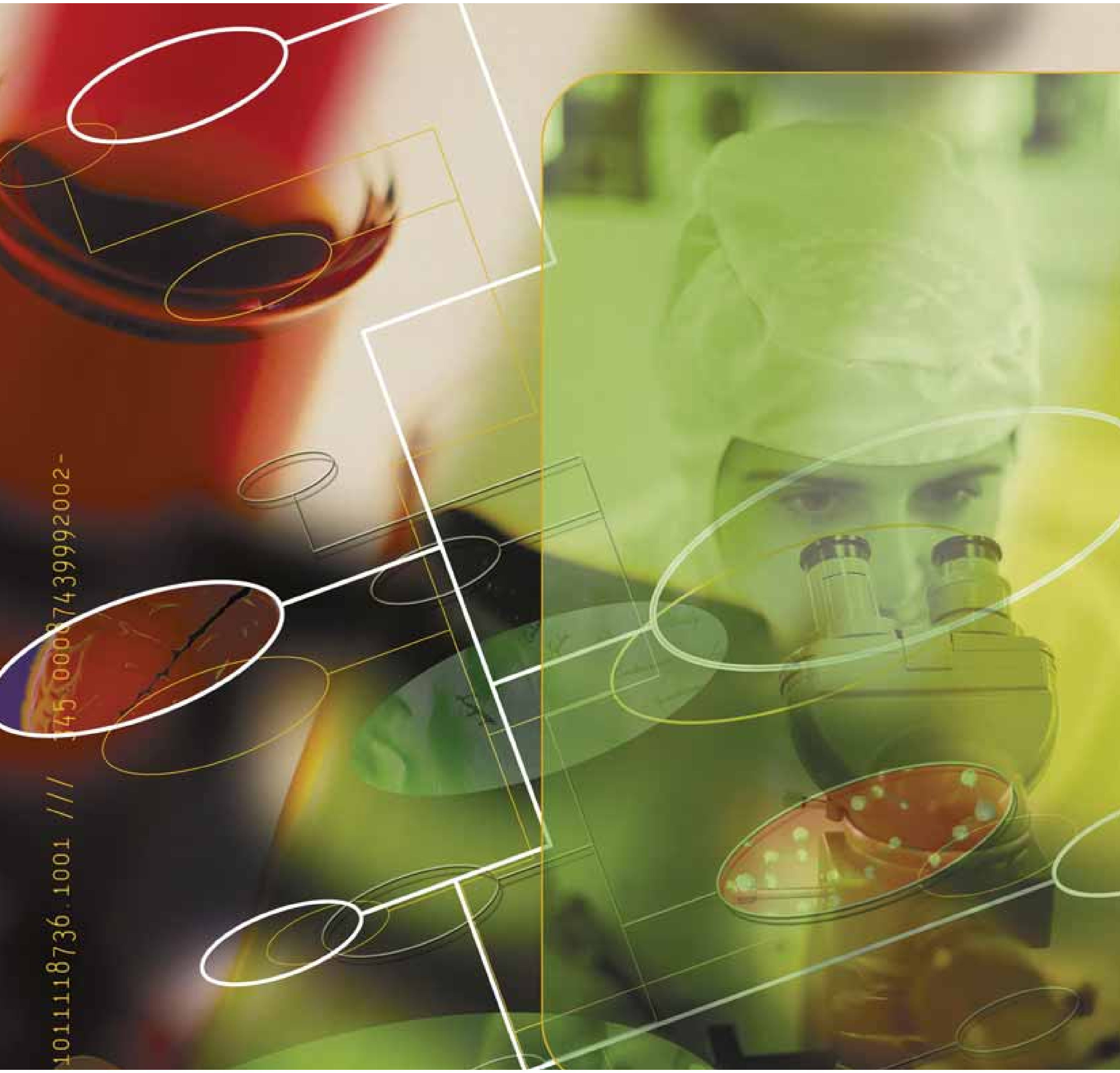
VICNISS
Hospital Acquired Infection Project

Year 6 report–August 2008



A Victorian Government initiative

Victoria
The Place To Be

VICNISS Hospital Acquired Infection Project
Year 6 report
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The year in review

Welcome to the 2008 Victorian Hospital-Acquired Infection Surveillance System (VICNISS) annual report.

This past year has been one of great activity and progress, including the development and successful piloting of the Safer Hospitals Integrated Information Network (SHIINe) software, expansion of surveillance modules, integration of VICNISS data into public hospital report cards, and some promising preliminary data from VICNISS surveillance activities showing infection rates decreasing in important areas.

The trends presented in this report are encouraging as there appears to be a reduction in surgical site infection rates for coronary bypass graft surgery, knee arthroplasty, colon surgery and Caesarean sections. The data will require further analysis before definitive findings can be made, which we will undertake during the next year. These results are particularly encouraging in that coronary artery bypass and joint replacements represent some of the surgeries for which infections have the most serious consequences.

The VICNISS Coordinating Centre, in collaboration with the Victorian Partnership for Advanced Computing (VPAC), has developed standardised software that integrates into hospital information systems. The SHIINe software has been piloted successfully at St Vincent's and Geelong hospitals. Over the next 12 months the software will be integrated into the remaining larger (type 1) hospitals. We expect that the software will facilitate more efficient surveillance data collection, improve data quality, and will enable hospitals to generate their own reports.

Data validation studies are critical to understanding the quality and accuracy of the data submitted to the VICNISS program. These studies help identify improvements in surveillance methods, and target educational activities. Over the past 12 months an evaluation has been conducted on the intensive care unit surveillance module.

The type 2 hospitals (less than 100 beds) surveillance program is now well established. This has allowed the VICNISS Coordinating Centre to carry out a review of the major elements, and refine surveillance activities. Data auditing and close communication with participating infection control staff has been central to refining the program.

VICNISS collects and reports on the pathogens for surgical site infections and ICU acquired infections. *Staphylococcus aureus* remains the most important pathogen in surgical site infections, however the spectrum of pathogens has changed for hip prosthesis surgery. There has been an increasing proportion of infections caused by aerobic gram-negative pathogens. This type of information is important in guiding choice of antibiotics for surgical antibiotic prophylaxis. For central line-associated bloodstream infections, the proportion of coagulase-negative staphylococcal infections reported from our larger teaching hospitals has increased, while Enterococcus remains a relatively infrequent problem, in contrast to overseas data reports.

The VICNISS Coordinating Centre has been invited into hospitals with higher than expected hospital infection rates to assist with identifying potential issues and making recommendations on areas of improvement. It has been proposed that this will become a central role for VICNISS over the next 24 months.

The Department of Human Services has commenced using hospital participation in VICNISS surveillance activities in hospital report cards as a quality-of-care measure. We anticipate these report cards will be further expanded to include infection outcomes over the next year.

Looking forward, a new initiative for the type 1 hospitals will be monitoring bloodstream infections and other complications in long-term haemodialysis and peritoneal dialysis patients. This surveillance module has already been well received and found useful in type 2 surveillance.

Over the next 12 months the Coordinating Centre will be approaching the private hospital sector to participate in the VICNISS program. This initiative has been accelerated by the expressed interest from the private hospitals themselves. We expect this will eventually enable a comprehensive data collection of surgical procedures in Victoria and allow comparisons between all hospitals, both public and private.

The Australian Commission for Safety and Quality in Healthcare recently released a national discussion paper called *Reducing harm to patients from health care associated infection: the role of surveillance, July 2008*. The report summarises the state of hospital-acquired infections in Australia and makes recommendations for reducing these through surveillance and prevention in both the public and private sectors. The current activities of the VICNISS program will form Victoria's foundation for any national activities that are developed.

The staff from the VICNISS Coordinating Centre have presented at many local, national and international meetings, and published VICNISS research in peer-reviewed journals. VICNISS have welcomed international visitors from Spain and Argentina to the centre.

Phil Russo, the Operational Director of the Coordinating Centre, has resigned to take up the national hand hygiene project management role with the Australian Commission on Safety and Quality in Healthcare. On behalf of the staff at VICNISS, I thank Phil for his outstanding role in developing the VICNISS program.

Once again I thank the committed staff at the VICNISS Coordinating Centre and the large number of enthusiastic infection control professionals in the public hospitals throughout Victoria who have contributed to another very successful year for the VICNISS program. I also thank the Department of Human Services for their continued support for this project.

Associate Professor Mike Richards
Director, VICNISS Coordinating Centre

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Acknowledgements

The Statewide Quality 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 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
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
NHSN	National Healthcare Safety Network (United States)
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
VCC	VICNISS Coordinating Centre
VICNISS	Victorian Hospital-Acquired Infection Surveillance System

Developments over the last 12 months

ICU validation

Similar to the validation of data on surgical site infections (SSIs) following coronary artery bypass graft (CABG) surgery that was completed in 2006, a validation study of data on central line-associated bloodstream infection (CLABSI) in intensive care units (ICUs) was undertaken during 2007. While the final results are yet to be analysed, initial data indicates that there is some variation between hospitals in applying surveillance methodology and definitions. These initial results have led us to consider revising the definition criteria for this activity and maintaining consistency with National Healthcare Safety Network (NHSN, formerly NNIS) methodology in the US. As from July 2008, the revised definitions will be used in VICINSS surveillance. This will likely result in more reliable data and allow VICINISS to continue to make comparisons with US data.

Software

The development of surveillance software Safer Hospitals Integrated Information Network (SHIINe) is now complete, and successfully piloted at St Vincent's Hospital and Geelong Hospital. 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 VICNISS Coordinating Centre (VCC) to generate reports and make comparisons with aggregate data.

The next stage is to roll out SHIINe to all type 1 hospitals. Work has commenced on this important software integration process, and is expected to be completed during 2009.

Hospital investigations/reviews?

As part of our efforts in attempting to lower hospital acquired infection (HAI) rates, VCC staff were invited by two hospitals to review the infection control practices following increases in HAI rates. As part of these reviews, the VCC reviewed all relevant data, and in some cases undertook case-control studies to identify factors possibly associated with the infections, visited the hospitals on several occasions, held discussions with key stakeholders including clinicians and administrative staff and toured relevant areas. A report outlining multiple recommendations was then provided to each hospital. Following this, the VCC continued to monitor data from these hospitals, undertook follow-up visits and made further recommendations where required.

As a result of the reviews, these hospitals have been able to improve on a number of infection control processes, thereby continuing to minimise the risk of HAI to patients.

Private hospital surveillance

While VICNISS surveillance was originally established to address HAI surveillance in public hospitals, private hospitals have frequently expressed an interest in VICNISS surveillance activities.

It is important to recognise that HAI surveillance is equally important in private hospitals as in public hospitals. Therefore, following discussions and funding from the department, over the next few years VICNISS will be inviting private hospitals to participate in the program. Staff from the VCC will be available to provide support and educational resources. SHIINe will also be available to private hospitals. While reporting of private hospital data will be determined by each hospital, the VCC will have the ability to compare public hospital HAI rates to private hospital HAI rates.

This is an exciting and important venture for Victoria, and VICNISS look forward to working with the private hospital sector on this initiative.

Introduction of journal club and user groups

Since VICNISS commenced, a feature of the education program has been regular VICNISS User Group (VUG) sessions. The VUG provides a forum for exchanging views and experiences among VICNISS surveillance project participants and the VCC. Interesting or challenging case scenarios are frequently presented and discussed. To increase attendance, VICNISS introduced the option of attending these sessions via teleconference. This has proved to be very popular, particularly for those staff working outside metropolitan areas, or those who are unable to leave their workplace.

In another initiative, a collaborative effort between the VCC and the Victorian Infection Control Professionals Association, the bimonthly Journal Club has commenced. The Journal Club aims to provide a forum for infection control professionals to more widely engage with literature and published data in the field. While also dealing with issues outside surveillance, VICNISS has demonstrated its strong support for infection control staff in all their efforts to reduce HAI.

Type 2 surveillance program achievements

The type 2 surveillance program has been shown to be useful for several reasons.

First, as a result of the program, statewide baseline surveillance results have now been established. Results for the process indicator modules have highlighted ‘areas for improvement’, most notably choice and timing of surgical prophylactic antibiotics and healthcare worker compliance with immunisation recommendations for measles and hepatitis B. Results for the outcome indicator modules have highlighted results such as methicillin-resistant *Staphylococcus aureus* infections, laboratory-confirmed bloodstream infections, occupational exposures and SSIs, although sometimes serious, affect relatively few patients or hospital employees in the type 2 hospitals.

Second, the program has been shown to be effective in improving compliance with best practice processes. For those hospitals that consistently participated in the surgical antibiotic prophylaxis module, the results highlighted improved compliance with processes related to the choice, timing and/or duration of prophylactic surgical antibiotics over time. These improvements were frequently statistically significant.

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 including:
   i) CLABSIs and causative organisms
b) surgical site infection rates – annual data including:
   i) coronary artery bypass grafts – deep and organ space infections
   ii) colon surgery
   iii) Caesarean section
   iv) hip arthroplasty – deep and organ space infections
   v) knee arthroplasty – deep and organ space infections
c) neonatal intensive care unit – cumulative data including:
   i) CLABSIs 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 group A1 hospitals

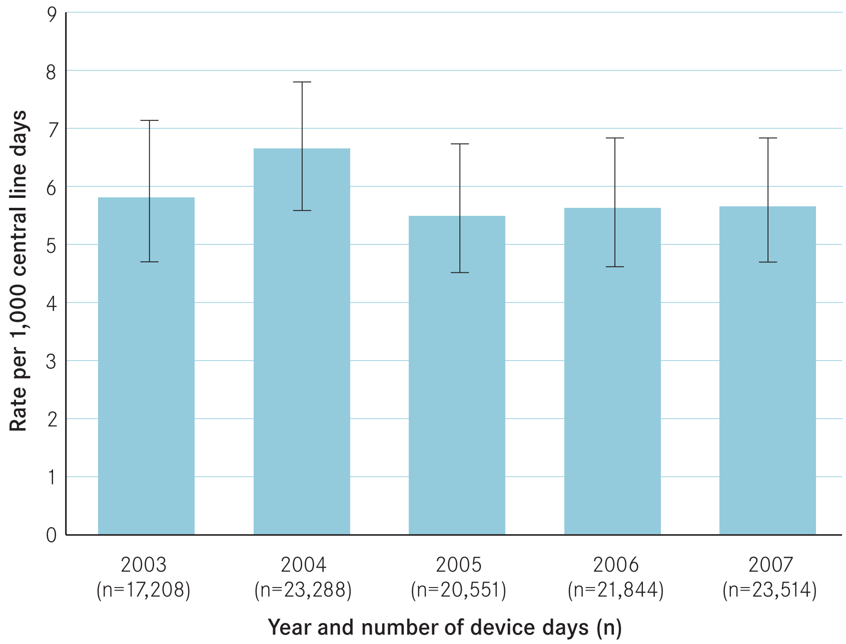


Figure 1 displays the annual CLABSI rate in the group A1 hospitals (the larger medical-school teaching hospitals) since the beginning of the VICNISS program. The aggregate rate has decreased from 6.6 per 1000 line days reported in 2004 to 5.6 per 1000 line days in 2007.

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

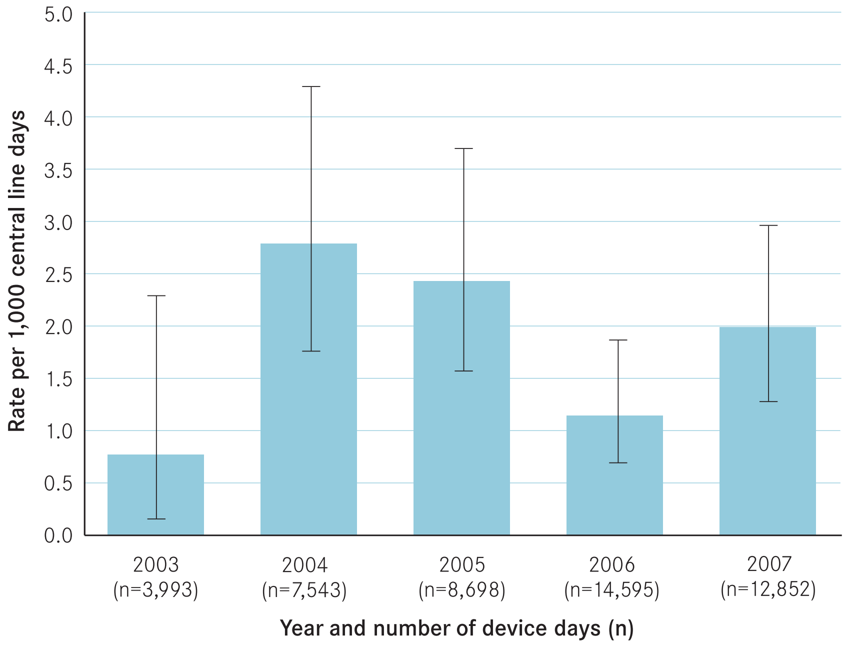


Figure 2 displays the annual CLABSI rate in the other hospitals since the beginning of the VICNISS program. Again there appears to be a downward trend since 2004. The rate has decreased from 2.8 per 1000 line days in 2004 to 2.0 per 1000 line days in 2007. Twelve hospitals submitted data for this procedure.

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

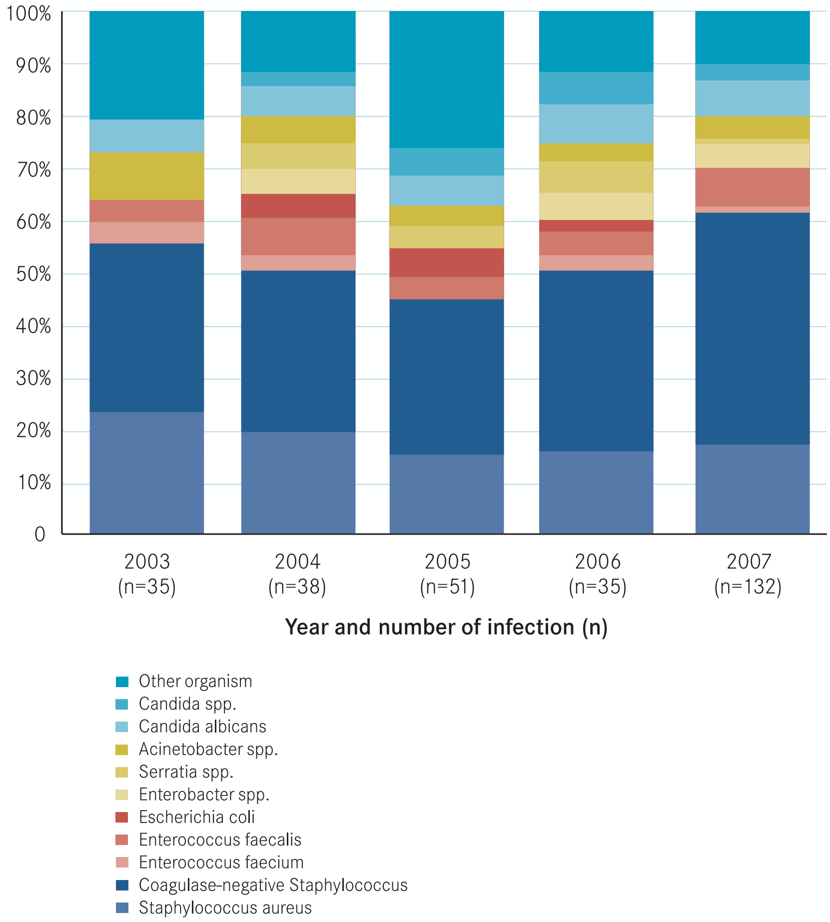


Figure 3 represents the annual frequency of causative organisms in A1 ICU CLABSIs. Please note 'n' represents the number of infections with organism data. Not all hospitals submit organism data, hence 'n' does not equal the total number of infections represented by the rates displayed in Figure 1. Infections caused by the most common organism, coagulase-negative Staphylococcus, have been increasingly reported on an annual basis, and possibly *Staphylococcus aureus* infection is decreasing. Enterococcus is still relatively infrequently reported in comparison with many developed countries, where vancomycin-resistant enterococci are a major problem in ICU bloodstream infections.

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

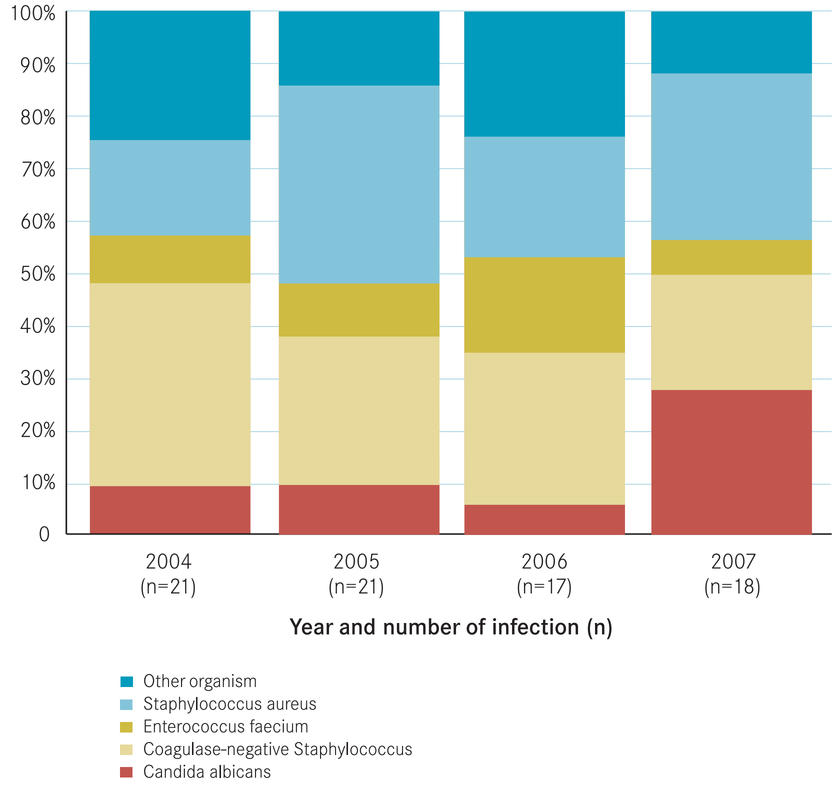
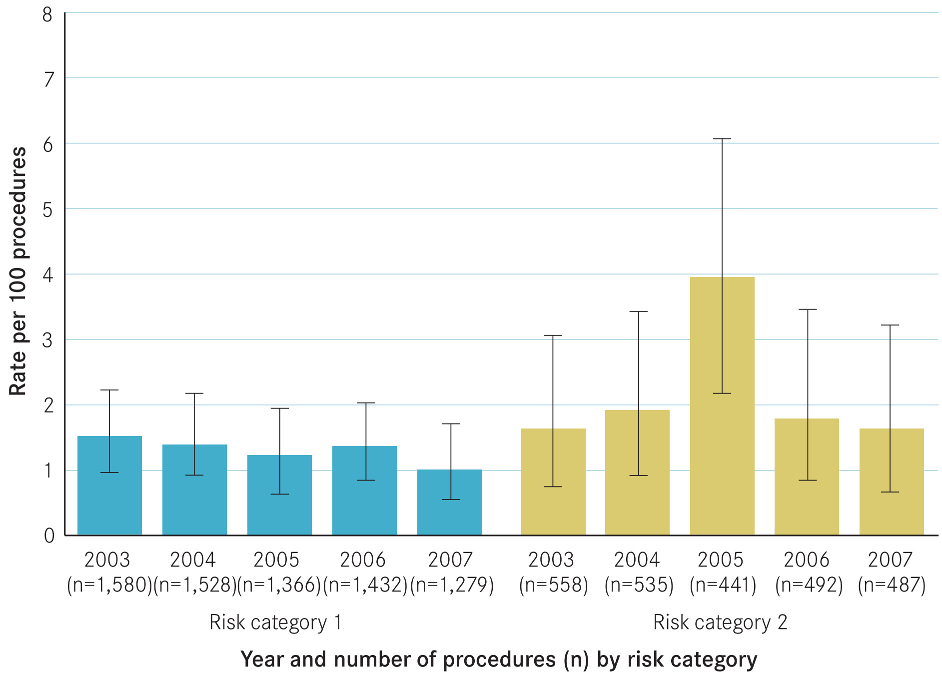


Figure 4 represents the annual frequency of causative organisms in 'other' hospital (large but less specialised hospitals) ICU CLABSIs. The number of infections for which we have pathogen data are small. There appears to be an increasing proportion of bloodstream infections caused by Candida in these ICUs.

Surgical site infection data

Figure 5: Annual coronary artery bypass grafts, deep and organ space surgical site infection rates by risk category



Figures 5 displays the annual coronary artery bypass graft deep and organ space SSI rates since 2003. Six hospitals submitted data for this procedure. Since 2003, the deep and organ space SSI rate in risk category 1, the category in which most patients fall, has decreased from 1.5 per 100 procedures to 1 per 100 procedures in 2007. In risk category 2, the rate also appears to be trending downwards since 2005.

Figure 6: Annual colon surgery surgical site infection rates by risk category

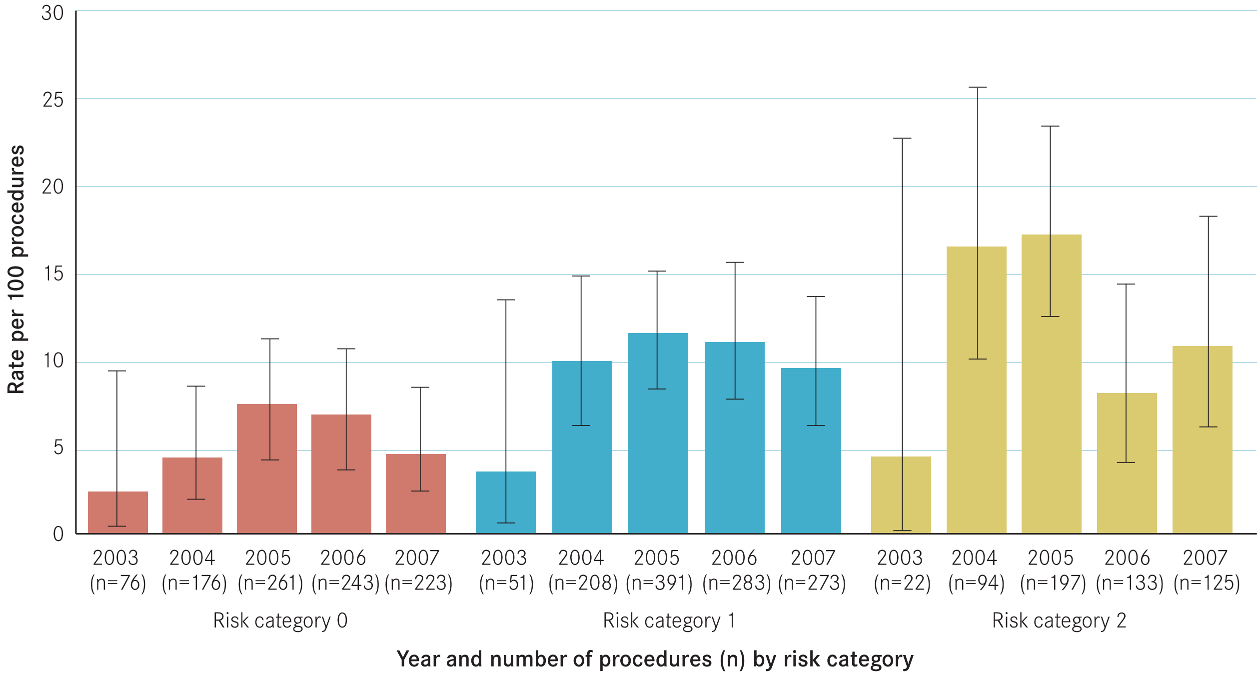


Figure 6 displays the colon surgery SSI rates since 2003. This procedure is classified as 'dirty' surgery, and it is expected, as observed, that higher rates of infection will be seen than for 'clean' procedures (such as knee arthroplasty). This data includes superficial SSIs. In risk categories 0 and 1, the two categories with the largest number of patients, the rates for 2007 have continued to decrease. Nine hospitals submitted data for this procedure.

Figure 7: Annual Caesarean section surgical site infection rates by risk category

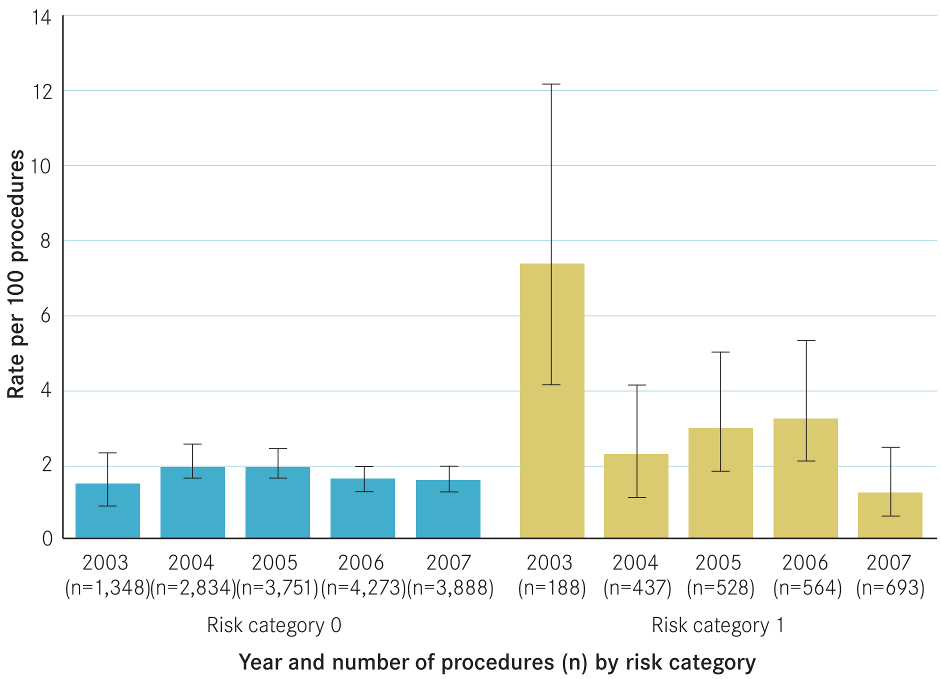


Figure 7 displays the Caesarean section surgery SSI rates since 2003. The rates for risk category 0, the largest category, are trending downwards. Since 2004 the rate has decreased from 2.0 per 100 procedures to 1.5 per 100 procedures in 2007. Following a high rate in 2003, rates for risk category 1 vary greatly from year to year. Procedure numbers in 2003 are small in category 1, so a small number of infections may change the appearance of the figure markedly .The hospitals contributing data have changed in different years, and those years of more substantial numbers should give a clearer picture of the infection rate. Twenty-three hospitals submitted data for this procedure.

Figure 8: Annual hip arthroplasty deep and organ space surgical site infection rates by risk category

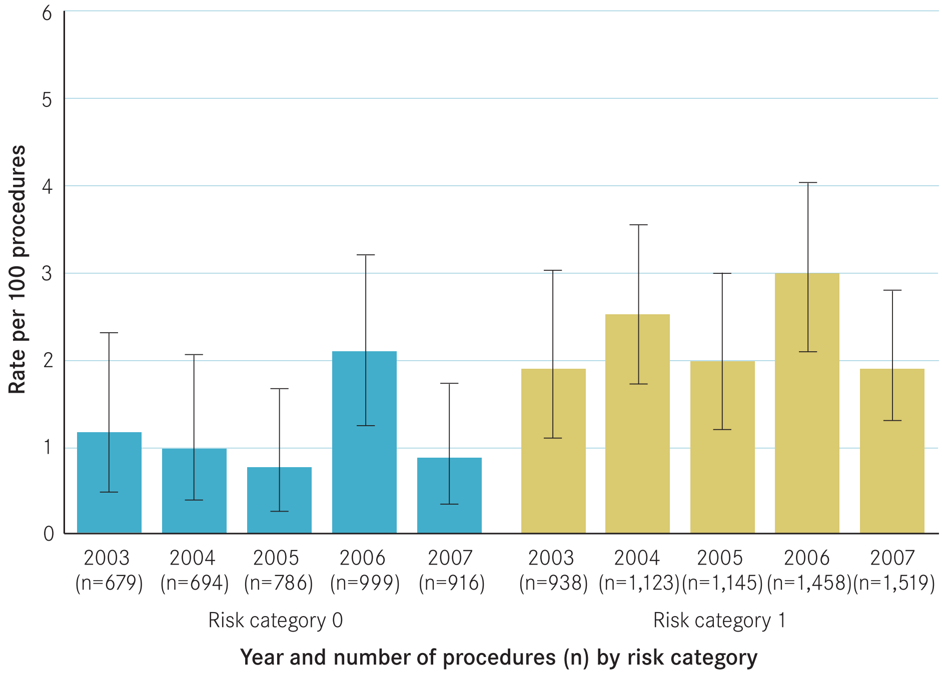


Figure 8 displays the hip arthroplasty surgery deep and organ space SSI rates since 2003. In both risk categories annual rates continue to fluctuate with no real trends apparent.

Figure 9: Annual knee arthroplasty deep and organ space surgical site infection rates by risk category

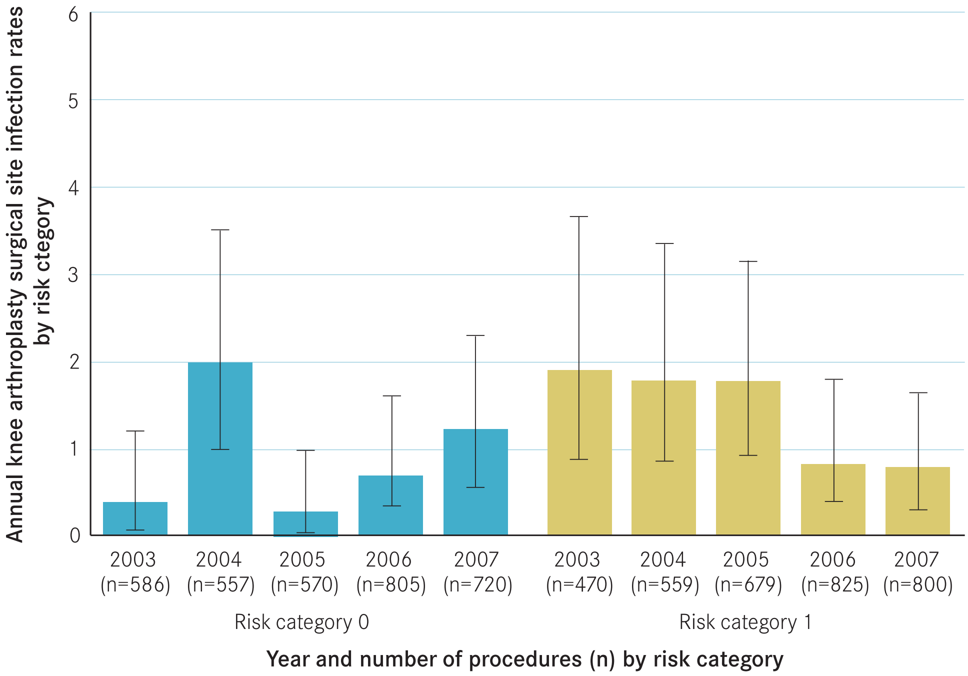


Figure 9 displays the knee arthroplasty surgery deep and organ space SSI rates since 2003. In risk category 1, the 2003 rate of 1.9 per 100 procedures has dropped to 0.8 per 100 procedures. Seventeen hospitals submitted data for this procedure.

Surgical site infection pathogens

Figure 10: Annual frequency of causative organisms following coronary artery bypass grafts

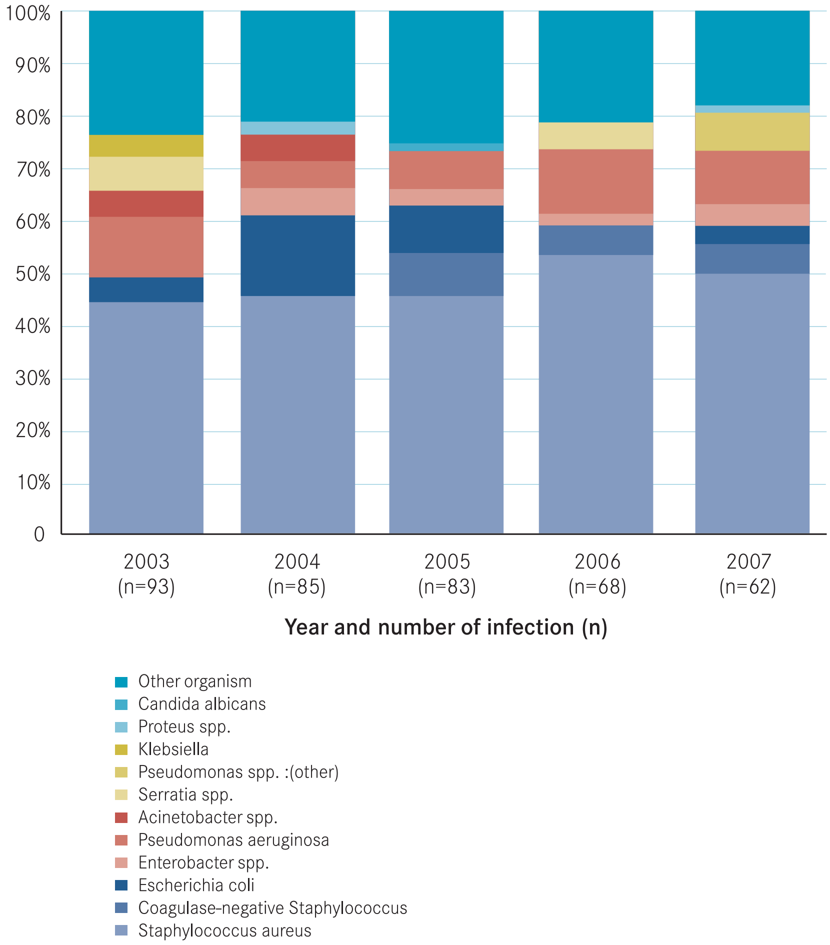


Figure 10 displays the frequency of causative organisms in SSIs following coronary artery bypass graft surgery. *Staphylococcus aureus* is the most commonly found pathogen in these SSIs over the four-year period. The mix of aerobic gram-negative pathogens has changed a little, with less Acinetobacter infections reflecting a general reduction of this pathogen in major Victorian public hospitals in recent years. Serratia, Enterobacter and Pseudomonas infections are gram-negative infections reported in the past two years, and awareness of this may help guide choice of surgical antibiotic prophylaxis.

Please note 'n' represents the number of infections with organism data, including superficial infections; hence 'n' does not equal the total number of infections represented by the rates displayed in Figure 5.

Figure 11: Annual frequency of causative organisms following knee arthroplasty

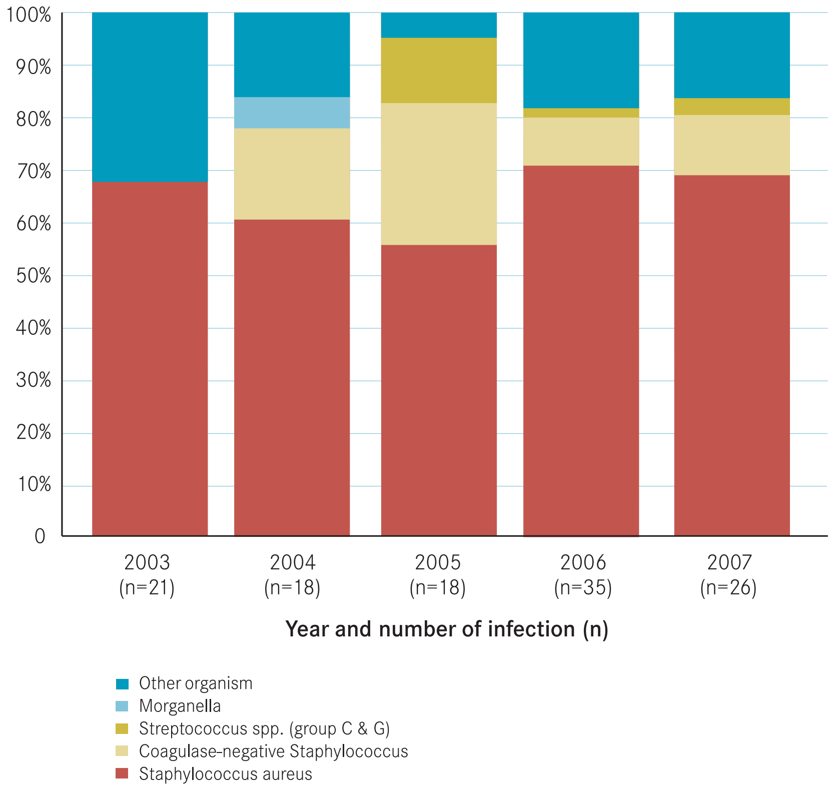


Figure 11 displays the frequency of causative organisms in SSIs following knee arthroplasty. Clearly, the most common organism is *Staphylococcus aureus*, and this has remained reasonably constant over the four years.

Please note ‘n’ represents the number of infections with organism data, including superficial infections; hence ‘n’ does not equal the total number of infections represented by the rates displayed in Figure 8.

Figure 12: Annual frequency of causative organisms following hip arthroplasty

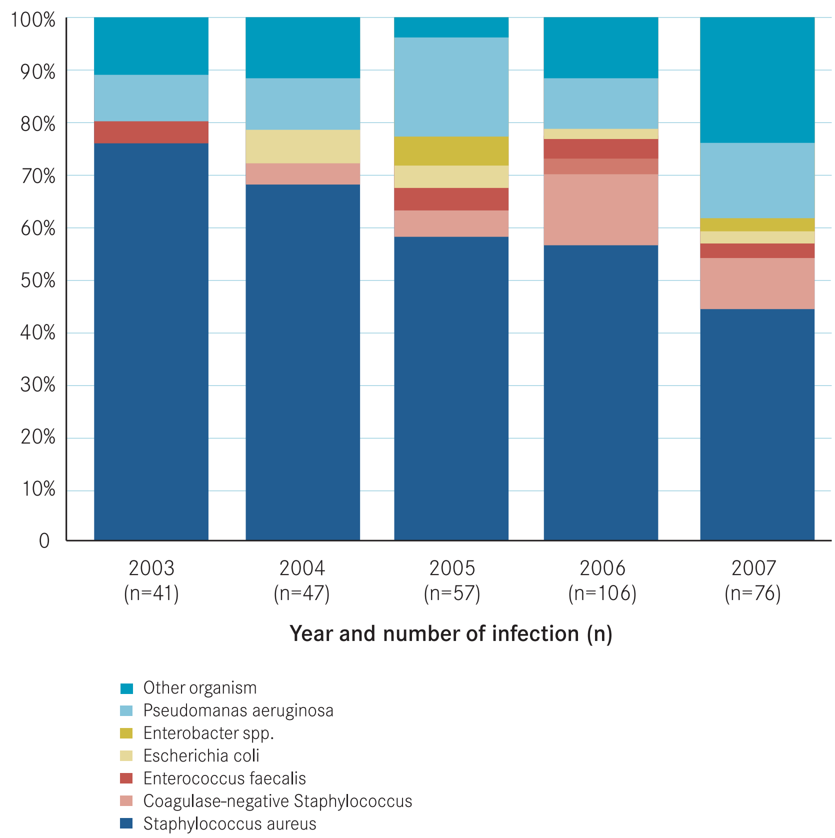


Figure 12 displays the frequency of causative organisms in SSIs following hip arthroplasty. The most dominant organism is *Staphylococcus aureus*, which has decreased in frequency over the five years. This may influence choice of surgical antibiotic prophylaxis, suggesting a need for gram-negative cover in antibiotic choice.

Please note 'n' represents the number of infections with organism data, including superficial infections; hence 'n' does not equal the total number of infections represented by the rates displayed in Figure 8.

Neonatal intensive care unit data

Figure 13: Neonatal intensive care unit central line-associated bloodstream infection rate – April 2004 to December 2007

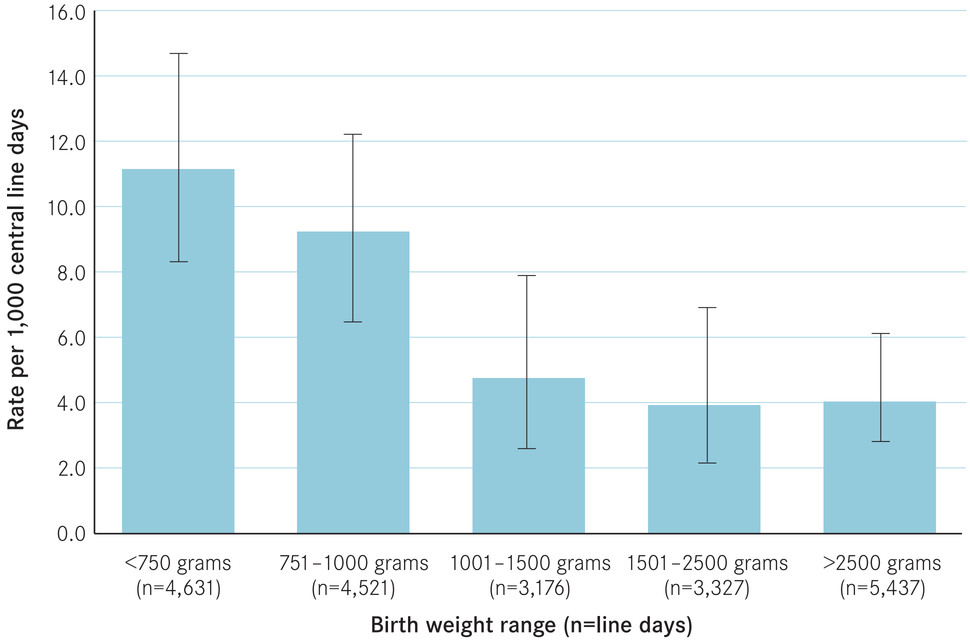


Figure 13 displays the CLABSIs in neonatal ICUs. Rates are stratified by birthweight as babies with lower birthweight are generally considered to be at a higher risk of developing infection. This mostly explains the trend seen in this figure, which represents data submitted from three hospitals.

Figure 14: Neonatal intensive care unit peripheral line-associated bloodstream infection rate – April 2004 to December 2007

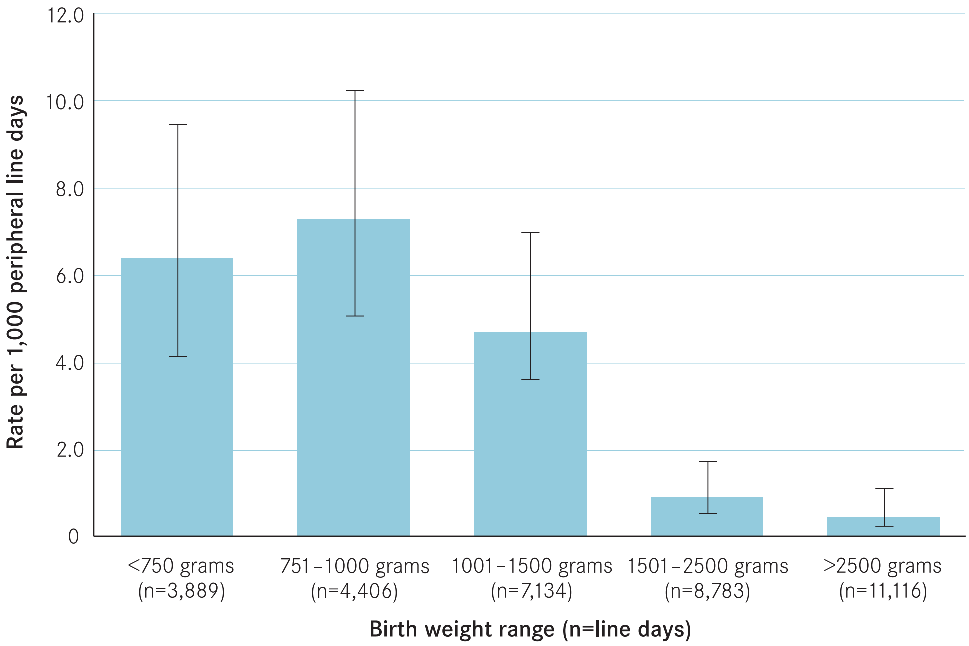


Figure 14 displays the peripheral line-associated BSI in neonatal ICUs. Rates are stratified by birthweight as babies with lower birthweight are generally considered to be at a higher risk of developing infection. This explains the trend seen in this figure. Three hospitals submitted data for this procedure.

Figure 15: Frequency of causative organisms in neonatal care unit central line-associated bloodstream infections

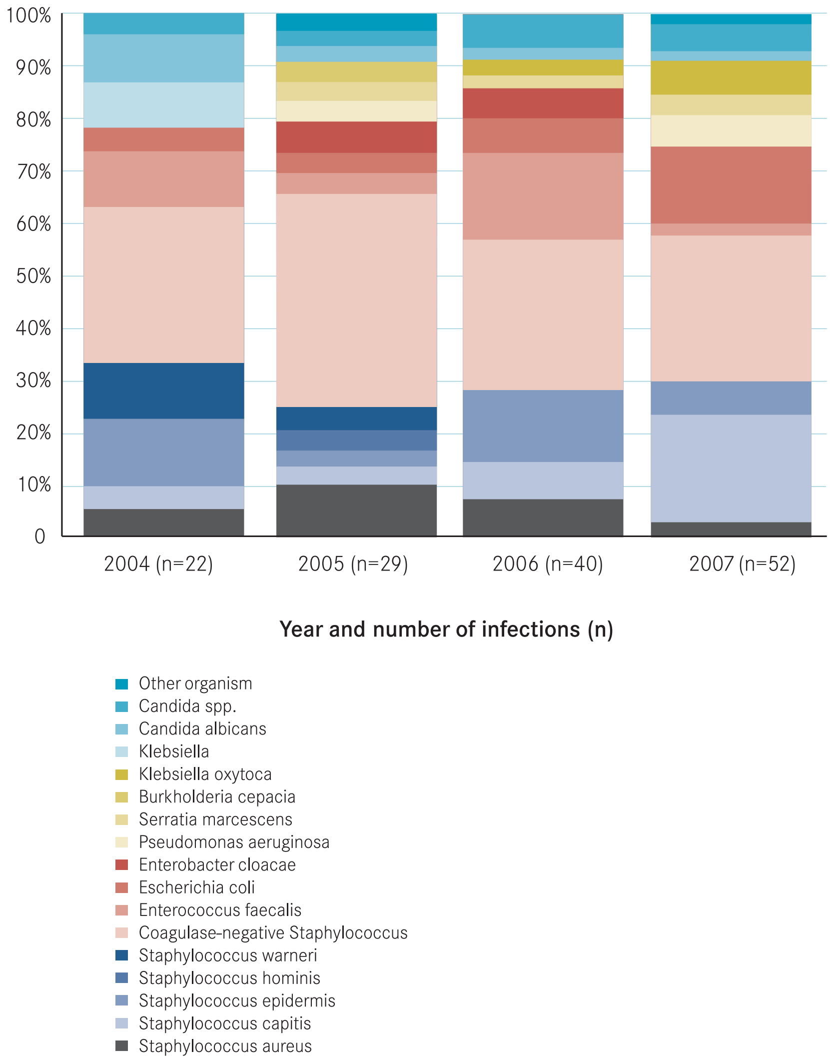


Figure 15 shows the annual frequency of causative organisms in neonatal CLABSIs all birthweights combined. As in adult ICUs, the most common pathogen is coagulase-negative Staphylococcus. Not all hospitals submit organism data, hence 'n' does not equal the total number of infections represented by the rates displayed in Figure 13.

Figure 16: Frequency of causative organisms in neonatal care unit peripheral line-associated bloodstream infections

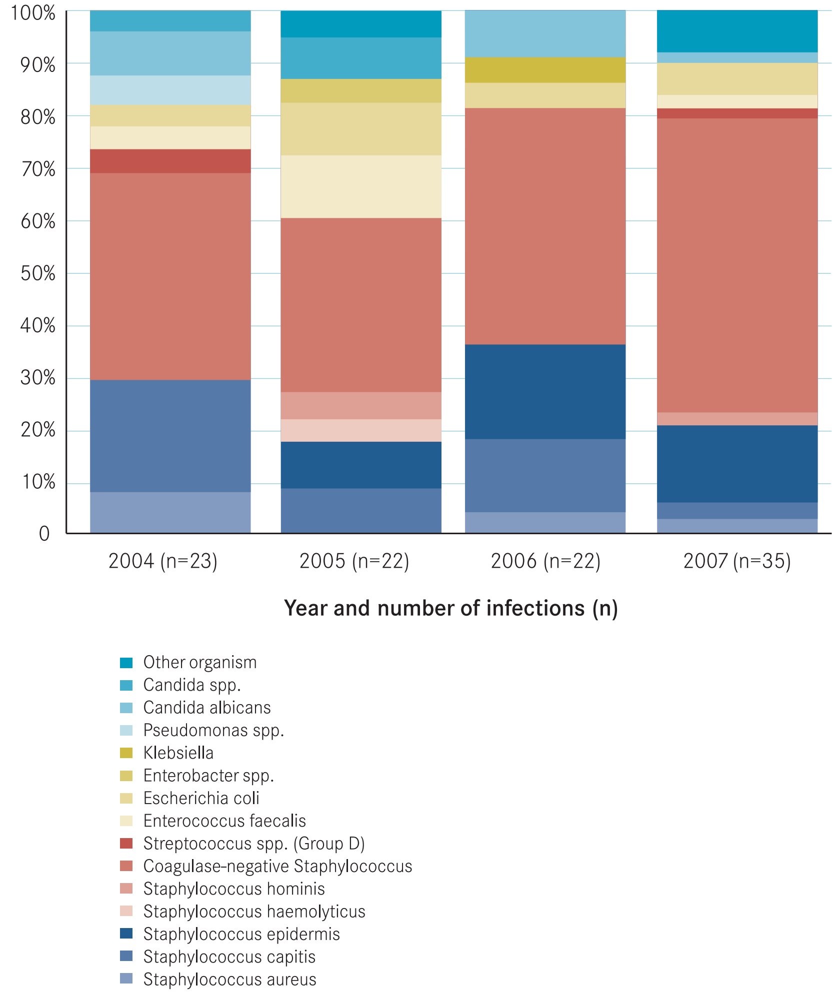


Figure 16 shows the annual frequency of causative organisms in neonatal peripheral line-associated bloodstream infections for all birthweights combined. Similar to the figures above, the most common pathogen is coagulase-negative Staphylococcus. Not all hospitals submit organism data, hence 'n' does not equal the total number of infections represented by the rates displayed in Figure 14.

Type 2 data

Healthcare workers and measles vaccination

The main aim of this process indicator surveillance module is to 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 2007

Objective (24 participating hospitals)	Frequency
Total staff (born >1966) with documented evidence immunity to measles or laboratory-confirmed measles	43.4%

Healthcare workers and hepatitis B vaccination

The main aim of this process indicator surveillance module is to 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 2007

Objective (46 participating hospitals)	Frequency
Total staff vaccinated with confirmatory blood tests	52.3%

Peripheral venous catheter use

The aim of this process indicator surveillance module is to help reduce the infection risk associated with using 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 (PVC) use from 1 January 2005 to 31 December 2007

Objective	Frequency
Number of aggregate PVCs	2,050
Removal or replacement within 96 hours	83.8%
Removal reason – phlebitis	8.0%
Removal reason – exit site infection	0.1%
Removal reason – primary bloodstream infection	0

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 (present on admission <48 hours) from 1 May 2004 to 31 December 2007

Category	No. of participating hospitals	No. of events	Acute occupied bed days	Rate	95% confidence interval
Aggregate	89	165	1,226,952	1.3	1.1–1.6
Small	54	36	278,713	1.3	0.9–1.8
Medium	24	53	474,943	1.1	0.8–1.5
Large	11	76	473,296	1.6	1.3–2.0

Table 5: MRSA infection (>48 hours) from 1 May 2004 to 31 December 2007

Category	No. of participating hospitals	No. of events	Acute occupied bed days	Rate	95% confidence interval
Aggregate	89	82	1,226,952	0.7	0.5–0.8
Small	54	13	278,713	0.5	0.2–0.8
Medium	24	20	474,943	0.4	0.3–0.7
Large	11	49	473,296	1.0	1.3–2.0

The data in these tables indicate a much lower detection of MRSA in patients after 48 hours of hospital admission when compared with 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 2007

Category	No. of participating hospitals	No. of events	Acute occupied bed days	Rate	95% confidence interval
Aggregate	89	51	1,303,515	0.4	0.3–0.5
Small	54	2	278,713	0.1	0.0–0.3
Medium	24	12	475,407	0.3	0.1–0.4
Large	11	37	549,395	0.7	0.5–0.9

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 validation activity and removal of BSI that did not meet the definitions, the number of events described in Table 6 is lower than those reported in the 2005 annual report.

Outpatient haemodialysis events

This report provides the rate of haemodialysis events (that is, positive blood culture or vancomycin start) for individual hospitals and the corresponding rate 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 31 December 2007

Category	No. of participating hospitals	No. of events	Patient months	Rate	95% confidence interval
Aggregate	20	28	4,455	0.63	0.4–0.9

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 2007

Category	No. of participating hospitals	No. of events	Acute occupied bed days	Rate	95% confidence interval
Statewide	90	406	1,115,850	3.6	3.3–4.0
Small	54	25	231,194	1.1	0.7–1.6
Medium	24	116	388,534	3.0	2.5–3.6
Large	12	265	496,122	5.3	4.7–6.0

Table 9: Non-parenteral occupational exposures data from 1 January 2005 to 31 December 2007

Category	No. of participating hospitals	No. of events	Acute occupied bed days	Rate	95% confidence interval
Statewide	90	128	1,115,850	1.1	1.0–1.4
Small	54	11	231,194	0.5	0.2–0.9
Medium	24	27	388,534	0.7	0.5–1.0
Large	12	90	496,122	1.8	1.5– 2.2

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 2007

Category	No. of events
Statewide	209
Small	12
Medium	85
Large	112

Influenza vaccination

As part of the department providing the annual influenza vaccine to hospital-based healthcare workers, 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).

In 2007, 84 (93 per cent) of hospitals were able to provide data on the specific staff category of recipients. Results from these 84 sites are shown in Table 11 below. Some improvements are evident in the proportions of staff vaccinated and significantly, these are in the medical and nursing categories where staff would have the greatest clinical contact.

Table 11: Influenza vaccines administered by minor staff category 2005 and 2007

Major staff category	Minor staff category	2005		2006		2007	
		Total staff	Proportion vaccinated (%)	Total staff	Proportion vaccinated (%)	Total staff	Proportion vaccinated (%)
Clinical	Medical	5,410	29.7	7,733	31.8	7,976	33.9
	Nursing	19,412	35.7	26,566	39.2	24,413	42.1
	Allied health	4,529	46.0	6,018	38.4	6,601	47.4
	Other	7,239	50.8	5,566	51.3	6,143	50.8
Non-clinical	Non-clinical	5,529	37.4	11,485	46.7	9,446	46.8
Laboratory	Laboratory	740	41.6	1,021	52.2	1,372	41.6

The NHMRC recommends that all healthcare workers involved in direct patient care should be vaccinated. Increases in the uptake rate of influenza vaccine were seen in all clinical categories between 2005 and 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. Measuring 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 13* (2005) and the guidelines from the National Surgical Infection Prevention Project.

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

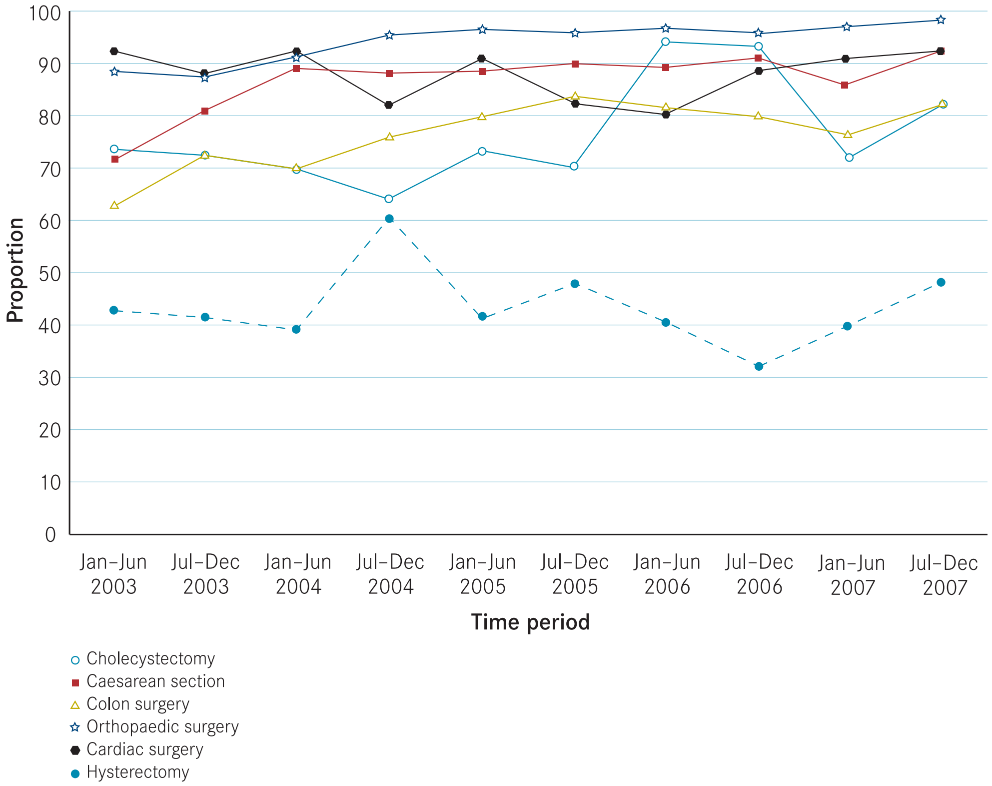
- VICNISS surveillance collects basic antibiotic information only, and does not include comprehensive patient-level clinical information that may influence the individual clinician's decisions on each of the above criteria. For example, no information is collected on allergies or comorbidities that may 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. In some hospitals documentation of antibiotic prophylaxis remains problematic, and in fact compliance may be better than shown here as undocumented procedures are included in the denominators.

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

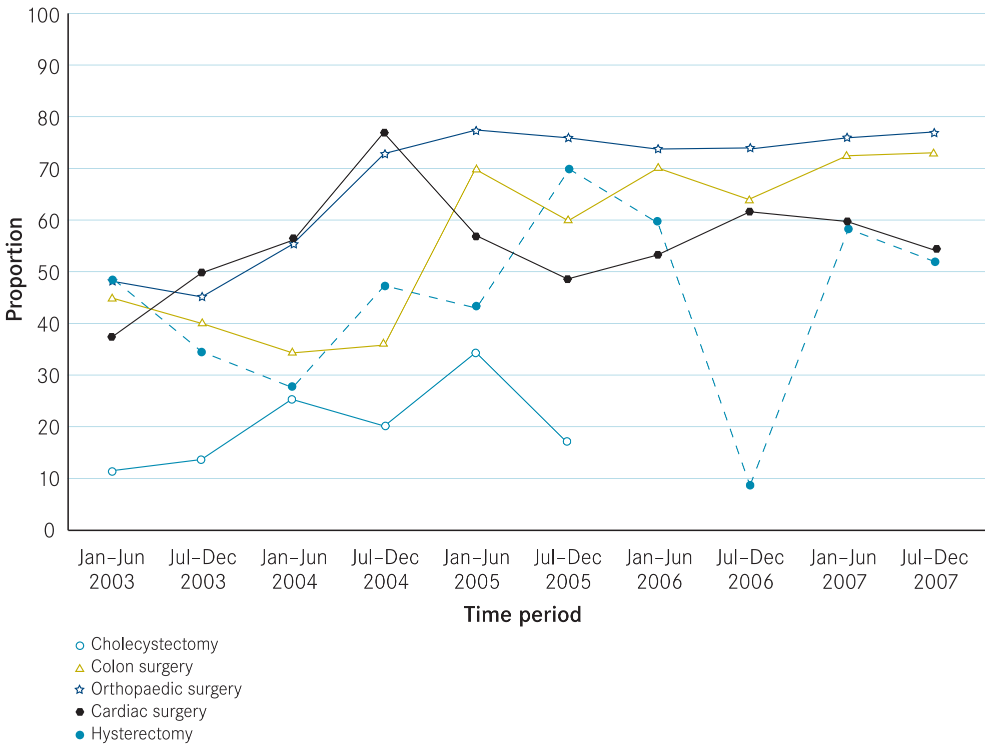
Figure 17: Surgical antibiotic prophylaxis compliance with guidelines: choice of antibiotics appropriate



Note: Total number of procedures: cholecystectomy (1,810), Caesarean section (19,472), colon surgery (3,046), orthopaedic surgery (18,304), cardiac surgery (7,188), hysterectomy (1,748).

Figure 18 shows the aggregate surgical antibiotic prophylaxis six-monthly compliance rates for 2003 to 2007. 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 overall improvement in compliance with guidelines for choice among all groups with some variation usually due to a hospital either beginning or suspending surveillance on the particular procedure group.

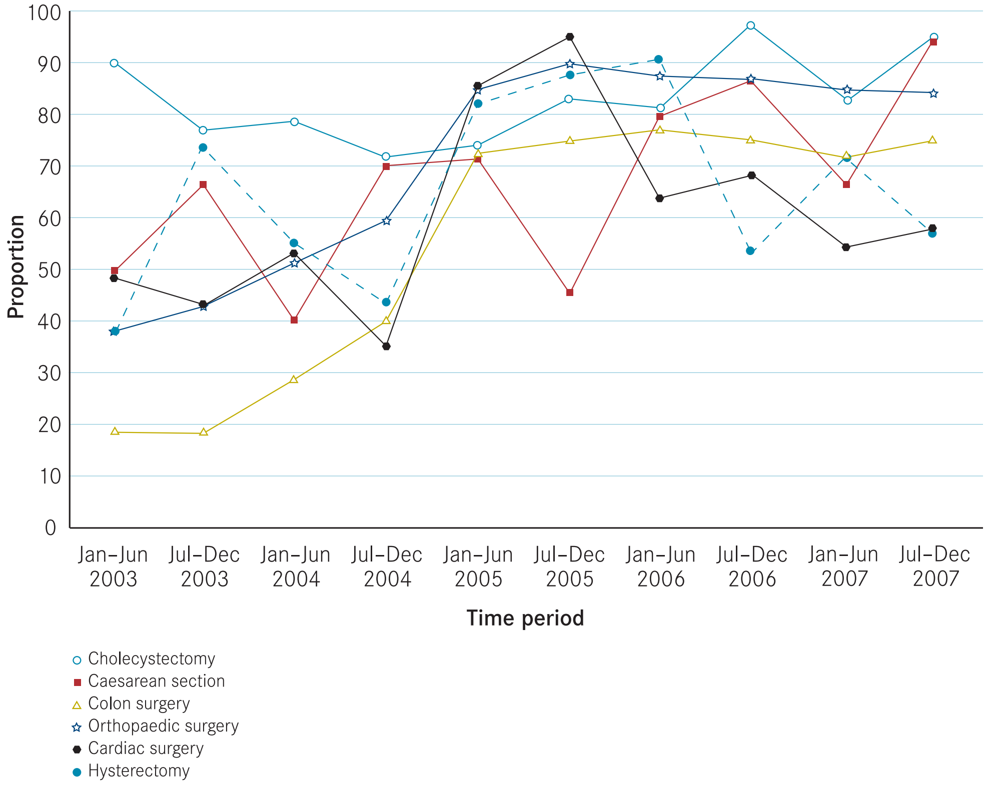
Figure 18: Surgical antibiotic prophylaxis compliance with guidelines: timing of antibiotics appropriate



Note: Total number of procedures: cholecystectomy (1,810), Caesarean section (19,472), colon surgery (3,046), orthopaedic surgery (18,304), cardiac surgery (7,188), hysterectomy (1,748).

Figure 19 shows the aggregate surgical antibiotic prophylaxis six-monthly compliance rates for 2003 to 2007. There has been an improvement in compliance with timing in all groups of surgery since 2003. The variability in compliance for hysterectomy is partially explained through the contributions of a poorly performing hospital that was not contributing continuously. In July-December 2006 this hospital was the only contributor for this time period.

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



Note: Total number of procedures: cholecystectomy (1,810), Caesarean section (19,472), colon surgery (3,046), orthopaedic surgery (18,304), cardiac surgery (7,188), hysterectomy (1,748).

Figure 20 shows the aggregate surgical antibiotic prophylaxis six-monthly compliance rates for 2003 to 2007. There has been an improvement in compliance with duration in most groups of surgery since 2003. Compliance rates for hysterectomy are variable and compliance for cardiac surgery appears to be decreasing after an initial increase. Two hospitals began data submission later (starting in 2005) so this may partially explain this result.

Type 2 Surgical antibiotic prophylaxis

Table 12: Surgical antibiotic prophylaxis data from 1 May 2004 to 31 December 2007

Objective 29 participating hospitals	**Concordant with guidelines**	**Adequate**	**Inadequate**	**Unknown**
Choice 3281 procedures	53.6%	14.7%	29.5%	2.1%
Timing 2692 procedures	52.5%	–	37.3%	10.2%

Duration: In 15.4 per cent of 3,629 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 per cent and 40.9 per cent, so there has been improvement demonstrated in this area.

How do hospitals assess their performance?

The public hospital participation rate in VICNISS has been constant at about 98 per cent. During 2007, the Department of Human Services informed hospitals that participation in VICNISS surveillance activities was now required. The level of participation is dependent on the size of the hospital and the surgical procedures undertaken. These requirements are set out in the VICNISS performance indicators, which are reviewed annually by the VCC, the department and endorsed by the VICNISS Advisory Committee (VAC). On occasion, some hospitals have been unable to participate for periods of time due to a temporary shift in priorities or demands on limited infection-control resources. When a hospital was unable to participate, the VCC was responsible for notifying the department and outlining the reasons for the lack of participation. The department reports the level of participation back to the chief executive officer and hospital board via its quarterly *Improving performance* reports.

The VCC continues to provide reports to the hospitals on a quarterly basis, however as SHIINe is introduced hospitals will not be reliant on VCC for these reports. 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 VCC contacts the infection control staff at the hospital. Once the rate has been confirmed, the VCC sends a letter to the chief executive officer informing them of the result and providing details of the high rate, and in a new initiative for 2007, the hospital is also required to outline an action plan to address the high infection rate. The VCC also notifies the department of hospitals with statistically significantly higher rates.

The VCC continues to feedback de-identified hospital-level infection rates so hospitals can compare their rate with other hospitals. Discussions continue to be held regarding the release of hospital-identifiable data in the future.

Limitations and challenges

Data collection continues to be done using paper forms. Issues concerning data quality, data management and reporting will be addressed with implementing a new software system into the type 1 hospitals.

As noted in previous years, 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.

Also, 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.

Data quality is a constant challenge. At the VCC, several data quality checks are undertaken every quarter. While unable to guarantee the validity of all data submitted, through the routine and ad hoc data quality checks, as well as the CABGS and ICU validation studies, we are able to identify areas where data quality can be improved.

What's next for VICNISS?

In our ongoing endeavours to ensure VICNISS data continues 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 continuing to develop web pages for type 2 surveillance modules
- inviting private hospitals to participate in VICNISS surveillance activities
- providing advice to the department 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 VICNISS Advisory Committee, and user groups of hospital infection control consultants
- consulting further with consumer groups and exploring the release of meaningful hospital infection information into the public arena
- contributing at a national level, particularly with the Australian Commission of Safety and Quality in Healthcare, in identifying a 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, and the Australian New Zealand Intensive Care Society to explore specific infection risk factors in ICU patients
- continuing research initiatives and presenting the results locally, nationally and internationally
- exploring collaborative activities with both interstate and 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 presentations originating from VICNISS.

Publications

1. Bennett NJ, Bull AL, Dunt DR, Gurrin LC, Russo PL, Spelman DW, Richards MJ 2007, MRSA Infections in Smaller Hospitals, Victoria, Australia. *Am J Infect Control*, 35:697-699.
2. Bennett NJ, Bull AL, Dunt DR, Gurrin LC, Russo PL, Spelman DW, Richards MJ 2007, Occupational Exposures to Blood-borne Pathogens in Smaller Hospitals. *Infection Control Hosp Epidemiol*;28:896–898.
3. Bennett NJ, Bull AL, Dunt DR, Gurrin LC, Russo PL, Spelman DW and Richards MJ 2007, Bloodstream infection surveillance in smaller hospitals. *Australian Infection Control Journal*, 12:45–47.
4. Bennett NJ, Bull AL, Dunt DR, Motley JE, Russo PL, Spelman DW, Richards MJ 2008, A users evaluation of a smaller hospital surveillance program. In press: *Am J Infect Control*.
5. 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.
6. Bennett NJ, Bull A, Dunt DR, Richards MJ, Russo PL, Spelman DW 2006, 'Surgical antibiotic prophylaxis in smaller hospitals', *Australian and New Zealand Journal of Surgery*, 76:676–678.
7. Bennett NJ, Bull A, Dunt DR, Richards MJ, Russo PL, Spelman DW 2007, 'The implementation of a pilot surveillance program for smaller acute care hospitals', *Infection Control and Hospital Epidemiology*, 28:486-488.
8. Bennett NJ, Bull A, Dunt DR, Richards MJ, Russo PL, Spelman DW 2007, 'The quality of data reported to a smaller hospital pilot surveillance program', *Infection Control and Hospital Epidemiology*, 28:486–488.
9. 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.
10. 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.
11. 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.
12. Friedman ND, Bull AL, Russo PL, Boardman CJ, Bennett NJ, Burrell SJ, Motley JE, Gurrin L, Richards MJ 2007, 'Performance of the NNIS Risk Index in predicting surgical site infections in an Australian setting', *Infection Control and Hospital Epidemiology*, 28:55-59.

13. Friedman ND, Bull A, Russo PL, Gurrin LC, Richards MJ 2007, 'Performance of the National Nosocomial Infections Surveillance (NNIS) Risk Index at predicting surgical site infection (SSI) in an Australian setting', *Infect Control Hosp Epidemiol*, 28:55–59.
14. 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.
15. Friedman ND, Russo PL, Bull A, Richards MJ, Kelly H 2007, 'Validation of coronary artery bypass graft surgical site infection surveillance data from a state-wide surveillance system in Australia', *Infect Control Hosp Epidemiol*, 28:812–817.
16. 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.
17. Russo PL, Bull AL, Bennett NJ, Boardman CJ, Burrell SJ, Motley JE, Friedman ND, Richards MJ, 2006, 'The establishment of a statewide surveillance program for hospital-acquired infections in large Victorian public hospitals', *AJIC*, 34:430–6.
18. 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.
22. 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', Society of Healthcare Epidemiology Conference, April, Baltimore.
23. Friedman ND, Russo PL, Bull AL, Richards MJ, Kelly H 2007, 'Validation of coronary artery bypass graft surgical site infection surveillance data from a state-wide surveillance system in Australia', Society of Healthcare Epidemiology Conference, April, Baltimore.
24. Motley JE, Bull AL, Boardman CJ, Bennett NJ, Berry KS, Burrell SJ, Friedman ND, Russo PL, Richards MJ 2004, 'Development of the VICNISS web-based interactive learning package for infection control consultants', Australian Infection Control Association Third Biennial Conference, June, Hobart.
25. Richards MJ, Bull AL, Bennett NJ, Boardman CJ, Burrell SJ, Motley JE, Friedman ND, Berry KS, Russo PL 2004, 'Establishment of a statewide surveillance program for hospital-acquired infections in large adult acute care Victorian public hospitals', Australian Infection Control Association Third Biennial Conference.
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.

29. Russo PL 2003, 'An update from the VICNISS Coordinating Centre', Victorian Infection Control Professionals Association Conference, 22–23 May, Melbourne.

30. Russo PL, Bull A, Bennett NJ, Boardman C, Burrell SJ, Motley JE, Friedman ND, Richards M 2004, 'Nosocomial infection surveillance and epidemiology', The 29th Australian and New Zealand Annual Scientific Meeting on Intensive Care, October, Melbourne.

31. 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', Association for Practitioners in Infection Control and Epidemiology 32nd Educational Conference and International Meeting, 19–23 June, Baltimore, Maryland.

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.

33. Russo PL, Bull AL, Bennett NJ, Boardman C, Burrell SJ, Motley JE, Friedman ND, Richards MJ 2005, 'Data from larger hospitals participating in the VICNISS Hospital-Acquired Infection Surveillance System – Victoria, Australia', Communicable Diseases Control Conference, May, Sydney.

34. Russo PL, Bull AL, Bennett NJ, Boardman C, Burrell SJ, Motley JE, Friedman ND, Richards MJ 2005, 'The establishment of a statewide surveillance program for hospital-acquired infections in large Victorian public hospitals', Communicable Diseases Control Conference, May, Sydney.

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 Anaesthesiology (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 a 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 using invasive devices (such as catheters) or surgical procedures.
Group A1 hospitals	Large tertiary teaching hospitals.
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.
Intravascular device	The device used to administer a solution into a vein, such as the familiar IV drip.

Area	Definition
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*.
Neonate	A baby within the first four weeks of birth.
NHSN	National Healthcare Safety Network.
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 calculating 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 more than 100 beds.
Type 2 surveillance	Surveillance activities designed for hospitals with less than 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 and 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)
- 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. Measuring surgical antibiotic prophylaxis compliance 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 more 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 with 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 Anaesthesiology 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 where the 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.

VICNISS recommends that surgical patient surveillance and calculating infection rates only applies to hospitals with sufficient surgical throughput. Alternative methods are more appropriate for smaller hospitals, such as 'process' surveillance and reporting 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 Department of Human Services 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 HAI surveillance with routine data collection and continuous quality improvement systems, and strategic management planning for infection control
- promote consumer participation in developing 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 2007

Member	Representing
Prof. Graham Brown	Victorian Infectious Diseases Service
Ms Donna Cameron	Victorian Infection Control Professionals Association
Mrs Sally Campbell	Executive Director, Business Development and Corporate Secretary, Melbourne Health
Mr Richard Chua	Consumer representative
Mr Clinton Dunkley	Senior Program Advisor, Statewide Quality Branch, Department of Human Services
Ms Christine Griffiths	Consumer representative
Ms Glenys Harrington	Victorian Infection Control Professionals Association
Mr Rondhir Jithoo	Royal Australasian College of Surgeons
A/Prof. Paul Johnson	Australasian Society for Infectious Diseases
Dr Chris MacIsaac	Victorian Regional Committee, Joint Faculty of Intensive Care Medicine
Mr Matthew Mason	Victorian Infection Control Professionals Association
Mr Felix Pintado (Chair)	Australian College of Health Service Executives
A/Prof. Mike Richards	VICNISS Coordinating Centre
Mr Phil Russo	VICNISS Coordinating Centre
Prof. Denis Spelman	VACIC Surveillance Sub-committee (Chair) and Australasian Society for Infectious Diseases

Appendix C: VICNISS Coordinating Centre staff

A/Prof. Michael Richards MD, MB, BS, FRACP	Director
Mr Phil Russo BN, M Clin Epid	Operational Director
Dr Ann Bull PhD, BSc (Hons), M App Epid	Epidemiologist
Mr Simon Burrell	Database Manager
Ms Noleen Bennett RN, MPH	CNC Infection Control
Ms Claire Boardman RN, MPH	CNC Infection Control
Ms Judy Brett BN, RM	CNC Infection Control
Dr Leon Worth, MB, BS, FRACP	Infectious Diseases Physician
Dr Emma McBryde, MB, BS, FRACP	Infectious Diseases Physician FRACP, PhD
Ms Wendy Wang	.NET/SQL Programmer
Ms Kylie Berry	Administrative Officer
Ms Megan Hardwick	Data Entry/Administrative Assistant

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