GUIDANCE ON PUBLIC REPORTING OF HEALTHCARE-ASSOCIATED

INFECTIONS

Recommendations of the Healthcare Infection Control Practices Advisory

Committee

Executive Summary

Healthcare-associated infections (HAIs) are a major public health problem in the United States. In hospitals alone, HAIs account for an estimated 2 million infections, 90,000 deaths, and $4.5 billion dollars in excess healthcare costs annually. Since 1970, a group of U.S. hospitals (now numbering nearly 300) has voluntarily reported to the Centers for Disease Control and Prevention (CDC), on a confidential basis, data on selected HAIs that occur in their hospitals.

Since 2002, four states have enacted legislation that requires healthcare organizations to publicly disclose HAI rates. Similar legislative efforts are underway in several other states. Advocates of mandatory public reporting of HAIs believe that making such information publicly available will enable consumers to make more informed choices about their healthcare and improve overall healthcare quality by reducing HAIs. Further, they believe that patients have a right to know this information. However, others have expressed concern that the reliability of public reporting systems may be compromised by institutional variability in the definitions used for HAIs, or in the methods and resources used to identify HAIs.

Presently, there is insufficient evidence on the merits and limitations of an HAI public reporting system. Therefore, the Healthcare Infection Control Practices Advisory Committee (HICPAC) has not recommended for or against mandatory public reporting of HAI rates. However, HICPAC has developed this guidance document based on established principles for public health and HAI reporting systems. This document is intended to assist policymakers, program planners, consumer advocacy organizations,

and others tasked with designing and implementing public reporting systems for HAIs. The document provides a framework for legislators, but does not provide model legislation.

HICPAC recommends that persons who design and implement such systems 1) use established public health surveillance methods when designing and implementing mandatory HAI reporting systems; 2) create multidisciplinary advisory panels, including persons with expertise in the prevention and control of HAIs, to monitor the planning and oversight of HAI public reporting systems; 3) choose appropriate process and outcome measures based on facility type and phase in measures to allow time for facilities to adapt and to permit ongoing evaluation of data validity; and 4) provide regular and confidential feedback of performance data to healthcare providers.

Specifically, HICPAC recommends that states establishing public reporting systems for HAIs select one or more of the following process or outcome measures as appropriate for hospitals or long-term care facilities in their jurisdictions: 1) central-line insertion practices; 2) surgical antimicrobial prophylaxis; 3) influenza vaccination coverage among patients and healthcare personnel; 4) central line-associated bloodstream infections; and 5) surgical site infections following selected operations. HICPAC will update these recommendations as more research and experience become available.

Introduction

Consumer demand for healthcare information, including data about the

performance of healthcare providers, has increased steadily over the past decade. Many

state and national initiatives are underway to mandate or induce healthcare organizations

to publicly disclose information regarding institutional and physician performance.

Mandatory public reporting of healthcare performance is intended to enable stakeholders,

including consumers, to make more informed choices on healthcare issues.

Public reporting of healthcare performance information has taken several forms.

Healthcare performance reports (report cards and honor rolls) typically describe the

outcomes of medical care in terms of mortality, selected complications, or medical errors

and, to a lesser extent, economic outcomes. Increasingly, process measures (i.e.,

measurement of adherence to recommended healthcare practices, such as handwashing)

are being used as an indicator of how well an organization adheres to established

standards of practice with the implicit assumption that good processes lead to good

healthcare outcomes. National healthcare quality improvement initiatives, notably those

of the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO), the

Centers for Medicare & Medicaid Services (CMS), and the Hospital Quality Alliance, use

process measures in their public reporting initiatives.

Healthcare-associated infections (HAIs) are infections that patients acquire during

the course of receiving treatment for other conditions (see Glossary for full definition of

this and other terms used in this document). In hospitals alone, HAIs account for an

estimated 2 million infections, 90,000 deaths, and $4.5 billion dollars in excess healthcare

costs annually (1); however, few of the existing report cards on hospital performance use

HAIs as a quality indicator. Since 2002, four states (Illinois, Pennsylvania, Missouri, and Florida) have enacted legislation mandating hospitals and healthcare organizations to publicly disclose HAI rates. Similar legislative efforts are underway in several other states.

Because of the increasing legislative and regulatory interest in this area, the Healthcare Infection Control Practices Advisory Committee (HICPAC) conducted a scientific literature review to evaluate the merits and limitations of HAI reporting systems. We found no published information on the effectiveness of public reporting systems in reducing HAIs. Therefore, HICPAC has concluded that there is insufficient evidence at this time to recommend for or against public reporting of HAIs.

However, to assist those who will be tasked with designing and implementing such reporting systems, HICPAC presents the following framework for an HAI reporting system and recommendations for process and outcome measures to be included in the system. The framework and recommendations are based on established principles for public health and HAI surveillance. This document is intended primarily for policymakers, program planners, consumer advocacy organizations, and others who will be developing and maintaining public reporting systems for HAI. The document does not provide model legislation.

This document represents the consensus opinion of HICPAC. HICPAC is a federal advisory committee that was established in 1991 to provide advice and guidance to the Department of Health and Human Services and CDC regarding surveillance, prevention, and control of HAIs and related events in healthcare settings. These recommendations also have been endorsed by the Association for Professionals in

Infection Control and Epidemiology, the Council of State and Territorial

Epidemiologists, and the Society for Healthcare Epidemiology of America. These

recommendations will be updated as new information becomes available.

Essential Elements of a Public Reporting System for HAIs

As a first step, the goals, objectives, and priorities of a public reporting system

should be clearly specified and the information to be monitored should be measurable to

ensure that the system can be held accountable by stakeholders.   The reporting system

should collect and report healthcare data that are useful not only to the public, but also to

the facility for its quality improvement efforts. This can be achieved by selection of

appropriate measures and patient populations to monitor; use of standardized case-finding

methods and data validity checks; adequate support for infrastructure, resources, and

infection control professionals; adjustment for underlying infection risk; and production

of useful and accessible reports for stakeholders, with feedback to healthcare providers.

The planning and oversight of the system should be monitored by a multidisciplinary

group composed of public health officials, consumers, healthcare providers, and

healthcare infection control professionals.

Identifying Appropriate Measures of Healthcare Performance

Monitoring both process and outcome measures and assessing their correlation is

a comprehensive approach to quality improvement. Standardized process and outcome

measures for national healthcare performance for hospitals, nursing homes, and other

settings have been endorsed through the National Quality Forum (NQF) voluntary

consensus process (2-4). NQF also has developed a model policy on the endorsement of

proprietary performance measures (5). Several other agencies and organizations,

including CDC, CMS, the Agency for Healthcare Quality and Research, JCAHO, the

Leapfrog organization, and the National Committee for Quality Assurance, also have

developed healthcare quality measures. Healthcare performance reports should identify

the sources and endorsers of the measures and the sources of the data used (e.g.,

administrative or clinical).

Process measures are desirable for inclusion in a public reporting system because

the target adherence rate of 100% to these practices is unambiguous. Furthermore,

process measures do not require adjustment for the patient's underlying risk of infection.

Process measures that are selected for inclusion in a public reporting system should be

those that measure common practices, are valid for a variety of healthcare settings (e.g.,

small, rural vs. large, urban hospitals); and can be clearly specified (e.g., appropriate

exclusion and inclusion criteria). Process measures meeting these criteria include

adherence rates of central-line insertion practices and surgical antimicrobial prophylaxis

and coverage rates of influenza vaccination for healthcare personnel and

patients/residents (Table 1). Collection of data on one or more of these process measures

already is recommended by the NQF and required by CMS and JCAHO for their

purposes.

Outcome measures should be chosen for reporting based on the frequency,

severity, and preventability of the outcomes and the likelihood that they can be detected

and reported accurately (6). Outcome measures meeting these criteria include central

line-associated, laboratory-confirmed primary bloodstream infections (CLA-LCBI) in

intensive care units (ICU) and surgical site infections (SSIs) following selected

operations (Table 2). Although CLA-LCBIs and SSIs occur at relatively low rates, they are associated with substantial morbidity and mortality and excess healthcare costs. Also, there are well-established prevention strategies for CLA-LCBIs and SSIs (7,8). Therefore, highest priority should be given to monitoring these two HAIs and providers' adherence to the related processes of care (i.e., central-line insertion practices for CLA-LCBI and surgical antimicrobial prophylaxis for SSIs).

Use of other HAIs in public reporting systems may be more difficult. For example, catheter-associated urinary tract infections, though they may occur more frequently than CLA-LCBIs or SSIs, are associated with a lower morbidity and mortality; therefore, monitoring these infections likely has less prevention effectiveness relative to the burden of data collection and reporting. On the other hand, HAIs such as ventilator-associated pneumonia, which occur relatively infrequently but have substantial morbidity and mortality, are difficult to detect accurately. Including such HAIs in a reporting system may result in invalid comparisons of infection rates and be misleading to consumers.

Monitoring of process and outcome measures should be phased in gradually to allow time for facilities to adapt and to permit ongoing evaluation of data validity.

Identifying Patient Populations for Monitoring

CDC (9) and other authorities (10) no longer recommend collection or reporting of hospital-wide overall HAI rates because 1) HAI rates are low in many hospital locations (which makes routine inclusion of these units unhelpful), 2) collecting hospital-wide data is labor intensive and may divert resources from prevention activities, and 3) methods for hospital-wide risk adjustment have not been developed. Rather than

hospital-wide rates, reporting rates of specific HAI for specific hospital units or

operation-specific rates of SSIs is recommended (9). This practice can help ensure that

data collection is concentrated in populations where HAIs are more frequent and that

rates are calculated that are more useful for targeting prevention and making comparisons

among facilities or within facilities over time.

Case-Finding

Once the population at risk for HAIs has been identified, standardized methods

for case-finding should be adopted. Such methods help to reduce surveillance bias (i.e.,

the finding of higher rates at institutions that do a more complete job of case-finding).

Incentives to find cases of HAI may be helpful. Conversely, punitive measures for

hospitals that report high rates may encourage underreporting.

Traditional case-finding methods for HAIs include review of medical records,

laboratory reports, and antibiotic administration records. However, these standard case-

finding methods can be enhanced. For example, substantially more SSIs are found when

administrative data sources (e.g., *International Classification of Diseases, 9th Revision*

[ICD-9], discharge codes) are used in combination with antimicrobial receipt to flag

charts for careful review (11,12). However, the accuracy of case-finding using ICD-9

codes alone likely varies by HAI type and by hospital. Therefore, ICD-9 discharge codes

should not be relied upon as the sole source for HAI monitoring systems.

Traditional HAI case-finding methods were developed in an era when patients'

lengths of hospitalization were much longer than they are today, allowing most HAIs to

be detected during the hospital stay. However, for SSIs in particular, the current climate

of short stays and rapid transfers to other facilities makes accurate detection difficult

because as many as 50% of SSIs do not become evident until after hospital discharge or

transfer (13). Since there is no consensus on which postdischarge surveillance methods

are the most accurate and practical for detection of SSIs (7), the limitations of current

case-finding methods should be recognized if SSIs are selected for inclusion in

mandatory reporting systems.

Validation of Data

A method to validate data should be considered in any mandatory reporting

system to ensure that HAIs are being accurately and completely reported and that rates

are comparable from hospital to hospital or among all hospitals in the reporting system.

The importance of validation was emphasized by a CDC study of the accuracy of

reporting to the NNIS system, which found that although hospitals identified and reported

most of the HAIs that occurred, the accuracy varied by infection site (14).

Resources and Infrastructure Needed for a Reporting System

A reporting system can not produce quality data without adequate resources. At

the institution level, trained personnel with dedicated time are required, e.g., infection

control professionals to conduct HAI surveillance. At the system level, key infrastructure

includes instruction manuals, training materials, data collection forms, methods for data

entry and submission, databases to receive and aggregate the data, appropriate quality

checks, computer programs for data analysis, and standardized reports for dissemination

of results. Computer resources within reporting systems must include both hardware and

software and a standard user interface. In order to collect detailed data on factors such as

use of invasive devises (e.g., central lines), patient care location within the facility, and

type of operation, extensive data dictionaries and coding schema must be developed and maintained.

HAI Rates and Risk Adjustment

For optimal comparison purposes, HAI rates should be adjusted for the potential differences in risk factors. For example, in the NNIS system, device-associated infections are risk adjusted by calculating rates per 1,000 device-days (e.g., CLA-LCBI per 1,000 central line-days) and stratifying by unit type (15,16,17). For that system, risk adjustment of SSIs is done by calculating of operation-specific rates stratified by a standardized risk index (17,18,19). Although these methods do not incorporate all potential confounding variables, they provide an acceptable level of risk adjustment that avoids the data collection burden that would be required to adjust for all variables.

Risk adjustment is labor intensive because data must be collected on the entire population at risk (the denominator) rather than only the fraction with HAIs (the numerator). Risk adjustment can not correct for variability among data collectors in the accuracy of finding and reporting events. Further, current risk-adjustment methods improve but do not guarantee the validity of inter-hospital comparisons, especially comparisons involving facilities with diverse patient populations (e.g., community versus tertiary-care hospitals).

Valid event rates are facilitated by selecting events that occur frequently enough and at-risk populations that are large enough to produce adequate sample sizes. Unfortunately, use of stratification (e.g., calculation of rates separately in multiple categories) for risk adjustment may lead to small numbers of HAIs in any one category

and thereby yield unstable rates, as is the case of a small hospital with low surgical

volume.

Producing Useful Reports and Feedback

Publicly released reports must convey scientific meaning in a manner that is

useful and interpretable to a diverse audience. Collaboration between subject matter

experts, statisticians, and communicators is necessary in developing these reports. The

reports should provide useful information to the various users and highlight potential

limitations of both the data and the methods used for risk adjustment. In a new reporting

system, data should be examined and validated before initial release; in addition,

sufficient sample size should be accumulated so that rates are stable at the time of public

release. Lastly, feedback of performance data should be given to healthcare providers

regularly so that interventions to improve performance can be implemented as quickly as

possible. For example, feedback of SSI rates to surgeons has been shown to be an

important component of strategies to reduce SSI risk (20).

Adapting Established Methods for Use in Mandatory Reporting Systems

Where appropriate, developers of reporting systems should avail themselves of

established and proven methods of collecting and reporting surveillance data. For

example, many of the methods, attributes, and protocols of CDC's NNIS system may be

applicable for public reporting systems. A detailed description of the NNIS

methodologies has been described elsewhere (17), and additional information on NNIS is

available at www.cdc.gov/ncidod/hip/surveill/nnis.htm.

Most reporting systems, such as NNIS, use manual data collection methods. In

most instances, information in computer databases, when available, can be substituted for

manually collected data (21,22). However, when manual data collection is necessary,

alternate approaches include limiting reporting to well-defined and readily identifiable

events, using simpler and more objective event definitions (23), and sampling to obtain

denominators (24). These approaches could decrease the burden of data collection and

improve the consistency of reporting among facilities. If data collection were simplified,

expanding the number of infection types and locations in which they are monitored may

become more feasible.

Potential Consequences of Mandatory Public Reporting Systems

Mandatory reporting of HAIs will provide consumers and stakeholders with

additional information for making informed healthcare choices. Further, reports from

private systems suggest that participation in an organized, ongoing system for monitoring

and reporting of HAIs may reduce HAI rates (25,26). This same beneficial consequence

may apply to mandatory public reporting systems. Conversely, as with voluntary private

reporting, mandatory public reporting that doesn't incorporate sound surveillance

principles and reasonable goals may divert resources to reporting infections and

collecting data for risk adjustment and away from patient care and prevention; such

reporting also could result in unintended disincentives to treat patients at higher risk for

HAI. In addition, current standard methods for HAI surveillance were developed for

voluntary use and may need to be modified for mandatory reporting. Lastly, publicly

reported HAI rates can mislead stakeholders if inaccurate information is disseminated.

Therefore, in a mandatory public report of HAI information, the limitations of current

methods should be clearly communicated within the publicly released report.

Research and Evaluation Needs

Research and evaluation of existing and future HAI reporting systems will be needed to answer questions about 1) the comparative effectiveness and efficiency of public and private reporting systems and 2) the incidence and prevention of unintended consequences. Ongoing evaluation of each system will be needed to confirm the appropriateness of the methods used and the validity of the results.

Recommendations

The Healthcare Infection Control Practices Advisory Committee (HICPAC) proposes four overarching recommendations regarding the mandatory public reporting of healthcare-associated infections (HAIs). These recommendations are intended to guide policymakers in the creation of statewide reporting systems for healthcare facilities in their jurisdictions.

1. **Use established public health surveillance methods when designing and implementing mandatory HAI reporting systems.** This process involves:

   a.   selection of appropriate process and outcome measures to monitor;

   b.   selection of appropriate patient populations to monitor;

   c.   use of standardized case-finding methods and data validity checks;

   d.   provision of adequate support and resources;

   e.   adjustment for underlying infection risk; and

   f.   production of useful and accessible reports to stakeholders.

   Do not use hospital discharge diagnostic codes as the sole data source for HAI public reporting systems.

2. **Create a multidisciplinary advisory panel to monitor the planning and oversight of the operations and products of HAI public reporting systems.** This team should include persons with expertise in the prevention and control of HAIs.

3. **Choose appropriate process and outcome measures based on facility type and phase in measures gradually to allow time for facilities to adapt and to permit ongoing evaluation of data validity.** States can select from the

following measures as appropriate for hospitals or long-term care facilities in their jurisdictions.

a. Three process measures are appropriate for hospitals and one (iii below) is appropriate for long-term care facilities participating in a mandatory HAI reporting system (Table 1).

   i. Central-line insertion practices (with the goal of targeting intensive care unit [ICU]-specific central line-associated, laboratory-confirmed bloodstream infections [CLA-LCBIs] can be measured by all hospitals that have the type of ICUs selected for monitoring (e.g., medical or surgical).

   ii. Surgical antimicrobial prophylaxis (with the goal of targeting surgical site infection [SSI] rates) can be measured by all hospitals that conduct the operations selected for monitoring.

   iii. Influenza vaccination coverage rates for healthcare personnel and patients can be measured by all hospitals and long-term care facilities. For example:

      1. Coverage rates for healthcare personnel can be measured in all hospitals and long-term care facilities.

      2. Coverage rates for high-risk patients can be measured in all hospitals.

      3. Coverage rates for all residents can be measured in all long-term care facilities.

     b. Two outcome measures are appropriate for <u>some</u> hospitals participating in a mandatory HAI reporting system (Table 2).

         i.   CLA-LCBIs.

         ii.   SSIs following selected operations.

Hospitals for which these measures are appropriate are those in which the frequency of the HAI is sufficient to achieve statistically stable rates. To foster performance improvement, the HAI rate to be reported should be coupled with a process measure of adherence to the prevention practice known to lower the rate (see 3ai and 3aii). For example, hospitals in states where reporting of SSIs is mandated should monitor and report adherence to recommended standards for surgical prophylaxis (see 3aii).

4. **Provide regular and confidential feedback of performance data to healthcare providers.** This practice may encourage low performers to implement targeted prevention activities and increase the acceptability of the public reporting systems within the healthcare sector.

Acknowledgements

Table 1. Recommended Process Measures for a Mandatory Public Reporting System on

Healthcare-associated Infections

Events	Measures	Rationale for Inclusion	Potential Limitations
Central line insertion (CLI) practices	Two measures (expressed as a percentage) (8): Numerators: Number of CLI in which: 　1) Maximal sterile barrier precautions were used 　2) Chlorhexidine gluconate (preferred), tincture of iodine, an iodophor, or 70% alcohol used as skin antiseptic Denominator: Number of CLIs	Unambiguous target goal (100%). Risk-adjustment is unnecessary. Proven prevention effectiveness (8): 　Use of maximal barrier precautions during insertion and chlorhexidine skin antisepsis have been shown to be associated with an 84% and 49% reduction in central line-associated bloodstream infection rates, respectively (27,28).	Methods for data collection not yet standardized. Manual data collection likely to be tedious and labor intensive, and data are not included in medical records.
Surgical antimicrobial prophylaxis (AMP)	Three measures (expressed as a percentage) (29): Numerators: Number of surgical patients: 　1) Who received AMP within 1 hour prior to surgical incision (or 2 hours if receiving vancomycin or a fluoroquinolone) 　2) Who received AMP recommended for their surgical procedure 　3) Whose prophylactic antibiotics were discontinued within 24 hours after surgery end time Denominator: All selected surgical patients	Unambiguous target goal (100%). Risk-adjustment is unnecessary. Proven prevention effectiveness (7): 　Administering the appropriate antimicrobial agent within 1 hour before the incision has been shown to reduce surgical site infections (SSIs). Prolonged duration of surgical prophylaxis (>24 hrs) has been associated with increased risk of antimicrobial-resistant SSI.	Manual data collection may be tedious and labor intensive, but data can be abstracted from medical records.

| Influenza vaccination of patients and healthcare personnel | Two measures (each expressed as a percentage of coverage) (30):

Numerators: Number of influenza vaccinations given to eligible patients or healthcare personnel

Denominators: Number of patients or healthcare personnel eligible for influenza vaccine | Proven prevention effectiveness (30-32):
    Vaccination of high-risk patients and healthcare personnel has been shown to be effective in preventing influenza . | Manual data collection may be tedious and labor intensive. |

Table 2. Recommended Outcome Measures for a Mandatory Public Reporting System on

Healthcare-associated Infections

Events	Measures	Rationale for Inclusion	Potential Limitations
1. Central line-associated laboratory-confirmed primary bloodstream infection (CLA-LCBI)*	<u>Numerator</u>: Number of CLA-LCBI <u>Denominator</u>: Number of central-line days in each population at risk, expressed per 1,000 <u>Populations at risk</u>: Patients with central lines cared for in different types of intensive care units (ICUs)* <u>Risk stratification</u>: By type of ICU <u>Frequency of monitoring</u>: 12 months per year for ICU with $\leq$5 beds; 6 months per year for ICU with >5 beds <u>Frequency of rate calculation</u>: Monthly (or quarterly for small ICUs) for internal hospital quality improvement purposes <u>Frequency of rate reporting</u>: Annually using all the data to calculate the rate	Overall, an infrequent event but one that is associated with substantial cost, morbidity, and mortality. Reliable laboratory test available for identification (i.e., positive blood culture). Prevention guidelines exist (8) and insertion processes can be monitored concurrently. Sensitivity*: 85%; predictive value positive (PVP)*: 75% (14)	LCBI* can be challenging to diagnose since the definition includes criteria that are difficult to interpret (e.g., single-positive blood cultures from skin commensal organisms may not represent true infections.) To offset this limitation, a system could include only those CLA-LCBI identified by criterion 1, which will result in smaller numerators and therefore will require longer periods of time for sufficient data accumulation for rates to become stable/meaningful. Standard definition of central line* requires knowing where the tip of the line terminates, which is not always documented and can therefore lead to misclassification of lines.

Events	Measures	Rationale for Inclusion	Potential Limitations
2. Surgical site infection (SSI)*	Numerator: Number of SSI for each specific type of operation* Denominator: Total number of each specific type of operation, expressed per 100 Risk stratification: Focus on high-volume operations and stratify by type of operation and National Nosocomial Infections Surveillance (NNIS) SSI risk index* Alternate risk adjustment: For low-volume operations, by standardized infection ratio*	Low frequency event but one that is associated with substantial cost, morbidity, and mortality. Prevention guidelines exist (7) and certain important processes can be monitored concurrently. Sensitivity*: 67%; PVP*: 73% (14)	Rates dependent on surveillance intensity, especially completeness of post-discharge surveillance (50% become evident after discharge and may not be detected). SSI definitions include a "physician diagnosis" criterion, which reduces objectivity.

*See Glossary.

GLOSSARY

- **Central line**: A vascular infusion device that terminates at or close to the heart or in one of the great vessels. In the National Healthcare Safety Network (NHSN), the system replacing NNIS, the following are considered great vessels for the purpose of reporting central-line infections and counting central-line days: aorta, pulmonary artery, superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins, and common femoral veins.

  NOTE: In neonates, the umbilical artery/vein is considered a great vessel.

  NOTE: Neither the location of the insertion site nor the type of device may be used to determine if a line qualifies as a central line. The device must terminate in one of these vessels or in or near the heart to qualify as a central line. NOTE: Pacemaker wires and other noninfusion devices inserted into central blood vessels or the heart are <u>not</u> considered central lines.

- **CLA-LCBI**: please see **Laboratory-confirmed primary bloodstream infection**.

- **Confounding**: The distortion of the apparent effect of an exposure on risk brought about by the association with other factors that can influence the outcome (33). Risk adjustment is performed to minimize the effects of patient co-morbidities and use of invasive devices (the confounding factors) on the estimate of risk for a unit or facility (the exposure).

- **Device-associated infection**: An infection in a patient with a device (e.g., ventilator or central line) that was used within the 48-hour period before the infection's onset.

If the time interval was longer than 48 hours, compelling evidence must be present

to indicate that the infection was associated with use of the device. For

catheter-associated urinary tract infection (UTI), the indwelling urinary catheter

must have been in place within the 7-day period before positive laboratory results or

signs and symptoms meeting the criteria for UTI were evident (17).

- **Healthcare-associated infection**: A localized or systemic condition resulting

  from an adverse reaction to the presence of an infectious agent(s) or its toxin(s)

  that a) occurs in a patient in a healthcare setting (e.g., a hospital or outpatient

  clinic), b) was not found to be present or incubating at the time of admission

  unless the infection was related to a previous admission to the same setting, and c)

  if the setting is a hospital, meets the criteria for a specific infection site as defined

  by CDC (17). (See also **Nosocomial**.)

- **Intensive-care unit (ICU):** A hospital unit that provides intensive observation,

  diagnostic, and therapeutic procedures for adults and/or children who are critically

  ill. An ICU *excludes* bone marrow transplant units and nursing areas that provide

  step-down, intermediate care or telemetry only. The type of ICU is determined by

  the service designation of the majority of patients cared for by the unit (i.e., if 80%

  of the patients are on a certain service [e.g., general surgery], then the ICU is

  designated as that type of unit [e.g., surgical ICU]). An ICU with approximately

  equal numbers of medical and surgical patients is designated as a combined

  medical/surgical ICU (17).

- **Laboratory-confirmed primary bloodstream infection (LCBI)**: A primary

  bloodstream infection identified by laboratory tests with or without clinical signs or

symptoms; most often associated with the use of catheters or other invasive medical

devices. For the CDC surveillance definition of LCBIs, please see reference 14 or

www.cdc.gov/ncidod/hip/surveill/nnis.htm.

- **NNIS SSI Risk index**: A score used to predict a surgical patient's risk of

  acquiring a surgical-site infection. The risk index score, ranging from 0 to 3, is

  the number of risk factors present among the following: a) a patient with an

  American Society of Anesthesiologists' physical status classification score of 3, 4,

  or 5 (34), b) an operation classified as contaminated or dirty infected (35,36), and

  c) an operation lasting over T hours, where T depends upon the operation being

  performed (19).   Current T values can be found in the NNIS Report at

  www.cdc.gov/ncidod/hip/surveill/nnis.htm.

- **Nosocomial**: Originating or taking place in a hospital.

- **Outcomes**: All the possible results that may stem from exposure to a causal

  factor or from preventive or therapeutic interventions (33) (e.g., mortality, cost,

  and development of a healthcare-associated infection).

- **Predictive value positive**: The proportion of infections reported by a

  surveillance or reporting system that are true infections (6,14).

- **Private reporting system**: A system that provides information about the quality

  of health services or systems for the purposes of improving the quality of the

  services or systems. By definition, the general public is not given access to the

  data; instead, the data are typically provided to the organization or healthcare

  workers whose performance is being assessed. The provision of these data is

  intended as an intervention to improve the performance of that entity or person.

- **Process measure:** A measure of recommended infection control or other

    practices (e.g., compliance with hand hygiene recommendations).

- **Public reporting system:** A system that provides the public with information

    about the performance or quality of health services or systems for the purpose of

    improving the performance or quality of the services or systems.

- **Risk adjustment**: A summarizing procedure for a statistical measure in which

    the effects of differences in composition (e.g., confounding factors) of the

    populations being compared have been minimized by statistical methods (e.g.,

    standardization and logistic regression) (33).

- **Sensitivity**: The proportion of true infections that are reported by a surveillance

    or reporting system. May also refer to the ability of the reporting system to detect

    outbreaks or unusual clusters of the adverse event (in time or place) (6,14).

- **SSI Risk Index**: please see **NNIS SSI Risk Index.**

- **Standardized infection ratio**: The standardized infection ratio as used in this

    document is an example of indirect standardization in which the observed number

    of surgical site infections (SSIs) is divided by the expected number of SSIs. The

    expected number of SSIs is calculated by using NNIS SSI risk index category-

    specific data from a standard population (e.g., the NNIS system data published in

    the NNIS Report) and the number of operations in each risk index category

    performed by a surgeon, a surgical subspecialty service, or a hospital. [Detailed

    explanation and examples can be found in Horan TC, Culver DH. Comparing

    surgical site infection rates. In: Pfeiffer JA, Ed. APIC text of infection control

and epidemiology. Washington, DC: Association for Professionals in Infection

Control, 2000. Chapter 14, p. 1-7.]

- **Surgical site infection (SSI)**: An infection of the incision or organ/space operated

  on during a surgical procedure. For the CDC surveillance definition of an SSI,

  please see reference 14 or www.cdc.gov/ncidod/hip/surveill/nnis.htm.

- **Surveillance**:   The ongoing, systematic collection, analysis, interpretation, and

  dissemination of data regarding a health-related event for use in public health

  action to reduce morbidity and mortality and to improve health (6).

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