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MULTI-RESISTANT ORGANISM (MRO) SURVEILLANCE INDICATOR DEFINITIONS

Please note that the "Introduction to National Guidelines for Surveillance" must be read in conjunction with this document.

Originally devised by the National Advisory Board of the Australian Infection Control Association.

Revised by the Healthcare Infection Surveillance Subcommittee of the HCAIAC, National Quality and Safety Council.

PREAMBLE

These surveillance indicators are designed for antibiotic resistant organisms that can spread amongst patients within hospitals and can colonise or cause invasive infections during healthcare procedures including:

- Methicillin-resistant *Staphylococcus aureus* (MRSA);
- Vancomycin resistant *Enterococcus* spp (VRE);
- Extended-spectrum β -lactamase (ESBL) producing *Klebsiella pneumoniae*; and
- Multiple antimicrobial resistant *Acinetobacter*

Most of these resistant bacteria are readily identified in microbiology laboratories and on laboratory reports (e.g., MRSA). Close liaison with the microbiology laboratory is of utmost importance as some of these bacteria can now be introduced into hospitals from the community (e.g., community strains of MRSA that are usually not multi-resistant). Surveillance across areas using multiple laboratories must ensure that each laboratory uses a common definition in their reports for these resistant bacteria.

Three indicators are described. The most important is the primary indicator which measures the Morbidity caused by a multi resistant organism (MRO) (i.e., new infections). The other two are secondary indicators. They measure the estimated MRO Burden and MRO Acquisition rate (i.e., measure not only infection but also colonisation).

INTRODUCTION

Measurement of the dynamics of MRO spread within healthcare facilities is able to provide important information about focal outbreaks, levels of endemicity and the ongoing effectiveness of infection control interventions.

MRSA incidence and prevalence in acute care facilities has been proposed as a key infection control indicator and has been adopted by South Australia and New South Wales across all facilities. The comparability of such indicators is improved by the adoption of recommended minimum standards for MRSA screening and clearance (see MRO Screening and Clearance Recommendations). MRSA spreads within healthcare facilities mainly by contact transmission, especially on the hands of healthcare workers. Measurement of MRSA cross infection rates enables indirect assessment of health care worker compliance with hand hygiene within a facility or unit. Programs that have achieved sustained increases in hand hygiene compliance have been accompanied by reductions in MRSA transmission and morbidity.

Comparison of Indicator Rates

Intra health care facility (within own facility) comparison

These indicators enable single facilities to track reduction of MRO infections and acquisition resulting from actions taken and therefore are able to provide evidence that their control programs are having an effect, by using comparisons between different time periods. Microbiological surveillance and definitions must remain consistent over the periods to be compared. Stratification of indicators by Intensive Care or Specialised Unit/ Clinical Division is strongly recommended.

Inter health care facility (between facilities or hospitals) comparisons

The most valid measure that can be used for comparison is morbidity, particularly morbidity related to sterile site infection. **Such comparisons should be risk stratified at minimum by type and size of facility, intensive care status and/or specialised unit/ clinical division.**

Estimated rates for burden or acquisition include colonisation and as methods of detection may differ significantly from facility to facility (e.g., How often and from where are swabs collected to look for MRSA), these measures are not recommended for inter health care facility comparisons.

Analysis of Data

Monthly, quarterly or annual rates can be calculated. The denominator will represent the period chosen for the identification of MROs (i.e., MROs identified in one quarter will be divided by the number of occupied bed days (OBDs) for that quarter).

Rates should be quoted with calculated 95% confidence intervals. Alternatively, control charts can be used to display longitudinally, both absolute numbers and rates, stratified by ward or service depending upon the organisational structure of the facility.

PRIMARY INDICATOR: MRO MORBIDITY

This indicator measures infection (i.e., does *not* include colonisation). It measures how much disease (i.e., infection) the MRO has caused. Occupied bed days (OBDs) are used as the denominator so the incidence density (rate) function can be compared over different time periods at the same facility.

Procedure

Count all patients with new health care associated infections attributed to the MRO of interest for the surveillance period (count only the first infection in each patient for each surveillance period; colonisation is *not* counted).

Use the following equation:

$$\frac{\text{Number of patients with a new infection occurring within the surveillance period}}{\text{Total overnight occupied bed-days in the facility or unit for the surveillance period}} \times 10,000$$

Total **overnight** occupied bed-days in the facility or unit for the surveillance period

The top number is multiplied by 10,000 in order to reduce confusion as this removes decimal points in the final answer. The rate is now expressed as the number of patients with a new MRO infection per 10,000 OBDs.

NOTES ON PRIMARY INDICATOR

1. Numerator

Collect data on all new health care associated infections caused by a MRO, even if the patient is previously known to be MRO colonised. Note that a patient colonised with a community-acquired strain of MRSA who is admitted and then develops a healthcare-associated infection (e.g., intravascular line-associated blood stream infection) is counted as a numerator event.

When counting sterile site events, a new episode of MRSA blood stream infection in a patient previously counted with a non-sterile site MRSA infection (e.g., wound infection) is counted. If the new event occurs during the same

surveillance period then the sterile site event takes precedence and the non-sterile site event is not counted. If the non-sterile site event occurred in a previous surveillance period then it remains included in the numerator for that period. Aside from this proviso, only one infection is counted in an individual patient during a single admission. **This is in contrast to the bloodstream event indicators - if a patient develops blood stream infection more than once with same MRO and the time between events is greater than 14 days, both events get counted as numerators in that indicator.**

Same Day or Day Only Patients

These patients can be included. However, if included, then same-day or single-day episodes of care will need to be also included in the denominator. For these patients, the wider definition of health care associated that includes non-inpatient associated events (refer Blood Stream Infection Definition) will also need to be used (that is not just the 48 hour rule). These patients will usually have a much lower rate of acquisition and infection with MROs compared to patients who are in hospital for more than 1 day.

2. Denominator

In most circumstances, 'same day' patients will not be included in surveillance. This means that the denominator (OBDs) should exclude them also. Non 'same day' or 'overnight' OBDs are calculated by subtracting from the total OBDs the number of same day separations. Where a separate rate is calculated for Intensive Care, then the total OBD for that unit for the surveillance period are used as the denominator.

Baby-days: only 'qualified' baby-days are counted in with the total OBD figure.

3. Sterile Site / Non-Sterile Site Stratification

To better identify which MROs are causing more serious disease, these data can be stratified as to whether they involve sterile sites or not.

Surveillance for non-sterile site infection events is inherently less accurate than detection of sterile site events. It is therefore useful to record the details of each MRO infection in terms of this parameter. If a patient with a non-sterile site MRO event later develops a sterile site MRO (same type of MRO) event during the surveillance period, this latter event should be counted rather than the existing non-sterile event.

4. Stratification by Place of Likely Acquisition

To help identify and follow those areas within the hospital with a higher burden of problems with MROs, the data should also be stratified by ward areas (e.g., Intensive Care Unit (ICU)). Individual MRO events should be identified as either sterile site (e.g., blood stream) or non-sterile site (e.g., wound) during surveillance. For the purpose of stratification by wards, infections or colonisations that occur or are detected more than 48 hours after ICU admission or within 48 hours of discharge from ICU are deemed to be ICU-acquired or associated.

TABLE 1 – CORE DATA SET TO BE COLLECTED FOR EACH PATIENT WITH MRO

This is a suggested example of a data sheet that should to be completed for each patient with an MRO during a surveillance period.

Field Name	Values/ notes
Organism name	<i>Organism name identifying type of MRO e.g., MRSA, or non multi-resistant MRSA, VRE etc.</i>
Patient's name	
Medical record number	
Same day patient?	<i>(i.e., day only)</i> Yes – No
Specialty unit, service or ward that MRO was associated with	<i>(e.g., ICU)</i>
Admission date	
Discharge date	
Specimen date	<i>Date of this isolate</i>
New acquisition	<i>(i.e., have they ever had this MRO before)</i> Yes – No
Infection Status	Infected or Colonised
Infection or colonisation site	Sterile site or non-sterile site <i>(plus record the actual site e.g., Blood, sputum, groin etc.</i>
Nosocomial status	Health care associated inpatient, HCA non inpatient or Community
Healthcare facility	Health care facility name associated with the MRO event
Laboratory name	
Laboratory specimen number	or antibiotic sensitivity data (optional)

SECONDARY MRO SURVEILLANCE INDICATORS

These indicators measure both infection and colonisation combined. One measures the estimated prevalence rate (or Burden) and the other the estimated incidence rate (or Acquisition). They are not as important as the primary indicator and are subject to significant bias because they depend upon the intensity of surveillance culturing (i.e., screening) undertaken in the facility in question and the degree to which past records are able to indicate history of previous colonisation. This will effect how much colonisation is detected.

Any attempt to make comparisons requires a uniform approach to screening and is therefore, in general, discouraged. However, they can at times be extremely useful and should be used as one of the surveillance tools in the infection control program within a facility.

MRO Burden Indicator (Estimated Prevalence)

Procedure

Count all known patients who are discharged during the surveillance period who had a positive culture for a MRO, regardless of whether it was infection or colonisation. Also ignore whether the status of the carriage of the MRO is new or old. If the same patient with MRSA is discharged twice in a particular period, he/she is counted twice.

Use this equation to estimate prevalence:

$$\frac{\text{No. of MRO+ve separations (old and new infection and/or colonisation for surveillance period)}}{\text{Total overnight occupied bed-days in the facility or unit for the surveillance period}} \times 10,000$$

Total overnight occupied bed-days in the facility or unit for the surveillance period

MRO Acquisition Indicator (Estimated Incidence)

This is used to estimate how many patients newly acquire the 'target' resistant bacteria over the surveillance period.

Procedure

Count all MRO positive (i.e., those colonised as well as those with infections) where there is a new acquisition of resistant bacterium during the surveillance period. This means that patients known to have been previously colonised or infected with the same resistant bacteria are excluded unless they have been formally 'cleared' through a screening procedure (see MRO Screening and Clearance Recommendations).

Use the following equation to estimate the incidence of 'new' acquisition:

$$\frac{\text{No. of new MRO positive acquisitions (new infection or colonisation for surveillance period)}}{\text{Total overnight occupied bed-days in the facility or unit for the surveillance period}} \times 10,000$$

Total **overnight** occupied bed-days in the facility or unit for the surveillance period

SECONDARY INDICATOR NOTES

1. Numerators

For the estimate of 'new' MRO acquisition, only new health care associated MRO infections and colonisations should be counted (i.e., Patients neither previously documented as colonised or infected). In determining whether a patient has had previous colonisation or infection with an MRO, it is important to examine relevant pathology laboratory information from at least the previous 12 months.

To determine whether an event is 'health care associated' (either inpatient or non-inpatient, use the definitions included in the glossary because the allocation of a place (ward or other facility) for acquisition can be difficult and subject to bias). The 48 hour rule can usually be used for defining an inpatient associated health care infection; however, the infection control practitioner (ICP) may need to allocate the patient on a consistent 'best guess' basis on some occasions.

For the estimate of MRO Burden, MRO colonised patients should continue to be counted as colonised until they are formally 'cleared'. For the estimated MRO Burden indicator, a previously colonised patient is counted as colonised even if no screening sample was taken for that admission if they have not formally been 'cleared'. Guidelines on when patients are 'cleared' of MROs and when and where surveillance cultures should be collected are given in a companion document – Multi-Resistant Organism Screening and Clearance Recommendations. Patients formally 'cleared' during an admission are then not counted in the burden numerator for that surveillance period.

Same Day or Day Only Patients

These patients can be included. However, if included, then same-day or single-day episodes of care will need to be also included in the denominator. For these patients, the wider definition of health care associated that includes non-inpatient associated events will also need to be used (that is not just the 48 hour rule). These patients will usually have a much lower rate of acquisition and infection with MROs compared to patients who are in hospital for more than 1 day.

2. Denominator

OBDs was chosen as the denominator as it is consistent with other similar indicators and preferred by hospital epidemiologists. It is preferable if OBDs are used, that only 'overnight' stays are included (i.e., exclude day only cases). If 'same day' patients are not included in surveillance then the denominator should exclude them also. Another denominator that can be used is the number of separations. The calculated rates will then be expressed per 10,000 separations.

In facilities where the numbers of patients admitted overnight are relatively stable, the ratio of MRO positive patients to the number of hospitalised patients is likely to be as accurate as a rate determination using OBDs.

Where possible, stratify this acquisition rate by ICU or non intensive care. Non intensive care areas can be further subdivided as appropriate (e.g., by service or ward) to provide service-specific morbidity rates.

Baby-days: only 'qualified' baby-days are counted in with the total OBD figure.

3. Stratification by Place of Likely Acquisition / Association

In most acute care settings, acquisition and morbidity rates for MROs are significantly higher in ICU patients than non-ICU patients. As such, it is important that the primary indicator be stratified by ICU status, with separate rates produced for each type of ICU service operating within the hospital.

Acquisitions within 48 hrs of discharge from Intensive care are regarded as ICU-associated for the purposes of these indicators.

Reference:

Ferguson, J. Current Approaches to Screening for Multi-resistant Organisms (MRO) in Acute Care Australian and Selected New Zealand Hospitals and Recommendations for a Minimum Standard. Australian Infection Control Journal. Volume 7(3). 2002. pp 8-12.

DEFINITION OF TERMS/GLOSSARY

Colonised: Patient with a non-sterile site isolate (e.g., nose) and not receiving MRO-specific antibiotic therapy.

Place of Acquisition:

Healthcare-associated event satisfies at least one (1) of the following criteria:

- a. acquired during hospitalisation and not present or incubating on admission;
- b. is a complication of the presence of an indwelling medical device (e.g. IV catheter, urinary catheter);
- c. occurs within thirty days of a surgical procedure, where the bloodstream infection is related to the Surgical Site Infection;
- d. an invasive instrumentation or incision related to the bloodstream infection was performed within 48 hours before onset of the infection. If the time interval was longer than 48 hours, there must be compelling evidence that the infection was related to the invasive device or procedure; or
- e. associated with neutropænia ($<1 \times 10^9/L$) contributed to by cytotoxic therapy.

Health care associated events are then subcategorised as being either:

Non-inpatient associated OR Inpatient-associated*

*Inpatient events are those that occur more than 48 hours after hospital admission or within 48 hours of discharge. For inpatient neonates, such events occur more than 48 hours after delivery.

Community Associated

These events are when the episode is:

NOT health care associated

AND

manifests within 48 hours after admission unless an organism with a long incubation period (e.g. *Salmonella* Typhi) is isolated.

AND

are **not** maternally-acquired (see below)

Maternally Acquired

This is an infection in a neonate that is acquired from the mother during delivery. Unless strong evidence suggests otherwise, an infection that appears less than 48 hours after birth is considered to be acquired from the mother.

Infection: An event associated with a sterile site isolate, or an event associated with a non-sterile site clinical isolate, where MRO specific antibiotic therapy was administered by a clinician (e.g., when vancomycin or fusidate/rifampicin are administered as therapy for pneumonia after MRSA has been isolated from sputum). Patients that are given empirical therapy for an MRO infection on the basis of clinical suspicion and no other evidence other than previous positive screening swabs should not be included.

New Acquisitions: Patients who become colonised or infected for the first time in your institution during the period of surveillance. Note that some MROs can be community acquired. The 48 hour rule can be applied or the episode allocated as a healthcare associated event if in the judgement of the ICP this is likely to have been the case. A patient who has formally 'cleared' their MRO (as per recommended process) can be regarded as a new acquisition if they re-isolate the same MRO at a later time.

New Infections: The number of patients who develop health care associated infections (i.e., become 'infected' not just colonised) during the period of surveillance. Previously colonised patients who develop infection are counted as events. Only the first infection event for an admission is counted.

Occupied Bed Days: For each patient/client the number of OBDs is calculated as: separation date minus admission date; except for same-day inpatients who will be included as having one OBD. Only 'qualified' baby-days are counted in with the total OBD figure. **OBDs (monthly)** is the sum of all bed-days attributable to patients who were separated from the hospital during the period regardless of the calendar period(s) of their stay. **Non same-day OBDs** are calculated by subtracting from the total OBDs the number of same-day separations.

Sterile Site Isolate: A significant isolate obtained from the blood stream, a normally sterile body cavity (peritoneum, pleural or pericardial space or CSF) or a tissue sample collected by aseptic means.

ACKNOWLEDGEMENT

The Health Care Associated Infection Advisory Committee on behalf of the Australian Council for Safety & Quality in Health Care would like to acknowledge the use of information contained within the Australian Infection Control Association (AICA) "*Surveillance Definitions for Multi-Resistant Organisms (MRO's)*" developed by the National Advisory Committee to AICA.

We would like to acknowledge the contribution of the Health Care Associated Infection Advisory Committee (HCAIAC) and the Surveillance Working Party (SWP), the Australian Society of Infectious Diseases (ASID) and Oz Bug subscribers.