Protocol for National Surveillance of Healthcare Associated Infection in Intensive Care Units

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General enquiries and contact details

If you have any enquiries or comments on this protocol or in conducting surveillance we would be happy to hear from you.

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Surveillance of Healthcare Associated Infection in ICU

Healthcare Associated Infection (HAI) surveillance in Scotland's Intensive Care Units (ICU) is a mandatory surveillance programme as set out in HAI DL (2015) 19[1]. This letter states that "All NHS Boards are required to undertake surveillance of HAI within Intensive Care Units as per the HPS/SICSAG protocol." The surveillance programme is led by Health Protection Scotland (HPS) in collaboration with the Scottish Intensive Care Society Audit Group (SICSAG).

- Surveillance of HAI in Intensive Care Units includes pneumonia, bloodstream infections and central venous catheter related infections (CRI). Case definitions and methods are aligned to the European Centre for Disease Prevention and Control (ECDC)[2]. Data for surveillance is collected using WardWatcher[TM] (WW) software.

1. Objectives of HAI surveillance in ICU

At Hospital/Unit Level:

- To monitor and reduce the incidence of HAI

At National Level:

- Provide analysis and monitor trends of HAI at national level
- Investigate problems and provide epidemiological support to NHS Boards, as required
- Plan and examine the impact of interventions, as required
- Gain information on the quality of care
- Prioritise the allocation of resources

2. Data Collection

Data are collected at unit level using WardWatcher™. The following HAI are included in surveillance:

- Bloodstream infection (BSI)
- Central venous catheter related infection (CRI)
- All pneumonia including both ventilator associated non-ventilator associated pneumonia (PN and VAP)

Data collection should be co-ordinated locally by a designated individual to ensure that data are routinely collected and that staff have the appropriate level of knowledge and training.

3. Inclusion Criteria

Inclusion criteria are based on the definitions and methods set out in the European Centre for Disease Prevention and Control (ECDC) protocol for Surveillance of HAI in ICU[2].

Identification of the study population

- All patients who have been in-patients in ICU for more than two days [Date of discharge from the ICU - Date of admission to the ICU + 1 > 2] should be included in HAI surveillance.
- Units should have a system in place locally to ensure that these patients are identified and included in surveillance.

Monitoring Patients for HAI

- Surveillance should be co-ordinated locally to ensure that data are routinely collected.

- All patients staying more than two calendar days should be monitored for HAI.

- Information from clinical personnel, medical and nursing records, and positive microbiology cultures can be used to identify HAI.

- The date of onset is the date of onset of symptoms or if unknown, the date that treatment was started or the first diagnostic examination was done.

- Surveillance of HAI ends when a patient is discharged transferred from the ICU or dies.

4. Denominator Data

Denominator data are calculated using data that are collected in WardWatcher^{TM} and includes data from all patients with an in-patient stay for more than two days.

- **Patient days**: ICU Discharge date- ICU Admission date + (1)

- **CVC days**: Total of all days where a CVC was present. Calculated from the augmented care period (ACP) data.

- **Ventilator days**: Total of all days where the patient was ventilated. Calculated from the ACP data.

5. The National Dataset

The following data items are required for surveillance.

Demographic Data

ECDC data item	ECDC data definition and codes	Corresponding WW field
ICU code	A unique code which identifies an individual unit (Anonymous numerical code).	N/A
Patient Counter	Numeric Code for each patient, unique within hospital, anonymous.	Hospital No. *[Admission and Identity]*
Age in years	Age of the patient on the date of admission to the ICU (in years).	Unit Admit age *[Admission and Identity]*
Gender	Gender of the patient. M = Male; F = Female; O = Other; UNK = Unknown	Sex (M/F) *[Admission and Identity]*
Date ICU admission	Date the patient was discharged from the ICU or date of in-ICU death or date of last follow-up in the ICU.	Unit admit date *[Admission and Identity]*
Discharge date from the ICU	Date the patient was discharged from the ICU or date of in-ICU death or date of last follow-up in the ICU. Required.	Actually discharged from Unit on (Last ACP date will be used if Discharge Date is not available) *[Unit Discharge]*
ICU Discharge Outcome	Patient status at discharge from the ICU or at end of follow-up in the ICU. A = Alive; D = Dead in ICU; UNK = Unknown.	Unit Outcome *[Unit Discharge]*
Origin of the Patient	Origin of the patient at the time he/she was admitted at the ICU HOSP = Ward in this/other hospital. OICU = Other ICU; COM = Community (patient came from his home, via emergency or not); LTC = Long-term care/nursing home; O = Other; UNK = Unknown.	Source; Housed within; Previously located *[Admission and Identity]*
Type of ICU admission	As defined in SAPS II score: 1=medical: no surgery within 1 week of admission to ICU 2=scheduled surgical: surgery was scheduled at least 24 hours in advance +/- 7 days ICU admission 3=unscheduled surgical: patients added to the operating room schedule within 24 hours of the operation) -1 = unknown	Surgery at admission to this Unit or in previous 7 days (Y/N); Surgery after Unit admission but within first 7 days in this Unit (Y/N); nature surgery (most acute) *[Admission and Identity]*

ECDC data item	ECDC data definition and codes	Corresponding WW field
Trauma patient	Trauma patient: intensive care unit admission resulted from blunt or penetrating traumatic injury to the patient, with or without surgical intervention. Y = Yes; N = NO; UNK = Unknown.	Admission to this Unit prompted by blunt or penetrating trauma (Y/N) *[History]*
Antibiotic treatment in 48 hours before or after ICU admission	Antibiotic treatment in 48 hours before or after ICU admission: specify 'yes' if any antibiotic therapy in the 48 hours preceding ICU admission and/or during the first two days of ICU stay (=antibiotic therapy for an infectious event around ICU admission, excl. antifungal and antiviral treatment) has been given; not: antimicrobial prophylaxis, SDD, local treatment. Y = Yes; N = NO; UNK = Unknown	Antimicrobials in 48 hours prior to admission to this Unit (Y/N) *[History]*
APACHE II score	Other severity score name and value: add another severity of illness score and the corresponding value. Possible scores [and possible values]: **APACHE** = Acute Physiology and Chronic Health Evaluation score (APACHE II [0-71], APACHE III [0-299], APACHE IV [0-286]), **MPM** = Mortality Prediction Model (MPM II [0-100], MPM III [0- 100]), **McCabe score** [0=non-fatal (survival >= 5 years); 1=ultimately fatal (survival < 5 years), 2=rapidly fatal (survival<1 year); 9=unknown], **SAPS 3** = Simplified Acute Physiology Score 3 [0-217]; **ASA** = Physical Status Classification System of the American Society of Anesthesiology [1=normally healthy patient, 2=patient with mild systemic disease, 3=patient with severe systemic disease that is not incapacitating, 4=patient with an incapacitating systemic disease that is a constant threat to life, 5=moribund patient who is not expected to survive for 24 hours with or without operation]	Various
CVC in ICU	Patient had a central vascular catheter during the current ICU stay; if yes, fill dates in corresponding exposure data. Y = Yes; N = NO; UNK = Unknown. Required.	Central venous catheter (including dialysis catheter) Y/N *[ACP Details]*

ECDC data item	ECDC data definition and codes	Corresponding WW field
Intubation in ICU	Patient was intubated (invasive respiratory device) during the current ICU stay; if yes, fill dates in corresponding exposure data. Y = Yes; N = NO; UNK = Unknown. Required.	Respiratory Support *[ACP Details]*
Antimicrobial received during ICU stay	Patient received any antimicrobial during ICU stay. If yes, fill corresponding antimicrobial use data. Y = Yes; N = NO; UNK = Unknown. Optional.	Antibiotic, antifungal or antiviral administered today (Y/N) *[ACP Details]*

Exposure Data

ECDC data item	ECDC data definition and codes	Corresponding WW field
Patient Counter	Numeric code for each patient, unique within hospital, anonymous.	Hospital No. *[Admission and Identity]*
Type of Exposure	Type of exposure (invasive device) for this exposure episode entry. In case of stop and restart of an exposure type on the same day (e.g. re-intubation), start a new exposure episode. Overlapping exposure episodes are allowed for CVC (more than one CVC on the same day), but not for intubation or indwelling urinary catheters.	Extrapolated from data collected on the ACP pages
Exposure Start date	Start date exposure episode within the ICU.	Extrapolated from data collected on the ACP pages
Exposure End date	End date exposure episode within the ICU.	Extrapolated from data collected on the ACP pages

Infection Data

ECDC Data Field	ECDC data definition and codes	Corresponding WW field
Patient Counter	Numeric code for each patient, unique within hospital, anonymous.	Hospital No. *[Admission and Identity]*
Date of infection onset	Date of onset of symptoms or, if unknown, date treatment was started or date first diagnostic examination was done. Required.	Confirmed Unit Infections (Date) *[HAI page]*
Case definition code (Site of infection):	Required. Site of infection according the case definition (including subcategory), taking into account signs and symptoms of the entire infection episode (not just day one of the HAI). See **Case definitions**. BSI = Bloodstream infection; PN = Pneumonia (unknown subcategory); PN1 =Pneumonia (protected sample + quantitative culture); PN2 = Pneumonia (non-protected sample (ETA) + quantitative culture); PN3 = Pneumonia (alternative microbiological criteria); PN4 = Pneumonia (sputum bacteriology or non-quantitative ETA); PN5 = Pneumonia (no microbiology) CRI1-CVC = CVC-related infection (local); CRI2-CVC = CVC-related infection (generalised no positive haemoculture); CRI3-CVC = CVC-related infection (generalised with positive haemoculture); If catheter-related infections (CRIs) are included in the surveillance, report a CVC-related BSI corresponding to the case definition of CRI3-CVC as CRI3-CVC (do not report twice)	Confirmed Unit Infections (Date) *[HAI page]*
Relevant invasive *device in situ* before onset	Relevant invasive device was present (even intermittently) in the 48 hours preceding the infection: intubation for pneumonia and central vascular catheter for bloodstream infection. Necessary to distinguish device-associated infections. Y = Yes; N = No; UNK = Unknown. Required.	Infection criteria *[HAI page]*
Microorganism (isolate result)	Microorganism (MO) six letter code or negative code including reason why the isolate result is not available. _NA = Results not available; _NOEXA = Examination not done; _NONID =Microorganism not identified; _STERI = Sterile examination. Minimum one code per HAI is required. The recommended maximum per HAI is three microorganisms.	Infection criteria *[HAI page]*

6. Case definitions

The case definitions and data definitions in this document are those specified by the [European Centre for Disease Prevention and Control (ECDC) protocol for Surveillance of HAI in ICU](#)[2].

PNEUMONIA (PN 1–PN 5)

X-ray
Two or more serial chest X-rays or CT-scans with a suggestive image of pneumonia for patients with underlying cardiac or pulmonary disease* (in patients without underlying cardiac or pulmonary disease, one definitive chest X-ray or CT-scan is sufficient).

Symptoms
and at least one of the following:
- fever > 38 °C with no other cause
- leukopenia (< 4 000 WBC/mm3) or leucocytosis (≥ 12 000 WBC/mm3).

and at least one of the following (or at least two, if clinical pneumonia only = PN 4 and PN 5):

- new onset of purulent sputum, or change in character of sputum (colour, odour, quantity, consistency)
- cough or dyspnea or tachypnea
- suggestive auscultation (rales or bronchial breath sounds), rhonchi, wheezing
- worsening gas exchange (e.g. O2 desaturation or increased oxygen requirements or increased ventilation demand)

and
according to the used diagnostic method:

Microbiology
a) Bacteriologic diagnostic performed by:

Positive quantitative culture from minimally contaminated LRT specimen **(PN 1)**
- broncho-alveolar lavage (BAL) with a threshold of ≥ 104 colony forming units (CFU)/ml or ≥ 5% of BAL-obtained cells contain intracellular bacteria on direct microscopic exam (classified on the diagnostic category BAL)
- protected brush (PB Wimberley) with a threshold of ≥ 103 CFU/ml
- distal protected aspirate (DPA) with a threshold of ≥ 103 CFU/ml.

- *Positive quantitative culture from possibly contaminated LRT specimen* **(PN 2)**
- Quantitative culture of LRT specimen (e.g. endotracheal aspirate) with a threshold of 106 CFU/ml.

b) Alternative microbiology methods **(PN 3)**
- positive blood culture not related to another source of infection
- positive growth in culture of pleural fluid
- pleural or pulmonary abscess with positive needle aspiration
- histologic pulmonary exam shows evidence of pneumonia
- positive exams for pneumonia with virus or particular germs (e.g. *Legionella*, *Aspergillus*, mycobacteria, mycoplasma, *Pneumocystis jiroveci* [previously *P. carinii*]):
  - ° positive detection of viral antigen or antibody from respiratory secretions (e.g. EIA, FAMA, shell vial
  - ° assay, PCR)
  - ° positive direct exam or positive culture from bronchial secretions or tissue
  - ° seroconversion (example: influenza viruses, *Legionella*, *Chlamydia*)
  - ° detection of antigens in urine (*Legionella*).
c) Others
- positive sputum culture or non-quantitative LRT specimen culture **(PN 4)**
- no positive microbiology **(PN 5).**

Notes:
- PN 1 and PN 2 criteria were validated without previous antimicrobial therapy. However, this does not exclude the diagnosis of PN 1 or PN 2 in the case of previous antimicrobial use

- *In case recent chest X-rays are available for patients with underlying cardiac or pulmonary disease, one definitive chest X-ray or CT-scan during the current ICU stay may be sufficient.

BLOODSTREAM INFECTION

Patient has at least one positive blood culture for a recognised pathogen

– or –

Patient has at least one of the following signs or symptoms: fever (> 38 °C), chills, or hypotension

and

 two positive blood cultures for a common skin contaminant (from two separate blood samples, usually within 48 hours).

Skin contaminants = Coagulase-Negative Staphylococci, *Micrococcus* spp., *Propionibacterium acnes*, *Bacillus* spp., *Corynebacterium* spp.

CVC-RELATED INFECTION

CRI1-CVC: Local CVC-related infection (no positive blood culture)

- Quantitative CVC culture ≥ 10^3 CFU/ml (3) or semi-quantitative CVC culture > 15 CFU

and

- Pus inflammation at the insertion site or tunnel

CRI2-CVC: general CVC-related infection (no positive blood culture)
- Quantitative CVC culture ≥ 10^3 CFU/ml or semi-quantitative CVC culture > 15 CFU

and
- clinical signs* improve within 48 hours after catheter removal

CRI3-CVC: microbiologically confirmed CVC-related bloodstream infection

- BSI (according to the definition for BSI A or BSI B) occurring 48 hours before or after catheter removal

and positive culture with the same micro-organism of **EITHER**:

- Quantitative CVC culture ≥ 10^3 CFU/ml or semi-quantitative CVC culture > 15 CFU
- Quantitative blood culture ratio CVC blood sample/peripheral blood sample> 5
- Differential delay of positivity of blood cultures: CVC blood sample culture positive 2 hours or less before peripheral blood culture (blood samples drawn at the same time)
- Positive culture with the same micro-organism from pus from insertion site

7. Quality Assurance

All data received are quality checked by staff at HPS. Validation of the surveillance data is necessary to ensure its credibility, to identify methodological problems within the surveillance programme, to help increase compliance and participation in the surveillance programme, and to identify data quality issues at local level.

8. Reporting of data

- HPS encourage regular local reporting of surveillance data by NHS Boards to aid local quality improvement. SICSAG generate monthly reports of HAI data for individual units to monitor their data locally.

- An annual report of data is produced by Health Protection Scotland every year and this is published within the SICSAG report published in August of each year.

- Data collected from the surveillance programme is shared with ECDC and forms part of the European dataset which is published annually.

9. References

1. Scottish Government. Healthcare Associated Infection (HAI) and Antimicrobial Resistance (AMR) Policy Requirements. DL(2015)19. 2015 **http://www.sehd.scot.nhs.uk/dl/DL%282015%2919.pdf**

2. European Centre for Disease Prevention and Control. Surveillance of healthcare-associated infections and prevention indicators in European intensive care units. Stockholm: ECDC; 2017.

Appendix 1: Other definitions

ICU Associated
An infection is considered as ICU Associated if it occurs in the ICU after more than 48 hours. In practice, all infections with onset from day three onwards in the ICU should be reported. The day of admission to the ICU is counted as day 1.

Second infection episode
To consider an infection as a new infection episode, the combination of a) new signs and symptoms and b) radiographic evidence (for pneumonia) or other diagnostic testing is required.

Device-associated HAI
A device-associated, healthcare-associated infection is an HAI in a patient with a (relevant) device that was used within the 48-hour period before onset of infection (even if it was used only intermittently). The term 'device associated' is only used for pneumonia, bloodstream infections, and urinary tract infections. 'Relevant device' refers to intubation, a central vascular catheter or an indwelling urinary catheter. If the interval is longer than 48 hours, there must be compelling evidence that the infection was associated with device use. For catheter-associated UTI, an indwelling urinary catheter must have been in place within seven days before positive laboratory results or signs and symptoms meeting the criteria for UTI were evident.

Example: Pneumonia is defined as intubation-associated pneumonia (IAP) if an invasive respiratory device was present (even intermittently) in the 48 hours preceding the onset of infection.

Central Venous Catheter
A central vascular catheter (or central line) is an intravascular catheter that terminates at, or close to, the heart or in one of the great vessels, which is used for infusion, withdrawal of blood or hemodynamic monitoring. The following are considered great vessels for the purpose of reporting central-line BSI and counting central-line days in the NHSN system: aorta, pulmonary artery, superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins, common iliac veins, common femoral veins, and in neonates, the umbilical artery/vein.

Notes: Neither 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. An introducer is considered an intravascular catheter. Pacemaker wires and other non-lumen devices inserted into central blood vessels or the heart are not considered central lines, because fluids are not infused, pushed, nor withdrawn through such devices.

Infusion
The introduction of a solution through a blood vessel via a catheter lumen. This may include continuous infusions such as nutritional fluids or medications, or it may include intermittent infusions such as flushes or IV antimicrobial administration, or blood, in the case of transfusion or haemodialysis.

Umbilical catheter
A central vascular device inserted through the umbilical artery or vein in a neonate.

Temporary central line
A non-tunnelled catheter

Permanent central line
This includes tunnelled catheters, including certain dialysis catheters; and implanted catheters (including ports).