Chapter 3
Surveillance for Healthcare-Associated Infections

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Key points

- Monitor infection patterns (sites, pathogens, risk factors, location within the facility); only collect data that will be useful in decision-making.
- Detect changes in the patterns that may indicate an infection problem.
- Direct the rapid implementation of control measures.
- Monitor antibiotic use and resistance.
- Provide the staff with exactly the information they need in order to improve infection prevention practices.

Introduction

Hospital programmes of infection prevention and control (IC) should include surveillance to detect common source outbreaks, identify problem areas, help set priorities for IC activity, and meet national standards. Surveillance can also provide data to help clinicians and managers improve IC practices.

Surveillance can be defined as the systematic, active, on-going observation of the occurrence and distribution of disease within a population and of the events that increase or decrease the risk of the disease occurrence. If the incidence, distribution and associations of a disease are known, then resources can be targeted, predisposing factors can be reduced or eliminated, and the incidence of the disease reduced.

The purpose of surveillance for healthcare-associated infections (HAI) is to reduce the incidence of HAI and thus to reduce associated morbidity, mortality, and costs. It can have a significant impact on rates of HAI. The Study on the Efficacy of Nosocomial Infection Control (SENIC)[1] found that hospitals with a surveillance program providing data to clinical staff had considerably lower infection rates. French and colleagues demonstrated the effectiveness of repeated prevalence surveys[2] and the US National Nosocomial Infections Surveillance System (NNIS) has shown a significant reduction of healthcare-associated infection rates in the US.[3]

Before beginning surveillance activities it is essential to develop a clear plan. It should address 1) what questions are being asked, 2) how infections are to be defined, 3) how the data are to be collected, stored, retrieved, summarized and interpreted, 4) how to provide the results to frontline practitioners, and 5) how to use the information to bring about change.

Surveillance practices are similar to clinical audit, except that for an audit the practice and outcomes of medical care (in this case the prevention and control of HAI) is compared with a standard. By repeated audit cycles, practice is brought closer to the ideal.

Methods of Surveillance for HAI

Surveillance requires strict definitions. In many cases there are no universally agreed definitions and so the infection rate will vary with the definition used. Comparisons can only be made if the same set of definitions is used and applied in exactly the same way. It is often more meaningful to use surveillance data from a single institution to measure trends over time, either to alert staff to increasing problems or to monitor the effectiveness of interventions.

The definitions should distinguish between HAI and community-acquired infection (CAI). Healthcare-associated infections can be defined as those that were neither present nor incubating at the time the patient was admitted. Detailed definitions of specific infections have been published by several organisations, including the World Health Organization[4], the US NNIS[5], and the Hospital Infection Society.[6]

Some infections may present after the patient leaves hospital. In surveillance for surgical site infection, as many as 70% of infections may present after discharge. This has led to 'post-discharge surveillance'. However, this often poses considerable logistic problems and may add further expense to surveillance activities.

Formal surveillance for infections requires each patient to be assessed, often repeatedly, by trained staff. For this reason, true infection surveillance (and especially incidence surveillance) is very expensive. Because of this, routine surveillance is often performed by analyzing laboratory reports, by informal ward visits, or by a combination of the two. However these methods are not accurate. Laboratory reports are not always indicative of true infection. Negative reports (or no report) do not always mean infection is absent. Case finding using active surveillance by an Infection Control Nurse (ICN) increased detection from approximately 25% of defined infections to more than 85% in some studies. These methods are particularly useful for identifying infections that may require action by the Infection Control Team (ICT) and for measuring trends over periods when laboratory, medical, and IC nursing practice remain constant. (See Table 3.1)

Table 3.1. Types of Surveillance

Type	Advantages	Disadvantages
Comprehensive – all infections	Provides a global view Detects trends	Labour intensive Time consuming
Selective/targeted, e.g., by ICU, by device	Flexible Resource efficient Can focus on high-risk areas	Provides limited information May miss outbreaks
Prevalence	Timely Can evaluate the surveillance system	Provides only an estimate of infections
Post-discharge	Increases case-finding	Not timely

Incidence and prevalence of HAI

The prevalence of HAI is the number of cases of active HAI in a defined patient population either during a specified period of time (the period prevalence) or at a specified point in time (point prevalence). The prevalence rate is the proportion of patients in the population who have an active infection at the time of the survey. The incidence of HAI is the number of new cases of disease that occur in the defined patient population during a specified time period. The incidence rate is the number of new cases of HAI that appear in the population at risk during the specified time period.

Alert condition surveillance

Alert condition surveillance means monitoring the incidence of specific clinical conditions, such as infectious diarrhoea or tuberculosis. This is part of the daily work of the ICT which is directed towards, for

example, the early identification of outbreaks of viral diarrhoea and the implementation of control procedures. Because this activity is usually not performed in a systematic way, it is not an accurate measure of true incidence.

Alert organism surveillance

Alert organism surveillance is the continuous monitoring of the incidence of specified microorganisms isolated by the microbiology laboratory. Alert organisms might include methicillin-resistant *S. aureus* (MRSA), glycopeptide-resistant enterococci, gentamicin-resistant coliforms and *Clostridium difficile* (by identification of its toxin). The isolation of an organism is not necessarily indicative of infection and the failure to isolate a microorganism does not prove the absence of infection. Furthermore, care must be taken to avoid bias produced by duplicates and screening cultures. When tracking an organism it should only be counted once. Nevertheless, this surveillance is useful for IC purposes. It has the advantages of simplicity and economy, and in computerized laboratories, the surveillance can be automated. In particular, in an individual hospital, it can show trends in the isolation of specific microorganisms in different wards over time.

Prevalence surveys

In this method, hospital inpatients are surveyed over a short period of time, ideally on a single day. These surveys are more practical than incidence surveillance since they can be performed by just a few people - often temporarily recruited from other tasks - once or twice a year. Repeated prevalence surveys are not a complete substitute for incidence surveillance, but helpful where resources are limited.

Prevalence surveys are useful to indicate the extent of HAI within a hospital or region, to indicate specific problems requiring more extensive investigation, and to define the changing patterns of HAIs in a single hospital. If prevalence surveys are repeated at regular intervals with the results provided to medical and nursing staff they can perform some of the same functions as continuous surveillance.

Prevalence rates tend to be lower than incidence rates since prevalence studies are less effective at identifying acute or short-lived infections.

Repeated prevalence surveys are useful for monitoring trends in rates of both HAI and CAI. They can be performed with relatively limited resources and produce information on both infected and uninfected patients that can be used to identify independent risk factors. When properly applied, prevalence surveys can also be used to analyse the effectiveness of intervention strategies.

Prevalence studies have shown that, depending on the patient population, the prevalence of HAI averages around 9-10%. Although most prevalence studies have been applied to the entire hospital, it is probably more effective to target certain areas or services where infection rates are suspected or known to be high.

Incidence surveillance

In this method, all patients are monitored for HAI. This produces accurate measures of infection rates. However it requires structured analysis, strict definitions, and trained staff to visit all patients repeatedly. Because it is time consuming, incidence surveillance usually cannot be performed continuously; rather it is often targeted in areas where problems are known or suspected. For example, surgical teams should survey clean surgical wound infection, supervised by the ICT. This means the surgical teams take ownership of the problem and are more likely to make interventions if rates are high.

Numerator data

The patient's name, identifying number or code, ward or unit, medical service at the time the infection began to develop, and date of admission are required. The date of onset of the infection, preceding risk factors such as respiratory therapy before new pneumonia, site of infection, significant microorganisms and their sensitivity patterns help to describe the infection. Additional information should not be collected routinely unless it will be used. Other information may include patient's primary diagnosis, age, sex, a measurement of severity of illness, physician's name, antimicrobial therapy, and indirect risk factors such as immunosuppressive diseases or therapies.

Denominator data (population at risk)

Rates are always calculated with the numerator (number of persons with the infection or condition) divided by the denominator (number of persons at risk for the infection). The more precisely the denominator captures the potentially preventable risk elements the better. For example, healthcare-associated pneumonia cases among patients who had respiratory therapy divided by number of patients discharged in a month or on a specific care unit provides some estimate of risk. However, healthcare-associated pneumonia among such patients divided by number of patients receiving respiratory therapy, e.g., on a ventilator, yields a much better and more useful rate. Thus, when evaluating risks associated with procedures that are long term, such as urinary catheterisation, it is important to use the number of catheter days as the denominator instead of the number of patients.

What are the standards for rates of HAI?

There are no published standard HAI rates. The rate will vary with patient risk and, therefore, there will be different rates in different units. Ayliffe pointed out that there is an 'irreducible minimum' rate due to the inherent risks of underlying disease and medical interventions. Rates will also vary depending on the level of facilities and staffing available. In general rates should be compared with peer institutions.

Prevalence surveys show average whole hospital rates of HAI of 7-10%. About 30% of these may be preventable, depending on the patient population. Surgical site infection rates in clean surgery should probably be less than 5%, and even less than 1% may be achievable.

Feedback

It is pointless to collect masses of data if they are only seen by the ICT. Surveillance results must be provided regularly to the front-line clinical staff in order to help them choose actions to reduce infection rates. It has been shown on many occasions that feedback – with educational and practical help from the ICT – is one of the most effective ways of effecting change in hygienic practice.

There should be a written surveillance plan for the health care facility. It should include the definitions used, which infections are followed, how data are collected, and the frequency of data collection. It should also outline who is responsible for surveillance activities.

References and Further Reading

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