Hospital in **E**urope
Link for **I**nfection **C**ontrol through
Surveillance

Surveillance of Nosocomial Infections in Intensive Care Units

Protocol
Version 6.1
(Based on Version 5.0 including technical amendments)

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Surveillance of Nosocomial Infections in Intensive Care Units: Master Protocol

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Main Changes since version 5.0

Version 5.0 of this document was produced in October 2003. Since then a series of technical changes have been applied to this document.

Summary of major changes:

- Country codes have been updated to include new EU member states as of 2004
- The code for unknown has consistently been set to –1 (used to be 9, 99 etc. in previous versions of this document); to avoid problems for networks using ASCII type data communication internally, the field length of those numeric variables was changed to minimum 2 positions
- Structure and text of the chapter on data collection was changed to improve clarity
- Duplicate table **icu_i** were unified (was separate for levels 1 and 2)
- It was made clear that, for the surveillance of infections, a unique Patient ID and Admission data in ICU are mandatory since they are part of the unique key to trace infections. Only the hospital, however, and not the network should be able to trace the individual corresponding to this unique patient ID.
- Concatenated ID fields were removed and components mentioned explicitly in tables
- The structure o table **icu_e** was changed to reflect technical considerations of the IT group
- The name of table **helics_n** was changed to **icu_net** to avoid confusion with similar SSI table
- Some variable names and labels were changed to improve consistency
- All variable names are consistently in lowercase
- Some minor typographical errors were corrected

1 Rationale and objectives for surveillance of nosocomial infections in intensive care units

Surveillance of nosocomial infections in intensive care units was chosen as a Helics component based on the existence of such networks in about half of the EU member states, on the fact that patients admitted to intensive care are at 5 to 10 times higher risk of acquiring a NI due to both intrinsic (e.g. immunodepression) and extrinsic (e.g. mechanical ventilation) risk factors, and because the ICU is often the epicentre of emerging NI problems in the hospital.

The main objective of this protocol is to ensure standardisation of definitions, data collection and reporting procedures for hospitals participating in the national/regional surveillance of nosocomial infections (NI) in Intensive Care Units (ICUs) across Europe, in order to contribute to the EU surveillance of nosocomial infections and to improve the quality of care in the ICU in a multicenter setting.

Specific objectives are:

a At the level of the intensive care unit and the hospital:

- To monitor the size of the NI problem in a unit and identify the areas where prevention activities are needed,
- To compare the results of the unit with its previous ones, and for inter-unit comparison, compare groups of patients stratified for infection risk, in order to be able to identify areas where the quality of care can be improved.
- To sensitize personnel to infection problems (micro-organisms, antibiotic resistance...), set local targets for prevention.
- To provide relevant information to monitor and target infection control policies:
  - the compliance with existing guidelines and good practices,
  - the correction or improvement of specific practices,
  - the development, implementation and evaluation of new practices.

Participation to the European network will also produce gains at local level from international comparisons that may provide insights that would not be revealed by surveillance limited at the regional or national level.

b At the level of regional or national network coordination:

- To provide to the units the necessary reference data to make comparisons of risk-adjusted rates between units/hospitals,
- To follow-up epidemiological trends in time:
  - Identification of important nosocomial pathogens
  - Epidemiology of emerging infections, antimicrobial resistance
- To identify and follow-up risk factors of nosocomial infections
- To improve the quality of data collection

c At the EU (HELICS) level

- To monitor and describe the epidemiology of nosocomial infections in intensive care units in the EU in view of responding to the objectives of Decision 2119/98 EC of the European Parliament and the Council.(1)
  - To identify emerging nosocomial pathogens in the ICU
  - To follow-up the incidence and the geographical spread of nosocomial infections by type and pathogen in the ICU
  - To assess the risk and the occurrence of international spread of nosocomial pathogens in the ICU
  - To identify regions or countries at higher need of EU support with regard to surveillance and control of nosocomial infections
  - To ensure communication of relevant data on nosocomial infections to the European Commission as a complement to the data transmission by the national Health authorities
- To facilitate the communication and the exchange of experience between national/regional networks for the surveillance of nosocomial infections
- To stimulate the creation of national/regional coordination centres for the surveillance of nosocomial infections in the ICU where these centres/networks do not exist
- To provide methodological and technical support to the national/regional coordination centres
- To improve surveillance methodology, data validation and utilization
- To validate risk factors of nosocomial infections in the ICU at the EU level
- To explore the correlation between structure and process indicators and the incidence of nosocomial infections in the ICU throughout Europe in order to generate hypotheses and new insights in nosocomial infection control (collaboration Brussels-Berlin).

2 Elaboration of the HELICS protocol for the surveillance of nosocomial infections in intensive care units

The need for a new standardised protocol for the surveillance of NI in the ICU became apparent from the comparative analysis of the current surveillance methods in the EU during implementation phase 1 of HELICS.(2)

The consensus for the new protocol is based on:

- an in-depth analysis of the methodology of the existing national/regional surveillance networks for the surveillance of NI in the ICU

- a questionnaire sent out to the HELICS-ICU Working Party members designed to measure their opinions about some key issues for the design of a new protocol.

- meetings of the HELICS-ICU working party (WP1)

- several meetings of the WP1 coordinator with the steering groups or coordinators of different networks in the member states (France, Spain, Germany, The Netherlands, Portugal, Denmark, Belgium, Luxemburg). The final HELICS-ICU protocol integrates as much as possible the conclusions of the different discussions, the results of the questionnaire and the existing national/regional surveillance protocols.

The results of the questionnaire and discussions about a new standardised protocol directed towards a combined patient-based (level 2) and less labour-intensive unit-based protocol (level 1).

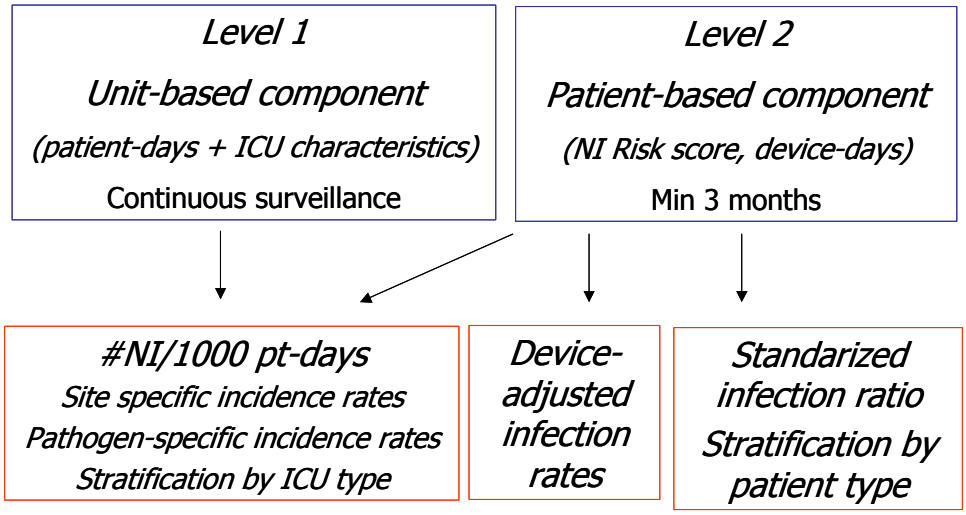
The final HELICS-ICU protocol integrates as much as possible the conclusions of the different discussions, the results of the questionnaire and the analysis of the methods used in the existing national/regional surveillance protocols.

3 Indicators to be produced at the European level on the occurrence and characteristics of nosocomial infections in intensive care units

The indicators generated by the different levels of the ICU-surveillance are shown in figure 1.
Level 1 (unit-based surveillance) represents the minimal data to be collected and is intended for continuous surveillance. The denominator is collected at the level of the unit and consists in the number of patient-days for patients staying longer than 2 days in the ICU (unit-based surveillance). Indicators issued by level 1 are suited for the follow-up of indicators in time within the same unit and for regional, national and international follow-up of trends for pathogen-specific infection rates. They offer limited inter-unit comparability but, only when stratified according to the type of unit.

Level 2 is intended for advanced risk-adjusted comparison of infection rates between ICUs (benchmarking), as a measure of quality of care in terms of infection control. Risk factors are collected for every patient staying more than 2 days in the ICU, whether infected or not (patient-based surveillance). In order to obtain sufficient precision of indicators, a surveillance period of 6 months is recommended.
.
A more comprehensive list of indicators generated by the different levels is given in the appendix.

Figure 1. Indicators generated by the different levels of the protocol for the surveillance of NI infections in the ICU



4 Case definitions of ICU-acquired infections

The minimal requirement for HELICS is to include ICU-acquired bloodstream infection (BSI) or ICU-acquired pneumonia. Other infection types such as urinary tract infections may be added optionally. A specific option is developed under level 2 for the surveillance of catheter infection (surveillance of catheters rather than patients).

Definition of key terms:

ICU-acquired: an infection is considered as ICU-acquired if it occurs later than 48 hours in the ICU.

Second infection episode: The combination of 1) new signs and symptoms and 2) radiographic evidence (for pneumonia) or other diagnostic testing is required.

4.1 Case definition of bloodstream infection

CODE: BSI

BSI-A:

- 1 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 2 positive blood cultures for a common skin contaminant (from 2 separate blood samples drawn within 48 hours).

skin contaminants = coagulase-negative staphylococci*, Micrococcus sp., Propionibacterium acnes, Bacillus sp., Corynebacterium sp.*

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

And either

- 1 positive blood culture with a skin contaminant in patient with an intravascular line in place and in whom the physician instituted appropriate antimicrobial therapy.

or

- positive blood Antigen test (e.g. *H.influenzae, S.pneumoniae, N. meningitidis* or Group B *Streptococcus*)

Comment:
BSI-A is the definition used by the majority of NI surveillance networks in Europe. BSI-B extents this definition to the CDC definition of laboratory-confirmed bloodstream infection. Networks should specify in the network data (table **icu_net**, see 6.3.1) whether only BSI A or both BSI B and BSI A are included in the surveillance (i.e. networks using CDC definition of laboratory confirmed bloodstream infection [CDC_{LCBI}=BSI-A+B]). If this is the case, then BSI A and BSI B categories should be specified in the data collection.

4.2 Case definition of ICU-acquired pneumonia

CODE: PN

Rx

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.

and at least one of the following

Symptoms

- Fever > 38 °C with no other cause
- Leukopenia (<4000 WBC/mm^3) or leucocytosis (≥ 12 000 WBC/mm^3)

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 (color, odor, quantity, consistency)
- Cough or dyspnea or tachypnea
- Suggestive auscultation (rales or bronchial breath sounds), ronchi, wheezing
- Worsening gas exchange (e.g., O_2 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[1] specimen **(PN 1)**

- Broncho-alveolar lavage (BAL) with a threshold of ≥ 10^4 CFU[2]/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 ≥10^3 CFU/ml
- Distal protected aspirate (DPA) with a threshold of ≥ 10^3 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 10^6 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 (*Legionella*, *Aspergillus*, mycobacteria, mycoplasma, *Pneumocystis 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 (ex : 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)**

Note: PN 1 and PN 2 criteria were validated without previous antimicrobial therapy

[1] LRT = Lower Respiratory Tract
[2] CFU = Colony Forming Units

Comment: The subdivision of the pneumonia definition in 5 categories allows for the comparison of similar entities of pneumonia within and between networks. *It is essential that all networks report PN4 and PN5 (clinical pneumonia without microbiological evidence) in order to achieve overall comparability, even if a microbiological exam was performed and yielded negative results*. It is also advised, both for clinical and surveillance purposes, that networks promote as much as possible microbiological confirmation (PN1-3) as a routine practice in the ICU.

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

Note with regard to IAP: It is strongly recommended to report directly the presence of intubation in the 48 hours before the infection. The variable is required in the minimal data set (level 1). Networks deriving this information from daily exposure data should not consider pneumonia in which the intubation was started on the same day as the onset of infection as IAP. Although very early onset IAP may occur rapidly after intubation, in the majority of these cases the ventilation was started because of the increasing ventilation demand of the patient with pneumonia.

4.3 Case definition of CVC-related infection

CODE: CRI

A central venous catheter-related infection relies on:

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

- quantitative CVC culture $\geq 10^3$ CFU/ml (3) or semi-quantitative CVC culture > 15 CFU (4)

and

- pus/inflammation at the insertion site or tunnel

CRI2: General CVC-related infection (no positive blood culture)

- quantitative CVC culture $\geq 10^3$ CFU/ml or semi-quantitative CVC culture > 15 CFU

and

- clinical signs improve within 48 hours after catheter removal

CRI3: CVC-related BSI

- BSI occurring 48 hours before or after catheter removal

and positive culture with the same micro-organism of either:

- quantitative CVC culture $\geq 10^3$ CFU/ml or semi-quantitative CVC culture > 15 CFU
- quantitive blood culture ratio CVC blood sample/peripheral blood sample> 5 (5)
- differential delay of positivity of blood cultures (6): 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

Note: definition of catheter colonisation

CODE: CCO

Surveillance of catheter colonisation can only be done if all hospitals participating to the network carry out systematic culture of all CVC tips after removal. Catheter colonisation is defined as follows:

- quantitative CVC culture $\geq 10^3$ CFU/ml or semi-quantitative CVC culture > 15 CFU

In case of CRI3 only, the three following criteria may also be accepted:
- positive culture from pus from insertion site
- quantitive 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)

4.4 Case definition of urinary tract infection

CODE: UTI

Surveillance of UTI is optional (both in level 1 and level 2). Since the diagnosis of urinary tract infections in the ICU is complicated by the fact that symptoms are often masked in the comatous patient, asymptomatic bacteriuria is sometimes included in networks for the surveillance of nosocomial infections in the ICU. In order to compare similar diagnostic entities between networks, the UTI should be reported as one of following three categories (UTI-A, B or C):

UTI-A: microbiologically confirmed symptomatic UTI

- Patient has at least one of the following signs of symptoms with no other recognized cause: fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness

and

- patient has a positive urine culture, that is, ≥ 10^5 microorganisms per ml of urine with no more than two species of microorganisms.

UTI-B: not microbiologically confirmed symptomatic UTI

- Patient has at least two of the following with no other recognized cause: fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness

and

at least one of the following:
- Positive dipstick for leukocyte esterase and/or nitrate
- Pyuria urine specimen with ≥10 WBC/ml or ≥ 3 WBC/high-power field of unspun urine
- Organisms seen on Gram stain of unspun urine
- At least two urine cultures with repeated isolation of the same uropathogen (gram-negative bacteria or *S. saprophyticus*) with ≥ 10^2 colonies/ml urine in nonvoided specimens
- ≤10^5 colonies/ml of a single uropathogen (gram-negative bacteria or *S. saprophyticus*) in a patient being treated with effective antimicrobial agent for a urinary infection
- Physician diagnosis of a urinary tract infection
- Physician institutes appropriate therapy for a urinary infection

UTI-C: asymptomatic bacteriuria

- Patient has no fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness

and either of the following criteria:

1. Patient has had an indwelling urinary catheter within 7 days before urine is cultured
and
patient has a urine culture, that is, ≥10^5 microorganisms per ml of urine with no more than two species of microorganisms.

2. Patient has not had an indwelling urinary catheter within 7 days before the first positive culture
and
Patient has had at least two positive urine cultures ≥10^5 microorganisms per mm^3 of urine with repeated isolation of the same microorganism and no more than two species of microorganisms.

5 Procedures for participation

5.1 Participation to the HELICS network

The partners of the European network of networks will sign a convention with the HELICS co-operation. They are expected to report relevant data for at least the minimal data set described in the current protocol. Only networks coordinated by officially mandated centres should participate. The institutions in charge of official networks and receiving data from the hospitals must validate the system and the quality of the data before data are transmitted to the EU database (see below). Data will not be transmitted directly from the hospitals to the project database (with the exception of temporary participation of pilot hospitals in the context of creation of a new network). However, if an official national or regional network exists, individual hospital data from an area covered by such a network will be refused.

5.2 Minimal participation period

The minimal participation period for participation to the ICU protocol is 3 months. However, in order to stabilise NI indicators, a minimum period of 6 months is recommended. The simplicity of level 1 encourages a continuous surveillance.

6 Data collection

6.1 Population under surveillance

6.1.1 Eligibility criteria for Intensive Care Units

The Intensive Care Units admitted in the surveillance networks must fit the definition established by the European Society of Intensive Care Medicine (7):
"An ICU is a geographically defined area in the hospital providing care for critically ill patients with specialised personnel and complex equipment."…
"The ICU is staffed with a specific group of specially trained doctors, nurses and other allied personnel (e.g. physiotherapists, technicians) in appropriate numbers."…
"The ICU should provide at least facilities for temporary cardiac pacing and invasive haemodynamic monitoring, ventilation supports and pump-controlled administration of infusions. Facilities for blood gas, haemoglobin and electrolyte measurements should be provided in the ICU or in the immediate vicinity. An ICU should function 24 hrs a day, 7 days a week. There must be at least one doctor immediately available at all times who can deal with all emergencies."…
Neonatal and paediatric ICU can be included in the network, but results should be separately identified in the analysis.
The aim should be to include as many units as possible. The range of units that are included in the definition is too wide. Therefore within the very broad group of ICUs, subgroups should be defined that will allow comparisons (see below). A questionnaire to be filled in by all ICU that take part in the system will be used to define criteria for the subgroups.

6.1.2 Inclusion of patients

Only patients staying more than two calendar days are included in the surveillance, according to the following algorithm:
Date of discharge from the ICU – Date of admission to the ICU + 1 > 2

Patients staying less than 3 days in the ICU are excluded. These patients add a lot of patient-days and also device-days to the denominator, but are not at risk of developing an infection after day 2 in the ICU. Infections appearing after discharge from the ICU (post-discharge) are excluded. Post-discharge surveillance is time consuming, adds little to the performance of the surveillance system and is in practice rarely done(8,9).

In level 1 (unit-based surveillance), patient-days are included in the denominator if patients are present (since more than 2 days) in the time window of the surveillance, even if they were admitted before the beginning of that period.

In level 2 (patient-based surveillance) patients may be included following two separate methods:

- Prospective inclusion: patients are included if the admission date to the ICU falls within the time window of the surveillance. After the end of the surveillance period, patients still under follow-up are censored (arbitrarily discharged) at the last day of the month following the end of the surveillance period (e.g. 31 July if the surveillance is conducted from 1 January to 30 June), in order to allow for data encoding and transmission to the national/regional coordination centre. The follow-up of these patients may be completed and data sent in for correction, e.g. at the end of the following surveillance period.
- Retrospective inclusion: patients are included if the discharge date from the ICU falls within the time window of the surveillance. Censoring is not an issue in this case and therefore, this method of inclusion is recommended.

Note: The different inclusion methods result in slightly different denominator data for the same unit during the same surveillance period. In practice however, these differences are very small.

Approximately 2-3% of patients stay longer than 30 days in the ICU and less than 0.05% stay more than 3 months. The difference between unit-based and patient-based denominator data such as patient-days will decrease as the surveillance period increases.

6.2 Type of infections under surveillance

Nosocomial infections occurring after day two and later in the ICU should be reported. Infections occurring before day 3 may be recorded, but will not be included in the analysis. Data on at least ICU-acquired bloodstream infection and/or pneumonia should be reported. Other infection types are optional.

In level 1, only infections occurring within the time window of the surveillance are included.
In level 2, infections may occur outside the time window, since the inclusion criterion is either the admission or the discharge date of the patient.

6.3 Information to be collected

Variables are classified according to 3 levels:

- **M**=mandatory: data will be rejected if this variable is missing
- **R**=required: these variables are required for the correct interpretation of the results and/or for routine analysis
- **O**=optional, data used for additional analysis

In the tables the first column indicates whether data belong to level 1 and/or level 2 surveillance, or to one of the optional registrations under level 2. The attribute column indicates whether data are mandatory (M), required (R) or optional (O).

6.3.1 Data at the Network level

Information at the level of the regional or national nosocomial infections surveillance network should be collected once a year.

Data table icu_net: network data table (one record per network per year per surveillance component)

L	Attr.	Variable Label	Variable Name	Format	Length
L1,2	M	[1]Country code	country_id	text	2
L1,2	M	[2]Network code	net_id	text	2
L1,2	M	[3]Surveillance component code	sur_id	number	1
L1,2	M	[4]Year	net_year	number	4
L1,2	M	[5]BSI-A alone or BSI-A+B	net_bsi	number	1
L1,2	M	[6]All pneumonia or only IAP	net_pneu	number	1
L1,2	R	[7]UTI	net_uti	number	1
L1,2	R	[8]Other infections	net_oth	number	1
L1,2	R	[9]Catheter infection	net_cri	number	1
L1,2	R	[10]Catheter colonisation	net_cvc	number	1
L1,2	M	[11]Level 1 (unit-based surveillance)	net_l1	number	1
L1,2	M	[12]Level 2 (patient-based surveillance)	net_l2	number	1
L1,2	R	[13]L2, option a (NI risk score)	net_oa	number	1
L1,2	R	[14]L2, option b (CVC surveillance)	net_ob	number	1
L1,2	R	[15]L2, option c (antimicrobial use)	net_oc	number	1

Unique key=country code + network code + surveillance component code + year

ID variables

1. **Country code**: country codes based on EARSS protocol (EARSS manual 2004, www.earss.rivm.nl) and ISO codes (International Organization for Standardization ISO 3166-1-alpha-2-code elements); AT=Austria; BE=Belgium; BG=Bulgaria; HR=Croatia; CY=Cyprus; CZ=Czech Republic; DK=Denmark; EE=Estonia; FI=Finland; FR=France; DE=Germany; GR=Greece; HU=Hungary; IS=Iceland; IE=Ireland; IL=Israel; IT=Italy; LV=Latvia; LT=Lithuania; LU=Luxembourg; MT=Malta; NL=Netherlands; NO=Norway; PL=Poland; PT=Portugal; RO=Romania; RU=Russian Federation; SK=Slovakia; SI=Slovenia; ES=Spain; SE=Sweden; CH=Switzerland; UK=United Kingdom

2. **Network code**: internal code given by the national coordinator to each sub-network in the country, e.g. different C.Clin networks in France; 00 if not applicable; EN,SC,WA,NI designate England, Scotland, Wales and Northern-Ireland
3. **Surveillance component code**: always 1 for ICU surveillance (2=SSI surveillance)
4. **Year**: year for which data apply (yyyy)

Infections included in the national/regional surveillance network

These data are required for the interpretation of data coming from the different networks: e.g. zero rates for a given (sub-)type of infections due to the fact that the national/regional protocol does not include that type of infections.

5. **BSI**: 0=not included in the protocol, 1=Inclusion of BSI-A alone or 2=BSI-A+BSI-B
6. **Pneumonia**: 0:not included, 1=intubator-associated pneumonia only or 2=all Pneumonia (recommended)
7. Inclusion of **urinary tract infections** 0=not included in the protocol: 1=UTI-A+UTI-B+UTI-C; 2=UTI-A+UTI-B (=CDC); 3=UTI-A+UTI-C; 4=UTI-A only
8. Inclusion of the category **"other infections";** 1=yes; 0=no
9. Inclusion of central **catheter related infections** (CRI) 1=yes; 0=no
10. Inclusion of central **catheter colonization** (CCO) 1=yes; 0=no

Note: systematic culture of all central catheters at removal in all hospitals participating to the network is required for the inclusion of central catheter colonization

Mode of surveillance

11. **Level 1**: minimal data (unit-based): 1=yes; 0=no
12. **Level 2**: basic patient-based level: 1=yes; 0=no

Note: level 1 and level 2 surveillance may be implemented simultaneously in the same network

Options for L2:

13. Option a: standardised infection ratio for PN/BSI (see 6.3.4 and 6.3.6.5): 1=yes; 0=no
14. Option b: surveillance of central venous catheters + standardised infection ratio for CVC-related infection (see 6.3.4 and 6.3.6.6): 1=yes; 0=no
15. Option c: antimicrobial use in the ICU (see 6.3.4 and 6.3.6.7): 1=yes; 0=no

Note: if only some participating hospitals choose L2 or L2 + one of the options, mark "yes"

6.3.2 Data at the Hospital and unit level

Data at the level of the hospital and the intensive care unit should be collected once a year. These data will be used to stratify infection rates (by e.g. type of ICU) to improve comparibility.

For each hospital, collect:

Data table icu_h: Hospital characteristics data table (one record per hospital and per year)

L	Attr.	Variable Label	Variable Name	Format	Length
L1,2	M	[1] Country code	country_id	text	2
L1,2	M	[2] Network code	net_id	text	2
L1,2	M	[3] Surveillance component code	sur_id	number	1
L1,2	M	[4] Year	net_year	number	4
L1,2	M	[5] Hospital code	h_code	number	4
L1,2	R	[6] Hospital size (n of beds in categories)	h_size	number	2
L1,2	R	[7] Hospital type	h_type	number	2
L1,2	O	[8] Hospital location	h_region	text	2

unique key=country code + network code + surveillance component code + year + hospital code

For each separate Intensive Care Unit, collect:

Data table icu_u: ICU characteristics data table (one record per ICU and per year)

L	Attr.	Variable Label	Variable Name	Format	Length
L1,2	M	[1] Country code	country_id	text	2
L1,2	M	[2] Network code	net_id	text	2
L1,2	M	[3] Surveillance component code	sur_id	number	1
L1,2	M	[4] Year	net_year	number	4

L1,2	M	[5] Hospital code	h_code	number	4
L1,2	M	[9] ICU code	icu_id	text	3
L1,2	R	[10] ICU size	icu_size	number	3
L1,2	R	[11] ICU type	icu_type	number	2
L1,2	R	[12] ICU, % of intubated patients over last year	icu_pint	number	3

unique key=country code + network code + surveillance component code + year + hospital code + ICU code

1. **Country code**: see 6.3.1
2. **Network code**: see 6.3.1
3. **Surveillance component code**: see 6.3.1 (1 for ICU)
4. **Year**: year for which data apply
5. **Hospital code:** hospital codes should be anonymized at the level of the surveillance network. Hospital names or codes used within a network should be converted to a new numeric code before sending data to Helics and the resulting code table (mapping of usual hospital ID's to new Helics code) should be available at the level of the surveillance network only.
6. **Hospital size** (n beds in categories): 0=0-99, 1=100-199, 2=200-299, 3=300-399, 4=400-499,5=500-599,…,-1= unknown
7. **Hospital type**: 1=University hospital, 2=general hospital, teaching; 3=general hospital, non-teaching; 4=specialist or other hospital; -1= unknown
8. **Hospital location/region**: optional; region within a country where hospital is located; geographical code defined by the national coordination and used for mapping at EU level (e.g. pathogen-specific infection rates); may coincide with Network code; 00 if not applicable
9. **ICU code:** unique code for ICU, should remain identical in different surveillance periods/ years; ICUs from the same hospital should have different codes
10. **ICU size**: number of beds in the ICU
11. **ICU type**: 1=mixed, 2=medical, 3=surgical, 4=Coronary Care Unit, 5=burns, 6=neurosurgical; 7=pediatric, 8=neonatal; 9=other; -1= unknown: if 80% of the patients belong to a particular category, the ICU falls within that category
12. **Percentage intubated patients over last year in the ICU**: measured or estimated percentage of patients with an invasive respiratory device over the last year

These hospital and ICU characteristics represent the minimal data set that will be used for stratification of reference data. A more comprehensive questionnaire about relevant structural and process indicators is developed elsewhere.

6.3.3 Level 1 surveillance (unit-based surveillance)

Level 1 represents the minimal data to be collected by every surveillance network and is suited for continuous surveillance because of its limited workload. Since the patient case mix of a single ICU usually remains quite stable over time, it can be used to follow-up trends of infection rates in the same unit. Most variations in risk-adjusted rates (e.g. n of intubator-associated pneumonia/1000 intubation days) are paralleled by variations in incidence densities (e.g. n of pneumonia/1000 patient-days). However, although level 1 surveillance offers limited inter-ICU comparison possibilities (e.g. pathogen-specific infection rates), level 2 is more suited for benchmarking (e.g. on a temporary basis combined with level 1).

For level 1 surveillance, denominator data should be collected at least every 3 months but preferably by month, using table **icu_d** (denominator data: one record per ICU and per surveillance period). For each infection episode with onset (infection date) within the start and end date of the surveillance period, a record should be entered in table **icu_i** (infection data: one record per infection episode and per infection site).

6.3.4 Level 2 surveillance (patient-based surveillance)

In level 2, patient data and exposure data are collected for each patient staying longer than 2 days in the ICU. This patient-based surveillance collects both intrinsic and extrinsic risk factors and allows for stratification of nosocomial infection rates, e.g. device-adjusted infection rates by patient type. Level 2 without options represents the basic (minimal) patient data set.

For level 2 without further options tables **icu_p** (one record per patient and ICU admission), **icu_i** (infection data: one record per infection episode and per infection site) and **icu_e** (day by day exposure: one record per patient-day and per device-exposure during that day) are required.

Three optional modules can be combined with level 2.
- **Option a:** standardized infection ratio (SIR) for pneumonia and BSI.(10)
- **Option b:** SIR for catheter-related infections, based on risk factors by catheter.(11)
- **Option c:** follow-up of antimicrobial use in the ICU.

For **option a** additional variables (indicated as Oa) should be recorded in tables **icu_p** and **icu_e**.
For **option b** table **icu_c** should be completed (one record per central venous catheter and per patient-ICU admission.
For **option c** table **icu_a** should be completed (one record per infection episode and per infection site)

6.3.5 Optional antimicrobial resistance data (level 1 or level 2)

Instead of using the predefined list of antimicrobial resistance "tracer" phenotypes as available in table **icu_i**, networks may prefer to use complete or partial antibiogram data. In this case, **instead of** table **icu_i**, two separate tables should be transferred, one table with a unique record per infection (table **icu_inf) and** a second table with a unique record for each micro-organism (table **icu_res)**.

6.3.6 Detailed description of patient data tables

6.3.6.1 Denominator data: table icu_d (level 1 only)

Denominator data should be collected at least every 3 months but preferably by month.

Data table icu_d: Level 1 denominator data (one record per ICU and per surveillance period)

L	Attr.	Variable Label	Variable Name	Format	Length
L1	M	[1] Country code	country_id	text	2
L1	M	[2] Network code	net_id	text	2
L1	M	[3] Surveillance component code	sur_id	number	1
L1	M	[4] Hospital code	h_code	number	4
L1	M	[5] ICU code	icu_id	text	3
L1	M	[6] Start date surveillance period	start_dt	date	10
L1	M	[7] End date surveillance period	end_dt	date	10
L1	R	[8] Number of new admissions staying more than 2 days ICU	adi_2d	number	5
L1	M	[9] Number of patient-days for patients staying more than 2 days in the ICU	pdi_2d	number	6
L1	O	[10] Number of new admissions in the ICU, all	adi_all	number	5
L1	O	[11] Number of patient-days in the ICU, all	pdi_all	number	6

unique key= country code + network code + surveillance component code + hospital code + ICU code + start date + end date

1. **Country code**: see 6.3.1
2. **Network code**: see 6.3.1
3. **Surveillance component code**: see 6.3.1 (1 for ICU)
4. **Hospital code:** see 6.3.2
5. **ICU code:** see 6.3.2
6. **Start date surveillance period** (dd/mm/yyyy): e.g.1/1/2004
7. **End date surveillance period** (dd/mm/yyyy): e.g. 31/1/2004 or 31/3/2004; data by month or by 3 months.
8. **Number of new admissions in the ICU staying more than 2 days**: number of patients for whom the admission date to the ICU falls within the surveillance period and for whom the length of stay is longer than 2 calendar days (discharge date-admission date+1>2)

9. **Number of patient-days for patients staying more than 2 days in the ICU**: number of patient-days within the surveillance period from patients staying more than 2 calendar days (discharge date-admission date+1>2), possibly admitted before the surveillance period, see appendix
10. **Number of new admissions in the ICU, all**: number of patients for whom the admission date to the ICU falls within the surveillance period
11. **Number of patient-days, all**: number of patient-days within the surveillance period

Notes:
- The collection of all ICU admissions is done as an indicator of the workload represented by patients with a short ICU stay (1 or 2 days)
- Since the primary objective of level 1 surveillance is the follow-up of trends, it is preferred to collect denominator data (patients and patient-days) by month
- The collection of unit-based denominator data should, as much as possible, be computerized, based on a list (e.g. administrative database) of ICU patients with admission date to the ICU and discharge date from the ICU. An example of an algorithm to compute the denominator data from such a database is given in the appendix.

6.3.6.2 Infection data: table icu_i (level 1 or level 2)

For each infection episode with onset (infection date) within the start and end date of the surveillance period, following variables should be collected.

Data table icu_i: Level 1 numerator (infection) data (one record per infection episode and per infection site)

	Attr.	Variable Label	Variable Name	Format	Length
L1,2	M	[1] Country code	country_id	text	2
L1,2	M	[2] Network code	net_id	text	2
L1,2	M	[3] Surveillance component code	sur_id	number	1
L1,2	M	[4] Hospital code	h_code	number	4
L1,2	M	[5] ICU code	icu_id	text	3
L1,2	M	[6] Patient ID	pat_id	text	20
L1,2	M	[7] Date ICU admission	addt_icu	date	10
L1,2	M	[8] Infection date	inf_dt	date	10
L1,2	M	[9] Infection site (categories)	inf_site	text	5
L1,2	R	[10] Micro-organism 1	mo1	text	6
L1,2	R/O	[11] Resistance micro-organism 1	res1	number	2
L1,2	R	[12] Micro-organism 2	mo2	text	6
L1,2	R/O	[13] Resistance micro-organism 2	res2	number	2
L1,2	O	[14] Micro-organism 3	mo3	text	6
L1,2	O	[15] Resistance micro-organism 3	res3	number	2
L1,2	R/O	[16] Invasive device in 48 hours preceding infection	inv_dev	number	2
L1,2	O	[17] Origin of bloodstream infection	bsi_ori	text	5
L1,2	O	[18] Antimicrobial treatment	amt	number	2
L1,2	O	[19] Validated infection	val	number	2
L2	O	[20] CVC number	cvc_num	number	2

unique key = country code + network code + surveillance component code + hospital code + ICU code + patient ID + date ICU admission + infection date + infection site

1. **Country code**: see 6.3.1
2. **Network code**: see 6.3.1
3. **Surveillance component code**: see 6.3.1 (1 for ICU)
4. **Hospital code:** see 6.3.2
5. **ICU code :** see 6.3.2
6. **Patient ID** unique patient code. This code should be anonymous and prevent the network coordination from tracing back the patient. However, a patient that is infected or admitted several times to the ICU should keep the same number. Since this number will also be used for validation studies, (only) the hospital should be able to link the number to the patient's file.
7. **Date ICU admission** (dd/mm/yyyy): date of admission in the ICU.

8. **Infection date** (dd/mm/yyyy): date onset infection (date all necessary case definition criteria are met, date of sample if appropriate); include all infections occurring after day 2 in the ICU for which the infection date falls within the surveillance period; infections occurring on day 1 and day 2 may be reported but will not be included in the indicators.
9. **Infection site (also see case definitions): PN1-5, BSI-A/B, UTIA-C, CRI1-3, CCO, OTH**

Pneumonia : always specify subcategory !

- PN1: protected sample + quantitative culture (10^4 CFU/ml BAL/10^3 PB,DPA)
- PN2: non-protected sample (ETA) + quantitative culture (10^6 CFU/ml)
- PN3: alternative microbiological criteria
- PN4: sputum bacteriology or non-quantitative ETA
- PN5: no microbiological criterion (only clinical criteria, see case definition)

BSI: Bloodstream infection

- BSI-A: positive hemoculture recognized pathogen/ 2 HC+ skin contaminant
- BSI-B: CDC extension (see case definition) - optional

UTI: Urinary tract infection (optional)

- UTI-A: microbiologically confirmed symptomatic UTI
- UTI-B: symptomatic UTI, not microbiologically confirmed
- UTI-C: asymptomatic bateriuria

CRI: CVC-related infection (optional)

- CRI1: local catheter infection
- CRI2: generalized catheter infection
- CRI3: CVC-related bloodstream infection

CCO: CVC colonization (optional)

OTH: other ICU-acquired infection (optional)

10. **Micro-organism1**: Required. 6 character code list (WHOCARE-based) – see code list in appendix; if no micro-organism is available, specify either _NONID (Micro-organism not identified or not found), _NOEXA(examination not done) or _STERI (Sterile examination).
11. **Antimicrobial resistance1:** 1 digit (see code list in appendix)
    - required: oxacillin resistance in *S. aureus* (0=MSSA 1=MRSA -1= unknown)
    - other micro-organisms: optional
12. **Micro-organism2**: Required
13. **Antimicrobial resistance2:** Required for *S.aureus* , optional for other micro-organisms
14. **Micro-organism3**: Optional
15. **Antimicrobial resistance3:** Required for *S.aureus* , optional for other micro-organisms
16. **Invasive device in 48 hours preceding the infection**: Mandatory for pneumonia (to distinguish device-associated pneumonia from other pneumonia), optional (but recommended) for bloodstream infection (presence of central venous catheter) and UTI (presence of urinary catheter). 0=no 1=yes --1= unknown (unknown not allowed if infection site=PN)
17. **Origin of bloodstream infection** (optional): C (C-CVC,C-PER,C-ART), S (S-PUL, S-UTI, S-DIG, S-SSI, S-SST, S-OTH), U
    - Catheter (**C**): the same micro-organism was cultured from the catheter or symptoms improve within 48 hours after removal of the catheter (C-CVC: central venous catheter, C-PER: peripheral catheter, C-ART: arterial catheter)
    - Secondary to another site (**S**): the same micro-organism was isolated from another infection site or strong clinical evidence exists that bloodstream infection was secondary to another infection site, invasive diagnostic procedure or foreign body.
        - Pulmonary (S-PUL)
        - Urinary tract infection (S-UTI)
        - Digestive tract infection (S-DIG)
        - SSI (S-SSI): surgical site infection
        - Skin and soft tissue (S-SST)
        - Other (S-OTH)
    - Unknown (**U**): None of the above, bloodstream infection of unknown origin
18. **Antimicrobial treatment** (optional): patient received antimicrobial treatment for this infection (incl. antiviral and antifungal treatment); 0=no 1=yes -1= unknown
19. **Validated infection** (optional): e.g. for use in electronic surveillance, detected “infections” on the basis of positive microbiological result and/or antimicrobial treatment should be validated by the clinician (confirm that the infection matches the case definition) 0=no 1=yes 9=not applicable -1= unknown
20. **CVC number** (optional): links infection record to a specific central venous catheter in level 2 option b (CVC-based surveillance), see table **icu_c**

6.3.6.3 Level 2 patient data: table icu_p

In level 2, patient data and exposure data are collected for each patient staying longer than 2 days in the ICU.

In the following tables, data are classified according to the data structure. The first column indicates whether data belong to basic level 2 surveillance or to one of the optional modules.

Data table icu_p: Level 2 patient data (one record per patient and ICU admission)

L	Attr.	Variable Label	Variable Name	Format	Length
L2	M	[1] Country code	country_id	text	2
L2	M	[1] Network code	net_id	text	2
L2	M	[1] Surveillance component code	sur_id	number	1
L2	M	[2] Hospital code	h_code	number	4
L2	M	[3] ICU code	icu_id	text	3
L2	M	[4] Patient ID	pat_id	text	20
L2	M	[5] Date ICU admission	addt_icu	date	10
L2	M	[6] Discharge date from the ICU	disdt_icu	date	10
L2	R	[7] Discharge status	dis_st	number	2
L2	R	[8] Gender	sex	text	1
L2	R	[9] Age in years	age	number	3
L2	O	[10] Patient origin	pt_ori	number	2
L2	R	[11] Admission date in the hospital	addt_h	date	10
L2	R	[12] SAPS II score	saps	number	3
L2	O	[13] APACHE II score	apache	number	3
L2	R	[14] Type of admission	adm_typ	number	2
L2	R	[15] Trauma	trauma	number	2
L2	O	[16] Impaired immunity	immune	number	2
L2	R	[17] Antimicrobial treatment within 48 h around admission (<>48h)	amt_adm	number	2
Oa	R	[18] Acute coronary care	coro	number	2
Oa	R	[19] Surgery in 30 days before admission (2 variables for 2 possible sites)	surg_sit1 surg_sit2	number number	2 2
Oa	O	[20] Glasgow coma score, estimated	glas_est	number	2
Oa	O	[21] Glasgow coma score, measured	glas_mea	number	2

unique key = country code + network code + surveillance component code + hospital code + ICU code + patient ID + date ICU admission

1. **Country code, network code, surveillance component code**: link with network data table, see 6.3.1
2. **Hospital code**: see 6.3.2
3. **ICU code**: see 6.3.2
4. **Patient ID**: unique patient code. This code should be anonymous and prevent the network coordination from tracing back the patient. However, a patient that is infected or admitted several times to the ICU should keep the same number. Since this number will also be used for validation studies, (only) the hospital should be able to link the number to the patient's file.
5. **Date ICU admission** (dd/mm/yyyy): date of admission in the ICU
6. **Date ICU discharge** (dd/mm/yyyy): date of discharge from the ICU - it is recommended to include patients based on this date, e.g. when participating to the surveillance from 1/4/2002 to 30/4/2002, include all patients that are discharged in this period and where (date of discharge - date of admission + 1) > 2 (=patients staying more than 2 calendar days in the ICU); patients may also be included prospectively based on admission date (see higher)
7. **Discharge status** (number 1): status at discharge from ICU (1 = discharged alive from ICU, 2 = death in ICU, -1 = unknown); record date of death as date of discharge from ICU; (Note:DNR/withdrawal may be added as supplementary category- discharged alive with therapeutic withdrawal - DNR=do not resuscitate)
8. **Gender** (string 1): gender of the patient (M/F/U)
9. **Age** (numeric 3): age in years, -1= unknown
10. **Patient origin**: 1=ward in this/other hospital; 2=other ICU; 3=community (patient came from his home, via emergency or not); 4=long term care/nursing home; -1= unknown
11. **Admission date in hospital** (dd/mm/yyyy): date of admission in the hospital

12. **SAPS II score** on admission (numeric 3): Simplified Acute Physiology Score (12) at admission - Severity of illness score developed to predict mortality (see appendix); SAPS II score is preferred because it was validated in the nosocomial infection risk score; -1= unknown; if not available, use
13. **APACHE II score** on admission (numeric 3): Acute Physiology, Age, Chronic Health Evaluation score (13) - see appendix 1; -1= unknown; prefer SAPS II score because of use in NI risk score. Also see appendices for details on risk scores.
14. **Type of admission** (numeric 1): 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
15. **Trauma**: ICU admission resulted from blunt or penetrating traumatic injury to the patient, with or without surgical intervention; 1=yes; 0=no; -1= unknown
16. **Impaired immunity**: 1=yes; 0=no; -1= unknown; yes: <500 PMN/mm3, due to treatment (chemotherapy, radiotherapy, immune suppression, corticosteroids long duration or high doses recently), due to disease (leucemia, lymphoma, AIDS) - Apache II definition
17. **Antimicrobial therapy around admission**: 1=yes; 0=no; -1= unknown; specify "yes" if any antibiotic therapy in the 48 hours *preceding* ICU admission and/or *during the first 2 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
18. **Acute coronary care** : All acute non-surgical cardiac disease. Larger than coronary suffering; 1=yes; 0=no; -1 = unknown
19. **Surgery before admission + site**: specify whether patient had surgery in the last 30 days before ICU admission including the day of admission, and if so, specify the surgery site; codes: 0=no surgery;1=coronary surgery; 2=other cardiac; 3=other thoracic; 4=other vascular; 5= neurosurgery; 6=other surgery; -1= unknown
20. **Glasgow Coma score, estimated** (numeric 2): Use the lowest value in first 24 hours; -1= unknown; record both a. the "original"=estimated GCS, i.e. if the patient is sedated, record the estimated Glasgow Coma Score before sedation (see appendix 1) (=component of both SAPS II and APACHE II score) and,
21. **Glasgow Coma score, measured** (numeric 2): the "measured" GCS, i.e. if the patient is sedated, record measured status at that moment; see appendix for details on GCS; -1= unknown

6.3.6.4 Level 2 day by day exposure data: table icu_e

Data table icu_e: Level 2 day-by-day exposure data (one record per day and per patient-device-exposure during that day)

L	Attr.	Variable Label	Variable Name	Format	Length
L2	M	[1] Country code	country_id	text	2
L2	M	[1] Network code	net_id	text	2
L2	M	[1] Surveillance component code	sur_id	number	1
L2	M	[2] Hospital code	h_code	number	4
L2	M	[3] ICU code	icu_id	text	3
L2	M	[4] Patient ID	pat_id	text	20
L2	M	[5] Date ICU admission	addt_icu	date	10
L2	M	[6] Date in ICU	e_date	date	10
L2/Oa	R/O	[7] ICU Exposure	icu_exp	text	5

unique key = country code + network code + surveillance component code + hospital code + ICU code + patient ID + date ICD admission + date in ICU

1. **Country code, network code, surveillance component code**: link with network data table, see 6.3.1
2. **Hospital code**: see 6.3.2
3. **ICU code**: see 6.3.2
4. **Patient ID**: unique patient code. This code should be anonymous and prevent the network coordination from tracing back the patient. However, a patient that is infected or admitted several times to the ICU should keep the same number. Since this number will also be used for validation studies, (only) the hospital should be able to link the number to the patient's file.
5. **Date ICU admission** (dd/mm/yyyy): date of admission in the ICU
6. **Date in the ICU:** day in the ICU for which daily exposure data are recorded

7. **ICU Exposure**: Required for Level 2: CVC and INT; Optional for Level 2: UC; Required for option a: NIT, FNIT, PN; Optional for option a: NIV, VEN, REINT. **CVC=Central venous catheters**: specify whether >=1 CVC was present in this patient on that day; CVC = vascular access device that terminates at or close to the heart or one of the great vessels; excluded: arterial catheters, external pacemaker, implanted chambers; included: v. subclavia, v. jugularis, v. basilica, v. cephalica, v. femoralis, v.umbilicalis, other veins, dialysis catheters, Swann-Ganz; optionally fill out one record by catheter (option b); **INT=Intubation**: patient has oro-tracheal or naso-tracheal intubation or tracheotomy , even if intermittent during the day (1 hour is counted as 1 day); **UC=Urinary catheter**: urinary catheter use; suprapubic catheters are included; iterative urinary catheterization excluded (e.g. for urinary sampling or in case of urine retention); optional, if UTI are registered; **NIT=Naso-oro intestinal tube without feeding in ICU**: specify whether patient had a naso-oro intestinal tube without feeding in the ICU; **FNIT=Naso-oro intestinal tube with feeding in ICU**: specify whether patient had a naso-oro intestinal tube with feeding in the ICU; **PN=Parenteral nutrition in ICU**: specify whether patient had parenteral nutrition in the ICU =patient receives minimum 2 nutritional elements via perfusion (2 out of 3: proteins, fats and sugars); **NIV=Non-invasive mechanical ventilation**: patient is ventilated (any form of mechanical respiratory assistance of inspiration and/or expiration) without intubation (BIPAP/CIPAP); **VEN=Invasive mechanical ventilation**: patient is ventilated (any form of mechanical respiratory assistance of inspiration and/or expiration) with intubation; **REINT=Re-intubation**: patient was extubated and re-intubated on that day (at least once)

6.3.6.5 Level 2 option a: PN/BSI risk score

Additional variables in tables **icu_p** and **icu_e** (see related description) need to be recorded to compute the risk scores for pneumonia and bloodstream infections originally developed by the NSIH surveillance network in Belgium (10). Optional variables were added on suggestion of the ICU working party and members of the infection section of ESICM in order to validate and possibly customize the risk score at the European level.

6.3.6.6 Level 2 option b: risk score for catheter-related infection: table icu_c

This option includes variables to be recorded for each central venous catheter (CVC) to allow the calculation of the standardized catheter-infection ratio developed by the REACAT surveillance network (C.Clin Paris-Nord, France) as an indicator of quality of catheter care.(11)

Data table icu_c: Level 2 Option b: central venous catheter (CVC) data (one record per CVC and per patient-ICU admission)

L	Attr.	Variable Label	Variable Name	Format	Length
Ob	M	[1] Country code	country_id	text	2
Ob	M	[1] Network code	net_id	text	2
Ob	M	[1] Surveillance component code	sur_id	number	1
Ob	M	[2] Hospital code	h_code	number	4
Ob	M	[3] ICU code	icu_id	text	3
Ob	M	[4] Patient ID	pat_id	text	20
Ob	M	[5] Date ICU admission	addt_icu	date	10
Ob	M	[6] CVC number	cvc_num	number	2
Ob	R	[7] Date insertion CVC	cvc_idt	date	10
Ob	R	[8] Insertion site CVC	cvc_site	number	2
Ob	R	[9] Antibiotic perfusion through catheter	cvc_abf	number	2
Ob	R	[10] Date CVC removal	cvc_rdt	date	10
Ob	R	[11] Other infection at removal	cvc_rinf	number	2
Ob	R	[12] At least 1 organ failure at removal	cvc_ofa	number	2

unique key = country code + network code + surveillance component code + hospital code + ICU code + patient ID+ date ICU admission + CVC number

1. **Country code, network code, surveillance component code**: link with network data table, see 6.3.1
2. **Hospital code**: see 6.3.2
3. **ICU code**: see 6.3.2

4. **Patient ID**: unique patient code. This code should be anonymous and prevent the network coordination from tracing back the patient. However, a patient that is infected or admitted several times to the ICU should keep the same number. Since this number will also be used for validation studies, (only) the hospital should be able to link the number to the patient's file.
5. **Date ICU admission** (dd/mm/yyyy): date of admission in the ICU
6. **CVC number:** ID number for this central venous catheter (link with infection data: table **icu_i**)
7. **Insertion date:** date CVC was inserted
8. **Site:** catheter insertion site; 1=subclavia, 2=jugular, 3=femoral, 4=other site; -1= unknown
9. **ATB perfusion**: antibiotic perfusion given via CVC; 1=yes; 0=no; -1= unknown
10. **Date removal:** date CVC was removed
11. **Other infection at removal:** did the patient have an infection at any other site at the moment of CVC removal? 1=yes; 0=no; -1= unknown
12. **At least 1 organ failure at removal:** did the patient have an organ failure (at least one) at the moment of CVC removal? 1=yes; 0=no; -1= unknown

6.3.6.7 Level 2 option c: antimicrobial use: icu_a

Data table icu_a: Level 2, Option c: antimicrobial use data (one record per antimicrobial class per day and per patient-ICU admission)

L	Attr.	Variable Label	Variable Name	Format	Length
Oc	M	[1] Country code	country_id	text	2
Oc	M	[1] Network code	net_id	text	2
Oc	M	[1] Surveillance component code	sur_id	number	1
Oc	M	[2] Hospital code	h_code	number	4
Oc	M	[3] ICU code	icu_id	text	3
Oc	M	[4] Patient ID	pat_id	text	20
Oc	M	[5] Date ICU admission	addt_icu	date	10
Oc	M	[6] Date in ICU	e_date	date	10
Oc	R	[7] Antimicrobial ATC-code	ab_atc	text	7
Oc	R	[8] Reason for antimicrobial use	ab_ind	text	1

unique key= country code + network code + surveillance component code + hospital code + ICU code + patient ID+ date ICU admission + date in ICU + antimicrobial class

1. **Country code, network code, surveillance component code**: link with network data table, see 6.3.1
2. **Hospital code**: see 6.3.2
3. **ICU code**: see 6.3.2
4. **Patient ID**: unique patient code. This code should be anonymous and prevent the network coordination from tracing back the patient. However, a patient that is infected or admitted several times to the ICU should keep the same number. Since this number will also be used for validation studies, (only) the hospital should be able to link the number to the patient's file.
5. **Date ICU admission** (dd/mm/yyyy): date of admission in the ICU
6. **Date in the ICU:** day in the ICU for which daily exposure data are recorded
7. **Antimicrobial molecule (ATC code)**: 41: antimicrobial ATC code list in appendix, ordered by antimicrobial class e.g. J01CE= Beta-lactamase sensitive penicillins; ATC-code J01CE01=Benzylpenicillin
8. **Reason for antimicrobial use**: S: SDD (selective digestive decontamination), P:prophylaxis (ex. surgical); E: empiric therapy - antimicrobial treatment of an infection (or suspicion of infection) without microbiological proof, M: gram-stain or micro-organism known, A: antibiogram known

6.3.6.8 Optional antimicrobial resistance data tables (level 1 or level 2)

Instead of using a predefined list of antimicrobial resistance "tracer" phenotypes, networks may prefer to use complete or partial antibiogram data. In this case, two separate tables should be transferred, one with a unique record per infection (**icu_inf**) and a second table with a unique record for each micro-organism (**icu_res**).

Data table icu_inf: Infection data (one record per infection episode and per infection site)

L	Attr.	Variable Label	Variable	Format	Length
L1,2	M	[1] Country code	country_id	text	2
L1,2	M	[1] Network code	net_id	text	2

L1,2	M	[1] Surveillance component code	sur_id	number	1
L1,2	M	[2] Hospital code	h_code	number	4
L1,2	M	[3] ICU code	icu_id	text	3
L1,2	M	[4] Patient ID	pat_id	text	20
L1,2	R	[5] Date ICU admission	addt_icu	date	10
L1,2	M	[6] Infection date	inf_dt	date	10
L1,2	M	[7] Infection site (categories)	inf_site	text	5
L1,2	R	[8] Invasive device in 48 hours preceding infection	inv_dev	number	2
L1,2	O	[9] Origin of bloodstream infection	bsi_ori	text	5
L1,2	O	[10] Antimicrobial treatment	amt	number	2
L1,2	O	[11] Validated infection	val	number	2
L1,2	O	[12] CVC number	cvc_num	number	2

unique key = country code + network code + surveillance component code + hospital code + ICU code + patient ID + infection date + infection site

1. **Country code, network code, surveillance component code**: link with network data table, see 6.3.1
2. **Hospital code**: see 6.3.2
3. **ICU code**: see 6.3.2
4. **Patient ID**: unique patient code. This code should be anonymous and prevent the network coordination from tracing back the patient. However, a patient that is infected or admitted several times to the ICU should keep the same number. Since this number will also be used for validation studies, (only) the hospital should be able to link the number to the patient's file.
5. **Date ICU admission** (dd/mm/yyyy): date of admission in the ICU
6. **Infection date** (dd/mm/yyyy): date onset infection (date all necessary case definition criteria are met, date of sample if appropriate); include all infections occurring after day 2 in the ICU for which the infection date falls within the surveillance period; infections occurring on day 1 and day 2 may be reported but will not be included in the indicators.
7. **Infection site (also see case definitions): PN1-5, BSI-A/B, UTIA-C, CRI1-3, CCO, OTH**

   Pneumonia : always specify subcategory !
   - PN1: protected sample + quantitative culture (10^4 CFU/ml BAL/10^3 PB,DPA)
   - PN2: non-protected sample (ETA) + quantitative culture (10^6 CFU/ml)
   - PN3: alternative microbiological criteria
   - PN4: sputum bacteriology or non-quantitative ETA
   - PN5: no microbiological criterion (only clinical criteria, see case definition)

   BSI: Bloodstream infection
   - BSI-A: positive hemoculture recognized pathogen/ 2 HC+ skin contaminant
   - BSI-B: CDC extension (see case definition) - optional

   UTI: Urinary tract infection (optional)
   - UTI-A: microbiologically confirmed symptomatic UTI
   - UTI-B: symptomatic UTI, not microbiologically confirmed
   - UTI-C: asymptomatic bateriuria

   CRI: CVC-related infection (optional)
   - CRI1: local catheter infection
   - CRI2: generalized catheter infection
   - CRI3: CVC-related bloodstream infection

   CCO: CVC colonization (optional)

   OTH: other ICU-acquired infection (optional)
8. **Invasive device in 48 hours preceding the infection**: Mandatory for pneumonia (to distinguish device-associated pneumonia from other pneumonia), optional (but recommended) for bloodstream infection (presence of central venous catheter) and UTI (presence of urinary catheter). 0=no 1=yes --1= unknown (unknown not allowed if infection site=PN)
9. **Origin of bloodstream infection** (optional): C (C-CVC,C-PER,C-ART), S (S-PUL, S-UTI, S-DIG, S-SSI, S-SST, S-OTH), U
   - Catheter (**C**): the same micro-organism was cultured from the catheter or symptoms improve within 48 hours after removal of the catheter (C-CVC: central venous catheter, C-PER: peripheral catheter, C-ART: arterial catheter)
   - Secondary to another site (**S**): the same micro-organism was isolated from another infection site or strong clinical evidence exists that bloodstream infection was secondary to another infection site, invasive diagnostic procedure or foreign body.

- Pulmonary (S-PUL)
- Urinary tract infection (S-UTI)
- Digestive tract infection (S-DIG)
- SSI (S-SSI): surgical site infection
- Skin and soft tissue (S-SST)
- Other (S-OTH)

▪Unknown (**U**): None of the above, bloodstream infection of unknown origin

10. **Antimicrobial treatment** (optional): patient received antimicrobial treatment for this infection (incl. antiviral and antifungal treatment); 0=no 1=yes -1= unknown
11. **Validated infection** (optional): e.g. for use in electronic surveillance, detected "infections" on the basis of positive microbiological result and/or antimicrobial treatment should be validated by the clinician (confirm that the infection matches the case definition) 0=no 1=yes 9=not applicable -1= unknown
12. **CVC number** (optional): links infection record to a specific central venous catheter in level 2 option b (CVC-based surveillance), see table **icu_c**

Data table icu_res: Micro-organism & antimicrobial resistance data (one record per micro-organism)

L	Attr.	Variable Label	Variable	Format	Length
L1,2	M	[1] Country code	country_id	text	2
L1,2	M	[1] Network code	net_id	text	2
L1,2	M	[1] Surveillance component code	sur_id	number	1
L1,2	M	[2] Hospital code	h_code	number	4
L1,2	M	[3] ICU code	icu_id	text	3
L1,2	M	[4] Patient ID	pat_id	text	20
L1,2	R	[5] Date ICU admission	addt_icu	date	10
L1,2	M	[6] Infection date	inf_dt	date	10
L1,2	M	[7] Infection site (categories)	inf_site	text	5
L1,2	M	[8] Micro-organism	mo	text	6
L1,2	O	[9] Penicillin susceptibility	r_peni	text	1
L1,2	O	[10] Ampicillin	r_ampi	text	1
L1,2	O	[11] Amoxicillin/clavulanate	r_aug	text	1
L1,2	R	[12] Methicillin/oxacillin (beta-lact.res.penic.)	r_oxa	text	1
L1,2	O	[13] Piperacillin/ticarcillin (anti-pseudom. penic.)	r_pip	text	1
L1,2	O	[14] Piperacillin/ticarcillin + enzyme inhibitor	r_pipenz	text	1
L1,2	O	[15] Cefalotin/cefazolin (1st gen cephalosporins)	r_c1	text	1
L1,2	O	[16] Cefuroxim/cefamandole/cefoxitin (2G ceph)	r_c2	text	1
L1,2	O	[17] Cefotaxime/ceftriaxone (3rd gen ceph.)	r_c3	text	1
L1,2	O	[18] Ceftazidim (anti-pseudom 3G ceph)	r_caz	text	1
L1,2	O	[19] Cefepime/cefpirome (4G cephalosporin)	r_c4	text	1
L1,2	O	[20] Extended Spectrum Beta-Lactamase (ESBL)	r_esbl	text	1
L1,2	O	[21] Meropenem/imipenem (carbapenems)	r_carba	text	1
L1,2	O	[22] Co-trimoxazole (sulfamethoxazole + trimet.)	r_ctmx	text	1
L1,2	O	[23] Tetra-/doxy-/minocycline (tetracyclines)	r_tetra	text	1
L1,2	O	[24] Erythromycin (macrolides)	r_erytro	text	1
L1,2	O	[25] Clindamycin (lincosamides)	r_clinda	text	1
L1,2	O	[26] Quinupristin/dalfopristin (streptogramins)	r_dalfo	text	1
L1,2	O	[27] Gentamycin	r_genta	text	1
L1,2	O	[28] Netilmycin	r_netil	text	1
L1,2	O	[29] Tobramycin	r_tobra	text	1
L1,2	O	[30] Amikacin	r_amika	text	1
L1,2	O	[31] Ciprofloxacin/oflocacin	r_cipro	text	1
L1,2	O	[32] Levofloxacin	r_levo	text	1
L1,2	O	[33] Gatifloxacin/Sparfloxacin	r_gatiflo	text	1
L1,2	O	[34] Moxifloxacin/Trovafloxacin	r_moxiflo	text	1
L1,2	O	[35] Nalidixic acid	f_nalid	text	1
L1,2	O	[36] Vancomycin/teicoplanin (Glycopeptides)	r_glyco	text	1
L1,2	O	[37] Colistin (polymixins)	r_coli	text	1
L1,2	O	[38] Fusidic acid	r_fusid	text	1
L1,2	O	[39] Fosfomycin	r_fosfomy	text	1
L1,2	O	[40] Linezolid	r_linezo	text	1
L1,2	O	[41] Ketoconazol	r_keto	text	1

L1,2	O	[42] Fluconazole	r_fluco	text	1
L1,2	O	[43] Itraconazole	r_itra	text	1
L1,2	O	[44] Amphotericin-B	r_ampho	text	1
L1,2	O	[45] Flucytosine	r_flucyt	text	1
L1,2	O	[46] Echinocandins (ex. caspofungin)	r_caspo	text	1

unique key=country code + network code + surveillance component code + hospital code + ICU code + patient ID + Infection date + infection site + micro-organism code

1. **Country code, network code, surveillance component code**: link with network data table, see 6.3.1
2. **Hospital code**: see 6.3.2
3. **ICU code**: see 6.3.2
4. **Patient ID**: unique patient code. This code should be anonymous and prevent the network coordination from tracing back the patient. However, a patient that is infected or admitted several times to the ICU should keep the same number. Since this number will also be used for validation studies, (only) the hospital should be able to link the number to the patient's file.
5. **Date ICU admission** (dd/mm/yyyy): date of admission in the ICU
6. **Infection date** (dd/mm/yyyy): date onset infection (date all necessary case definition criteria are met, date of sample if appropriate); include all infections occurring after day 2 in the ICU for which the infection date falls within the surveillance period; infections occurring on day 1 and day 2 may be reported but will not be included in the indicators.
7. **Infection site (also see case definitions): PN1-5, BSI-A/B, UTIA-C, CRI1-3, CCO, OTH**

   Pneumonia : always specify subcategory !
   - PN1: protected sample + quantitative culture (10^4 CFU/ml BAL/10^3 PB,DPA)
   - PN2: non-protected sample (ETA) + quantitative culture (10^6 CFU/ml)
   - PN3: alternative microbiological criteria
   - PN4: sputum bacteriology or non-quantitative ETA
   - PN5: no microbiological criterion (only clinical criteria, see case definition)

   BSI: Bloodstream infection
   - BSI-A: positive hemoculture recognized pathogen/ 2 HC+ skin contaminant
   - BSI-B: CDC extension (see case definition) - optional

   UTI: Urinary tract infection (optional)
   - UTI-A: microbiologically confirmed symptomatic UTI
   - UTI-B: symptomatic UTI, not microbiologically confirmed
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   CRI: CVC-related infection (optional)
   - CRI1: local catheter infection
   - CRI2: generalized catheter infection
   - CRI3: CVC-related bloodstream infection

   CCO: CVC colonization (optional)

   OTH: other ICU-acquired infection (optional)
8. **Micro-organism**: Required. 6 character code list (WHOCARE-based) – see code list in appendix; if no micro-organism is available, specify either _NONID (Micro-organism not identified or not found), _NOEXA(examination not done) or _STERI (Sterile examination).

9-46. **Susceptibility of micro-organisms to antimicrobials**: U: unknown / not determined/ not available / not applicable (default value); S: sensitive; I: intermediate; R: resistant; oxacillin susceptibility in *S. aureus* is required;

7 Control of the quality and validation of data

7.1 Role of the official network

The official networks in the countries are responsible for the quality of the data, for validation and for data checks. They will be asked to provide an indication of the kind of selection in their data so that the European centre can judge its representativeness. The official centres will be also be asked to describe their procedures to guarantee the quality of the data.

7.2 Validation of nosocomial infections in the ICU

7.2.1 External data validation

The primary objective of a validation study is to determine the sensitivity and the specificity of the surveillance as well as some other parameters such as the exhaustiveness of the denominator and the accurateness of risk factors collected in the surveillance.
The method for the validation of nosocomial infections in the ICU depends on the infection type. Laboratory-confirmed infections such as bloodstream infection may be traced directly from the laboratory information system. For the validation of other infections, e.g. pneumonia, a sample of patient files reported negative to the surveillance should be examined by a trained investigator in order to estimate the number of false negatives. This sample should be big enough in order to obtain results at the network level with a reasonably small confidence interval. The detailed methodology of external data validation will be addressed during training sessions and is developed elsewhere. In any case, validation is a very labour-intensive work involving mainly the members of the national coordination team.

7.2.2 Internal data validation

Data should also be validated in the hospital whenever the collected data appear to be inconsistent, for example checking of missing information by the person in charge of data entering. The user software in the hospital should also include data entry checks that prohibits the user of entering impossible data or omitting essential data.

The automatic creation of lists of possible infections (e.g. based on positive laboratory results or antibiotic use) that is regularly submitted to the clinician for validation (check whether or not it was an ICU-acquired infection that matches the case definition), may be more efficient in case finding than relying on the active step of reporting an infection. Electronic surveillance (automatic data collection from existing databases) will also have an impact on the workload of the surveillance, which is essential for the sustainability of the surveillance at long term.

7.3 Role of the HELICS management team

When receiving the data, the HELICS data manager will realise a new check of the quality of data for completeness of information and consistency. The modalities of the consistency checks will be defined in the appropriate validation tools.

8 Confidentiality

8.1 Patient confidentiality

It will not be possible to identify individual patients in the European database on NI in the ICU by coding patient information at the hospital level or at the level of the official networks in the countries. However, for validation purposes, the hospitals should be able to trace back patients based on anonymous unique patient numbers.

8.2 Hospital and ICU confidentiality

A unique code is assigned to each hospital (unit) by the national surveillance system. The key linking each hospital (unit) to its HELICS code remains strictly within the national surveillance system to secure confidentiality. It is not to be transmitted to any other organization under any circumstance. This number will be used for correspondence and feedback.

8.3 Publication policy

The data will be used to generate European annual reports on nosocomial infections in the ICU, reference tables on the internet, mapping of pathogen-specific incidence of nosocomial infections in European ICUs (mapping) and scientific publications. Official networks in the countries have to provide written consent with any publication before publication. Authorships will be dealt with according to the authorship regulations used by the British Medical Journal; in any publication reference will be made to the official networks in the countries, including their acronym and contact information, if desired by the networks.

9 Data flow, accessibility and storage

Most of these topics are developed in the Standard Operating Manual for the surveillance of nosocomial infections.

The data files to be exported for the surveillance of nosocomial infections in intensive care units are the following:

File (table) name	Description	Level 1 (Unit-based surveillance)	Level 2 (Patient-based surveillance)
icu_net	Country and network data	R	R
icu_h	Hospital characteristics	R	R
icu_u	ICU characteristics	R	R
icu_d	Unit-based denominator data	R	-
icu_l	Infection data	R	R
icu_inf & icu_res*	Optional infection & AMR data	O	O
icu_p	ICU patient data, level 2 minimal data	-	R
icu_e	day-by-day exposure data	-	R
icu_c	central venous catheter data	-	Option b
icu_a	antimicrobial use data	-	Option c

Level 1 data are the minimal data set to be transmitted by participating networks. Level 2 data are more complete and are compatible with level 1 data. Therefore, they may replace or complete level 1 data. For option a additional variables in tables **icu_p** and **icu_e** are required.

* When both **icu_inf** and **icu_res** are used they replace table **icu_i.**

10 References

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11 Appendices

11.1 Appendix 1: Participants to the meetings and the elaboration of the ICU protocol

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[1] National/Regional network for the surveillance of nosocomial infections - coordination;
[2] Intensivist, NI expert; [3] Microbiologist/Infectious diseases specialist; [4] Epidemiologist;
[5] Ministry of Health

11.2 Appendix 2: Microorganism code list

Note: The code list is adapted from the original WHOCARE coding system. The current list is a selection of micro-organisms based on their frequency of occurrence in nosocomial infections in different EU networks and infection types and/or on their public health importance. The minimal list represents the minimal level of detail that should be provided by every network. Networks/countries preferring to use the complete WHOCARE list may obtain the database from the HELICS coordination centre.

Micro-organism selection and minimal list

	Microorganism	Code	Minimal list
Gram + cocci	*Staphylococcus aureus*	STAAUR	**STAAUR**
	Staphylococcus epidermidis	STAEPI	**STACNS**
	Staphylococcus haemolyticus	STAHAE	
	Coag-neg. staphylococci, not specified	STACNS	
	Other coagulase-negative staphylococci (CNS)	STAOTH	
	Staphylococcus sp., not specified	STANSP	**GPCTOT**
	Streptococcus pneumoniae	STRPNE	**STRSPP**
	Streptococcus agalactiae (B)	STRAGA	
	Streptococcus pyogenes (A)	STRPYO	
	Other haemol. Streptococci (C, G)	STRHCG	
	Streptococcus sp., other	STROTH	
	Streptococcus sp., not specified	STRNSP	
	Enterococcus faecalis	ENCFAE	**ENCSPP**
	Enterococcus faecium	ENCFAC	
	Enterococcus sp., other	ENCOTH	
	Enterococcus sp., not specified	ENCNSP	
	Gram-positive cocci, not specified	GPCNSP	**GPCTOT**
	Other Gram-positive cocci	GPCOTH	
Gram - cocci	*Moraxella catharralis*	MORCAT	**GNCTOT**
	Moraxella sp., other	MOROTH	
	Moraxella sp., not specified	MORNSP	
	Neisseria meningitidis	NEIMEN	
	Neisseria sp., other	NEIOTH	
	Neisseria sp., not specified	NEINSP	
	Gram-negative cocci, not specified	GNCNSP	
	Other Gram-negative cocci	GNCOTH	
Gram + bacilli	*Corynebacterium sp.*	CORSPP	**GPBTOT**
	Bacillus sp.	BACSPP	
	Lactobacillus sp.	LACSPP	
	Listeria monocytogenes	LISMON	
	Gram-positive bacilli, not specified	GPBNSP	
	Other Gram-positive bacilli	GPBOTH	
Enterobacteriaceae	*Citrobacter freundii*	CITFRE	**CITSPP**
	Citrobacter koseri (e.g. *diversus*)	CITDIV	
	Citrobacter sp., other	CITOTH	
	Citrobacter sp., not specified	CITNSP	
	Enterobacter cloacae	ENBCLO	**ENBSPP**
	Enterobacter aerogenes	ENBAER	
	Enterobacter agglomerans	ENBAGG	
	Enterobacter sakazakii	ENBSAK	
	Enterobacter gergoviae	ENBGER	
	Enterobacter sp., other	ENBOTH	
	Enterobacter sp., not specified	ENBNSP	

	Escherichia coli	ESCCOL	**ESCCOL**
	Klebsiella pneumoniae	KLEPNE	**KLESPP**
	Klebsiella oxytoca	KLEOXY	
	Klebsiella sp., other	KLEOTH	
	Klebsiella sp., not specified	KLENSP	
	Proteus mirabilis	PRTMIR	**PRTSPP**
	Proteus vulgaris	PRTVUL	
	Proteus sp., other	PRTOTH	
	Proteus sp., not specified	PRTNSP	
	Serratia marcescens	SERMAR	**SERSPP**
	Serratia liquefaciens	SERLIQ	
	Serratia sp., other	SEROTH	
	Serratia sp., not specified	SERNSP	
	Hafnia sp.	HAFSPP	**ETBTOT**
	Morganella sp.	MOGSPP	
	Providencia sp.	PRVSPP	
	Salmonella enteritidis	SALENT	
	Salmonella typhi or *paratyphi*	SALTYP	
	Salmonella typhimurium	SALTYM	
	Salmonella sp., not specified	SALNSP	
	Salmonella sp., other	SALOTH	
	Shigella sp.	SHISPP	
	Yersinia sp.	YERSPP	
	Other enterobacteriaceae	ETBOTH	
	Enterobacteriaceae, not specified	ETBNSP	
Gram - bacilli	*Acinetobacter baumannii*	ACIBAU	**ACISPP**
	Acinetobacter calcoaceticus	ACICAL	
	Acinetobacter haemolyticus	ACIHAE	
	Acinetobacter lwoffii	ACILWO	
	Acinetobacter sp., other	ACIOTH	
	Acinetobacter sp., not specified	ACINSP	
	Pseudomonas aeruginosa	PSEAER	**PSEAER**
	Stenotrophomonas maltophilia	STEMAL	**STEMAL**
	Burkholderia cepacia	BURC EP	**PSETOT**
	Pseudomonadaceae family, other	PSEOTH	
	Pseudomonadaceae family, not specified	PSENSP	
	Haemophilus influenzae	HAEINF	**HAESPP**
	Haemophilus parainfluenzae	HAEPAI	
	Haemophilus sp., other	HAEOTH	
	Haemophilus sp., not specified	HAENSP	
	Legionella sp.	LEGSPP	**LEGSPP**
	Achromobacter sp.	ACHSPP	**GNBTOT**
	Aeromonas sp.	AEMSPP	
	Agrobacterium sp.	AGRSPP	
	Alcaligenes sp.	ALCSPP	
	Campylobacter sp.	CAMSPP	
	Flavobacterium sp.	FLASPP	
	Gardnerella sp.	GARSPP	
	Helicobacter pylori	HELPYL	
	Pasteurella sp.	PASSPP	
	Gram-neg Bacilli, not specified	GNBNSP	
	Other Gram-neg Bacilli, non enterobacteriaceae	GNBOTH	
Anaerobic bacilli	*Bacteroïdes fragilis*	BATFRA	**BATSPP**

	Bacteroïdes other	BATOTH	
	Clostridium difficile	CLODIF	**ANATOT**
	Clostridium other	CLOOTH	
	Propionibacterium sp.	PROSPP	
	Prevotella sp.	PRESPP	
	Anaerobes, not specified	ANANSP	
	Other anaerobes	ANAOTH	
Other bacteria	Mycobacterium, atypical	MYCATY	**BCTTOT**
	Mycobacterium tuberculosis complex	MYCTUB	
	Chlamydia sp.	CHLSPP	
	Mycoplasma sp.	MYPSPP	
	Actinomyces sp.	ACTSPP	
	Nocardia sp.	NOCSPP	
	Other bacteria	BCTOTH	
Fungi	*Candida albicans*	CANALB	**CANSPP**
	Candida glabrata	CANGLA	
	Candida tropicalis	CANTRO	
	Candida parapsilosis	CANPAR	
	Candida sp., other	CANOTH	
	Candida sp., not specified	CANNSP	
	Aspergillus fumigatus	ASPFUM	**ASPSPP**
	Aspergillus niger	ASPNIG	
	Aspergillus sp., other	ASPOTH	
	Aspergillus sp., not specified	ASPNSP	
	Other yeasts	YEAOTH	**PARTOT**
	Fungi other	FUNOTH	
	Filaments other	FILOTH	
	Other parasites	PAROTH	
Virus	Adenovirus	VIRADV	**VIRTOT**
	Cytomegalovirus (CMV)	VIRCMV	
	Enterovirus (polio, coxsackie, echo)	VIRENT	
	Hepatitis A virus	VIRHAV	
	Hepatitis B virus	VIRHBV	
	Hepatitis C virus	VIRHCV	
	Herpes simplex virus	VIRHSV	
	Human immunodeficiency virus (HIV)	VIRHIV	
	Influenza A virus	VIRINA	
	Influenza B virus	VIRINB	
	Influenza C virus	VIRINC	
	Parainfluenza virus	VIRPIV	
	Respiratory syncytial virus (RSV)	VIRRSV	
	Rhinovirus	VIRRHI	
	Rotavirus	VIRROT	
	SARS virus	VIRSAR	
	Varicella-zoster virus	VIRVZV	
	Virus, not specified	VIRNSP	
	Other virus	VIROTH	
Micro-organism not identified or not found		_NONID	**_NONID**
Examination not done		_NOEXA	**_NOEXA**
Sterile examination		_STERI	**_STERI**

_NONID: evidence exists that a microbiological examination has been done, but the micro-organism can not be correctly classified or the result of the examination can not be found; _NOEXA: no diagnostic sample taken, no microbiological examination done; _STERI: a microbiological examination has been done, but the result was negative (e.g. negative culture)

Antimicrobial resistance

1. Tracer antimicrobial resistance fenotypes

	0	1	2	3	-1
S. aureus*	oxa-S	oxa-R		GISA	unk
Enterococcus faecalis and ***faecium***	ampi-S	ampi-R	vanco-R	-	unk
Enterobacteriaceae	ampi-S	ampi-R & C3-S	C3-R	-	unk
Acinetobacter baumannii	-	CAZ-S	CAZ-R	-	unk
Pseudomonas aeruginosa	ticar-S	ticar-R & CAZ-S	CAZ-R	-	unk

*minimal data=*S.aureus*, MSSA or MRSA
code STAAUR/0 for MSSA, STAAUR/1 for MRSA, STAAUR/-1 if unknown

R = intermediate or resistant
Note : an I strain is coded as resistant (I = R)
S = sensitive
oxa = oxacillin
GISA = intermediate or resistant to glycopeptides (MIC vancomycin or teicoplanin)
vanco = vancomycin
ampi = penicillin A or amoxicillin
C3 = cefotaxim or ceftazidim
ESBL = Extended spectrum beta-lactamase producer
ticar = ticarcillin or piperacillin
CAZ = ceftazidim
unk = unknown

2. Optional antibiogram

Instead of using a predefined list of antimicrobial resistance “tracer” phenotypes, networks may prefer to use complete or partial antibiogram data. The complete list is given in Appendix (data collection forms) and in section 6.3.5. (table icu_res).

11.3 Appendix 3: List of antimicrobials (from ABC Calc 1.91)

ATC_cl	ATC_cl_label	Included antibacterials (+ ATC code)
J01A	Tetracyclines	Demeclocycline (J01AA01), Doxycyline (J01AA02), Chlortetracycline (J01AA03), Lymecycline (J01AA04), Metacycline (J01AA05), Oxytetracycline (J01AA06), Tetracycline (J01AA07), Minocycline (J01AA08), Rolitetracycline (J01AA09), Penimepicycline (J01AA10), Clomocycline (J01AA11), Tet.+chlor.+demecl. (J01AA20), Other comb. of tetracyclines (J01AA20), Oxytetracycline combinations (J01AA56)
J01B	Amphenicols	Chloramphenicol (J01BA01), Thiamphenicol (J01BA02)
J01CA_1	Penicillins, extended spectrum without anti-pseudomonal activity	Ampicillin (J01CA01), Pivampicillin (J01CA02), Amoxicillin (J01CA04), Bacampicillin (J01CA06), Epicillin (J01CA07), Pivmecillinam (J01CA08), Mecillinam (J01CA11), Metampicillin (J01CA14), Talampicillin (J01CA15), Temocillin (J01CA17), Hetacillin (J01CA18), Pivampi. + pivmecillinam (J01CA20), Other combinations (J01CA20), Ampicillin combinations (J01CA51)
J01CA_2	Penicillins, extended spectrum with anti-pseudomonal activity	Carbenicillin (J01CA03), Carindacillin (J01CA05), Azlocillin (J01CA09), Mezlocillin (J01CA10), Piperacillin (J01CA12), Ticarcillin (J01CA13), Sulbenicillin (J01CA16), Combinations (J01CA20)
J01CE	Beta-lactamase sensitive penicillins	Benzylpenicillin (J01CE01), Phenoxymethylpenicillin (J01CE02), Propicillin (J01CE03), Azidocillin (J01CE04), Pheneticillin (J01CE05), Penamecillin (J01CE06), Clometocillin (J01CE07), Benzathine benzylpenicillin (J01CE08), Procaine penicillin (J01CE09), Benzathine phenoxymethylpenicillin (J01CE10), Procaine pen.+benzylpen.(1800:360) (J01CE30), Combinations (other) (J01CE30)
J01CF	Beta-lactamase resistant penicillins	Dicloxacillin (J01CF01), Cloxacillin (J01CF02), Methicillin (J01CF03), Oxacillin (J01CF04), Flucloxacillin (J01CF05)
J01CG	Beta-lactamase inhibitors	Sulbactam (J01CG01), Tazobactam (J01CG02)
J01CR_1	Comb. of penicillins, incl. beta-lactamase inhib., without anti-pseud. activity	Ampicillin and enzyme inhibitor (J01CR01), Amoxicillin and enzyme inhibitor (J01CR02), Sultamicillin (J01CR04)
J01CR_2	Comb. of penicillins, incl. beta-lactamase inhib., with anti-pseud. activity	Ticarcillin and enzyme inhibitor (J01CR03), Piperacillin and enzyme inhibitor (J01CR05)
J01CR_3	Other combinations of penicillins	Ampicillin + cloxacillin (J01CR50), Ampicillin + flucloxacillin (J01CR50), Other combinations of penicillins (J01CR50)
J01DA_1	First generation cephalosporins	Cefalexin (J01DA01), Cefaloridine (J01DA02), Cefalotin (J01DA03), Cefazolin (J01DA04), Cefadroxil (J01DA09), Cefazedone (J01DA15), Cefatrizine (J01DA21), Cefapirin (J01DA30), Cefradine (J01DA31), Cefacetrile (J01DA34), Cefroxadine (J01DA35), Ceftezole (J01DA36)
J01DA_2	Second generation cephalosporins	Cefoxitin (J01DA05), Cefuroxime (Oral) (J01DA06), Cefuroxime (Parenteral) (J01DA06), Cefamandole (J01DA07), Cefaclor (J01DA08), Cefotetan (J01DA14), Cefonicide (J01DA17), Cefotiam (J01DA19), Loracarbef (J01DA38), Cefmetazole (J01DA40), Cefprozil (J01DA41)

APPENDIX: List of antimicrobials (continued)

ATC_cl	ATC_cl_label	Included antibacterials (+ ATC code)
J01DA_3	Third generation cephalosporins	Cefotaxime (J01DA10), Ceftazidime (J01DA11), Cefsulodin (J01DA12), Ceftriaxone (J01DA13), Cefmenoxime (J01DA16), Latamoxef (J01DA18), Ceftizoxime (J01DA22), Cefixime (J01DA23), Cefodizime (J01DA25), Cefetamet (J01DA26), Cefpiramide (J01DA27), Cefoperazone (J01DA32), Cefpodoxime (J01DA33), Ceftibuten (J01DA39), Cefdinir (J01DA42), Ceftriaxone, combinations (J01DA63)
J01DA_4	Fourth generation cephalosporins	Cefepime (J01DA24), Cefpirome (J01DA37)
J01DF	Monobactams	Aztreonam (J01DF01)
J01DH	Carbapenems	Meropenem (J01DH02), Imipenem and enzyme inhibitor (J01DH51)
J01EA	Sulfonamides: Trimethoprim and derivatives	Trimethoprim (J01EA01), Brodimoprim (J01EA02),
J01EB	Short-acting sulfonamides	Sulfaisodimidine (J01EB01), Sulfamethizole (J01EB02), Sulfadimidine (J01EB03), Sulfapyridine (J01EB04), Sulfafurazole (J01EB05), Sulfanilamide (J01EB06), Sulfathiazole (J01EB07), Sulfathiourea (J01EB08), Combinations (J01EB20)
J01EC	Intermediate acting sulfonamides	Sulfamethoxazole (J01EC01), Sulfadiazine (J01EC02), Sulfamoxole (J01EC03), Combinations (J01EC20),
J01ED	Long-acting sulfonamides	Sulfadimethoxine (J01ED01), Sulfalene (J01ED02), Sulfametomidine (J01ED03), Sulfametoxydiazine (J01ED04), Sulfamethoxypyridazine (J01ED05), Sulfaperin (J01ED06), Sulfamerazine (J01ED07), Sulfaphenazole (J01ED08), Sulfamazon (J01ED09), Combinations (J01ED20)
J01EE	Combinations of sulfonamides and trimethoprin, incl. deriv.	Sulfamethox. + trimeth. (40:8, 80:16) (J01EE01), Sulfamethox. + trimeth. (oth. comb.) (J01EE01), Sulfadiazine and trimethoprim (J01EE02), Sulfametrole and trimethoprim (J01EE03), Sulfamoxole and trimethoprim (J01EE04), Sulfadimidine and trimethoprim (J01EE05)
J01FA	Macrolides	Erythromycin (J01FA01), Erythromycin ethylsuccinate tabl. (J01FA01), Spiramycin (J01FA02), Midecamycin (J01FA03), Oleandomycin (J01FA05), Roxithromycin (J01FA06), Josamycin (J01FA07), Troleandomycin (J01FA08), Clarithromycin (J01FA09), Azithromycin (J01FA10), Miocamycin (J01FA11), Rokitamycin (J01FA12), Dirithromycin (J01FA13), Flurithromycin (J01FA14), Telithromycin (J01FA15)
J01FF	Lincosamides	Clindamycin (Oral) (J01FF01), Clindamycin (Parenteral) (J01FF01), Lincomycin (J01FF02),
J01FG	Streptogramins	Pristinamycin (J01FG01), Quinupristin/dalfopristin (J01FG02)
J01GA	Aminoglycoside antib, streptomycins	Streptomycin (J01GA01), Streptoduocin (J01GA02)
J01GB	Other aminoglycosides	Tobramycin (Parenteral) (J01GB01), Tobramycin (Inhal. sol.) (J01GB01), Gentamicin (J01GB03), Kanamycin (J01GB04), Neomycin (J01GB05), Amikacin (J01GB06), Netilmicin (J01GB07), Sisomicin (J01GB08), Dibekacin (J01GB09), Ribostamycin (J01GB10), Isepamicin (J01GB11)

APPENDIX: List of antimicrobials (continued)

ATC_cl	ATC_cl_label	Included antibacterials (+ ATC code)
J01MA	Fluoroquinolones	Ofloxacin (J01MA01), Ciprofloxacin (Oral) (J01MA02), Ciprofloxacin (Parenteral) (J01MA02), Pefloxacin (J01MA03), Enoxacin (J01MA04), Temafloxacin (J01MA05), Norfloxacin (J01MA06), Lomefloxacin (J01MA07), Fleroxacin (J01MA08), Sparfloxacin (J01MA09), Rufloxacin (J01MA10), Grepafloxacin (J01MA11), Levofloxacin (J01MA12), Trovafloxacin (J01MA13), Moxifloxacin (J01MA14), Gemifloxacin (J01MA15), Gatifloxacin (J01MA16)
J01MB	Other quinolones	Rosoxacin (J01MB01), Nalidixic acid (J01MB02), Piromidic acid (J01MB03), Pipemidic acid (J01MB04), Oxolinic acid (J01MB05), Cinoxacin (J01MB06), Flumequine (J01MB07)
J01R	Combinations of antibacterials	Penicillins, comb. With other antibacterials (J01RA01), Sulfonamides, comb. (excl. trimethoprim)(J01RA02), Cefuroxime, comb. with other antibacterials (J01RA03)
J01XA	Glycopeptides	Vancomycin (Parenteral) (J01XA01), Teicoplanin (J01XA02)
J01XB	Polymixins	Colistin (Parenteral) (J01XB01), Polymyxin B (Parenteral) (J01XB02)
J01XC	Steroid antibacterials	Fusidic acid (J01XC01)
J01XD	Imidazole derivates	Metronidazole (Parenteral) (J01XD01), Tinidazole (Parenteral) (J01XD02), Ornidazole (Parenteral) (J01XD03)
J01XE	Nitrofuran derivates	Nitrofurantoin (J01XE01), Nifurtoinol (J01XE02),
J01XX	Other antibacterials	Fosfomycin (Parenteral) (J01XX01), Fosfomycin (Oral) (J01XX01), Xibornol (J01XX02), Clofoctol (J01XX03), Spectinomycin (J01XX04), Methenamine, hippurate, (J01XX05), Methenamine, mandelate (J01XX05), Mandelic acid (J01XX06), Nitroxoline (J01XX07), Linezolid (J01XX08)
J02A	Antimycotics for systemic use	Amphotericin B (J02AA01), Hachimycin (J02AA02), Miconazole (J02AB01), Ketoconazole (J02AB02), Fluconazole (J02AC01), Itraconazole (J02AC02), Voriconazole (J02AC03) Flucytosine (J02AX01) , Caspofungin (J02AX04), Micafungin (J02AX05), Nystatin (J02AX10)

11.4 Appendix 4: Calculation of denominator data in unit-based surveillance.

Example based on a list (database) including at least the admission date to the ICU and discharge date from the ICU for each patient.

Include ICU patients from list/database in analysis if:
1) admis_dt>=start_dt AND admis_dt<=end_dt (patients admitted within surveillance period)
OR
2) disch_dt>=start_dt AND disch_dt<=end_dt (patients discharged within surveillance period)
OR
3) admis_dt<start_dt AND disch_dt>end_dt (patients present during the entire surveillance period)

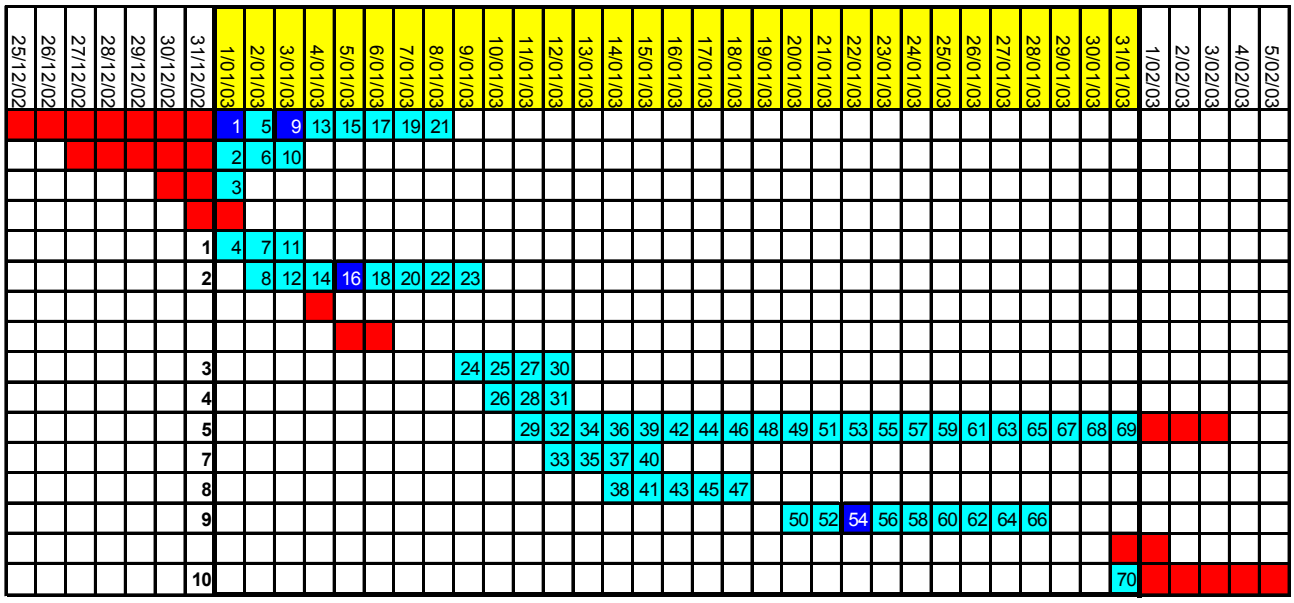
* step 1: compute length of stay (LOS) per patient
los= disch_dt – admis_dt + 1

* step 2: compute days outside surveillance period
days_out1 = start_dt – admis_dt (positive if ICU-days fall before start surveillance period)
days_out2 = disch_dt – end_dt (positive if ICU-days fall after end surveillance period)
recode days_out1 min/0 → 0 (all negative values recoded to 0)
recode days_out2 min/0 → 0 (all negative values recoded to 0)

*step 3: compute days in ICU within surveillance period (los_in)
los_in= los - days_out1 - days_out2

*step 4: compute denominators
a. N of new admissions in surveillance period, all=
count (sum) of patients IF admis_dt>=start_dt AND admis_dt<=end_dt
b. N of new admissions in surveillance period and staying more than 2 days
count (sum) of patients IF admis_dt>=start_dt AND admis_dt<=end_dt AND los>2
c. N of patient-days in surveillance period, all= sum(los_in)
d. N of patient-days in surveillance period, patients staying >2D = sum(los_in IF los>2)

Figure: Patient-days to be counted in unit-based surveillance (level 1) for patients staying more than 2 calendar days in the ICU, example (blue=days included in denominator; red=days not included in denominator; dark blue=included infections). E.g., first patient: patient is admitted to the ICU on 25 December 2002, and is discharged on 8 January 2003. For the surveillance period January 2003, only 8 days are counted. Two infections occurring after day 2 in the ICU are both registered in the numerator data. E.g., fourth patient: this patient is not counted because the length of stay is less than 3 days. E.g., totals: the total number of patient-days for patients staying more than 2 days in this example is 70, the total number new admissions staying more than 2 days is 10. The totals for all patients (optional) are 75 and 13 respectively.



11.5 Appendix 5. Risk scores definitions

SAPS II score[3]

The Simplified Acute Physiology Score II (SAPS II) is one of the most used in ICU to evaluate the probability of hospital or ICU mortality and a starting point for evaluation of the efficiency of a intensive care unit. It includes 17 variables, 12 physiology variables and three underlying disease variables.

Variable	DEFINITION	COMMENTS
SAPS II	The SAPS II components should be measured 24 hours after admission to the ICU. The worst values within those 24 hours are to be recorded; each category of values has a weighted value in points.	The total score must be computed adding the weighted values.
Age	Use the patient's age (in years) at his last birthday.	
Heart rate	Use the worst value in 24 hours, either low or high heart rate; if it varied from cardiac arrest (11points) to extreme tachycardia (7points), assign 11 points	
Systolic blood pressure	Use the same method as for heart rate: eg, if it varied from 60 mm Hg to 205 mm Hg, assign 13 points.	
Body temperature	Use the highest temperature in degrees Centigrade or Fahrenheit	
PaO_2/FiO_2 ratio	If ventilated or continuous pulmonary artery pressure, use the lowest value of the ratio.	Only if the patient has been mechanically ventilated.
Urinary output	Total urinary output in 24 hours	Patients staying less than 48 hours are not included in the HELICS surveillance
Serum urea or serum urea nitrogen level	Use the highest value in mmol/L for serum urea, in mg/dL for serum urea nitrogen.	
WBC count	Use the worst (high or low) WBC count according to the scoring sheet	
Serum potassium level	Use the worst (high or low) in mmol/L, according to the scoring sheet	
Serum sodium level	Use the worst (high or low) in	

[3] Le Gall JR, Lemeshow S, Saulnier F. A new simplified acute physiology score (SAPS II) based on a European / North American Multicenter Study. JAMA 1993; **270**:2957-2963.

	mmol/L, according to the scoring sheet	
Serum bicarbonate level	Use the lowest value in mEq/L.	
Bilirubin level	Use the highest value in µmol/L or mg/dL.	
Glasgow Coma score*	Use the lowest value; if the patient is sedated, record the estimated Glasgow Coma Score before sedation (see definition below).	This variable must be repeated on the HELICS form.
Type of admission	a) Unscheduled surgical, b) Scheduled surgical c) Medical	Patients added to the operating room schedule within 24 hours of the operation. Patient whose surgery was scheduled at least 24 hours in advance. Patients having no surgery within 1 week of admission to ICU. This variable must be repeated on the HELICS form.
AIDS	Select YES if HIV-positive with clinical complications such as *Pneumocystis carinnii* pneumonia, Kaposi's sarcoma, lymphoma, tuberculosis, or toxoplasma infection.	
Hematologic malignancy	Select YES, if lymphoma, acute leukaemia or multiple myeloma.	
Metastatic cancer	Select YES, if proven metastasis by surgery, computed tomographic scan, or any other method	This variable must be repeated on the HELICS form.

SAPS II weights

Age (in years)	○ <40[0]	○ 40-59[7]	○ 60-69[12]	○ 70-74[15]	○75-79[16]	○≥80[18]
Heart rate (beats/min)	○ <40[11]	○ 40-69[2]	○ 70-119[0]	○ 120-159[4]	○ ≥ 160[7]	
Systolic BP (mm Hg)	○ <70[13]	○ 70-99[5]	○ 100-199[0]	○ ≥200[2]		
Body temperature (°C)	○ <39[0]	○ ≥ 39[3]				
Only if ventilated or positive airway pressure (BPAP/CPAP)						
PaO2(mmHg)/FiO2 ratio PaO2(Kpa)/FiO2 ratio	○ <100[11] (<13.3)	○ 100-199[9] (13.2-26.4)	○ ≥200[6] (≥ 26.5)	e.g. 70 mmHg / 0.5 = 140 10 Kpa/ 0.5 = 20		
Urinary output (ml/day)	○ <500[12]	○ 500-999[4]	○ ≥1000[0]			
Serum urea (mg/dl) (mmol/L)	○ <60[0] (<10.0)	○ <60-179[6] (10.0-29.9)	○ ≥ 180[10] (≥ 30.0)			
WBC count ($10^3/mm^3$)	○ <1.0[12]	○ 1.0-19.9[0]	○ ≥ 20.0[3]			
Serum potassium (mEq/L)	○ <3.0[3]	○ 3.0-4.9[0]	○ ≥5.0[3]			
Serum sodium (mEq/L)	○ <125[5]	○ 125-144[0]	○ ≥145[1]			
Bicarbonate (mEq/L)	○ <15[6]	○ 15-20[3]	○ ≥20[0]			
Bilirubin (mg/dl) (µmol/L)	○ <4.0[0] (<68.4)	○ <4.0-5.9[4] (68.4-102.5)	○ ≥ 6.0[9] (≥ 102.6)			
Glasgow coma score (if patient is sedated, estimate status before sedation)	○ <6[26]	○ 6-8[13]	○ 9-10[7]	○ 11-13[5]	○ 14-15[0]	
Chronic diseases	○ metastatic cancer[9]		○ hematol.malignancy[10]		○ AIDS[17]	
Type of admission	○ medical[6]		○ scheduled surgical[0]		○ unscheduled surgical[8]	

APACHE 2 score

William A. Knaus, MD ; Elizabeth A. Draper, MS; Douglas P. Wagner, PhD; Jack E. Zimmerman, MD. APACHE II: A severity of disease classification system. Crit. Care Med. 1985; 818-829

THE APACHE II SEVERITY OF DISEASE CLASSIFICATION SYSTEM

PHYSIOLOGIC VARIABLE	HIGH ABNORMAL RANGE					LOW ABNORMAL RANGE			
	+ 4	+ 3	+ 2	+ 1	0	+ 1	+ 2	+ 3	+ 4
TEMPERATURE – rectal (C°)	O ≥ 41°	O 39° – 40.9°		O 38.5° – 38.9°	O 36° 38.4°	O 34° - 35.9°	O 323° - 33.9°	O 30° - 31.9°	O ≤ 29.9°
MEAN ARTERIAL PRESSURE – mm Hg	O ≥ 160	O 130 – 159	O 110 – 129		O 70 – 109		O 50 – 69		O ≤ 49
HEART RATE (ventricular response)	O ≥ 180	O 140 – 179	O 110 – 139		O 70 – 109		O 55 – 69	O 40 – 54	O ≤ 39
RESPIRATORY RATE – (non ventilated or ventilated)	O ≥ 50	O 35 – 49		O 25 – 34	O 12 – 24	O 10 – 11	O 6 – 9		O ≤ 5
OXYGENATION: A aDO_2 or PaO_2 (mm Hg) a. FIO_2 ≥ 0.5 record a A aDO_2	O ≥ 500	O 350 – 499	O 200 – 349		O <200				
b. FIO_2 < 0.5 record only PaO_2					O PO_2 > 70	O PO_2 61 – 70		O PO_2 55 – 60	O PO_2 <55
ARTERIAL pH	O ≥ 7.7	O 7.6 – 7.69		O 7.5 – 7.59	O 7.33 – 7.49		O 7.25 – 7.32	O 7.15 – 7.24	O < 7.15
SERUM SODIUM (mMol/L)	O ≥ 180	O 160 – 179	O 155 – 159	O 150 – 154	O 130 – 149		O 120 – 129	O 111 – 119	O ≤ 110
SERUM POTASIUM (mMol/L)	O ≥ 7	O 6 – 6.9		O 5.9 – 5.9	O 3.5 – 5.4	O 3 – 3.4	O 2.5 – 2.9		O < 2.5
SERUM CREATININE (mg/100ml) (Double point score for acute renal failure)	O ≥ 3.5	O 2 – 3.4	O 1.5 – 1.9		O 0.6 – 1.4		O < 0.6		
HEMATOCRIT (%)	O ≥ 60		O 50 – 59.9	O 46 – 49.9	O 30 – 45.9		O 20 – 29.9		O < 20
WHITE BLOOD COUNT (total/mm3) (in 1.000s)	O ≥ 40		O 20 – 39.9	O 15 – 19.9	O 3 – 14.9		O 1 – 2.9		O < 1
GLASGOW COMA SCORE (GCS) Score = 15 minus actual GCS									
A Total ACUTE PSYSIOLOGIC SCORE (APS) Sum of the 12 individual variable points									
Serum HCO2 (venous mMol/L) (Not preferred, use if no ABGs)	O ≥ 52	O 41 – 51.9		O 32 – 40.9	O 22 – 31.9		O 18 – 21.9	O 15 – 17.9	O < 15

B AGE POINTS:
Assign points to age as follows

AGE (yrs)	Points
≤ 44	0
45 – 54	2
55 – 64	3
65 – 74	5
≥ 75	6

C CHRONIC HEALTH POINTS
If the patient has a history of severe organ system insufficiency or is immuno-compromised assign points as follows

a. for nonoperative or emergency postoperative patients – 5 points

or

b. for elective postoperative patients – 2 points

DEFINITIONS
Organ Insufficiency or immuno-compromised state must have been evident **prior** to this hospital admission and conform to the following criteria
LIVER: Biopsy proven cirrhosis and documented portal hypertension , episodes of past upper GI bleeding attributed to portal hypertension or prior episodes of hepatic failure/encephalopathy/coma

CARDIOVASCULAR: New York Heart Association Class IV
RESPIRATORY: Chronic restrictive, obstructive or vascular disease resulting in severe exercise restriction, i e, unable to climb stairs or perform household duties; or documented chronic hypoxia, hypercapnia, secondary polycythemia, severe pulmonary hypertension (>40mmHg); or respirator dependency.
RENAL: Receiving chronic dialysis
IMMUNO-COMPROMISED: The patient has received therapy that suppresses resistance to infection, e g immuno-suppression, chemotherapy, radiation, long term or recent high dose steroids or has a disease that is sufficiently advanced to suppress resistance to infection e g, leukemia, lymphoma, AIDS

1.1 APACHE II SCORE

A + B + C

A APS points

B Age points

C Chronic Health points

Total ---- APACHE II

Glasgow coma score[4]**: Score Glasgow = Y + V + M**

Best Eye Response (**Y**)	Best Verbal Response (**V**)	Best Motor Response (**M**)
1. No eye opening. 2. Eye opening to pain. 3. Eye opening to verbal command. 4. Eyes open spontaneously.	1. No verbal response 2. Incomprehensible sounds. 3. Inappropriate words. 4. Confused 5. Orientated	1. No motor response. 2. Extension to pain. 3. Flexion to pain. 4. Withdrawal from pain. 5. Localising pain. 6. Obeys Commands

Note that the phrase 'GCS of 11' is essentially meaningless, and it is important to break the figure down into its components, such as E3V3M5 = GCS 11. A Coma Score of 13 or higher correlates with a mild brain injury, 9 to 12 is a moderate injury and 8 or less a severe brain injury.

Glasgow Paediatric Coma Score[5]

The Paediatric GCS is scored between 3 and 15, 3 being the worst, and 15 the best. It is composed of three parameters: Best Eye Response, Best Verbal Response, and Best Motor Response, as given below:

Best Eye Response. (4)

1. No eye opening.
2. Eye opening to pain.
3. Eye opening to verbal command.
4. Eyes open spontaneously.

Best Verbal Response. (5)

1. No vocal response
2. Inconsolable, agitated
3. Inconsistently consolable, moaning.
4. Cries but is consolable, inappropriate interactions.
5. Smiles, oriented to sounds, follows objects, interacts.

Best Motor Response. (6)

1. No motor response.
2. Extension to pain.
3. Flexion to pain.
4. Withdrawal from pain.
5. Localising pain.
6. Obeys Commands.

Note that the phrase 'GCS of 11' is essentially meaningless, and it is important to break the figure down into its components, such as E3V3M5 = GCS 11. A Coma Score of 13 or higher correlates with a mild brain injury, 9 to 12 is a moderate injury and 8 or less a severe brain injury.

[4] Teasdale G., Jennett B., Assessment of coma and impaired consciousness. A practical scale. Lancet. 1974 Jul 13;2(7872):81-4.

[5] http://www.trauma.org/scores/gpcs.html

11.6 Appendix 6. Comprehensive list of indicators

	Indicator	Definition	Level 1	Level 2
Bloodstream infection				
	Incidence density of nosocomial bloodstream infection in the ICU	# BSI (of all origin) >D2*1000/n of patient-days	R	R
	Pathogen-specific bloodstream infection incidence rate	# BSI (of all origin, by pathogen) >D2*1000/n of patient-days	R	R
	Standardised bloodstream infection ratio	Observed n of patients with BSI/ Expected n of patients with bloodstream infection	-	Option a
	Stratification of device-adjusted infection rates	Infection rates by ICU-type Infection rates by risk factors	R -	R R
Pneumonia				
	Incidence density of nosocomial pneumonia (clinical + microb. confirmed) in the ICU	# pneumonia (of all origin) >D2*1000/n of patient-days	R	R
	% microbiol. confirmed pneumonia	# PN with microbiol. documentation by semi-quantitative (BAL,PB…) or quantitative culture of endotracheal aspirate/ total PN	R	R
	Pathogen-specific pneumonia incidence rate	# pneumonia (of all origin, by pathogen) >D2*1000/n of patient-days	R	R
	Intubator-associated pneumonia rate in the ICU	# device-associated pneumonia*1000/n of intubation days	-	R
	Standardised pneumonia ratio	Observed n of patients with pneumonia/ Expected n of patients with pneumonia	-	Option a
	Stratification of infection rates	Infection rates by ICU-type Infection rates by risk factors	R -	R R
Urinary tract infections				
	Incidence density of nosocomial UTI in the ICU	# UTI >D2*1000/n of patient-days	O	O
	Pathogen-specific UTI incidence rate	# UTI (of all origin, by pathogen) >D2*1000/n of patient-days	O	O
	Catheter-associated UTI rate in the ICU	# device-associated UTI*1000/n of urinary catheter days	-	O
	Stratification of infection rates	Infection rates by risk factors	O	O
Catheter Infections				
	Incidence density of catheter infections in the ICU	# catheter-associated infections*1000/n of central line days (catheter-total)	-	Option b
	Idem, by insertion site	# catheter-associated infections by insertion site*1000/n of central line days (catheter-total by site)	-	Option b
	Standardised Catheter Infection ratio	Observed n of patients with catheter infection/ Expected n of patients with catheter infection	-	Option b
Antimicrobial use in the ICU				
	Antimicrobial treatment utilization rate	N of antibiotic treatment days/N of patient-days	-	Option c
	Ratio documented treatment/empiric treatment	N of Documented AB treatment days/ N of Empiric AB treatment days	-	Option c
	Stratified AM use	N of antibiotic treatment days/N of patient-days by risk factors	-	Option c
	Indicator	Definition	Level 1	Level 2
Device use in the ICU				
	Central line utilization rate	N of central line days/N of patient-days	-	R
	Intubation utilization rate	N of days with intubation/N of pt-d	-	R
	Non-invasive ventilation utilization rate	N of non-invasive ventilation days/N of patient-days	-	Option a
	Urinary catheter utilization rate	N of urinary catheter days/N of pat-days	O	O

11.7 Appendix 7: Example of graphical output of level 1 surveillance at various levels

Legend: upper-left: comparison of individual infection rates with other ICUs participating to the network; Upper right: follow-up of indicators in time compared to national percentiles (10,50,90); Lower left: mapping of pathogen-specific incidence at the national level; Lower right: international mapping of indicators

Figure: MRSA -BSI incidence in the ICU

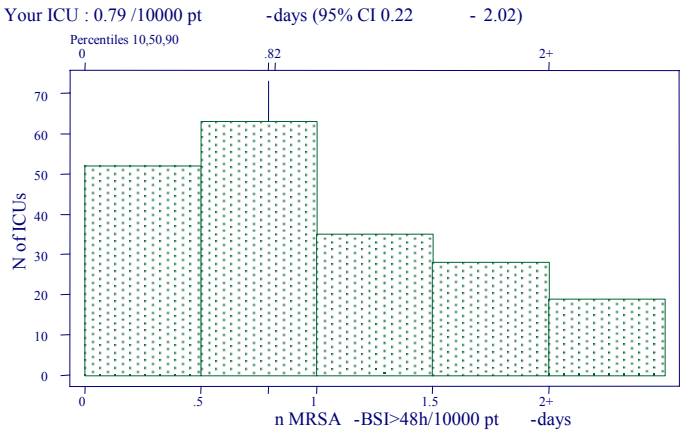
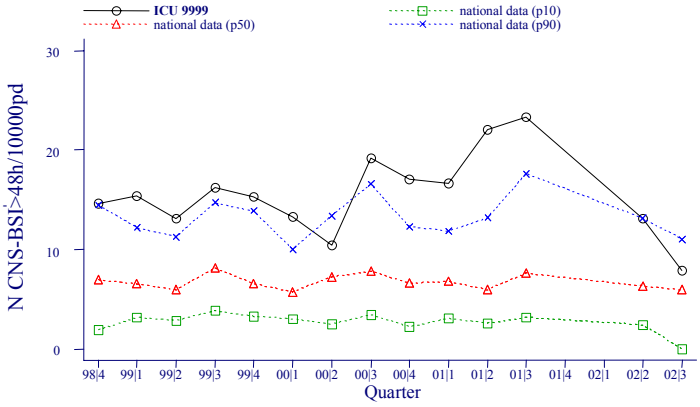
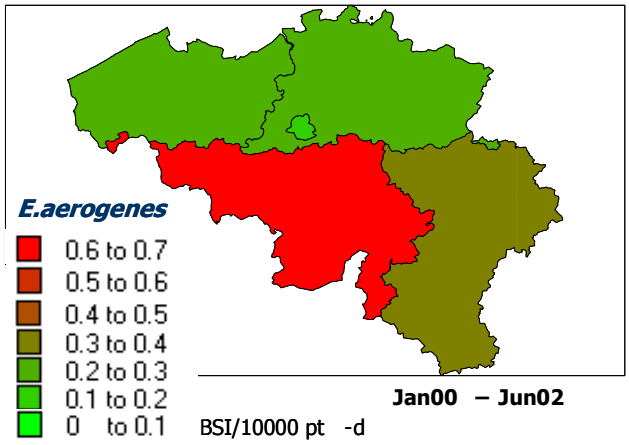
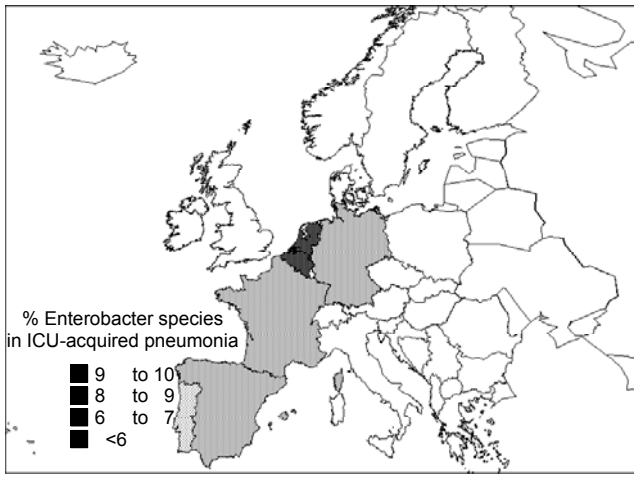


Figure. CNS -BSI incidence/10000 pt.days by quarter







11.8 Appendix 8: Data collection forms (models)

L1: DENOMINATOR DATA

Hospital _____ Unit _____ Period from: _____ to: _____

	Patients staying > 2 days (>=3 d)	All patients (o)
Number of admissions to ICU		
Number of patient-days		

L1: INFECTION DATA

Patient ID	Admission date ICU	Infection date	Site	MO1/R	MO2/R	MO3/R°	IDU 48h	BSI ORI°	AMT°	VAL°

Patient ID: unique patient code; Adm.dt. ICU: admission date in unit; Infection date: date onset infection (date of sampling if appropriate); Infection Site: BSI-A/B bloodstream infection; PN1-PN5: ICU-acquired pneumonia; UTI-A/B/C urinary tract infection; CRI1-CRI3: CVC infection; (CCO:catheter colonization); OTH: other infection site; MO1-MO3/R: 6 character micro-organism code/resistance profile code (e.g. STAAUR/0=MSSA, STAAUR/1=MRSA, STAAUR/-1=*S.aureus*, resistance unknown); IDU 48: invasive device exposure in 48 hours before infection, required if site=pneumonia (intubation), optional for other infection sites; BSI ORI: Origin of bloodstream infection(o):C:catheter-associated;S:secondary (pulmonary (S-PUL), urinary (S-UTI), digestive (S-DIG), surgical site infection (S-SSI), skin and soft tissue (S-SST), other (S-OTH);U:unknown; AMT: antimicrobial treatment (Y if AMT was started); VAL: for validation (e.g. in case of electronic surveillance) if infection is nosocomial and matches case definition, Y/N;°=optional

NOSOCOMIAL INFECTION SURVEILLANCE IN INTENSIVE CARE UNITS

Level 2: basic data set for patient-based surveillance

Country: ____ **Hospital code:** _____ **Unit:** _____ **Patient ID:** _____

Date ICU admission: ____-____-_____ **Date ICU discharge:** ____-____-_____

Discharge status O alive O death in ICU

Gender: O M O F O U **Age (yrs) :** _____

Origin of the patient: O ward in this/other hospital O ICU O community O long-term care

Admission date in hospital: ____/____/_____ *(dd/mm/yyyy)*

SAPS II score ☐ and/or **APACHE II score** ☐

Type of admission: O medical O scheduled surgical O unscheduled surgical

Trauma O Yes O No **Impaired immunity** O yes O no

Antimicrobial treatment *+/- 48 Hrs around admission* O Yes O No

day[a] **date**	Adm /	2 /	3 /	4 /	5 /	6 /	7 /	8 /	9 /	10 /	11 /	12 /	13 /	14 /
Central venous catheter(s)	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Intubation	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Urinary catheter (o)	O	O	O	O	O	O	O	O	O	O	O	O	O	O

[a] Registration can cover more than 14 days

Option a: Risk score for ICU-acquired pneumonia and bloodstream infections (additional variables)

Acute coronary care O Yes O No

Surgery site (within last 30 days before admission, incl. day of admission) : O no surgery
O coronary surgery O other cardiac O other thoracic O other major vascular O abdominal O neurosurgery O other sites

Glasgow Coma Scale°: $CGS_{estimated}$ _____ ; **$CGS_{measured}$** _____

day **date**	Adm /	2 /	3 /	4 /	5 /	6 /	7 /	8 /	9 /	10 /	11 /	12 /	13 /	14 /
Mechanical ventilation non-invasive°	O	O	O	O	O	O	O	O	O	O	O	O	O	O
invasive	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Re-intubation°	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Naso/oro-intestinal tube present	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Feeding through naso/oro-intestinal tube	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Parenteral nutrition	O	O	O	O	O	O	O	O	O	O	O	O	O	O

Option b: Option central venous catheter surveillance

For each central venous catheter

CVC number[a]	date insertion	Site[b]	ATB perfusion[c]	date removal	Other infection at removal[b]	>1 organ failure at removal[b]
CVC 1						
CVC 2						
CVC 3						
CVC 4						

[a] More than 4 CVC registrations are allowed [b] 1=subclavia, 2=jugular, 3=femoral, 4=other site; [c] Y/N

Option c: Antimicrobial use in the ICU

	Antibiotic	Adm /	2 /	3 /	4 /	5 /	6 /	7 /	8 /	9 /	10 /	11 /	12 /	13 /	14 /
Antimicrobial 1 *															
Antimicrobial 2 *															
Antimicrobial 3 *															
Antimicrobial 4 *															

*by day: **P**(prophylaxis)/ **S** (SDD)// **E** (empiric therapy)/ **M** (therapy based on micro-organism or gram stain) or **A** (AMT based on antibiogram)
More than 4 Antimicrobial registrations are allowed

LEVEL 2 INFECTION DATA

Hospital code: _____ ICU code: _____ Patient ID: _____
Admission date in the ICU: _____

Infection date	Site	MO1/R	MO2/R	MO3/R°	IDU 48h	BSI ORI°	AMT°	VAL°	CVC num°

Patient ID: unique patient code ; Adm.dt. ICU: admission date in unit; Infection date: date onset infection (date of sampling if appropriate); Infection Site: BSI-A/B bloodstream infection; PN1-PN5: ICU-acquired pneumonia; UTI-A/B/C urinary tract infection; CRI1-CRI3: CVC infection; (CCO: catheter colonization); OTH: other infection site; MO1-MO3/R: 6 character micro-organism code/resistance profile code (e.g. STAAUR/0=MSSA, STAAUR/1=MRSA, STAAUR/-1=*S.aureus*, resistance unknown); IDU 48: invasive device exposure in 48 hours before infection, required if site=pneumonia (intubation), optional for other infection sites; BSI ORI: Origin of bloodstream infection(o):C:catheter-associated;S:secondary (pulmonary (S-PUL), urinary (S-UTI), digestive (S-DIG), surgical site infection (S-SSI), skin and soft tissue (S-SST), other (S-OTH);U:unknown; AMT: antimicrobial treatment (Y if AMT was started); VAL: for validation (e.g. in case of electronic surveillance) if infection is nosocomial and matches case definition, Y/N;CVC num: CVC number – for CCO in option c (catheter colonization), link with CVC risk factors; °=optional

INFECTION DATA & ANTIMICROBIAL RESISTANCE DATA (optional) (one form per infection)

Hospital code: _____ ICU code: _____ Patient ID: _____

Admission date in the ICU: _____ Infection date: _____ Infection type _____

Invasive device in 48h before infection: Y / N **Origin of bloodstream infection _____**

Antimicrobial treatment°: Y / N **Validated infection°:** Y / N **CVC number°: _____**

	Micro-organism1	Micro-organism2	Micro-organism3
Micro-organism code :			

	ANTIMICROBIAL	**U**	**S**	**I**	**R**	**U**	**S**	**I**	**R**	**U**	**S**	**I**	**R**
Penicillins	Penicillin												
	Ampicillin												
	Amoxicillin-clavulanic acid												
	Methicillin/oxacillin (B-lactamase res.pen.)												
	Piperacillin/ticarcillin (anti-pseudom. peni.)												
	Piperacillin/ticarcillin + enzyme inhibitor												
Cephalo-sporins	Cefalotin/cefazolin (1st gen. ceph.)												
	Cefuroxim/cefamandole/cefoxitin (2nd GC)												
	Cefotaxime/ceftriaxone (3rd GC)												
	Ceftazidime (anti-pseudom. 3rd GC)												
	Cefepime/cefpirome (4th GC)												
Carbap.	Meropenem/imipenem												
Sulfa & tr.	Co-trimoxazole (sulfamethox. + trimeth.)												
Tetracycl.	Tetracycline/doxycycline/minocycline												
Macrolid. & similar	Erythromycin (macrolides)												
	Clindamycin (lincosamides)												
	Quinupristin-dalfopristin (streptogramins)												
Amino-glyco-sides	Gentamicin												
	Netilmicin												
	Tobramycin												
	Amikacin												
Fluoro-quinolones	Ciprofloxacin/ofloxacin												
	Levofloxacin												
	Gatifloxacin/sparfloxacin												
	Moxifloxacin/trovafloxacin												
Oth. quin.	Nalidixic acid												
Glycopep.	Vancomycin/teicoplanin												
Polymyx.	Colistin												
Other	Fusidic acid												
	Fosfomycin												
	Linezolid												
Anti-fungal	Nystatin												
	Fluconazole												
	Amphotericin B												

Patient ID: unique patient code ; Adm.dt. ICU: admission date in unit; Infection date: date onset infection (date of sampling if appropriate); Infection Site: BSI-A/B bloodstream infection; PN1-PN5: ICU-acquired pneumonia; UTI-A/B/C urinary tract infection; CRI1-CRI3: CVC infection; (CCO: catheter colonization); OTH: other infection site; Invasive device exposure in 48 hours before infection, required if site=pneumonia (intubation), optional for other infection sites; BSI ORI: Origin of bloodstream infection(o):C:catheter-associated (C-CVC: central catheter; C-PER: peripheral catheter; C-ART: arterial catheter; S:secondary (pulmonary (S-PUL), urinary (S-UTI), digestive (S-DIG), surgical site infection (S-SSI), skin and soft tissue (S-SST), other (S-OTH);U:unknown; AMT: antimicrobial treatment (Y if AMT was started); VAL: for validation (e.g. in case of electronic surveillance) if infection is nosocomial and matches case definition, Y/N;CVC num: CVC number – for link with option c data (catheter infections); Micro-organism: 6 character micro-organism code (e.g. STAAUR) - if no micro-organism is available, specify either _NONID (Micro-organism not identified or not found), _NOEXA(examination not done) or _STERI (Sterile examination); Antimicrobial resistance data: U: unknown/ not available / not applicable; S: sensitive; I: intermediate; R: resistant; °=optional