Report of the Expert Working Group on Surveillance of Nosocomial Infections

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Executive Summary

For patients, a hospital-acquired infection can have significant consequences. Infections result in significant morbidity, mortality and potential legal liability. The cost of hospital-acquired infections to society, the hospital system, patients and their carers is substantial. Infections increase length of stay. Prolonged hospitalisation and readmissions result in lost bed days and decreased patient throughput.

Between five and ten per cent of hospital patients acquire an infection in hospital. Research has demonstrated that up to one-third of hospital-acquired infections could be avoided by better application of existing knowledge and realistic infection control practices.

Infection control and surveillance of nosocomial infections needs to be understood within the broader context of continuous quality improvement and clinical risk management. Infection control practices can reduce the occurrence of hospital-acquired infections, and surveillance is a vital tool in achieving this. Active surveillance has been demonstrated to decrease the incidence of hospital-acquired infection. A survey of Victorian public hospitals in 1997 indicated that while various infection control processes were in place in hospitals, surveillance was underdeveloped and the dissemination of surveillance results ranged widely. While most hospitals had carried out some limited surveillance, there was an absence of comparable data on rates and trends. This limits the ability of hospitals and the Department of Human Services to fully understanding infection problems and the effectiveness of any intervention measures employed.

Surveillance is defined as the ongoing, systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of health practice. It is closely integrated with the timely dissemination of these data to those who need to know, and those who are accountable. Surveillance assists in identifying:

- Whether or not there is a problem.
- The magnitude of the problem.
- The factors that contribute to infections.

Surveillance also allows hospitals to institute appropriate interventions. Data should not be used punitively, but to enhance continuous quality improvement efforts.

While many hospitals are collecting hospital-wide data as part of the Australian Council on Healthcare Standards (ACHS) accreditation requirements, there is an increasing recognition that a more developed approach is needed that clearly focuses on prevention. A good system would have immediate flow-on to everyday patient care. Key contributing factors to reducing infections on a day-to-day basis include:

- Early identification of infection.
- Comparability with other available data.
- Feedback to clinicians.
- Identification of factors that contribute to infection.

Further development of evidence-based infection control practice is needed, as well as the identification of risk factors that contribute to infection. A targeted surveillance system is the first step in accomplishing this. It would be directed to areas that are identified as problematic and produce the greatest gains (for example, high risk patients, complex surgical procedures). Research demonstrates that this would have the most impact in reducing infection, and make the best use of available resources.

In view of the demonstrated benefits of surveillance, the Infection Control Taskforce (1998) recommended that the Expert Working Group on Nosocomial Infection Surveillance (EWG) be established, with a brief to identify a system for use as a standardised surveillance system for nosocomial infections in large Victorian public hospitals. The EWG was asked to focus on larger hospitals, because they have a more complex patient mix and sicker patients (particularly in teaching hospitals). They have also been demonstrated to have higher infection rates.

After an extensive literature review and evaluation of national and international surveillance systems, the EWG recommended the adoption of components of the US National Nosocomial Surveillance System (NNIS) as the basis of the Victorian Nosocomial Infection Surveillance System for larger hospitals, supported by an independent coordinating centre. As a guide, participating hospitals will normally have over 100 beds, but other casemix considerations may come into play. Further consideration needs to be given to other, smaller, rural hospitals, where alternative infection control approaches (for example, point prevalence surveys) are more appropriate.

It is recommended that piloting of the Victorian Nosocomial Infection Surveillance System (VICNISS) commence across a number of Victorian metropolitan teaching and rural base hospitals. VICNISS is designed to be a dynamic surveillance system that will undergo refinement and review over time, in order to meet the needs of the participating institutions, consumer groups and government. The expected outcome of VICNISS is a reduction in Victorian public hospital infection rates.

Recommendations

Recommendation 1

That Victorian metropolitan and rural base hospitals (those with more than 100 beds) adopt a targeted risk-adjusted nosocomial infection surveillance system to reduce hospital-acquired infections and improve patient care.

Recommendation 2

That components of the CDC NNIS system be adopted and used as the basis of the Victorian Nosocomial Infection Surveillance System for metropolitan and rural base hospitals.

Recommendation 3

That the laboratory-based Victorian hospital surveillance system of the Microbiological Diagnostic Unit (MDU) continue as a complementary surveillance system.

Recommendation 4

That an independent coordinating centre with clearly defined accountability to the Department of Human Services be established to provide advice and support for the Victorian Nosocomial Infection Surveillance System (VICNISS). The centre will collect, feed back, benchmark and publish aggregated, risk-adjusted, procedure-specific infection rates, and provide education and training to participating institutions.

Recommendation 5

That the Department of Human Services assure confidentiality of non-aggregated nosocomial infection surveillance data through clarification of freedom of information and statutory immunity requirements.

Recommendation 6

That once interpreted and aggregated, data be fed back to those within the participating hospitals who will take any necessary action.

Recommendation 7

That the VICNISS be implemented through a phased-in process.

Recommendation 8

That metropolitan and rural base hospital participation in the VICNISS be strongly recommended by the Department of Human Services, but be voluntary in the first year.

Recommendation 9

That all metropolitan hospitals and rural base hospitals (participating and non-participating) be required to develop institutional nosocomial infection surveillance programs, develop objectives relevant to local circumstances and casemix, and put internal supporting structures in place.

Recommendation 10

That boards of health services and CEOs be ultimately responsible for the delivery of effective infection control surveillance and prevention programs.

Recommendation 11

In order to reduce duplication of data collection, that linkages between the VICNISS and the ACHS EQuIP accreditation process be sought by the Department of Human Services.

Recommendation 12

That the undertaking of post-discharge nosocomial infection surveillance be encouraged. That research be funded to develop validated approaches. In the interim, that post-discharge surveillance be undertaken at the discretion of each individual institution.

Recommendation 13

That hospitals participating in the VICNISS be required to submit performance indicator data to the Department of Human Services.

Recommendation 14

That the timing of antibiotic prophylaxis be explored as a possible indicator for all Victorian hospitals.

1 Background

For the last 20 years, hospital-acquired infections (also known as nosocomial infections) have been of increasing concern to health care providers, consumers, insurers and governments. Historically, about five to 10 per cent of admitted patients are affected, and the highest rates of infection usually occur in large teaching hospitals. Up to one-third of hospital-acquired infections are regarded as preventable (Cruse et al, 1980).

The Australian Council on Healthcare Standards (ACHS) first organised investigations into the establishment of a surveillance system for hospital-acquired infections in Australia. However, experience in the system indicated that, in terms of day-to-day management of infection, more was required. Significant effort and time had been spent on data collection, rather than prevention.

A good system would have an immediate flow-on regarding everyday patient care. Some of the factors that have been identified as helping to reduce infections include early identification of infection, comparability with other available data, feedback to clinicians, and identification of factors that contribute to infection.

Infection control resource commitments are more efficiently directed to areas identified as problematic and produce the greatest gains (for example, high risk patients, complex surgical procedures). Further development of evidence-based infection control practice is needed, and this should include precise identification of contributing infection-related risk factors. A targeted surveillance system is the first step in accomplishing this.

The Study on the Efficacy of Nosocomial Infection Control (SENIC) in the US (undertaken from 1975 to 1985) was one of the most substantial studies on hospital-acquired infections. It demonstrated that surveillance was essential component of an effective infection control program (Cruse et al, 1980). Surveillance assists in identifying whether or not there is a problem, and then what its magnitude is. Surveillance helps to establish factors that contribute to infections, and so allows hospitals to institute appropriate interventions. When infection problems are recognised, surveillance data allow the hospital to institute appropriate intervention measures. Surveillance then evaluates the efficacy of the interventions and completes the quality loop. However, feedback of data to those who need to know, and implementation of infection control measures, must occur for surveillance to be effective. Data should not be used in a punitive manner, but rather to enhance continuous quality improvement efforts.

As there was little information about the status of infection control programs and practices in Victorian hospitals, the Infection Control Taskforce and the Department of Human Services undertook a series of activities. A detailed literature review was commissioned and published (DHS, 1998a). A survey of Victorian public hospitals was also undertaken, to establish baseline data about infection control programs, risk management programs, surveillance activities, cleaning, disinfection and sterilisation.

1.1 The Infection Control Taskforce

To measure the efficacy of this approach to surveillance, the Infection Control Taskforce sought information from hospitals on data collection on nosocomial infections. The survey of Victorian public

hospitals in 1997 indicated that surveillance, the cornerstone of an effective infection control program, was underdeveloped in many Victorian hospitals (DHS, 1998b).

The Taskforce reported, in May 1998, that:

- There was no standardisation of surveillance data definitions or collection methodologies across the Victorian hospital sector. Rates were not procedure specific or risk adjusted; consequently, no valid comparison of hospital-specific rates could be made.
- Hospital-wide surveillance programs were commonly undertaken in Victorian hospitals, whereas targeted surveillance of identified high risk areas (as recommended in the literature) was rarely undertaken.
- Ninety-four per cent of facilities collected data on surgical wound infections and/or bacteraemia using Australian Council of Health Care Standards (ACHS) definitions.
- About half of Group A hospitals used the Centre for Disease Control's (CDC) national Nosocomial Infection System (NNIS) definitions. Forty per cent of all surveyed acute hospitals used in-house systems.
- Data were predominantly collected manually. The capacity to download from some databases was limited to eight hospitals (nine per cent).
- Data were regularly entered into a computerised database in 76 per cent of Group A hospitals, but limited in Group B to E hospitals (zero per cent to 38 per cent).
- Eighty-seven per cent of Victorian hospitals did not meet the accepted standard staffing ratio of one infection control practitioner per 250 beds.
- Few infection control teams had access to epidemiologists or statisticians to assist with analysis of data.
- Feedback of results to clinical units or to individual clinicians occurred in less than half of the facilities surveyed.

The results of the survey indicate that most Victorian hospitals were not able to maximise the benefits of surveillance, and that a standardised monitoring system based on individual hospital infection monitoring programs should be investigated. The Taskforce suggested that a more broadly based, procedure-specific, risk-adjusted validated monitoring system would enable hospitals to benchmark themselves against other institutions. This system would have to ensure confidentiality of data from individual institutions, while, at an aggregate level, they also meet community accountability requirements. Ideally, a substantial proportion of the data would be derived from existing collections and databases.

The Infection Control Taskforce also made a number of recommendations relating to the development of improved infection control programs in Victorian hospitals. To date, $13.8 million has been allocated to hospitals to address deficiencies identified through the survey process. In the majority of institutions, these non-recurrent funds have gone to address capital works and equipment deficiencies, rather than surveillance or infrastructure issues (DHS, 1998a).

1.2 The Expert Working Group (EWG)

The Taskforce recommended that an Expert Working Group be established to:

- Identify the components of a standardised surveillance system, including identifying a valid, reliable minimum data set for measuring hospital-acquired infections.
- Develop the parameters of the program. For example:
    - Whether the system is voluntary or compulsory.
    - Whether all of a targeted group of hospitals participate.
    - Whether the program is hospital wide, or targets specific procedures or populations.
    - Whether the reporting cycle is for a defined period or ongoing.
    - What issues exist regarding confidentiality and reporting requirements.
- Identify the resource implications of participating in a standardised surveillance system.
- Determine how a standardised program would operate; for example, through an independent third party.

The Expert Working Party on the Surveillance of Nosocomial Infections (EWG) was set up in September 1998. The membership and terms of reference are found in Appendix 1.

2 Infection Control and Patient Care

Infection control is not just a matter of following standards and guidelines. It involves improving awareness and changing attitudes and work practices at both the institutional and individual level. It is essential that everyone involved in health care contribute to improving the quality of patient care (NHMRC, 1996).

2.1 The Benefits of Infection Control

The aim of an effective infection control program is to reduce infections. The cost of hospital-acquired infections to society, the hospital system, patients and their carers is substantial. Infections increase the duration of hospitalisation (length of stay). Prolonged hospitalisation and readmissions result in lost bed days and opportunity costs. Infections result in significant morbidity, mortality and potential legal liability.

2.2 Infection Control and Quality Improvement

In considering infection control surveillance, the EWG considered infection control and surveillance of nosocomial infections within the broader context of continuous quality improvement and clinical risk management. Infection control is an important aspect of any hospital-based quality management program. The infection control program and practitioners in hospitals (by virtue of training, experience, and focus) can uniquely contribute to the institution's quality improvement program and the prevention of adverse events.

Infection control is essentially a clinical service directly related to improving and maintaining quality standards. With the recent changes in health care financing, it is essential to reduce potentially preventable complications and legal liabilities. Infection control is a matter of risk management, and involves balancing the costs and consequences of specific infection control policies and standards against the benefits that will flow from their application.

The ongoing challenge is to minimise the risks of transmission by adopting a cost-effective infection control strategy. To reduce infection rates, an effective infection control program has to be given sufficient designated personnel, who have clearly defined responsibilities, adequate lines of communication, authority and other resources, in order to facilitate the effective prevention, detection and control of infections within the strategic framework of the institution. Essential components of effective programs include:

- Conducting organised surveillance and control activities.
- Having trained, effective infection control physicians and one infection control clinical practitioner per 250 beds (this recommendation is currently under review in the US).
- Instituting a system for reporting infection rates to practicing surgeons.

Among American hospitals without effective programs, the overall infection rates have increased by up to 18 per cent (Haley et al, 1980).

2.3 Infection Control and Risk Management

Hospital-acquired infection remains an important risk management problem. Multiple studies, dating from the 1950s to the 1990s, have demonstrated that hospital-acquired infections are associated with prolonged length of stay and increased cost (DHS, 1998a; Clark, 1957; Freeman et al, 1979). In these studies, the range in prolonged length of stay varied from 1.3 to 23.8 days.

The first National Prevalence Survey of Hospitals in Australia (1984) showed that 6.3 per cent of 29,000 patients had acquired an infection during their hospital stay (Green et al, 1977). Hospitals with more than 50 beds had a nosocomial infection prevalence of 8.6 per cent (Green et al, 1977). Hospital-acquired infections were most often associated with surgical wounds, and with the respiratory and urinary tracts. Adverse outcomes, length of stay and the associated costs vary by type of infection. On the basis of cost and prolongation of length of stay, surgical wound infections have the highest impact, followed by pneumonia, urinary tract infection and bacteraemia (See Table 1). Urinary tract infections, though common, are generally the least severe and least costly (Meers et al, 1981; DPH, 1987).

Table 1 Targets of Studies on Cost-Effectiveness in Hospital Infection Control

Most Costly Infections	Most Costly Patients (Examples)	Most Costly Care
Wound infection	Transplant patients	Multi-trauma patients
Pneumonia	NICU/ICU patients	Multi-trauma patients nursing procedures
Septicaemia	HIV patients	Time consuming disinfection procedures
	Patients with severe underlying disease	Building and architectural design
	Oncology patients	
	Cardiac surgery patients	
	Multi-trauma patients	

Source: Haley, 1986.

2.4 Infection Control and the Cost of Hospital-Acquired Infection

The cost implications of hospital-acquired infections are difficult to measure with accuracy. Based on the assumption of an extra four days in an acute hospital and a 6.3 per cent rate of infection, the cost of hospital-acquired infections in Australia in 1988 was estimated to be $A500,000 per day or $180 million per year with 20,000 lost bed days (Haley, 1986).

Similar findings have been reported in the US and UK. In the US in 1999, surgical-site infection prolonged hospital stay by a median of 6.5 days and incurred attributable direct increased costs of $A4,826. Mortality rates of 7.8 per cent were reported in patients with surgical-site infections compared to 3.5 per cent of matched patients without infections (McLaws et al, 1988). In the UK in 1998, 7.8 per cent of patients developed hospital-acquired infection, and the average cost of patients with infection was 2.9 times greater than patients uninfected. This represented an absolute increase of $A9,462 per case. Hospital overheads, capital charges and the cost of management time accounted for 33 per cent of the additional costs reported in 1998 (Kirkland et al, 1999).

In general, available literature has focused on the direct costs borne by hospitals in treating hospital-acquired infection, using charges rather than actual costs, because of a lack of cost data. With the advent of prospective Diagnostic Related Group (DRG) funding, it may be possible to explore more accurately the economic impact of infection control programs in achieving reductions in health care

costs associated with improvement in patient outcomes. Preventive and future/indirect costs have usually not been included in costings, and this has resulted in underestimation of infection costs attributable to hospitals (CPHL, 2000).

The additional costs to the community are largely unknown; nor are the longer-term effects and costs for the infected patient. These figures are more significant when about a third of hospital-acquired infections are considered preventable through the existence of an effective infection control program (Haley et al, 1980).

2.5 Assessing Costs and Savings of Infection Control Services

Infection control costs can be divided into two types:

- **Predictable** (implementation and maintenance of infection control programs).
- **Unpredictable** (outbreaks).

Savings (direct and indirect) that are a result of effective infection control policies, and measures taken to reduce or prevent hospital-acquired infections and control outbreaks, have been demonstrated in numerous studies all over the world. Studies have demonstrated lower infection rates in hospitals with active infection control programs, and that 32 per cent of all nosocomial infections are avoidable (see Table 2) (Haley et al, 1980; Haley, 1986).

Table 2 shows the impact of reduced infection rates on patient numbers and costs, and potential savings to the hospital after allowing for the cost of surveillance. Table 3 lists the extent of preventability of different types of infections.

Table 2 Yearly Costs and Benefits of an Infection Control Program in the Average 250-Bed Hospital Demonstrating Three Possible Levels of Program Efficiency (2000 Australian Dollars)

Area			
Nosocomial Infection Reduction—per cent	6%	32%	50%
Number of patients prevented from acquiring an infection	42	168	262
Number of extra hospital bed days avoided by reduced infections	160	640	1,000
Hospital dollar costs avoided by reduced infections (Australian dollars)	$147,000	$750,000	$1,227,000
Cost of infection control program	$147,000	$147,000	$147,000
Net savings to the hospital	$0	$610,000	$1,031,000

Note: To apply to different sized hospitals, multiply each number in the table by the N/250, where N is the number of beds in the hospital Table from Haley et al , 1985.

Table 3 Percentage of Nosocomial Infections Prevented by the Most Effective Infection Surveillance and Control Programs

Type of Infection	Components of Most Effective Program	Per cent Prevented
Surgical wound infection	An organised hospital-wide program with: ▪ Intensive surveillance and control. ▪ Reporting surgical wound infection rates to surgeons.	20
	Plus: ▪ A physician with special interest and knowledge in infection control.	35
Urinary tract infection	An organised hospital-wide program with: ▪ Intensive surveillance in operation for at least one year. ▪ An infection control clinical nurse consultant per 250 beds.	38
Nosocomial bacteraemia	An organised hospital-wide program with: ▪ Intensive control alone.	15
	Plus: ▪ Moderately intensive surveillance in operation for at least one year. ▪ An infection control clinical nurse consultant per 250 beds. ▪ An infection control physician.	35
Post-operative pneumonia in surgical patients	An organised hospital-wide program with: ▪ Intensive surveillance. ▪ An infection control clinical nurse consultant per 250 beds.	27
Pneumonia in medical patients	An organised hospital-wide program with: ▪ Intensive surveillance and control.	13

Table from Haley et al, 1985.

Figure 1 illustrates how often different types of nosocomial infections occur. Figure 2 shows the financial impact of different nosocomial infections.

Figure 1 The Relative Frequency of Nosocomial Infection by Site of Infection

Source: Haley et al, 1980.

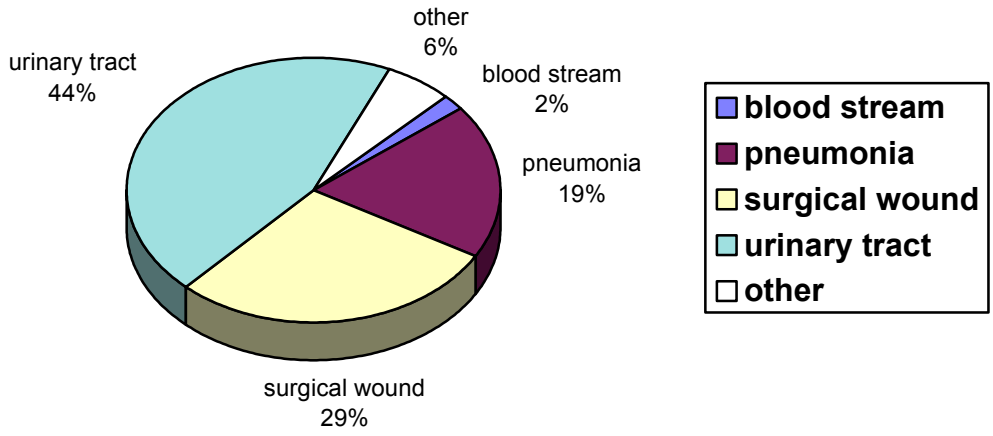


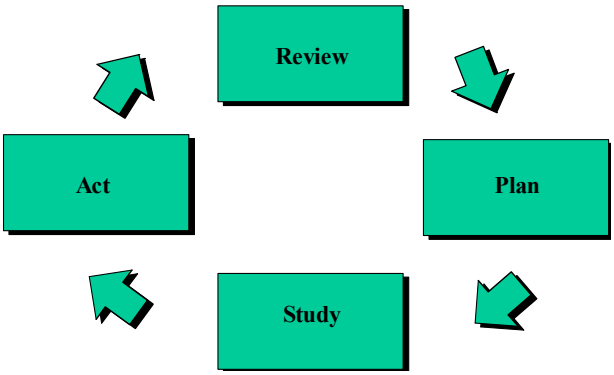
Figure 2 The Relative Impact of Nosocomial Infections by Site of Infection—All Extra Charges Attributable to Nosocomial Infections (Costs and Bed Days)

Source: Haley et al, 1980.

2.6 Quality Frameworks for Infection Control Indicators

Infection control is part of a hospital's quality program. It shares the same approach as other quality areas, where data collection is part of a commitment to act on the data and evaluate the effectiveness of actions that are taken. Having accurate data about hospital-acquired infections is essential to this process.

Figure 3 The Quality Circle



Several models describing frameworks for good quality indicators are described in the literature (Wakefield, 1993; QISG, 1995). One recent approach, adopted by the US Presidential Advisory Group as its framework for indicators, is described below (McLaws et al, 1988). These were the type of criteria the EWG used in considering its approach to infection control surveillance and performance indicators.

2.6.1 US Presidential Advisory Group Quality Indicator Criteria

- Scientific soundness (that is, reliable, valid, appropriately adjusted).
- Importance of the quality concern.
- Relevance to various users.
- Potential to foster improvements in health status or wellbeing.
- Evidence basis.
- Interpretability.
- Actionability (that is, the degree to which steps can be taken to address the concern).
- Feasibility.
- Ease and cost-effectiveness of measurement.

(Taken from PACCPQHCI, 1998.)

The EWG considers the primary task is to recommend an approach to nosocomial infection surveillance that will make a tangible difference to rates of hospital-acquired infections. To do this, an approach is required that will have credibility with those clinicians and health care professionals who are most directly responsible for patient care. It must also provide them with information in a meaningful form, and enable action to be taken to identify and reduce the risk of infection. The EWG considers it important to develop an evidence-based approach to infection control that will be assisted by clear identification of risk factors contributing to infection. An approach is needed that is scientifically sound and appropriately risk adjusted. Good risk adjustment is a critical issue in gaining credibility with clinicians.

Another important audience for the EWG is hospital and network managers, whose support for the recommended surveillance system is essential. As part of their responsibility for quality, they require indicators they have confidence in, and which enable them to see how their hospital is performing. A problem identified with hospital-wide indicators (which many managers rely on) is that they

underestimate infection rates, are imprecise, and can conceal the need for improvement, particularly at hospital clinical level. There is further discussion of hospital-wide indicators in the next sections.

2.7 Developing a Set of Indicators

At the same time, the EWG was asked to develop a small number of indicators that will form part of the suite of indicators, on which Victorian hospitals will be required to report by the Department of Human Services. Some aggregate performance data on Victorian hospitals will be publicly reported after a trial period. In its approach to selecting reportable indicators (see Appendix 2), the Department of Human Services has stated that indicators should:

- Have clinical significance, in relation to burden, validity and usefulness.
- Have data value.
- Be definable, accessible, reliable, identifiable and meaningful.
- Be responsive; that is, have the potential for action to improve processes and/or outcomes.

Indicators would generally be selected that were acceptable, demonstrated cost utility, minimised data burden/cost, and had potential for influence at the individual and/or State level.

Developing meaningful performance indicators to be reported to the Department of Human Services brings special challenges. The most important of these is that hospital-acquired infections share the characteristics of other adverse events. The reported infection rate can often reflect effective case finding, rather than actual occurrence of infection. Difficulties in reporting accurate infection rates are accentuated by shorter lengths of hospital stay, so infections are sometimes not identified during inpatient stay.

In general, the EWG takes the view that the primary task is to develop an effective surveillance system. This will allow hospitals to benchmark their infection rates against other hospitals. The EWG also believes that a staged approach should be taken to a small number of indicators that would be reported at hospital level to the Department of Human Services. These, in turn, would meet the requirements of accountability, and could form the basis of public reporting of aggregate hospital rates. In the first instance, some process indicators could be recommended for adoption. In the medium term, the implementation of the surveillance system would itself contribute to a rigorous and scientific approach to the further development of indicators of effectiveness. By that time, matters about the reliability and credibility of the data collected could be settled and assured. These would build on data that were collected for surveillance. Later sections discuss these issues further.

2.8 Criteria for a Surveillance System

Having considered these issues, the EWG developed a set of criteria as the basis of its approach to selecting a surveillance system for Victorian hospitals. It recommends the selection of infection control indicators that would form part of the Department of Human Services's suite of clinical indicators.

The criteria are:

- Potential to reduce nosocomial infections.
- Actionable: useful on a day-to-day management basis. It should:

        - Allow for timely dissemination of data.
        - Provide information that will improve infection rates.
        - Contribute to an evidence base about prevention.
        - Be flexible for individual institutional requirements.
        - Be acceptable to a range of stakeholders.
- Acceptability to clinicians.
- Adequate risk adjustment.
- Scientifically sound—valid and reliable definitions.
- Capacity for reliable inter-hospital comparison.
- Feasibility.
- Cost-effectiveness.
- Capacity to generate systems improvements.

The next section provides a broad overview of the EWG's findings and recommendations.

3 Recommended Strategies

3.1 Targeted Surveillance

3.1.1 The Case for Surveillance

The major objective in developing and implementing a practical, useful, flexible and valid surveillance system is to improve patient outcome by reducing nosocomial infections in hospitals. This would be achieved by using a continuous quality improvement framework where infection rates are monitored, reviewed, fed back to staff, appropriate interventions implemented as necessary, and further monitoring is undertaken.

Surveillance methodology adheres to sound epidemiological principles. Surveillance assists in identifying whether there is a problem and its magnitude. It helps to establish factors that contribute to infections, and allows hospitals to institute appropriate interventions. Surveillance then evaluates the efficacy of the interventions and completes the quality loop. The principles of surveillance of nosocomial infections strongly resemble the principles for continuous quality improvement.

3.1.2 Highly Effective Infection Control Surveillance Programs

The Study on the Efficacy of Nosocomial Infection Control (SENIC) project remains the only study to have comprehensively evaluated which components of infection control surveillance programs are effective in reducing hospital-acquired infections. Performed in the US over 10 years (1975–85), the project found that 'highly effective' infection control surveillance programs, consisting of four essential components, reduced the rates of the four most common infections on average by 32 per cent (Haley, 1986).

The four components are:

1. Intensive surveillance, including feedback of infection data to hospital-care staff.
2. An intensive control program that regularly ensures appropriate preventive practices (such as disinfection, sterilisation, sterile technique and aseptic handling of medical devices) were carried out.
3. An infection control nurse who collects and analyses surveillance data, and supervises the infection control program.
4. A physician or microbiologist with special skill in infection control who is actively involved in the program.

Among hospitals without effective programs, the overall infection rates increase by 18 per cent (Haley, 1986).

Studies performed before and after SENIC, in a variety of hospital settings, have confirmed the effectiveness of SENIC's overall and site-specific infection control surveillance programs. The introduction of an intensive infection control surveillance program into a 1,400-bed Hong Kong hospital in 1986 saw hospital-acquired infection rates fall from 10.5 per cent to 5.6 per cent (French et al,

1989). Surveillance and feedback of data to surgeons have been shown to reduce surgical wound infection surgical wound infection rates by 35–80 per cent in a number of studies (DHS, 1998a; French et al, 1989; Mead et al, 1986).

The SENIC validated programs are recommended by the Centers for Disease Control. They are required for accreditation in American hospitals by the Joint Commission on Accreditation of Healthcare Organisations (JCAHO), and are endorsed and recommended by the International Surgical Infection Society. In 1993, the UK Public Health Laboratory Service reversed a longstanding anti-surveillance stance. Its new Standards in Infection Control in Hospitals requires surveillance and feedback of infection rates throughout hospitals in the National Health Service.

3.1.3 Benefits of Targeted Surveillance

Surveillance takes time and costs money. While monitoring the entire hospital population is appealing, it is time consuming and often inaccurate. The limited available resources may be more appropriately committed to a subset of high risk patients (for example, intensive care, cancer patients, patients undergoing complex surgical procedures). Data can therefore be efficiently and accurately collected, adjusted for infection risk, and they can allow informed management decisions with a focus on prevention (Olson et al, 1990). To achieve the most favourable cost-benefit ratio, surveillance systems should ideally concentrate on the most important and predominant problems (in terms of morbidity, mortality and costs).

Approaches to reduce time investment will make surveillance of nosocomial infections more attractive to hospitals. There is no single source of information and no simple way of accurately determining the presence of nosocomial infection without expending considerable time and effort. Despite its time-consuming nature, evidence suggests that accurate case finding of nosocomial infections can be achieved.

In addition, the traditional use of crude overall (hospital-wide) infection rates provides no means of risk adjustment for patients' intrinsic infection risk, or extrinsic risks associated with exposure to medical interventions. Therefore, overall infection rates are limited in their application for inter-hospital comparison (Gaynes, 1997). Intrinsic factors are those inherent in the patient (for example, the old and the young) or medical conditions (such as cancer, obesity or diabetes). Extrinsic factors include the treatment process, use of devices and/or institutional characteristics (for example, the use of invasive devices, such as catheters or undergoing surgical procedures). The literature suggests that more than 90 per cent of nosocomial infections are endemic; that is, they do not occur as part of recognised epidemics or outbreaks (NNISS, 1991).

3.1.4 Aggregated Data and Inter-Hospital Comparability

An inter-audit comparison between patient populations or procedures in a single hospital can be difficult because of sample size, especially when measuring infections in surgical patient populations. This problem may be overcome through risk adjustment and aggregation of data or multi-centre studies.

National surveillance systems to provide risk-adjusted surgical wound infection rates and inter-hospital comparison are emerging internationally. Many are based on the National Nosocomial Infection Surveillance system (NNIS) developed by the Centers for Disease Control in the US. In the US, comparisons of nosocomial infection rates to national benchmarks enable practitioners to evaluate and improve their surveillance, prevention and control efforts (Miller et al, 2000). The English Nosocomial Infection Surveillance Scheme began in 1997. In the first two years of surveillance, data

have been collected on more than 27,000 operations, and more than 44 per cent of all acute hospitals have participated. There is evidence that participating hospitals have reduced the incidence of surgical wound infection (Wilson et al, 2000). Brazil established a national NNIS-based surgical surveillance system in 1997 to allow inter-hospital comparison (Starling et al, 2000). Over the last decade in France, surveillance of surgical-site infections has been considered one of the tools for evaluating hospital quality care. However, arguments have been put that casemix should be adjusted for infection risk (Golliot et al, 2000).

Across Europe, hospitals have sought to undertake a collaborative approach (Hospitals in Europe Link for Infection Control through Surveillance—HELICS) using the NNIS-based definitions. Participants in HELICS sought to provide a framework of reference to improve interpretation of national and local results, and identify relevant risk factors amenable to prevention. The HELICS project was undertaken because:

- It provided opportunities for sharing information and experience.
- Multi-centre and multinational collaboration was essential for modern clinical research.
- Standardised methods and tools added value to the augmentation of local results with external reference data.
- It provided economy of scale, as the same solutions did not have to be reinvented in all hospitals and countries (NSW HCCPP, 1996).

3.1.5 Risk Adjustment

Inadequate risk adjustment for intrinsic and extrinsic risks will result in lack of exactness and comparability. It may result in different infection rates reported between institutions, and create difficulties when undertaking inter-hospital comparison. Risk factors for surgical wound infections differ between patient groups and surgical procedures, as well as between institutions. A patient's predisposition for becoming infected is strongly influenced by certain risk factors. The risks for surgical wound infection and other nosocomial infections are many. As infection control cannot eliminate all risks, infection rates must be adjusted for these risks before the rates can be used for comparison.

Expert Working Group Findings

Without external comparison, a hospital may not be able to determine if its endemic rate is high. Therefore, it cannot make informed management decisions on the resources required to undertake further investigative or interventional measures. Differences in rates among hospitals are assumed by many to represent differences in practices and processes in preventing nosocomial infections. Comparison across hospitals means effective preventive practices and processes can be identified.

3.1.6 Expert Working Group Recommendation

Recommendation 1

That Victorian metropolitan and rural base hospitals (those with more than 100 beds) adopt a targeted risk-adjusted nosocomial infection surveillance system to reduce hospital-acquired infections and improve patient care.

Surveillance in large hospitals should initially be addressed, as it is in these institutions that high endemic rates of nosocomial infection have been recognised as being associated with high risk patients, complex surgical procedures and intensive care unit admissions. In addition, a higher prevalence of antibiotic-resistant nosocomial pathogens has been reported in metropolitan hospitals.

As with quality approaches, the surveillance system proposed should be one that identifies the problem and produces a solution, rather than looking for fault.

3.2 Surveillance System

In considering approaches to infection control and the surveillance of nosocomial infections, the EWG's objective was to develop process to manage and prevent infections, while fulfilling accountability to the public and assuring the safety of their care.

3.2.1 Reviewing Other Models of Surveillance

The EWG critically reviewed currently available surveillance systems and assessed their suitability for use as a standardised surveillance system for nosocomial infections in Victorian public hospitals using the criteria outlined on page 18. These systems included :

- NSW Health Hospital Infection Surveillance system (HISS).
- Australian Council on Healthcare Standards EQuIP (ACHS).
- The National Nosocomial Infection Surveillance System (NNIS).
- Victorian Hospital Pathogen Surveillance System.
- Victorian Infection Control Surveillance Project.

3.2.2 NSW Health Hospital Infection Surveillance System (HISS)

The NSW Taskforce reviewed existing surveillance definitions and made recommendations for a statewide, standardised system. The development and implementation of HISS was tendered out, and managed by the newly created Hospital Infection Epidemiology and Surveillance Unit, School of Health Services Management, University of NSW. In 1998, the system was introduced across 10 pilot sites across NSW, and includes major metropolitan, large regional and rural hospitals. All participating hospitals have an intensive care unit. The surveillance models are sentinel surgical site infections (procedure-specific), intravascular device-related bacteraemia, respiratory syncytial virus (RSV) or rotavirus, and multiple antibiotic resistant organisms. In the first 12 months of data collection, HISS was based on CDC NNIS (surgical site infections with minor modifications) and the John Hunter Hospital definitions (intravascular device related bacteraemia). HISS members are now using the Australian Infection Control Association (AICA) recommended definitions (NSW HCCPP, 1996). There is risk adjustment using the minimum NNIS risk variables. Variables include age, sex, pre-operative length of stay, American Society of Anesthesiology (ASA) classification, duration of operation, degree of contamination of the surgical site and expertise of the surgical team.

The Australian Council on Healthcare Standards (ACHS) approved HISS for purposes of accreditation through EQuIP. HISS used a modified version of the eICAT software developed by the Queensland Health, Royal Princess Alexandra Hospital in Brisbane.

To support HISS participants, there are user groups, training days, newsletters, site visits, teleconferences and a proposed website. It was estimated that participation in HISS takes 40–60 per cent of the time of an infection control practitioner.

HISS data will be published in an aggregated format in the *NSW Public Health Bulletin*. De-identified aggregated rates will be published or provided to NSW Health Department and its chief executive, the Minister for Health. The pilot hospital commenced training in October 1998 and began data collection in December 1998.

While the EWG identified a number of positive features in NSW HISS, it was not recommended because, as the HISS pilot phase was to determine whether a statewide program could be put in place, validation studies were not available at the time of this report.

3.2.3 Australian Council on Healthcare Standards EQuIP (ACHS)

There are limited formal systems in place for assessing quality outcomes of infection control programs in Victoria or nationally. The Australian Council on Healthcare Standards accreditation program is currently the only national Australian standard nosocomial infection surveillance monitoring system available for health care agencies.

The ACHS Care Evaluation Program has, in conjunction with various medical colleges and associations, developed performance measures (clinical indicators) that address the process and outcomes of care. The ACHS's initial approach to establishing a system that examines hospital-acquired infections led to data being collected in a number of ways. The ACHS system requires participating hospitals to undertake hospital-wide surveillance for hospital-acquired infections (clinical indicators), including bacteraemia and clean or contaminated surgical wound infections. Thresholds for different sized institutions are available for self-assessment and performance review. ACHS has developed a national database containing information from approximately 48 per cent of Australian acute hospitals (ACHS, 1994).

The EWG did not recommend the ACHS infection control clinical indicators because:

- The validity and specificity of ACHS clinical indicator definitions have long been debated by infection control practitioners, infectious diseases physicians and epidemiologists.
- Under-reporting of infection rates has been widely reported in Australia as one potential problem with the application of ACHS definitions.
- The ACHS data collection methodologies are retrospective, and have limited day-to-day applications.
- Retrospective data do not assist in the early detection and management of infection episodes, and identification of variation from baseline data.
- The ACHS indicators do not adjust for risk adjustment for intrinsic or extrinsic infection risks essential for inter-hospital data comparability.

At the time of publication, ACHS was in the process of adopting new definitions, which are expected to be compatible with the recommended Victorian definition.

3.2.4 The National Nosocomial Infection Surveillance System (NNIS)

NNIS is the most developed and validated nosocomial surveillance system currently available, and many argue that it has become the premier model internationally. The NNIS system began in 1970, and it currently consists of approximately 300 hospitals with 100 or more beds voluntarily submitting nosocomial infection data for aggregation into a national database coordinated by the CDC, which acts as an independent agency. Reports from the NNIS are aggregated and published in the public domain every six months. NNIS has provided a model that many countries have sought to follow (Thomas et al, 2000).

All NNIS data are collected using four standardised protocols called surveillance components:

1. Hospital-wide
2. Adult and paediatric intensive care units
3. High risk nursery
4. Surgical patient.

The hospital-wide component is the only one in which risk-adjusted, nosocomial infection rates cannot be calculated. The CDC no longer advocates the use of the hospital-wide component. In the US, the hospital-wide component is being phased out. The components may be used singly or simultaneously but, once selected, must be used for a minimum of one calendar month. Most participating hospitals would collect for periods longer than this. The CDC is currently reviewing the minimum duration, and a move is expected toward a minimum of three calendar months' data collection, to allow for adequate sample size. All infections are categorised into major and specific infection sites, using standard CDC definitions that include laboratory and clinical criteria (MMWR, 2000).

NNIS has established a series of minimum entry criteria for hospitals to participate in the system. Each facility is required to provide general medical-surgical inpatient services to adults or children requiring acute care. These hospitals may be of any size and ownership and can be affiliated with a medical school. Participating hospitals must have at least 1.5 effective full-time (EFT) equivalent infection control personnel to conduct surveillance, of which one EFT is a qualified infection control practitioner. At a minimum, there must be another one EFT for every additional 250 beds above 100 for other infection control activities, such as education, staff health and policy development (Scheckler et al, 1998).

NNIS has been demonstrated to be a successful model in preventing hospital-acquired infections. In March 2000, the CDC reported a 10-year decline of over 30 per cent in rates of hospital-acquired infections (MMWR, 2000). The CDC argues that the elements of NNIS that are critical for the rate reduction include:

- Voluntary participation and confidentiality for NNIS hospitals.
- Standard definitions and protocols.
- Targeted, high risk populations (for example, intensive care and surgical patients).
- Site-specific, risk-adjusted infection rates comparable across institutions.
- Adequate numbers of trained infection control practitioners.
- Data dissemination to health care providers.

- Links between monitored rates and prevention efforts (NSW HCCPP, 1996; Gaynes et al, 1996; Horan et al, 1992; Emori et al, 1991).

The EWG found the advantages of the NNIS system were:

- It uses definitions and criteria that are internationally accepted and used widely, while being practical in application.
- It uses validated risk adjustment methodologies.
- Its definitions and methods have some limitations, but are in a state of continuous ongoing development, from which Victoria can continue to benefit.
- It provides pre-existing manuals for participating institutions.
- There is clinician acceptability of the its validated definitions, methodologies and risk adjustment.
- It provides the ability for participating organisations to undertake inter-hospital comparison at a State and international level for targeted surveillance.
- Its data collection methodologies are prospective, and provide the potential for greater application from a day-to-day management basis.
- There is prospective data available for early detection and management of infection episodes, identification of variation from baseline data, and timely dissemination of data.
- It provides flexibility at an institutional level to target activities according to services provided or patient population.
- It is complementary to the MDU, Victorian Hospitals Pathogens Surveillance System (VHPSS) laboratory-based voluntary surveillance system.

3.2.5 Victorian Hospitals Pathogens Surveillance System (VHPSS)

The Department of Human Services funds the Melbourne Diagnostic Unit (MDU) at the University of Melbourne to provide testing and reference services for public health in Victoria. A proportion of this money is being used to fund the VHPSS. The VHPSS was established in 1988 to collect data on significant laboratory isolates or organisms from blood and cerebrospinal fluid sent in by participating hospital laboratories on a voluntary basis.

The MDU program includes medical, epidemiologic, nursing, information technology, scientific and support staff. Components of this program include:

- The monitoring of bacterial antimicrobial resistance in hospital infections through the VHPSS.
- The monitoring of specific community infections.
- Antimicrobial resistance in food-borne organisms (for example, the National Salmonella Surveillance Scheme).
- The monitoring of bacteria causing nosocomial (hospital-acquired) bloodstream infections in Victorians.
- The monitoring of Methicillin-resistant *Staphylococcus aureus* (MRSA) and Vancomycin-resistant *enterococci* (VRE) in Victorian hospitals.

The VHPSS data provide laboratory-based numerator information only; denominator data are not collected, and so actual infection rates cannot be calculated. The limitation of laboratory-based surveillance systems is the under-reporting of infections as a consequence of clinical specimens not being obtained from patients with infections prior to commencement of therapy.

The EWG recommended the VHPSS voluntary surveillance program continue on the following grounds:

- The complementary value of the MDU pathology monitoring system to the VICNISS (bacteraemia, CSF infections, antimicrobial resistant organisms).
- The value of baseline data (in some cases up to 10 years) for future trend mapping and monitoring of effectiveness of infection control and antibiotic guidelines or policies.

3.2.6 Victorian Infection Control Surveillance Project

The Victorian Infection Control Surveillance Project was established in June 1998 specifically to address the issue of reducing nosocomial infections. The project is an initiative of an independent group of Victorian infection control practitioners who have collaborated in an effort to undertake a multi-centred surveillance project focusing on surgical wound infection, nosocomial infections and device use in long-term care facilities. The project has sought to establish risk factors through collecting risk-adjusted, aggregated data targeting coronary artery bypass surgery, total hip replacement and total knee replacement.

3.2.7 Expert Working Group Recommendations

Having reviewed available options, the group identified components of the United States National Nosocomial Infection Surveillance (NNIS) system and risk adjustment methods as the most appropriate system to adopt for Victoria.

Recommendation 2

That components of the CDC NNIS system be adopted and used as the basis of the Victorian Nosocomial Infection Surveillance System for metropolitan and rural base hospitals.

Recommendation 3

That the laboratory-based Victorian hospital surveillance system of the Microbiological Diagnostic Unit (MDU) continue as a complementary surveillance system.

In recommending the adoption of the NNIS system and refining definitions, the EWG sought to take advantage of the extensive work already undertaken in developing the system. By using the data collected by NNIS as a benchmark, Victorian data could be compared internationally. The established NNIS manuals and other tools mean Victoria will not need to duplicate research.

The EWG recommended the following NNIS targeted surveillance components:

- Surgical-site infection surveillance (adult and paediatric).
- Adult intensive care unit (ICU) surveillance.
- Paediatric ICU surveillance.

- Paediatric high risk nursery surveillance.

3.2.8 Surgical-Site Infection Surveillance (Adult and Paediatric)

Participating VICNISS hospitals would be required to select from the following list of surgical procedures and collect data for the minimum participation period.

Table 4 List of Surgical Procedures

- CABG
- Total knee joint replacement
- Mastectomy
- Craniotomy
- Vascular surgery
- Spinal fusion
- Cholecystectomy
- Abdominal hysterectomy
- Colorectal surgery
- Total hip prosthesis
- Lower uterine caesarean section (LUSCS).

From the operative procedure list, hospitals choose those procedures they wish to follow and monitor the patients undergoing those procedures for all infections or surgical-site infections only. A record on every patient undergoing the selected procedure is generated. It includes information for risk-adjustment for surgical site infections, such as wound class, duration of operation, and American Society of Anesthesiology (ASA) score (Emori et al, 1991).

3.2.9 Adult Intensive Care Unit (ICU) Surveillance

Participating VICNISS hospitals with adult intensive care units may choose to undertake surveillance that targets infections, such as respiratory tract infections or bacteraemia.

Data are collected on all sites of nosocomial infection patients located in ICUs, as well as ICU-specific denominator data. Site-specific infection rates can be calculated by using the number of patients at risk, total bed days, and days of indwelling catheterisation, central vascular cannulation, or ventilator support as denominators (Emori et al, 1991).

3.2.10 Paediatric ICU Surveillance

Participating VICNISS hospitals with paediatric ICUs may choose to undertake surveillance targeting infections such as respiratory tract infections or bacteraemia.

Data are collected on all sites of nosocomial infection patients located in paediatric ICUs, as well as ICU-specific denominator data. Site-specific infection rates can be calculated by using the number of

patients at risk, total bed days, and days of indwelling catheterisation, central vascular cannulation, or ventilator support as denominators (Emori et al, 1991).

3.2.11 Paediatric High Risk Nursery Surveillance

Participating VICNISS hospitals with paediatric high risk nurseries (HRN) may choose to undertake surveillance all sites of nosocomial infections for all patients.

Data are collected on all sites of nosocomial infection patients located in ICUs, as well as ICU-specific denominator data. Site-specific infection rates can be calculated by using the number of patients at risk, total bed days, and days of ventilator assistance for each of four birthweight categories (≤1000 g, 1001–1500 g, 1501–2500 g, and >2500 g) (Emori et al, 1991).

3.2.12 Non-NNIS Paediatric Surveillance

Each year, on a seasonal basis, a number of infections occur that affect the children in the general community. A number of these children may require hospitalisation for treatment; consequently, cross-infection to unaffected hospitalised paediatric patients may occur. In NSW, HISS has chosen to include rotavirus and RSV as components of the NSW surveillance system.

The EWG debated this issue at length. The EWG was concerned about the efficiency and reliability of denominator data. The prime purpose of any surveillance is to provide data that assist hospitals to manage and prevent hospital-acquired infections. If numerator data were sufficient, then it may be sufficient for these seasonal paediatric infections. Consequently, the EWG suggested that, in addition to the NNIS-based paediatric surveillance components, paediatric viral/syndrome surveillance (for example, rotavirus and RSV) may be undertaken at the discretion of the hospital on a seasonal basis at local level. Further validation studies need to be undertaken to enable inter-hospital benchmarking.

3.3 Coordination

3.3.1 Rationale for a Coordinating Centre

A statewide risk-adjusted database should be developed with a capacity for analysis and feedback of aggregated data to participating hospitals. An independent coordinating centre with epidemiological, statistical, infection control and infectious diseases expertise will manage the database.

The EWG considered that an organisation should be established, funded by government but independent of it, to collect, collate, benchmark and return benchmarked data to hospitals. The independent structure of the centre, and the inherent economies of scale and resource efficiencies should encourage hospital participation in submission of data. At the same time, it would be accountable to government, and provide advice and guidance on the prevention of nosocomial infection. The database would enable submission of data that can be benchmarked against other participating hospitals as well as internationally. It will evolve to form the reference database for future Victorian research into the prevention of nosocomial infections, and evaluate the effectiveness and cost-effectiveness of infection control interventions. The system will allow for local and international ongoing development, refinement and continuous quality improvement.

Recommendation 4

That an independent coordinating centre with clearly defined accountability to the Department of Human Services be established to provide advice and support for the Victorian Nosocomial Infection Surveillance System (VICNISS). The centre will collect, feed back, benchmark and publish aggregated, risk-adjusted, procedure-specific infection rates, and provide education and training to participating institutions.

Expert Working Group Findings

The responsibilities of the coordinating centre will include:

- Developing a manual of methods and definitions, forms and software based on the NNIS system.
- Delivering confidential hospital-level and State-aggregated data to the Department of Human Services for referral to the Minister by within three years of the coordinating centres' inception, and supporting information to assist in the interpretation of data.
- Developing a system to facilitate the timely feedback of data to all key stakeholders.
- Providing, for each participating hospital, the hospital's own detailed identified data and de-identified or summary data for comparison.
- Providing consultative support to all participating hospitals and infection control practitioners.
- Providing risk-adjusted aggregated quality data for publication/public domain within two years of inception.
- Delivering infection control practitioner education to all participating hospitals in definitions and methods of the system, and in the use of software for data entry, analysis, presentation, education and training.
- Providing education to enhance case finding intensity and consistency between participating institutions and intra-hospital comparability of data.
- Provide additional supporting tools/guidelines for VICNISS participants including (but not exclusively):
    - Conformance assessment surveys and reports.
    - Data analysis.
    - Report generation.
    - Costing nosocomial infections.
    - Using VICNISS data publicly.
    - Using surveillance to bring about change in the risk of infections to patients.
    - Rate analysis tools.
    - Evaluating control measures.
    - Case finding.
    - Identifying outbreaks.

- Developing discharge criteria/definitions for the nosocomial infection surveillance system, in conjunction with relevant experts.
- Reviewing the process, minimum data set and risk adjustment methodologies within 12 months of inception in conjunction with key stakeholders (that is, consumers, clinicians, infection control practitioners and the Department of Human Services).
- In the 2001–03 period, focusing on the inpatient data collection surveillance component and delaying the incorporation of post-discharge surveillance until further research is undertaken into the development of validated definitions and methods.
- Delivering a minimum of one update and feedback forum/seminar per year addressing surveillance methods, data review and project planning.
- Establishing and maintaining the nosocomial infection surveillance website for reference material, and providing topical relevant information.
- Providing advice and assistance for hospitals with outlier infection rates.
- Providing feedback to the Department of Human Services on long-term outlier hospitals (greater than six months), where advice and implementation of interventional measures has not reduced infection rates to acceptable thresholds.
- Identifying specific infection risks in Victorian populations by procedure within three years of inception, and providing feedback for inclusion in the system review and refinement process.
- Developing close links with the Microbiological Diagnostic Unit to provide a consistent surveillance framework and the development of standards.

3.3.2 Resource Requirements for a VICNISS Coordinating Centre

Capital Requirements

- Off-the-shelf computer hardware and software that is widely supported, user-friendly, suitable for electronic transfer, and has the ability to capture NNIS definitions and minimum data set (including spreadsheets, database software, etc).
- Office space and equipment.
- Educational facilities and equipment.

Recurrent Budgetary Requirements

- Director (infectious diseases physician).
- Infection control practitioners.
- Database manager/IT support.
- Statistician.
- Epidemiologist.
- Secretarial/administrative support.

- Specialist library support (journals and texts).

Timelines for the implementation and review of VICNISS and performance measure development is attached in Appendix 3.

3.4 Data Dissemination

3.4.1 Data Confidentiality

Issues about health service data and its use remains a debated topic. It is important that measures are taken to ensure the confidentiality of the information collected for patients and hospital staff members. The aim is to develop an environment that is free from blame, where clinical units and individual clinicians can constructively examine their data and work on improvements. Lack of confidentiality, it is argued, may lead to the corruption of data and consequent failure to implement appropriate change where required. Establishing reliable infection rates involves active case finding (that is, finding patients with infections through trained staff vigorously looking for data), so an apparent higher infection rate may be more about effective surveillance than having more infections. Passive case finding (where untrained staff identify and report infections) is associated with problems of under-reporting.

Potential problems with lack of confidentiality have reputedly been associated with the public release of adverse events, and other hospitals' or clinicians' performance indicator data. Clinicians and hospital management have raised concerns regarding the use of information for purposes that these data are not designed for. These include malpractice legal proceedings, public ranking of hospitals or clinicians, financial incentives or disincentives, and political lobbying. Some have argued that such fears and reservations regarding data use or misuse may lead to the corruption of reported data, lack of credibility and loss of public confidence in the system, failure to identify problems and, most importantly, the failure of surveillance systems to identify potential problems and the need for infection control intervention.

3.4.2 Statutory Immunity

Section 139 of the *Health Services Act 1988* enables quality assurance bodies of registered funded agencies, health service establishments, psychiatric services or professional associations to obtain statutory immunity to promote full and open discussion of quality issues. The term 'statutory immunity' refers to the devices in Section 139 that aim to ensure that patient and clinician identifiable information generated by approved quality assurance bodies cannot be disclosed to persons outside quality assurance committees, and is not admissible in court proceedings.

A number of different mechanisms currently exist within the Department of Human Services for processing statutory immunity applications. The Acute Health Division is responsible for statutory immunity for all hospitals. The Public Health Division is responsible for statutory immunity for all non-hospital agencies. The ultimate responsibility for declaring quality assurance bodies for the purposes of Section 139 rests with the Minister for Health.

Statutory immunity provisions have been in place for 10 years. In April 1998, a review to assess the effectiveness and application of the provisions in non-hospital agencies was commissioned by the Public Health and Development Division. A final report was submitted in June 1998. The results of the review provided input into the process to review statutory immunity for acute health services.

In January 1999, the Department of Human Services tendered a review of statutory immunity for acute health services. The project scope covered public and private hospitals and day procedure centres. Coinciding with the review, *The Age* newspaper sent a freedom of information (FoI) application to all Health Care Networks requesting documents pertaining to adverse events. A number of shortfalls with the statutory immunity legislation and its current application within hospitals were identified as a result of this action. This included the assumption by hospitals that the immunity afforded to declared quality committees also extended to their subcommittees.

The Department of Human Services sought legal advice on areas of potential concern. The preliminary advice received indicates that Section 139 will require amendment to strengthen the provisions. The results of the statutory immunity review for acute health services will provide valuable input into this process, by providing detailed information on organisations' understanding of the provisions, and how the legislation is currently being applied.

The problems with the current legislation are becoming common knowledge within the health sector. It has been reported that clinicians and other health care professionals are reluctant to participate in quality assurance activities for fear of potential ramifications. The key will be to strike a balance between the release of information to assist in the quality assurance process and provide public accountability, and the protection of sensitive material.

Following receipt of the report, it was proposed to develop a Departmental position paper outlining suggested changes to legislation and the processes for approval of committees attracting statutory immunity. This paper will be disseminated to key stakeholder groups for comment.

Recommendation 5

That the Department of Human Services assure confidentiality of non-aggregated nosocomial infection surveillance data through clarification of freedom of information and statutory immunity requirements.

3.4.3 Inter-Hospital Benchmarking

Increasingly, health care institutions are being asked to benchmark, or compare, their rates of key events to other, similar institutions. The VICNISS system allows hospitals to compare their data for particular procedures. For example, the Victorian Infection Control Surveillance Project has targeted coronary artery bypass surgery and total hip replacement, and provided opportunities for participating hospitals to benchmark risk-adjusted procedure-specific data. In adult and paediatric ICUs, VICNISS hospitals can compare their rates of specific infections (such as nosocomial bacteraemia) with other similar Victorian and international institutions. This may be a more complex and difficult undertaking than is immediately obvious, because the rate of nosocomial infections may be affected by numerous variables. These include, for example, the length of surgery, the skill of the clinician and surgical team, the number of people present at the time of surgery, the administration and timing of antibiotic prophylaxis, the material used for skin closure, air-conditioning within the operating theatre, equipment sterilisation, the patient's medical condition, and the length of pre-operative stay in hospital. Credibility rests on having agreed definitions that are not open to local interpretation, adequate risk adjustment, and protocols about case finding.

The challenges of inter-hospital comparison of nosocomial infection rates are many, but results from the NNIS suggest that such a comparison may assist in reducing the rate of infections (Haley et al, 1980; Thomas et al, 2000). For example, a high infection rate compared with other hospitals may signal that

the infection control program should investigate the potential problem; it does not necessarily define an infection control problem. Comparisons should only be used as an initial guide for setting priorities for further comparison.

An overall hospital-wide nosocomial infection rate is not a valid measure for inter-hospital comparison. Aggregated inter-hospital data comparison is only possible when data are risk-adjusted and accurate data collection is available. The NNIS provides both criteria essential for inter-hospital comparison. Since 1990, the NNIS has undergone 10 years of rigorous review and refinement to enable monitoring and benchmarking of the incidence of hospital-acquired infections, in an effort to better prevent their occurrence. The adoption of NNIS components in the VICNISS will enable comparison with international and Victorian benchmarks.

3.4.4 Data Dissemination to Hospital Staff

Surveillance is not complete until the data are disseminated to those who will use it to prevent and control infections. The sensitive nature of nosocomial infection surveillance data means information containing patient or clinician details must be carefully handled and remain confidential. After a problem has been identified through surveillance data and preventive strategies are implemented, continued surveillance and feedback is needed to ensure the problem has been contained.

Once interpreted, data and analysis are distributed to the infection control or quality assurance committee that maintains the hospital records for nosocomial infections and other adverse events. Reports should also be distributed to clinicians, individual units, departments or department heads.

One of the most difficult tasks of an infection control program is convincing hospital personnel to accept and adopt recommended infection control preventive strategies. Behavioural change will only occur if personnel believe that the recommendations are relevant to the specific issue in question. If surveillance data are analysed appropriately and routinely fed back, clinicians usually come to rely strongly on them for guidance. Information dissemination is one of the most effective means in influencing personnel to adopt recommendations.

Recommendation 6

That once interpreted and aggregated, data be fed back to those within the participating hospitals who will take any necessary action.

3.4.5 Public Disclosure of Health Performance Information

Internationally, more and more health performance information is entering the public domain. In the US, the rationale for the release of data is market competition. Data are made available to enable consumers to select high quality, high performing health care providers and avoid those performing poorly. In contrast, in the UK, the rationale has been public accountability. It is also seen as a tool to encourage quality improvement. Research suggests that today's consumers want more information on their health services to make sense of the risks to which they might potentially be exposed. Research efforts are needed to provide insight into the public's responses to health performance data, and the sort of information most useful to the various stakeholders. Consumer involvement in the development of nosocomial infection performance measure reporting may help to generate confidence in its reliability, and confidence in the ways hospital detect and prevent infections.

3.4.6 Informing Consumers

True informed consent is only gained from consumers after they are apprised of the risks that may occur. In addition, open disclosure of nosocomial infection rates may assist patients to make informed decisions from the choices of available procedures, treating clinicians or agencies.

Through improving the information given to consumers regarding the associated risks factors of hospital-related infection, consumers and clinicians can gain greater understanding of how some procedures carry inherent risks, and how some patient-related factors are associated with higher infection risks (for example, age, sex, obesity, diabetes, peripheral vascular disease, smoking). Procedure-related risks are many and may include the site of the surgery or type of procedure. Clean surgical procedures (for example, heart or hip surgery where no contamination, necrotic tissue or pus is present) should normally be associated with a lower risk of infection than contaminated surgical procedures (for example, involving the gastro-intestinal tract, wounds contaminated with dirt or debris).

There are cogent arguments on both sides of the public disclosure issue. The demand for public disclosure will not go away, and hospital-acquired infections are an important concern for consumers. The Health Services Policy Review, completed in November, 1999, recommended that the Department of Human Services publish annual hospital-level comparative performance information from July 2002. The Victorian Government has endorsed this recommendation.

As with other adverse events, infection control is a multidisciplinary achievement, in which all staff have a role to play. It is a system-level issue that involves adequate resources, proper surveillance, development and rigorous implementation of protocols, and failsafe procedures.

For the EWG, there was increasing acceptance of the case for public disclosure of hospital-level data, as long as the data met the criteria about risk adjustment and case finding. Adequate risk adjustment was a major key to clinician acceptability and credibility. These issues needed to be assured.

The EWG concluded that the VICNISS should have a period during which only statewide-level aggregate risk-adjusted data were published, until data collection had been trialled and any issues that arise about the data were resolved.

Expert Working Group Findings

The EWG recommended that the following data feedback and distribution issues be assured:

- That collection of good data allow accurate identification of risk factors and delivery of better information to consumers regarding individual risk, which may assist in more informed decision making.
- That aggregated statewide data be provided six monthly to the Department of Human Services, which can be used as a formal report, and publicly reported in an Australian medical publication annually.
- That consumer research be undertaken by the coordinating centre in conjunction with consumer organisations to identify what sort of data are most useful to various stakeholders (that is, what patients want, can understand and will use) to ensure any public release of data on infection is not fundamentally flawed.

In addition, the EWG recommended:

- That patient and surgeon or clinician-related data remain confidential.
- That data reliability be assured for the consumer and participating hospitals.
- That confidentiality in the data analysis process be observed by the coordinating centre.

3.5 Implementation

The initial components (surgical procedures and paediatric) of the VICNISS are aimed at large metropolitan and rural base hospitals that provide general medical-surgical inpatient services to adults or children requiring acute care. There is a need for further development of evidence-based infection control practice, and the identification of risk factors contributing to infection. The EWG believes a targeted surveillance system will assist in achieving this. As argued earlier in this report, this would be directed to areas identified as problematic and producing the greatest gains (for example, high risk patients, complex surgical procedures). This is expected to have the most impact on reducing infection, and would make the best use of available resources. This approach would be reviewed as the program and coordinating centre undergo fine tuning.

Recommendation 7

That the VICNISS be implemented through a phased-in process.

Table 5 Phased Implementation of the VICNISS

Phase	Steps in Implementation
Phase 1	The establishment of a coordinating surveillance centre, educational packages/programs, surveillance system manuals, information technology systems and software development.
	Enlistment of pilot sites from metropolitan and rural acute public hospitals with greater than 100 acute beds.
	The selection of targeted procedures/components for inclusion in the pilot project.
	The review of the pilot project in conjunction with pilot institutions and other key stakeholders.
	The development of reporting format, mechanisms and release of pilot-aggregated data.
	The final pilot project report and recommendations for key performance indicators and monitoring.
Phase 2	The adoption of an appropriate Victorian standardised nosocomial surveillance system by Victorian metropolitan network, non-network hospitals and rural base hospitals.
	Exploration of the feasibility of including rural base hospitals to be undertaken in conjunction with rural discussion groups and key stakeholders.
Phase 3	The development of appropriate surveillance methods for rural hospitals.

3.5.1 Participating Hospital Resource Requirements

Hospitals participating in the VICNISS will need to make available the following equipment and resources to support the nosocomial infection surveillance, prevention and control program of the hospital:

- A minimum of one qualified infection control practitioner per 250 beds.
- Supporting surveillance clerical services that are proportional to the size, complexity, and estimated risk of the population served by the hospital.

- A paper or paperless (that is, hand-held units) system for data collection.
- A dedicated infection control surveillance computer/printer with external email access to facilitate electronic transfer of data.

Expert Working Group Findings

The EWG recommended that initially the program be voluntary, with a view towards compulsory enrolment by all Victorian metropolitan and rural base hospitals as the system, minimum data set and risk adjustment methodologies undergo refinement.

> Recommendation 8
>
> That metropolitan and rural base hospital participation in the VICNISS be strongly recommended by the Department of Human Services, but be voluntary in the first year.

Participation will provide opportunities for:

- The effective allocation and utilisation of infection control practitioner resources.
- Overall economies of scale, scope and teamwork through reducing site-based data analysis, validation and systems development.
- The reduction in surveillance-associated resource total average costs incurred at both hospital and State level.
- The creation of benchmarks for target patient procedures and populations.
- The benchmarking of institutional surveillance data and rates by participating institutions against aggregated State and international rates.
- Meeting the requirements for ACHS accreditation.
- Meeting the accountability requirements for consumer groups for valid and reliable data on hospital associated risks.

3.5.2 Strategic Infection Control

As the surveillance system would be phased in, and further consideration is needed for a suitable process for smaller rural hospitals (whether hospitals are participating or not), there are a number of characteristics of all infection control programs that should apply across all Victorian hospitals. These reflect the need to have defined objectives at a local level that are relevant to local circumstances.

The support of hospital management is particularly critical to the success of infection control. As an editorial by Leape and Berwick observed in a recent edition of the *British Medical Journal*:

> While local 'champions'—individual doctors, pharmacists, or nurses—can, by their enthusiasm, motivate others to make improvements, major systems changes require direction and support from the top leaders who communicate their own commitment by insisting on safety as an explicit organisational goal backed by adequate resources. The necessary changes are as much cultural as technical; creating a culture of safety requires attention not only to the design of tasks and processes, but to how we train every health care worker to participate in the quest for infection control and prevention and safer patient care (Leape et al, 2000).

Expert Working Group Findings

Recommendation 9

That all metropolitan hospitals and rural base hospitals (participating and non-participating) be required to develop institutional nosocomial infection surveillance programs, develop objectives relevant to local circumstances and casemix, and put internal supporting structures in place.

The EWG recommends:

- That all Victorian hospitals have clear objectives for undertaking nosocomial infection surveillance and defined linkages with internal quality infrastructures.
- That all infection control committees report to the senior management/executive committee on surveillance outcomes, variances in rates, and the effectiveness of infection control prevention and quality improvement strategies.
- That all nosocomial surveillance objectives be reviewed and updated frequently to meet new infection risks in changing patient populations.
- That the collection and analysis of data be performed in conjunction with a nosocomial infection prevention strategy.
- That all hospitals develop strategies for encouraging and supporting surveillance best practice at local level, including data management systems and systems of care.
- That all non-participating hospitals ensure infection control practitioners and teams are consulted routinely to provide expert guidance in selecting indicators, overseeing data collection, and analysing indicators that are used for inter-hospital comparison.

3.5.3 Accreditation Requirements

Satisfying the requirements of nationally recognised health care agency accreditation bodies, such as the ACHS, is an important requirement and application of the surveillance system. However, if it is used only for the purpose of accreditation, is not an efficient and effective use of resources. The most important objective of the system is the detection and prevention of infection. Surveillance should be used in a directed manner to lessen the number of adverse events, and should not be collected for the sole purpose of satisfying a periodic survey process. As with all forms of data collection, staff will be most committed to collecting if they can see the tangible benefit in terms of timely and local improvement. This is consistent in seeing nosocomial infection surveillance as a central component of continuous evaluation and improvement performance. It is desirable that the data and the processes that are used to improve infection control on a day-to-day basis meet the requirements for accreditation.

After considering these issues, the EWG recommended that the Department of Human Services seek Approval from ACHS accreditation authorities. This would ensure that participants in the VICNISS would be exempt from collecting ACHS infection clinical indicator data, and ensure participation met the requirements for accreditation. Linkages with ACHS EQuIP accreditation are recommended because:

- Duplication in data collection efforts and infection control practitioner resource utilisation is reduced.
- The system provides validated, aggregated statewide data, while using well-accepted and widely used definitions and methods.
- There are opportunities for participating institutions to benchmark rates with State and international aggregated data.

Recommendation 10

That Boards of health services and CEOs be ultimately responsible for the delivery of effective infection control surveillance and prevention programs.

Recommendation 11

In order to reduce duplication of data collection, that linkages between the VICNISS and the ACHS EQuIP accreditation process be sought by the Department of Human Services.

3.6 Post-Discharge Surveillance

The impetus for post-discharge surveillance stems from the trend in decreased length of stay after surgery, early discharge, and hospital in the home program initiatives. The shorter length of post-operative stay means that an estimated 50–70 per cent of surgical wound infections occur post-discharge, which leads to subsequent under-reporting of infection rates (Crowe, 1996). The Infection Control Taskforce reported that post-discharge surveillance was not routinely performed in most hospitals (DHS, 1998a).

There is currently no standard method for following patients for evidence of infections once they have left the hospital.

Recommendation 12

That the undertaking of post-discharge nosocomial infection surveillance be encouraged. That research be funded to develop validated approaches. In the interim, that post-discharge surveillance be undertaken at the discretion of each individual institution.

Expert Working Group Findings

The EWG recommended that, until a standard method for post-discharge surveillance is developed and validated, hospitals adopt a method that accommodates their resources and data requirements, because:

- There is no validated or standard methodology currently available for post-discharge surveillance—nationally or internationally.
- Post-discharge surveillance is expensive and labour intensive.
- There are problems with timeliness and accuracy of post-discharge surveillance data.
- Patients with serious infections will re-present to hospital for clinical management and will be captured through inpatient surveillance systems.
- There are methodological problems, including:

- The reliance on physicians to return infection information on patients in a timely manner.
- The patient's ability to accurately diagnose their own infection.
- How to determine the best method to handle patients not followed up.
- The ability to capture data on patients presenting with infections post-discharge to other institutions.

Further research needs to be undertaken in this area.

3.7 Performance Indicators

In recent years, much work has been done in developing and implementing appropriate quality performance indicators for use in the acute health sector within Australia and internationally. Considerable experience has been gained in developing effective performance indicators. Developing indicators that meet a range of purposes and the needs of a variety of audiences provides particular challenges, including consumers, clinicians and health care professionals, hospital and network managers and the government. Some of the purposes that have been articulated include:

- Enabling consumers to make informed choices about treatment options.
- Allowing providers to know the level at which they are practising by being able to compare their results against other providers.
- Fulfilling the need for public accountability to governments as funders and purchasers of health services.
- Assuring the public about the quality and reliability of public health services.
- Enabling purchasers to make appropriate policy and purchasing decisions.

More work needs to be done to develop the VICNISS performance indicators at the hospital and system level. Once the VICNISS is in place, it will be possible to develop some outcome indicators for Victorian hospitals and the coordinating centre. The EWG had reservations about the use of infection rates themselves as a performance indicator because of the issue of case finding. Nevertheless, there was willingness to consider that information about infection rates be publicly available, once adequately validated and risk adjusted, and hospitals had had a period to address problems identified by the data. Earlier, this report suggests that work on this be undertaken in conjunction with consumer organisations.

Recommendation 13

That hospitals participating in the VICNISS be required to submit performance indicator data to the Department of Human Services.

The approach taken was to identify some participation indicators, so participation in an effective surveillance system was one indicator of an organisational commitment to decreasing infection rates, and a public assurance about a hospital's infection control approach. The indicators listed below could be used as components of a participation indicator.

VICNISS Pilot Hospitals

- Delivery of generic surgical-site infection component minimum data set (hip, cholecystectomy, appendectomy).
- Delivery of ICU/NICU bacteraemia component minimum data set.
- Delivery of one other elective surgical site infection component minimum data set.

VICNISS Participating Hospitals

- Delivery of data to the coordinating centre on time and in a useable format.
- Delivery of good quality data with the minimum data set fields completed.
- Establishment of internal (hospital-based) data validation systems.

VICNISS Coordinating Centre

The coordinating centre should also be expected to meet a number of performance criteria:

- Delivery of meaningful summary and aggregated risk-adjusted data to participating hospitals and the Department of Human Services within one month of data submission.
- Delivery of outcome data within six months of the VICNISS pilot project, and estimates of infection rates in hip, cholecystectomy, appendectomy and bacteraemia in ICU/NICU.
- Delivery of comparable and interpretable data against international NNIS benchmarks.

3.7.1 Other Performance Indicators

The EWG considered a further indicator, the timing of antibiotic prophylaxis, should be explored as a possible indicator for all Victorian hospitals. It is a process indicator, but one clearly associated with outcomes. It is recommended on the basis that is it important for prevention of surgical wound infection, and contributes to prudent antibiotic use. There is currently variation in practice in Victorian hospitals, and the data are collectable.

> Recommendation 14
>
> That the timing of antibiotic prophylaxis be explored as a possible indicator for all Victorian hospitals.

Appendix 1 Expert Working Group on Surveillance of Nosocomial Infection Membership and Terms of Reference

The Expert Working Group on Surveillance of Nosocomial Infection was set up in September 1998 with the following terms of reference:

- Identify a system for use as a standardised surveillance system for nosocomial infections in Victorian public hospitals, including:
    - The purpose of the surveillance system.
    - Numerator and denominator definitions.
    - Identification of cases.
    - Risk-adjustment.
    - Feedback to clinical units.
    - Targeted versus hospital-wide surveillance.
    - Mechanisms to ensure confidentiality of data.
- Identify the minimum data set required.
- Identify resource implications.
- Recommend an appropriate consultation process for introducing the system.
- Identify components of the surveillance system suitable for use as performance indicators.

Members

These members were selected on the basis of their expertise and interest in infection control and nosocomial infection.

Ruth Cornish	Manager	Safety Unit	Acute Health (Chair until January 1999)
Mary Draper	Manager	Effectiveness Unit	Acute Health (Chair from February 1999)
Dr Derrick Bui	Disease Control Section	Communicable Diseases Section	Public Health
Dr John Carnie	Manager	Communicable Diseases Section	Public Health Division
Sue Evans	Infection Control Practitioner		Maroondah Hospital
Glenda Gorrie	Section Manager	Infection Control	North Western Health Network
Glenys Harrington	Infection Control Practitioner		The Alfred Hospital
Associate Professor Geoff Hogg	Director	Microbiological Diagnostic Unit	Microbiology and Immunology, The University of Melbourne
Dr Marion Kainer	Infectious Diseases Physician		Maroondah Hospital and Western Hospital
Dr Heath Kellys	Head	Epidemiology and Public Health	Victorian Infectious Diseases Reference Laboratory

Jacqueline Kennon	Infection Control Practitioner	Victorian Infection Control Nurses Association	Frankston Hospital (from September 1998 to May 1999)
Rhea Martin	Victorian Infection Control Practitioner	Infection Control Nurses Association	Austin and Repatriation Medical Centre (from June 1999)
Rodney Moran	Project Officer	Communicable Diseases Section	Public Health Division
Dr Mike Richards	Head	Infectious Diseases	Austin and Repatriation Medical Centre
Genevieve Ryan	Senior Nurse Adviser	Private Hospitals Unit	Acute Health Division
Sue Scott	Infection Control Practitioner	Pathology Department	The Royal Children's Hospital
Associate Professor Denis Spelman	Director	Microbiology	The Alfred Hospital
Dr David Hillis	General Manager	Acute Health Service	Peninsula Health Care Network (from December 1999)

Appendix 2 Attributes for Indicator Selection

Attributes	Encompass	Selection
Clinical significance	Burden Volume	Acceptable
	Cost morbidity	Cost utility
	$$$	
	Valid Content	
	Evidence-based (NHMRC levels)	
	Usefulness	
Data value	Definable	Data burden/cost
	Accessible	
	Reliable	
	Identifiable	
	Meaningful	
Responsiveness	Potential for action to improve process and/or outcomes	Potential for individual and/or State-level influence

Source: ACHS Care Evaluation Program, Monash University Department of Epidemiology and Preventative Medicine. *Acute Health Indicator Project Report 1*, 17 December 1998.

Appendix 3 Australian Surveillance Timeline 1961–2002

Epidemic *S. aureus phage* 80–81	1961
First Australian hospital infection nurse at Princess Alexandra Hospital (Brisbane)	1962
Infection Control Association established	1974
Australian Council Healthcare Standards established	1974
Standing Committee on Infection Control (SCIC) established	1978
First Australian nosocomial infection prevalence study	1984
Victorian Hospital Pathogen Surveillance System (VHPSS)	1988
ACHS clinical indicators developed for surgical site wound and nosocomial bloodstream infection	1992
NSW Nosocomial Infection Outcome Indicator Study	1994
National Hospital Quality Management Program	1994
NSW Nosocomial Infection Taskforce	1996
Australian Hospital Care Study	1996
NHMRC Infection Control in the Health Care Setting	1996
NSW Hospital Infection, Epidemiology and Surveillance Unit Hospital Infection Surveillance System (HISS)	1998
Communicable Diseases Network Australia New Zealand (CDNANZ) Nosocomial Advisory Group	1998
Nosocomial Advisory Group to the Commonwealth	1998
Victorian Infection Control Surveillance Project (VICSP)	1998
Infection Control Automated Technology (ICAT) launch (commercially available surveillance system)	1998
Victorian Expert Working Party on the Surveillance of Nosocomial Infections	1998
Victorian Nosocomial Infection Surveillance System (VICNISS) Launch	2002

Source: Adapted from the HISS website http://www.med.unsw.edu.au/hiss

Appendix 4 Minimum Data Set

The following information is a sample of the minimum data set for the VICNISS surgical site infection surveillance component.

Surgical Site Infection (SSI) component

Field	Values for Field	Details	R = Required CR = Conditionally Required NR = Not Required
Hospital code	Three-digit identification number assigned to hospital	Each hospital is assigned a three-digit code.	R
Infection ID #	YY###	Unique identification number of each nosocomial infection.	R
Type: N	N = NNIS nosocomial infection C = Community-acquired R = Rehabilitation	Provides flexibility in application.	R
Patient ID#	12 letters and or numbers	UR number. Allows validation of data at a later date.	R
Patient name			NR
DOB	In years	Year, month, day.	R
Gender	F/M		R
Admission date	Year, month, day	Identifies the admission the exposure occurred; that is, write admission date of preceding admission, if requires readmission.	R
Unit code	Two or three character code	For example, cardiac, respiratory medicine.	R
Ward	Ward code	Ward code specific to hospital.	R
ICU (Intensive Care Unit)	YES/NO	If in ICU at time of infection (or within 48 hours preceding infection).	R
Type of ICU	Codes		CR R = If patient in ICU
Operation	YES/NO	VICNISS operative procedure. Regardless of infection site, must report information on operation. Important for data analysis process.	R
VICNISS operative procedure code		If more than one operative procedure is done, enter the code of the procedure that is thought to be related to the infection.	R
Operation date	Year, month, day		R

Field	Values for Field	Details	R = Required CR = Conditionally Required NR = Not Required
Operation duration	Hours and minutes	Interval in hours and minutes between skin incision and skin closure. If patient returns to the operating room, and a procedure is performed through same incision, add the time of the second operation to the duration time.	R
Wound class	Clean Clean-contaminated Contaminated Dirty U= unknown	If patient goes to the operating room more than once, and is operated on through same incision, then report the wound classification with highest degree of contamination.	CR (SSI)
Surgeon	20 letters or numbers		NR Data not sent
General anaesthesia	YES/NO		R
ASA Class	1, 2, 3, 4, 5	If patient goes to the OR more than once, and is operated on through same incision, then report the highest ASA classification recorded.	R
Emergency	YES/NO		R
Trauma	YES/NO		R
Implant	YES/NO condition dependant	Includes prosthesis, for example, heart valve.	R
Endoscopic approach	YES/NO/Convert	Yes: If entire operative procedure performed through endoscopic approach. No: If endoscope used for diagnostic purposes only. Convert: If started off using endoscopic approach but then had to convert to open procedure.	R
Multiple VICNISS procedures performed through same incision	YES/NO	Yes: If more than one VICNISS operative procedure through the same surgical site.	R
Infection date	Year, month, day	Date of first clinical or laboratory evidence of infection.	R
SSI-specific site	SKN, SKNC, SKNL ST/STC/STL Organ code (23 codes)		CR If SSI is present
SSI detected during admission/post-discharge/readmission	A/P/R	A = admission. P = post-discharge surveillance. R = readmission.	CR If SSI is present
Secondary bloodstream infection (BSI)	YES/NO	Yes: culture confirmed BSI and a related nosocomial infection at another site (except If a vascular access device is present). No: If major site of infection is BSI.	R
Died	YES/NO	Patient died during this admission. If patient had multiple nosocomial infections, then each infection needs to be coded with Yes.	R

Field	Values for Field	Details	R = Required CR = Conditionally Required NR = Not Required
Relationship to death	CA/CO/NR/U	CA = caused the death. CO = contributed to the death. NR = death not related. U = relationship between this nosocomial infection and the patients death is unknown.	CR If patient died during hospitalisation.
Laboratory diagnosis	C/A/V/N/IF	C = culture. A = antigen/antibody. V = visualisation for example, histology. N = none. IF = immunoflorescence.	R
Culture specimen type	12 codes	The specimen from which the pathogen is identified.	CR If the patient has an infection confirmed by culture.
Pathogen code	Multiple codes for pathogens Also: CTM/UNK	Can enter four (4) pathogens. Pathogen one (1) is most important. CTM = culture contaminated. UNK = pathogen isolated, but not on VICNISS pathogen list.	CR If the patient has an infection confirmed by laboratory.
Antibiogram	Specific codes S/I/R	S = sensitive. I = intermediate. R= resistant.	CR If the patient has an infection confirmed by laboratory.
Discharge date	Year, month, day		R
Optional Field 1			
Optional Field 2			
Optional Field 3			
Optional Field 4			
Optional Field 5			
Antibiotic given pre/peri-operatively	YES/NO		R
Antibiotic name 1, 2, 3, 4	Specific code	Use antibiotic code.	CR If patient was given antibiotic peri-operatively.
Antibiotic route 1, 2, 3, 4	IV/IM/PR/oral	IV = intravenous. IM = intramuscular. PR = per rectum. Oral = per mouth.	CR If patient was given antibiotic peri-operatively.

Field	Values for Field	Details	R = Required CR = Conditionally Required NR = Not Required
Antibiotic time 1, 2, 3, 4	Hours, minutes		CR If patient was given antibiotic peri-operatively.

Glossary

Area	Definition
Aggregation of data	Collection of many data units into one body of data.
Adjustment	A summarising procedure for statistical measure, in which the effects of differences in composition of the populations being compared have been minimised by statistical methods. Examples are adjustment by regression analysis and by standardisation. Adjustment often is performed on rates or relative risks, commonly because of differing age distributions in populations that are being compared.
Baseline data	A set of data collected the beginning of a study.
Bacteraemia	A significant bloodstream infection.
Case finding	A person in the population or study group identified as having the particular disease, health disorder, or condition under investigation. A variety of criteria may be used to identify cases, for example, physicians' diagnosis, clinical records and pathology reports. In surveillance programs, case finding may be described as being passive or active. Passive case finding is where persons who do not have a primary surveillance role are relied upon for identifying and reporting infections. Active surveillance case finding is the process of actively looking for infection data using trained personnel and various data sources to accumulate information, and deciding whether or not a nosocomial infection has occurred.
Denominator	The lower portion of a fraction used to calculate a rate or ratio. The population (or population experience, as in person years, surgical procedures performed, etc) at risk in the calculation of a rate or ratio.
Endemic	The constant presence of a disease or infectious agent within a given geographical area or population group. This term may also refer to the usual prevalence of a given disease within such an area or group.
Epidemic	The occurrence in the community or region of cases of an illness, specific health-related behaviour, or other health-related events clearly in excess of normal expectancy. Epidemicity is relative to usual frequency of the disease in the same area, among the specified population, at the same season of the year.
Epidemiology	The study of the distribution and determinants of health-related conditions or events in specific populations, and the application of this study to control of health problems.
Extrinsic risk	Extrinsic risk factors include treatment process, use of devices and/or institutional characteristics; for example, the use of invasive devices, such as catheters, or undergoing 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 episode	Period in which a health problem (that is, infection) or illness exists, from its onset to its resolution.
Intrinsic risk	Intrinsic risk factors are those inherent in the patient (for example, the old and the young) or medical conditions (such as cancer, obesity or diabetes).
Intravascular device related	Significant bloodstream infection linked with the presence of an intravascular cannula to the occurrence of a medical procedure preceding the episode.
Minimum data set	A widely agreed upon and generally accepted set of terms and definitions constituting a core of data collected and used for developing statistics suitable for diverse types of analyses and users.
Multi-centre study	A study in which the data collected and rates reported on events in a target population are derived from a number of centres/hospitals.
Numerator	The upper portion of a fraction used to calculate a rate or a ratio; for example, number of patients undergoing a surgical procedure who develop an infection.
Outlier infection rate	Observations differing widely from the rest of the data.
Prevalence	The number of events (for example, instances of a given disease or other condition) in a given population at a designated

Area	Definition
	time.
Point prevalence	The number of events or persons with a given disease or other attribute during a specified point in time.
Procedure-specific	The number of events (for example, specific procedures) in a given population at a designated time.
Prospective study	A study in which subsets of a defined population can be identified who are, have been, or in the *future* may be exposed/not exposed to a factor/factors hypothesised to influence the probability or occurrence of a given disease or other outcome. Observation of the population for a sufficient number of person years to generate reliable incidence or mortality rates in the population subsets. This generally implies a study of a large population, or a study for a prolonged period.
Rate	A measure of the frequency of occurrence of a phenomenon. An expression of the frequency with which an event occurs in a defined population. The use of rates rather than raw numbers is essential for comparison between populations at different times, different places, or among different classes of persons. All rates are ratios, calculated by dividing a numerator by a denominator: Rate = Numerator (number of events in specified period; for example, infections) Denominator (average population during the period; for example, cardiac surgical patients)
Retrospective study	See prospective study. Study on events or experiences in the *past*.
Risk adjustment	A standardised method used to ensure intrinsic and extrinsic factors that may affect the risk of acquiring a nosocomial infection, are considered in the calculation of nosocomial infection rates.
Surgical site infection (SSI)	Surgical wound infection. For surveillance purposes, SSIs are divided into incisional SSI and organ/space SSI (Horan et al, 1992).
Surveillance	The ongoing systematic collection, analysis and interpretation of health data essential to the planning, implementation and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know.
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.
Targeted	The collection of individuals, measurements, etc, about which we want to make inferences; for example, patients undergoing hip prothesis implants, patients undergoing colon surgery.
Transmission of infection	Transmission of infectious agents. Any mechanism by which an infectious agent is spread from a source or reservoir to another person.
Trend	A long-term movement in an ordered series; for example, a time series.
Validation	A program series of checks and challenges, repeated periodically, and carried out using a documented protocol that demonstrates the process being studied is reliable and repeatable for the purpose for which it is being used.

Taken from Last, 1995.

Acronyms

ACHS	Australian Council for HealthCare Standards
AICA	Australian Infection Control Association
ASA	American Society of Anesthesiology
CDC	Centers for Disease Control and Prevention (US)
CDNANZ	Communicable Diseases Network Australia New Zealand
DRG	Diagnostic Related Group
EFT	Effective full-time
EWG	Expert Working Group
FoI	Freedom of information
HELICS	Hospitals in Europe Link for Infection Control through Surveillance
HISS	NSW Health Hospital Infection Surveillance system
HRN	High risk nurseries
ICAT	Infection Control Automated Technology
ICP	Infection control practitioner
ICU	Intensive care unit
JCAHO	Joint Commission on Accreditation of Healthcare Organisations
MDU	Melbourne Diagnostic Unit
MDU	Microbiological Diagnostic Unit
NHMRC	National Health and Medical Research Council
NNIS	National Nosocomial Infection Surveillance
RSV	Respiratory syncytial virus
SCIC	Standing Committee on Infection Control
SENIC	Study of the Efficacy of Nosocomial Infection Control
SSI	Surgical site infection
VHPSS	Victorian Hospitals Pathogens Surveillance System
VHPSS	Victorian Hospital Pathogen Surveillance System
VRE	Vancomycin-resistant *enterococci*

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