health

Healthcare-associated infection in Victoria

Surveillance report for 2010–11 and 2011–12

State Government Victoria

Department of Health

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Surveillance report for 2010–11 and 2011–12

Acknowledgements

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Contents

Introduction

This report summarises data related to:

- healthcare-associated infections (HAI)
- their causative organisms
- compliance with infection prevention processes

in Victorian acute-care public hospitals for the two years 1 July 2010 to 30 June 2011 and 1 July 2011 to 30 June 2012.

Eleven private hospitals now also contribute data on a voluntary basis and the data is included in the report. This is an important step, since some private hospitals perform large numbers of surgical procedures, including cardiac bypass and joint replacement surgery.

The HAI surveillance methodology is based on that developed at the Centers for Communicable Disease (CDC) in the United States. This methodology is used in many parts of the world, including North and South America, Canada, Japan, United Kingdom and many European countries.

Victorian HAI surveillance is targeted to those activities with the highest risk. The results of HAI surveillance activities for 2010–11 and 2011–12 are presented in the following categories:

- intravenous lines in different care settings
- surgical sites of infection including surgical antibiotic prophylaxis
- specific organisms or types of organisms
- healthcare worker seasonal influenza immunisation and healthcare worker occupational exposures.

There are two surveillance programs. Type 1 or larger hospitals (100 beds or greater) submit data on surgical procedures and intensive care unit (ICU) infections. Type 2 or smaller hospitals (fewer than 100 beds) submit data on serious and antibiotic-resistant infections, and infection-related process measures such as peripheral catheter care and use of antibiotics prior to surgery.

Victoria's progress with HAIs is extremely encouraging, with falling infection rates and demonstrated improvements in processes. It reflects the contribution of hospital infection prevention teams and others.

In certain risk categories there has been significant improvement in surgical site infection rates – for deep- and organ-space site infections after cardiac surgery, for overall infection rates after colorectal surgery, and for hip and knee replacement surgery.

Data shows continuing improvements in the choice of surgical antibiotic prophylaxis in cardiac, orthopaedic, colon, and caesarean-section surgery. There remains room for improvement in timing (and documentation) of antibiotic prophylaxis for some procedures.

The data also suggests improvements for caesarean-section surgery, central-line associated bloodstream infections (CLASBI) in major hospital ICUs.

There has been a noticeable decrease in the number of Methicillin-resistant *Staphylococcus aureus* (MRSA) central line-associated bloodstream infections reported by Victorian public hospital intensive care units since 2003.

However, enterococcal bacteraemias have been increasingly reported. This has lead to scrutiny and controversy as to their significance and pathogenesis; particularly as to how many are true complications of central-line use. This microbiological data should help guide antibiotic choice for prophylaxis, when indicated, and initial empiric therapy.

For the first time, data on *Clostridium difficile* (*C. difficile*) is included in the report. *C. difficile* surveillance is now routine, following the recognition of hypervirulent *C. difficile* infection in New South Wales in 2010, and the international experience of this as a major and increasing problem in the developed world. In the United States, this has emerged as the single most important healthcare-acquired pathogen. This suggests we need to consider appropriate prevention strategies and monitor this issue carefully.

Rates in this report represent cases most likely associated with healthcare. Of initial concern was the significant progressive rise in reports of *C. difficile* diarrhoea in Victoria for the first year of surveillance. Heightened awareness and changes in testing methods may account for some of this increase, and the initial rise has not continued into the second year.

It is possible an increase in rates of *C. difficile* in Victoria since 2011 could be linked to transmission and infection pathways in the community, not inside hospitals. Victoria is not seeing an increase in the hyper-virulent strains of *C. difficile* which have been associated with severe mortality and morbidity overseas.

Staphylococcus aureus bacteraemias (SAB) are another important healthcare-associated infection, with a mortality of up to 20 per cent. All public hospitals report on these infections. Rates of these have been falling significantly in Victoria since standardised data collation began in 2009–10.

Using this report

Health services

This report provides data at a statewide level to enable health services and clinicians to examine the results of infection surveillance from a statewide perspective. Clinicians are encouraged to use the data to highlight issues and generate improvements in infection prevention.

Hospitals receive quarterly reports from VICNISS Coordinating Centre on their infection rates and compliance with recommended practices and processes to reduce infections. These reports enable staff to be aware of their performance and take action where required.

Hospitals with rates that are statistically higher than the benchmark or statewide average are notified and asked to respond with an action plan to address the infection rate.

The Department of Health healthcare-associated infection program

The Department of Health (the department) HAI program will use this report to assist with planning and coordination of Victorian infection prevention and control activities. For a copy of this report and information regarding the HAI program see: www.health.vic.gov.au/infectionprevention.

The use of the data for quality and performance monitoring is seen as increasingly important. Victorian public hospitals are required to participate in the statewide HAI surveillance program. Specific measures form part of the Victorian Health Service Performance Monitoring Framework or are included in public hospital performance agreements with the department. Victorian hospitals (100 beds or more) are expected to meet benchmarks or levels of compliance for selected measures. For more information see: www.health.vic.gov.au/hospital-performance.

Commonwealth Government

In November 2009, the Health Ministers endorsed the recommendation of the Australian Commission on Safety and Quality in Health Care that hospitals routinely monitor and review a succinct set of indicators.

The objectives were to enhance the focus on quality and safety, drive improvement at the local level through fostering supportive feedback, and improve transparency and accountability in quality and safety reporting.

Indicator definitions and specifications have been approved for *Staphylococcus aureus* bacteraemia (SAB) and are in draft form for *Clostridium difficile* infection (CDI).

SAB now forms part of reporting to the Commonwealth Government and hospital rates are published on the MyHospitals website www.myhospitals.gov.au.

VICNISS Coordinating Centre

Data is used more widely for analysis and promotion of interventions to reduce HAIs as well as for research projects, with appropriate approvals, both within and outside the VICNISS Coordinating Centre.

Results from surveillance – intravenous lines in different care settings

Introduction

This section consolidates the results from HAI surveillance of patients who have intravenous lines inserted in a variety of different care settings. In particular:

- inpatients in intensive care units (ICU)
- babies in neonatal ICU
- same-day admission haemodialysis patients.

It describes the results of the:

- rates of patient bloodstream infections (BSIs)
- type of causative organisms associated with intravenous lines
- monitoring the practice of central line and peripheral line insertion.

Rationale for surveillance

Infections can occur in patients who have a central or peripheral line inserted as part of their care.

Central lines are catheters inserted in a large vein in the neck, chest or groin and are used to administer intravenous fluids and fluid-dynamic medications, obtain blood samples or take measurements.

Peripheral lines are catheters inserted into a peripheral vein, usually in a limb, and are generally used to administer intravenous fluids and medications.

Adult or paediatric patients in ICU or babies in neonatal ICU are at high risk for central line-associated blood stream infections (CLABSI) or peripheral line-associated blood stream infections (PLABSI).

Haemodialysis patients are at a high risk of infection because the process of haemodialysis requires frequent use of catheters or insertion of needles to access the bloodstream. Also, haemodialysis patients have weakened immune systems, which increases their risk for infection, and they require frequent hospitalisations and surgery if they acquire an infection.[1]

A high proportion of intravenous line-associated infections are thought to be preventable with good practices and processes for line insertion and care.[2]

[1] Centres for Disease Control and Prevention United States, *Dialysis safety*, www.cdc.gov/dialysis, accessed 11 December 2012.
[2] Pronovost P, Needham D, Berenholtz S, Sinopoli D, Chu H, Cosgrove S, Sexton B, Hyzy R, Welsh R, Roth G, Bander J, Kepros J, Goeschel C 2006, 'An intervention to decrease catheter-related bloodstream infections in the ICU', *N Engl J Med.*, vol. 355, no. 26, pp.2725–32; and Stuart RL, Cameron DR, Scott C, Kotsanas D, Grayson ML, Korman TM, Gillespie EE, Johnson PD 2013, 'Peripheral intravenous catheter-associated Staphylococcus aureus bacteraemia: more than 5 years of prospective data from two tertiary health services', *Med J Aust,* vol. 198, no. 10, pp. 551–3.

Infections associated with central lines in ICU settings

Scope

CLABSI surveillance data was collected for adult and paediatric patients in ICUs who had central lines inserted and where the infections were considered to be associated with that central line.

Participating organisations

In Victoria, ICUs are located only in the larger metropolitan, regional and teaching hospitals. There are 20 public hospitals and six private hospitals with adult and/or paediatric ICUs.

Participation in CLABSI surveillance is mandatory for Victorian public hospitals with ICUs. For more information see the Victorian Health Service Performance Monitoring Framework www.health.vic.gov.au/hospital-performance.

In 2010–11 and 2011–12, 26 hospitals (20 public and six private) participated in surveillance for ICU CLABSI. This represents 100 per cent of all Victorian public hospitals eligible to participate.

Method

Active, patient-based prospective surveillance of central line-associated infection was conducted in accordance with *VICNISS surveillance module (type 1) central line-associated bloodstream infection (CLABSI) or peripheral line-associated bloodstream infection (PLABSI) (ICU/NNL): protocol*. This is based on the CDC National Healthcare Safety Network (NHSN), United States surveillance program. Hospitals with ICUs monitor and collect data on a continuous basis for this measure. Data was submitted by participating health services to VICNISS Coordinating Centre quarterly.

In July 2008, there were revisions to the definition of CLABSI to align with international standards. For more information see *Revisions to the CLABSI definition* (2008) on the VICNISS website www.vicniss.org.au. Comparable data is available for the four-year period 2008–09 to 2011–12, after the new CLASBI definition was introduced. Results are presented as a rate per 1,000 central line days.

Observations on the surveillance data

Table 1 displays the annual rates of ICU CLABSI from 1 June 2008 to 30 June 2012 for all participating Victorian public and private hospitals.

Table 1: Annual aggregate ICU CLASBI

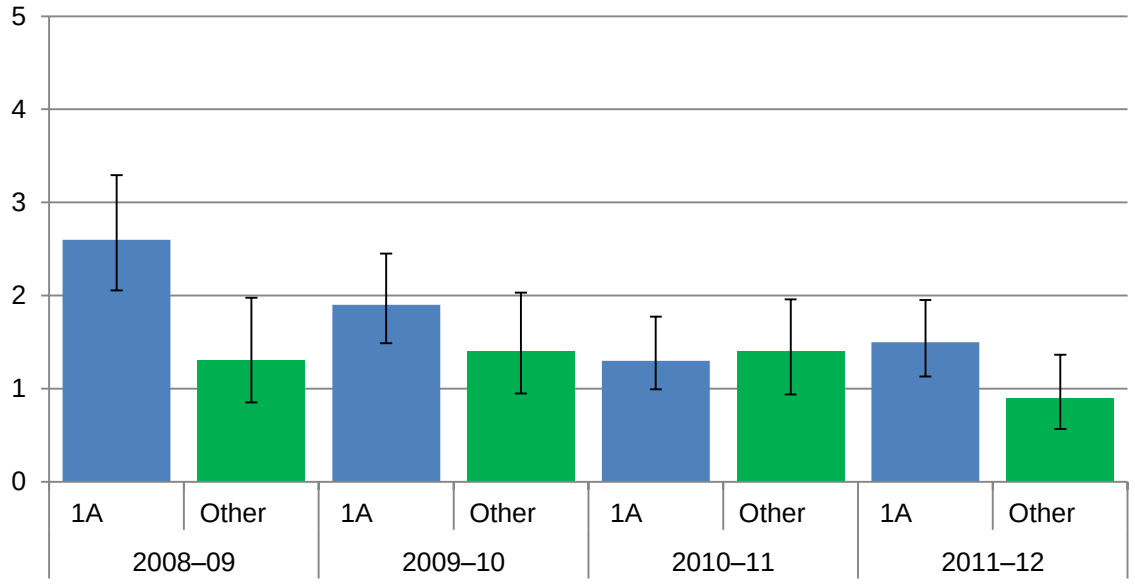
Year	Number participating	Total valid infections	Total line days	CLABSI rate per 1,000 line days
2008–09	22	97	45,919	2.1
2009–10	24	95	54,767	1.7
2010–11	26	79	58,995	1.3
2011–12	26	72	59,210	1.2

Historically, major teaching hospitals have shown higher rates of CLABSI than other hospitals. Figure 1 displays the annual ICU CLABSI rates with results presented in two groups: major teaching hospitals (A1 hospitals) and 'other' hospitals (larger but less specialised hospitals).The A1 hospital group is comprised of six public and two private hospitals. The 'other' hospital group is comprised of 14 public and five private hospitals. Not all private hospitals contribute in each year.

From 2008–09 to 2011–12 the statewide rate for A1 hospitals decreased from 2.6 to 1.5 infections per 1,000 central line days ($p < 0.001$). This decrease is equivalent to approximately 25 fewer patients acquiring CLASBI in ICUs in any given year. Regression analysis suggests the decrease is statistically significant.

Rates in 'other' hospitals remained relatively stable although there has been a decrease in 2011–12 to a rate of 0.9 per 1,000 central line days. This data does not demonstrate a detectable trend.

Figure 1: Annual aggregate ICU CLABSI rate – per 1,000 central line days by hospital type



The data is encouraging since considerable effort has gone into lowering infection rates by the majority of Victorian public hospitals.

Efforts include:

- process monitoring – for more information see the section in this report called 'Process measure: monitoring of central line practice in larger hospitals'
- intensive implementation of the National Hand Hygiene Initiative.

Increased awareness of CLABSIs has also resulted from 10 years of continuous surveillance of, and feedback on, rates in Victoria. This is reinforced by the national CLABSI prevention project of 2010–11 led by the Australian Commission on Safety and Quality in Healthcare (ACSQHC) and the Australian and New Zealand Intensive Care Society (ANZICS).

Infections associated with central and peripheral lines in neonatal ICU

Scope

CLABSI and PLASBI surveillance data was collected for babies in level 3 neonatal ICUs who had a central or peripheral line inserted and where the infections were considered to be associated with those lines.

Participation

Participation by Victorian public health services in this measure is voluntary.

In Victoria, four public hospitals have level 3 neonatal ICUs. All four, or 100 per cent, submitted data in each surveillance year. The exception is 2010–11 where three hospitals participated in surveillance for neonatal ICU CLASBI and PLASBI, representing 75 per cent of all hospitals eligible to participate.

Method

Active, patient-based prospective surveillance of central and peripheral line-associated infections were conducted in accordance with *VICNISS surveillance module (type 1) central line-associated bloodstream infection (CLABSI) or peripheral line-associated bloodstream infection (PLABSI) (ICU/NNL): protocol*. This is based on the CDC NHSN, United States surveillance program. Hospitals with level 3 neonatal ICUs monitor and collect data on a continuous basis for these measures. Data is submitted by participating health services to VICNISS Coordinating Centre quarterly. Infection rates are calculated per 1,000 line days.

In July 2008, there were revisions to the definition of CLABSI to align with international standards. For more information see 'Revisions to the CLABSI definition' (2008) www.vicniss.org.au. Comparable data is available for the four-year period 2008–09 to 2011–12, after the new CLASBI definition was introduced. Results are presented as rates per 1,000 central line or peripheral line days.

Observations on surveillance

Table 2 displays the annual rates of ICU CLABSI from 1 June 2008 to 30 June 2012. Infections are more likely to be associated with central lines than with peripheral lines.

Table 2: Aggregate statewide neonatal ICU CLASBI and PLASBI infections

Year	Number of participating hospitals	CLASBI			PLASBI		
		Total valid infections	Total line days	Rate / 1,000 line days	Total valid infections	Total line days	Rate / 1,000 line days
2008–09	4	20	9,426	2.1	13	15,596	0.8
2009–10	4	28	9,834	2.8	12	17,228	0.7
2010–11	3	28	10,314	2.7	10	15,781	0.6
2011–12	4	26	10,867	2.4	5	15,559	0.3

Historically there have been two main factors impacting on CLABSI and PLASBI rates in neonates:

- low birth weight babies are more likely to contract infections
- babies with central lines are more likely to contract infections than those with peripheral lines.

HAI surveillance data in neonates is therefore presented for CLASBI and PLASBI by birth weight category: less than 750 g; 751–1,000 g; 1,001–1,500 g; 1,501–2,499 g; and greater than 2,500 g.

Figure 2 displays the CLABSI rates stratified by birth weight for neonatal ICUs in Victoria for the four years from 2008–09 to 2011–12. These rates have particularly wide confidence intervals reflecting the small pool of data available to calculate infection rates (see Appendix C).

There are no apparent trends in this data. The inability to detect trends is due to the small sample sizes which result in significant chance variation and are reflected in the wide 95 per cent confidence intervals.

Figure 2: Neonatal ICU central line-associated bloodstream infection rates, 1 July 2008 to 30 June 2012 – rates expressed per 1,000 line-days

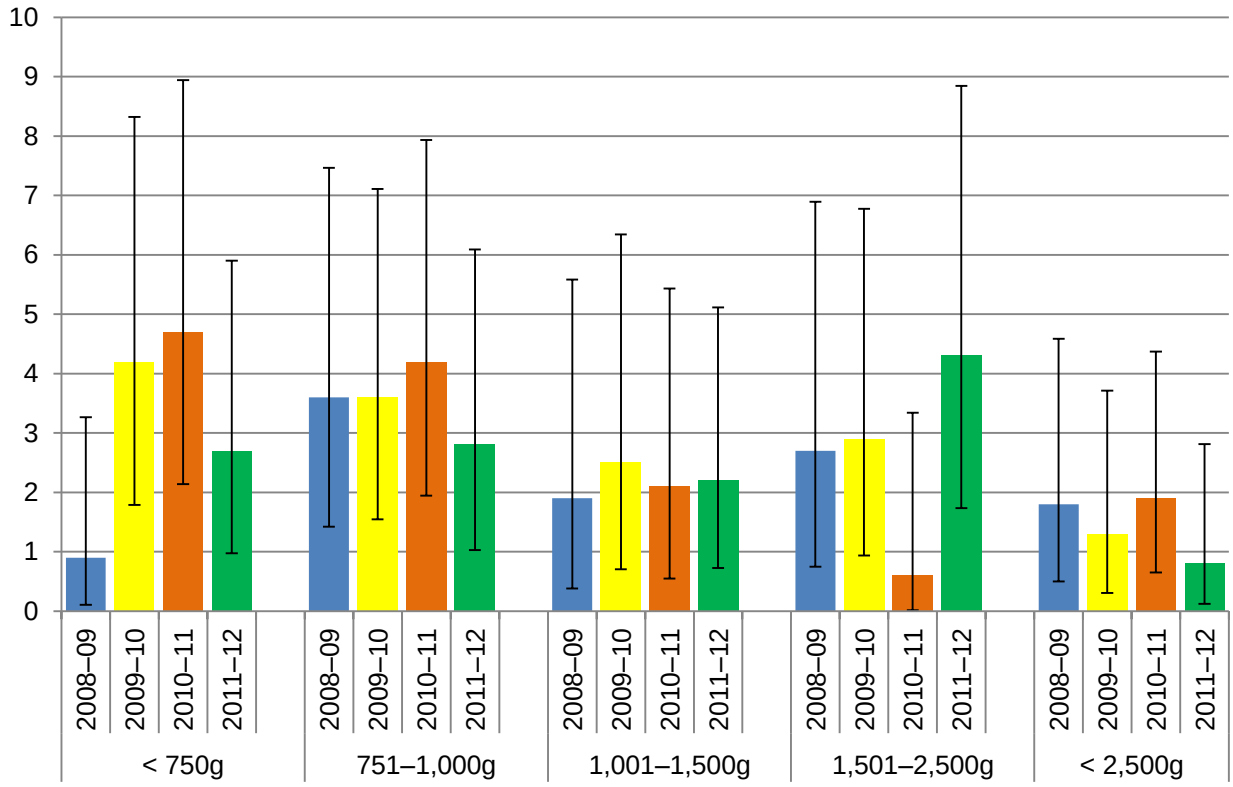
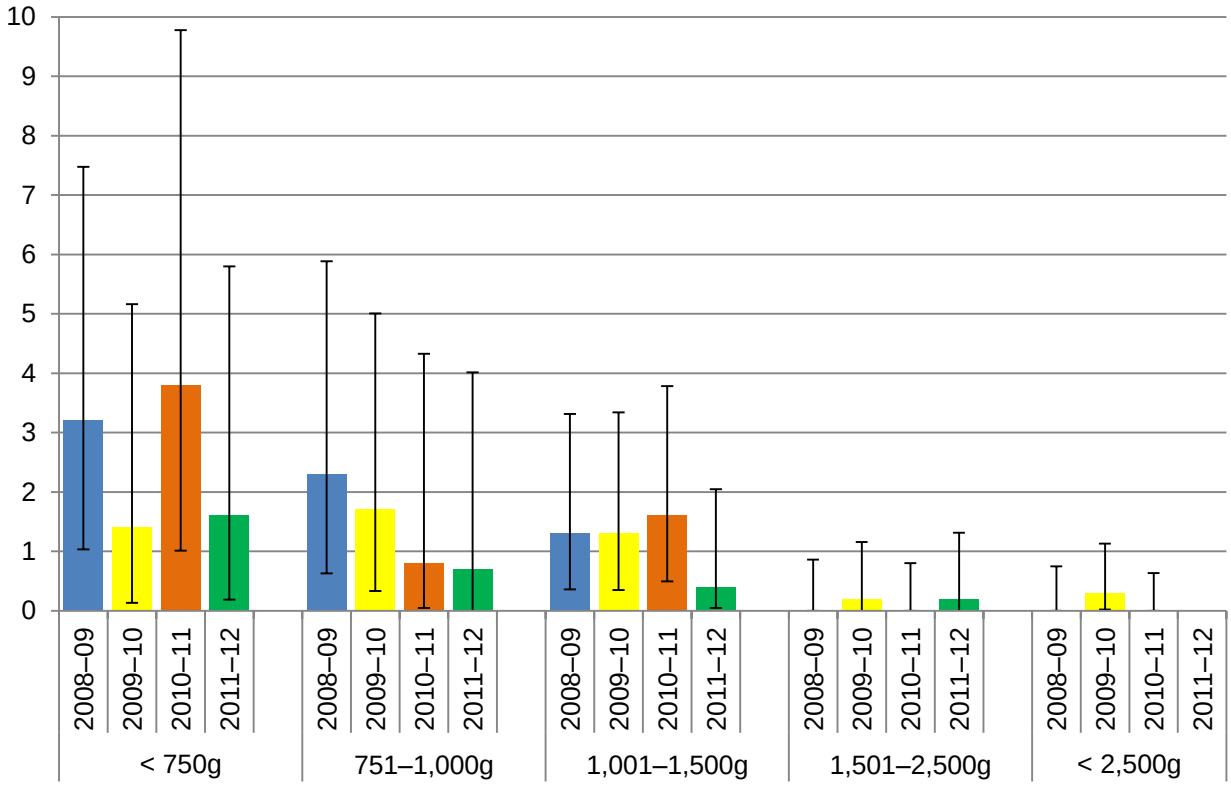


Figure 3 displays the PLASBI rates stratified by birth weight for neonatal ICUs in Victoria for the four years from 2008–09 to 2011–12. These rates have particularly wide confidence intervals reflecting the small pool of data available to calculate infection rates (see Appendix C).

The one observable pattern in the data is that, as expected, there are generally fewer infections in babies with higher birth weights.

Figure 3: Neonatal ICU peripheral line-associated bloodstream infection rates, 1 July 2008 to 30 June 2012 – rates expressed per 1,000 line-days



Causative organisms in intensive care

CLABSI definition changes and impact on trend analysis

In July 2008, there were revisions to the definition of CLABSI to align with international standards. For more information see 'Revisions to the CLABSI definition' (2008), www.vicniss.org.au.

The previous definition was over-inclusive of coagulase-negative staphylococcal (CNS) infections. CNS are bacteria commonly found on the skin. When they are found in blood samples, it is often a result of contamination of the sample during collection rather than a bloodstream infection. Previous reports have included potential episodes that were due to contamination rather than true infection.

While the updated definition may exclude some true bloodstream infections, it is a practical compromise to allow more consistent and simplified data collection. The overall effect has been to lower the CLABSI rates from 2008–09 onwards. Similar effects have been observed internationally following implementation of the revised definition.

Comparable data is available for the four-year period from 2008–09 to 2011–12, after the new CLASBI definition was introduced. Results for causative organisms are presented as a percentage of total organisms identified.

Observations on surveillance – causative organisms in ICU

Table 3 depicts the frequency of causative organisms in ICU CLABSI in A1 and other hospitals.

Note 'n' represents the number of infections where organism data was provided. Organism data is not available for every infection. Therefore 'n' is not necessarily equal to the total number of infections represented by the rates displayed in Table 1.

Infection rates have declined over time in both A1 and other hospitals, however there are no apparent changes in the types of organisms causing the infections. Given the small numbers of infections, any patterns would that did exist would be difficult to detect over a four-year period. The numbers of infections caused by Methicillin-resistant *Staphylococcus aureus* (MRSA) and also by potentially resistant enterococcal species appear to be stable over the time.

Table 3: Causative organisms for ICU CLASBI – percentage, by hospital type

Causative organisms	2008–09		2009–10		2010–11		2011–12	
	A1	other	A1	other	A1	other	A1	other
	n=74	n=24	n=67	n=29	n=48	n=31	n=52	n=20
	%	%	%	%	%	%	%	%
Acinetobacter spp.	3	8	3	0	0	3	6	0
Candida albicans	11	4	3	10	23	3	8	5
Candida spp.	9	4	7	0	10	0	13	5
Coagulase negative *Staphylococcus* spp.	9	0	13	21	13	13	4	20
Enterobacter spp.	4	13	9	0	13	3	8	0
Enterococcus faecalis	8	13	10	14	15	6	15	5
Enterococcus faecium	18	13	21	14	13	45	8	20
Escherichia coli	7	4	3	0	0	0	6	5
Klebsiella spp.	3	0	0	3	0	3	6	0
Other organism	9	17	7	10	4	6	10	15
Pseudomonas aeruginosa	3	4	1	0	0	0	4	0
Serratia spp.	3	0	9	0	4	3	4	5
Staphylococcus aureus (MSSA/unknown)	9	13	4	21	4	6	8	10
Staphylococcus aureus (MRSA)	4	8	7	7	2	6	2	10

A1 is major teaching hospitals and 'other' are larger but less specialised hospitals.
Note: Due to rounding down or up of decimal places column percentages may equal approximately 100 per cent.
In adult ICUs, only *Serratia* spp. and *Enterobacter* spp. are identified.

Observations on surveillance – causative organisms in neonatal ICU

Table 4 shows the causative organisms associated with CLABSI and PLASBI in neonatal units (all birthweights combined).

Note 'n' represents the number of infections where organism data was provided. Organism data is not available for every infection. Therefore 'n' is not equal to the total number of infections represented by the rates displayed in Table 2.

Interpretation of any trends in the data is difficult due to the small number of infections.

Table 4: Causative organisms for CLABSI and PLASBI in neonatal ICU – percentage by central or peripheral line

Causative organisms	2008–09		2009–10		2010–11		2011–12	
	CL	PL	CL	PL	CL	PL	CL	PL
	n=20	n=13	n=28	n=12	n=28	n=10	n=26	n=5
	%	%	%	%	%	%	%	%
Candida spp.	0	8	7	17	0	0	4	20
Coagulase negative *Staphylococcus*	5	38	21	0	4	0	4	0
Enterobacter cloacae	0	0	4	8	14	10	8	0
Enterococcus faecalis	0	8	4	17	4	20	8	20
Escherichia coli	20	0	18	8	14	40	8	0
Other organism	20	31	25	25	25	10	23	0
Pseudomonas aeruginosa	10	0	0	0	4	0	4	0
Serratia marcescens	5	8	0	0	0	0	0	0
Staphylococcus aureus (MSSA)	5	0	7	17	4	20	15	20
Staphylococcus aureus (MRSA)	0	0	0	0	7	0	0	0
Staphylococcus spp.	35	8	14	8	25	0	27	40

CL is ‘central line’ and PL is ‘peripheral line’.
Note: Due to rounding down or up of decimal places column percentages may equal approximately 100 per cent.

Process measure: monitoring of central line practice in larger hospitals

Purpose

Monitoring central line insertion practices for every occurrence in the nominated patient care location (for example, ICU) during the months nominated for surveillance.

Pilot program – rationale, method and findings

Evidence-based practices are recommended for proper insertion and management of central venous catheters (CVCs). A range of relevant risk-reducing processes can be identified:

- adequate hand hygiene by inserter
- use of maximal sterile barriers during insertion
- proper use of a skin antiseptic prior to insertion
- allowing skin antiseptic to dry before catheter insertion.

Standardised methods for monitoring have been developed internationally. In recent years, a number of Victorian hospitals have made enquiries about standardised process monitoring or enhancement of current in-house strategies for reporting these processes.

To address these issues, four Victorian healthcare facilities were invited to participate in a voluntary monitoring project for a minimum period of three months in 2011. Based on the CDC National Healthcare Safety Network (NHSN) Central line insertion practices adherence monitoring module[3], a standardised record was developed to capture data related to CVC insertion practices.

The project monitored the insertion of 267 CVCs in 226 patients. Most of the devices were non-tunnelled CVCs (70.4 per cent). Compliance was assessed for both individual components of the bundle and the overall bundle. Overall compliance with the CLABSI prevention bundle was 60.8 per cent. Compliance with bundle components was:

- 99.2 per cent for hand hygiene
- 92 per cent for appropriate skin asepsis
- 97.2 per cent for skin completely dry before CVC insertion
- 64.8 per cent for use of maximal barriers.

In contrast, overall bundle compliance has been reported as 91.5 per cent in ICU settings in the United States. Use of caps and full body drapes have been identified as the two processes with poorest uptake in both United States and pilot Victorian facilities.

Following the VICNISS pilot program, the CLABSI process-monitoring module has been introduced as an optional surveillance module for Victorian healthcare facilities, including ICU and non-ICU settings. This includes surveillance for central line insertion practices in a nominated patient care location (for example ICU) for at least three calendar months.

Active, patient-based, prospective surveillance is to be conducted in accordance with *VICNISS surveillance module (type 1) central line insertion practices (CLIP) adherence monitoring: protocol*. This is based on the CDC NHSN, United States surveillance program.

[3] Available at: www.cdc.gov/nhsn/PDFs/pscManual/5psc_CLIPcurrent.pdf

Process measure: monitoring peripheral venous catheter (PVC) use in smaller hospitals

Purpose

Data concerning PVC insertion and maintenance is collected for each PVC line inserted for 'multi-day patients' where the PVC was inserted at the participating hospitals (fewer than 100 beds). PVCs inserted at another hospital are excluded from monitoring.

Participation

Participation by Victorian public health services in this measure is voluntary.

In 2010–11, 14 public hospitals participated in monitoring of PVC use. This represents 40 per cent of eligible hospitals and represented a substantial increase on the six participating hospitals at commencement of reporting in 2004–05.

In 2011–12, seven hospitals participated in monitoring of PVC use. This represents 20 per cent of eligible hospitals.

Method

Monitoring was conducted in accordance with *VICNISS surveillance module (type 1) central line-associated bloodstream infection (CLABSI) or peripheral line-associated bloodstream infection (PLABSI) (ICU/NNL): protocol*. This module is based on recommendations outlined in the *Guidelines for the prevention of intravascular catheter-related infections* from the CDC 2002.

Hospitals collect data continuously for a three-month period for this measure. Data is submitted quarterly by participating health services to VICNISS Coordinating Centre.

Comparable data is available for the eight-year period 2004–05 to 2011–12. Results are presented as a percentage compliance with each of the three measures outlined below.

Observations on surveillance

Best practice in PVC use can help to reduce the infection risk associated with catheter insertion. There are three main measures which can indicate compliance with best practice for PVC use:

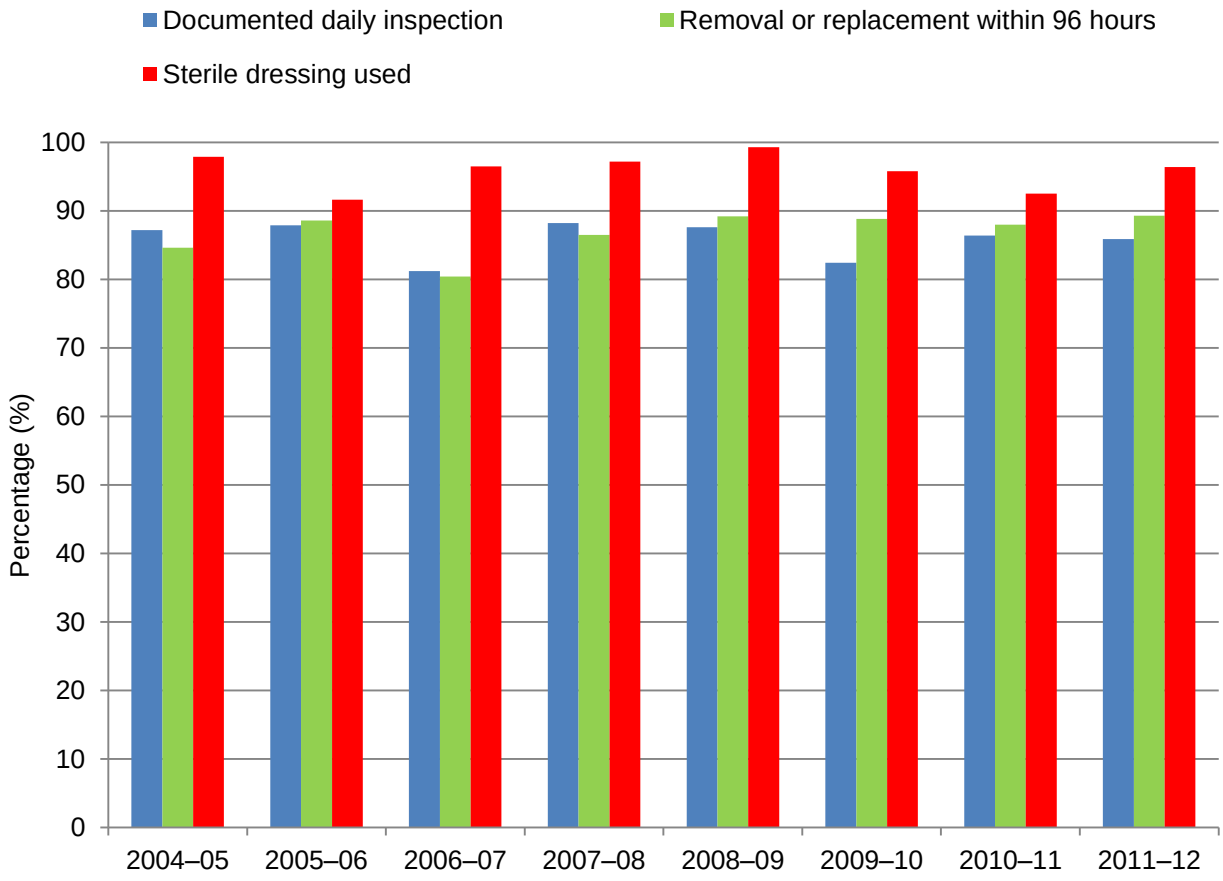
- Measure 1: PVCs are inspected daily and that this inspection is documented in the patient's medical record
- Measure 2: PVCs are removed or replaced within 96 hours
- Measure 3: Use of a sterile gauze or transparent semi-permeable site dressing for PVCs.

Figure 4 represents the annual percentage of catheters inserted that complied with each measure over the eight-year period 2004–05 to 2011–12.

The highest compliance is for the use of sterile dressings, which has consistently remained at greater than 90 per cent. Documented daily inspection and removal/replacement within 96 hours have varied between 80 and 90 per cent over the time the data have been collected.

It is difficult to interpret time trends in this data as the composition and number of participating hospitals has varied from year to year. The aim of this module is not to produce a time trend but rather to assess compliance at individual hospitals and report data back to these hospitals in order for them to improve performance where required. Over the eight years 30 hospitals have participated in this module and compliance with the three measures is relatively high in the majority of these hospitals.

Figure 4: PCV monitoring in small hospitals – percentage compliance with key measures



Infections associated with same-day admission haemodialysis patients

Purpose

All same-day admission haemodialysis patients were monitored for any intravenous antibiotic start, positive blood culture or presence of pus, redness or swelling at the vascular access site.

Rationale for surveillance

In Victoria, all patients who attend hospital for haemodialysis are considered admitted patients. Same-day admission haemodialysis is the primary non-ICU setting for HAI central-line surveillance.

Haemodialysis requires vascular access, which can either be a graft or an enlarged blood vessel that can be punctured to remove and replace blood.

Patients who undergo dialysis treatment have an increased risk of HAI. In the event of a suspected or actual infection patients may receive antibiotics.

Patients are monitored for HAI infection in three main ways: blood cultures, surface swab of a vascular access site, or clinical symptoms such as pus, redness, or increased swelling at the vascular access site.

The identified infection may be superficial and restricted to the access site, blood-borne, or rely on clinical diagnosis only. Bacteraemias and localised infections of the vascular access site are common in haemodialysis patients.[4]

Because of frequent hospitalisations and receipt of antimicrobial drugs, haemodialysis patients are also at high risk for infection with antimicrobial-resistant bacteria. However this does not seem to be a significant problem in Victoria at present where overall reported infection rates are low.

Participation

Surveillance of infections associated with same-day admission haemodialysis patients is voluntary. However, it has been enthusiastically adopted by many hospitals, with relatively consistent participation enabling limited analysis of trends over time.

From 2008–09 onwards, the same-day admission haemodialysis module was expanded to include all Victorian public hospitals. This was done in consultation with stakeholders including renal physicians, networks and haemodialysis nurses. A total of 42 hospitals have consistently participated in same-day admission haemodialysis surveillance during this period.

In 2010–11, 43 dialysis facilities, representing 34 public hospitals or health services participated in same day admission haemodialysis surveillance.

In 2011–12, 42 hospitals participated in same day admission haemodialysis surveillance.

Currently only public haemodialysis units participate in surveillance.

[4] *VICNISS surveillance (type 1/2) module haemodialysis event (HDE): protocol.*

Method

Active, patient-based prospective surveillance of infection was conducted in accordance with *VICNISS surveillance (type 1/2) module haemodialysis event (HDE): protocol*. This is based on the CDC NHSN, United States surveillance program.

Hospitals and other healthcare facilities that conduct same-day admission haemodialysis monitor and collect data on a continuous basis for this measure. Data was submitted quarterly by participating health services to VICNISS Coordinating Centre.

Comparable data is available for the four-year period 2008–09 to 2011–12. Results are presented as a rate of events per 100 patient months.

Observations on surveillance

Vascular access type

There are four main types of vascular access, and ordered according to increased risk of infection these are:[5]

- arteriovenous fistulas constructed from the patient's own blood vessels
- arteriovenous grafts often constructed from synthetic materials
- non-tunnelled central lines (permanent lines), which are CVCs that travels a distance under the skin from the point of insertion before terminating at or close to the heart or one of the great vessels.
- tunnelled central lines (temporary line) is a CVC that travels directly from the skin entry site to a vein and terminates close to the heart or one of the great vessels, typically intended for short term use

As shown in Table 5, the most common access type continues to be arteriovenous fistulas, followed by permanent central line, arteriovenous grafts and temporary central line.

Table 5: Haemodialysis access by vascular access type

Access type	2008–09 to 2011–12		2011–12	
	Cumulative patient months	Cumulative percentage	Annual patient months	Annual percentage
Arteriovenous fistula access	31,944	80.1%	8,420	81.3%
Arteriovenous graft access	3,038	7.6%	751	7.3%
Permanent central line	4567	11.5%	1,088	10.5%
Temporary central line	336	0.8%	92	0.9%

[5] CDC United States, www.cdc.gov/nhsn/PDFs/pscManual/8pscDialysisEventcurrent.pdf, accessed 13 December 2012.

Antibiotic and vancomycin starts

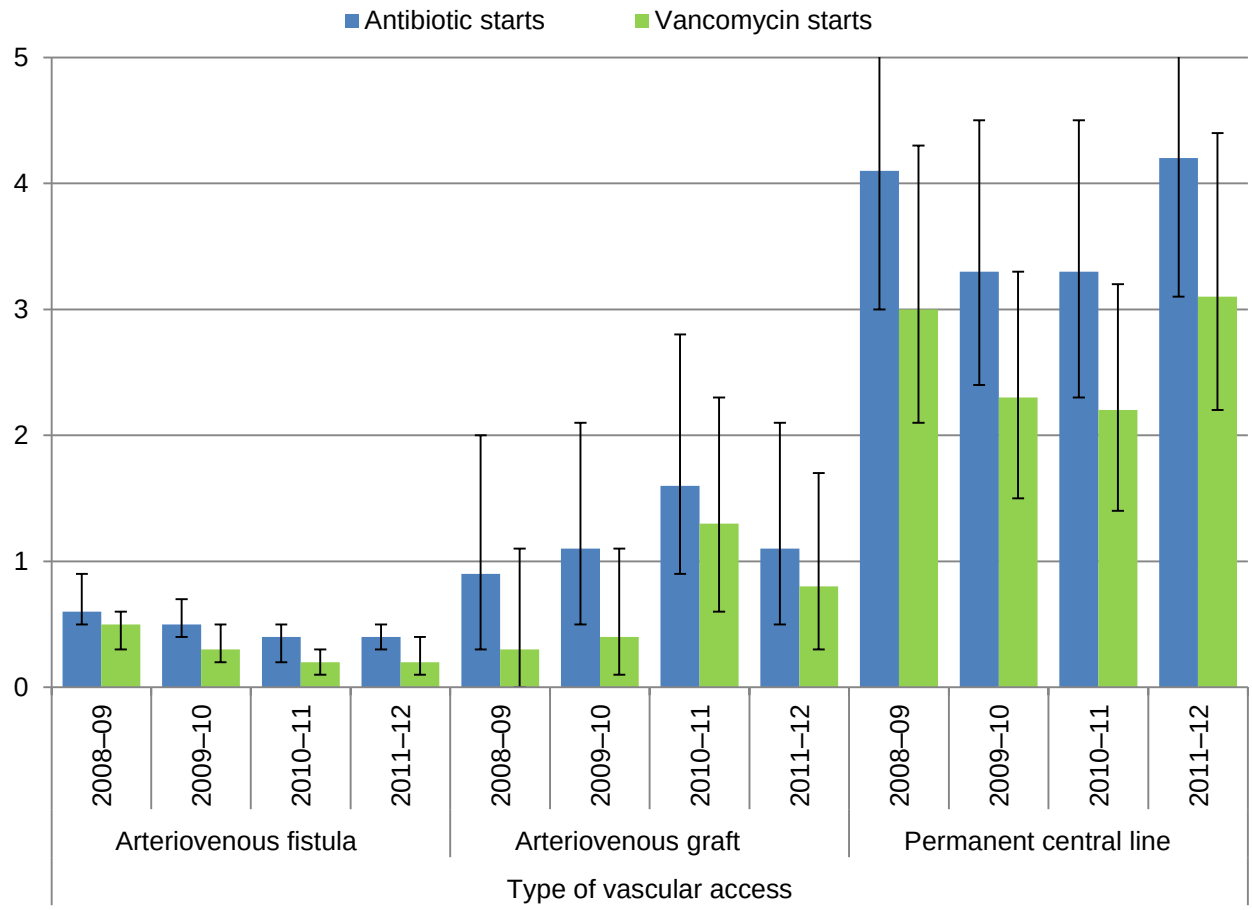
Patients may be administered antibiotics if an infection is confirmed or suspected. If the infection is caused by *staphylococcus* the haemodialysis patient may be administered the specific antibiotic, vancomycin.

Figure 5 below displays overall antibiotic starts and vancomycin starts for the four years from 2008–09 to 2011–12. Results are stratified by the type of vascular access. Rates are reported per 100 patient months.

The key findings are:

- arteriovenous fistula access – rates of antibiotic and vancomycin starts have reduced over time and the reduction is statistically significant (p = 0.008 and p = 0.003 respectively)
- arteriovenous graft access – antibiotic starts and vancomycin starts both appeared to be increasing until the most recent year, however overall the trend is not statistically significant
- permanent central line – rates of antibiotic and vancomycin starts appear to have remained relatively stable
- temporary central line – no instances of antibiotic or vancomycin starts were reported for any given year.

Figure 5: Rates of antibiotic starts and vancomycin starts by type of vascular access for 2008–09 to 2011–12 – per 100 patient months



Bloodstream infections by access type

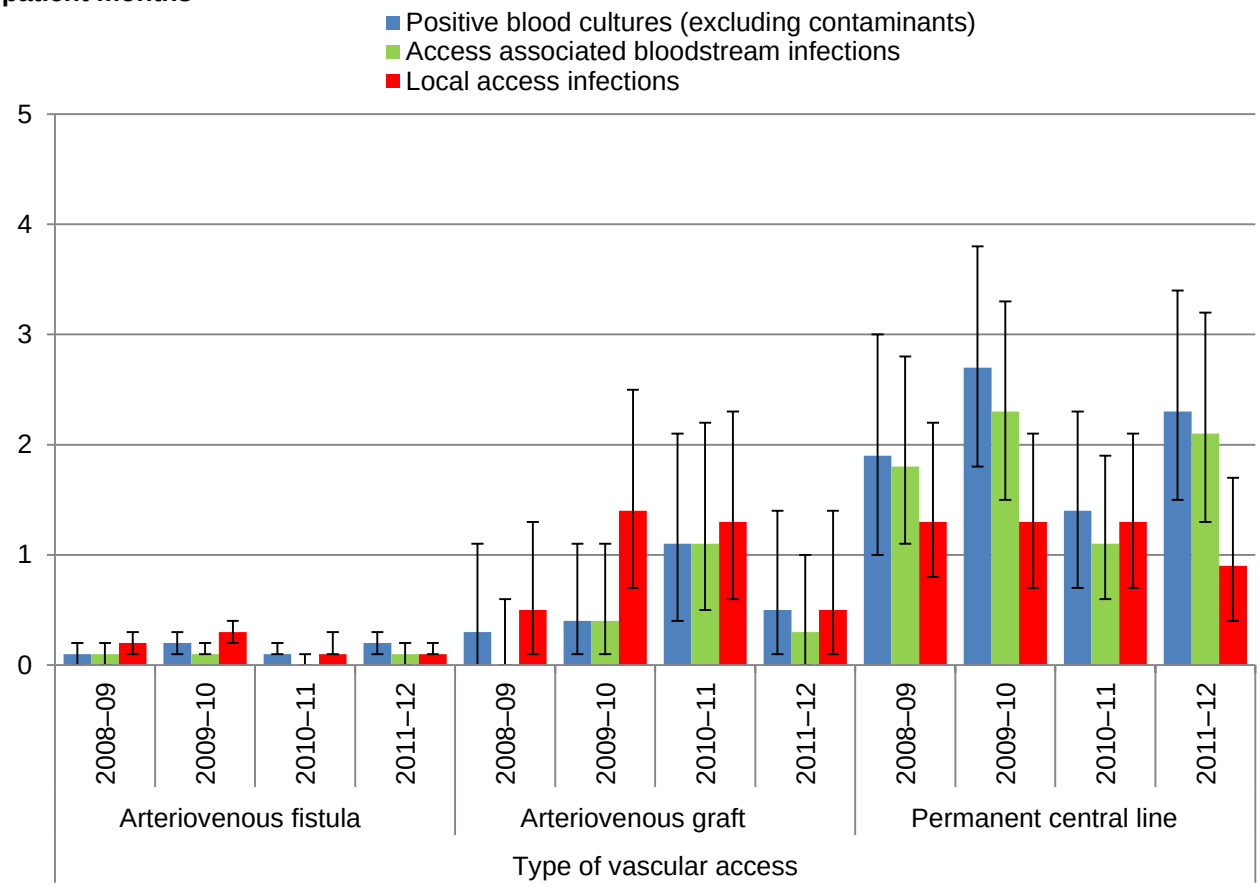
Figure 6 below displays rates of infectious events for 2008–09 to 2011–12. Rates are reported per 100 patient months. The haemodialysis surveillance may identify one of the following:

- positive blood cultures – isolation of any microorganism from a blood culture where contamination as a source has been excluded
- access-related BSI – positive blood culture with the suspected source is identified as the vascular access site or is uncertain, and where contamination as a source has been excluded
- local access infection – clinical symptoms of infection present but access-related BSI is not present.

Key findings are:

- arteriovenous fistula access – rates appear to have remained relatively stable
- arteriovenous graft access – rates have not changed significantly, and appeared lower in the most recent year but this was not statistically significant
- permanent central line – rates appear to have remained stable
- temporary central line – no infections reported
- rates of infectious events are lower in Victoria than reported by the NHSN.

Figure 6: Rates of infectious events by type of vascular access for 2008–09 to 2011–12 – per 100 patient months



Results from surveillance – surgical sites of infection (SSIs)

Introduction

This section consolidates the results from HAI surveillance of patients who have had specific types of surgery. In particular:

- abdominal hysterectomy
- caesarean section
- colorectal surgery
- coronary artery bypass surgery
- orthopaedic surgery (hip and knee replacement).

It describes the results of the:

- rates of SSI by surgical category with risk stratification
- types of causative organisms associated with SSI
- monitoring of surgical antibiotic prophylaxis.

Rationale for surveillance

Type of surgery

Patients undergoing different types of surgery have different risks of acquiring infections. For example, surgery where an implant is used (such as a knee replacement) has a higher risk than some other types of surgery. HAIs are monitored and reported for those types of surgery with the greatest infection risk.

Crude (unadjusted) infection rates

For the first time, crude infection rates have been provided in this report. A crude infection rate is an overall rate, not adjusted for the presence of any risk factors. Comparing these rates over time assumes that the mix of patients in each year has been similar. This assumption may be more valid for some procedures than others. For example, this may be valid for patients undergoing caesarean section, where gestational age remains constant and there is no alternative surgical procedure. In contrast, the population of patients undergoing cardiac bypass surgery may not be comparable over time, where alternative treatments, such as cardiac angioplasty, are increasingly used for management of ischaemic heart disease. It is conceivable that the risk profile of patients undergoing cardiac bypass could therefore change over time.

Risk stratification

Some patients will be at greater risk of infection than others having the same type of surgery. A major determinant of risk is the patient's general state of health, and also the type and length of the surgery.

To account for some of these differences in risk, patients undergoing surgery are allocated into risk categories depending on their risk of acquiring an infection. A patient in risk category 0 is expected to have less risk of a SSI than a patient in risk category 1, and so on.

One of the major considerations is that rates should be calculated based on groups of patients with a similar infection risk.

Superficial or deep/organ space infections

Infections are classified as superficial, deep or organ space. Superficial infections are generally less serious and can often be successfully treated with antibiotics alone. However, deep or organ space infections often require rehospitalisation and sometimes reoperation. Deep and organ space infections, as well as being more serious for patients, are considered the most reliable for investigating time trends or performing comparisons as they rarely go undetected – patients are usually readmitted to hospital. Deep and organ space infections are often combined into a single category for reporting purposes.

Antibiotic prophylaxis

Administering a dose of antibiotic prior to surgical procedures has been shown to be effective in reducing infections following many types of surgery. However, to be effective, the type of antibiotic chosen must be appropriate, and it must be administered at an optimal time to allow it to be present in the patient's tissues when the surgical incision is made.

Method

Active, patient-based prospective surveillance of SSI was conducted in accordance with *VICNISS surveillance (type 1/2) module surgical site infection (SSI): protocol*. This is based on the CDC NHSN, United States surveillance program. Surgical categories are classified as per the *VICNISS procedure groups, ICD10-AM codes and CMBS codes.* Antibiotic prophylaxis is assessed using the current version of the *Therapeutic guidelines antibiotic* and the guidelines from the National Surgical Infection Prevention Project in the United States.

Hospitals which conduct specific types of surgery monitor and collect data on a continuous basis for this measure. Data are submitted quarterly by participating health services to VICNISS Coordinating Centre. Analysis is conducted in accordance *VICNISS Surveillance type 1 module*.

Comparable data are available for the nine-year period 2003–04 to 2011–12. SSI results are presented as a rate per 100 procedures, stratified by risk category, and by overall infection or deep/organ space infection.

Rates of SSI by risk category

Table 6 below displays SSI rates by surgery type and risk index for 2010–11 and 2011–12. Higher rates of infection are usually seen in the higher risk categories (2–3). However the risk index is more predictive for some types of surgery than others.

Table 6: SSI rates by surgery type and risk index for 2010–11 and 2011–12

Procedure Group	Year	Total Procedures	Total valid infections	Infection rate by risk index (%)			
				Minus 1	0	1	2 & 3
Abdominal hysterectomy	2010–11	455	7	-	0.6	1.0	3.9
	2011–12	457	11	-	1.5	1.2	7.9
Appendicectomy	2010–11	56	1	-	-	0.0*	33.3*
	2011–12	112	0	-	-	0.0*	0.0*
CABG – chest and donor	2010–11	1,809	82	-	0.0*	3.9	6.2
	2011–12	1684	74	-	0.0*	3.0	8.4
CABG – chest only	2010–11	115	7	-	-	8.9	0.0*
	2011–12	106	4	-	-	4.4	2.7*
Caesarean section	2010–11	6,304	58	-	0.8	1.1	1.1
	2011–12	8,078	83	-	1.0	1.1	1.4
Cardiac surgery	2010–11	846	34	-	0.0*	3.6	3.9
	2011–12	769	19	-	0.0*	2.0	3.1
Cholecystectomy	2010–11	708	6	0.0	0.9*	5.8	0.0
	2011–12	861	2	0.0	0.4*	1.0	0.0
Colon surgery	2010–11	834	51	2.4	6.4	7.0	5.8
	2011–12	914	69	0.0	5.2	7.9	12.0
Craniotomy	2010–11	428	3	-	1.0	0.7	0.0
Herniorrhaphy	2010–11	203	1	-	0.0	1.4	0.0*
	2011–12	112	0	-	0.0	0.0*	0.0*
Hip prosthesis	2010–11	3,640	80	-	0.9	2.7	3.0
	2011–12	3,678	62	-	1.3	1.8	2.3
Knee prosthesis	2010–11	2,770	45	-	1.2	1.0	3.1
	2011–12	2,745	35	-	0.3	1.4	1.8
Vaginal hysterectomy	2010–11	111	1	-	1.6	0.0*	0.0*
	2011–12	151	2	-	0.0	3.1	0.0*

* Calculated rates based on fewer than 50 procedures.
- Not applicable

SSI: abdominal hysterectomy

Purpose

SSI surveillance data was collected for adult patients who had abdominal hysterectomy and where the infections were considered to be associated with that surgery.

Participation

Participation by Victorian public health services in SSI surveillance for this procedure is voluntary.

In 2010–11, four hospitals monitored and reported SSIs following 372 abdominal hysterectomies. In 2011–12, five hospitals monitored and reported SSIs following 690 abdominal hysterectomy procedures.

Twelve hospitals have participated in this data collection since reporting commenced in 2003–04, with a core group of three to four submitting data for most time periods. For this reason, time trends shown below must be interpreted with caution since hospitals do not continuously submit data for this procedure and hospitals may have stopped and started surveillance.

Observations on surveillance

Figure 7 displays the annual crude (unadjusted) infection rate for abdominal hysterectomy for Victoria. Comparing crude rates over the years assumes that the mix of patients in each year has been similar (see explanation under 'Rationale for SSI surveillance').

Figure 7: Annual SSI rates (crude rates) following abdominal hysterectomy – rates per 100 procedures

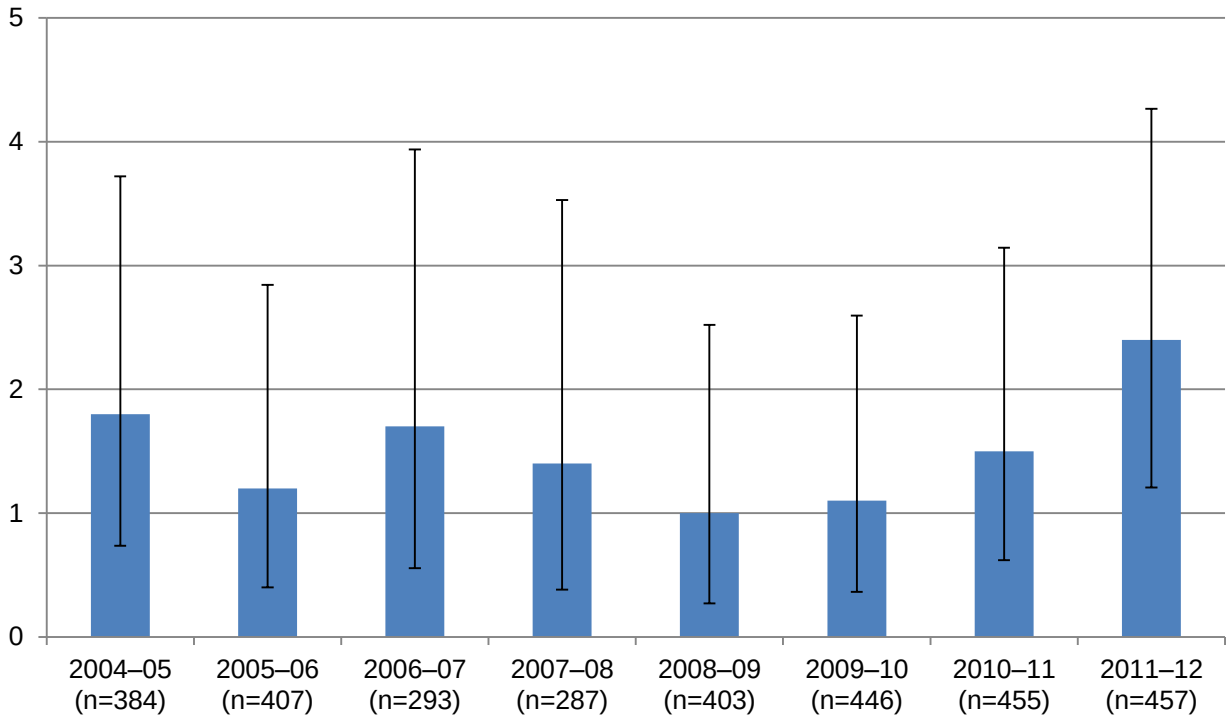
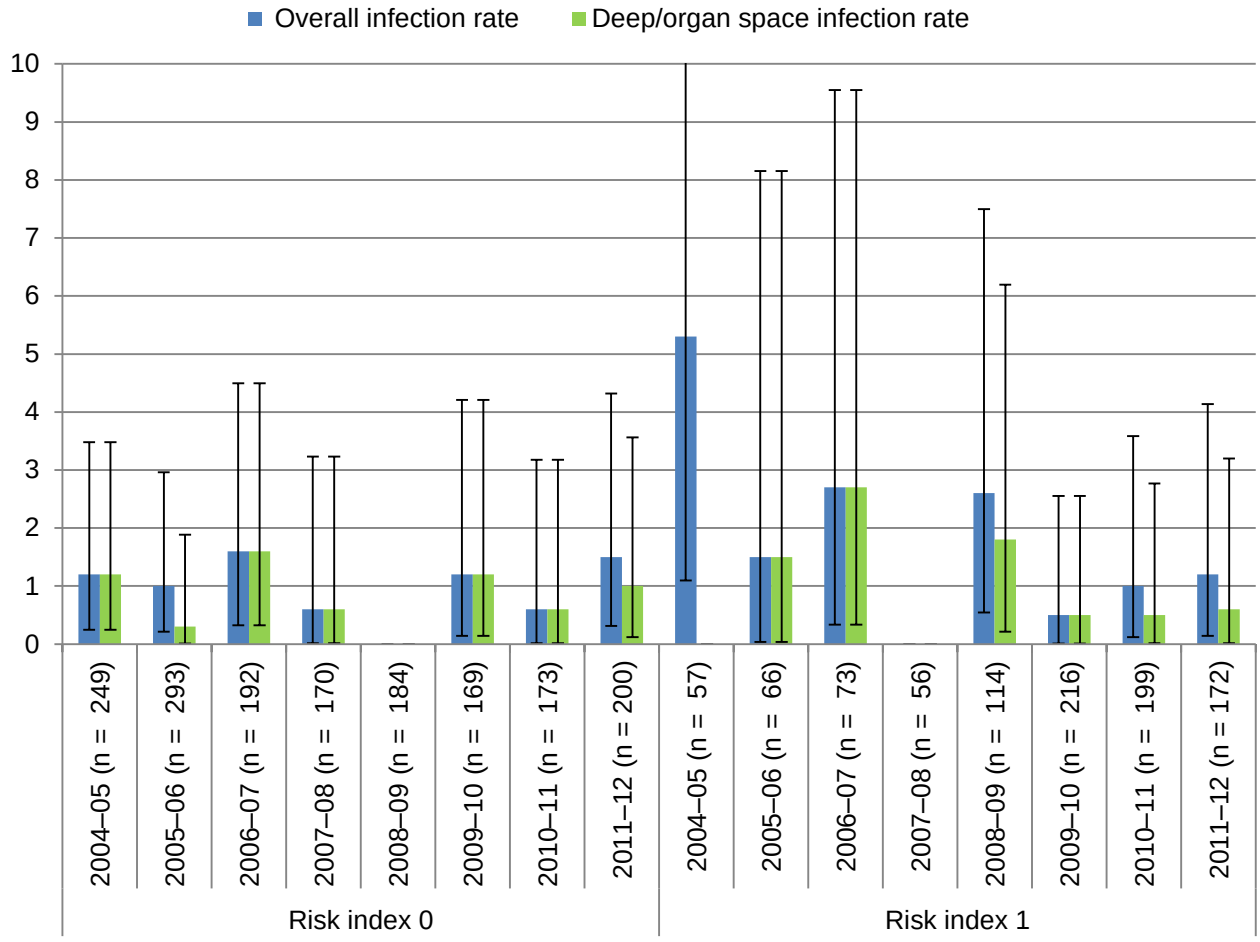


Figure 8 displays the annual SSI rates for abdominal hysterectomy by risk category since 2003–04. The figure ('n') represents the number of patients in the risk category for that year. Data is only included for procedures where a risk index was identified.

Total numbers of procedures are relatively low, and this is reflected in the wide confidence intervals surrounding these rates. Larger sample sizes provide better estimates of rates (see Appendix C). Trends are difficult to interpret.

Figure 8: Annual SSI rates by risk category following abdominal hysterectomy – rates per 100 procedures



SSI: caesarean section

Purpose

SSI surveillance data was collected for patients who patients who had caesarean section surgery and where the infections were considered to be associated with that surgery.

Participation

Participation in SSI surveillance for is mandatory for Mercy Health and The Royal Women's Hospital. For more information see the Victorian Health Service Performance Monitoring Framework www.health.vic.gov.au/hospital-performance.

Participation is voluntary for other Victorian public health services.

In 2010–11, 17 hospitals monitored and reported SSIs following 5,860 caesarean sections in risk indices 0 or 1. In 2011–12, 20 hospitals monitored and reported SSIs following 8,512 caesarean sections. This included two private hospitals.

Overall, 28 hospitals have submitted data for this procedure since surveillance began in 2003–04, including several private hospitals that began submitting data in 2009. Hospitals are not required to contribute continuously to this data. Participating hospitals have changed from year to year – more than surveillance monitoring of other procedures. A core group of about 10 to 12 hospitals have continuously contributed data so a trend analysis has been performed.

Observations on surveillance

Figure 9 displays the annual crude (unadjusted) infection rate for caesarean sections for Victoria. Comparing crude rates over the years assumes that the mix of patients in each year has been similar (see explanation under 'Rationale for SSI surveillance').

Figure 9: Annual SSI rates (crude rates) following caesarean sections – rates per 100 procedures

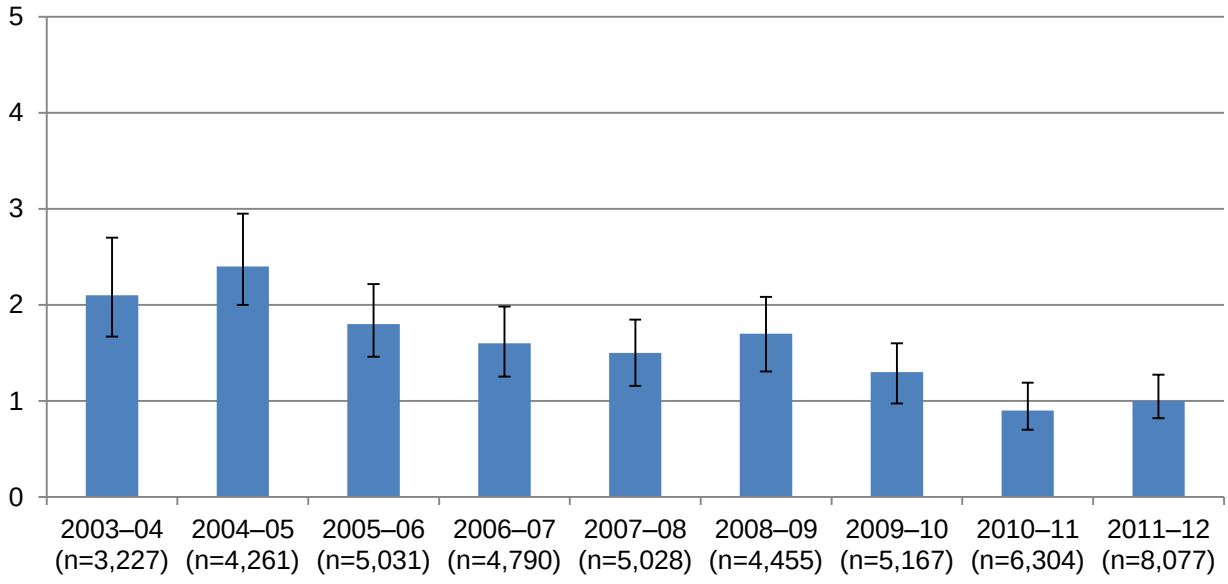
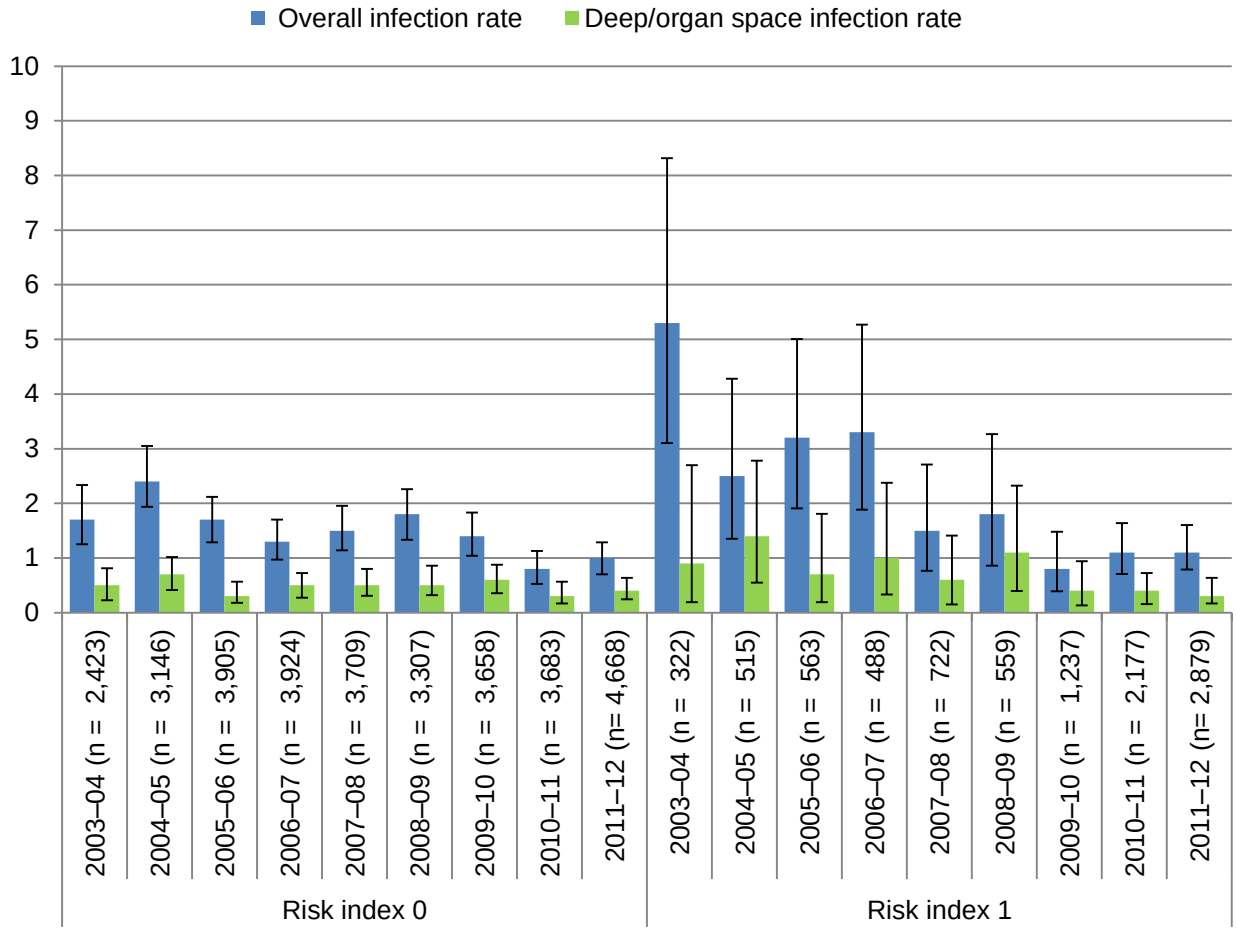


Figure 10 displays the annual SSI rates by risk category since 2003–04. The figure ('n') represents the number of patients in the risk category for that year. Data is only included for procedures where a risk index was identified.

Most caesarean patients fall into risk category 1, since they are younger and less likely to have chronic illnesses compared with patients undergoing surgery for heart conditions or joint replacements.

While regression analysis suggests that highly statistically significant decreases have occurred in these rates, caution must be exercised in interpreting this finding as a time trend given different hospitals have participated at different times. Decreases in infection rates have occurred in both risk indices and are statistically significant for all categories (except for deep infections in risk index 0) with p values of < 0.01 in each case.

Figure 10: Annual SSI rates by risk category following caesarean section – rates per 100 procedures



Causative organisms

Table 7 displays the frequency of causative organisms in SSIs following caesarean section. Note that '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 9. The most commonly reported organism was *S. aureus*, and this has remained constant during the entire period.

Table 7: Annual frequency of causative organisms following Caesarean section

Causative organisms	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12
	n=38	n=25	n=31	n=30	n=16	n=14
	%	%	%	%	%	%
Coagulase negative *Staphylococcus*	8	0	0	3	6	0
Enterobacter spp.	0	4	3	0	6	7
Escherichia coli	5	4	6	13	0	0
Other organism	32	24	19	23	13	29
Pseudomonas aeruginosa	0	4	3	3	6	0
Staphylococcus aureus	53	60	61	33	63	50
Staphylococcus aureus (MRSA)	3	0	0	17	6	14
Streptococcus spp. (Group B)	0	4	3	3	0	0
Streptococcus spp. (Group C & G)	0	0	3	3	0	0

Note: Due to rounding down or up of decimal places column percentages may equal approximately 100 per cent.

SSI: colorectal surgery

Purpose

SSI surveillance data was collected for adult patients who patients who had colorectal surgery and where the infections were considered to be associated with that surgery.

Participation

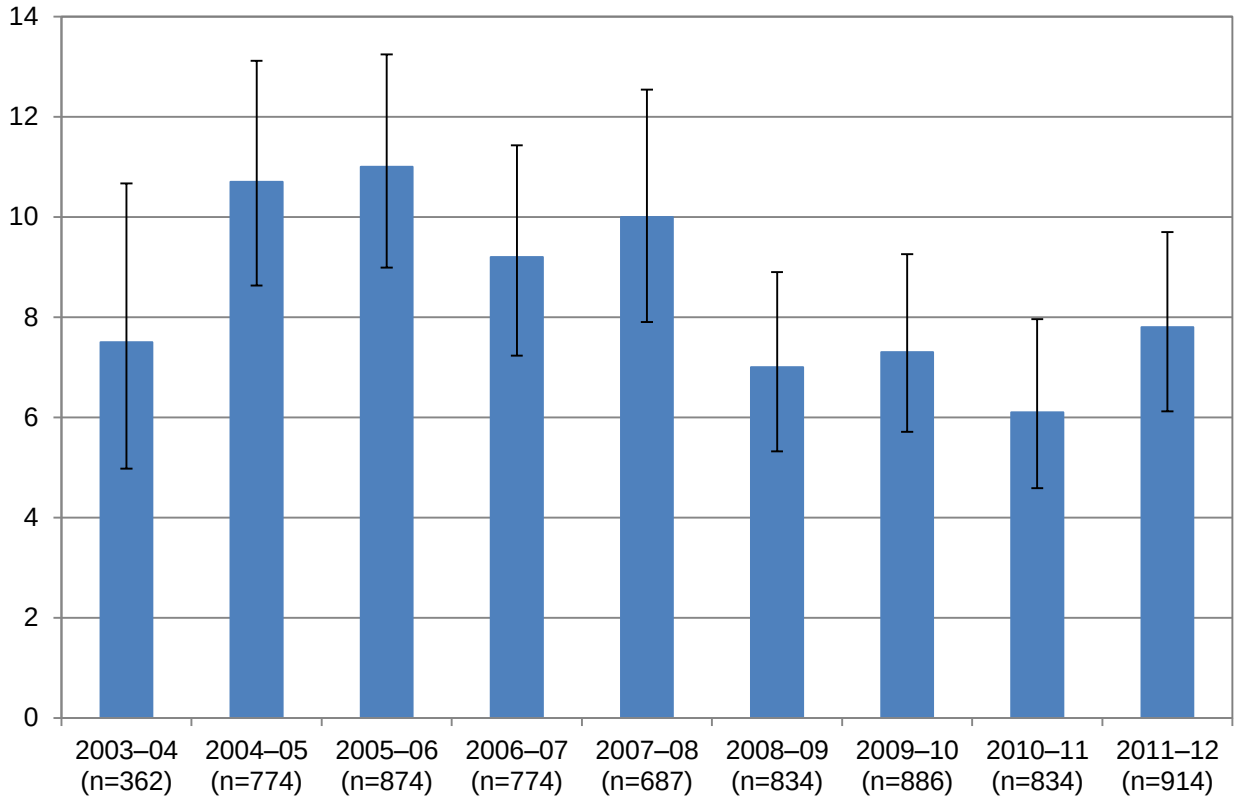
Participation by Victorian public health services in SSI surveillance for this procedure is voluntary. Fourteen have submitted SSI surveillance data for this procedure since 2002–03.

In 2010–11, nine hospitals monitored and reported SSIs following 749 colorectal surgeries where the patients were in risk index 0–3. In 2011–12, eight hospitals monitored and reported SSIs following 1,235 colorectal surgeries. This includes data from two private hospitals.

Observations on surveillance

Figure 11 displays the annual crude (unadjusted) infection rate for colorectal surgery for Victoria. Comparing crude rates over the years assumes that the mix of patients in each year has been similar (see explanation under Rationale for SSI surveillance).

Figure 11: Annual SSI rates (crude rates) following colorectal surgery – rates per 100 procedures

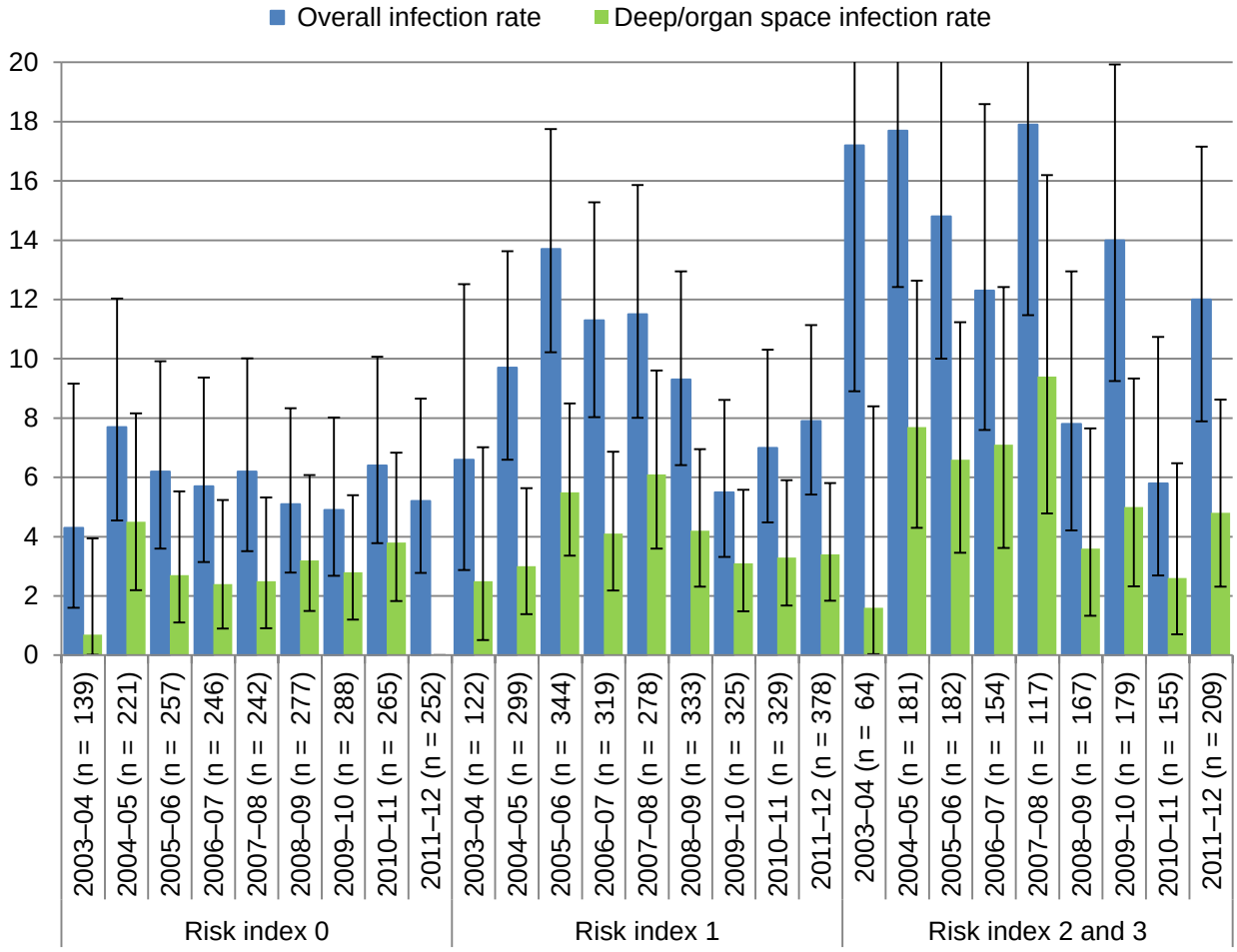


Any surgery that involves opening the gastrointestinal tract carries a higher risk of infection. This procedure is classified as 'dirty' surgery and, as expected, higher rates of infection are seen than for clean surgery such as joint replacements.

The definition of 'dirty' includes old traumatic wounds with retained devitalised tissue and those that involve existing clinical infection or perforated viscera. This definition suggests that the organisms causing postoperative infection were present in the operative field before the operation.[6]

Figure 12 displays the annual SSI rates by risk category since 2003–04. The figure ('n') represents the number of patients in the risk category for that year. Data is only included for procedures where a risk index was identified.

Figure 12: Annual SSI rates by risk category following colorectal surgery – rates per 100 procedures



[6] VICNISS Coordinating Centre July 2013, *Surveillance module, surgical site infection (SSI): protocol*, www.vicniss.org.au.

Data is presented for all SSIs as well as deep/organ space infections. Regression analyses of this data is encouraging in that it shows significant reductions for total infections in risk indices 1 and 2–3 with p values of 0.02 and 0.01 respectively. While participation in this surveillance is voluntary, a core group of eight to nine hospitals have participated for the past five to six years allowing trend analysis to be performed.

These reductions are encouraging, particularly since VICNISS Coordinating Centre has been working with one of the major data contributors to reduce their rates of SSIs following colon surgery.

Causative organisms

Table 8 shows the frequency of pathogens responsible for SSIs following colorectal surgery. Note that '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 11.

Staphylococcus aureus remains the most frequently reported pathogen. Methicillin-resistant *S. aureus* contributes a substantial proportion of these infections.

Gram-negative and other bacteria that make up bowel flora are more frequently identified as a cause of infections in colorectal surgery than in orthopaedic and cardiovascular 'clean' surgical procedures, where the surgical site is remote from the gut.

Table 8: Annual frequency of causative of causative organisms following colorectal surgery

Causative organisms	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12
	n=47	n=44	n=41	n=37	n=29	n=31
	%	%	%	%	%	%
Candida albicans	2	2	2	11	10	0
Coagulase negative *Staphylococcus*	0	2	0	3	0	0
Enterobacter spp.	0	7	0	0	10	7
Escherichia coli	23	18	15	22	7	23
Klebsiella spp.	0	2	0	5	10	3
Other organism	30	25	32	24	21	28
Pseudomonas aeruginosa	17	9	10	11	14	19
Pseudomonas spp.	0	0	0	3	0	0
Staphylococcus aureus	21	27	24	14	10	10
Staphylococcus aureus (MRSA)	6	5	12	8	17	10
Streptococcus spp. (group C and G)	0	2	5	0	0	0

Note: Due to rounding down or up of decimal places column percentages may equal approximately 100 per cent.

SSI: coronary artery bypass surgery

Purpose

SSI surveillance data was collected for adult patients who patients who had coronary artery bypass surgery (and donor sites were used to obtain grafts) and where the infections were considered to be associated with that surgery.

Participation

Participation in SSI surveillance is mandatory for Victorian public health services that undertake this procedure. For more information see the Victorian Health Service Performance Monitoring Framework www.health.vic.gov.au/hospital-performance.

Six public hospitals in Victoria perform coronary artery bypass surgery. All have submitted SSI surveillance data for this procedure since 2002–03. In January 2009 two private hospitals also began contributing data.

Eight hospitals monitored and reported SSIs following 1,796 and 1,988 coronary artery bypass surgeries in 2010–11 and 2011–12 respectively. This represents 100 per cent of Victorian public hospitals eligible to participate. Within the limits of data capture error, it includes 100 per cent of all coronary artery bypass surgery procedures performed across Victorian public hospitals since 2003–04.

Observations on surveillance

Figure 13 displays the annual crude (unadjusted) infection rate for coronary artery bypass surgery for Victoria. Comparing crude rates over the years assumes that the mix of patients in each year has been similar (see explanation under Rationale for SSI surveillance).

Figure 13: Annual SSI rates (crude rates) following coronary artery bypass graft surgery – rates per 100 procedures

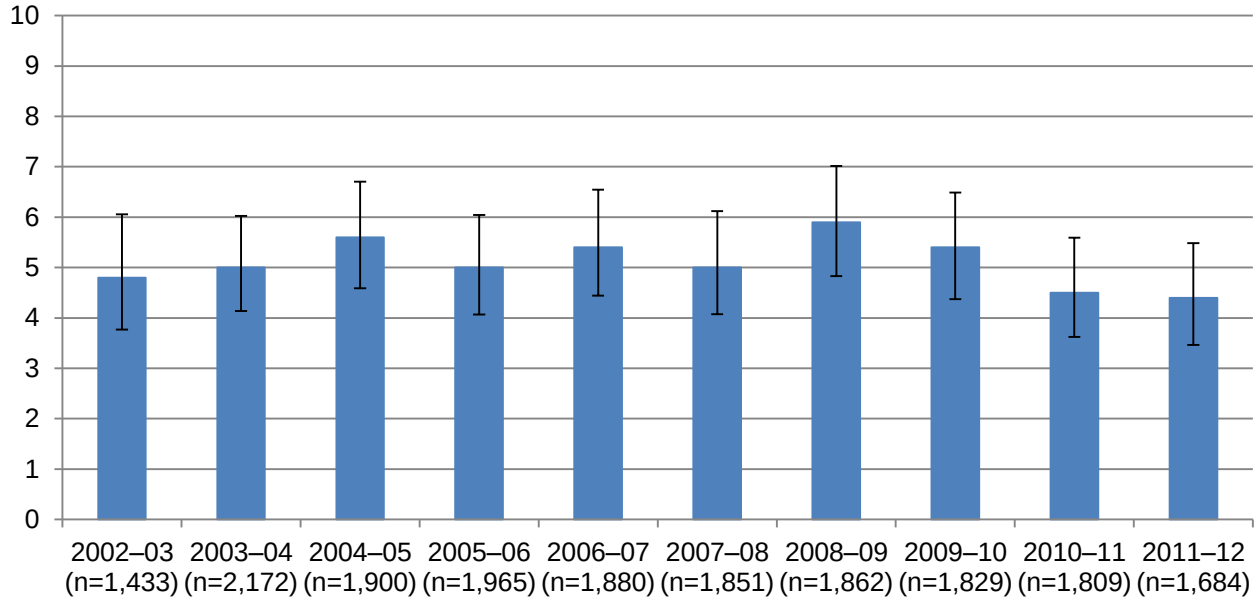


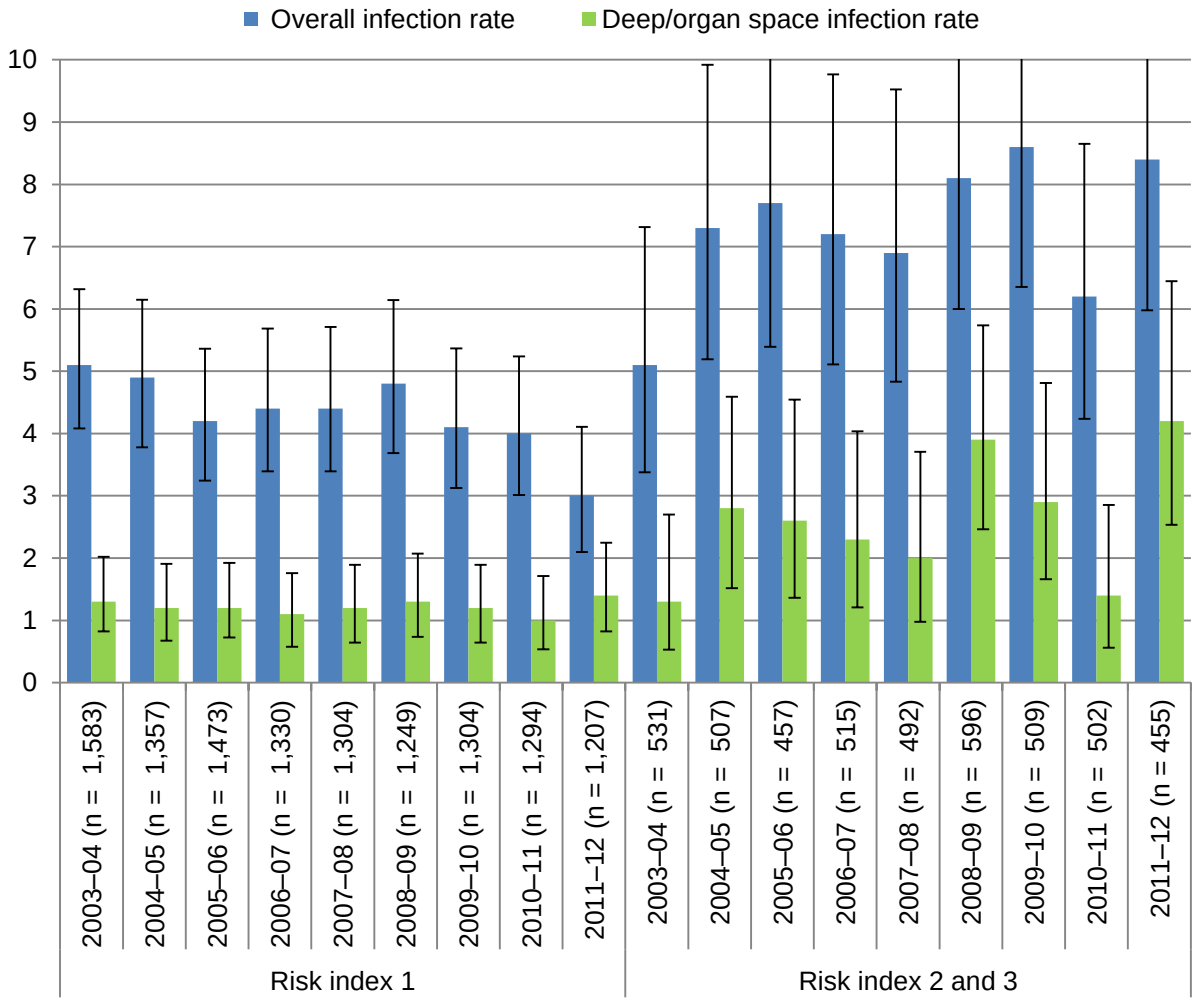
Figure 14 displays the annual SSI rates by risk category since 2003–04. The figure ('n') represents the number of patients in the risk category for that year. Data is only included for procedures where a risk index was identified.

Almost no patients undergoing coronary artery bypass grafts fell into risk category 0. This is not unexpected given that they are generally older and have heart disease – the reason for their surgery. The rates in risk categories 2–3 are higher, as would be expected, as these patients are considered to be at greater risk of infection.

The overall number of infections appears to be falling in risk index 1, which is the most populous risk index, with borderline statistical significance when analysed using Poisson regression (p = 0.05). On the other hand the rate of deep and organ space infections in patients in risk index 2–3 appears to be increasing and the increase appears to be statistically significant with a p value of 0.04.

This trend mainly appears to be influenced by the result in the most recent financial year when there was a noticeable increase in the infection rate. Both of these trends are borderline and may or may not represent real changes in the rates – other infection rates in this procedure group appear to be stable on statistical analysis.

Figure 14: Annual SSI rates by risk category following coronary artery bypass graft surgery – rates per 100 procedures



Causative organisms

Table 9 shows the frequency of causative organisms in SSIs following coronary artery bypass graft surgery. Note that '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 13.

Staphylococcus aureus remains the most commonly reported pathogen in these infections over the entire time period. The mix of aerobic Gram-negative pathogens has changed, with fewer *Acinetobacter* infections, which reflects a general reduction of this pathogen in major Victorian public hospitals in recent years. Awareness of reported pathogens may help guide choice of surgical antibiotic prophylaxis.

Table 9: Annual frequency of causative organisms following coronary artery bypass graft surgery

Causative organisms	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12
	n=66	n=66	n=87	n=67	n=53	n=53
	%	%	%	%	%	%
Acinetobacter spp.	0	0	0	0	0	0
Candida spp.	0	0	3	6	2	4
Coagulase negative *Staphylococcus*	5	3	6	12	13	11
Enterobacter spp.	8	6	9	6	6	11
Escherichia coli	3	2	2	1	0	4
Klebsiella spp.	0	3	0	1	6	2
Other organism	26	30	20	16	11	22
Proteus spp.	0	3	3	3	0	4
Pseudomonas aeruginosa	6	9	3	9	25	6
Staphylococcus aureus	39	32	47	39	28	30
Staphylococcus aureus (MRSA)	14	12	6	6	9	6

Note: Due to rounding down or up of decimal places column percentages may equal approximately 100 per cent.

SSI: orthopaedic surgery (hip and knee replacement)

Purpose

SSI surveillance data was collected for patients who had orthopaedic surgery (hip and knee replacement) and where the infections were considered to be associated with that surgery.

Participation

Participation in SSI surveillance is mandatory for Victorian public hospitals (100 beds or more) that undertake these two procedures, either as elective or emergency surgery. For more information see the Victorian Health Service Performance Monitoring Framework: www.health.vic.gov.au/hospital-performance.

Thirty hospitals have submitted data for these procedures since 2003–04, including six private hospitals that began submitting data in 2009.

In 2010–11, 28 hospitals monitored and reported SSIs following 3,560 hip replacements. In 2011–12, 29 hospitals monitored and reported SSIs following 5,074 hip replacements.

In 2010–11, 26 hospitals monitored and reported SSIs following 2,721 knee replacements. In 2011–12, 29 hospitals monitored and reported SSIs following 4,333 knee replacements.

Observations on surveillance – hip replacement

Figure 15 displays the annual crude (unadjusted) infection rate for hip replacement for Victoria. Comparing crude rates over the years assumes that the mix of patients in each year has been similar (see explanation under ‘Rationale for SSI surveillance’).

Figure 15: Annual SSI rates (crude rates) following hip replacement – rates per 100 procedures

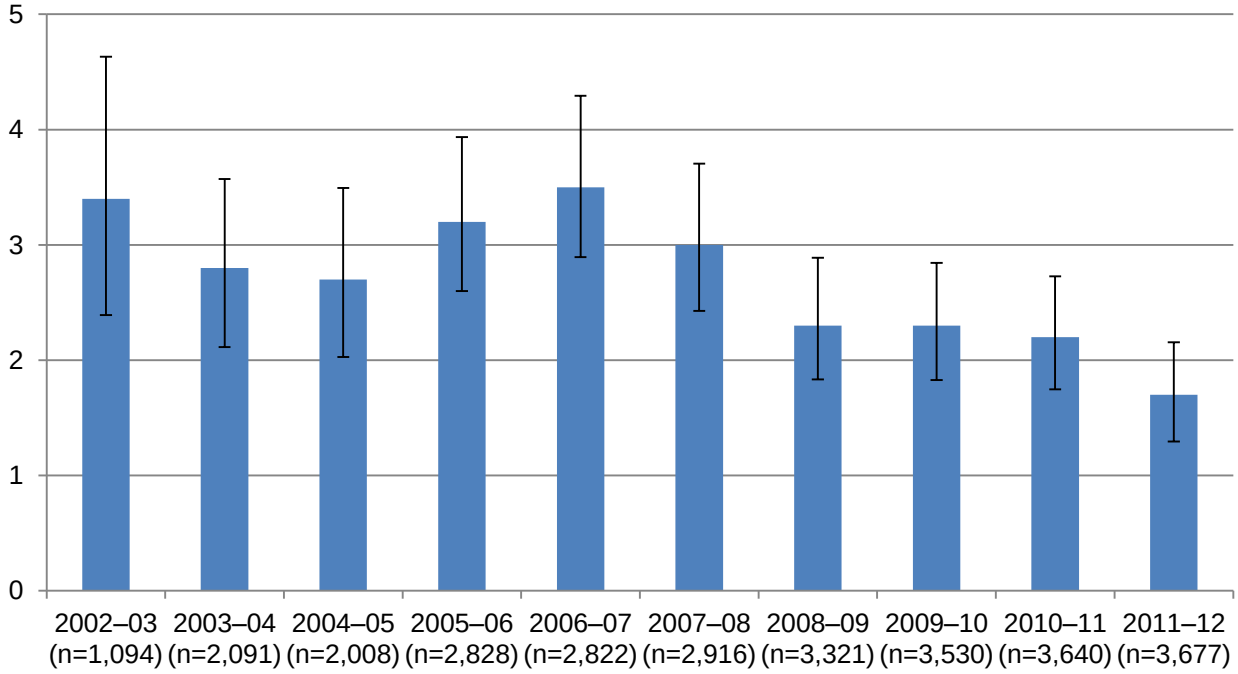
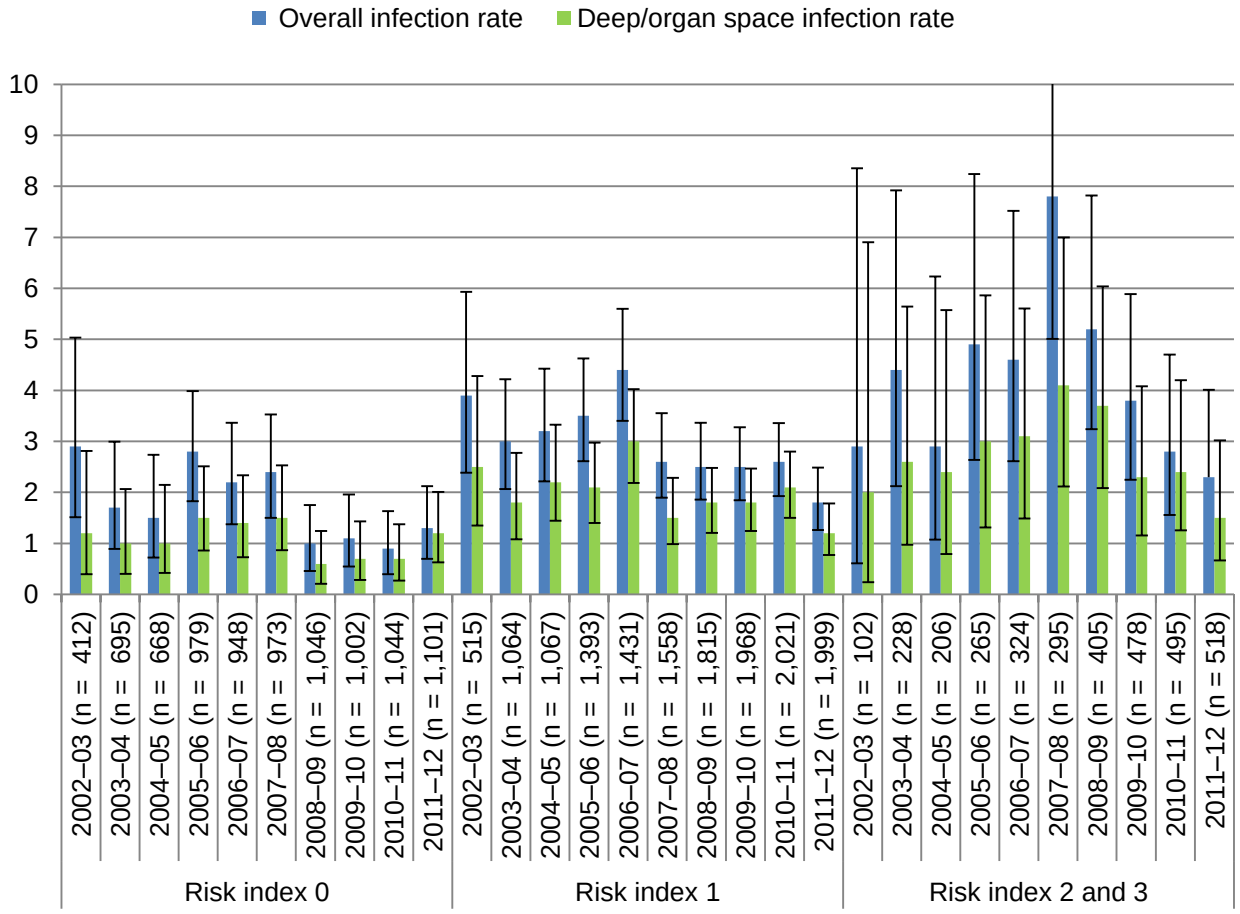


Figure 16 displays the annual SSI rates by risk category since 2003–04. The figure ('n') represents the number of patients in the risk category for that year. Data is only included for procedures where a risk index was identified.

There has been a marked decrease in overall infection rates in risk category 0 and 1, and also in deep infections in risk index 1. All of these categories showed statistically significant decreases with p values of < 0.001, < 0.001 and 0.04 respectively.

Risk index 2–3 exhibited an initial increase for the first few years and since then has decreased with no overall detectable trend. Participating hospitals and corresponding numbers of procedures have increased over the 10 year period in all risk indices.

Figure 16: Annual SSI rates by risk category following hip replacements - rates are per 100 procedures



Causative organisms – hip replacement

Table 10 displays the frequency of causative organisms in SSIs following hip arthroplasty. Note that '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 15.

The most frequently reported organism remains *Staphylococcus aureus*, and, most recently, methicillin-sensitive strains. This may have implications for antibiotic prophylaxis – see Bull, Worth and Richards 2012 for more on vancomycin surgical antibiotic prophylaxis (full reference in Appendix C).

Table 10: Annual frequency of causative organisms following hip replacement

Causative organisms	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12
	n=97	n=82	n=67	n=85	n=75	n=60
	%	%	%	%	%	%
Coagulase negative *Staphylococcus*	13	7	10	8	15	10
Enterobacter spp.	1	2	3	2	1	0
Enterococcus faecium	0	0	3	1	1	12
Enterococcus spp.	3	0	3	1	0	2
Escherichia coli	1	4	4	4	4	5
Other organism	23	22	10	7	23	10
Pseudomonas aeruginosa	10	15	16	14	15	17
Staphylococcus aureus	31	22	34	41	24	37
Staphylococcus aureus (MRSA)	18	28	15	21	17	8

Note: Due to rounding down or up of decimal places column percentages may equal approximately 100 per cent

Observations on surveillance – knee replacement

Figure 17 displays the annual crude (unadjusted) infection rate for knee replacement for Victoria. Comparing crude rates over the years assumes that the mix of patients in each year has been similar (see explanation under Rationale for SSI surveillance).

Figure 17: Annual SSI rates (crude rates) following knee replacement – rates per 100 procedures

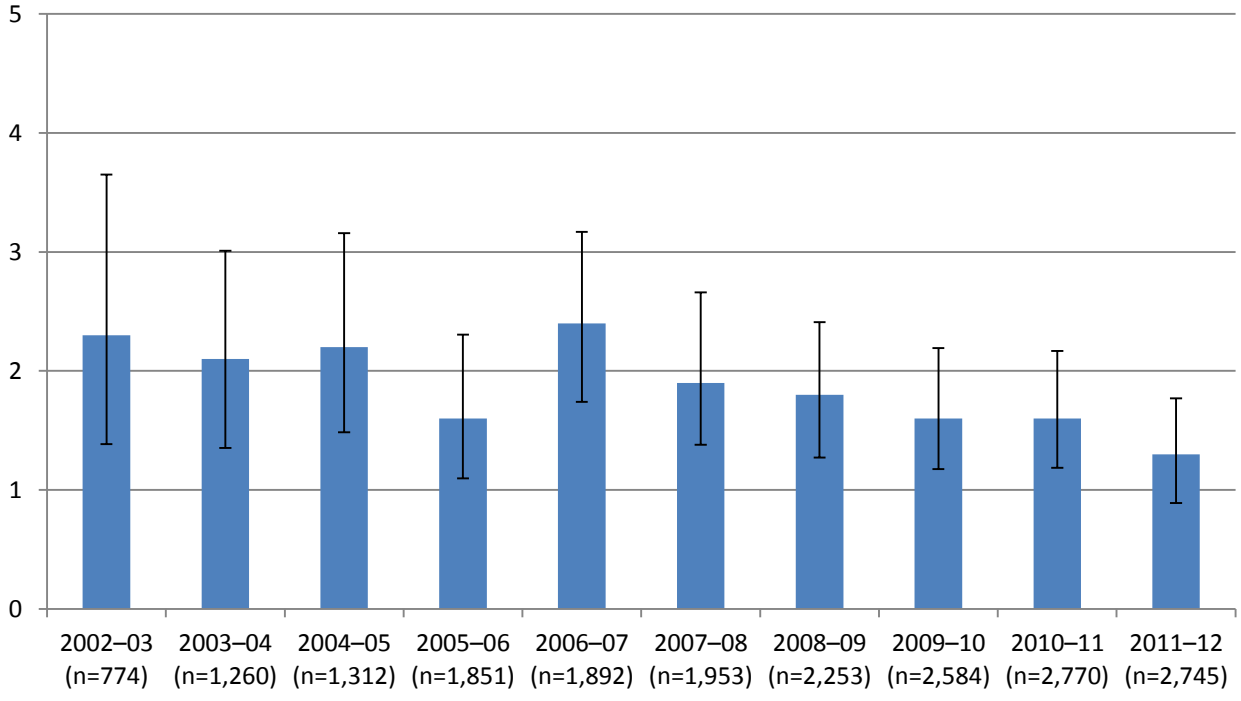
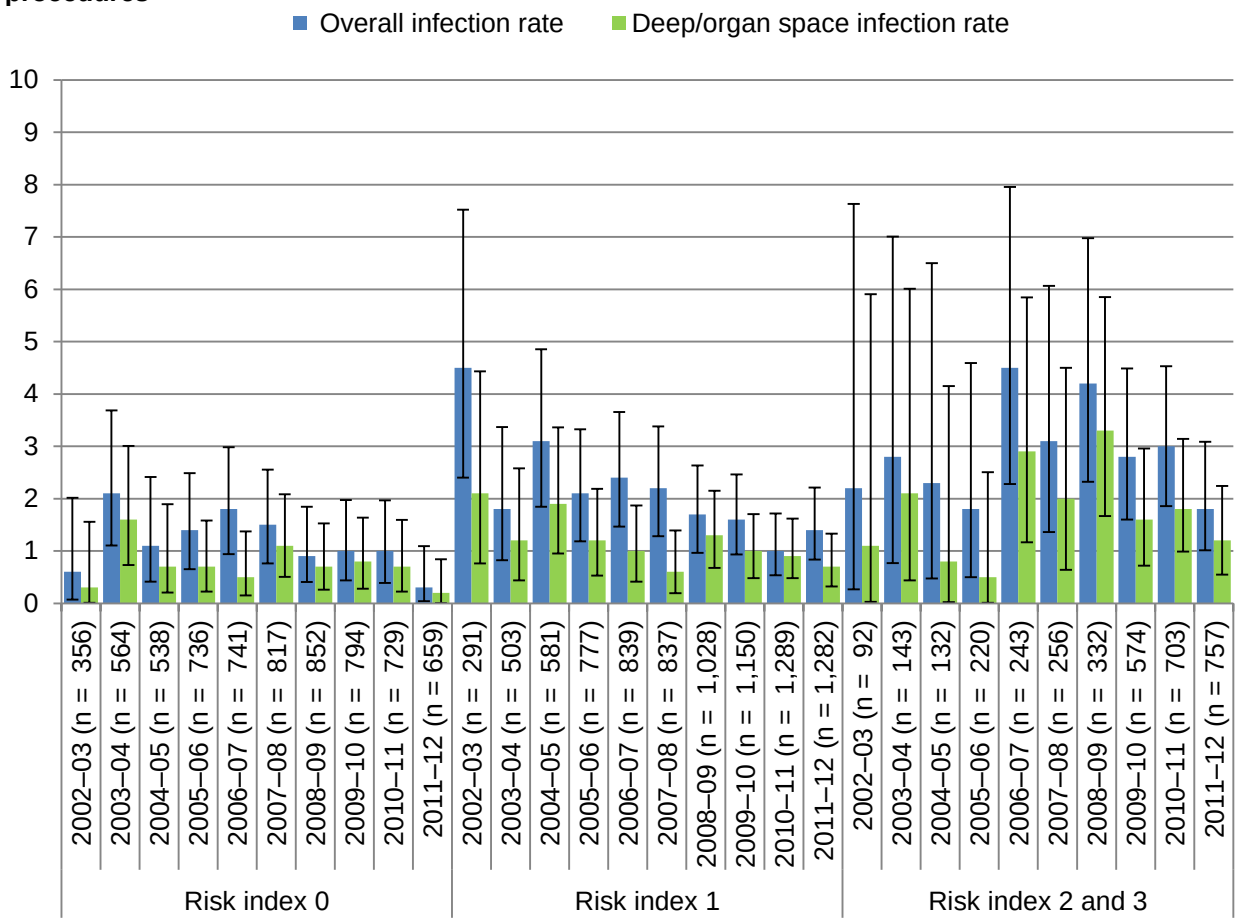


Figure 18 displays the annual SSI rates by risk category since 2003–04. The figure ('n') represents the number of patients in the risk category for that year.

All risk indices appear to exhibit a downward trend in recent years. Regression analysis confirms this trend with statistically significant decreases in overall infection rates for risk index 0 ($p = 0.04$) and 1 ($p < 0.001$) and for deep infections in risk index 1 ($p = 0.03$). No trend was detectable in the combined risk index 2–3.

Figure 18: Annual SSI rates by risk category following knee replacements – rates per 100 procedures



Causative organisms – knee replacement

Table 11 displays the frequency of causative organisms in SSIs following knee replacement. Note that '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 17.

Again, the most frequently reported organism was *Staphylococcus aureus*, and this has remained constant during the entire surveillance period.

Table 11: Annual frequency of causative organisms following knee replacement

Causative organisms	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12
	n=97	n=82	n=67	n=85	n=75	n=33
	%	%	%	%	%	%
Coagulase negative *Staphylococcus*	13	5	9	19	16	3
Other organism	21	11	18	29	32	24
Pseudomonas aeruginosa	0	5	3	14	2	6
Staphylococcus aureus	47	32	47	36	41	52
Staphylococcus aureus (MRSA)	13	47	12	2	0	6
Streptococcus spp. (group B)	3	0	6	0	5	6
Streptococcus spp. (group C and G)	3	0	6	0	5	3

Note: Due to rounding down or up of decimal places column percentages may equal approximately 100 per cent.

Process measure: surgical antibiotic prophylaxis

Observations on surveillance

Three measures are assessed:

- choice of an appropriate antibiotic
- administration of an antibiotic at the appropriate time
- duration of administration is appropriate (discontinued within 24 hours of surgery).

Results for the first two measures are shown below.

Measure 1: Choice of an appropriate antibiotic

Tables 12 and 13 are overall results for Victorian public health services. Data for type 1 (100 beds or more) and type 2 (fewer than 100 beds) are shown separately. Type 1 hospitals generally perform larger numbers of surgical procedures and also perform more complex surgeries such as cardiac surgery, compared with type 2 hospitals.

Individual hospitals have shown remarkable improvements in this area. These improvements are often a result of infection-control consultants using the data to demonstrate deficiencies to key staff and working with clinical and administrative staff to bring about changes in practice. In both type 1 and 2 hospitals data for compliance with antibiotic choice has always been high for orthopaedic and cardiac surgery and caesarean sections but more variable for other procedures. Improvements have been demonstrated for most of the procedures which showed lower levels of compliance initially.

Table 12: Percentage compliance with recommendations for antibiotic choice, type 1 hospitals

Reporting period	Cardiac (n=14,918) %	Caesareans (n=39,441) %	Colon surgery (n=5,409) %	Hysterectomy (n=2,122) %	Herniorrhaphy (n=1,618) %	Orthopaedic (n=39,176) %
2003–04	96	86	72	41	80	90
2004–05	97	90	79	49	34	97
2005–06	87	90	84	46	53	97
2006–07	91	90	79	40	64	98
2007–08	93	91	77	39	68	97
2008–09	97	92	94	35	76	98
2009–10	98	95	86	52	63	98
2010–11	98	96	85	57	78	98
2011–12	99	96	88	68	94	98

Table 13: Percentage compliance with recommendations for antibiotic choice, type 2 hospitals

Reporting period	Caesareans (n= 1,458) %	Cholecystectomy (n=1,996) %	Colorectal (n=1,020) %	Hysterectomy (n=1,252) %	Hernia repair (n=2,982) %	Orthopaedic (n=1,282) %
2004–05	82	79	73	38	33	91
2005–06	90	82	71	25	71	96
2006–07	81	85	85	54	85	98
2007–08	76	82	81	39	88	99
2008–09	94	76	84	36	90	98
2009–10	89	75	86	45	92	97
2010–11	94	89	81	46	95	99
2011–12	95	96	87	55	97	100

Data for hysterectomies is consistently lower and this may be because there is a lack of international consensus regarding the recommended antibiotics for this type of surgery compared with other surgery groups. Australian guidelines recommend administration of two antibiotics (a cephalosporin plus metronidazole) whereas US and Canadian guidelines recommend only a cephalosporin.

The evidence for use of two antibiotics is currently based on covering the expected microbial flora of the region and no antibiotic has so far been shown to be superior. Almost all of the surgeries performed in Victoria deemed to have been non-compliant have been categorised this way due to administration of a cephalosporin alone.

The VICNISS Coordinating Centre has been approached by gynaecologists and other interested parties regarding this issue and has referred these parties to the authors of the *Therapeutic guidelines: antibiotic*[7], which is reviewed every two years.

Measure 2: Timing of administration of antibiotics

Tables 14 and 15 show the percentage of patients who received prophylactic antibiotics at the appropriate time before surgery. This data is based on the same numbers of procedures as the previous tables. Improvements have been observed.

In the early years documentation was incomplete (for example, inadequately recorded time at which perioperative antibiotics were administered). While this is still a problem at some hospitals, both documentation of times and the appropriateness of the timing have shown improvements.

Achieving correct timing and documentation of antibiotic administration can be challenging and often involves coordination between surgeons and anaesthetists. It can be even more difficult for emergency and unplanned surgeries.

Correct timing is known to be an important aspect of antibiotic prophylaxis and contributes to the effectiveness of the antibiotic in reducing the risk of a surgical site infection. While documentation and timing have improved, there is still room for improvement generally across Victorian public hospitals with respect to correct timing of administration of antibiotics.

[7] Antibiotic Expert Group 2010, *Therapeutic guidelines: antibiotic*, version 14, Therapeutic Guidelines Limited, Melbourne, www.tg.org.au/index.php?sectionid=41, accessed 1 October 2013.

Table 14: Percentage compliance with timing of administration of antibiotics, type 1 hospitals

Reporting period	Cardiac %	Caesareans %	Colon surgery %	Hysterectomy %	Herniorrhaphy %	Orthopaedic %
2003–04	54	-	40	35	44	53
2004–05	55	-	62	66	24	74
2005–06	52	-	68	74	30	77
2006–07	57	-	69	56	25	75
2007–08	53	-	72	74	53	77
2008–09	57	-	72	41	78	81
2009–10	61	-	73	60	65	82
2010–11	58	-	82	50	62	87
2011–12	59	-	80	50	56	86

- Not applicable

Table 15: Percentage compliance with timing of administration of antibiotics, type 2 hospitals

Reporting period	Caesareans %	Cholecystectomy %	Colorectal %	Hysterectomy %	Hernia repair %	Orthopaedic %
2004–05	-	49	38	43	34	79
2005–06	-	62	64	63	50	79
2006–07	-	54	68	57	49	71
2007–08	-	57	62	57	53	67
2008–09	-	67	71	60	70	74
2009–10	-	81	66	73	74	75
2010–11	-	76	75	74	70	86
2011–12	-	78	80	71	79	94

- Not applicable

Measure 3: duration of administration is appropriate

Discontinuation of antibiotics is more related to slowing development of resistance to antibiotics and compliance is generally very high (data not shown).

Results from surveillance – specific organisms or types of organisms

Introduction

This section consolidates the results of HAI surveillance of patients who had the most common types of HAI bloodstream infections. In particular:

- *Clostridium difficile* infection (CDI)
- *S. aureus* bacteraemia (SAB).

Rationale for surveillance

Healthcare-associated bloodstream infections are a significant cause of mortality, and contribute to increased length of hospitalisation and associated healthcare costs.

Clostridium difficile infection

CDI is the most common cause of healthcare-associated diarrhoea. The effects of the disease vary from mild diarrhoea to colitis, toxic megacolon and death. The use of antibiotics as part of patient care increases the risk of this disease.

The disease has caused major problems in health services in the United States, Canada and Europe. Since 2000 there has been an increase in international rates of CDI associated with several epidemic strains of the organism which are characterised by increased toxin production and increased virulence. Some of these strains have recently been identified in Victoria.

To aid control of this pathogen in Australia, CDI has been identified as a national surveillance indicator under the National Healthcare Agreement. The specifications for this indicator remain in draft.

In Victoria, case reviews to identify healthcare-associated CDI were introduced so hospitals can identify cases attributable to their own facility. Statewide surveillance of hospital-identified cases of CDI commenced in October 2010. The results of the first nine months of surveillance are presented in this report.

Staphylococcus aureus bacteraemia (SAB)

SAB is the most common cause of HAI bloodstream infections. Many of these infections are related to a healthcare procedure (for example, the presence of a venous catheter), and are considered preventable.

Patients most at risk of contracting these infections are patients in acute care, or patients having regular haemodialysis or other invasive treatment such as chemotherapy.

SAB rates have been reported nationally by all jurisdictions on the Commonwealth Government MyHospitals Website www.myhospitals.gov.au since 2011.

Clostridium difficile infection (CDI)

Purpose

CDI surveillance includes all patients admitted to a public hospital with a *C. difficile* toxin positive specimen identified by a laboratory and confirmed by a suitably qualified healthcare worker, and where the infection was considered to be associated with their episode of care.

Participation

At the department's request, all Victorian public hospitals including (mental health facilities) must perform CDI surveillance. In 2011–12, all eligible public hospitals participated. Currently no private hospitals submit data for this module although several are planning to submit data in future.

Method

CDI surveillance was conducted in accordance with the *VICNISS surveillance module (type 1/2)* clostridium difficile *infection (CDI): protocol*. This surveillance module is based on the Australian Commission on Safety and Quality in Healthcare *Draft data set specification surveillance of healthcare associated infections:* Staphylococcus aureus *bacteraemia and* Clostridium difficile *infection (CDI)*, version 3.0 July/August 2010.

Hospitals collect data on a continuous basis for this measure. Data are submitted by participating health services to VICNISS Coordinating Centre quarterly for collation and analysis. Results are presented quarterly as rates per 10,000 occupied bed days. Comparable data are available from quarter 2 (Oct to Dec), 2010–11.

Observations on surveillance

Rates in this report represent cases most likely associated with healthcare. This is where symptom onset occurred in, or within four weeks of discharge from a healthcare facility.

According to Figure 19, rates of healthcare-associated CDI appear to be increasing. Regression analysis suggests this increase is highly statistically significant ($p < 0.001$) although the increase has not been maintained in recent quarters.

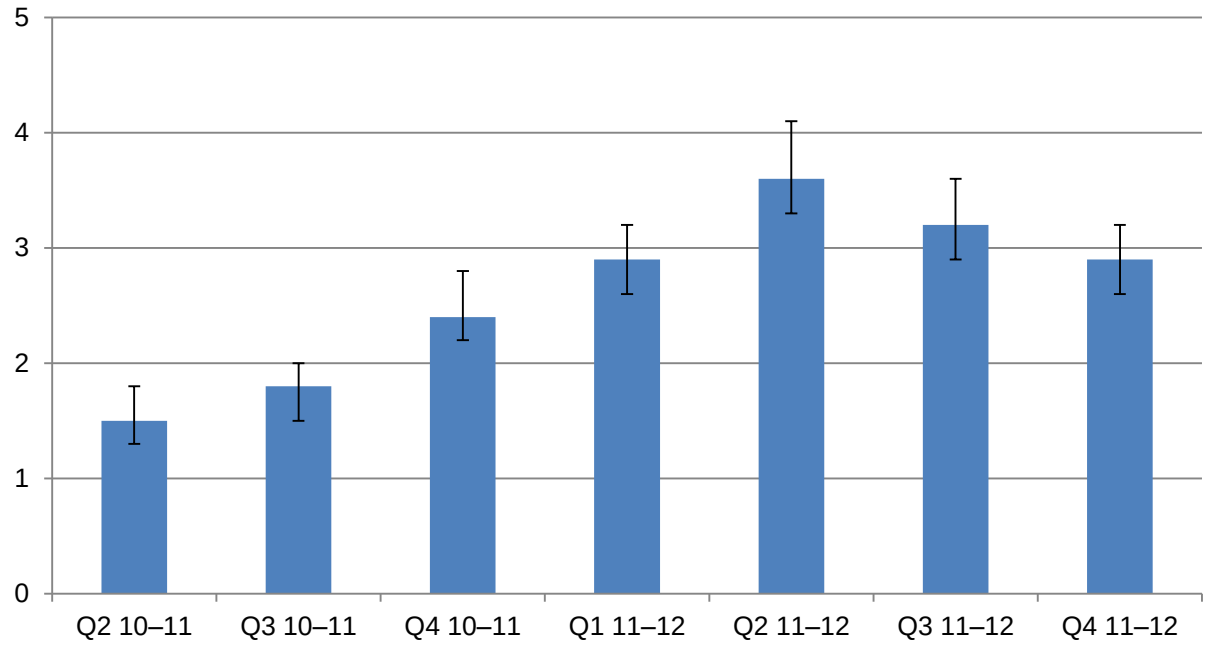
This increase may be partly explained by increased awareness and testing. Many conditions will increase initially following commencement of surveillance, particularly those where symptoms did not necessarily lead to laboratory testing prior to surveillance being instituted.

For example, whereas any patient with symptoms of a bloodstream infection was likely to be tested as a matter of course, whether or not surveillance was occurring, many patients with gastrointestinal symptoms would not ordinarily be tested. This may have changed somewhat with increased awareness of CDI. The situation will continue to be closely monitored.

Hypervirulent strains, those most associated with outbreaks and morbidity and mortality overseas, are still not being detected in appreciable numbers in Victoria. However, only a proportion of isolated strains are tested for hypervirulence.

There is currently no standardisation of testing protocols in Victoria, and the issues surrounding this are not always simple. For example, it is not always clear when testing for hypervirulence is indicated and/or justified and this will normally be a decision made by the treating clinician.

Figure 19: Quarterly rates of healthcare-associated Clostridium difficile in Victoria – rates per 10,000 occupied bed days



Strains with ribotypes associated with severe disease and those most associated with outbreaks and morbidity and mortality overseas are still not being detected in appreciable numbers in Victoria. However, only a proportion of isolated strains are sent for ribotyping. There is currently no standardisation of testing protocols in Victoria, and the issues surrounding this are not always simple. For example, it is not always clear when testing for ribotyping is indicated and/or justified and this will normally be a decision made by the treating clinician.

Staphylococcus aureus bacteraemia

Purpose

SAB surveillance includes all patients admitted to a public hospital with a bacteraemia caused by either methicillin-susceptible *S. aureus* (MSSA) or methicillin-resistant *S. aureus* (MRSA) and where the infection was considered to be associated with their episode of care.

Participation

Participation in SAB surveillance is mandatory for Victorian public hospitals (including mental health facilities). For more information see the Victorian Health Service Performance Monitoring Framework: www.health.vic.gov.au/hospital-performance.

In 2010–12, 100 per cent of eligible Victorian public health services participated.

Method

SAB surveillance was conducted in accordance with the *VICNISS surveillance module (type 1/2)* Staphylococcus aureus *bacteraemia (SAB): protocol*. This surveillance module is based on the Australian Commission on Safety and Quality in Healthcare *Draft data set specification surveillance of healthcare associated infections:* Staphylococcus aureus *bacteraemia and* Clostridium difficile *infection (CDI)*, version 3.0 July/August 2010.

Hospitals collect data on a continuous basis for this measure. Data is submitted quarterly by participating health services to VICNISS Coordinating Centre. Comparable data is available from the third quarter (January to March) of 2009–10. Rates of SAB are reported quarterly per 10,000 occupied bed days.

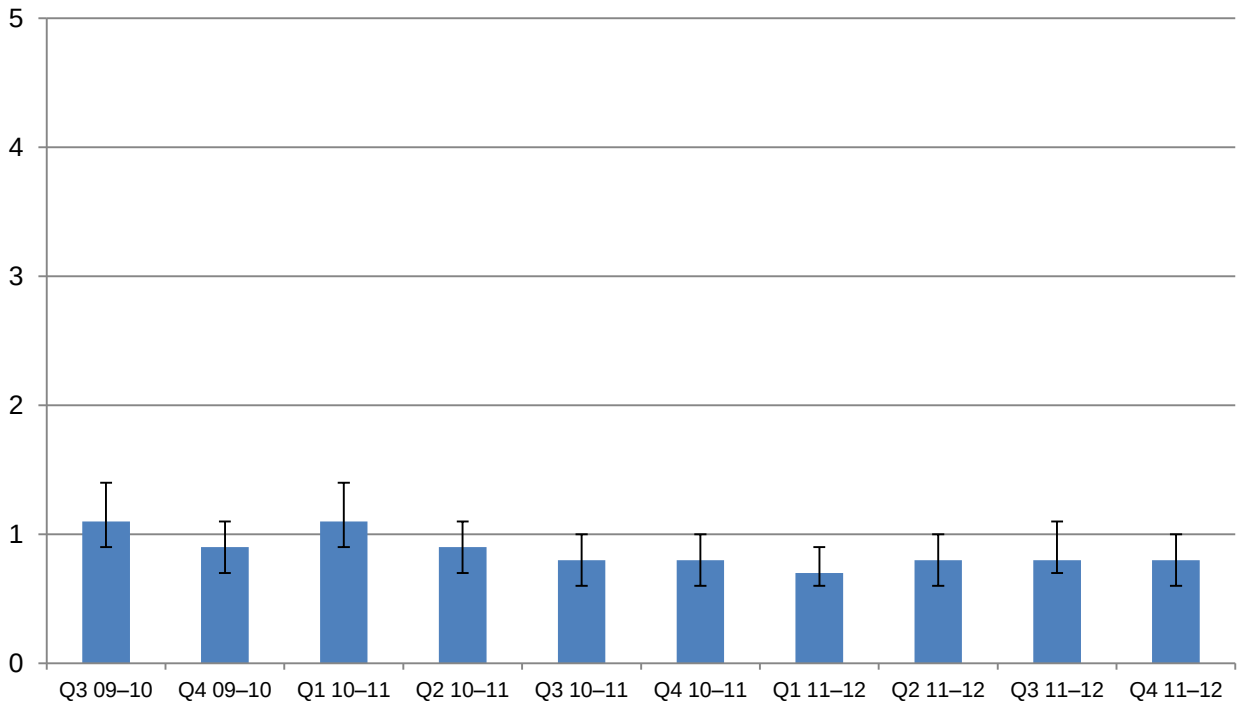
Observations on surveillance – SAB

Figure 20 displays rates of SAB calculated using occupied bed days as the denominator, including the hospital bed days accrued by patients most at risk for SAB.

SAB rates in Victoria appear to be decreasing, and Poisson regression analysis suggests that this decrease is likely to be a real decrease as the p value is highly statistically significant (p = 0.001). This is encouraging given that many of these infections are considered to be preventable.

A number of interventions have taken place in Victoria during this time which are thought to have contributed to this decrease including the introduction of the VICNISS surveillance program and the National Hand Hygiene Initiative.

Figure 20: Victorian quarterly *Stapyhlococcus aureus* bloodstream infection rate since 2009 – rates per 10,000 occupied bed days



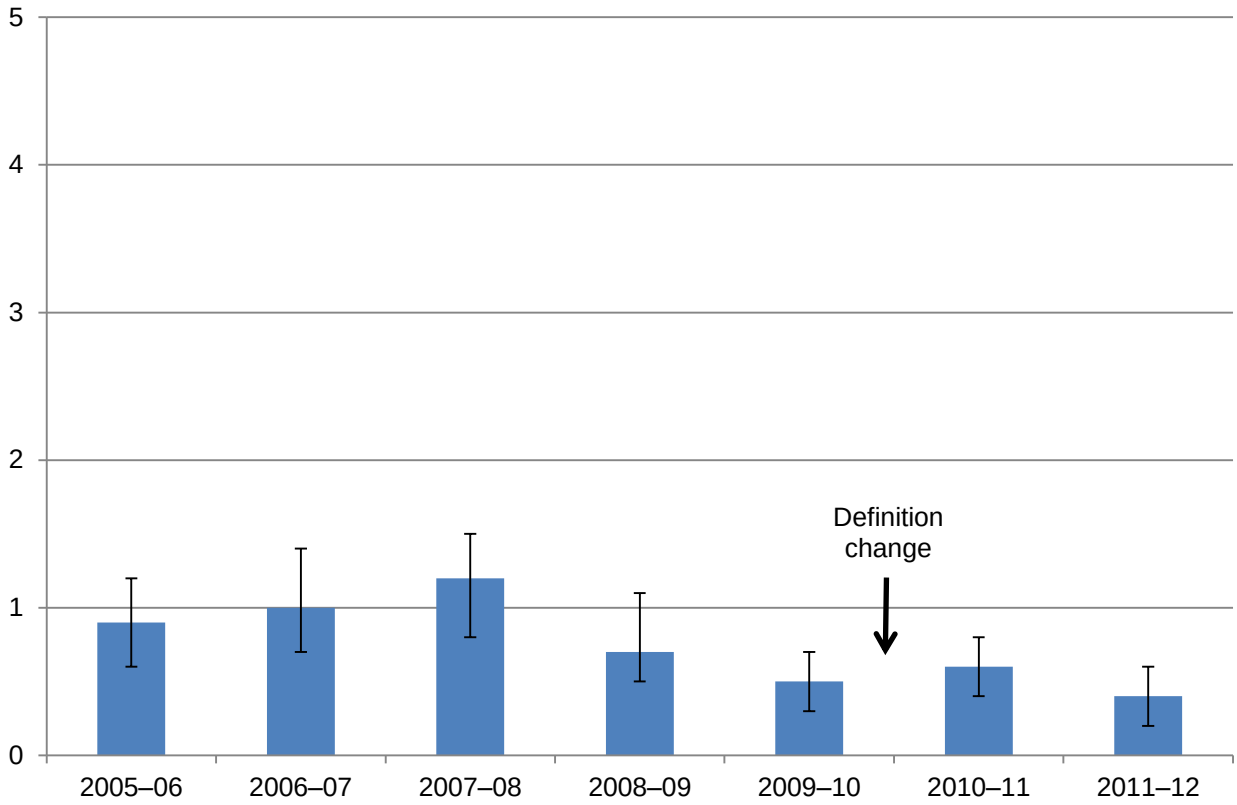
Observations on surveillance – methicillin resistant *Staphylococcus aureus* (MRSA) infections (type 2 hospitals)

Figure 21 displays an aggregate rate of MRSA infections per 10,000 occupied bed days for type 2 hospitals (fewer than 100 beds). These rates are for all infections (not just bloodstream infections) classified as healthcare associated; that is the patient's first positive specimen was collected more than 48 hours after admission (or within 48 hours of discharge from hospital) or within 48 hours of admission where certain key clinical criteria were met.

The clinical criteria include such situations as surgery within 30 days prior to the positive MRSA specimen. Patients returning positive cultures within 48 hours of admission who do not meet the clinical criteria are considered to have a community acquired infection.

Note that the definition described above came into effect from the 1 July 2010. Prior to this the definition was less specific and consisted of basically separating infections diagnosed within 48 hours of admission (considered community acquired) from those diagnosed greater than or equal to 48 hours after admission (considered healthcare associated). The data for the two time periods should be compared with caution as any change to definitions can affect the rates of infection.

Figure 21: Annual healthcare-associated MRSA infection rates for Type 2 hospitals – rates per 10,000 occupied bed days



Results from surveillance – healthcare worker immunisation and occupational exposures

Introduction

This section consolidates the results from HAI surveillance of occupational exposures of healthcare workers in Victorian public health services. In particular:

- healthcare worker uptake of the seasonal influenza vaccination
- occupational exposures in smaller health services.

Purpose and rationale for surveillance

Healthcare staff are considered to be a group of special interest for influenza vaccination, since vulnerable patients who are exposed to a healthcare staff member with influenza can become infected. Additionally, reduction in healthcare staff numbers due to illness will adversely affect the care of vulnerable patients. The National Health and Medical Research Committee (NHMRC) recommends that all healthcare workers involved in direct patient care should be vaccinated.

The department provides seasonal influenza vaccination free of charge to Victorian health services for their healthcare workers.

Occupational exposures constitute a risk to healthcare workers and most are considered preventable with use of safety engineered medical devices. It has been estimated that there are up to 18,000 sharps injuries in Australia each year and they are one of the most common causes of physical, pathological and psychological hazards for many healthcare workers. VICNISS collates data on these exposures in small health services however does not currently collate the data in large health services.

Healthcare worker seasonal influenza vaccination uptake

Purpose

To identify the proportion of healthcare workers vaccinated against seasonal influenza.

Participation

All Victorian public health services can request the seasonal influenza vaccination to immunise their staff. For more information: www.health.vic.gov.au/immunisation.

In 2010–11 and 2011–12, Victorian public health services were asked in writing by the department to participate in this measure. Almost all hospitals have submitted data each year. In 2012, 99 per cent of all Victorian public health services participated.

Method

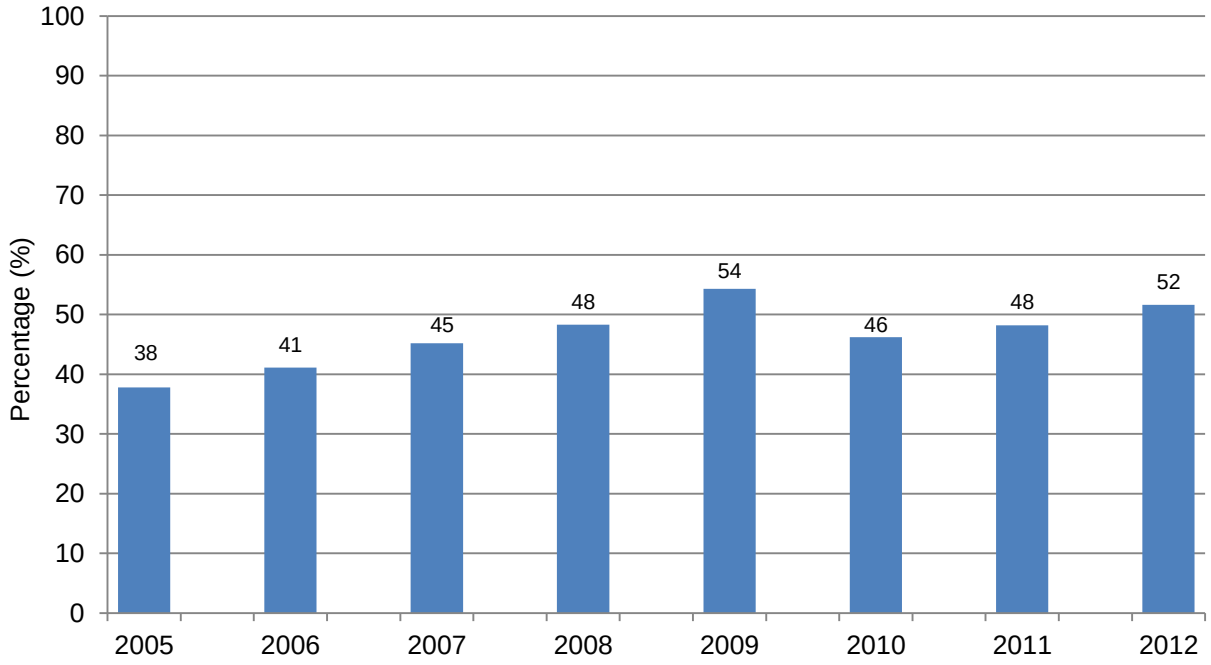
Surveillance was conducted in accordance with the *VICNISS surveillance module: staff influenza vaccination: protocol*. Hospitals collect data on a continuous basis for this measure. Data are submitted quarterly by participating health services to VICNISS Coordinating Centre.

Results are presented as the proportion of staff known to be immunised by clinical category. Comparable data are available for the seven-year period 2005 to 2012.

Observations on the surveillance data

Figure 22 displays the percentage of staff in Victorian public health services known to be vaccinated against seasonable influenza from 2005 to 2012. There has been overall increase in the total proportion of staff known to be vaccinated against seasonal influenza over the seven year period.

Figure 22: Overall percentage of staff known to be immunised against seasonal influenza

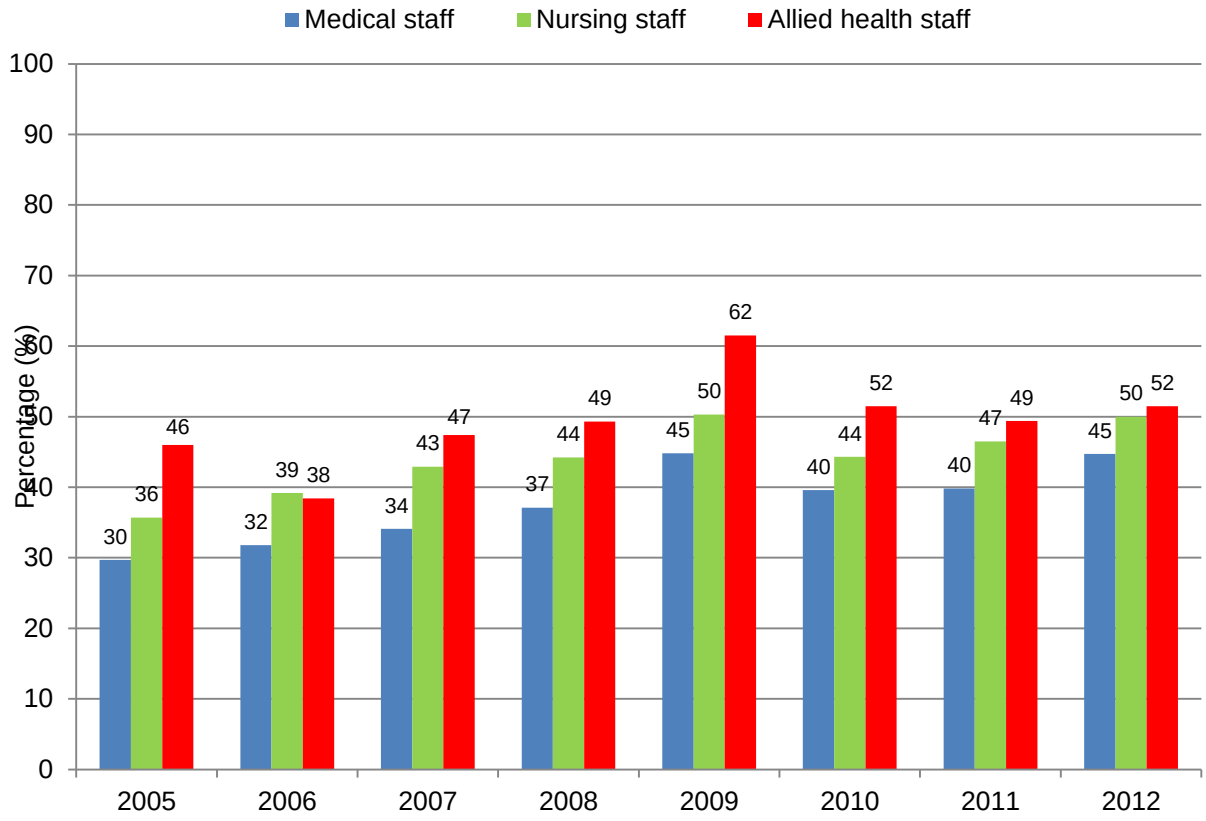


Not all hospitals are able to report for the different staff groups. Table 16 and Figure 23 display the results for those hospitals that were able to provide these data. Importantly, there has been a significant increase in the proportion of medical, nursing and allied health staff vaccinated. These clinical staff groups are usually involved in direct patient care.

Table 16: Proportion of staff known to be immunised for seasonal influenza by major and minor staff groups

Reporting period		Medical	Nursing	Allied health	Other	Non-clinical	Laboratory	Emergency department staff
2005	Number of staff	5,410	19,412	4,529	7,239	5,529	740	N/A
	Proportion vaccinated	29.7	35.7	46	50.8	37.4	41.6	N/A
2006	Number of staff	7,733	26,566	6,018	5,566	11,485	1,021	N/A
	Proportion vaccinated	31.8	39.2	38.4	51.3	46.7	52.2	N/A
2007	Number of staff	7,984	24,832	6,683	6,301	9,533	1,389	N/A
	Proportion vaccinated	34.1	42.9	47.4	51.2	47.2	42.6	N/A
2008	Number of staff	9,980	34,434	10,110	10,724	10,931	1,829	6,722
	Proportion vaccinated	37.1	44.2	49.3	55	46.7	50.4	52.2
2009	Number of staff	6,453	25,728	5,730	9,945	9,691	1,363	8,111
	Proportion vaccinated	44.8	50.3	61.5	57.8	43.9	58.4	57.5
2010	Number of staff	7,967	32,150	8,657	11,548	10,792	1,816	5,572
	Proportion vaccinated	39.6	44.3	51.5	48.2	48.2	49.0	53.7
2011	Number of staff	10,877	38,484	11,105	12,040	10,401	1,741	5,455
	Proportion vaccinated	39.8	46.5	49.4	56.1	50.0	49.9	55.0
2012	Number of staff	13,142	43,146	13,058	13,646	13,395	2,025	4,693
	Proportion vaccinated	44.7	50.1	51.6	57.5	46.1	57.1	54.3

Figure 23: Percentage of clinical staff known to be immunised 2005 to 2012



Occupational exposures in smaller health services

Purpose

Transmission of bloodborne pathogens through occupational exposures such as needlestick injuries represent a significant risk to healthcare workers.

Occupational exposures to blood or body fluids in healthcare settings have the potential to transmit hepatitis B, hepatitis C or human immunodeficiency virus (HIV).

Participating organisations

Participation by Victorian public health services in this surveillance module is voluntary. Only type 2 health services (less than 100 beds) participate in notification of occupational exposures.

Data collection

Surveillance was conducted in accordance with the *VICNISS type 2 occupational exposure surveillance data collection form* as needed. This is based in part on the CDC *Workbook for designing, implementing and evaluating a sharps injury prevention program* and NSW Health *Infection control program quality monitoring indicators user manual*.

Health services submit data if an occupational exposure is reported. Comparable data are available from 2006–07 to date. Results are presented annually as the number of exposures per 10,000 acute occupied bed days.

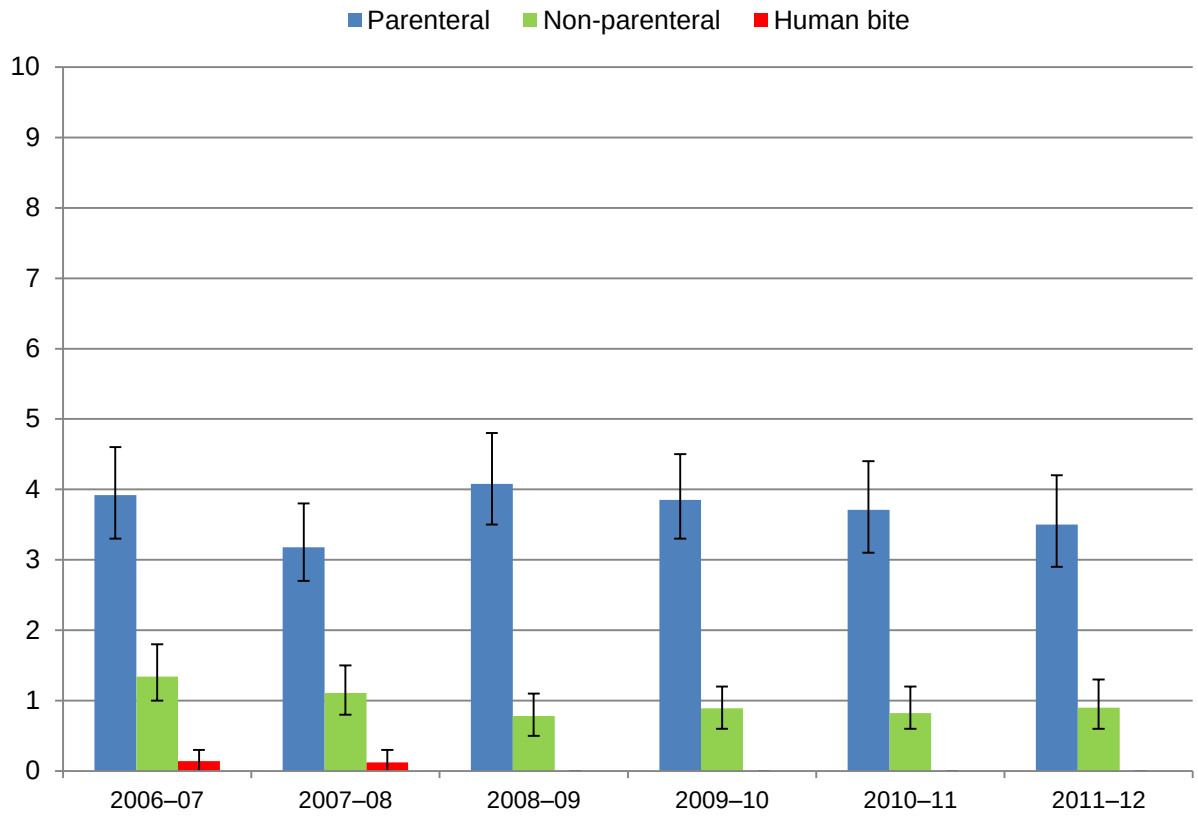
Observations on the surveillance data

There are three key types of occupational exposures involving acute patient sources:

- parenteral exposure – the piercing of skin with a contaminated sharp (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)
- non-parenteral exposure – when blood or other potentially infectious materials makes contact with the eye, mouth, other mucous membrane or non-intact skin contact
- human bite.

The results are displayed in Figure 24 below. The Victorian Blood Exposure Surveillance Group (ViBES), a voluntary group comprising 18 large health services which collates similar data. ViBES recently reported a rate of 5.5 percutaneous exposures (equivalent to parenteral and non-parenteral combined) per 10,000 occupied bed days. The rates for the type 2 hospitals (fewer than 100 beds) are comparable to those reported from type 1 hospitals (100 beds or more).

Figure 24: Annual rates of occupational exposures by exposure type for Type 2 hospitals – number of exposures per 10,000 occupied bed days



Glossary

Term	Definition
Antibiotic prophylaxis	Use of antibiotics prior to surgery to prevent infections at the surgical site
ASA score	American Society of Anaesthesiology score – designed to assess the patient's physical status. Ranges from 1 for a healthy patient to 5 for a patient who is not expected to survive 24 hours post-surgery
Bloodstream infection (BSI)	Presence of live pathogens in the blood, causing an infection
CDC	Centers for Disease Control and Prevention (United States)
CDI / *C. difficile*	*Clostridium difficile* infection
Central line / central venous catheter (CVC)	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
Central line-associated bloodstream infection (CLABSI)	A bloodstream infection thought to have been caused by the presence of a central line
Cholecystectomy	A surgical procedure to remove the gallbladder
CNS	Coagulase-negative *Staphylococcus*
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
the department	the Department of Health
Healthcare-associated infection (HAI)	Any infection that occurs during or after hospitalisation that was not present or incubating at the time of the patient's admission
Infection	Invasion of pathogenic micro-organisms in a bodily part or tissue that may produce tissue injury and progress to disease
Intensive care unit (ICU)	A hospital unit that usually treats very sick patients. Patients in intensive care units are at a higher risk of developing infections
Methicillin-resistant *Staphylococcus aureus* (MRSA)	A methicillin (antibiotic) resistant strain of *Staphylococcus aureus*
Neonatal	A baby within the first four weeks of birth
NHSN	The National Healthcare Safety Network is a surveillance system that integrates patient and healthcare personnel safety surveillance systems managed by the Division of Healthcare Quality Promotion (DHQP) at CDC
Non-parenteral exposure	Blood or other potentially infectious materials makes contact with the eye, mouth, other mucous membrane or non-intact skin contact

Term	Definition
Occupied bed days (OBD)	Number of days a patient is admitted to a hospital bed
Outcome indicator	An indicator that measures an outcome (for example, infection rate)
Pathogen	An agent of disease. The term pathogen is used most commonly to refer to infectious organisms such as bacteria, viruses and fungi
Parenteral exposure	Piercing of skin with a contaminated sharp instrument
Peripheral line / peripheral venous catheter (PVC)	An intravenous (IV) catheter inserted into a vein, usually in the arm
Peripheral line-associated bloodstream infection (PLASBI)	A bloodstream infection thought to have been caused by the presence of a peripheral line
Process indicator	Infection-related process, for example, compliance with hand-washing
Risk index	A means of stratifying patients according to their risk of infection, this then allows appropriate comparison of infection rates
SAB	*Staphylococcus aureus* bacteraemia
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 data
Type 1 hospitals	Victorian hospitals with 100 beds or more
Type 2 hospitals	Victorian hospitals with fewer than 100 beds
VICNISS Advisory Committee	A committee providing stakeholder advice to the VICNISS Coordinating Centre on the implementation, development and deliverables of the VICNISS program
VICNISS	Victorian healthcare-associated infection surveillance system

Appendix A: VICNISS Coordinating Centre

Introduction

The VICNISS and Coordinating Centre was established in August 2002. Through cooperation between the VICNISS Coordinating Centre and participating hospitals, a Victorian healthcare-associated infection (HAI) database is now well established. VICNISS aims to:

- promote a standardised approach to HAI surveillance methods
- provide aggregated risk-stratified data on HAIs that will enable health services and hospitals to undertake inter-hospital 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 provides stakeholder input and advice to the Coordinating Centre on the implementation and extension of VICNISS. The committee advises the Coordinating Centre on the implementation, development and deliverables of VICNISS.

Membership 2010–12

In alphabetical order by surname:

Member	Representing
Dr Peter Bradford	Executive Director, Clinical Governance/Medical Services, Melbourne Health
Dr Ann Bull	VICNISS Coordinating Centre (*from January 2011*)
Mr Clinton Dunkley	VICNISS Coordinating Centre (*until December 2010*)
Ms Sue Flockhart	Victorian Infection Control Professionals Association
Ms Sarah Gray	Consumer
Ms Bernadette Kennedy	Manager, Infection Prevention, Quality, Safety and Patient Experience, Department of Health (*until February 2012*)
Mr Chris MacIsaac	Victorian Regional Committee – Joint Faculty of Intensive Care Medicine
Mr Steven Peushel	Consumer
Mr Felix Pintado	Health Service Administrators (Chairperson)
Mr Matthew Richards	Victorian Infection Control Professionals Association

Member	Representing
Prof Michael Richards	VICNISS Coordinating Centre
Dr Rhonda Stuart	Australian Society for Infectious Diseases
Mr Deane Wilks	Manager, Quality and Safety Programs, Quality, Safety and Patient Experience, Department of Health (*until October 2011*)
Dr Simon Williams	Royal Australasian College of Surgeons
Ms Theresa Williamson	Manager, Quality and Safety Programs, Quality, Safety and Patient Experience, Department of Health (*from February 2012*)

Appendix B: VICNISS Coordinating Centre staff

Professor Michael Richards MD, MB, BS, FRACP, Director

Dr Ann Bull PhD, M.App.Epid., A/g Operations Director

Simon Burrell, Database Manager

Noleen Bennett RN, MPH, CNC Infection Control

Jennifer Bradford RN, CNC Infection Control

Judy Brett BN, RM, CNC Infection Control

Dr Leon Worth, MB, BS, FRACP, Grad Dip Epi, PhD, Infectious Diseases Physician

Ling Wang, NET/SQL Programmer

Kylie Berry, Administrative Officer

Tom Aitken, Data Entry/Administrative Officer

Megan Hardwick, Data Entry/Administrative Assistant

Appendix C: 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 list of the most recent papers and presentations originating from VICNISS Coordinating Centre.

Publications

Bennett NJ, Berry K, Bull AL, Burrell SJ, Russo PL, and Richards MJ 2010, 'A statewide smaller hospital healthcare-acquired infection surveillance program: a five-year report, Victoria, Australia', Fifth Decennial International Conference on Healthcare Associated Infections 2010, Atlanta GA.

Bradford J, Brett J, Bull A, Borrell S, Kennedy B, McMillan A and Richards MJ 2010, 'Changing behaviour: ensuring hand hygiene is an institutional priority', ICPIC Conference, Geneva Switzerland.

Brett J, Bradford J, Bull A, Bennett N, Worth LJ, Richards MJ 2010, 'Establishment of a statewide SAB surveillance program in Victoria', Australian Infection Control Association (AICA) annual conference, Perth.

Bull AL, Wilson J, Gillespie E, Stuart R, Worth LJ, Richards M, Waxman B, and Shearer W 2010, 'Piloting a bundle of care for colorectal surgery in an Australian hospital: the challenge of achieving normothermia', International Conference on Healthcare-associated Infections (SHEA), Boston MA.

Bull A, Wilson J, Worth LJ, Stuart RL, Gillespie E, Waxman B, Shearer W and Richards M 2011, 'A bundle of care to reduce colorectal surgical infections: an Australian experience', *J of Hosp Infect*, vol. 4, no. 78, pp. 297–301.

Bull A, Wilson J, Worth LJ, Stuart RL, Gillespie E, Waxman B, Shearer W, Richards M 2011, 'A bundle of care to reduce colorectal surgical infections: an Australian experience', *J Hosp Infect*, vol. 78, pp. 297–301.

Bull AL and Worth LJ 2012, 'Reply: a bundle of care to reduce colorectal surgical infections: an Australian experience. Is it the real revolution?', *J Hosp Infect*, vol. 80, no. 1, p. 95.

Bull AL, Worth LJ and Richards MJ 2012, 'Impact of vancomycin surgical antibiotic prophylaxis on the development of methicillin-sensitive *Staphylococcus aureus* surgical site infections: report from Australian surveillance data (VICNISS)', *Ann Surg*, vol. 256, pp. 1089–92.

Bull AL, Worth LJ and Richards MJ 2012, 'Implementation of standardised surveillance for *Clostridium difficile* infections in Australia: initial report from the Victorian Healthcare Associated Infection Surveillance System', *Intern Med J*, vol. 42, pp. 715–18.

Bull AL, Worth L and Richards MJ 2010, 'Vancomycin is inferior to anti-staphylococcal beta-lactam antibiotics for prevention of surgical-site infections due to methicillin-sensitive *Staphylococcus'*, 2010 Interscience Conference on Antimicrobial Agents and Chemotherapy, Boston MA.

Bull AL, Wilson J, Gillespie E, Worth L, Stuart R, Waxman B, Shearer B and Richards MJ 2010, 'Piloting a bundle of care for colorectal surgery in an Australian hospital – the challenge of achieving

normothermia', Fifth Decennial International Conference on Healthcare Associated Infections 2010, Atlanta GA.

Burrell SJ, Brett J, Bull AL and Richards MJ 2010, 'Secondary data usage: driving quality change at point of entry in acute care settings', MedInfo 2010, Johannesburg South Africa.

Doyle JS, Buising KL, Thursky KA, Worth LJ, Richards MJ 2011, 'Epidemiology of infections acquired in intensive care units', *Sem Resp Crit Care Med,* vol. 32, pp. 115–38.

Richards MJ, Bull AL and Worth LJ 2010, 'Vancomycin is inferior to anti-staphylococcal β-lactam antibiotics for prevention of surgical site infections due to methicillin-sensitive *Staphylococcus aureus*', Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC), Boston 2010.

Worth LJ 2011, 'Modifiable risk factors and current strategies to prevent surgical site infections', Asia Pacific Society of Infection Control (APSIC), Melbourne 2011.

Worth LJ 2011, '*Staphylococcus aureus* bacteraemia in Victoria: findings from a statewide program', Australasian Society for Infectious Diseases meeting, Lorne. [invited speaker]

Worth LJ 2009. 'A state of change? Central venous catheter-associated bloodstream infections in Victoria', Victorian Infection Control Professionals Association (VICPA), Melbourne 2009.

Worth LJ, Bull AL and Richards MJ 2011, 'Reporting surgical-site infections following primary and revision hip arthroplasty – one size does not fit all', *Infection Control and Hospital Epidemiology*, vol. 32, no. 11, pp. 296–7.

Worth LJ, Bull AL, Richards MJ 2012. '*Clostridium difficile* infections in Victoria: rapid increase in healthcare and community-onset cases (2010–2011)'. Australasian College for Infection Prevention and Control (ACIPC), Sydney.

Appendix D: Confidence intervals on charts

Confidence intervals

Whenever an infection rate is generated by VICNISS Coordinating Centre, 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 1,000 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.

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