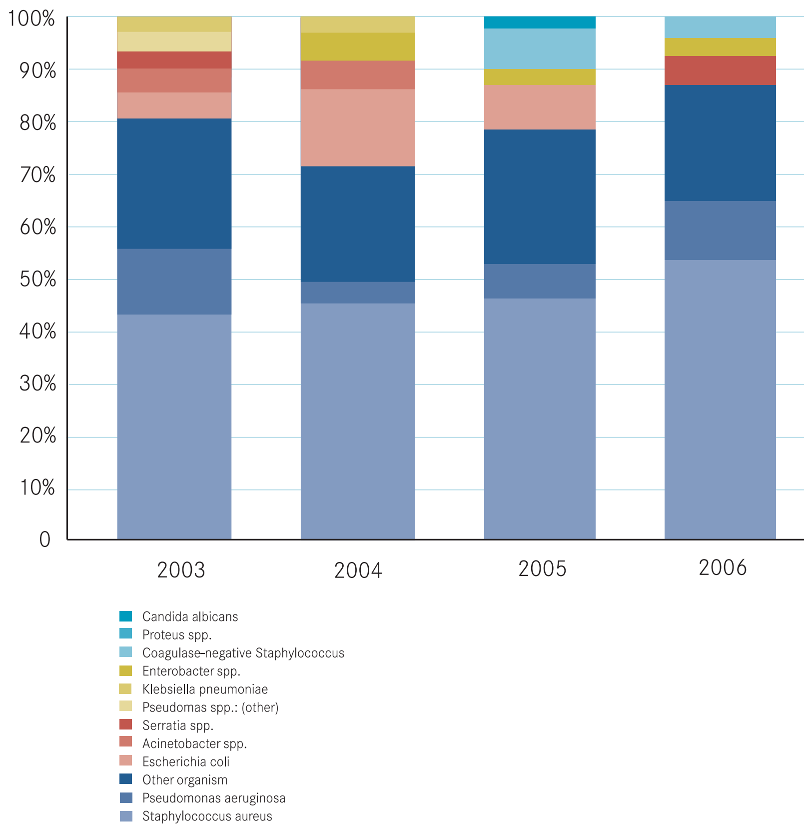


Figure 11 displays the frequency of causative organisms in SSIs following coronary artery bypass graft surgery. *Staphylococcus aureus* is the most commonly found pathogen in these SSIs over the four-year period.

Figure 12. Annual frequency of causative organisms following knee arthroplasty

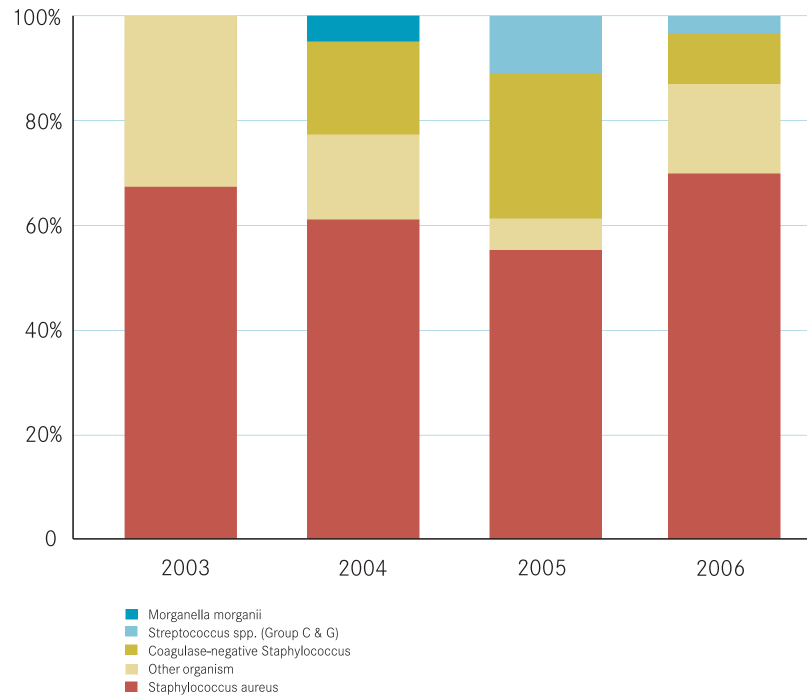


Figure 12 displays the frequency of causative organisms in SSIs following knee arthroplasty. Clearly, the most common organism is *Staphylococcus aureus*, and this has remained reasonably constant over the four years.

Figure 13. Annual frequency of causative organisms following hip arthroplasty

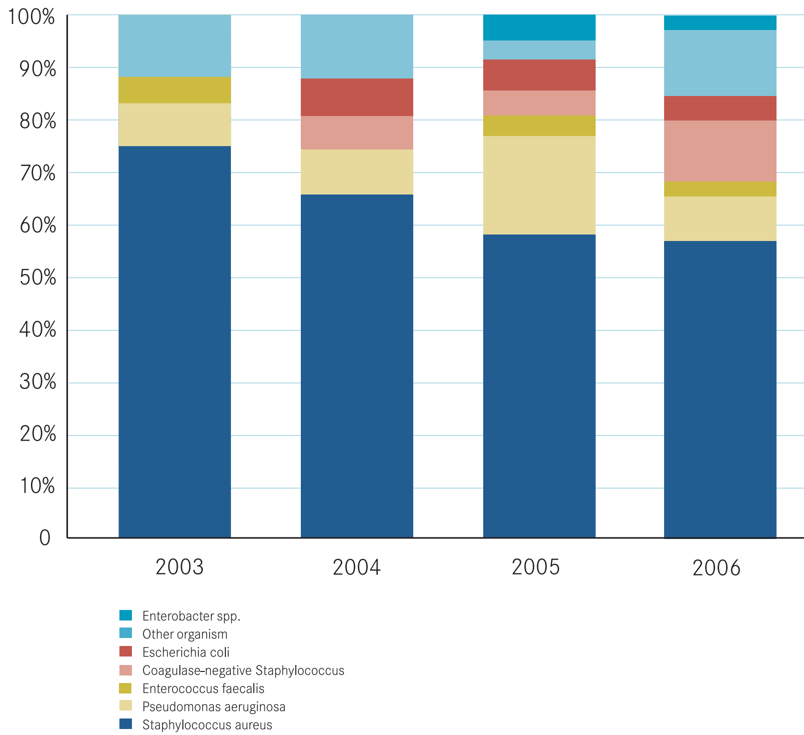


Figure 13 displays the frequency of causative organisms in SSIs following hip arthroplasty. The most dominant organism is *Staphylococcus aureus*, which has decreased slightly in frequency over the three years.

Neonatal intensive care unit data

Figure 14. Neonatal intensive care unit central line-associated bloodstream infection rate – April 2004 to December 2006

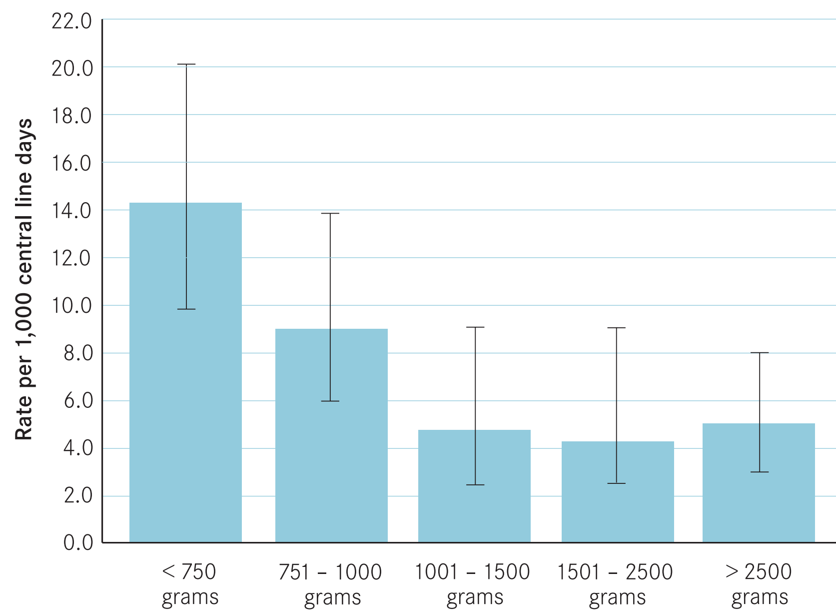


Figure 14 displays the central line-associated BSI in neonatal ICUs. Rates are stratified by birthweight as babies with lower birthweight are generally considered to be at a higher risk of developing infection. This mostly explains the trend seen in this figure, which represents data submitted from three hospitals.

Figure 15. Neonatal intensive care unit peripheral line-associated bloodstream infection rate – April 2004 to December 2006

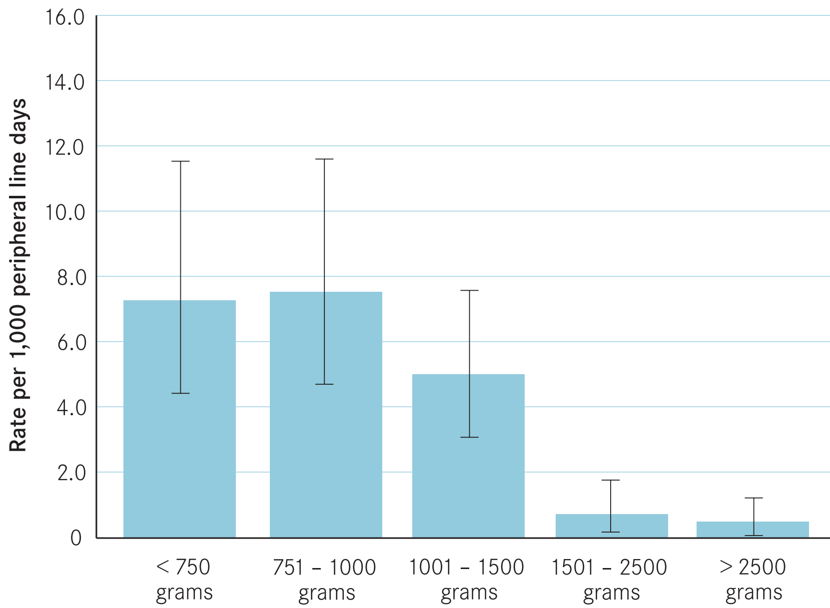


Figure 15 displays the peripheral line-associated BSI in neonatal ICUs. Rates are stratified by birthweight as babies with lower birthweight are generally considered to be at a higher risk of developing infection. This explains the trend seen in this figure. Three hospitals submitted data for this procedure.

Figure 16. Frequency of causative organisms in neonatal care unit central line-associated bloodstream infections

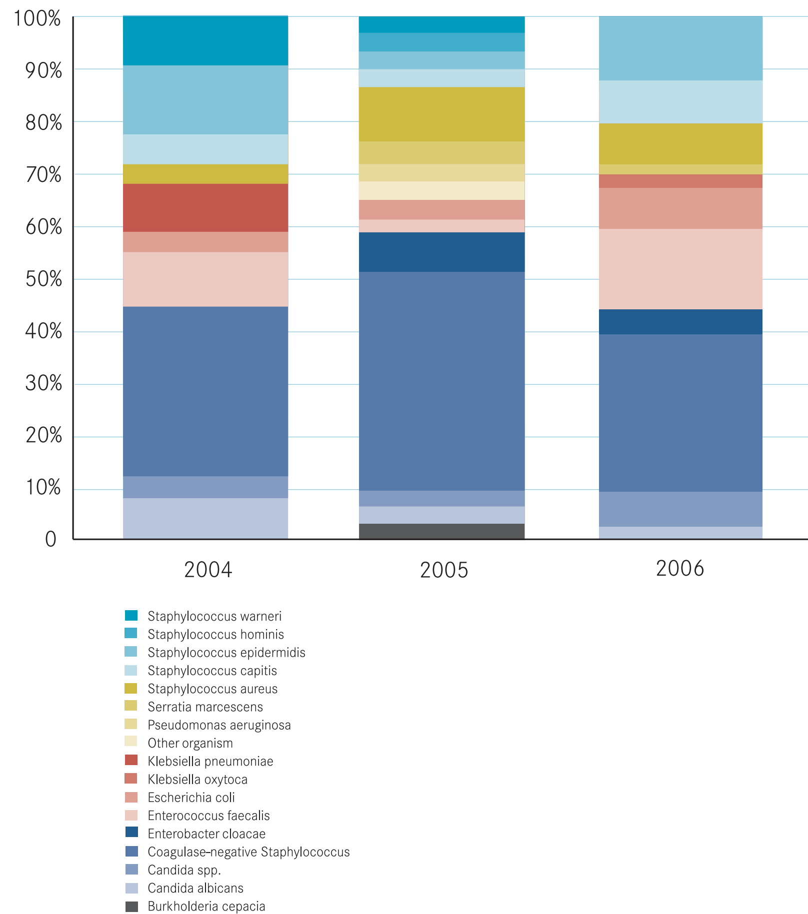


Figure 16 shows the annual frequency of causative organisms in neonatal central line-associated bloodstream infections for all birthweights combined. Similar to the adult ICUs, the most common pathogen is coagulase-negative Staphylococcus.

Figure 17. Frequency of causative organisms in neonatal care unit peripheral line-associated bloodstream infections

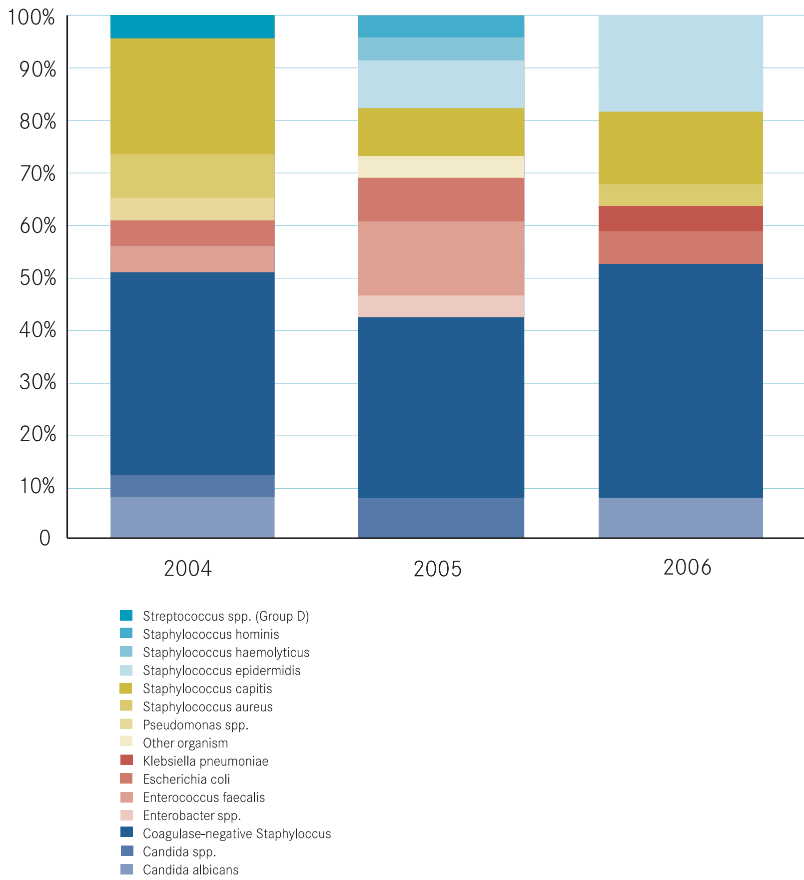


Figure 17 shows the annual frequency of causative organisms in neonatal peripheral line-associated bloodstream infections for all birthweights combined. Similar to the figures above, the most common pathogen is coagulase-negative Staphylococcus.

Type 2 data

Healthcare workers and measles vaccination

The aims of this process indicator surveillance module are to:

- assess Victorian public hospitals' policy compliance with the National Health, Medical and Research Council (NHMRC) and Department of Human Services (DHS) recommendations for susceptible healthcare workers, specifically in regard to measles-mumps-rubella (MMR) vaccination
- determine the current status of healthcare workers susceptible to measles.

Table 1. Healthcare workers and measles vaccination data from 1 January 2005 to 31 December 2006

Objective (13 participating hospitals)	Frequency
Documented measles policy	100%
Measles policy consistent with guidelines	85%
Total staff (born >1966) with documented evidence immunity to measles or laboratory-confirmed measles	51.1%

Healthcare workers and hepatitis B vaccination

The aims of this process indicator surveillance module are to:

- assess Victorian public hospitals' policy compliance with NHMRC recommendations
- identify the uptake of hepatitis B vaccine offered to at-risk healthcare workers.

Table 2. Healthcare workers and hepatitis B vaccination data from 1 January 2005 to 31 December 2006

Objective (35 participating hospitals)	Frequency
Documented hepatitis B policy	97.7%
Hepatitis B policy consistent with guidelines	75%
Total staff vaccinated with confirmatory blood tests	39.9%

Peripheral venous catheter use

The aim of this process indicator surveillance module is to help reduce the infection risk associated with the use of peripheral venous catheters (PVCs). This module is based on recommendations outlined in the *Guidelines for the prevention of intravascular catheter-related infections* from the Centers for Disease Control and Prevention (2002).

Table 3. Peripheral venous catheter use from 1 January 2005 to 31 December 2006

Objective (11 participating hospitals)	Frequency
Hospitals with usage guidelines	100%
Compliance with recommendations	
PVCs with no topical antimicrobial	87.7%
PVCs with sterile dressing	91.6%
Daily inspection of PVCs	86.0%
PVCs removed or replaced within 96 hours	89.2%

Outcome indicators

Methicillin-resistant Staphyloccus aureus (MRSA) infection

This report provides an aggregate rate of MRSA infections categorised by hospital size (small, medium or large). The rates were stratified using the time the infection was detected; that is, within 48 hours or after 48 hours. This was based on the assumption that those identified within 48 hours were not considered to be acquired at the reporting hospital.

The rate was calculated by dividing the number of MRSA infections by the number of acute occupied bed days, and multiplying by 10,000. Therefore, the rate is expressed as the number of MRSA infections per 10,000 occupied bed days.

Table 4. MRSA infection (<48 hours) from 1 May 2004 to 31 December 2006

Category	No. of participating hospitals	No. of events	Acute occupied bed days	Rate	95% confidence interval
Aggregate	88	89	877097	1	0.8-1.2
Small	54	14	204582	0.7	0.4-1.1
Medium	24	41	352633	1.2	0.8-1.6
Large	10	34	319882	1.1	0.7-1.5

Table 5. MRSA infection (>48 hours) from 1 May 2004 to 31 December 2006

Category	No. of participating hospitals	No. of events	Acute occupied bed days	Rate	95% confidence interval
Aggregate	88	46	877097	0.5	0.4-0.7
Small	54	8	204582	0.4	0.2-0.8
Medium	24	14	352633	0.4	0.2-0.7
Large	10	24	319882	0.8	0.5-1.1

The data in these tables indicate a much lower detection of MRSA in patients after 48 hours of hospital admission when compared to detection of MRSA in the first 48 hours of admission. This demonstrates a low rate of acquisition of MRSA in Type 2 hospitals, and that much of the MRSA detected is a result of patients acquiring MRSA elsewhere prior to admission.

Laboratory-confirmed bloodstream infections (>48 hours)

This report provides an aggregate rate of primary laboratory-confirmed bloodstream infections (LC-BSIs) categorised by hospital size (small, medium or large). Only hospital-acquired infections are now reported; that is, those that occur 48 hours or more after admission to hospital. This was based on the assumption that those identified within 48 hours were not considered to be acquired at the reporting hospital.

The rate is calculated by dividing the number of infections by the number of acute occupied bed days, and multiplying by 10,000. Therefore, the rate is expressed as the number of primary LC-BSIs per 10,000 acute occupied bed days.

Table 6. Laboratory-confirmed BSI (> 48 hours) from 1 May 2004 to 31 December 2006

Category	No. of participating hospitals	No. of events	Acute occupied bed days	Rate	95% confidence interval
Aggregate	88	31	950691	0.3	0.2-0.5
Small	54	1	204582	0.1	0.0-0.3
Medium	24	9	352633	0.3	0.1-0.5
Large	10	21	393476	0.5	0.3-0.8

This table demonstrates very low rates of laboratory-confirmed bloodstream infections in Type 2 hospitals. The rate is seen to increase with the size of the hospitals, which may reflect increased complexity of patient mix and higher risk of BSI in larger hospitals. Following data validation activity during 2006 of data that was reported in 2005, it was noted that there was some ‘over-reporting’ of BSIs in this group. Consequently, the VICNISS Coordinating Centre staff and the notifying hospital now validate all notifications of BSI from Type 2 hospitals. Due to this continuous validation activity, the number of events described in the above table is lower than those reported in the annual report of 2005.

Outpatient haemodialysis events

This report provides the rate of haemodialysis events (that is, positive blood culture or vancomycin start) for the VICNISS aggregate.

The rate is calculated by dividing the number of events by the number of patient months multiplied by 100. Therefore, the rate is expressed as the number of events per 100 patient months.

Table 7. Outpatient haemodialysis events data from 1 May 2004 to 30 September 2005

Category	No. of participating hospitals	No. of events	Patient months	Rate	95% confidence interval
Aggregate	20	18	2385	0.76	0.4-1.2

Occupational exposures

This report provides an aggregate rate of parenteral and non-parenteral occupational exposures involving acute patient sources categorised by hospital size (small, medium or large).

Parenteral exposure is defined as the piercing of skin with a contaminated sharp. Contaminated sharp means any contaminated object that can penetrate the skin including, but not limited to, needles, scalpels, broken glass, broken capillary tubes and exposed ends of dental wires.

An exposure is classified as non-parenteral when the eye, mouth, other mucous membrane or non-intact skin contact with blood or other potentially infectious materials.

The rate is calculated by dividing the number of occupational exposures by the number of acute occupied bed days, and multiplying by 10,000. Therefore, the rate is expressed as the number of occupational exposures per 10,000 acute occupied bed days.

Table 8. Parenteral occupational exposures data from 1 January 2005 to 31 December 2006

Category	No. of participating hospitals	No. of events	Acute occupied bed days	Rate	95% confidence interval
Statewide	89	276	743,470	3.7	3.3-4.2
Small	54	14	157,063	0.9	0.5-1.5
Medium	24	81	264,878	3.1	2.4-3.8
Large	11	181	321,529	5.6	4.8-6.5

Table 9. Non-parenteral occupational exposures data from 1 January 2005 to 31 December 2006

Category	No. of participating hospitals	No. of events	Acute occupied bed days	Rate	95% confidence interval
Statewide	89	77	743,470	1.0	0.8-1.3
Small	54	7	157,063	0.4	0.2-0.9
Medium	24	21	264,878	0.8	0.5-1.2
Large	11	49	321,529	1.5	1.1-2.0

Surgical infection report

This module is designed to identify unusual clusters of deep or organ space surgical site infections (SSIs) that might otherwise go unnoticed.

This report provides information on the total *number* of deep and organ space SSIs categorised by hospital size. It includes infections that are present at the time of hospital admission.

Please note: this is not a rate but the number of infections identified. Therefore, comparison against the VICNISS aggregate or another hospital is not recommended as these figures do not take into account the number or complexity of procedures or patient mix at each site.

Table 10. Surgical infection report SSIs from 1 May 2004 to 31 December 2006

Category	No. of events
Statewide	151
Small	8
Medium	60
Large	83

Influenza vaccination report

As part of the annual provision of influenza vaccine for healthcare workers in hospitals by DHS, staff administering the vaccine were requested to complete and return data forms regarding the staff category of recipients.

The annual survey's objective is to measure the uptake rate of influenza vaccine at each site, and to review the breakdown of professions receiving the vaccine. The survey was sent to all Type 1 and Type 2 hospitals (total 117).

A total of 83 (71 per cent) hospitals responded to the survey. Of these, 43 were able to provide data on the specific staff category of recipients. Results from these 43 sites are demonstrated in Table 11 below.

Table 11. Influenza vaccines administered by minor staff category 2005 and 2006

Major staff category	Minor staff category	2005		2006	
		Total staff	Proportion vaccinated (%)	Total staff	Proportion vaccinated (%)
Clinical	Medical	5410	29.7	7733	31.8
	Nursing	19,412	35.7	26566	39.2
	Allied health	4529	46.0	6018	38.4
	Other	7239	50.8	5566	51.3
Non-clinical	Non-clinical	5529	37.4	11,485	46.7
Laboratory	Laboratory	740	41.6	1021	52.2

The NHMRC recommends that all healthcare workers involved in direct patient care should be vaccinated. An increase in the uptake rate of influenza vaccine was seen in all staff categories except allied health for 2006. Further increases are expected in 2007.

Surgical antibiotic prophylaxis

Surgical antibiotic prophylaxis has been shown to be effective in reducing the incidence of surgical wound infections for many types of surgery. The measurement of compliance of surgical antibiotic prophylaxis against recommended guidelines is a common process measurement in many surveillance programs worldwide.

Reporting is based on three criteria, each of which is assessed separately:

- antibiotic choice
- antibiotic timing
- duration of antibiotics following surgery.

These criteria were assessed against the Therapeutic Guidelines Antibiotic Version 12 (2003) and the Guidelines from the National Surgical Infection Prevention Project.

When interpreting these reports the following important points should be taken into consideration:

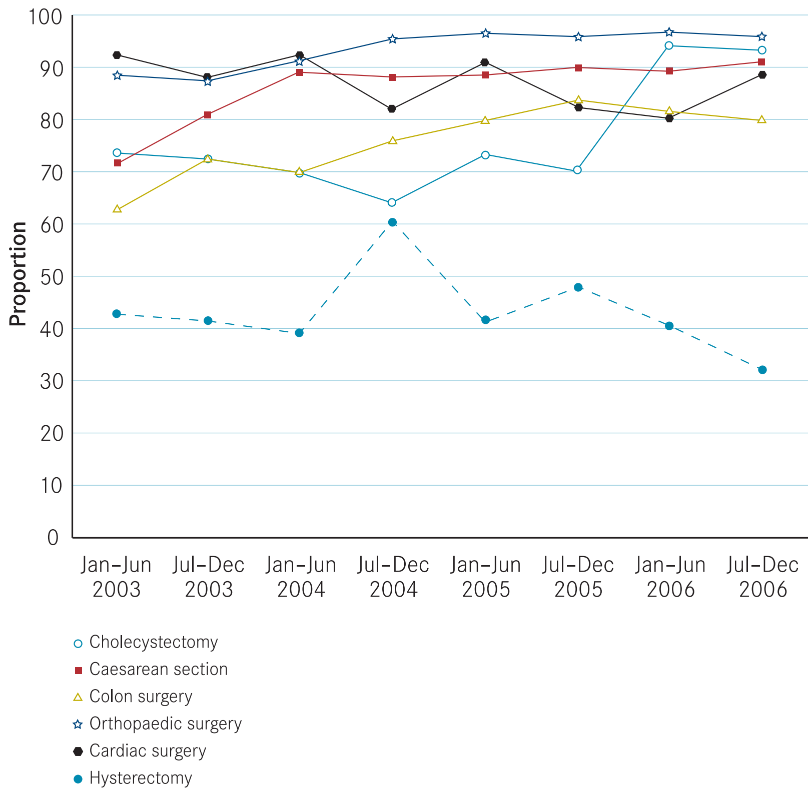
- VICNISS surveillance collects basic antibiotic information only, and **does not** include comprehensive patient-level clinical information that may influence the individual clinician's decisions on each of the above criteria. For example, no information is collected on allergies or co-morbidities that may influence antibiotic choice.
- The list of antibiotics recorded in the VICNISS database is limited and uncommonly used drugs not on this list may be recorded in the database as 'other', meaning the antibiotic choice cannot always be judged for concordance with the guidelines, even when information was provided by the hospital. These cases are reported as 'unknown'.

For simplicity, surgical procedures from Type 1 data are grouped: the cardiac group includes procedures such as coronary artery bypass graft surgery, heart valve replacement, and other cardiac surgery; orthopaedic includes total knee and total hip arthroplasty.

When reviewing the Type 1 charts, take into account that data from some procedures such as hysterectomy are heavily influenced by one or two hospitals that contribute most of the data. In this case, if one hospital is performing poorly, low compliance will be indicated in the charts. In addition, the number of hospitals contributing data for this activity can vary from quarter to quarter in accordance with which activities are under surveillance.

Type 1 Surgical antibiotic prophylaxis

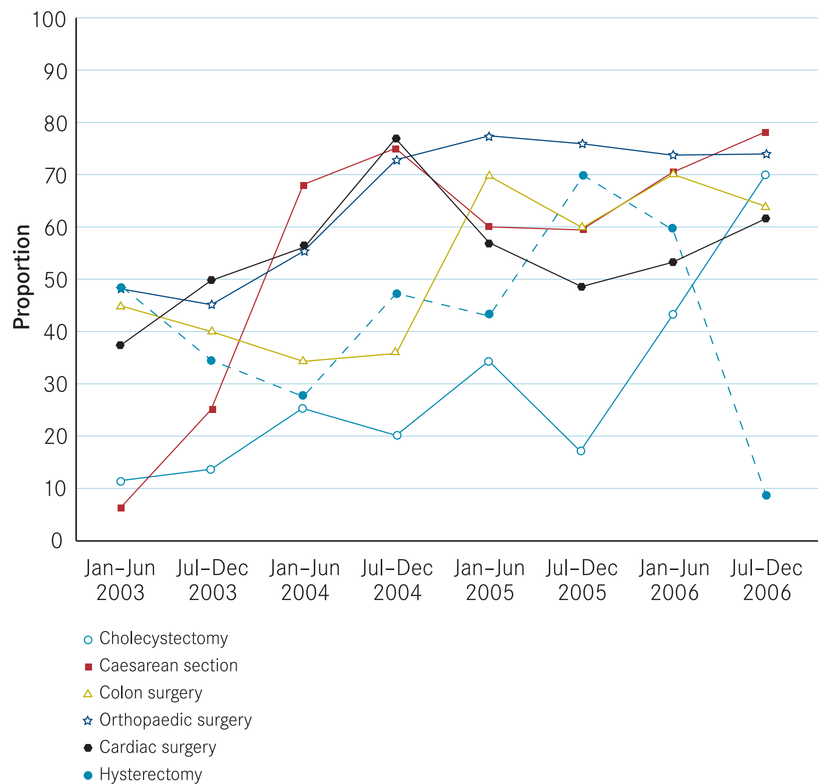
Figure 18. Surgical antibiotic prophylaxis compliance with guidelines: choice of antibiotics appropriate



Note: Total number of procedures: cholecystectomy (1629), Caesarean section (13,814), colon surgery (2115), orthopaedic surgery (13,155), cardiac surgery (4917), hysterectomy (1310).

Figure 18 shows the aggregate surgical antibiotic prophylaxis six-monthly compliance rates for 2003 to 2006. The compliance rates are based on the choice of antibiotics being considered optimal or adequate for the specific surgical procedure. As is demonstrated in this figure, there has been an improvement in compliance with guidelines for choice for all groups except hysterectomy.

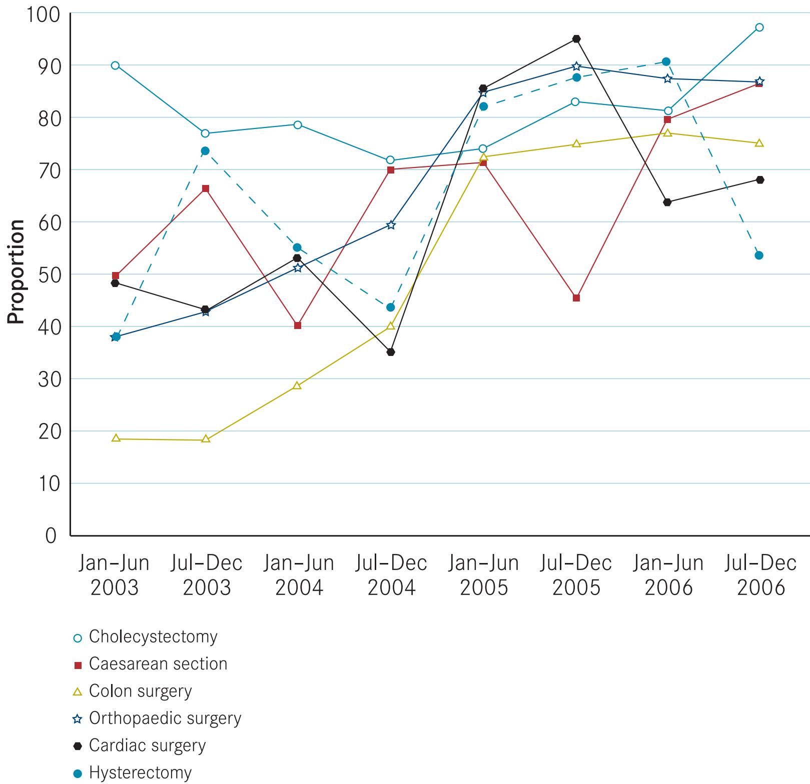
Figure 19. Surgical antibiotic prophylaxis compliance with guidelines: timing of antibiotics appropriate



Note: Total number of procedures: cholecystectomy (1629), Caesarean section (13,814), colon surgery (2115), orthopaedic surgery (13,155), cardiac surgery (4917), hysterectomy (1310).

Figure 19 shows the aggregate surgical antibiotic prophylaxis six-monthly compliance rates for timing from 2003 to 2006. There has been an improvement in compliance with timing in all groups of surgery since 2003. However, for the last half of 2006, the compliance rate decreased for hysterectomy.

Figure 20. Surgical antibiotic prophylaxis compliance with guidelines: duration of antibiotics appropriate



Note: Total number of procedures: cholecystectomy (1629), Caesarean section (13,814), colon surgery (2115), orthopaedic surgery (13,155), cardiac surgery (4917), hysterectomy (1310).

Figure 20 shows the aggregate surgical antibiotic prophylaxis six monthly compliance rates for 2003 to 2006. There has been an improvement in compliance with duration in all groups of surgery since 2003. However, for the last half of 2006, the compliance rate decreased for hysterectomy.

Type 2 Surgical antibiotic prophylaxis

Table 12. Surgical antibiotic prophylaxis data from 1 May 2004 to 31 December 2006

Objective 27 participating hospitals	**Concordant with guidelines**	**Adequate**	**Inadequate**	**Unknown**
Choice 3281 procedures	56.8%	17.2%	23.7%	2.3%
Timing 2692 procedures	53.2%	-	37.8%	9.1%

Duration: In 17% of 2691 procedures, surgical prophylactic antibiotics were administered for a period exceeding 24 hours after the procedure.

The aim is to get a zero proportion for the inadequate category. In 2005, the *inadequate rates* for choice and timing were 27.4% and 40.9%, so there has been improvement demonstrated in this area.

How do hospitals assess their performance?

Victoria now has an established standardised surveillance program for hospital-acquired infections in all of its public hospitals. This is a huge step forward from the situation identified in a survey of public hospitals in the late 1990s when surveillance resources (including staffing and information technology) were limited, there was little standardisation of methods, and frequently data were not fed back to treating clinicians to drive improvements in quality of care.

The public hospital participation rate in VICNISS is maintained at about 98 per cent, and this is a significant achievement in such a short time. Some hospitals were unable to participate for periods of time due to a temporary shift in priorities or, occasionally, other demands on limited infection control resources. When a hospital was unable to participate, the VICNISS Coordinating Centre was responsible for notifying the Department of Human Services and outlining the reasons for the lack of participation.

The VICNISS Coordinating Centre provides reports to the hospitals on a quarterly basis. These reports allow hospitals to compare their rates with the state aggregate. When a hospital is noted to have a statistically significantly higher rate than the state aggregate, the VICNISS Coordinating Centre contacts the infection control staff at the hospital. Once the rate has been confirmed, the VICNISS Coordinating Centre sends a letter to the chief executive officer informing them of the result and providing details of the high rate. The VICNISS Coordinating Centre also notifies the Department of Human Services of hospitals with statistically significantly higher rates.

Recently, the VICNISS Coordinating Centre developed reports displaying de-identified hospital-level infection rates so hospitals could compare their rate with other hospitals. This report was developed in response to hospitals that not only wanted to compare their rates with the state aggregate, but also rank themselves against other hospitals. Plans are under way to release hospital-identifiable data in the near future.

Like all surveillance programs, VICNISS requires ongoing evaluation and refinement, and expansion to important new areas (including staff health and infections in haemodialysis patients), but already VICNISS represents the most ambitious state program in Australia.

How do hospitals use VICNISS data?

Data continue to be posted quarterly on the password-protected VICNISS website. This allows hospitals to review their rates over time, compare these with aggregate rates and compare themselves with other hospitals. Hospitals can download data in a number of different formats that allow them to present the information in a variety of ways.

As with any surveillance system, it is crucial to ensure appropriate feedback mechanisms are in place.

It is strongly recommended that surgical site infection rates should be fed back to surgeons and surgical teams, central line-associated bloodstream infection rates should be fed back to intensivists and intensive care unit staff, and that surgical antibiotic prophylaxis data should be fed back to surgeons, anaesthetists and surgical teams. Of course, all these data should also be provided to infection control committees, quality committees and executive management. VICNISS Coordinating Centre staff are occasionally invited to make presentations at hospital committees to provide updates.

When a hospital is identified as having a higher than expected rate of infection, the VICNISS Coordinating Centre notifies the chief executive officer of that hospital, as well as the infection control team and DHS. On occasion, the VICNISS Coordinating Centre staff have been invited to undertake a review of infection control and prevention processes at the hospital and make recommendations. DHS are informed of any recommendations and receive regular updates on preventive actions.

Many hospitals have used VICNISS data in their annual quality of care reports to demonstrate their performance against the state aggregate.

Limitations and challenges

We are constantly striving to improve the quality of data, and this is evident in the validation studies and research into improved risk adjustment instigated by the VICNISS Coordinating Centre.

As a result of these studies, we are exploring better ways to review and report the data. These include using only the 'serious' surgical wound infections to compare hospitals, and providing more detailed feedback to the hospitals on the CLABSI rates.

In many hospitals, data collection continues to be done using paper forms. Issues concerning data quality, data management and reporting will be addressed with the implementation of the new software system.

Many hospital-acquired infections are not apparent until after the patient has left hospital and these may be successfully treated without the need to return to hospital. The infections identified in this VICNISS report are only those diagnosed during hospital admission or a subsequent readmission for the infection. Therefore, the true hospital-acquired infection rates will be higher than those reported.

Not all hospitals contribute data continuously. As the manual data collection method currently used is very resource intensive, at times infection control staff need to concentrate on other infection control issues. Therefore, it is not uncommon for some hospitals to opt out of certain VICNISS surveillance activities for short periods during the year. In addition, although we encourage prospective data collection, due to resources, some hospitals are only able to collect data retrospectively.

What's next for VICNISS?

In our ongoing endeavours to ensure VICNISS data continue to be meaningful for consumers and healthcare workers, some of the planned activities for the next 12 months include:

- implementing the SHIINe software into the Type 1 hospitals, and the development of web pages for Type 2 Surveillance modules will continue
- providing advice to DHS and hospitals on methods to lower infection rates
- continuing to explore improvements by refining existing modules and examining new areas of importance, and through understanding local needs and resources as communicated by direct hospital contact, the advisory committee, and user groups of hospital infection control consultants
- ensuring consumers and healthcare workers have confidence in the infection rate data, risk adjustment, definitions and benchmarks
- consulting further with consumer groups and exploring the release of meaningful hospital infection information into the public arena
- examining specific surveillance activities for patients undergoing renal dialysis
- contributing at a national level, particularly with the Australian Commission of Safety and Quality in Healthcare in identifying uniform methodology for surveillance activities
- continuing the collaborative work with participating hospitals and specialist surgical groups such as the Australian Cardiothoracic Society in identifying specific risk factors for surgical site infections in these patient groups
- continuing research initiatives and presenting the results locally, nationally and internationally
- exploring collaborative activities with international experts involved in similar surveillance methodology.

Spreading the word about VICNISS

VICNISS Coordinating Centre staff have presented at a number of local, national and international conferences and had articles published in peer-reviewed journals.

Below is a comprehensive list of papers and presentation originating from VICNISS.

Publications

1. Bennett NJ, Bull AL, Dunt DR, Gurrin LC, Richards MJ, Russo PL & Spelman DW 2006, 'A profile of smaller hospitals – planning for a novel statewide surveillance program, Victoria, Australia', *Am J Infect Control,* 34:170–75.
2. Bennett NJ, Bull A, Dunt DR, Richards MJ, Russo PL & Spelman DW, 'Surgical antibiotic prophylaxis in smaller hospitals' (accepted *ANZ J Surg* 2006).
3. Bennett NJ, Bull A, Dunt DR, Richards MJ, Russo PL & Spelman DW, 'The implementation of a pilot surveillance program for smaller acute care hospitals' (accepted *AJIC* March 2006).
4. Bennett NJ, Bull A, Dunt DR, Richards MJ, Russo PL & Spelman DW, 'The quality of data reported to a smaller hospital pilot surveillance program' (accepted *ICHE* February 2006).
5. Bennett NJ, Bull AL, Dunt DR, Spelman DW, Russo PL & Richards MJ 2007, 'Implementation of a pilot surveillance program for smaller acute care hospitals', *Am J Infect Control*, 35:196–199.
6. Bull AL, Bennett N, Pitcher HC, Russo PL & Richards MJ 2007, 'Influenza vaccine coverage among health care workers in Victorian public hospitals', *MJA*, 186(4):185–186.
7. Bull AL, Russo PL, Bennett NJ, Boardman CJ, Burrell SJ, Motley JE, Friedman ND & Richards MJ 2006, 'Compliance with surgical antibiotic prophylaxis – reporting from a statewide surveillance program', *J Hosp Inf*, 63(2):140–47.
8. Friedman ND, Bull AL, Russo PL, Boardman CJ, Bennett NJ, Burrell SJ, Motley JE, Gurrin L & Richards MJ, 'Performance of the NNIS Risk Index in predicting surgical site infections in an Australian setting' (accepted *Inf Control Hosp Epi* 2006).
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10. Friedman ND, Bull AL, Russo PL, Leder K, Reid C, Billah B, Marasco S, McBryde E & Richards MJ 2007, 'An alternative scoring system to predict risk for surgical site infection complicating coronary artery bypass graft surgery', *Infect Control Hosp Epidemiol*, 28:1162–68.
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12. Russo PL, Bull AL, Bennett NJ, Boardman CJ, Burrell SJ, Motley JE, Friedman ND & Richards MJ 2005, 'Infections after coronary artery bypass graft surgery in Victorian hospitals – VICNISS hospital-acquired infection surveillance', *Aust N Z J Public Health*, 20:244–48.

13. Russo PL, Bull AL, Bennett NJ, Boardman CJ, Burrell SJ, Motley JE, Friedman ND & Richards MJ, 'The establishment of a statewide surveillance program for hospital-acquired infections in large Victorian public hospitals' (accepted *AJIC* April 2006).

14. Russo PL, Friedman ND, Bull AL, Marasco S, Kelly H, Boardman CJ, & Richards MJ 2007, 'Interhospital comparisons of coronary artery bypass graft surgical site infection rates differ if donor sites are excluded', *Infect Control Hosp Epidemiol*,28:1210–12.

Abstracts and presentations

1. Bennett N, Berry K, Boardman C, Bull A, Burrell S, Friedman N, Motley J, Richards M & Russo P 2005, 'A statewide smaller hospital nosocomial infection surveillance program: the first report, Victoria, Australia', Communicable Diseases Control Conference, May, Sydney.

2. Bennett N, Berry K, Boardman C, Bull A, Burrell S, Friedman N, Motley J, Richards M & Russo P 2005, 'A statewide smaller hospital nosocomial infection surveillance program: the first report, Victoria, Australia', Improving Patient Safety: Preventing Associated Infections (Change Champions), August, Brisbane.

3. Bennett N, Berry K, Boardman C, Bull A, Burrell S, Friedman N, Motley J, Richards M & Russo P 2005, 'A statewide smaller hospital nosocomial infection surveillance program: the first report, Victoria, Australia', New Zealand Infection Control Conference, August, Auckland.

4. Bennett N, Berry K, Boardman C, Bull A, Burrell S, Friedman N, Motley J, Richards M & Russo P 2005, 'A statewide smaller hospital nosocomial infection surveillance program: the first report, Victoria, Australia', Society for Healthcare Epidemiology of America 15th Annual Scientific Meeting, 9–12 April, Los Angeles.

5. Bennett N, Berry K, Boardman C, Bull A, Burrell S, Friedman N, Motley J, Richards M & Russo P 2004, 'Piloting a statewide smaller hospital nosocomial infection surveillance program', NSW Infection Control Conference, 15 September, Sydney.

6. Bennett N, Berry K, Boardman C, Bull A, Burrell S, Friedman N, Motley J, Richards M & Russo P 2005, 'Piloting a statewide smaller hospital nosocomial infection surveillance program', Third Australasian Conference on Safety and Quality in Health Care, July, Adelaide.

7. Bennett N, Berry K, Boardman C, Bull A, Burrell S, Friedman N, Motley J, Richards M & Russo P, 'Surveillance for smaller hospitals: what are the alternatives?', Victorian Infection Control Professionals Biennial Conference, November 2005, Melbourne.

8. Bennett N, Berry K, Boardman C, Bull A, Burrell S, Friedman N, Motley J, Richards M & Russo P 2005, 'The potential for surgical site infection rate surveillance in smaller acute public hospitals, Victoria, Australia', Society for Healthcare Epidemiology of America 15th Annual Scientific Meeting, 9–12 April, Los Angeles.

9. Bennett N, Berry K, Boardman C, Bull A, Burrell S, Friedman N, Richards M & Russo P 2006, 'Educating smaller rural hospital infection control nurses, Victoria, Australia', APIC Annual Educational Conference and International Meeting, June, Tampa.

10. Bennett N, Berry K, Boardman C, Bull A, Burrell S, Friedman N, Richards M & Russo P 2006, ‘Piloting a novel statewide smaller hospital nosocomial infection surveillance program’, APIC Annual Educational Conference and International Meeting, June, Tampa.
11. Bennett N, Berry K, Boardman C, Bull A, Burrell S, Friedman N, Richards M & Russo P 2006, ‘Surgical antibiotic prophylaxis in smaller hospitals’, APIC Annual Educational Conference and International Meeting, June, Tampa.
12. Bennett N, Berry K, Boardman C, Bull A, Burrell S, Friedman N, Richards M & Russo P 2006, ‘Surgical antibiotic prophylaxis in smaller hospitals’, Society for Healthcare Epidemiology of America 16th Annual Scientific Meeting, March, Los Angeles.
13. Bennett N, Boardman C, Bull A, Burrell S, Friedman N, Richards M & Russo P 2007, ‘A statewide smaller hospital nosocomial infection surveillance program: an update report, Victoria, Australia’, Society of Healthcare Epidemiology Conference, April, Baltimore.
14. Bennett N, Bull A, Motley J, Richards M & Russo P 2007, ‘A user evaluation of a statewide smaller hospital nosocomial infection surveillance program’, Society of Healthcare Epidemiology Conference, April, Baltimore.
15. Bennett NJ 2005, ‘Surveillance for smaller hospitals – what are the alternatives?’, Victorian Infection Control Professionals Association Conference, November, Melbourne.
16. Bennett NJ, Berry KS, Boardman CJ, Bull AL, Burrell SJ, Friedman ND, Motley JE, Richards MJ & Russo PL 2004, ‘The potential for surgical site infection rate surveillance in smaller Victorian public acute care hospitals’, Australian Infection Control Association Third Biennial Conference, June, Hobart.
17. Boardman C 2005, ‘The VICNISS costing study of infections associated with selected orthopaedic procedures’, Australian Resource Centre for Healthcare Innovations Seminar, July, Brisbane.
18. Boardman C 2005, The VICNISS costing study of infections associated with selected orthopaedic procedures’, Victorian Infection Control Professionals Association Conference, November, Melbourne.
19. Bull A, Russo PL, Bennett NJ, Boardman C, Burrell SJ, Motley JE, Friedman ND & Richards M 2005, ‘Surgical antibiotic prophylaxis in Victorian public hospitals: early results from VICNISS, a statewide surveillance program’, Society for Healthcare Epidemiology of America 15th Annual Scientific Meeting, 9–12 April, Los Angeles.
20. Friedman ND, Bull AL, Russo PL, Boardman CJ, Bennett NJ, Burrell SJ, Motley JE, Gurrin L & Richards MJ 2005, ‘Performance of the NNIS Risk Index in predicting surgical site infections in an Australian setting’, Association for Practitioners in Infection Control and Epidemiology 32nd Educational Conference and International Meeting, 19–23 June, Baltimore, Maryland.
21. Friedman ND, Bull AL, Russo PL, Boardman CJ, Bennett NJ, Burrell SJ, Motley JE, Gurrin L & Richards MJ 2005, ‘Performance of the NNIS Risk Index in predicting surgical site infections in an Australian setting’, Society for Healthcare Epidemiology of America 15th Annual Scientific Meeting, 9–12 April, Los Angeles.

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26. Richards MJ, Russo PL, Bull AL, Bennett NJ, Boardman CJ, Burrell SJ, Motley JE & Friedman ND 2004, 'A statewide surveillance program for hospital-acquired infections in large Victorian public hospitals-early days and early data health outcomes 2004', Perspectives in Population Health, 10th National Conference, 15–16 September, Canberra.

27. Richards MJ, Russo PL, Bull AL, Bennett NJ, Boardman CJ, Burrell SJ, Motley JE & Friedman ND 2004, 'Early data from the VICNISS surveillance program for hospital-acquired infection in Victoria, Australasian Society for Infectious Diseases Annual Scientific Meeting, May, Alice Springs.

28. Richards MJ, Russo PL, Bull AL, Bennett NJ, Boardman CJ, Burrell SJ, Motley JE & Friedman ND 2004, 'Establishment of a statewide surveillance program for hospital-acquired infections in large adult acute care Victorian public hospitals', Second Australasian Conference on Safety and Quality in Health Care, 9–10 August, Canberra.

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32. Russo PL, Bull A, Bennett NJ, Boardman C, Burrell SJ, Motley JE, Friedman ND & Richards M 2005, 'The establishment of a statewide surveillance program for hospital-acquired infections in large acute public hospitals, Victoria, Australia', Society for Healthcare Epidemiology of America 15th Annual Scientific Meeting, 9–12 April, Los Angeles.

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35. Russo PL, Bull AL, Boardman C, Friedman ND & Richards MJ 2006, 'Central line-associated bloodstream infection rates in intensive care units in Victorian public hospitals. A report from the VICNISS Coordinating Centre, Victoria, Australia', APIC Annual Educational Conference and International Meeting, June, Tampa.

36. Russo PL, Gurrin L, Friedman ND, Bull A, Marasco S, Kelly H, Boardman C & Richards M 2007, 'The effect on hospital rankings when using different numerators to calculate surgical site infection rates following coronary artery bypass graft surgery', Society of Healthcare Epidemiology Conference, April, Baltimore.

Glossary

Area	Definition
Aggregate data	Data in the VICNISS Coordinating Centre's database that are forwarded from hospitals
Antibiotic prophylaxis	Prophylaxis is the use of antibiotics to prevent infections at the surgical site
ASA score	American Society of Anesthesiology (ASA) score. This index is designed to preoperatively assess the patient's overall physical status. The score ranges from 1 for a healthy patient to 5 for a patient who is not expected to survive 24 hours post-surgery
Birthweight	The first weight of the newborn
Bloodstream infection (BSI)	Presence of live pathogens in the blood, causing an infection. See also pathogen
Case	A patient identified as having an infection
CDC	Centers for Disease Control and Prevention (United States)
Central line	A catheter (tube) that is passed through a vein to end up in the thoracic (chest) portion of the vena cava (the large vein returning blood to the heart) or in the right atrium of the heart. A central venous line is also called a central venous catheter. Sometimes, the 'venous' is omitted and it is called a central line or central catheter
Central line-associated bloodstream infection	A bloodstream infection thought to have been caused by the presence of a central line
Cholecystectomy	A surgical procedure to remove the gallbladder. This procedure can be performed through keyhole surgery. See *laparoscopy*
Coronary artery bypass graft surgery	A surgical procedure that creates new pathways around blocked or narrowed arteries to allow blood to reach the heart muscle again
Device days	The number of days for which an intravenous catheter or ventilator has been present in a patient
Epidemiology	The study of populations to determine the frequency and distribution of disease and measure risks
Extrinsic risk	A risk that is not inherent in the patient. Some forms of treatment are considered extrinsic risk factors, such as the use of invasive devices (such as catheters) or surgical procedures
Group A1 hospitals	Large tertiary teaching hospital
Hospital-acquired infection or nosocomial infection	Any infection that occurs during or after hospitalisation that was not present or incubating at the time of the patient's admission
Infection	Invasion by, and multiplication of, pathogenic micro-organisms in a bodily part or tissue that may produce tissue injury and progress to disease
Intensive care unit	A hospital unit that usually treats very sick patients. Patients in intensive care units are at a higher risk of developing infections because they are sicker than other patients

Area	Definition
Intravascular device	The device used to administer a solution into a vein, such as the familiar IV drip
Intravascular device related	Bloodstream infection linked with the presence of an intravascular device
Laparoscopy	Type of surgery in which a small incision (cut) is made in the abdominal wall through which an instrument (a laparoscope) is placed to permit structures within the abdomen and pelvis to be seen. A diversity of tubes can be pushed through the same incision in the skin. Probes or other instruments can be introduced through the same opening. In this way, a number of surgical procedures can be performed without the need for a large surgical incision. Often called keyhole surgery, the risk of infection in surgical procedures using a laparoscope is much less than for operations where a large incision is performed
Methicillin-resistant *Staphylococcus aureus* (MRSA)	A methicillin (antibiotic) resistant strain of *Staphylococcus aureus*
Neonatal	A baby within the first four weeks of birth
NNIS	National Nosocomial Infection Surveillance. The NNIS system at the Centers for Disease Control & Prevention (Atlanta, Georgia) has served as an aggregating institution for US hospitals for over 30 years
Nosocomial	The term nosocomial comes from two Greek words: 'nosus' meaning 'disease' + 'komeion' meaning 'to take care of'. Hence, *nosocomial* should apply to any disease contracted by a patient while under medical care. However, nosocomial has been whittled down over the years and now just refers to hospitals. It is now synonymous with hospital-acquired
Occupied bed days (OBD)	Number of days a patient is admitted to a hospital bed
Other hospitals	All hospitals not defined as Group A1. See *Group A1*
Outcome indicator	An indicator that measures an outcome (for example, infection rate)
Pathogen	An agent of disease; that is, a disease producer. The term pathogen is used most commonly to refer to infectious organisms. These include micro-organisms such as bacteria, viruses and fungi
Peripheral line	An intravenous (IV) catheter inserted into a vein, usually in the arm
Peripheral line-associated bloodstream infection	A bloodstream infection thought to have been caused by the presence of a peripheral line
Pneumonia	Inflammation of one or both lungs. Pneumonia is frequently, but not always, due to infection. The infection may be bacterial, viral, fungal or parasitic
Point prevalence	The number of events or persons with a given disease or other attribute during a specified point in time
Prevalence	The number of events (for example, instances of a given disease or other condition) in a given population at a designated time

Area	Definition
Procedure specific	Related to a specific procedure. Procedure-specific infection rates for total hip replacements, for example, are only those infection rates that relate to total hip replacements
Process indicator	An indicator that measures a process; for example, compliance with hand-washing guidelines.
Prophylactic antibiotic	An antibiotic given prior to a procedure to reduce the risk of infection
Prospective surveillance	Monitoring patients for infection while they are still in hospital. This surveillance can also include post-discharge surveillance where patients are monitored for a set period once they leave hospital. See also *retrospective surveillance*
Rate	A measure of the frequency of occurrence of an event phenomenon
Retrospective surveillance	Using chart review after the patient has been discharged from hospital as the sole means of identifying infections
Risk adjustment	A standardised method used to ensure intrinsic and extrinsic risk factors for a hospital-acquired infection are considered in the calculation of hospital-acquired infection rates
Risk index	A means of stratifying patients according to their risk of infection. This then allows appropriate comparison of infection rates. See also *risk adjustment*
Standardisation	A set of techniques used to remove, as far as possible, the effects of differences in age or other confounding variables when comparing two or more populations
Surgical site infection (SSI)	An infection at the site of an operation (usually an incision) that is caused by the operation
Surveillance	The ongoing systematic collection, analysis and interpretation of health data
Targeted surveillance	Surveillance for infection in a specific area (for example, an intensive care unit) or for a specific procedure (for example, total hip replacement). Targeted surveillance for areas of concern is more efficient than doing surveillance across a whole hospital for all infections
Total hip replacement	Surgery in which the diseased ball and socket of the hip joint are completely removed and replaced with an artificial joint
Total knee replacement	A surgical procedure in which damaged parts of the knee joint are replaced with an artificial joint
Transmission of infection	Any mechanism by which an infection is spread
Trend	The general direction in which something tends to move. Surveillance involves observing the trend of infection rates to help identify any increases
Type 1 surveillance	Surveillance activities designed for hospitals with >100 beds
Type 2 surveillance	Surveillance activities designed for hospitals with <100 beds
Validation	A program series of checks and challenges, repeated periodically, to establish the soundness and accuracy of the data

Area	Definition
Ventilator	A machine that mechanically assists patients to breathe (sometimes referred to as artificial respiration)
Ventilator-associated pneumonia	Pneumonia that is has been caused by the presence of the ventilator
VICNISS Advisory Committee	A committee that provides stakeholder advice to the VICNISS Coordinating Centre on the implementation, development and deliverables of the VICNISS program
VICNISS Coordinating Centre	A centre that collects and analyses data from individual hospitals and reports to participants and the Department of Human Services on aggregate, risk-adjusted, procedure-specific infection rates
VICNISS Technical Advisory Group	A group that provides the VICNISS Advisory Committee with recommendations about specific surveillance issues
VICNISS user groups	User groups that provide a forum for program participants to support and/or liaise with the VICNISS Coordinating Centre and other participants

Appendix A: Type 1 and 2 surveillance

Type 1 surveillance (>100 bed hospitals)

Type 1 surveillance is derived from the traditional NNIS surveillance activities. Three surveillance components have been introduced with the VICNISS program. These are based on modules introduced into the NNIS system in 1986. Each surveillance component is a self-contained protocol that focuses on a particular high-risk patient group. Substantial information is collected in these components on infected and uninfected patients, which allows hospitals and the VICNISS Coordinating Centre to calculate infection rates.

The surveillance modules are:

- surgical site (SSI) surveillance component. Hospitals are encouraged to undertake surveillance on two or more VICNISS surgical procedures. It is recommended that surgical procedures selected have a minimum of approximately 100 of each procedure per annum
- intensive care unit surveillance (ICU) component. Hospitals with ICUs are encouraged to undertake surveillance on:
  - central line-associated bloodstream infections (CLABSIs)
  - ventilator associated pneumonia (VAP)
- neonatal intensive care unit (NNL) component. Hospitals with NNL units are encouraged to undertake surveillance on:
  - central line-associated bloodstream infections
  - peripheral line-associated bloodstream infections.

Each hospital is able to choose which surveillance activity it undertakes by considering the priorities within the strategic plan of the infection control program at each hospital, the number of procedures and infection control resources. It is recommended that all surveillance activities are conducted prospectively.

Surgical antibiotic prophylaxis

Surgical antibiotic prophylaxis has been shown to be effective in reducing the incidence of surgical wound infections for many types of surgery. The measurement of compliance of surgical antibiotic prophylaxis against recommended guidelines is a common process measurement in many surveillance programs worldwide.

This report presents statewide data that assess compliance with current recommendations for antibiotic prophylaxis in Victorian public hospitals with greater than 100 beds. Reporting to individual hospitals on compliance with published recommendations for surgical antibiotic prophylaxis has recently commenced. It is hoped that regular reporting on antibiotic prophylaxis as part of the statewide surveillance program, and the ability for hospitals to be able to compare their performance with statewide data, will result in improvements in documentation and, most importantly, compliance with guidelines that promote the optimal use of antibiotics.

Adjusting for risk

Surgical patients

When comparing infection rates of hospitals, it is important to be sure the comparison is fair. Some patients are at greater risk of infection because they have other medical conditions, or because their surgery was complex and prolonged; therefore, the infection rate is likely to be higher in these patient groups. Comparing the infection rate for these very sick patients to the rate for patients who are fitter or who have had simpler operations would not be reasonable or useful. One patient, previously well, having an elective cholecystectomy (removal of the gallbladder) through keyhole surgery is at lower risk of postoperative infection than another patient with complex medical problems who is also having the gallbladder removed through a large incision in the abdomen in a prolonged procedure that is technically complex due to local problems with previous surgery. Extending this notion, individual hospital infection rates may be influenced by the mix of patients treated: a hospital with more sick patients would be expected to have higher infection rates.

VICNISS applies a risk stratification process that groups patients according to their likelihood of developing an infection. This is known as risk adjustment. Many factors are thought to increase the likelihood of infection, and investigators continue to search for new risk factors and explanations of why certain factors increase risk. In most cases, hospital-acquired infections are the result of many factors.

SSI reporting is grouped according to the type of operation and the NNIS Risk Index that United States Centers for Disease Control and Prevention researchers developed in 1991. The NNIS Risk Index has received international acceptance as the most useful risk index for stratifying SSI rates. Using this risk index, patients are categorised into one of four risk groups (ranging from 0 to 3) depending on three criteria: the length of surgery, the degree of bacterial contamination of the wound, and the patient's American Society of Anesthesiology score. The higher the risk index score, the higher the risk of infection. Thus, the infection rate in risk index group 3 is higher than the infection rate in risk index group 2. Similarly, the infection rate in risk index group 2 is higher than in risk index 1, and so on. No risk adjustment method is perfect, and the VICNISS Coordinating Centre is undertaking work to test how well the NNIS Risk Index works in the Australian setting.

Stratifying ICU data

VICNISS reporting of ICU infection rates recognises that the greatest risk factor for patients acquiring infections in ICUs is the use of 'invasive devices' such as mechanical ventilation and central venous catheters (CVCs). Rates are expressed as infections per days of mechanical ventilation or CVC day.

Not all ICUs are alike in their mix of patients. It would be expected that the major teaching hospital ICUs with sicker patients would have higher infection rates than other ICUs whose patient population have less complex conditions. Therefore, following recommendations of the VICNISS Advisory Committee, data from ICUs is categorised into two groups: Group A1 and Other. Even though the hospitals in Group A1 have more in common with each other than the ICUs in the 'other' group, we acknowledge that

differences may still exist in the patient populations of the ICUs in Group A1. There may also be some unanticipated differences between these two groups of ICUs: the fact that some smaller hospital ICUs have more sick medical patients and no surgical patients being ventilated for a short time after their operation influences the rates for VAP.

Type 2 surveillance (<100 bed hospitals)

Type 2 surveillance methods are the methods used for smaller (<100 acute bed) Victorian public hospitals.

Most hospital-acquired infection surveillance in large hospitals that perform high volumes of surgery and with ICUs is directed at producing risk-adjusted infection rates. These can be compared with aggregate rates compiled from statewide data. This type of surveillance is not appropriate for many smaller hospitals as the numbers of infections and patients at risk of infection are too small to calculate valid and reliable infection rates.

Appropriate surveillance programs for small hospitals are not well documented in the international literature. In many ways, Australia is in a unique situation with respect to the numbers of smaller rural hospitals serving the population.

The approach being used by VICNISS is that surveillance of surgical patients and calculation of infection rates are only recommended for hospitals with sufficient surgical throughput. Alternative methods are more appropriate for most smaller hospitals, such as ‘process’ surveillance and reporting of selected infections.

Process indicator surveillance

An alternative to infection (or outcome) surveillance is ‘process’ surveillance, which aims to monitor processes that have been demonstrated to affect outcomes rather than the outcomes (infections) themselves.

The most effective surveillance activities monitor processes that have been shown to be most closely associated with the outcome. For example, correct administration of prophylactic antibiotics to surgical patients has been shown to be effective in reducing the rate of SSIs. Therefore, for hospitals performing low volumes of surgery, it may be more appropriate to monitor the administration of prophylactic antibiotics (a frequent event) than to calculate an infection rate that is based on much lower numbers of events/infections.

Other processes that have been demonstrated to be closely related to infection outcomes include hand-washing, catheter insertion techniques, and staff vaccination programs for influenza and measles.

Type 2 surveillance modules

Module	Aim
Surgical antibiotic prophylaxis	To improve the selection, timing and duration of prophylactic antibiotics used to prevent infections at the surgical site
Healthcare workers and measles vaccination	To assess Victorian public hospitals' policy compliance with NHMRC and DHS recommendations for susceptible healthcare workers, specifically in regard to measles-mumps-rubella vaccination To determine current status of healthcare workers susceptible to measles
Healthcare workers and hepatitis B vaccination	To assess Victorian public hospitals' policy compliance with NHMRC recommendations To identify uptake of hepatitis B vaccine offered to at-risk healthcare workers
Peripheral venous catheter (PVC) use	To optimise the safety associated with the use of PVCs. Short-term PVCs are inserted in peripheral veins for vascular access. Although the incidence of local or bloodstream infections associated with PVCs is usually low, serious infectious complications may result in considerable annual morbidity
Multi-resistant organism (MRO)	To provide a method for individual hospitals to measure infections caused by MRSA or vancomycin-resistant enterococci (VRE)
Primary laboratory confirmed bloodstream infection (LC-BSI)	To provide a method for individual hospitals to measure LC-BSIs
Outpatient haemodialysis centre	To provide a method for individual outpatient haemodialysis centres to monitor bloodstream and vascular access infections and IV vancomycin use
Occupational exposure	To provide a method for individual hospitals to measure reported occupational exposures
Surgical site infection	To provide a method for hospitals to monitor targeted surgical procedures
Surgical infection report	To ensure certain significant but infrequent deep and organ space infections are counted. The following infections are to be recorded: • deep SSI • organ space SSI

Appendix B: VICNISS Advisory Committee

Introduction

The Victorian Hospital-Acquired Infection Surveillance System (VICNISS) and Coordinating Centre were launched in August 2002. Through cooperation between the VICNISS Coordinating Centre and participating hospitals, a state-based hospital-acquired infection (HAI) database will be established over the next three years. VICNISS and the database will be used to:

- promote a standardised approach to HAI surveillance methods
- provide aggregated risk-adjusted data on HAIs that will enable health services and hospitals to undertake inter-hospital and international comparisons
- promote the use of evidence-based information, validated methodology and analytical methods to permit timely recognition of HAI and promote prevention and early intervention
- improve the way surveillance results are used in feedback, prevention and cost containment for individual hospitals, and across metropolitan health services or statewide
- promote the integration of surveillance of HAI with routine data collection and continuous quality improvement systems, and strategic management planning for infection control
- promote consumer participation in the development of HAI performance measure reporting.

Purpose

The VICNISS Advisory Committee will provide stakeholder input and advice to the Coordinating Centre on the implementation and extension of VICNISS. The committee will advise the Coordinating Centre on the implementation, development and deliverables of VICNISS.

Members in 2006

Member	Representing
Professor Graham Brown	Victorian Infectious Diseases Service
Ms Donna Cameron	Victorian Infection Control Professionals Association
Mr Clinton Dunkley	Senior Program Advisor Infection Control, Quality and Safety Branch, Department of Human Services
Mr David Ford	Director of Clinical Support, Melbourne Health
Professor Lindsay Grayson	Australasian Society for Infectious Diseases
Ms Sheila Hargrave	Consumers
Ms Glenys Harrington	Victorian Infection Control Professionals Association
Dr Chris MacIsaac	Victorian Regional Committee, Joint Faculty of Intensive Care Medicine
Mr Matthew Mason	Victorian Infection Control Professionals Association
Ms Alison McMillan	Manager, Quality and Safety Branch, Department of Human Services
Mr Felix Pintado (Chair)	Australian College of Health Service Executives
Dr Mike Richards	Director, VICNISS Coordinating Centre
Mr Phil Russo	Operational Director, VICNISS Coordinating Centre
Professor Denis Spelman	VACIC Surveillance Subcommittee and Australasian Society for Infectious Diseases
Mr Bruce Waxman	Royal Australasian College of Surgeons

Appendix C: VICNISS Coordinating Centre staff

Dr Michael Richards MD, MB, BS, FRACP	Director
Phil Russo BN, M Clin Epid	Operational Director
Dr Ann Bull PhD, BSc (Hons)	Epidemiologist
Simon Burrell	Database Manager
Noleen Bennett RN, MPH	CNC Infection Control
Claire Boardman RN, MPH	CNC Infection Control
Dr Deb Friedman MB, BS, FRACP	Infectious Diseases Physician [to June 2006]
Dr Emma McBryde MB, BS, FRACP	Infectious Diseases Physician
Wendy Wang	.NET/SQL Programmer
Jane Motley, B App Sc (Nsg), Grad Dip (Health Ed), M Ed	Education Development Officer
Kylie Berry	Administrative Officer
Sharon McKenzie	Data Entry Clerk

Appendix D: Formulae

Surgical site infection (SSI)

$$\text{SSI rate} = \frac{\text{Number of SSIs*}}{\text{Number of procedures}} \times 100$$

Central line-associated bloodstream infection (CLABSI)

$$\text{CLABSI rate} = \frac{\text{Number of BSI* in patients with central line}}{\text{Number of central line days}} \times 1000$$

Ventilator-associated pneumonia (VAP)

$$\text{VAP rate} = \frac{\text{Number of pnuemonia* in patients with ventilator}}{\text{Number of ventilator days}} \times 1000$$

**As per VICNISS definition*

Confidence intervals

Whenever an infection rate is generated by VICNISS, it is always accompanied by '95 per cent confidence intervals'. The calculated rates reported here are generally estimates of the 'true' rate. The true rate could only be calculated from accurate data on every relevant surgical procedure in Victoria. Thus, infection rates are provided with 95 per cent confidence intervals, which provide a measure of the estimated rate's closeness to the true rate. The 95 per cent confidence intervals for the VICNISS rates are provided in the tables and displayed in the figures by a vertical line crossing through the top of the bar.

Example of a confidence interval

Confidence intervals provide a good idea of the true infection rate and are important to consider when interpreting these rates. They represent the lowest and highest values that the true rate is likely to be. An infection rate based on 10,000 surgical procedures that resulted in 1000 infections would be calculated to be 10 per cent, with upper and lower confidence intervals of 9.4 and 10.6 respectively. This means the true rate is highly likely to lie between 9.4 per cent and 10.6 per cent. The same infection rate of 10 per cent would also be calculated from a sample of 10 procedures with one infection, but the confidence interval would be 0.3–44.5 (meaning the true rate lies between 0.3 per cent and 44.5 per cent), which suggests the calculated rate of 10 per cent may be very different from the true rate. Generally, the larger the sample size, the better the estimate of the rate and thus the confidence intervals are narrower.

State Government Victoria

Department of Human Services