VICNISS
Hospital Acquired Infection Project
Year 2 report–March 2004

Victoria
The Place To Be

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Foreword

VICNISS was previously an acronym for Victorian Nosocomial Infection Surveillance System, but is now used to mean the Victorian Hospital Acquired Infection Surveillance System. The aim of the VICNISS program is to lower the number of infections acquired by Victorians in their hospitals. Patients attending Victoria's public hospitals expect to receive high quality healthcare and to benefit from recent advances in medicine and surgery. Modern healthcare has risks as well as benefits. One of the most serious risks is that of acquiring infection in hospital. Infection may lead to pain, suffering, prolonged hospital stays, delayed rehabilitation and even death. The risk of acquiring infection in hospital cannot be eliminated; it is a cost of some of the most substantial technological advances, such as intensive care support and complex surgical procedures. However, the risk of infection can be reduced.

The Victorian Government is committed to promoting safety and quality in the state's public hospitals. VICNISS is an example of the government's commitment to achieving this reduction. It is a key element of the government's five-point Infection Control Strategy, which aims to develop a coordinated approach to infection control and improve hospital structures and processes for managing infection control.

This is the first annual report from the VICNISS Hospital Acquired Infection Surveillance Coordinating Centre, which was established in February 2002. The project was initiated after a review of infection control and hospital acquired infection surveillance in Victorian public hospitals found that various infection control processes were in place, but surveillance was underdeveloped and surveillance results often were not fed back to clinicians, who are most likely to respond to and use this information to improve practice. There was an absence of comparable data on hospital acquired infection.

An expert working group was formed to review existing hospital acquired infection surveillance systems and to make a recommendation for implementation in Victoria. After an extensive review and evaluation of national and international surveillance systems, the group recommended adopting components of the US National Nosocomial Infection Surveillance (NNIS) System and developing a system suitable for smaller health care facilities. The modified program would be VICNISS.

This report highlights the progress made in the implementation of VICNISS since the program commenced in February 2002. The first 12 months of data presented here provide hospital acquired infection rates in Victorian public hospitals for several of the most important hospital procedures, and allows comparison with rates reported from the USA. Some areas will need to be monitored carefully as Victorian data become stronger.

VICNISS is an important expression of how we help hospitals work together to achieve better results. I look forward to developments in the VICNISS program as hospital acquired infection surveillance activities expand to other patient groups at high risk of infections. And I look forward to the benefits of this program supporting clinicians in safer hospitals as the strength of the data increases.

Dr Mike Richards
Director, VICNISS Coordinating Centre

Acknowledgments

The Clinical Governance Unit, Office of Chief Clinical Advisor, Metropolitan Health and Aged Care Services Division, Department of Human Services produced this report in collaboration with the VICNISS Hospital Acquired Infection Surveillance Coordinating Centre on the centre's activities.

A special acknowledgment is extended to all of the infection control nurses and staff who have participated in this project and whose commitment have made this report possible.

Abbreviations

ACHS	Australian Council for Healthcare Standards
CABGS	Coronary artery bypass grafts
CDC	Centers for Disease Control and Prevention (United States)
KISS	Krankehaus Infektions Surveillance System
NNIS	National Nosocomial Infection Surveillance (United States)
SSI	surgical site infection
VICNISS	Victorian Hospital Acquired Infection Surveillance System

Executive summary

This is the first report of the Victorian Hospital Acquired Infection Surveillance (VICNISS) project. The report presents the first 12 months of data collected from Victorian public hospitals and aggregated by the newly established VICNISS Coordinating Centre. The report also provides background information on the inception of VICNISS, and an overview of the progress made during the first two years of the project.

For patients, a hospital acquired infection can be extremely traumatic and have significant consequences. Infections can result in significant morbidity, mortality and potential legal liability. Infection increases the patient's length of stay in hospital and often substantially delays the patient's return to both work and previous recreational activities. The cost of hospital acquired infections to society, the hospital system, patients and their carers is substantial. Prolonged hospitalisation and re-admissions result in lost bed days and decreased patient throughput. Around 5–10 per cent of hospital patients acquire an infection in hospital. Research has demonstrated that up to one third of hospital acquired infections can be avoided by introducing high intensity hospital acquired infection surveillance and implementing active infection control programs (Haley et al. 1985).

Surveillance is defined as the ongoing, systematic collection, analysis and interpretation of health data essential to the planning, implementation and evaluation of health practice. Surveillance assists in identifying whether there is a problem, the magnitude of the problem and the factors that contribute to infections. Surveillance also allows hospitals to institute appropriate interventions and evaluate their effectiveness.

Data are used to enhance continuous quality improvement efforts. To do this, the first step is the establishment of a standardised, simple and robust system for measuring how often hospital acquired infections occur. Establishing a statewide infection surveillance system like VICNISS is an enormous task. Many challenges have arisen: finding the right people to communicate within the hospitals, capitalising on the work already being undertaken, developing educational materials and planning risk management were just a few.

Not all patients undergoing a given surgical procedure face the same risk of infection. VICNISS reports risk adjusted infection rates to allow fair and meaningful comparisons of infection rates over time and for benchmarking against state rates.

The infection rates reported here are for surgical site infection after some of the most important surgical procedures in Victorian hospitals, and the major device-associated infections in our intensive care units. They are compared to those reported in the United States where a similar surveillance program has been in place for more than 30 years. Infection rates using the US National Nosocomial Infection Surveillance (NNIS) System methods are not reported by all other Australian states, so direct local comparisons are not generally available. Direct comparison with recently released data from New South Wales cannot be made for surgical site infection rates because the data were not risk adjusted, meaning it would not be clear whether any difference between the states reflected differences in the mix of patients rather than the effectiveness of infection prevention strategies. While recognising the differences in methods, the infection rates reported here are broadly comparable to those reported by New South Wales. It is necessary to exercise caution when interpreting the data because inaccuracies can occur when a program is being established. Despite some limitations, as infection rates are reported to participating hospitals, the information will be used to assist hospitals in the continuous improvement of standards of care.

There is opportunity for further developing this project: a method of evaluating infection control practice is urgently needed, as is accurate identification of risk factors that contribute to infection. This type of information would enable clinicians to focus proven infection prevention strategies on those most at risk. A targeted surveillance system such as VICNISS is the first step in accomplishing this focus. The activities of VICNISS are directed to those areas that have been identified as problematic, to produce the greatest benefits for patients.

Over the past 12 months, participating Victorian hospitals received quarterly reports, allowing them to benchmark their own infection rates with a state aggregate. Such comprehensive, relevant and local benchmarking has never before been possible.

About this report

This is the first annual report from the VICNISS Hospital Acquired Infection Surveillance System Coordinating Centre. The report provides background information on the inception of VICNISS, and an overview of the VICNISS Coordinating Centre's progress during the first two years of the establishment. VICNISS is an acronym for Victorian Nosocomial Infection Surveillance System, but it is now used to indicate hospital acquired infection surveillance–the latter indicates more clearly what the program does. Although VICNISS is based on the US NNIS methods, it has evolved and adapted to local needs, and it includes new innovations (especially for smaller hospitals) that are not part of the NNIS system.

The primary objective of VICNISS is to reduce the number of hospital acquired infections. To achieve this, it must first accurately measure the current rates of hospital acquired infection. The infection rates summarised in this report represent the most comprehensive and detailed hospital acquired infection surveillance project undertaken in Victoria.

The VICNISS Coordinating Centre provides reports on aggregated statewide data. Hospital-level risk adjusted data will not be publicly released until at least 2005. This will allow time to refine the system, definitions and methods, and to ensure the public release of rigorous, objective and reliable data. Health services will also be given an opportunity to respond to data before their release.

The limitations to the data include the following:

1. **Completeness.** It is not compulsory for hospitals to participate in the VICNISS project. At present, selected data are obtained from all 26 larger adult hospitals. Data collection can be time consuming, so hospitals are advised to focus on the activities of this program that are most useful to them. To ensure a representative sample, hospitals that perform large numbers of a high risk procedure are encouraged to routinely collect data on that procedure.
2. **Sample size.** Given that the project still deals with only low numbers, small numbers of infections may greatly influence the overall infection rate. Over time, as numbers increase, this effect will lessen, allowing more accurate and stable rates to be reported.
3. **Data collection.** Any surveillance system is enhanced by the use of uniform methods for case finding and data collection. Quality and consistency of data collection will be greatly assisted by the development and use of software within participating hospitals. Once the software is in place, the plan is to evaluate formally whether the data are collected consistently.

Introduction–why surveillance?

For patients, a hospital acquired infection can have painful and sometimes dire consequences. Infections can result in significant pain, prolonged illness and even, in rare cases, death. A 65 year old woman who develops a deep wound infection of her new hip joint replacement, for example, faces a prolonged stay in hospital, further extensive surgery, several weeks of antibiotics, and delayed rehabilitation–the next six to 12 months of her life may be totally disrupted before this infection is cured. The cost of hospital acquired infections to society, the hospital system, patients and their carers is substantial.

Research has demonstrated that up to one third of hospital acquired infections can be prevented with high intensity hospital acquired infection surveillance and control programs (Haley et al. 1985). Assuming that Australian infection rates are similar to those in the United States, as many as 150,000 hospital acquired infections may occur annually (Australian Infection Control Association Expert Working Group 2001).

Unfortunately, there is a paucity of reliable data on the cost of hospital acquired infection in Australia. It has been suggested that if surgical site infections occur in 2–13 per cent of patients, the cost of surgical site infections alone could be well over $600 million per year (Australian Infection Control Association Expert Working Group 2001). In a recent study in Victoria, the average additional cost of one surgical site infection following coronary bypass artery graft surgery was estimated to be at least $12,000 (Jenney et al. 2001). Using these figures, it is easy to see that the prevention of just a few infections per month at one hospital could have substantial cost savings to all Victorians.

A brief history of hospital acquired infection surveillance

During the 1990s, many Victorian hospitals collected hospital-wide infection data as part of the Australian Council on Healthcare Standards (ACHS) accreditation requirements. This was the first example in Australia of a systematic and standardised method for collecting and reporting on hospital acquired infection rates. While a great step forward, the data were not sufficiently sensitive to be used to measure the quality of care. There was growing concern in the infection control community that a more developed and specific approach would be needed to truly measure the effectiveness of infection control strategies. The ACHS system, although widely implemented, employed nonspecific definitions of infection that lacked credibility for clinicians. Data collection relied heavily on clinical documentation and was often incomplete, leading to underreporting of infections. The ACHS system focused on hospital-wide rather than targeted surveillance. This approach had the advantage of providing a global view of what was happening in a hospital, but hospital-wide surveillance is expensive and highly resource intensive: it does not provide meaningful infection rates that allow for comparison, and it is often inaccurate. There was a growing demand from infection control nurses and others interested in surveillance for a system that focused on prevention and would have clear benefits to patient care. Optimally, this new system would include the following elements:

- the early identification of infection
- comparability with other available data
- feedback to clinicians
- the identification of factors that contribute to infection.

In 1996, a statewide infection control survey conducted by the Department of Human Services identified shortcomings in surveillance activities in Victorian public hospitals. Not all hospitals were monitoring hospital acquired infections. Those that were often used different methods, meaning that they could not compare their results to those of other hospitals undertaking similar activities. An important finding was that the infection information was not getting back to those who needed it most: the surgeons and other clinicians.

The Victorian Government responded to the survey findings and to growing community concern about infection control in public hospitals by investing $33 million to improve the state of infection control in Victorian public hospitals. As a part of this strategy, the Department of Human Services formed the Expert Working Group on the Surveillance of Nosocomial Infections in September 1998. This group was charged with recommending the best method of surveillance for hospital acquired infections in Victoria. After nearly two years work, the group finalised a report that recommended implementing a system modelled closely on the US Centers for Diseases Control and Prevention (CDC) National Nosocomial Infection Surveillance (NNIS) System (Department of Human Services 2000).

The NNIS system in the United States was established in 1970 as a voluntary system to monitor hospital acquired infections and guide prevention efforts of infection control personnel (Gaynes et al. 2001). Currently, more than 300 hospitals with more than 100 beds participate. The NNIS system is confidential, in that the identity of participating hospitals is not revealed. During the 1990s, NNIS hospitals demonstrated a significant decrease in infection rates. The dissemination of risk adjusted, reliable infection rates played an essential role in this decrease (Gaynes et al. 2001).

In August 1998, a group of infection control nurses joined together to form the Victorian Infection Control Surveillance Project group. The group collaborated to implement the NNIS system, with a view to sharing the data and comparing local infection rates. By 1999, five hospitals had contributed data on coronary artery bypass graft surgery and 11 had contributed data on prosthetic joint infections. These data were presented at meetings of the Victorian Infection Control Professionals Association and the Australasian Society for Infectious Diseases. The VICNISS program has built on these foundations, extending the surveillance to all large public hospitals and developing the infection prevention, educational, information technology, epidemiological and biostatistical supports required for a comprehensive statewide program.

In 2000, there was growing interest in establishing a national approach to hospital acquired infection surveillance. The Australian Infection Control Association, on behalf of the Australian Council for Safety and Quality in Health Care, conducted a major national survey. The survey found that hospitals were using a wide variety of definitions and methods for surveillance activities, including the ACHS definitions, CDC definitions and a mix of local and hospital-specific definitions, meaning there was little opportunity for national benchmarking. With several states now devoting new resources to their local programs, the coordination of surveillance and the development of a national database of hospital acquired infections are important issues on the national agenda.

What is surveillance?

Surveillance is defined as the ongoing systematic collection, analysis and interpretation of health data essential to the planning, implementation and evaluation of health practice. Surveillance data such as infection rates form the basis of continuous quality improvement in clinical care. Another key function of ongoing surveillance is the detection of increased infection rates. When an infection rate is higher than expected, a review of infection control practices should be conducted. This review, using evidence based guidelines, may identify hospital practices that require improvement. Without the reliable information provided by a surveillance system, such continuous quality improvement would never be achieved. In summary, surveillance of hospital acquired infection assists in identifying:

- whether there is an infection problem
- the magnitude of the problem
- the factors that contribute to infections.

Surveillance also allows hospitals and clinicians to measure the effectiveness of strategies that are implemented to decrease infection rates. Infection rate data are intended to be used in a positive way to improve the quality and safety of healthcare.

Examples–using surveillance information to lower infection rates

- In a US paediatric intensive care unit, analysis revealed a central line associated bloodstream infection rate significantly higher than the NNIS average (37.31 versus 8.88 per 1000 central line days). A review of procedures in the unit identified that the dressing used over the intravenous entry site was causing sweating, leading the dressing adhesive to lift. Staff frequently cut this dressing with nonsterile scissors. With doctor and nurse education, the use of more appropriate dressings, and a reduction in the handling of central lines, a reduction in infection rates was achieved, documented and maintained (Hebden et al. 1998).
- An increase in surgical site infections after coronary artery bypass surgery was noted in a US NNIS hospital. The patients' records were reviewed, and the reviewers found a higher infection rate in patients who had diabetes. Many improvements in clinical practice were implemented, including improved diabetes management, changed pre-operative antiseptic baths, a change of surgical skin antiseptic and the administration of antibiotics before operations. Use of NNIS data allowed the identification of trends in infection rates over a three year period, and the evaluation of the benefit of interventions (Huang et al. 1998).
- In a US NNIS hospital, surgical site infection rates after large bowel procedures were found to be above the NNIS average (12.36 per cent versus 6.59 per cent). A study was undertaken to identify additional risk factors. Of those patients with infections, 5 per cent had antibiotics administered too early for optimal infection prevention and 30 per cent received no antibiotics at all. Discussion of these high infection rates with the doctors in the surgical department prompted improved use of antibiotics. In the following two years, the infection rate fell significantly to 8.91 per cent, then to 4.21 per cent (Ward et al. 1998).

Two fundamental principles of hospital infection surveillance must be understood. First, going through the process of undertaking surveillance will not usually influence infection rates appreciably unless surveillance is linked to a prevention strategy. Second, the information must be fed back to those who need to know: infection control nurses, surgeons, intensive care clinicians and hospital management.

NNIS investigators have identified the following seven critical elements of a surveillance system for successful reduction in infection rates. VICNISS is making progress in all seven areas.

1. Voluntary participation
2. Standard definitions and protocols
3. Defined populations at risk (for example, intensive care unit and surgical patients)
4. Site-specific, risk adjusted infection rates that are comparable across institutions
5. Adequate numbers of trained infection control personnel
6. The dissemination of data to health care providers
7. A link between monitored rates and prevention efforts (Gaynes et al. 2001).

What is VICNISS?

The US CDC established the NNIS system in 1970. The system has been widely used and is generally considered to be the most developed and validated infection surveillance system worldwide. Because a cornerstone of the system is the use of clinically validated risk adjustment methods, there is a high level of acceptance by clinicians in the United States and other developed countries. Most importantly, the NNIS system has been proven to reduce hospital acquired infections. Surveillance activities are targeted at those patients at highest risk of hospital acquired infections–namely, patients after surgery and patients in adult and neonatal intensive care units.

Before the VICNISS program commenced, it was recognised that the NNIS system would meet the surveillance needs of Victoria's larger hospitals but is not designed for smaller hospitals with fewer patients and operations. A second strategy would need to be developed to accommodate the needs of these hospitals. Together, the two strategies would form the foundation of the first statewide coordinated hospital acquired infection surveillance project in Victoria: VICNISS.

To coordinate all aspects of the surveillance program, the VICNISS Coordinating Centre was established in February 2002 under the auspices of Melbourne Health. The centre is staffed by a multidisciplinary team comprising infection control nurses, epidemiologists, infectious diseases physicians, an information technology officer and an education officer. Its primary function is to coordinate the implementation and maintenance of the VICNISS program. It offers full surveillance support to all participating hospitals. including:

- a comprehensive manual
- education workshops
- user groups
- information technology support, including a help desk
- expertise in nosocomial infection surveillance and healthcare epidemiology.

The VICNISS Coordinating Centre collects and analyses data from individual hospitals, and reports quarterly to participants and the Department of Human Services on aggregate, risk adjusted, procedure-specific infection rates. This information contributes to the development of accurate and reliable benchmarks against which hospitals and health services can assess their performance.

Type 1 surveillance

Given that the needs of small and large hospitals are very different, the VICNISS surveillance program is divided into two major areas:

1. a program for larger hospitals, which is based on the NNIS method and designed for hospitals that have more than 100 beds, perform large numbers of procedures and often have intensive care units
2. a new innovative program designed for smaller hospitals with low surgical throughput and no (or few) intensive care unit beds. These hospitals are mostly in rural and regional areas.

The program for larger hospitals, referred to as type 1 surveillance, monitors infections related to surgical procedures that are:

- known to have a high risk of infection, or
- known to have high morbidity and costs associated with an infection, or
- performed in large numbers.

Targeting these procedures is a key feature of this surveillance method. Targeted surveillance allows hospitals to undertake surveillance on procedures that they consider to be important for their hospital. The VICNISS Coordinating Centre was available to help hospitals choose the procedures for which surveillance would most benefit them.

Surgical site infections are only one example of infections that patients acquire in hospital. Urinary tract infections, bloodstream infections, pneumonia and diarrhoea are other common examples. Studies have demonstrated that these hospital acquired infections occur more often in patients in intensive care units than in patients in general hospital areas (Gaynes et al. 1999). Type 1 surveillance includes a component that focuses on the serious and potentially preventable infections associated with patients in intensive care units–specifically, infection in the blood and in the lungs. The most significant risk factor for the development of these infections is the presence of an invasive device. In bloodstream infections, a particular type of intravascular device (or IV) called a central venous line is associated with an increased risk for infection. Pneumonia may be caused by the presence of ventilatory support, when the patient has a tube in the throat to allow mechanical ventilation. Surveillance in intensive care units targets only those patients with central lines or ventilators.

How to know what is an infection

Following a surgical procedure, a patient is likely to have an incision site covered by a dressing. It is not uncommon that the incision site may discharge straw coloured fluid into this dressing for a few days after the surgery. The site is also likely to be painful and a little red. This is all normal, although the untrained eye may perceive it as an infection developing.

To determine whether an infection has developed, the infection control staff have been trained to apply a number of criteria (appendix A). If the wound and the patient's condition match these criteria, then an infection is considered to have developed. The criteria include observations such as the type of fluid draining from the wound, the presence of pain, redness and heat, the number of days after surgery when the fluid started being discharged, the patient's temperature and microbiology results. If there is doubt about whether an infection has developed, the infection control staff consult with the surgeon or other medical staff.

Adjusting for risk

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

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

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

Table 1: American Society of Anaesthesiology (ASA) scores

1	A normally healthy patient
2	A patient with mild systemic disease
3	A patient with severe systemic disease that is not incapacitating
4	A patient with an incapacitating systemic disease that is a constant threat to life
5	A moribund patient who is not expected to survive for 24 hours with or without the operation

The anaesthetist pre-operatively allocates and documents the ASA score in the medical record of each patient.

Type 2 surveillance– getting smaller hospitals involved

Surveillance methods and definitions for larger hospitals with high surgical throughput and intensive care unit beds are well established and widely accepted. The same is not true for smaller hospitals. In the United States, hospitals with fewer than 100 beds are excluded from participating in the NNIS system. In Victoria, approximately 70 per cent of all of public hospitals have fewer than 100 beds. To support smaller hospitals in their hospital acquired infection surveillance endeavours, the VICNISS Coordinating Centre developed a suite of surveillance activities aimed at identifying infection risks and safe infection control practices. This suite has been termed 'type 2 surveillance'. Being a novel program, these activities' effectiveness will be thoroughly evaluated. The pilot phase of type 2 surveillance commenced in November 2003, and a rollout to all Victorian public hospitals with fewer than 100 beds will occur during 2004.

As well as outcome based surveillance, type 2 surveillance focuses on performance and practices. The definitions and method are not yet validated and will be used only to monitor performance internally over time. Rather than measuring how many infections are occurring (because this number may be extremely small in small hospitals), the project will devise a method to ensure a hospital is complying with best known practice to prevent infections. This approach is unlikely to provide data for comparisons, but it will allow hospitals to identify where they can improve their compliance with best practice.

Hospitals participating in type 2 surveillance will be able to choose from a range of surveillance activities, including the following:

1. **Process indicators.** Point prevalence audits will be developed to measure compliance against best practice infection control recommendations.
2. **Measurement of multi-resistant organism infections.** The rate of infection caused by methicillin resistant *Staphylococcus aureus* and vancomycin resistant enterococci will be measured for a given surveillance period.
3. **Measurement of bloodstream infections.** The rate of laboratory confirmed bloodstream infections will be measured for a given surveillance period.
4. **Number of outpatient haemodialysis events.** Bloodstream infections and intravenous vancomycin use will be monitored in outpatient haemodialysis centres.
5. **Measurement of surgical site infections.** Selected operative procedures will be monitored for surgical site infections, as with type 1 surveillance.

Given the novel nature of this surveillance plan, it was important to develop an education strategy to ensure the new methods and definitions are well understood, and that data are consistently collected. The strategy included workshops and broad consultation with key stakeholders. An interactive web based education program is also being developed to deliver ongoing education programs to rural infection control professionals. This element of the project is still early in the pilot phase. The next VICNISS Coordinating Centre annual report will provide more detail about type 2 surveillance activities and results.

VICNISS–getting started

Initially, the VICNISS Coordinating Centre had to find an office location and recruit a team with the skills to establish the program. It co-located with the Victorian Infectious Diseases Reference Laboratory–an organisation with public health, epidemiological and information technology expertise–in North Melbourne. Importantly, it is independent of any hospital.

Among the first work undertaken by the VICNISS Coordinating Centre was the development of effective mechanisms to communicate to, and to evaluate the preparedness of, Victorian public hospitals for the project's implementation. There was a considerable interest in the work of the VICNISS Coordinating Centre, along with substantial expertise in the field in implementing surveillance systems. To reap the full benefit of this expertise, the centre spoke with many different groups, including infection control nurses, hospital executives, infectious disease physicians, surgeons, intensivists and information technology consultants.

Although some hospitals had already implemented the NNIS system, for others the NNIS system represented a major change. To make the transition as smooth as possible, a number of educational and support materials were developed: a comprehensive manual was developed, educational workshops were conducted and a user group was established. These materials were distributed to all sites and freely available for download from the VICNISS website.

To capitalise on the substantial local expertise relating to infection control and hospital acquired infection surveillance and epidemiology, and to ensure the program understands the needs of stakeholders (including infection control professionals, hospital administrators and consumers), the VICNISS Advisory Committee was established. The committee advises the VICNISS Coordinating Centre on the implementation, development and results of VICNISS. All committee members provide their expertise on a voluntary basis. The committee meets bimonthly and has been integral to the successful establishment and implementation of VICNISS. Appendix B details the committee's terms of reference and membership.

The VICNISS user groups have been one of the most successful supporting strategies to date. Meetings are held at least twice yearly and are an opportunity for those nurses collecting and managing VICNISS data to share information, discuss progress and identify any issues, as well as meet with the staff from the VICNISS Coordinating Centre. The user groups have been well attended by infection control clinical nurse consultants who are involved in VICNISS surveillance, and have resulted group members sharing many tips and ideas on the day-to-day surveillance activities.

A pilot phase of nine months was planned, followed by the implementation of any modifications (including changes to software) before the system was rolled out to the other hospitals. However, due to problems with the software development and consequent delays in commencing the program, the pilot phase was replaced with phase I. It was followed by the automatic rollout of the system, which was divided into phases II and III.

How is the information collected?

Each hospital determines which areas of hospital acquired infection surveillance would be most beneficial to undertake, and completes an annual surveillance plan. The plans are submitted to the VICNISS Coordinating Centre and kept on file. On occasion, the centre has helped hospitals plan their annual surveillance activities. Using the VICNISS definitions and method, infection control nurses follow patients during their stay in hospital, identifying those patients who have developed an infection. Certain information about the patient and infection is then recorded. In most instances, data are required to be collected on a daily basis, but this approach depends on the types of activity that the hospital has chosen to undertake.

Data are collected using a variety of methods at participating hospitals. The recommended method for identifying infections is prospective surveillance. This method involves following patients throughout their hospital stay. It is a superior method of surveillance compared with retrospective surveillance, which relies heavily on accurate documentation of events and data. Prospective surveillance also alerts the hospital infection control staff to possible outbreaks or clusters of infections in a timely fashion. Keeping these factors in mind, the infection control team at each hospital is encouraged to collect data in the most efficient way for that site.

Data are obtained from a variety of sources–for example, computerised patient information systems, operating theatre systems, admission records, microbiology data and regular ward rounds. No patient- or surgeon-identifiable data are forwarded to the VICNISS Coordinating Centre. Data collected include information such as gender, age, admission and discharge dates, operation type, duration of the operation, infection type, location of infection, and any organisms believed to cause the infection. The NNIS system calls for a review of patients at an individual level, and some data may be difficult to capture from the patient records. For this reason, infection control nurses who are experienced in surveillance methods, and who are trained in consistently applying definitions, collect this information.

The manner in which the infection control nurses manage the data at each site will continue to vary until specific surveillance software is developed. All participating sites forward their data to the VICNISS Coordinating Centre quarterly. The data are transferred by fax, on paper forms or electronically, then entered into the VICNISS aggregation database that is used to produce statewide infection rates. The centre then gives each site this aggregate information, together with the hospital infection rates, to allow hospitals to benchmark their rates against the statewide data. Statistical interpretation of the data is also provided.

Completeness of data is essential for gaining the full benefit of this program. Missing data are a frequent problem for all surveillance activities. The VICNISS quality assurance program includes providing performance feedback to participants in the form of a quarterly quality report. This report contains information about the amount of data received by the VICNISS Coordinating Centre, the proportion of data that was missing, and information on any unusual responses from the hospital. The centre regularly communicates with infection control professionals in the hospitals to help ensure data accuracy and the consistency of methods.

Project rollout

Phase I data collection commenced in November 2002. With the commencement of phase III in June 2003, all Victorian adult acute care public hospitals with more than 100 beds are now contributing data to the VICNISS Coordinating Centre database, and have participated in the surveillance training programs developed by the centre. System modifications were initially proposed to occur after a formal review post the pilot phase; instead, modifications to suit local needs and resources have been implemented as surveillance activities have continued. Ten hospitals were recruited for phase I. They were requested to submit a surveillance plan indicating the surveillance activities that they would undertake. For phase I, hospitals were requested to undertake surgical site infection surveillance on one or more of the following procedures:

- coronary artery bypass graft
- total hip replacement
- total knee replacement
- cholecystectomy (removal of the gall bladder).

These procedures are performed in large numbers or are associated with a high risk of infection. Surveillance for procedures with higher throughput provides more meaningful information because the infection rate calculated can be confidently interpreted as the true rate and is less subject to sampling error and misinterpretation. Real changes in infection rates are easier to detect, so the effects of any interventions can be measured. Hospitals with an intensive care unit were asked to undertake surveillance for central line associated bloodstream infection and ventilator associated pneumonia.

At the end of phase I, and for phases II and III, hospitals could choose their own surveillance activities from a list 20 procedures provided by the VICNISS Coordinating Centre.

Figure 1: VICNISS implementation timeline

February 2002	VICNISS Coordinating Centre commences operations.
November 2002	Phase I type 1 surveillance commences.
April 2003	Phase II type 1 surveillance commences.
June 2003	Phase III type 1 surveillance commences.
November 2003	Pilot type 2 surveillance commences.
June 2004	Type 2 surveillance is rolled out.

How is privacy maintained?

The VICNISS Coordinating Centre is committed to protecting the privacy of personal information. The information that it collects from hospitals includes information such as gender, age, admission and discharge dates, operation type, duration of the operation, infection type, location of infection, and any microorganisms thought to cause the infection. The centre is bound by the Victorian privacy laws, the Information Privacy Act 2000 and the Health Records Act 2001. As part of its obligation to protect hospital level data, the centre is not allowed to release any hospital identifiable data for the first three years of the program.

All hospitals have been assigned codes known only to the VICNISS Coordinating Centre and the hospital. To ensure patient privacy is maintained at all times, no patient- or surgeon-identifying information is forwarded to the centre. Rather, this information is kept on file at each of the participating sites, to allow the infection control nurses at individual hospitals to follow up patients if required and provide feedback to surgeons if appropriate.

The VICNISS Coordinating Centre is committed to protecting sensitive information and using data appropriately. Each participating hospital was required to sign a deed of confidentiality with the centre. The purpose of this deed is to prevent the release, without the centre's prior approval, of any aggregated data provided to the hospitals. A confidentiality agreement also exists between Melbourne Health and the Department of Human Services to protect the data that hospitals forward to the VICNISS Coordinating Centre. Finally, all VICNISS employees are bound by confidentiality requirements as part of their employment contract. The VICNISS Coordinating Centre also complies with the requirements of the national privacy principles.

Results

Discussion

The data presented here represent risk adjusted procedure-specific infection rates derived from data combined from all participating hospitals during the first 12 months of VICNISS (for the period 11 November 2002 to 31 December 2003). Data presented in this report are for coronary artery bypass grafts, hip and knee replacements, and caesarean sections. These are the procedures for which the largest numbers are available, thus allowing a more valid estimate of the infection rate. Infection rates based on small procedure numbers are subject to random variation. Small increases in the number of infections can cause a disproportionately large difference to the infection rate. Data on device associated infection rates in intensive care is also included.

NNIS Risk Index

The infection rates are stratified using the NNIS Risk Index (as described previously) to allow appropriate comparisons. The index is a simple method of stratifying patients by infection risk. For some procedures, certain risk categories are combined because there is no significant difference in the infection rates of patients in the two groups. For hip and knee replacements, for example, risk index groups 2 and 3 are combined.

Confidence intervals

The calculated rates reported here are generally estimates of the 'true' rate. The true rate could be calculated only from accurate data on every relevant surgical procedure in Victoria. Infection rates are thus 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 also displayed in the figures by a vertical line crossing through the top of the bar.

Example of a confidence interval

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

Post discharge surveillance

Infections included in the calculation of VICNISS rates include only those diagnosed during hospital admission or a subsequent re-admission for the infection. At this stage of VICNISS (as with NNIS), post discharge surveillance is not included, because it is an extremely problematic area. The VICNISS Coordinating Centre acknowledges that not all hospital acquired infections are likely to be identified without rigorous post discharge surveillance.

It is hoped that future VICNISS activities will include the development of an efficient post discharge surveillance method, although a reliable method that can be generally used has not yet been identified anywhere in the world.

Data not presented in this report

Several other surgical procedures for which VICNISS collects data are not presented in this report because the numbers are still small. (Some surveillance activities have not been ongoing for a full 12 months.) These procedures include: abdominal aortic aneurysm repair, appendicectomy, carotid endarterectomy, cholecystectomy, colon surgery, craniotomy, femoropopliteal bypass graft, gastric surgery, hernia repair, hysterectomy, mastectomy, thoracotomy and ventricular shunt surgery. The next VICNISS annual report will include data for these procedures, as well as for device associated infection rates in neonatal intensive care.

Table 2: Data from VICNISS surgical site infection surveillance, by risk category

Procedure	Risk category	Number of procedures	Infection rate per 100 procedures	95 % CI	Risk category	Number of procedures	Infection rate per 100 procedures	95 % CI	Risk category	Number of procedures	Infection rate per 100 procedures	95 % CI
Coronary artery bypass graft	0	27	3.7	0.1-18.9	1	1715	3.9	3.0-4.9	2	601	5.7	3.9-7.8
Arthroplasty of hip	0	642	2.3	1.3-3.8	1	918	2.8	1.9-4.2	2,3	170	2.4	0.6-5.9
Arthroplasty of knee	0	573	1.2	0.5-2.5	1	450	3.6	2.0-5.7	2,3	139	2.9	0.8-7.2
Caesarean section	0	1048	1.5	0.9-2.5	1	170	7.6	4.1-12.7	2,3	8	0	n/a

CI = confidence interval. n/a = not applicable. Infection rate = number of infections/number of procedures x 100.

Note: This table displays rates (with 95 per cent confidence intervals) by operative procedure and NNIS Risk Index. Risk indices have been combined for some procedures where there was no significant difference in the infection rates of the two patient groups. There were no CABGS patients in risk category 3.

Table 3: Data from VICNISS intensive care unit surveillance–device associated infection rates for laboratory confirmed bloodstream infections

Hospital type	Device days	Infection Rate per 1000 device days	95% CI	Device use ratio
Group 1A	16,511	6.5	5.3–7.9	0.87
Other hospitals	6,522	0.9	0.3–2.0	0.74

Infection rate = number of infections / device days x 1000
Device use ratio = central line days/patient days

Note: To allow for appropriate grouping of intensive care units, VICNISS use the Department of Human Services hospital groupings. These groupings are based on the size, number of separations and function of each hospital. Device days consist of the total number of central line days. The device use ratio is a measure of invasive practices that represent an extrinsic risk for hospital acquired infection. The ratio may serve as a marker for severity of illness in a patient group. The closer the ratio is to 1, the higher the group's use of this device.

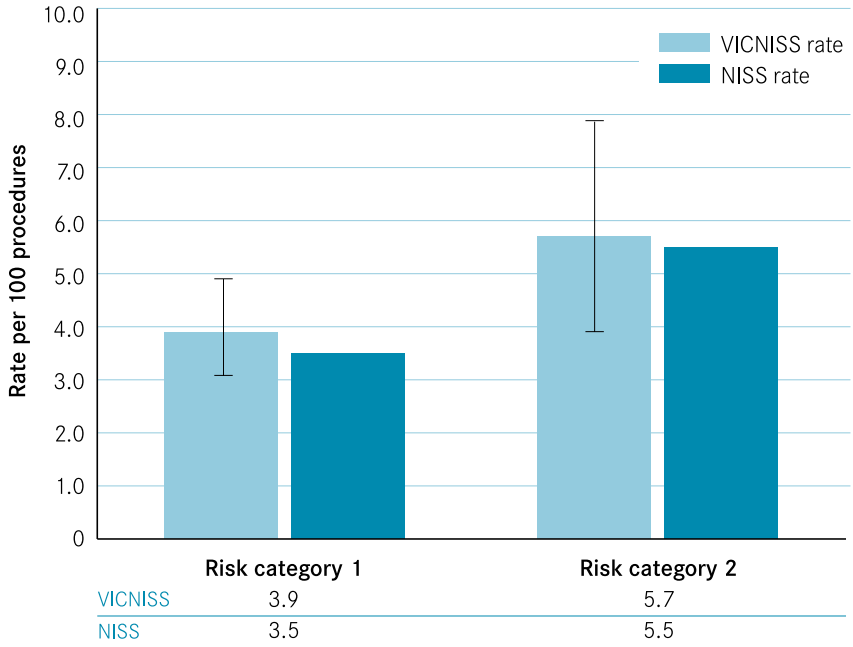
Table 4: Data from VICNISS intensive care unit surveillance–device associated infection rates for ventilator associated pneumonia

Hospital type	Device days	Infection Rate per 1000 device days	95% CI	Device use ratio
Group 1A	9714	4.3	3.1-5.8	0.68
Other hospitals	2283	8.3	5.0-13.0	0.26

Infection rate = number of infections / device days x 1000
Device use ratio = ventilator days/patient days

Note: To allow for appropriate grouping of intensive care units, VICNISS use the Department of Human Services hospital groupings. These groupings are based on the size, number of separations and function of each hospital. Device days consist of the total number of ventilator days. The device use ratio is a measure of invasive practices that represent an extrinsic risk for hospital acquired infection. The ratio may serve as a marker for severity of illness in a patient group. The closer the ratio is to 1, the higher the group's use of this device.

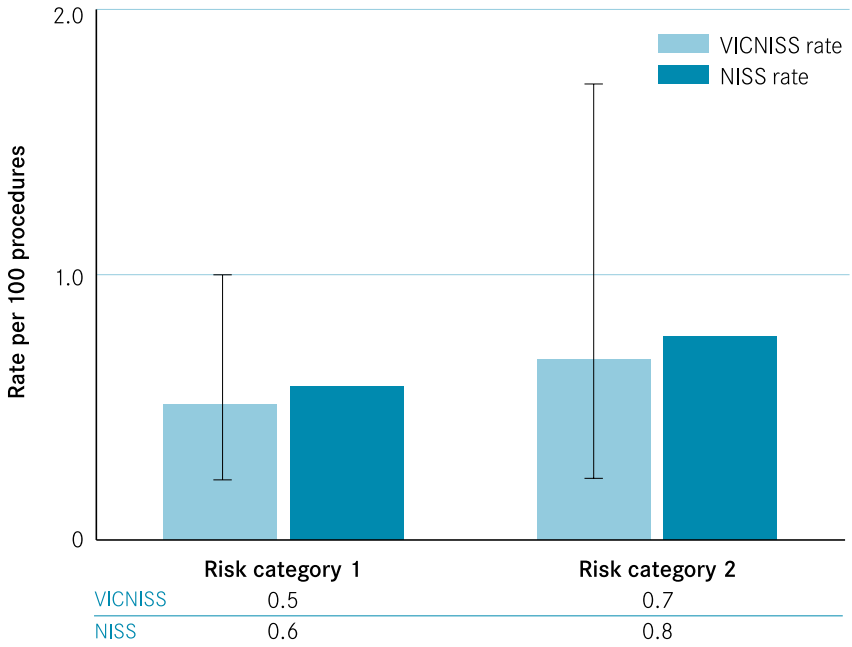
Figure 2: Comparison of all surgical site infection rates for coronary artery bypass grafts, by risk category–VICNISS versus NNIS



Note: Risk categories 0 and 3 have been omitted from this figure due to small numbers. This figure demonstrates similar rates of infection reported to VICNISS following coronary artery bypass grafts, compared to the NNIS system in the United States. Note that the NNIS system has been collecting data for several decades, and the NNIS rates are based on hundreds of thousands of procedures.

Source: NNIS data extracted from Division of Healthcare Quality Promotion, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Public Health Service, US Department of Health and Human Services. National Nosocomial Infections Surveillance (NNIS) System report: data summary from January 1992 to June 2003. Am J Infect Control 2003;31:481–98.

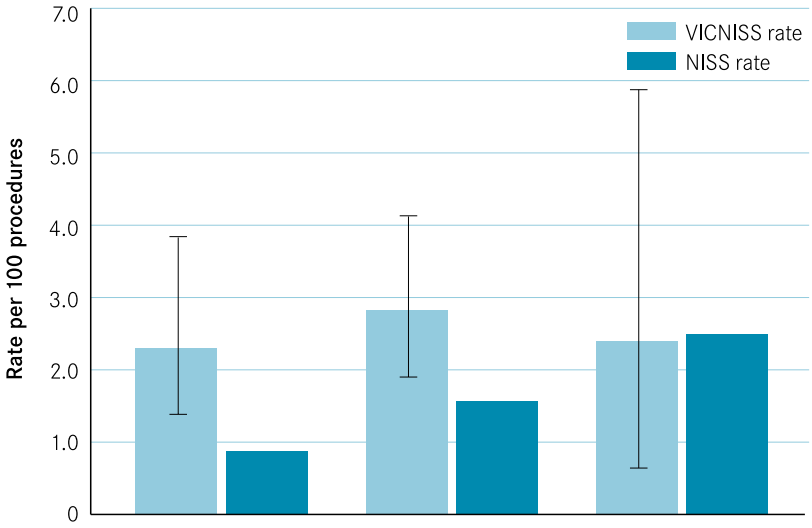
Figure 3: Comparison of deep sternal surgical site infection rates for coronary artery bypass grafts, by risk category–VICNISS versus NNIS



Note: Risk categories 0 and 3 have been omitted from this figure due to small numbers. (No VICNISS patients were risk category 3.) This figure demonstrates similar rates of infection reported to VICNISS following coronary artery bypass grafts, compared to the NNIS system in the United States. Note that the NNIS system has been collecting data for several decades, and the NNIS rates are based on hundreds of thousands of procedures.

Source: NNIS data extracted from Division of Healthcare Quality Promotion, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Public Health Service, US Department of Health and Human Services. National Nosocomial Infections Surveillance (NNIS) System report: data summary from January 1992 to June 2003. Am J Infect Control 2003;31:481–98.

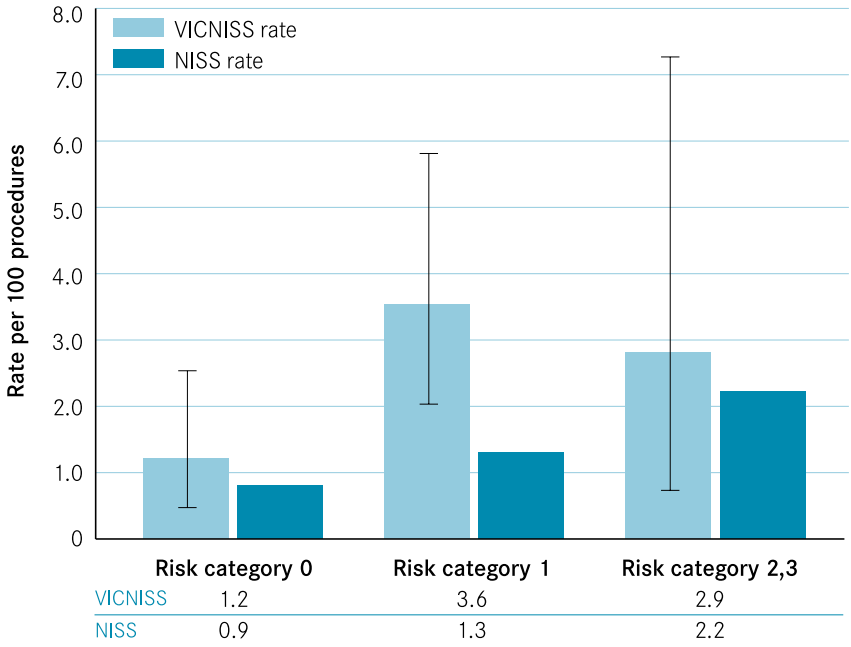
Figure 4: Comparison of surgical site infection rates for arthroplasty of hip, by risk category–VICNISS versus NNIS



Note: Risk categories 2 and 3 have been combined in this figure due to little difference in rates. This figure demonstrates that rates of infection reported to VICNISS following arthroplasty of the hip are higher than those reported by the NNIS system in the United States for risk category 0 and 1. These rates include all hip replacement surgery (including total and partial hip replacements), as do the NNIS rates with which they can be compared. Again, there is a large difference in the numbers of procedures on which these rates have been calculated, compared with the NNIS rates.

Source: NNIS data extracted from Division of Healthcare Quality Promotion, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Public Health Service, US Department of Health and Human Services. National Nosocomial Infections Surveillance (NNIS) System report: data summary from January 1992 to June 2003. Am J Infect Control 2003;31:481–98.

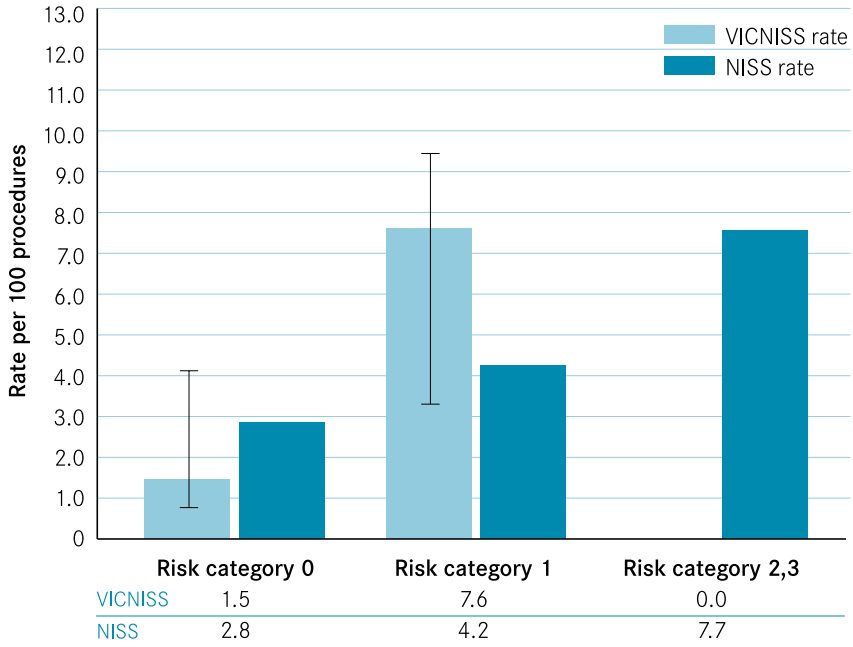
Figure 5: Comparison of surgical site infection rates for arthroplasty of knee, by risk category–VICNISS versus NNIS



Note: Risk categories 2 and 3 have been combined in this figure due to little difference in rates. This figure demonstrates that rates of infection reported to VICNISS following arthroplasty of the knee are higher than those reported by the NNIS system in the United States. Again, there is a large difference in the numbers of procedures on which these rates have been calculated, compared with the NNIS rates.

Source: NNIS data extracted from Division of Healthcare Quality Promotion, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Public Health Service, US Department of Health and Human Services. National Nosocomial Infections Surveillance (NNIS) System report: data summary from January 1992 to June 2003. Am J Infect Control 2003;31:481–98.

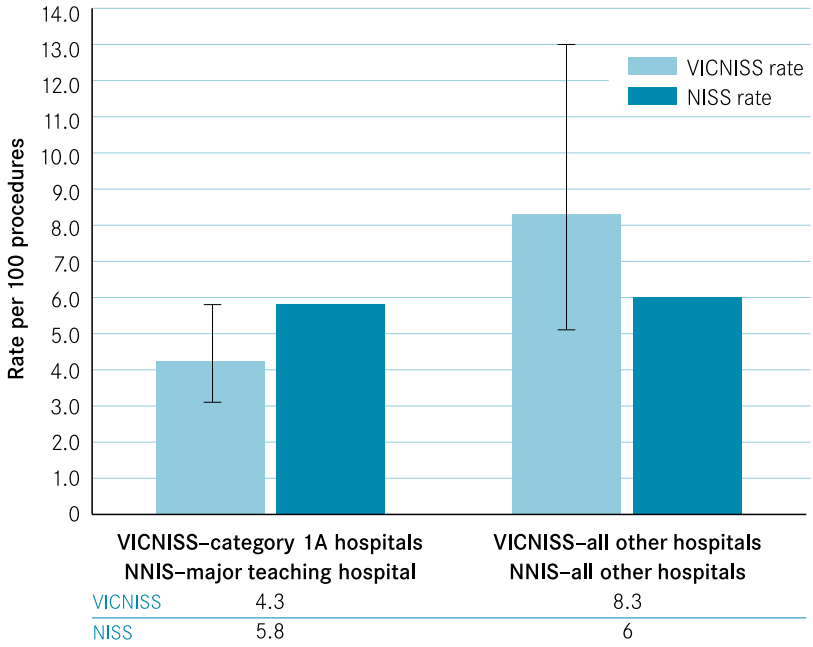
Figure 6: Comparison of surgical site infection rates for caesarean section, by risk category–VICNISS versus NNIS



Note: US research has demonstrated the standard NNIS Risk Index to be inadequate for predicting risk of infection following caesarean section. Both the NNIS and VICNISS programs are trialling an alternative method to risk adjust for this procedure. However, because the most recent published NNIS rates still use the standard risk index, that index has been used to adjust the VICNISS rates presented here. This figure demonstrates that rates of infection reported to VICNISS following caesarean section in risk category 0 are lower than those reported by the NNIS system in the United States, whilst those in risk category 1 are higher than those reported by the NNIS system.

Source: NNIS data extracted from Division of Healthcare Quality Promotion, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Public Health Service, US Department of Health and Human Services. National Nosocomial Infections Surveillance (NNIS) System report: data summary from January 1992 to June 2003. Am J Infect Control 2003;31:481–98.

Figure 7: Comparison of ventilator associated pneumonia rates in intensive care units–VICNISS versus NNIS



Note: This figure demonstrates that rates of ventilator associated pneumonia reported to VICNISS are similar to those reported by the NNIS system in the United States.

Source: NNIS data extracted from Division of Healthcare Quality Promotion, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Public Health Service, US Department of Health and Human Services. National Nosocomial Infections Surveillance (NNIS) System report: data summary from January 1992 to June 2003. Am J Infect Control 2003;31:481–98.

How is Victoria tracking?

When attempting to compare the data from VICNISS to data from surveillance systems in other states or countries, comparisons could be misleading unless the definitions, method and reporting are identical. Given that VICNISS uses the same definitions and method used by the NNIS system, direct comparisons with US data can be made in most areas. These comparisons are presented in the 'Results' section. A comparison with NNIS could not be made for device associated bloodstream infection rates because the methods differed slightly.

Within Australia, there has been a lack of uniformity in hospital acquired infection surveillance (Australian Council for Safety and Quality in Healthcare 2001). In the past, individual hospitals and states adopted slightly different methods in identifying and counting infections, and calculating infection rates. Some hospitals in other states now use the same definitions but do not use the same risk stratification; without risk adjustment, it is not useful or fair to compare infection rates. Slight differences in the definitions of infection can also make a large difference to reported infection rates. By emphasising education about surveillance methods, the VICNISS Coordinating Centre aims to ensure the quality of the data, to aid comparisons over time and across hospitals, states and countries.

While being able to compare Victorian data with that published internationally is useful, the ability to make comparisons with local data is also highly desirable. NSW Health recently published infection rates for surgical site and intensive care unit infections as a result of a mandatory reporting system for hospital acquired infections introduced in January 2003. Infection data in New South Wales is, however, collected using methodology and definitions as used for VICNISS data collection. The differences in methods do not allow direct comparison, however the infection rates reported by VICNISS and New South Wales are broadly comparable.

When will change be apparent?

The primary objective of VICNISS is to reduce the number of hospital acquired infections. The NNIS system, now aggregating data for over 300 hospitals, recently published aggregate data for intensive care unit surveillance over 10 years. Substantial and significant reductions in the rates of central line related bloodstream infections, catheter related urinary tract infections and ventilator associated pneumonia were all documented. The reduction in central line related bloodstream infections in medical intensive care units, for example, was over 40 per cent for the period–down from 11 to six infections per 1000 central line days (Centers for Disease Control and Prevention, 2000).

To demonstrate statewide improvement in Victoria, existing infection rates must first be established. The time required for this task will vary from procedure to procedure, and will depend on the number of procedures performed each year and the number of infections identified. With over 1000 coronary artery bypass graft operations performed each year, reliable infection rate data should be available for this procedure within two years. Overall, the period for this may vary from less than two years (for the most important and frequently reported procedures) to more than five. Once a baseline infection rate is established, ongoing surveillance needs to be maintained so comparisons can be made over time. Hospital acquired infection is an uncommon event, which means a statistically significant reduction in infection rates may not show for several years.

What happens in the meantime?

In the meantime, individual hospitals are already comparing their rates with state aggregate data, and will respond with interventions if their rates appear higher than expected. The VICNISS Coordinating Centre can assist hospitals with statistical analysis of these differences. If hospitals are performing surveillance in areas where local data are limited, they may use international data for benchmarking until the VICNISS program can accumulate local experience.

Nevertheless, much can be done at a local level using local data. Small clusters that may not be statistically significant can still be clinically significant and will be the impetus for reviewing improving patient care practices. New products and techniques can be evaluated using the data provided to monitor the benefits.

Limitations and challenges

The initial plan was to implement the NNIS definitions and method exactly as they had been implemented in the United States. However, after consultation with the infection control nurses of participating hospitals, small modifications to the NNIS system were required. In the reporting of bloodstream infections in intensive care units, for example, only those patients who have laboratory evidence of a bloodstream infection are reported to VICNISS, whereas NNIS hospitals in the United States also include a minority of patients with clinical sepsis for whom the laboratory tests are negative but who have no obvious focus of infection. Identification of this group of patients is resource intensive and more subjective.

Several of the minor changes for VICNISS were similar to those that the German KISS program made when adapting NNIS methods for German hospitals (Gastmeier et al. 2003). Changes were also needed in the data fields collected and reporting methods. As a result, the system better suits the needs and resources of the local infection control community. Further, in most instances, the VICNISS program can produce data that can be compared internationally.

Data collection for this surveillance project was hoped to be largely automated, using portable devices to expedite the process. However, the software product selected did not meet project requirements and could not be implemented. This was a significant setback for the project, and a contingency plan was implemented. This plan included:

- developing an aggregation database and paper forms for data collection
- providing a service to hospitals to input data (to avoid extra workload for hospitals)
- increasing site visits to ensure electronic efficient transfer of data where possible
- offering a first line helpdesk service for hospitals using old surveillance software.

Overall, hospitals have adopted the alternative data collection methods with minimal disruption, despite expressing disappointment. Most accept that neither the Department of Human Services nor the VICNISS Coordinating Centre could foresee the software problems. The process of appointing a new provider to deliver a new hospital acquired infection electronic database has commenced.

No surveillance program is perfect. The VICNISS program does not undertake surveillance for every surgical procedure, because this coverage would demand too many resources. It is more efficient to focus on areas of highest risk. Some important surveillance activities are yet to be addressed, such as surveillance for bloodstream infections in dialysis patients (an important challenge) and for the use of certain expensive and broad spectrum antibiotics. The VICNISS Coordinating Centre is already working with infection control staff to develop programs for hospital acquired infections in cancer patients, and to improve information on the use of prophylactic antibiotics before surgery. To collect all risk factors for infection so as to perfectly risk adjust infection rates is also impractical, but the VICNISS program will work towards improving risk adjustment. This effort will become easier as hospital patient information system technologies improve.

What's next for VICNISS?

VICNISS will be refined over time to meet the needs of the hospitals, consumer groups and the government. This work will include:

- resolving any problems with data collection and surveillance methods to ensure the data are consistent, reliable, valid and useful. Through the Advisory Committee and user groups, the VICNISS Coordinating Centre will improve the program by better understanding local needs and resources.
- developing new software for data collection, analysis and reporting in large participating hospitals to facilitate these processes. Through the software, the VICNISS Coordinating Centre will seek ways of linking to existing hospital information systems to make data collection more efficient and to improve data quality.
- rolling out and evaluating a surveillance program that is currently being piloted for smaller hospitals.
- promoting educational initiatives in infection prevention surveillance. During 2003, the VICNISS Coordinating Centre was awarded Telematic Course Development Trust funds to develop an interactive, instructional web based program for infection control nurses, particularly those working in rural areas and with limited access to resources. The program is being trialled and is due for complete rollout during 2004.
- examining improvements in surveillance for special patient groups (for example, patients with cancer), in collaboration with participating hospitals.
- developing relevant consumer information. Following consultation with several hospital consumer advisory committees, a consumer's section on the VICNISS website is being developed. This section will contain 'Frequently asked questions' about hospital acquired infection (for example, 'Why did I get an infection?', 'Can I pass it on to others?') and may also be used to publish aggregate infection rates for consumers.
- undertaking research initiatives, including a study of the costs of surgical site infections, and a formal evaluation of the sensitivity and specificity of the surveillance program.
- ensuring hospitals/surgeons/nursing staff have confidence in the infection rate data, risk adjustment, definitions and benchmarks, and consider the comparisons to be fair
- ensuring VICNISS is sustainable and robust over the long term, and responds to new hospital acquired surveillance needs as they are identified.
- examining international and local developments in this area, to identify useful improvements to the program for Victoria.
- contributing the VICNISS experience to national programs in this area.

The VICNISS Coordinating Centre provides reports on state aggregate data. Hospital-level risk adjusted data will not be publicly released until at least 2005. This timeline will allow for refinement of the system, definitions and methods, and ensure that data released to the public are accurate and reliable. Health services will be encouraged to comment on data before the data are released.

Conclusions

The establishment of the VICNISS program marks the commencement of the most comprehensive collection of validated data on hospital acquired infection in Victoria. By using internationally validated and accepted definitions and methods, the VICNISS program has been implemented in 27 large acute care public hospitals in remarkably short time. Data provided by the VICNISS Coordinating Centre will help identify hospitals with infection rates that are significantly different from state aggregate data. These data will allow comparisons with other hospitals, the state benchmark and international infection rates.

The program is in its early stages and, although it has achieved a great deal in its establishment, it is important to take care with comparisons. The data provided in this report indicate that infection rates in Victorian public acute care hospitals are generally comparable in some areas with those reported internationally for the procedures examined so far. However, improvement appears possible in some areas. The establishment of VICNISS provides the necessary information for public hospitals to focus their monitoring and infection prevention strategies in these areas, and to measure the resulting improvement.

The range of activities and the reliability of data will increase with the development of new surveillance software. The introduction of new software will remove some manual data collection and provide more time for infection control nurses to focus on other important aspects of infection control programs.

Further development of evidence based infection prevention and control strategies is needed, as is the identification of risk factors that contribute to infection. A targeted surveillance system is the first step in accomplishing these tasks. Surveillance activities will be directed to areas that are identified as problematic (for example, high risk patients and those undergoing complex surgical procedures). Research demonstrates that this approach will have the most impact in reducing infection and make the most efficient use of available resources.

Glossary

Area	Definition
ACHS	Australian Council for HealthCare Standards
aggregate data	Data in the VICNISS Coordinating Centre's database that are forwarded from hospitals
ASA score	American Society of Anaesthesiology (ASA) score. This index is designed to pre-operatively assess the overall physical status of the patient. The score ranges from 1 for a healthy patient to 5 for a patient who is not expected to survive 24 hours post surgery (table 1).
bloodstream infection	Presence of live pathogens in the blood, causing an infection. See also pathogen
case	A patient identified as having an infection
CDC	Centers for Disease Control and Prevention (United States)
central line	A catheter (tube) that is passed through a vein to end up in the thoracic (chest) portion of the vena cava (the large vein returning blood to the heart) or in the right atrium of the heart. A central venous line is also called a central venous catheter. Sometimes, the 'venous' is omitted and it is called a central line or central catheter.
central line associated bloodstream infection	A bloodstream infection thought to have been caused by the presence of a central line
cholecystectomy	A surgical procedure to remove the gallbladder. This procedure can be performed through keyhole surgery. See laparoscopy.
coronary artery bypass graft surgery	A surgical procedure that creates new pathways around blocked or narrowed arteries to allow blood to reach the heart muscle again
device days	The number of days for which an intravenous catheter or ventilator has been present in a patient
epidemiology	The study of populations to determine the frequency and distribution of disease and measure risks
extrinsic risk	A risk that is not inherent in the patient. Some forms of treatment are considered extrinsic risk factors, such as the use of invasive devices (such as catheters) or surgical procedures.
hospital acquired infection or nosocomial infection	Any infection that occurs during or after hospitalisation that was not present or incubating at the time of the patient's admission
infection	Invasion by and multiplication of pathogenic microorganisms in a bodily part or tissue, which may produce tissue injury and progress to disease
intensive care unit	A hospital unit that usually treats very sick patients. Patients in intensive care units are at a higher risk of developing infections because they are sicker than other patients.
intravascular device	The device used to administer a solution into a vein, such as the familiar IV drip
intravascular device related	Bloodstream infection linked with the presence of an intravascular device
laparoscopy	Type of surgery in which a small incision (cut) is made in the abdominal wall through which an instrument (a laparoscope) is placed to permit structures within the abdomen and pelvis to be seen. A diversity of tubes can be pushed through the same incision in the skin. Probes or other instruments can thus be introduced through the same opening.

	In this way, a number of surgical procedures can be performed without the need for a large surgical incision. Often called keyhole surgery, the risk of infection in surgical procedures using a laparoscope is much less than for operations where a large incision is performed.
NNIS	National Nosocomial Infection Surveillance
nosocomial	The term "nosocomial" comes from two Greek words: "nosus" meaning "disease" + "komeion" meaning "to take care of." Hence, "nosocomial" should apply to any disease contracted by a patient while under medical care. However, "nosocomial" has been whittled down over the years and now just refers to hospitals – it is now synonymous with hospital-acquired.
pathogen	An agent of disease–that is, a disease producer. The term pathogen is used most commonly to refer to infectious organisms. These include microorganisms such as bacteria, viruses and fungi.
pneumonia	Inflammation of one or both lungs. Pneumonia is frequently but not always due to infection. The infection may be bacterial, viral, fungal or parasitic.
point prevalence	The number of events or persons with a given disease or other attribute during a specified point in time
prevalence	The number of events (for example, instances of a given disease or other condition) in a given population at a designated time
procedure specific	Related to a specific procedure. Procedure-specific infection rates for total hip replacements, for example, are only those infection rates that relate to total hip replacements.
prospective surveillance	Monitoring patients for infection whilst they are still in hospital. This surveillance can also include post discharge surveillance, whereby patients are monitored for a set period once they leave hospital. See also retrospective surveillance.
rate	A measure of the frequency of occurrence of an event phenomenon
retrospective surveillance	Using chart review after the patient has been discharged from hospital as the sole means of identifying infections
risk adjustment	A standardised method used to ensure intrinsic and extrinsic risk factors for a hospital acquired infection are considered in the calculation of hospital acquired infection rates
risk index	A means of stratifying patients according to their risk of infection. This then allows appropriate comparison of infection rates. See also risk adjustment
standardisation	A set of techniques used to remove, as far as possible, the effects of differences in age or other confounding variables when comparing two or more populations
surgical site infection (SSI)	An infection at the site of an operation (usually an incision) that is caused by the operation.
surveillance	The ongoing systematic collection, analysis and interpretation of health data
targeted surveillance	Surveillance for infection in a specific area (for example, an intensive care unit) or for a specific procedure (for example, total hip replacement). Targeted surveillance for areas of concern is more efficient than doing surveillance across a whole hospital for all infections.

total hip replacement	Surgery in which the diseased ball and socket of the hip joint are completely removed and replaced with an artificial joint
total knee replacement	A surgical procedure in which damaged parts of the knee joint are replaced with an artificial joint
transmission of infection	Any mechanism by which an infection is spread
trend	The general direction in which something tends to move. Surveillance involves observing the trend of infection rates to help identify any increases.
validation	A program series of checks and challenges, repeated periodically to establish the soundness and accuracy of the data
ventilator	A machine that mechanically assists patients to breathe (sometimes referred to as artificial respiration)
ventilator associated pneumonia	Pneumonia that is has been caused by the presence of the ventilator
VICNISS Advisory Committee	A committee that provides stakeholder advice to the VICNISS Coordinating Centre on the implementation, development and deliverables of the VICNISS program
VICNISS Coordinating Centre	A centre that collects and analyses data from individual hospitals and reports to participants and the Department of Human Services on aggregate, risk adjusted, procedure-specific infection rates.
VICNISS Technical Advisory Group	A group that provides the VICNISS Advisory Committee with recommendations about specific surveillance issues
VICNISS user groups	User groups that provide a forum for program participants to support and/or liaise with the VICNISS Coordinating Centre and other participants

Appendix A: Defining infection

Superficial surgical site infection

A superficial incisional surgical site infection (SSI) must meet all the following criteria:

1. The infection occurs within 30 days after the operative procedure.
2. The infection involves only skin and subcutaneous tissue of the incision.
3. The patient has at least **one** of the following:

   (a) purulent drainage from the superficial incision

   (b) organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision

   (c) at least one of the following signs or symptoms of infection: pain or tenderness, localised swelling, redness or heat. The superficial incision is deliberately opened by surgeon and found to be culture positive or not cultured. A culture negative finding does not meet this criterion.

   (d) a diagnosis of superficial incisional SSI by the surgeon or attending physician.

Deep incisional surgical site infection

A deep incisional SSI must meet all the following criteria:

1. The infection occurs within 30 days after the operative procedure if no implant is left in place or within one year if the implant is in place and the infection appears to be related to the operative procedure.
2. The infection involves deep soft tissues (for example, fascial and muscle layers) of the incision.
3. The patient has at least **one** of the following:

   (a) purulent drainage from the deep incision but not from the organ/space component of the surgical site

   (b) a deep incision that spontaneously dehisces or is deliberately opened by a surgeon and is culture positive or not cultured when the patient has at least one of fever (greater than 38°C) and localised pain or tenderness. A culture negative finding does not meet this criterion.

   (c) an abscess or other evidence of infection involving the deep incision, as found on direct examination, during re-operation or by histopathologic or radiologic examination

   (d) a diagnosis of a deep incisional SSI by a surgeon or attending physician.

Organ space surgical site infection

An organ/space SSI involves any part of the body, excluding the skin incision, fascia or muscle layers, that is opened or manipulated during the operative procedure. Specific sites are assigned to organ/space SSIs to further identify the location of the infection. Listed below are the specific sites that must be used to differentiate organ/space SSIs. An example is appendectomy with subsequent subdiaphragmatic abscess, which would be reported as an 'Organ/space SSI at the intraabdominal specific site'.

An organ/space SSI must meet the following criterion:

1. Infection occurs within 30 days after the operative procedure if no implant is left in place or within one year if implant is in place and the infection appears to be related to the operative procedure and
2. infection involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure and
3. patient has at least **one** of the following:

   (a) purulent drainage from a drain that is placed through a stab wound into the organ/space

   (b) organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space

   (c) an abscess or other evidence of infection involving the organ/space, as found on direct examination, during re-operation or by histopathologic or radiologic examination

   (d) a diagnosis of an organ/space SSI by a surgeon or attending physician.

Bloodstream infection

Laboratory confirmed bloodstream infection must meet one of the following definitions:

1. The patient has at least **one or more** recognised pathogens cultured from **one or more** blood cultures,

   and

   organism cultured from blood is not related to an infection at another site.

   OR

2. The patient has **at least one** of fever (greater than 38˚C), chills or hypotension (less than 90 systolic), and the signs, symptoms and positive laboratory results are not related to an infection at another site. And, at least one of the following:

   (a) Common skin contaminant (for example, diphtheroids, *Bacillus* spp, coagulase negative staphylococci or micrococci) is cultured from **two or more** blood cultures drawn on separate occasions.

   (b) Common skin contaminant (for example, diphtheroids, *Bacillus* spp, coagulase negative staphylococci or micrococci, *Propionibacterium* spp) is cultured from **at least one blood culture** from a patient with an intravascular line, and the physician institutes appropriate antimicrobial therapy.

   (c) The patient has a positive antigen test on blood (for example, *H. influenzae, S. pneumoniae, N. meningitidis* or group B streptococcus).

   Organisms cultured from blood are reported as 'Laboratory confirmed bloodstream infection' when no other site of infection is evident. Pseudobacteremias are **not** hospital acquired infections and are not reported to VICNISS.

Appendix B: VICNISS Advisory Committee terms of reference (17 September 2002)

Introduction

The Victorian Nosocomial Infection Surveillance System and Coordinating Centre was launched in August 2002. Through cooperation between VICNISS and participating hospitals, a state based nosocomial infection database will be established over the next three years. VICNISS and the database will be used to:

- promote a standardised approach to nosocomial surveillance methods
- provide aggregated risk adjusted data on nosocomial infections, which enables health services and hospitals to undertake interhospital and international comparisons
- promote the use of evidence based information, validated methodology and analytical methods to permit timely recognition of nosocomial infections 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 nosocomial infections with routine data collection and continuous quality improvement systems, and strategic management planning for infection control
- promote consumer participation in the development of nosocomial infection performance measure reporting.

Purpose

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

Terms of reference

The Advisory Committee will be a high level committee that will provide focus on strategies and deliverables for VICNISS, including:

- ongoing review of aims, objectives and effectiveness of the role of VICNISS and its Coordinating Centre, in reducing hospital acquired infections
- ensure that the development of the VICNISS surveillance system is in context with what already exists, particularly in relation to overlapping areas and gaps
- provide advice on VICNISS broad business planning and service development, progress on deliverables, including development of indicators for service quality and accessibility
- provide comment on VICNISS hospital acquired infection surveillance reports
- ensure that the potential benefit of the VICNISS service and Coordinating Centre is maximised, including measures to achieve maximum participation by Health Services
- provide advice on the measures taken to ensure that VICNISS and the Coordinating Centre has an effective communication strategy in place, including communication with the community and consumers

- establish the mechanism for a technical reference group for the Coordinating Centre as required, on issues such as methods, definitions and the evaluation of eICAT Version 3 VICNISS surveillance software.

Committee membership

Membership will be sought from key stakeholders, including the groups listed so the Department of Human Services, hospital management, professional and community groups are represented:

- VICNISS Director
- College of Surgeons
- health services administrators
- Department of Human Services representatives: Acute Health Division, Public Health Division
- consumer representative
- Victorian Infection Control Surveillance Project
- Department of Epidemiology and Preventative Medicine
- Victorian Infection Control Professionals Association
- Australasian Society for Infectious Diseases
- Surveillance Subcommittee, Victorian Advisory Committee on Infection Control
- Melbourne Health Service Management.

The Advisory Committee may form working groups, coopt members to the committee or working groups and commission other activities as necessary.

The Department of Human Services appoints the committee chair and members. Members are appointed for a three year term, with the option to extend.

Membership at January 2004 attached
Reporting/advisory relationships schema attached

Meeting procedures

- Meeting will occur in alternate months. In addition there may be a requirement to call an extra ordinary meeting. There will be a minimum of five meetings a year
- Quorum will be deemed to be half full membership plus one. In the event that the quorum is not achieved, the meeting will continue but decisions be ratified at the next meeting
- Minutes: the activities of the council will be recorded, confirmed by the chair, forwarded to members and retained on a formal registered file
- Operating rules

Reporting arrangements

The Committee will provide an annual report to the Department of Human Services, Melbourne Health and the Victorian Quality Council.

The Assistant Director, Quality and Care Continuity Branch, is the principal Department of Human Services contact.

The Chief Executive Officer of Melbourne Health is the principal managerial contact for VICNISS.

The Chair, Department of Human Services, the Assistant Director, Quality and Care Continuity Branch, and the Chief Executive Officer, Melbourne Health, will form a joint Executive Sponsorship Committee.

Review of terms of reference

The terms of reference of the committee will be ratified at the first meeting and will be reviewed as required by the chair in consultation with the Department of Human Services.

VICNISS Advisory Committee membership

Name	Representing
Mr Michael Anderson	Victorian Regional Committee, Joint Faculty of Intensive Care Medicine
Mr Steve Anderson	Executive Director, Corporate and Clinical Services, Melbourne Health
Mr Stephen Blamey	Royal Australasian College of Surgeons
Prof Graham Brown	Victorian Infectious Diseases Service
Mr Clinton Dunkley	Victorian Infection Control Professionals Association
Ms Glenda Gorrie	Senior Project Officer, Clinical Governance Unit, Office of the Chief Clinical Advisor, Metropolitan Health and Aged Care Services, Department of Human Services
Prof Lindsay Grayson	Australasian Society for Infectious Diseases
Ms Sheila Hargrave	Consumer Representative
Ms Glenys Harrington	Coordinator, Victorian Infection Control Surveillance Project
To be appointed	Infection control consultant, rural representative
Ms Alison McMillan	Manager, Clinical Governance Unit, Office of the Chief Clinical Advisor, Metropolitan Health and Aged Care Services, Department of Human Services
Prof John McNeil	Director, Department of Epidemiology and Preventative Medicine, Monash University
Mr Rodney Moran	Manager, Information and Resources, Communicable Diseases Section, Department of Human Services
Mr Felix Pintado	Rural representative, Chair of the committee
Dr Mike Richards	Director, VICNISS Coordinating Centre
Mr Phil Russo	Deputy Director, VICNISS Coordinating Centre
Prof Denis Spelman	Chair, Surveillance Subcommittee, Victorian Advisory Committee on Infection Control
To be appointed	A health services administrators representative

Operating rules

Proxies

Members are required to notify the chair or secretariat when there is an intention for a proxy or substitute to represent the member at any Advisory Committee meeting or to undertake any membership role or responsibility.

Declaration of conflict of interest

Members should declare any personal interest at any meeting if it relates specifically to a particular issue under consideration. The secretariat will record this declaration in the minutes.

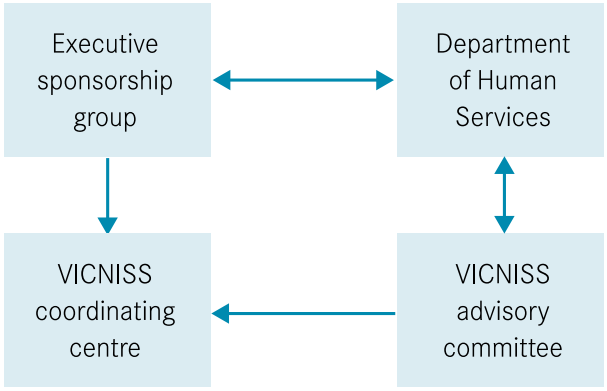
Media

To be directed to the Director of VICNISS in the first instance

Confidentiality

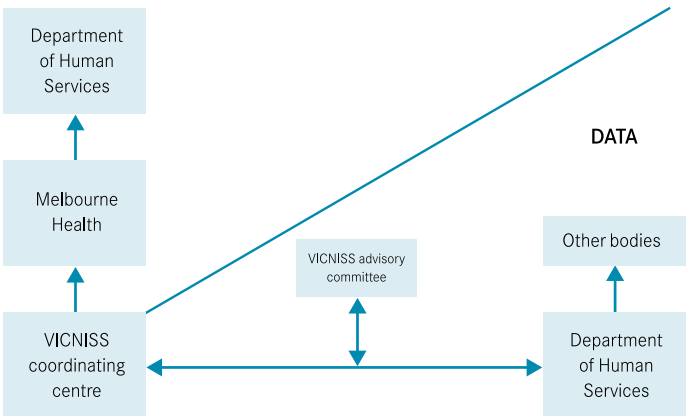
Unless stated, all papers are to be viewed as confidential. These papers are for the exclusive use of the committee members.

VICNISS advisory committee relationships



VICNISS advisory committee reporting relationships

Management and administration



Appendix C: VICNISS Coordinating Centre staff

Dr Michael Richards
Director
Mike is an infectious diseases physician with an interest in hospital acquired infections and infection prevention. He was previously head of the Infectious Diseases Unit at the Austin & Repatriation Medical Centre and worked as a guest researcher at the Hospital Infections Program at the CDC, Atlanta. Mike now works as a physician in the Victorian Infectious Diseases Service and in private practice. He is a member of the National Advisory Board of the Australian Infection Control Association and recently published in the area of epidemiology and intensive care unit acquired infections.

Phil Russo
Deputy Director
Phil has worked as an infection control consultant at Royal Melbourne and Alfred Hospitals, and was the coordinator of infection control and epidemiology at Southern Health. Phil completed his Masters of Clinical Epidemiology in 2002 and has published several articles on nosocomial infection and surveillance.

Dr Ann Bull
Epidemiologist
Ann completed a PhD in molecular biology before working for eight years with the federal Environment Department in Canberra and then in Kakadu National Park. She recently completed a Masters in Applied Epidemiology while located at the Australia New Zealand Food Authority in Canberra. Ann has an interest in the application of information technology systems for improving health.

Noleen Bennett
CNC Infection Control
Noleen is one of two senior infection control consultants employed at VICNISS. Previously, she was employed as a senior infection control consultant at Monash Medical Centre. Noleen obtained her Masters in Public Health in 2001 after completing a major critical appraisal of the Department of Human Services Guidelines for the classification and design of isolation rooms in health care facilities.

Claire Boardman
CNC Infection Control
Claire is one of two senior infection control consultants employed at VICNISS. She has infection control experience in both the public and private health sectors, with her last appointment at Melbourne Health. Claire is studying for her Master of Public Health at Melbourne University, and is the current President of the Victorian Infection Control Professionals Association.

Jane Motley
Education Development Officer
Jane has extensive education and health care experience in acute, community and public health settings. Her qualifications include a Dip App Sc (Nsg), Grad Cert Gerontology, Grad Cert Prom Con and Grad Dip Ed (Health), and a Certificate IV Assessment and Workplace Training. Jane obtained her Masters of Education in 2003 at Latrobe University.

Simon Burrell
Information Technology Support Officer
Simon is a Microsoft certified database administrator and has qualifications in electronics, with experience in the public, community and private business sectors.

Kylie Berry
Administrative Assistant
Kylie worked in administration related roles for about eight years, specifically in the medical industry. Her role involves supporting everybody else within VICNISS and ensuring have everything they need to do their job effectively.

Dr Deb Friedman
Infectious diseases physician
Deb is an infectious diseases physician with an interest in hospital acquired infection. She returned from conducting research at Duke University in 2002, and has published in the area of hospital infections.

Dr Heath Kelly
Medical epidemiologist
Heath is a medical epidemiologist and head of the Epidemiology Division at Victorian Infectious Diseases Reference Laboratory (VIDRL). At VIDRL, Heath has been on the surveillance subcommittee for influenza pandemic preparedness and the expert group advising the Department of Human Services on the surveillance of nosocomial infections. He is an invited reviewer in the area of infectious diseases epidemiology for a number of national and international journals, and has published more the 50 papers in the field.

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