TECHNICAL DOCUMENT

Surveillance of surgical site infections and prevention indicators in European hospitals

HAI-Net SSI protocol, version 2.2

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This report of the European Centre for Disease Prevention and Control (ECDC) was coordinated by Tommi Kärki.

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The current HAI-Net SSI protocol v2.2 is the final version of the new HAI-Net SSI protocol, slightly adapted after the pilot version 2.0 in the autumn of 2016.

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Contents

Abbreviations

ASA	American Society of Anesthesiologists
CARD	Cardiac surgery
CABG	Coronary artery bypass grafting
CBGB	Coronary artery bypass grafting with both chest and donor site incisions
CBGC	Coronary artery bypass grafting with chest incision only
CHOL	Cholecystectomy
COLO	Colon surgery
CSEC	Caesarean section
EC	European Commission
EU	European Union
GP	General practitioner
HAI	Healthcare-associated infection
HAI-Net	Healthcare-Associated Infection surveillance Network
HELICS	Hospitals in Europe Link for Infection Control through Surveillance project
HPRO	Hip prosthesis
IPC	Infection prevention and control
ICU	Intensive care unit
IPSE	Improving Patient Safety in Europe project
KPRO	Knee prosthesis
LAM	Laminectomy
LOS	Length of stay
NHSN	The US National Healthcare Safety Network (formerly NNIS System)
OR	Operating room
PAP	Perioperative antibiotic prophylaxis
REC	Rectum surgery
SPI	Structure and process indicator
SSI	Surgical site infection
TESSy	The European Surveillance System

Introduction and objectives

The European Council Recommendation of 9 June 2009 on patient safety, including the prevention and control of healthcare-associated infections (HAIs) (2009/C 151/01), recommends 'performing the surveillance of the incidence of targeted infection types', 'using surveillance methods and indicators as recommended by ECDC and case definitions as agreed upon at Community level in accordance with the provisions of Decision No 2119/98/EC' [1,2].

In 2000–2002, harmonised methods for the surveillance of two targeted infection types, surgical site infections (SSIs) and healthcare-associated infections in intensive care units (ICUs), were developed by the network HELICS (Hospitals in Europe Link for Infection Control through Surveillance), funded by the European Commission's Directorate-General for Health and Consumers (DG SANCO), and progressively implemented in Member States by HELICS and later as part of the Improving Patient Safety in Europe (IPSE) project. In July 2008, the coordination of the European surveillance of healthcare-associated infections was transferred from the IPSE network to the European Centre for Disease Prevention and Control (ECDC) in accordance with ECDC's mandate. ECDC continued HAI surveillance with protocols that were first updated during the annual meetings of the HAI surveillance network in 2009–2010.

In 2013, the European Commission requested ECDC to collect additional data on structure and process indicators for HAIs as well as data on mortality from HAIs, based on the ECDC PPS results and in accordance with the Council recommendation 2009/C 151/01 [2]. The latest changes to the HAI-Net SSI surveillance protocol, including the addition of structure and process indicators, were discussed in HAI-Net surveillance network meetings first in 2013 and 2014, and in a protocol meeting in June 2016. A pilot survey on the suggested protocol changes was carried out in the second half of 2016, and final decisions for the current protocol version 2.2 were done after a teleconference with the pilot survey countries in January 2017.

SSIs remain an important target for the surveillance of HAIs and an official priority for surveillance in several European countries. SSIs are among the most common HAIs [3]. They are associated with longer postoperative hospital stay, additional surgical procedures or stay at intensive care unit, and higher mortality. All patients undergoing surgery are at risk for complications, including SSIs.

The main objective of the European protocol for the surveillance of SSIs is to ensure standardisation of definitions, data collection and reporting procedures for hospitals participating in the national/regional surveillance of surgical site infections across Europe, in order to contribute to the EU surveillance of healthcare-associated infections and to improve the quality of care in a multicenter setting.

The specific objectives of the surveillance activities are:

At the level of the hospital:

- to lower the incidence of SSIs by encouraging the owners of the problem (primarily the surgical staff) to:
  - comply with existing guidelines and 'good surgical practice'
  - correct or improve specific practices
  - develop, implement and evaluate new preventive practices through follow-up and inter-hospital comparisons of adjusted SSI rates and of compliance with key preventive measures.
- participation in 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.

At the level of regional or national network coordination:

- to prevent SSIs through surveillance;
- to provide the units with the necessary reference data to make comparisons of risk-adjusted rates between units/hospitals:
  - to follow-up epidemiological trends in time
  - to identify and follow-up risk factors of SSIs
  - to improve the quality of data collection
- to compare and follow-up the implementation of key preventive measures of SSIs between hospitals and between EU/EEA countries.

At the European level:

- to prevent SSIs through surveillance by providing European reference data for adjusted SSI rates and compliance with key preventive measures
- to monitor the burden of SSIs in European hospitals, in terms of incidence and attributable mortality
- to monitor and describe the epidemiology of SSIs in selected surgical procedures in European hospitals
- to identify regions or countries at higher need of EU support with regard to surveillance and control of SSIs

- to facilitate the communication and the exchange of experience between national/regional networks for the surveillance of SSIs
- to stimulate the creation of national/regional coordination centres for the surveillance of SSIs 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 utilisation
- to validate risk factors of SSIs at the EU level
- to explore the correlation between structure and process indicators and the incidence of SSIs throughout Europe in order to generate hypotheses and new insights in healthcare-associated infection prevention and control.

1. From HAI-Net SSI 1.02 to 2.2: summary of major changes

The first version of this document was produced in October 2003 as the protocol *Surveillance of Surgical Site Infections* (HELICS/IPSE protocol 9.1, 2004). Changes to the protocol were applied, either based on agreements made during the annual meetings of the European network for the surveillance of healthcare-associated infections (HAI-Net) in June 2009 and June 2010, or because they were necessary for the integration of the HAI surveillance data into The European Surveillance System (TESSy) of ECDC. The latest version was the protocol version 1.02 released in 2012. Further changes on the protocol were discussed in HAI-Net network meetings in 2012–2014 and in June 2016, and with the HAI-Net SSI pilot survey participants in January 2017; following which the protocol version 2.2 has been drafted.

The main changes include:

- adding the structure and process indicators (SPIs) to the hospital/unit-level data collection as discussed in the earlier meetings in 2012–2014 and in 2016; the use of the new variables is recommended for all participating countries and hospitals
- the follow-up period for deep and organ/space SSIs if an implant is in place was shortened from one year to 90 days
- a new variable for implant has been added, linking to the length of the follow-up period to be used
- to better assess the excess mortality associated with SSIs, a variable has been added at the infection level to assess the relationship between the SSI and death (if applicable), in addition to the old in-hospital outcome variable
- The American Society of Anaesthesiologists (ASA) physical status classification system has been updated following the 2014 version
- a new variable for multiple surgical procedures performed through the same incision within the same session in the operating room has been added
- a variable for endoscopic/laparoscopic surgical procedures has been added to the unit-based reporting protocol
- reporting cardiac surgery (CARD) and rectum surgery (REC) is now allowed
- reporting of other coding for surgical procedures than ICD-9-CM is now possible, in case ICD-9-CM cannot be reported.

2. Unit-based (light) versus patient-based (standard) surveillance of SSIs

As for the protocol for the surveillance of ICU-acquired infections, a unit-based version has been included in the surveillance of surgical site infections since the protocol version 1.02. While the 'standard' patient-based protocol allows risk adjustment of SSI rates through the use of the basic NNIS (now NHSN, The US National Healthcare Safety Network) risk index for inter-hospital comparisons [3,4,5], the unit-based or 'light' protocol, provides a less-labour intensive solution, producing partially the same indicators as the patient-based version for follow-up of trends and the same possibilities for adjustment of differences in post-discharge surveillance. It also allows for descriptive results about infections and antimicrobial resistance, but with no possibility for risk-adjusted comparisons.

Case definitions and included patients are the same for both versions, but while in the patient-based protocol risk factors are collected for each patient (infected or not), in the unit-based protocol denominator data are aggregated at the hospital (and optionally surgical unit) level.

3. Definitions

3.1 Case definitions of SSIs

The same case definitions are used as in previous protocol versions, e.g. HELICS *Surveillance of Surgical Site Infections* – Version 9.1, September 2004 and HAISSI protocol – version 1.02 with the exception of the 90-day follow-up period for deep or organ/space infections if implant is in place.

3.1.1 Superficial incisional

Infection occurs within 30 days after the operation and involves only skin and subcutaneous tissue of the incision and at least one of the following:

- purulent drainage with or without laboratory confirmation, from the superficial incision
- organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision
- at least one of the following signs or symptoms of infection: pain or tenderness, localised swelling, redness, or heat and superficial incision is deliberately opened by surgeon, unless incision is culture-negative
- diagnosis of superficial incisional SSI made by a surgeon or attending physician.

3.1.2 Deep incisional

Infection occurs within 30 days after the operation if no implant[i] is left in place or within 90 days if implant is in place and the infection appears to be related to the operation and infection involves deep soft tissue (e.g. fascia, muscle) of the incision and at least one of the following:

- purulent drainage from the deep incision but not from the organ/space component of the surgical site
- a deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms: fever (> 38°C), localised pain or tenderness, unless incision is culture-negative
- an abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination
- diagnosis of deep incisional SSI made by a surgeon or attending physician.

3.1.3 Organ/space

Infection occurs within 30 days after the operation if no implant[i] is left in place or within 90 days if implant is in place and the infection appears to be related to the operation and infection involves any part of the anatomy (e.g. organs and spaces) other than the incision that was opened or manipulated during an operation and at least one of the following:

- purulent drainage from a drain that is placed through a stab wound into the organ/space
- organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space
- an abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathologic or radiologic examination
- diagnosis of organ/space SSI made by a surgeon or attending physician.

[i] The US National Nosocomial Infection Surveillance definition: a nonhuman-derived implantable foreign body (e.g., prosthetic heart valve, nonhuman vascular graft, mechanical heart, or hip prosthesis) that is permanently placed in a patient during surgery [6].

3.2 Other key definitions

3.2.1 Basic SSI risk index

The basic SSI risk index is the index used in the US National Healthcare Safety Network (NHSN) and assigns surgical patients into categories based on the presence of three major risk factors [4,5,6,7,8,9,10]:

- operation lasting more than the duration cut point hours, where the duration cut point is the approximate 75th percentile of the duration of surgery in minutes for the operative procedure, rounded to the nearest whole number of hours
- contaminated (class 3) or dirty/infected (class 4) wound class
- ASA classification of 3, 4, or 5.

The patient's SSI risk category is the number of these factors present at the time of the operation.

Table 1. Calculation of basic SSI risk index

Calculation	Score =0, if:	Score=1, if:
Wound contamination class	W1, W2	W3, W4
ASA classification	A1, A2	A3, A4, A5
Duration of operation under 75th percentile cut-off value in hours (see table in chapter 3.2.4)	≤ 75th percentile cut-off value in hours	> 75th percentile cut-off value in hours
Basic SSI risk index =	Sum of scores	

3.2.2 Wound contamination class

Wound contamination class as described by Altemeier *et al.* [9].

Table 2. Wound contamination classification

Wound contamination class	Description
W1	A **clean wound** is an uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital or uninfected urinary tracts are not entered. In addition, clean wounds are primarily closed and, if necessary, drained with closed drainage. Operative incisional wounds that follow non-penetrating trauma should be included in this category.
W2	**Clean-contaminated wounds** are operative wounds in which the respiratory, alimentary, genital or uninfected urinary tracts are entered under controlled condition and without unusual contamination. Specifically operations involving the biliary tract, appendix, vagina and oropharynx are included in this category provided no evidence of infection or major break in technique is encountered
W3	**Contaminated wounds** include open, fresh, accidental wounds. In addition operations with major breaks in sterile technique or gross spillage from the gastrointestinal tract, and incisions in which acute, nonpurulent inflammation is encountered are included in this category.
W4	**Dirty or infected wounds** include old traumatic wounds with retained devitalised tissue and those that involve existing clinical infection or perforated viscera. This definition suggests that the organisms causing postoperative infection were present in the operative field before the operation.

3.2.3 The ASA physical status classification (ASA score)

Physical status classification developed by the American Society of Anesthesiologists (ASA) [10].

Table 3. ASA physical status classification

ASA score	Definition	Examples
A1	**A normal healthy patient**	Healthy, non-smoking, no or minimal alcohol use
A2	A patient with **mild systemic disease or condition**	Mild diseases or conditions only without substantive functional limitations. Examples include (but not limited to): current smoker, social alcohol drinker, pregnancy, obesity (30<body mass index<40), well-controlled diabetes mellitus or hypertension, mild lung disease
A3	A patient with **severe systemic disease**	Substantive functional limitations; One or more moderate to severe diseases. Examples include (but not limited to): poorly controlled diabetes mellitus or hypertension, chronic obstructive pulmonary disease, morbid obesity (body mass index ≥40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, end stage renal disease undergoing regularly scheduled dialysis, premature infant postconceptional age < 60 weeks
A4	A patient with an **incapacitating systemic disease** that is a constant threat to life	Examples include (but not limited to): ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, sepsis, disseminated intravascular coagulation or end stage renal disease not undergoing regularly scheduled dialysis
A5	A **moribund** patient who is not expected to survive without the operation	Examples include (but not limited to): ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischaemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction

3.2.4 Duration of operation

The table below shows the 75th percentile cut-off values for the selected NHSN procedures. In case of a reintervention within 72 hours after the primary procedure, the duration of the re-intervention needs to be added to the duration of the primary procedure.

Table 4. Cut-off values for duration of operative procedure categories

Category	Description	75th percentile cut-off value in hours
CARD	Cardiac surgery	5
CABG	Coronary artery bypass graft, unspecified	5
CBGB	Coronary artery bypass graft with both chest and donor site incisions: chest procedure to perform direct revascularisation of the heart; includes obtaining suitable vein from donor site for grafting	5
CBGC	Coronary artery bypass graft with chest incision only: chest procedure to perform direct vascularisation of the heart using, for example, the internal mammary artery	4
CHOL	Cholecystectomy: removal of gallbladder; includes procedures performed using the laparoscope	2
COLO	Colon surgery: incision, resection or anastomosis of the large bowel; includes large-to- small and small-to-large bowel anastomosis	3
CSEC	Caesarean section	1
HPRO	Arthroplasty of hip	2
KPRO	Arthroplasty of knee	2
LAM	Laminectomy: exploration or decompression of spinal cord through excision or incision into vertebral structures	2
REC	Rectum surgery	4

3.3 Structure and process indicators for SSI prevention

Structure and process indicators (SPIs) of SSI prevention were selected based on the strength of available evidence and feasibility of their collection. Two of the SPIs are collected at the hospital/unit level. Other SPIs will be collected aggregated by operation type.

The collection of the SPI data is recommended for a minimum of three months and/or for 30 surgical procedures of a certain type per surveillance year (for example selecting the first 30 surgical procedures of a certain type from the start of the surveillance period). These data should be collected for at least one of the selected surgical procedure type(s), as agreed at the national/regional surveillance network level.

3.3.1 Hospital/unit-level SPIs

Two SPIs are collected at the hospital-level;

- **Alcohol handrub (AHR) consumption** during the previous year in surgical wards that participate to the SSI surveillance per 1 000 patients-days
  NOTE: The AHR consumption and the patient-days should represent the same ward(s). Data are to be collected from the hospital pharmacy or ward records for the year prior to the surveillance year.
- Is there a **system for root cause analysis/review of SSIs** in place in the hospital, and if so, in which cases the root cause analysis/review is triggered? Root cause analysis/review is defined as the systematic analysis of all the factors which are predisposed to, or had the potential to prevent, an error; in this case SSI [11].

Both of these SPIs can be collected per each hospital or per unit/ward.

3.3.2 SPIs aggregated by operation type

Other structure and process indicators are collected only as aggregated by selected surgical procedure type(s). For each SPI, the number of all observations and the number of observations that are compliant with the SPI should be reported. In the case of observations where the information is not available, i.e. is non-measured or non-documented, the observations should be omitted for the SPI in question.

The selected SPIs can be categorised into three groups; 1) Perioperative antibiotic prophylaxis (PAP) indicators, 2) Preoperative skin preparation indicators, and 3) other SSI prevention indicators.

3.3.2.1 Perioperative antibiotic prophylaxis

Perioperative antibiotic prophylaxis (PAP) is defined as administration of systemic antibiotics before or during a surgical procedure [12]. It is not within the scope of this protocol to assess which operations require PAP, nor the appropriateness of the administered PAP. In order to evaluate the compliance for the PAP indicators, auditing a selected number of surgical procedures in which PAP is indicated by the local protocol is recommended. In case of caesarean section, PAP means prophylaxis given after clamping of umbilical cord. Prophylaxis for premature rupture of membranes (PROM) is not considered as PAP.

Two PAP indicators have been added to the SSI protocol:

- **administration of PAP within 60 minutes before incision** (except when administering vancomycin and fluoroquinolones)
- **discontinuation of PAP within 24 hours after initiation of surgery**.

Both of these SPIs are based on the ECDC systematic review and evidence-based guidance on perioperative antibiotic prophylaxis [12]. Adhering to optimal timing for preoperative prophylaxis as well as avoiding the prolongation of prophylaxis are also strong recommendations in the WHO Global Guidelines for the Prevention of Surgical Site Infection supported by a moderate quality of evidence [13]. They are also included in the WHO safe surgery checklist, and supported by the Society of Healthcare Epidemiology of America/Infectious Diseases Society of America (SHEA/IDSA) practice recommendation for prevention of SSIs [14,15,16]. Data for both indicators should be collected from the review of the patient charts or checklists.

For the first PAP indicator, the compliance with the administration within 60 minutes before incision will be assessed for all surgical procedures where PAP was indicated (according to the local protocol) and administered:

$$\frac{\text{Number of PAP administered within 60 minutes before incision}}{\text{Number of all surgical procedures where PAP was indicated and administered}}$$

For the second PAP indicator the compliance with the discontinuation of PAP within 24 hours after initiation of surgery will be assessed for all surgical procedures where PAP was indicated (according to the local protocol) and administered:

$$\frac{\text{Number of PAP discontinued within 24 hours after initiation of surgery}}{\text{Number of all surgical procedures where PAP was indicated and administered}}$$

3.3.2.2 Preoperative skin preparation

The following preoperative skin preparation indicators have been added to the protocol:

- **No hair removal,** or if hair removal was necessary, only clipping.
- **Use of alcohol-based antiseptic solutions based on Chlorhexidine gluconate (CHG) for surgical site skin preparation** in the operating room (OR) (if no patient contraindication exists).

Moderate evidence is presented both in the WHO Global Guidelines for the Prevention of Surgical Site Infection and in the SHEA/IDSA practice recommendation for prevention of SSIs for no hair removal, with a strong recommendation in the WHO Guidelines [13,14,15]. Furthermore, moderate or moderate to low evidence is also backing the alcohol-based antiseptic solutions based on CHG preoperative skin antisepsis in the SHEA/IDSA practice recommendation as well as the WHO Guidelines [13, 14,15]. The abovementioned indicator for alcohol-based skin antisepsis includes all alcohol-based skin antisepsis solutions based on CHG used in the OR prior to the incision but does not include other skin antisepsis performed before the entry to the OR. Data for both SPIs should be collected by observation or from the review of the patient charts, even if included in the local protocol or standard operating procedure. In case of hair removal, patient's possible self-shaving performed at home is recommended to be recorded as a non-compliant observation.

The compliance with no hair removal (or if hair removal was necessary, only clipping) will be assessed for all surgeries in the selected operation type:

$$\frac{\text{Number of surgical procedures with no hair removal, or only clipping}}{\text{Number of all surgical procedures in the procedure type}}$$

The compliance with the use of alcohol-based antiseptic solutions based on CHG for surgical skin preparation in the OR will be assessed for all surgeries where no contraindication:

$$\frac{\text{Number of all surgical procedures with surgical site preparation with alcohol and CHG-based solution}}{\text{Number of all surgical procedures in the procedure type where no contraindication}}$$

3.3.2.3 Other prevention indicators

The last group of SPIs that are collected aggregated per operation type include two indicators:

- ensuring the patient's **normothermia** in the perioperative period (within one hour of the end of operation) (36-38°C (rectal measurement) or 35,5-37,5 °C (non-rectal measurement)), if no contraindication
- using a **protocol for intensive perioperative blood glucose control and blood glucose levels monitored** for adult patients undergoing surgical procedures.

Both the monitoring and ensuring patient's normothermia and glucose monitoring and control in the perioperative period have been presented in the WHO Global Guidelines for the Prevention of Surgical Site Infection as well as in the SHEA/IDSA practice recommendation for prevention of SSIs. In the SHEA/IDSA practice recommendation, high evidence was presented for maintaining normothermia during the perioperative period and for glucose control in cardiac surgery patients, and moderate evidence for glucose control in noncardiac surgery patients.

However, in the WHO Guidelines, evidence for maintaining normothermia was deemed moderate and evidence for glucose control low [13,15,16]. The WHO Guidelines found a smaller effect in studies concentrating on intraoperative intensive blood glucose control compared to those with intensive postoperative protocol, whilst for the normothermia the WHO Guidelines recommend the use of warming devices in the operating room and during the surgical procedure [13].

The SPI on the compliance with normothermia in the perioperative period should be collected as either direct observation or from the review of patient charts. The temperature should be measured in the recovery room within one hour after the end of the surgical procedure. Normothermia should NOT be assessed for surgical procedures where normothermia is contraindicated, as for example in the case of induced hypothermia for CABG. Normothermia is defined as the patient's temperature within one hour of the end of operation (36–38°C (rectal measurement) or 35,5–37,5 °C (non-rectal measurement)), if no contraindication:

$$\frac{\text{Number of all surgical procedures where patient normothermic within one hour after surgery}}{\text{Number of all surgical procedures in the procedure type where no contraindication}}$$

The SPI on the use of protocols for intensive perioperative blood glucose control for adult patients undergoing surgical procedures refers to blood glucose control intra- and postoperatively (24 hours after initiation of surgical procedure). It should be collected from the review of the patient charts or checklists [15]. The SPI will focus on whether protocol for intensive perioperative blood glucose control is used and the blood glucose levels are monitored rather that the exact blood glucose levels, and will be assessed for all surgical procedures in the selected procedure type:

$$\frac{\text{Number of all surgical procedures where a protocol for intensive blood glucose control is used and the blood glucose levels monitored}}{\text{Number of all surgical procedures in the procedure type}}$$

4. Indicators to be produced at the European level on the occurrence and characteristics of SSIs

For each procedure under surveillance and for each level of the NHSN risk index, the EU database will produce the rates of SSIs (superficial, deep, organ-space, total), as a percentage of the number of interventions and as an incidence density (number of SSI with onset before hospital discharge per 1 000 patient days in the hospital).

4.1 Percentage of SSIs by category

The first indicator (% SSIs) gives the most complete picture for a given operative procedure, but is highly dependent on the intensity of post-discharge surveillance, which varies considerably between hospitals and between countries.

$$\text{Percentage of SSIs (by category)} = \frac{\text{all first SSIs* in that category} \times 100}{\text{all operations in that category}}$$

**SSIs are included, if {DateOfOnset}−{DateOfOperation}+1 ≤31 or ≤91 days if implant is in place.*

4.2 Percentage of SSIs excluding post-discharge diagnosed SSIs

The second indicator only considers infections detected in the hospital (post-discharge diagnosed SSIs are excluded). It corrects differences between in post-discharge surveillance between hospitals and countries, but provides an incomplete epidemiological picture and is not adjusted for differences in length of post-operative stay.

$$\text{Percentage of SSIs excluding post-discarge (by category)} = \frac{\text{all first in-hospital SSIs* in that category} \times 100}{\text{all operations with known discharge date in that category}}$$

**SSIs are included, if {DateOfOnset}−{DateOfOperation}+1 ≤31 or ≤91 days if implant is in place and DateOfOnset < DateOfHospitalDischarge.*

Step 1. Delete/exclude all operations (with or without SSI) where DateOfHospitalDischarge is unknown.

Step 2. Exclude from numerator (not from denominator!) all SSIs where DateOfOnset > DateOfHospitalDischarge (= consider these records as having no SSI).

Step 3. Apply 30d/90d rule on (in-hospital) SSIs.

4.3 Incidence density of in-hospital SSIs

The third indicator (number of in-hospital SSIs/1 000 patient-days in the hospital) only considers infections detected in the hospital and therefore it does not reflect the complete epidemiological picture, e.g. in procedures with short post-operative hospital stay. However, it is independent of post-discharge surveillance and corrects for differences in post-operative hospital stay, and therefore this indicator may be more reliable for inter-hospital or inter-network comparisons.

$$\text{Incidence density in-hospital SSIs (by category)} = \frac{\text{all in-hospital SSIs* in that category} \times 1\,000}{\text{In-hospital postoperative patient days with known discharge date in that category}}$$

** SSIs are included, if {DateOfOnset}−{DateOfOperation}+1 ≤31 or ≤91 days if implant is in place and DateOfOnset < DateOfHospitalDischarge.*

Step 1. Delete/exclude all operations (with or without SSI) where DateOfHospitalDischarge is unknown.

Step 2. Calculate in-hospital postoperative patient days as sum of (DateOfHospitalDischarge-DateOfOperation+1).

Step 3. Apply 30d/90d rule on (in-hospital) SSIs.

5. Data collection

5.1 Population under surveillance

All data from participating hospitals (or specific wards within a hospital) that perform procedures included in the European protocol are eligible for inclusion. A minimum period of three months of collection of data on SSIs in the participating hospitals is recommended for both patient-based and unit-based reporting protocols.

5.2 Type of surgery under surveillance

In order to obtain sufficient numbers of records allowing statistically valid conclusions, the diversity of operations to be recorded is limited and focuses on relatively frequently registered procedures that are likely to be interpreted similarly in different settings.

The following table offers a selection of operations from which the participating centres may chose. At a later stage this list can be modified at the demand of participants (also see Annex 1 for ICD-9-CM code list). All ICD-9-CM codes are available on the website http://www.findacode.com/home.php.

Table 5. Selected type of surgical procedures for surveillance

NHSN category	Description	ICD-9-CM* Codes included in the category
COLO	Colon surgery Incision, resection or anastomosis of the large bowel; includes large-to-small and small-to-large bowel anastomosis Laparoscopic excision of large intestine Enterotomy Intestinal anastomosis	17.3–17.39, 45.00–45.03,45.15, 45.26, 45.31–45.34, 45.4, 45.41, 45.49, 45.50–45.52, 45.4, 45.41, 45.49, 45.50–45.52, 45.61–45.63, 45.7–45.95, 46.0, 46.03, 46.04, 46.1–46.14,46.20–46.24, 46.31, 46.39, 46.4, 46.41, 46.43, 45.5, 46.51, 46.52, 46.7–46.76, 46.9–46.94
REC	Rectum surgery	48.25, 48.35, 48.40, 48.42, 48.43, 48.49, 48.5–48.59, 48.6–48.69, 48.74
CHOL	Cholecystectomy	51.0,51.03, 51.04,51.13, 51.2–51.24
	Removal of gallbladder, includes procedures performed using the laparascope	
HPRO	Arthroplasty of hip	00.70–00.73, 00.85-00.87, 81.51–81.53
KPRO	Arthroplasty of knee	00.80–00.84, 81.54–81.55
LAM	Laminectomy Exploration or decompression of spinal cord through excision or incision into vertebral structures	03.0–03.09, 80.50, 80.51, 80.53, 80.54, 80.59, 84.60–84.69, 84.80–84.85
CSEC	Caesarean section	74.0–74.2, 74.4, 74.9–74.99
CARD	Cardiac surgery	35.00-35.04, 35.06, 35.08, 35.10-35.14, 35.20-35.28, 35.31-35.35, 35.39, 35.42, 35.50, 35.51, 35.53, 35.54, 35.60-35.63, 35.70-35.73, 35.81-35.84, 35.91-35.95, 35.98-35.99, 37.10-37.12, 37.31-37.33, 37.35-37.37, 37.41, 37.49, 37.60
CABG	Coronary artery bypass, unspecified	36.1–36.2
CBGB	Coronary artery bypass grafting with both chest and donor site incisions Chest procedure to perform direct revascularisation of the heart; includes obtaining suitable vein from donor site for grafting	36.10–36.14, 36.19
CBGC	Coronary artery bypass grafting with chest incision only Chest procedure to perform direct vascularisation of the heart using, for example, the internal mammary artery	36.15–36.17, 36.2

5.3 Levels of data requirement

In ECDC's TESSy system, variables are classified according to three levels of requirement:

- **required true (error):** data will be rejected if this variable is missing (also called 'mandatory')
- **required true (warning):** variables strongly recommended to be collected for routine analysis and/or for the correct interpretation of the results. A warning will be produced if these variables are missing, but the users can still approve their data in TESSy.
- **required false:** no error or warning if data is missing, data used for additional analysis (also called 'optional')

5.4 Hierarchy of datasets

The set of variables for **HAI-Net SSI reporting** consists of nine technical variables and a set of epidemiological variables. Technical variables are only relevant at the surveillance network coordination.

HAI-Net SSI patient-based protocol data *(RecordType 'HAISSI')* contains five datasets in four hierarchical levels:

- **first level** 'HAISSI' includes data referring to the hospital/unit that are repeated in all records reporting the operation data, infection data and microorganisms and resistance data.
  The level is required.
- **second level** 'HAISSI$IND' includes variables about structure and process indicators for SSI prevention.
  The level is optional.
- **second level** 'HAISSI$OP' includes variables about patient, operation and risk factors.
  The level is required.
- **third level** 'HAISSIOPINF' includes variables about SSIs.
  The level is required.
- **fourth level** 'HAISSIOPINF$RES' includes variables about pathogens and their resistance.
  The level is optional.

HAI-Net SSI unit-based protocol data *(RecordType 'HAISSILIGHT')* contains five datasets in four hierarchical levels:

- **first level** 'HAISSILIGHT' includes data referring to the hospital/unit that are repeated in all records reporting the operation data, infection data and microorganisms and resistance data.
  The level is required.
- **second level** 'HAISSILIGHT$IND' includes variables about structure and process indicators for SSI prevention.
  The level is optional.
- **second level** 'HAISSILIGHT$OPCAT' includes variables about operations.
  The level is required.
- **third level** 'HAISSILIGHT$OPCAT$INF' includes variables about SSIs and operations.
  The level is required.
- **fourth level** 'HAISSILIGHT$OPCAT$INF$RES' includes variables about pathogens and their resistance.
  The level is optional.

Furthermore, **'HAISSICOVERAGE'** dataset contains variables about different types of operation and their national denominators. The dataset is optional.

5.5 Technical variables

Reporting country: ISO codes (International Organization for Standardization ISO 3166-1 -alpha-2-code elements): AT = Austria, BE = Belgium, BG = Bulgaria, CY = Cyprus, CZ = Czech Republic, DE = Germany, DK = Denmark, EE = Estonia, ES = Spain, FI = Finland, FR = France, GB = Great Britain, GR = Greece, HR = Croatia, HU = Hungary, IE = Ireland, IT = Italy, IS = Iceland, LI = Liechtenstein, LV = Latvia, LT = Lithuania, LU = Luxembourg, MT = Malta, NL = Netherlands, NO = Norway, PL = Poland, PT = Portugal, RO = Romania, SK = Slovakia, SI = Slovenia, SE = Sweden.

Network id: Unique identifier for each network – Member State selected and generated. Code can be omitted, if the hospital identifiers are unique within the reporting country, but should be combined with HospitalId if same codes are used across different subnetworks that are reported through by single DataSource (e.g. data from five regional CCLIN networks reported as one database by France).

Subject: HAISSI

Table 6. Technical variables

Variable name (transport label)	Description	Value list	Required
Record ID (RecordId)	Unique identifier for the hospital (and, optionally, the surgical unit) within each Network. Recommended format: [Network ID]- [HospitalId]-[UnitId]-[DateUsedForStatistics]		True (Error)
Record type (RecordType)	Structure and format of the data (case based reporting and aggregate reporting).		True (Error)
Record type version (RecordTypeVersion)	There may be more than one version of a record type. This element indicates which version the sender uses when generating the message. Required when no metadata set is provided at upload		False
Subject (Subject)	Disease to report		True (Error)
Data source (DataSource)	The data source (surveillance system) that the record originates from	[List of data sources]	True (Error)
Reporting country (ReportingCountry)	The country reporting the record	[List of countries]	True (Error)
Date used for statistics (DateUsedForStatistics)	Year covered or the start date of the surveillance period	Yyyy, yyyy-mm-dd	True (Error)
Status (Status)	Status of reporting NEW/UPDATE or DELETE (deactivate). Default if left out: NEW/UPDATE. If set to DELETE, the record with the given recordId will be deleted from the TESSy database (or better stated, invalidated). If set to NEW/UPDATE or left empty, the record is newly entered into the database	NEW/UPDATE DELETE	False
Network ID (NetworkId)	Unique identifier for each network – Member State selected and generated. Can be omitted if the hospital identifiers are unique within the reporting country		False

6. Hospital/unit data (patient-based and unit-based protocol)

Hospital/unit data are the same for patient- and unit-based protocol and use the same forms (forms A1 and A2) to collect hospital/unit and the structure and process indicator data. The only difference is that the aggregated unit-based operation data are only collected and required for unit-based protocol. The first level (RecordType 'HAISSI' or 'HAISSILIGHT') is required for patient- and unit-based protocol.

In the TESSy database, hospital/unit, structure and process indicator data and the unit-based protocol denominator data are divided into separate levels (RecordTypes 'HAISSI'/'HAISSILIGHT', 'HAISSI$IND'/'HAISSILIGHT$IND' and 'HAISSILIGHT$OPCAT').

6.1 Hospital and unit characteristics – Form A1

Hospital code (required): Unique identifier for each hospital – Member State selected and generated, should remain identical in different surveillance periods/years. Required.

Hospital surveillance period start (required): The start date of the surveillance period or the surveillance year.

Hospital type: PRIM = Primary level, SEC = Secondary level, TERT = Tertiary level, SPEC = Specialised/Other, UNK = Unknown

- Primary:
  - often referred to as 'district hospital' or 'first-level referral'
  - often corresponds to a general hospital without teaching function
  - few specialities (mainly internal medicine, obstetrics-gynaecology, paediatrics, general surgery or only general practice)
  - limited laboratory services are available for general, but not for specialised pathological analysis.
- Secondary:
  - often referred to as 'provincial hospital'
  - often corresponds to general hospital with teaching function
  - highly differentiated hospital by function with five to 10 clinical specialities, such as haematology, oncology, nephrology, ICU
  - takes some referrals from other (primary) hospitals.
- Tertiary:
  - often referred to as 'central', 'regional' or 'tertiary-level' hospital
  - often corresponds to University hospital
  - highly specialised staff and technical equipment (ICU, haematology, transplantation, cardio-thoracic surgery, neurosurgery)
  - clinical services are highly differentiated by function
  - specialised imaging units
  - provides regional services and regularly takes referrals from other (primary and secondary) hospitals.
- Specialised hospital:
  - single clinical specialty, possibly with sub-specialties
  - highly specialised staff and technical equipment
  - e.g. paediatric hospital, infectious diseases hospital.

Hospital size: total number of beds in the hospital or rounded to the closest 100 beds.

Hospital location: region as NUTS-1 code where hospital is located. See: http://ec.europa.eu/eurostat/web/nuts/overview

Method used for post-discharge surveillance: Method used for post-discharge surveillance of surgical site infections:

- READM = Detection at readmission (=passive post-discharge surveillance): patient is readmitted with SSI, often because of the SSI;
- REPSURG = Reporting on surgeon's initiative: surgeon actively reports post-discharge infections detected at outpatient clinic or private clinic follow-up to the hospital surveillance staff, e.g. using standardised forms, web-based system, e-mail or telephone
- REPGP = Reporting on GP's initiative: general practitioner (GP) reports post-discharge infections detected at follow-up consultation to the hospital surveillance staff, e.g. using standardised forms, web-based system, e-mail or telephone
- REPPAT = Reporting on patient's initiative: e.g. form send to hospital surveillance staff
- ICSURG = Obtained by IC staff from surgeon: the hospital surveillance staff – usually infection control (IC) staff – obtains information from surgeon using telephone, additional questionnaire, visit to surgeon or patient chart review
- ICGP = Obtained by IC staff from GP: hospital surveillance staff obtains information from general practitioner using telephone, additional questionnaire or visit
- CPAT = Obtained by IC staff from patient: hospital surveillance staff obtains information from patient using telephone or additional questionnaire
- NONE = No post-discharge surveillance done
- UNK = Unknown, no data about post-discharge surveillance method available.

Alcohol handrub (AHR) consumption per year in surgical wards/units: AHR consumption per year in all surgical wards/units participating in SSI surveillance in the hospital.

Patient-days per year in surgical wards/units: Patient-days per year in all surgical wards/units participating in SSI surveillance in the hospital. Note: should be the denominator data for the AHR consumption, thus from the same wards as the AHR consumption in litres.

Do you have a system for root cause analysis/review in place: Does the hospital have a system for root cause analysis/review in place. Y = Yes; N = No; Unk = Unknown.

Root cause analysis specification: If there is a system for root cause analysis in place, specify in which cases.

Unit ID: Unique identifier for each surgical unit – Member State selected and generated.

European Surveillance of Surgical Site Infections
Form A1. Standard/light surveillance option: Hospital and ward/unit data

Hospital data

Hospital code: ☐

Hospital surveillance period start: ___/___/___

Hospital type : O primary O secondary O tertiary O specialised

Hospital size: ☐

Hospital location (NUTS-1): ☐

Post-discharge surveillance
method: O READM O REPSURG O REPGP O REPPAT O ICSURG O ICGP O ICPAT O NONE O UNK

Alcohol handrub (AHR) consumption per year in surgical wards/units: ☐ litres

Patient-days per year in surgical wards/ units (same wards/units as for the AHR): ☐ patient-days

Do you have a system for root cause analysis/review in place: O Yes O No O Unknown

If Yes, please specify in which cases:_____
_____
_____

Ward/unit identifier (optional)

Surgical ward/unit ID: ☐

6.2 Structure and process indicators – Form A2

The second level (RecordType 'HAISSI$IND' and 'HAISSILIGHT$IND') includes variables about structure and process indicators for SSI prevention. The collection of structure and process indicator data is strongly recommended, but the data level is optional for both patient- and unit-based reporting surveillance. In case data for structure and process indicators are reported, several variables on the level are required.

Operation code (required): NHSN code of the primary operative procedure under surveillance according to SSI surveillance protocol for which the structure and process indicator data is collected: CARD = cardiac surgery; CBGB = coronary artery bypass grafting with both chest and donor site incisions; CBGC = coronary artery bypass grafting with chest incision only; CABG = coronary artery bypass grafting, not specified; COLO = colon surgery; CHOL = cholecystectomy; CSEC = caesarean section; HPRO = hip prosthesis; KPRO = knee prosthesis; LAM = laminectomy; REC = rectum surgery.

Indicator period start (required): start date of the structure and process indicator data collection.

Indicator period end: end date of the structure and process indicator data collection.

Indicator code (required): code of the structure and prevention indicator:

- ASTPAP60MIN = administration of PAP within 60 minutes before incision (except when administering vancomycin and fluoroquinolones);
- ASTPAP24HRS = discontinuation of PAP within 24 hours after initiation of surgery;
- NOHAIRREM = no hair removal, or if hair removal was necessary, only clipping;
- ALCSKINANT = use of alcohol-based antiseptic solutions based on CHG for surgical site skin preparation in the OR;
- NORMTHERM = ensuring the patient's normothermia within one hour of the end of operation (36-38°C (rectal measurement) or 35,5-37,5 °C (non-rectal measurement));
- GLUCMONIT = protocol for intensive perioperative blood glucose control used and blood glucose levels monitored.

Number of observations (required): number of observations for each indicator code.

Number of compliant observations (required): number of compliant observations for each indicator code.

Comments: comments on the SPI data. Free text.

European Surveillance of Surgical Site Infections
Form A2. Standard/light surveillance option: Indicator data

Hospital/ward, surveillance year and operation type for which the indicators are observed

Hospital code: ____ *as in form A1*

Operation code:

O CARD O CBGB O CBGC O CABG O CHOL O COLO O CSEC O HPRO O KPRO O LAM O REC

Indicator period start: ___/___/___ *Period in which the indicators have been assessed*

Indicator period end: ___/___/___

Indicator data

	N of observations	N of compliant observations
Preoperative Antibiotic Prophylaxis (PAP)		
Administration of PAP within 60 minutes before incision (except when administering vancomycin and fluoroquinolones):		
Discontinuation of PAP within 24 hours after initiation of surgery:		
Preoperative skin preparation		
No hair removal, or if hair removal was necessary, only clipping:		
Use of alcohol-based antiseptic solutions based on CHG for surgical site skin preparation in the OR:		
Other indicators		
Ensuring the patient's normothermia within one hour of the end of operation (36-38°C (rectal measurement) or 35,5-37,5 °C (non-rectal measurement)):		
Protocol for intensive perioperative blood glucose control used and blood glucose levels monitored:		

Comments:_____

6.3 Unit-based protocol denominator data – Form AL3

The second level in the unit-based protocol (RecordType 'HAISSILIGHT$OPCAT') includes denominator data and variables about each operation category. The level is required in unit-based surveillance protocol.

Operation code (required): NHSN (National Healthcare Safety Network) code of the primary operative procedure under surveillance according to SSI surveillance protocol for which the aggregated denominator data is collected: CARD = cardiac surgery; CBGB = coronary artery bypass grafting with both chest and donor site incisions; CBGC = coronary artery bypass grafting with chest incision only; CABG = coronary artery bypass grafting, not specified;COLO = colon surgery; CHOL = cholecystectomy; CSEC = caesarean section; HPRO = hip prosthesis; KPRO = knee prosthesis; LAM = laminectomy; REC = rectum surgery

Endoscopic procedure: denominator data entry is for endoscopic/laparoscopic operations or open operations. Note that endoscopic/laparoscopic requires that the entire operation was performed using endoscopic/laparoscopic approach.

ICD-9-CM code: ICD-9-CM code of the primary operative procedure under surveillance according to SSI surveillance protocol for which the denominator data was collected. Use 4-digit code or 3-digit code if 4-digit code not available. Recommended coding system.

Non ICD-9-CM code: any other code of the primary operative procedure under surveillance according to SSI surveillance protocol for which the denominator data was collected, e.g. ICD-10-CM or NCSP codes. Alternative coding system to be used if ICD-9-CM code cannot be reported.

Non ICD-9-CM code name: name of the other code used for the primary operative procedure under surveillance, e.g. ICD-10-CM or NCSP. Alternative coding system to be used if ICD-9-CM code cannot be reported.

Surveillance period started (required): start date of the time period covered by this denominator entry.

Surveillance period ended (required): end date of the time period covered by this denominator entry.

Number of operations: number of surgical procedures in the category of operations according to operation code, endoscopic/laparoscopic (if given) and ICD-9 (if given) during the survey period.

Number of operations with known discharge date: number of surgical procedures in the category of operations with known discharge date according to operation code, endoscopic/laparoscopic (if given) and ICD-9 (if given) during the survey period.

Number of postoperative patient days: number of post-operation hospital patient days. Definition: the sum of patient days in the hospital following the operation (discharge date – operation date + 1) according to operation code, endoscopic/laparoscopic and ICD-9 (if given).

European Surveillance of Surgical Site Infections
Form AL3. Light surveillance option: Operation category denominator form

Aggregated operation category denominator data

Operation code:

O CARD O CBGB O CBGC O CABG O CHOL O COLO O CSEC O HPRO O KPRO O LAM O REC

Endoscopic operation: O Yes O No O Unknown

ICD-9-CM code: ☐

Other operation code: ☐ *If other code than ICD-9, please specify: _____*

Start date of the denominator entry ___/___/___

End date of the denominator entry ___/___/ ____

Number of operations: ☐

Number of operations with known discharge date ☐

Number of post-operation hospital patient-days ☐

7. Patient/operation data (patient-based and unit-based protocol)

7.1 Patient-based protocol patient/operation data – Form A3

The second level of the patient-based protocol (RecordType 'HAISSI$OP') includes variables about patient, operation and risk factors and are collected for each patient/operation. The level is required in patient-based surveillance protocol.

Patient/operation variables:
Patient counter: numeric code for each patient, unique within hospital. Anonymous code assigned by hospital to specify patient.

Age: age of the patient at date of operation.

Gender: the gender of the patient who undergoes the operation. F = Female; M=Male; O = Other; Unk = Unknown.

Date of hospital admission: date patient was admitted to hospital in order to undergo the operation under surveillance.

Date of hospital discharge: date the patient was discharged from hospital where they underwent the operation under surveillance or date of in-hospital death or date of last follow-up in hospital if discharge date is unknown. This date is used to calculate the number of post-operative in-hospital patient days.

Date of last follow-up post-discharge: date last information on the patient was obtained after discharge from hospital, for example from surgeon (out-patient department or private practice) or general practitioner. This date is used to calculate the total amount of follow-up days (in-hospital and post-discharge). (DateOfLastFollowup)

Date of last follow-up in hospital: date last information on the patient was obtained during the hospitalisation, for example from surgeon. Can be used when different from date of hospital discharge, e.g. if hospital stay is longer than 30 days, or follow-up of surveillance was discontinued for other reasons while patient was still in hospital to calculate the total amount of follow-up days (in-hospital).

Outcome from hospital: patient status at the last reported hospital discharge or at end of follow-up in hospital.

Operation ID (required): unique identifier for each operation – hospital selected and generated.

Date of operation (required): date operation under surveillance was carried out.

Operation code (required): NHSN (National Healthcare Safety Network) code of the primary operative procedure under surveillance according to SSI surveillance protocol.

ICD-9-CM code: ICD-9-CM code of the primary operative procedure under surveillance according to SSI surveillance protocol. See Annex 1. Use 4-digit code or 3-digit code if 4-digit code not available. Recommended coding system.

Other operation code: other code of the primary operative procedure under surveillance according to SSI surveillance protocol, for example ICD-10. Please also specify the other coding system in a separate field (see below). Alternative coding system to be used if ICD-9-CM code cannot be reported.

Name of the non ICD-9-CM code: name of the other code used for the primary operative procedure under surveillance: ICD-10-PCS = International classification of diseases-10 Procedure Coding System; ICD-10-AM = International classification of diseases-10-AM; ICD-11 = International classification of diseases 11 (2017/2018 onwards); CCAM = Classification des Actes Médicaux; CVV = Classificatie van verrichtingen; GOA = Gebührenordnung für Ärzte; ICPM = International Classification of Procedures in Medicine; NCSP = Nomesco Classification of Surgical Procedures; NPS = Nomenclature des prestations de santé; OPS-301 = Operationen- und Prozedurenschlüssel; OPCS-4 = OPCS Classification of Interventions and Procedures version 4. Alternative coding system to be used if ICD-9-CM code cannot be reported.

Endoscopic procedure: enter 'Yes' only if the entire operation was performed using an endoscopic/laparoscopic approach.

Multiple operations: enter 'Yes' if multiple procedures were performed through the same incision within the same session in the operating room. Duration of operation should be calculated for the combined duration of all procedures. If more than one NHSN operative procedure category was performed through the same incision, attribute the SSI to the procedure that is thought to be associated with the infection [4].

Implant in place: enter 'Yes' if there is an implant in place. The follow-up period if an implant in place should be extended to 90 days after the operation for deep or organ/space infections. Implant is defined according to the US National Nosocomial Infection Surveillance definition: a nonhuman-derived implantable foreign body (e.g., prosthetic heart valve, nonhuman vascular graft, mechanical heart, or hip prosthesis) that is permanently placed in a patient during surgery [6].

Wound contamination class: ehe wound contamination class as described in the section 3.2.2: W1 = Clean; W2 = Clean-contaminated; W3 = Contaminated; W4 = Dirty or infected; UNK = Unknown.

Duration of operation: duration of operation (in minutes) from skin incision to skin closure. In case of re-intervention within 72 hours after the primary procedure, the duration of the re-intervention needs to be added to the duration of the primary procedure.

Urgent operation: planning time of the operation. 'Yes' means urgent operation that was not planned at least 24 hours in advance. 'No' means elective operation that was planned at least 24 hours in advance.

ASA classification: physical status classification developed by the American Society of Anesthesiology. Status at the time of the operation: A1 = Normally healthy patient; A2 = Patient with mild systemic disease or condition; A3 = Patient with severe systemic disease that is not incapacitating; A4 = Patient with an incapacitating systemic disease that is a constant threat to life; A5 = Moribund patient who is not expected to survive for 24 hours with or without operation; UNK = Unknown.

Patient received surgical prophylaxis: Perioperative systemic administration of antimicrobial agent(s) at or within two hours prior to primary skin incision with the aim of preventing sepsis in the operative site. In case of caesarean section, after clamping of umbilical cord.

Surgical site infection (required): Presence of a SSI for this operation. For CBGB, only chest wound infections are to be reported.

Number of OR door openings: number of operating room (OR) door openings during the operation, measured from opening of the sterile equipment until the closure of the surgical wound. Recommended to be collected only if an automated system for OR door openings is in place.

European Surveillance of Surgical Site Infections
Form A3. Standard surveillance option: Operation/patient and infection data

Operation/patient data

Hospital code: ☐ Patient counter: ☐

Ward ID (optional): ☐

Age: ☐

Gender: O Male O Female O Other O UNK

Date of hospital admission: ___/___/___ Date of discharge: ___/___/___

Date of last follow-up post-discharge: ___/___/___ Date of last follow-up in hospital: ___/___/___

Outcome from hospital: O Alive O Dead in hospital O UNK

Operation ID: ☐ Date of operation: ___/___/___

Operation code: O CARD O CBGB O CBGC O CABG O CHOL O COLO O CSEC O HPRO O KPRO O LAM O REC

ICD-9-CM: ☐

Other operation code: ☐ If other code than ICD-9, please specify: _____

Endoscopic procedure: O Yes O No O UNK Multiple operations: O Yes O No O UNK

Implant in place: O Yes O No O UNK

Wound contamination class: O Clean O Clean-contaminated O Contaminated O Dirty or infected O UNK

Duration of operation: ☐ min. ASA classification: O A1 O A2 O A3 O A4 O A5 O UNK

Urgent operation: O Yes O No O UNK Antibiotic prophylaxis: O Yes O No O UNK

Surgical site infection: O Yes O No O UNK Number of OR door openings during operation: _____

7.2 Unit-based protocol patient/operation data – Form AL4

The third level of the unit-based protocol (RecordType 'HAISSILIGHT$OPCAT$INF') includes variables about patients and operations that are only collected for patients and operations with a SSI. The level is required in unit-based surveillance protocol.

Demographic/operation variables (unit-based reporting surveillance):

Patient counter: numeric code for each patient, unique within hospital. Anonymous code assigned by hospital to specify patient.

Age: age of the patient at date of operation.

Gender: the gender of the patient who undergoes the operation. F = Female; M=Male; O = Other; Unk = Unknown.

Date of hospital discharge: date the patient was discharged from hospital where they underwent the operation under surveillance or date of in-hospital death or date of last follow-up in hospital if discharge date is unknown. This date is used to calculate the number of post-operative in-hospital patient days.

Outcome from hospital: patient status at the last reported hospital discharge or at end of follow-up in hospital.

Operation ID (required): unique identifier for each operation – hospital selected and generated.

Date of operation (required): date of operation under surveillance.

Operation code (required): NHSN (National Healthcare Safety Network) code of the primary operative procedure under surveillance according to SSI surveillance protocol.

ICD-9-CM code: ICD-9-CM code of the primary operative procedure under surveillance according to SSI surveillance protocol. Use 4-digit code or 3-digit code if 4-digit code not available. Recommended coding system.

Other operation code: any other code of the primary operative procedure under surveillance according to SSI surveillance protocol, for example ICD-10. Alternative coding system to be used if ICD-9-CM code cannot be reported.

Name of the non ICD-9-CM code: name of the other code used for the primary operative procedure under surveillance. (NonICD9CodeName): ICD-10-PCS = International classification of diseases-10 Procedure Coding System; ICD-10-AM = International classification of diseases-10-AM; ICD-11 = International classification of diseases 11 (2017/2018 onwards); CCAM = Classification des Actes Médicaux; CVV = Classificatie van verrichtingen; GOA = Gebührenordnung für Ärzte; ICPM = International Classification of Procedures in Medicine; NCSP = Nomesco Classification of Surgical Procedures; NPS = Nomenclature des prestations de santé; OPS-301 = Operationen- und Prozedurenschlüssel; OPCS-4 = OPCS Classification of Interventions and Procedures version 4. Alternative coding system to be used if ICD-9-CM code cannot be reported.

Endoscopic procedure: enter 'Yes' only if the entire operation was performed using an endoscopic/laparoscopic approach.

Implant in place: enter 'Yes' if there is an implant in place. The follow-up period if an implant in place should be extended to 90 days after the operation for deep or organ/space infections.

European Surveillance of Surgical Site Infections
Form AL4. Light surveillance option: Operation/patient and infection data

Operation/patient data

Hospital code: ☐ Patient counter: ☐

Ward ID (optional): ☐

Operation ID: ☐

Age: ☐

Gender: O Male O Female O Other O Unknown

Date of hospital discharge: ___/___/___ *If readmission, record the first discharge*

Outcome from hospital: O Alive O Dead in hospital O UNK

Operation ID: ☐

Date of operation: ___/___/___

Operation code:

O CARD O CBGB O CBGC O CABG O CHOL O COLO O CSEC O HPRO O KPRO O LAM O REC

ICD-9-CM code: ☐

Other operation code: ☐ *If other code than ICD-9, please specify: _____*

Endoscopic procedure: O Yes O No O Unknown

Implant in place: O Yes O No O Unknown *If implant in place -> 90-day follow-up for D/O SSI*

8. SSI data and microorganism/resistance data (patient-based and unit-based protocol)

8.1 SSI data – Form A3/AL4

The SSI data (RecordTypes HAISSIOPINF and HAISSILIGHTOP_CATINF) collected on the third level are the same for patient- and unit-based protocol surveillance. These data are collected for each infection episode, by type of infection. In the unit-based protocol the level contains also patient/operation data (see also section 7.2). The level is required for both patient- and unit-based surveillance protocol.

Date of infection onset (required): date when the first clinical evidence of SSI appeared or the date the specimen used to make or confirm the diagnosis was collected, whichever comes first.

Type of infection (required): type of infection (see section 3.1): S=Superficial incisional; D = Deep incisional; O = Organ/space; UNK = Unknown

SSI diagnosis: SSI diagnosis in-hospital or post-discharge.

SSI Post-discharge surveillance method: method used for post-discharge surveillance of SSIs (see also section 6.1): READM = Detection at readmission; REPSURG = Reporting on surgeon's initiative; REPGP = Reporting on GP's initiative; REPPAT = Reporting on patient's initiative; ICSURG = Obtained by IC staff from surgeon; ICGP = Obtained by IC staff from GP; ICPAT = Obtained by IC staff from patient; UNK = Unknown.

Infection outcome (at hospital discharge): outcome of the patient with infection on discharge from the hospital. In case of death, appreciation of the relationship of death to the infection by clinician and/or surveillance staff: A = Discharged alive; DDEFREL = Death, infection definitely contributed to death; DNOTREL = Death, not related to infection; DPOSREL = Death, infection possibly contributed to death; DUNKREL = Death, unknown relationship to infection; UNK = Unknown.

Infection data
Date of onset: ___/___/___ Type of infection: O Superficial O Deep O Organ/Space O UNK
SSI diagnosis:
O HOSP O PD O UNK
SSI postdischarge surveillance method:
O READM O REPSURG O REPGP O REPPAT O ICSURG O ICGP O ICPAT O OTHER O UNK
Infection outcome (at hospital discharge): O alive O death, HAI definitely contributed to death
O death, HAI possibly contributed to death O death, no relation to HAI O death, relationship to HAI unknown O UNK

8.2 Microorganism and antimicrobial resistance data – Form A3/AL4

The fourth level (RecordTypes 'HAISSIOPINF$RES' and HAISSILIGHT$OP_CATINFRES) is the same for patient- and unit-based protocol surveillance and includes variables about isolated microorganisms and antimicrobial resistance. The level is optional for in both patient- and unit-based protocol surveillance.

Isolate result (required): microorganism or reason why not available. See Annex 2.

Antibiotic code: antibiotic code tested for susceptibility. See Annex 3.

SIR: final interpretation result of all different susceptibility tests performed. See Annex 3. Report S (susceptible), I (intermediate), R (resistant) or UNK (unknown) for the antimicrobial group (preferred) or for tested antimicrobials within the group. Reporting group susceptibility requires that at least one antimicrobial belonging to the group is tested. If several antibiotics within the group were tested (e.g. carbapenems (CAR)), report the least susceptible result for the group (e.g. meropenem R + imipenem I = CAR R).

Pandrug-resistant (PDR): microorganism is pandrug resistant. Not PDR = N (susceptible to at least one antimicrobial), possible PDR = P (I/R to all antimicrobials tested in hospital), confirmed PDR = C (I/R to all antimicrobials confirmed by reference laboratory), UNK=Unknown [17].

Microorganism and antimicrobial resistance data (repeatable per infection/microorganisms)							
Microorganism code	AM	S/I/R	PDR	Microorganism code 2	AM	S/I/R	PDR

9. HAISSICOVERAGE dataset

The HAISSICOVERAGE dataset/file was introduced to collect the total numbers of operations carried out at the national level per year (for the reported surveillance year). These data should only be reported for surgical procedures included in the national/regional surveillance and will be used for the calculation of the surveillance coverage of the operative categories included in the surveillance.

Table 7. Variables in the HAISSICOVERAGE dataset

Variable name (transport label)	Description	Value list	Required
Number of operations for coronary artery bypass grafting (NoOfOperationsCABG)	Total number of operations for coronary artery bypass grafting for the complete network or the Member State if only one network for the year		True (Warning)
Number of operations for colon surgery (NoOfOperationsCOLO)	Total number of operations for colon surgery for the complete network or the Member State if only one network for the year		True (Warning)
Number of operations for cholecystectomy (NoOfOperationsCHOL)	Total number of operations for cholecystectomy for the complete network or the Member State if only one network for the year		True (Warning)
Number of operations for caesarean section (NoOfOperationsCSEC)	Total number of operations for caesarean section for the complete network or the Member State if only one network for the year		True (Warning)
Number of operations for hip prosthesis (NoOfOperationsHPRO)	Total number of operations for hip prosthesis for the complete network or the Member State if only one network for the year		True (Warning)
Number of operations for knee prosthesis (NoOfOperationsKPRO)	Total number of operations for knee prosthesis for the complete network or the Member State if only one network for the year		True (Warning)
Number of operations for laminectomy (NoOfOperationsLAM)	Total number of operations for laminectomy for the complete network or the Member State if only one network for the year		True (Warning)

10. Confidentiality

10.1 Patient confidentiality

It will not be possible to identify individual patients in the European database on SSI by coding patient information, only 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 the anonymous unique operative procedure ID.

10.2 Hospital and unit confidentiality

Individual hospitals will not be identifiable in the European database on SSI by coding hospital information at the hospital level or at the level of the official networks in the countries. When presenting the results of the European SSI surveillance, it has to be secured that no individual hospital can be recognised.

10.3 Publication policy

Data will be published in ECDC's Annual Epidemiological Reports and in disease-specific reports on HAI surveillance, in online reports and scientific publications. Data can only be published if the official surveillance networks in the countries give written consent for publication. If requested by a network, publications have to acknowledge the data source (i.e. the networks) and provide contact information.

References

1. Official Journal of the European Union. Council recommendation of 9 June 2009 on patient safety, including the prevention and control of healthcare-associated infections (HAI) (2009/C 151/01). Available from: http://ec.europa.eu/health//sites/health/files/patient_safety/docs/council_2009_en.pdf
2. Decision No 2119/98/EC of the European Parliament and of the Council of 24 September 1998 setting up a network for the epidemiological surveillance and control of communicable diseases in the Community. Official Journal of the European Communities 1998:L268/1-6. Available from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31998D2119:EN:HTML
3. European Centre for Disease Prevention and Control. Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals. Stockholm: ECDC; 2013.
4. Centers for Disease Control and Prevention. Surgical Site Infection (SSI) Event. 2017. Available from: https://www.cdc.gov/nhsn/pdfs/pscmanual/9pscssicurrent.pdf
5. Gaynes RP. Surgical Site Infections and the NNIS SSI Risk Index: room for improvement. Infect Control Hosp Epidemiol 2000;21(3):184-5.
6. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for Prevention of Surgical Site Infection, 1999. Am J Infect Control 1999;27:97-134. Available from: http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/SSI.pdf
7. National Nosocomial Infections Surveillance (NNIS) System Report, data summary from January 1992 through June 2004, issued October 2004. Available from: http://www.cdc.gov/ncidod/dhqp/pdf/nnis/2004NNISreport.pdf
8. Culver DH, Horan TC, Gaynes RP et al. Surgical wound infection rates by wound class, operative procedure and patient risk index. Am J Med 1991;91(suppl 3B):152S-7S.
9. Altemeier WA, Burke JF, Pruitt BA, Sandusky WR. Manual on control of infection in surgical patients (2nd ed.) Philadelphia, PA: JB Lippincott, 1984.
10. American Society of Anesthesiologists. ASA physical status classification system. 2014. Available from: http://www.asahq.org/~/media/sites/asahq/files/public/resources/standards-guidelines/asa-physical-status-classification-system.pdf
11. World Health Organization. Patient safety workshop: learning from error. Geneva: WHO; 2010. Available from: http://apps.who.int/iris/bitstream/10665/44267/1/9789241599023_eng.pdf
12. European Centre for Disease Prevention and Control. Systematic review and evidence-based guidance on perioperative antibiotic prophylaxis. Stockholm: ECDC; 2013.
13. World Health Organization. Global guidelines for the prevention of surgical site infection. Geneva: WHO; 2016. Available from: http://www.who.int/gpsc/ssi-prevention-guidelines/en/
14. World Health Organization. Implementation manual. Surgical safety checklist. Geneva: WHO; 2008. Available from: http://www.who.int/patientsafety/safesurgery/ss_checklist/en/
15. Yokoe DS, Anderson DJ, Berenholtz SM, Calfee DP, Dubberke ER, Ellingson KD et al. Society for Healthcare Epidemiology of America (SHEA). A compendium of strategies to prevent healthcare-associated infections in acute care hospitals: 2014 updates. Infect Control Hosp Epidemiol 2014;35(8):967-77.
16. Anderson DJ, Podgorny K, Berríos-Torres SI, Bratzler DW, Dellinger EP, Greene L et al. Strategies to prevent surgical site infections in acute care hospitals: 2014 update. Infect Control Hosp Epidemiol 2014;35(Suppl 2):S66-88.
17. Magiorakos AP, Srinivasan A, Carey RB, Carmeli Y, Falagas ME, Giske CG, et al. Multidrug-resistant, extensively drug-resistant and pandrug-resistant bacteria: an international expert proposal for interim standard definitions for acquired resistance. Clin Microbiol Infect 2012;18(3):268-81. Available from: http://www.sciencedirect.com/science/article/pii/S1198743X14616323

Annex 1. ICD-9-CM code list of surgical procedures

ICD-9-CM code list of surgical procedures for EU surveillance	Other allowed operation codes included in NHSN
COLO 45.0 = Enterotomy 45.00 = Incision of intestine, not otherwise specified 45.03 = Incision of large intestine 45.4 = Local excision or destruction of lesion or tissue of large intestine 45.41 = Excision of lesion or tissue of large intestine 45.49 = Other destruction of lesion of large intestine 45.5 = Isolation of intestinal segment 45.50 = Isolation of intestinal segment, not otherwise specified 45.52 = Isolation of segment of large intestine 45.7 = Partial excision of large intestine 45.71 = Multiple segmental resection of large intestine 45.72 = Cecectomy 45.73 = Right hemicolectomy 45.74 = Resection of transverse colon 45.75 = Left hemicolectomy 45.76 = Sigmoidectomy 45.79 = Other partial excision of large intestine 45.8 = Total intra-abdominal colectomy 45.9 = Intestinal anastomosis 45.90 = Intestinal anastomosis, not otherwise specified 45.92 = Anastomosis of small intestine to rectal stump 45.93 = Other small-to-large intestinal anastomosis 45.94 = Large-to-large intestinal anastomosis 45.95 = Anastomosis to anus 46.0 = Exteriorisation of intestine 46.03 = Exteriorisation of large intestine 46.04 = Resection of exteriorised segment of large intestine	COLO 17.3 = Laparoscopic partial excision of large intestine: 17.31 = Laparoscopic multiple segmental resection of large intestine 17.32 = Laparoscopic cecectomy 17.33 = Laparoscopic right hemicolectomy 17.34 = Laparoscopic resection transverse colon 17.35 = Laparoscopic left hemicolectomy 17.36 = Laparoscopic sigmoidectomy 17.39 = Laparoscopic partial excision of large intestine 45.26 = Open biopsy of large intestine 45.81 = Laparoscopic total intra-abdominal colectomy 45.82 = Open total intra-abdominal colectomy 45.83 = Other and unspecified total intra-abdominal colectomy SB 45.01 = Incision of duodenum 45.02 = Other incision of small intestine 45.15 = Open biopsy of small intestine 45.31 = Other local excision of lesion of duodenum 45.32 = Other destruction of lesion of duodenum 45.33 = Local excision of lesion or tissue of small intestine, except duodenum 45.34 = Other destruction of lesion of small intestine, except duodenum 45.51 = Isolation of segment of small intestine 45.61 = Multiple segmental resection of small intestine 45.62 = Other partial resection of small intestine 45.63 = Total removal of small intestine 45.91 = Small-to-small intestinal anastomosis 46.01 = Exteriorisation of small intestine 46.02 = Resection of exteriorised segment of small intestine 46.20 = Ileostomy, not otherwise specified 46.21 = temporary ileostomy 46.22 = Continent ileostomy 46.23 = Other permanent ileostomy 46.24 = Delayed opening of ileostomy 46.31 = Delayed opening of other ileostomy 46.39 = Other enterostomy 46.41 = Revision of stoma of small intestine 46.51 = Closure of stoma of small intestine 46.71 = Suture of laceration of duodenum 46.72 = Closure of fistula of duodenum 46.73 = Suture of laceration of small intestine, except duodenum 46.74 = Closure of fistula of small intestine, except duodenum 46.93 = Revision of anastomosis of small intestine
REC 48.5 = Abdominoperineal resection of rectum (till 2008-10-10) 48.6 = Other resection of rectum 48.61 = Transsacral rectosigmoidectomy 48.62 = Anterior resection of rectum with synchronous colostomy 48.63 = Other anterior resection of rectum 48.64 = Posterior resection of rectum 48.65 = Duhamel resection of rectum 48.69 = Other resection of rectum	REC 48.25 = Open biopsy of rectum 48.35 = Local excision of rectal lesion or tissue 48.40 = Pull-through resection of rectum, not otherwise spec 48.42 = Laparoscopic pull-through resection of rectum 48.43 = Open pull-through resection of rectum 48.49 = Other pull-through resection of rectum 48.50 = Abdominoperineal resection of rectum, not specified 48.51 = Laparoscopic abdominoperineal resection of the rectum 48.52 = Open abdominoperineal resection of the rectum 48.59 = Other abdominoperineal resection of the rectum 48.74 = Rectorectostomy
HPRO 81.5 = Joint replacement of lower extremity	HPRO 00.70 = Revision of hip replacement, both acetabular and

ICD-9-CM code list of surgical procedures for EU surveillance	Other allowed operation codes included in NHSN	
81.51 = Total hip replacement 81.52 = Partial hip replacement 81.53 = Revision of hip replacement	femoral components 00.71 = Revision of hip replacement, acetabular component 00.72 = Revision of hip replacement, femoral components 00.73 = Revision of hip replacement, acetabularliner and/or femoral head only 00.85 = Resurfacing hip, total acetabulum, and femoral head 00.86 = Resurfacing hip, partial, femoral head 00.87 = Resurfacing hip, partial, acetabulum	
KPRO 00.80 = Revision of knee replacement, total (all components) 00.81 = Revision of knee replacement, tibial component 00.82 = Revision of knee replacement, femoral component 00.83 = Revision of knee replacement, patellar component 00.84 = Revision of knee replacement, tibial insert (liner) 81.54 = Total knee replacement 81.55 = Revision of knee replacement	KPRO <same>	
LAM 03.0 = Exploration and decompression of spinal canal structures 03.01 = Removal of foreign body from spinal canal 03.02 = Reopening of laminectomy site 03.09 = Other exploration and decompression of spinal canal 80.5 = Excision or destruction of intervertebral disc 80.50 = Excision or destruction of intervertebral disc, unspecified 80.51 = Excision of intervertebral disc fibrosus 80.59 = Other destruction of intervertebral disc	LAM 80.53 = Repair of the anulus fibrosus with graft or prosthesis 80.54 = Other and unspecified repair of the anulus fibrosus 84.60 = Insertion of spinal disc prosthesis, not otherwise specified 84.61 = Insertion of partial spinal disc prosthesis, cervical 84.62 = Insertion of total spinal disc prosthesis, cervical 84.63 = Insertion of spinal disc prosthesis, thoracic 84.64 = Insertion of partial spinal disc prosthesis, lumbosacral 84.65 = Insertion of total spinal disc prosthesis, lumbosacral 84.66 = Revision or replacement of artificial spinal disc prosthesis, cervical 84.67 = Revision or replacement of artificial spinal disc prosthesis, thoracic 84.68 = Revision or replacement of artificial spinal disc prosthesis, lumbosacral 84.69 = Revision or replacement of artificial spinal disc prosthesis, not otherwise 84.80 = Insertion or replacement of interspinosus process device(s) 84.81 = Revision of interspinosus process device(s) 84.82 = Insertion or replacement of pedicle-based dynamic stabilisation device(s) 84.83 = Revision of pedicle-based dynamic stabilisation device(s) 84.84 = Insertion of replacement of facet replacement device(s) 84.85 = Revision of facet replacement device(s)	
CBGB 36.1 = Bypass anastomosis for heart revascularisation 36.10 = Aortocoronary bypass for heart revascularisation 36.11 = Aortocoronary bypass of one coronary artery 36.12 = Aortocoronary bypass of two coronary arteries 36.13 = Aortocoronary bypass of three coronary arteries 36.14 = Aortocoronary bypass of four or more coronary arteries 36.19 = Other bypass anastomosis for heart revascularisation	CBGB <same>	CABG <same>
CBGC 36.15 = Single internal mammary-coronary artery bypass 36.16 = Double internal mammary-coronary artery bypass 36.17 = Abdominal – coronary artery bypass 36.2 = Heart revascularisation by arterial implant	CBGC <same>	
CHOL 51.0 = Cholecystotomy and cholecystostomy 51.03 = Other cholecystostomy 51.04 = Other cholecystotomy 51.2 = Cholecystectomy 51.21 = Other partial cholecystectomy	CHOL 51.13 = Open biopsy of gallbladder or bile ducts	

ICD-9-CM code list of surgical procedures for EU surveillance	Other allowed operation codes included in NHSN
51.22 = Cholecystectomy 51.23 = Laparoscopic cholecystectomy 51.24 = Laparoscopic partial cholecystectomy	
CSEC 74.0 = Classical caesarean section 74.1 = Low cervical caesarean section 74.2 = Extraperitoneal caesarean section 74.4 = Caesarean section of other specified type 74.9 = Caesarean section of unspecified type 74.91 = Hysterotomy to terminate pregnancy 74.99 = Other caesarean section of unspecified type	CSEC <same>
CARD 35.00 = Closed heart valvotomy, unspecified valve 35.01 = Closed heart valvotomy, aortic valve 35.02 = Closed heart valvotomy, mitral valve 35.03 = Closed heart valvotomy, pulmonary valve 35.04 = Closed heart valvotomy, tricuspid valve 35.06 = Transapical replacement of aortic valve 35.08 = Transapical replacement of pulmonary valve 35.10 = Open heart valvuloplasty without replacement, unspecified valve 35.11 = Open heart valvuloplasty of aortic valve without replacement 35.12 = Open heart valvuloplasty of mitral valve without replacement 35.13 = Open heart valvuloplasty of pulmonary valve without replacement 35.14 = Open heart valvuloplasty of tricuspid valve without replacement 35.20 = Replacement of unspecified heart valve 35.21 = Open and other replacement of aortic valve with tissue graft 35.22 = Open and other replacement of aortic valve 35.23 = Open and other replacement of mitral valve with tissue graft 35.24 = Open and other replacement of mitral valve 35.25 = Open and other replacement of pulmonary valve with tissue graft 35.26 = Open and other replacement of pulmonary valve 35.27 = Open and other replacement of tricuspid valve with tissue graft 35.28= Open and other replacement of tricuspid valve 35.31 = Operations on papillary muscle 35.32 = Operations on chordae tendineae 35.33 = Annuloplasty 35.34 = Infundibulectomy 35.35 = Operations on trabeculae carneae cordis 35.39 = Operations on other structures adjacent to valves of heart 35.42 = Creation of septal defect in heart 35.50 = Repair of unspecified septal defect of heart with prosthesis 35.51 = Repair of atrial septal defect with prosthesis, open technique 35.53 = Repair of ventricular septal defect with prosthesis, open technique 35.54 = Repair of endocardial cushion defect with prosthesis 35.60 = Repair of unspecified septal defect of heart with tissue graft 35.61 = Repair of atrial septal defect with tissue graft 35.62 = Repair of ventricular septal defect with tissue graft 36.63 = Repair of endocardial cushion defect with tissue graft 35.70 = Other and unspecified repair of unspecified septal defect of heart 35.71 = Other and unspecified repair of atrial septal defect	CARD <same>

ICD-9-CM code list of surgical procedures for EU surveillance	Other allowed operation codes included in NHSN
35.72 = Other and unspecified repair of ventricular septal defect 35.73 = Other and unspecified repair of endocardial cushion defect 35.81 = Total repair of tetralogy of Fallot 35.82 = Total repair of total anomalous pulmonary venous connection 35.83 = Total repair of truncus arteriosus 35.84 = Total correction of transposition of great vessels, not elsewhere classified 35.91 = Interatrial transposition of venous return 35.92 = Creation of conduit between right ventricle and pulmonary artery 35.93 = Creation of conduit between left ventricle and aorta 35.94 = Creation of conduit between atrium and pulmonary artery 35.95 = Revision of corrective procedure on heart 35.98 = Other operations on septa of heart 35.99 = Other operations on valves of heart 37.10 = Incision of heart, not otherwise specified 37.11 = Cardiotomy 37.12 = Pericardiotomy 37.31 = Pericardiectomy 37.32 = Excision of aneurysm of heart 37.33 = Excision or destruction of other lesion or tissue of heart, open approach 37.35 = Partial ventriculectomy 37.37 = Excision or destruction of other lesion or tissue of heart,thorac.approach 37.41 = Implantation of prosthetic cardiac support device around the heart 37.49 = Other repair of heart and pericardium 37.60 = Implantation or insertion of biventricular external heart assist system	

Annex 2. Microorganisms code list

The code list is adapted from the original WHOCARE coding system. The current list is a selection of microorganisms based on their frequency of occurrence in healthcare-associated 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.

Microorganism selection and minimal list

	Microorganism	Code	Minimal list
Gram-positive 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 spp., not specified	STANSP	**GPCTOT**
	Streptococcus pneumoniae	STRPNE	**STRSPP**
	Streptococcus agalactiae (B)	STRAGA	
	Streptococcus pyogenes (A)	STRPYO	
	Other haemol. Streptococcae (C, G)	STRHCG	
	Streptococcus spp., other	STROTH	
	Streptococcus spp., not specified	STRNSP	
	Enterococcus faecalis	ENCFAE	**ENCSPP**
	Enterococcus faecium	ENCFAI	
	Enterococcus spp., other	ENCOTH	
	Enterococcus spp., not specified	ENCNSP	
	Gram-positive cocci, not specified	GPCNSP	**GPCTOT**
	Other Gram-positive cocci	GPCOTH	
Gram-negative cocci	*Moraxella catharralis*	MORCAT	**GNCTOT**
	Moraxella spp., *other*	MOROTH	
	Moraxella spp., *not specified*	MORNSP	
	Neisseria meningitidis	NEIMEN	
	Neisseria spp., other	NEIOTH	
	Neisseria spp., not specified	NEINSP	
	Gram-negative cocci, not specified	GNCNSP	
	Other Gram-negative cocci	GNCOTH	
Gram-positive bacilli	*Corynebacterium* spp.	CORSPP	**GPBTOT**
	Bacillus spp.	BACSPP	
	Lactobacillus spp.	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 spp., other	CITOTH	
	Citrobacter spp., not specified	CITNSP	
	Enterobacter cloacae	ENBCLO	**ENBSPP**
Enterobacteriaceae (continued)	*Enterobacter aerogenes*	ENBAER	
	Enterobacter agglomerans	ENBAGG	
	Enterobacter sakazakii	ENBSAK	
	Enterobacter gergoviae	ENBGER	
	Enterobacter spp., other	ENBOTH	
	Enterobacter spp., not specified	ENBNSP	
	Escherichia coli	ESCCOL	**ESCCOL**
	Klebsiella pneumoniae	KLEPNE	**KLESPP**
	Klebsiella oxytoca	KLEOXY	
	Klebsiella spp., other	KLEOTH	
	Klebsiella spp., not specified	KLENSP	

	Microorganism	Code	Minimal list
	Proteus mirabilis	PRTMIR	**PRTSPP**
	Proteus vulgaris	PRTVUL	
	Proteus spp., other	PRTOTH	
	Proteus spp., not specified	PRTNSP	
	Serratia marcescens	SERMAR	**SERSPP**
	Serratia liquefaciens	SERLIQ	
	Serratia spp., other	SEROTH	
	Serratia spp., not specified	SERNSP	
	Hafnia spp.	HAFSPP	**ETBTOT**
	Morganella spp.	MOGSPP	
	Providencia spp.	PRVSPP	
	Salmonella Enteritidis	SALENT	
	Salmonella Typhi or Paratyphi	SALTYP	
	Salmonella Typhimurium	SALTYM	
	Salmonella spp., not specified	SALNSP	
	Salmonella spp., other	SALOTH	
	Shigella spp.	SHISPP	
	Yersinia spp.	YERSPP	
	Other enterobacteriaceae	ETBOTH	
	Enterobacteriaceae, not specified	ETBNSP	
Gram-negative bacilli	*Acinetobacter baumannii*	ACIBAU	**ACISPP**
	Acinetobacter calcoaceticus	ACICAL	
	Acinetobacter haemolyticus	ACIHAE	
	Acinetobacter lwoffii	ACILWO	
	Acinetobacter spp., other	ACIOTH	
	Acinetobacter spp., not specified	ACINSP	
	Pseudomonas aeruginosa	PSEAER	**PSEAER**
	Stenotrophomonas maltophilia	STEMAL	**STEMAL**
	Burkholderia cepacia	BURCEP	**PSETOT**
	Pseudomonadaceae family, other	PSEOTH	
	Pseudomonadaceae family, not specified	PSENSP	
	Haemophilus influenzae	HAEINF	**HAESPP**
	Haemophilus parainfluenzae	HAEPAI	
	Haemophilus spp., other	HAEOTH	
	Haemophilus spp., not specified	HAENSP	
Gram-negative bacilli (continuation)	*Legionella* spp.	LEGSPP	**LEGSPP**
	Achromobacter spp.	ACHSPP	**GNBTOT**
	Aeromonas spp.	AEMSPP	
	Agrobacterium spp.	AGRSPP	
	Alcaligenes spp.	ALCSPP	
	Campylobacter spp.	CAMSPP	
	Flavobacterium spp.	FLASPP	
	Gardnerella spp.	GARSPP	
	Helicobacter pylori	HELPYL	
	Pasteurella spp.	PASSPP	
	Gram-negative bacilli, not specified	GNBNSP	
	Other Gram-negative bacilli, non enterobacteriaceae	GNBOTH	
Anaerobes	*Bacteroides fragilis*	BATFRA	**BATSPP**
	Bacteroides other	BATOTH	
	Bacteroides spp., not specified	BATNSP	
	Clostridium difficile	CLODIF	**ANATOT**
	Clostridium other	CLOOTH	
	Propionibacterium spp.	PROSPP	
	Prevotella spp.	PRESPP	
	Anaerobes, not specified	ANANSP	
	Other anaerobes	ANAOTH	

	Microorganism	Code	Minimal list
Other bacteria	Mycobacterium, atypical	MYCATY	**BCTTOT**
	Mycobacterium tuberculosis complex	MYCTUB	
	Chlamydia spp.	CHLSPP	
	Mycoplasma spp.	MYPSPP	
	Actinomyces spp.	ACTSPP	
	Nocardia spp.	NOCSPP	
	Other bacteria	BCTOTH	
	Other bacteria, not specified	BCTNSP	
Fungi	*Candida albicans*	CANALB	**CANSPP**
	Candida auris	CANAUR	
	Candida glabrata	CANGLA	
	Candida krusei	CANKRU	
	Candida tropicalis	CANTRO	
	Candida parapsilosis	CANPAR	
	Candida spp., other	CANOTH	
	Candida spp., not specified	CANNSP	
	Aspergillus fumigatus	ASPFUM	**ASPSPP**
	Aspergillus niger	ASPNIG	
	Aspergillus spp., other	ASPOTH	
	Aspergillus spp., not specified	ASPNSP	
	Other yeasts	YEAOTH	**PARTOT**
	Fungi other	FUNOTH	
	Fungi, not specified	FUNNSP	
	Filaments other	FILOTH	
	Other parasites	PAROTH	
Viruses	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	
	Norovirus	VIRNOR	
	Parainfluenzavirus	VIRPIV	
	Respiratory syncytial virus (RSV)	VIRRSV	
	Rhinovirus	VIRRHI	
	Rotavirus	VIRROT	
	SARS virus	VIRSAR	
	Varicella-zoster virus	VIRVZV	
	Virus, not specified	VIRNSP	
	Other virus	VIROTH	
Microorganism not identified or not found		_NONID	**_NONID**
Examination not done		_NOEXA	**_NOEXA**
Sterile examination		_STERI	**_STERI**
Result not (yet) available or missing		_NA	**_NA**

_NONID: evidence exists that a microbiological examination has been done, but the microorganism cannot be correctly classified or the result of the examination cannot 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), _NA Result not (yet) available or missing.

Annex 3. Antimicrobial resistance markers and codes

Recommended method to collect AMR markers:

For each AMR marker, indicate whether the microorganism was susceptible (S), intermediate (I), resistant (R) or susceptibility unknown (U), for the following antimicrobials:

Staphylococcus aureus:

- Meticillin-resistant *S. aureus* (MRSA): Susceptibility to oxacillin (OXA) or other marker of MRSA such as cefoxitin (FOX), cloxacillin (CLO), dicloxacillin (DIC), flucloxacillin (FLC), meticillin (MET)
- Vancomycin-intermediate or vancomycin-resistant *S. aureus* (VISA, VRSA): Susceptibility to glycopeptides (GLY): vancomycin (VAN) or teicoplanin (TEC)

Enterococcus spp.:

- • Vancomycin-resistant *Enterococcus* spp. (VRE): Susceptibility to glycopeptides (GLY): vancomycin (VAN) or teicoplanin (TEC)

Enterobacteriaceae (Escherichia coli, Klebsiella spp., Enterobacter spp., Proteus spp., Citrobacter spp., Serratia spp., Morganella spp.)

- Susceptibility to third-generation cephalosporins (C3G): cefotaxime (CTX), ceftriaxone (CRO), ceftazidime (CAZ)
- Susceptibility to carbapenems (CAR): imipenem (IPM), meropenem (MEM), doripenem (DOR)

Pseudomonas aeruginosa:

- Susceptibility to carbapenems (CAR): imipenem (IPM), meropenem (MEM), doripenem (DOR)

Acinetobacter spp.:

- Susceptibility to carbapenems (CAR): imipenem (IPM), meropenem (MEM), doripenem (DOR)

If AMR markers are collected in accordance with the HAI-Net ECDC PPS I protocol methodology (not recommended), report S (susceptible), IR (non-susceptible) or U (unknown), except for MRSA, report nonsusceptibility to oxacillin (or equivalent) as R (resistant).

Previously used AMR markers (0,1,2,9), as indicated in the HAI-SSI protocol v1.02, must not be used.

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