ITS KISS

Protocol

Surveillance of patients with multi-resistant pathogens (MRE) and/or *Clostridioides difficile* infections(CDI)

in intensive care units and non-intensive care units

on

Institute of Hygiene and Environmental Medicine
Charité - University Medicine Berlin

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1. Introduction and objectives

MRE surveillance:

Meaning of MRE

The treatment of patients in hospital is sometimes complicated by the presence of multi-resistant pathogens (MRE).

MREs make treatment more difficult because the pathogens are typically no longer sufficiently sensitive to the antibiotics of first choice and other agents must be used to treat infections. In some cases, only a few or no antibiotics are available for effective treatment. But it is not only the more difficult treatment that complicates the care of patients with MRE. As MRE can be transmitted to other patients in hospital, measures must be taken to minimise the risk of transmission. This means that more personnel, time and material resources are required to care for patients with MRE.

Meaning of CDI

Clostridioides difficile are the most common anaerobic pathogens of nosocomial infections. In addition to *Clostridioides difficile* associated diarrhoea (CDI), they cause the most severe
diseases such as pseudomembranous enterocolitis and the often fatal toxic enterocolitis. Megacolon.

Surveillance of MRE/CDI

Surveillance is the ongoing, systematic collection, analysis and interpretation of health data necessary for the planning, implementation and evaluation of medical interventions; this includes the up-to-date transmission of data to those who need this information.

With the surveillance of MRE/CDI cases, data on the frequency of MRE/CDI cases can be obtained and measures for prevention can be adapted. In addition, MRE/CDI outbreaks may also be detected earlier. Recording data in accordance with KISS is used for quality assurance in the hospital itself. As the distribution of patients with MRE in a hospital is usually different, it makes sense to consider the MRE/CDI situation for individual wards separately (ward-based surveillance). In MRE surveillance, both MRE/CDI cases acquired on the ward and MRE/CDI cases brought to the ward are recorded.

MRE surveillance can be carried out for patients with different types of MRE or CDI.

The following multi-resistant pathogens or pathogen groups (MRE/MRE groups) or CDI can be selected and combined with each other for surveillance in MRE surveillance (so-called surveillance components):

- Methicillin-resistant *Staphylococcus aureus* (**MRSA**)
- Resistant *Enterococcus faecium* and *Enterococcus faecalis*, including vancomycin-resistant enterococci (**VRE**
- Linezolid and vancomycin-resistant Enterococcus faecium and Enterococcus faecalis (LVRE)
- Linezolid-resistant Enterococcus faecium and Enterococcus faecales (LRE)
- Multi-resistant Gram-negative bacteria with resistance to 3 or 4 classes of antibiotics (**MRGN**)
- *Clostridioides difficile* associated infections (**CDI**)

The definitions for the MRE/CDI are described in chapter 4.3.

The wards have the option of selecting individual MRE groups or CDI for surveillance (so-called surveillance components). The surveillance components can be freely combined by the ward; for example, a surgical intensive care unit could select the MRSA and MRGN components, while a peripheral oncology ward could conduct surveillance for VRE and CDI. At least one of the surveillance components must always be selected for participation in MRE surveillance.

When selecting an MRE group, all pathogen species to which the definition applies must always be included in the surveillance. For example, when selecting the resistant enterococci group, both *Enterococcus faecium* and *Enterococcus faecalis* with resistance to vancomycin and/or linzeolid must be included in MRE surveillance. A restriction to *Enterococcus faecium* only is not possible. The same applies to the selection of MRGN. Here too, the entire group of 3- and 4-antibiotic class MRGN (as well as the 2MRGN NeoPaed for paediatric patients) must be included in surveillance. A restriction to individual pathogens or groups is not possible.

Surveillance takes place regardless of whether the MRE/CDI was already brought to the ward or was only acquired on the ward. In MRE surveillance, all patients with the selected MRE are recorded, regardless of whether they are infections or colonisations with the MRE. *Clostridioides difficile* is only recorded for patients who fulfil the case definition for CDI.

The wards participating in MRE surveillance transmit their data to the NRC. This enables the frequency of MRE/CDI under surveillance to be analysed for each ward. In addition, the data from all wards is summarised over the evaluation period and, if sufficient data is available , made available as reference data for comparison.

Differences between different stations or time periods can provide an indication of problems that should then be investigated in more detail.

Participation in MRE surveillance is possible for both intensive care units and non-intensive care units irrespective of participation in other KISS modules. If required, a

ward participating in MRE surveillance can also take part in other KISS modules. Surveillance of nosocomial infections is also possible for intensive care units (see infection surveillance protocol in ITS-KISS). Surveillance of device-associated nosocomial infections is possible for non-intensive care units (see infection surveillance protocol in STATIONS-KISS).

The primary task of the surveillance protocol is to provide the necessary definitions and specifications for the hospitals involved in MRE surveillance. The aim is to standardise data collection and data analysis.

Secondly, other interested hospitals can also record according to these definitions and specifications and analyse their data analogously.

2. Requirements for the participation of wards in MRE surveillance and obligations of the institutions supporting KISS

The participating stations must fulfil the following requirements:

- Consent of the chief physicians responsible for the ward to participate in the project.
- Employment of full-time hygiene specialists in the hospital
  (The hygiene specialist is the most important contact person for the KISS and is responsible for the organisation of surveillance in the hospital.
  The employment of a hospital hygienist is desirable, but not an absolute requirement).
- Application of the mandatory provisions of the surveillance protocol (in addition, hospitals can record further data relevant to quality management).
- Surveillance of at least one of the MRE (MRSA, resistant enterococci, MRGN) or CDI available for selection in MRE surveillance.
- Registration in the web-based surveillance portal provided by the NRZ with a personal, individual e-mail address.
- Communication of descriptive parameters (structural and process parameters of the ward and the hospital, e.g. size of the hospital, screening for MRE).
- Willingness to carry out internal quality assurance measures in the event of corresponding findings from surveillance.

The institutions supporting the KISS assure the hospitals,

- to advise and support them professionally in the implementation of surveillance,
- to handle the data of the individual stations with strict confidentiality,
- to enable the participating hospitals to analyse the data,
- advise them on the implementation of the surveillance results for quality management.

3. Methods for the surveillance of pathogens with particular resistances and CDI

The methods proposed by KISS are primarily intended to support internal quality assurance measures.

3.1 Implementation of the surveillance

The pathogens surveillance are determined on a monthly basis, with the shortest detection period being one calendar month.

The following data is recorded daily and entered in the **monthly form for MRE surveillance wards** (see appendix, we recommend using the midnight statistics). MRE surveillance wards that also participate in ITS or ward KISS do not need to complete another monthly form, as the data required for MRE surveillance is then already available.

Mandatory recording within the MRE surveillance station:

1. Number of all new patients admitted to the ward. (All patients admitted to the ward in the last 24 hours are counted, including those who are no longer present at the time of the count and who may only have been on the ward for a few hours)
2. Number of patients on this day (at a certain time of day, e.g. midnight)

At the end of the month, the totals for 1. and 2. are calculated to determine the number of newly admitted patients during the month and the total number of all patient days on the ward.

If a patient is colonised or infected with an MRE selected in the MRE surveillance or if there is a CDI case according to the case definition, the patient is registered as an MRE/CDI case and further data is collected (see chapter 4.3 MRE/CDI case sheet).

- Attention:
  In MRE/CDI surveillance, all patients with the MRE/CDI selected for surveillance are documented, even if the MRE or CDI disease was already known on admission to the ward.
- Attention:
  In addition to MRE infections, MRE surveillance also documents pure colonisations with MRE

4. Specifications for the documentation

4.1 Electronic recording of survey data

The NRZ provides KISS participants with an electronic system for recording surveillance data. The webKess programme is used for this purpose. webKess can be accessed at the Internet address: www.webkess.de. webKess enables the recording of the station's surveillance data. Furthermore, each participant can create station-related analyses independently at any time.

In order to ensure that the reference data calculation takes into account the latest data, KISS participants are obliged to complete the survey data for the previous year by 15 February of the following calendar year.

If webKess is temporarily unavailable due to technical problems, the data entry forms contained in this protocol should be used for documentation during this period. This data must then be subsequently entered in webKess.

4.2 Monthly questionnaire for MRE surveillance wards

The monthly questionnaire is ideally completed by the ward staff. The *number of newly admitted patients* and the *number of patients* (see below) are recorded daily at the same fixed time of day (e.g. as part of the midnight statistics). Monthly totals for the individual columns are then calculated from the monthly sheet (an example documentation sheet is shown in the appendix). Only the totals of the columns per month are transmitted to the NRC. The following information is required (documentation should always be submitted at the same time of day if possible (e.g. midnight statistics).

Month/year	Month and year from which the data originates

Table:

Number of newly admitted patients	Number of all patients admitted to the ward in the last 24 hours (including patients only present for a short time who are no longer present at the time of documentation, e.g. at midnight).
Number of patients	Number of patients at the time of the count (even patients who have only recently been admitted and are present at the time of the count are counted; documentation should always be done at the same time of day, e.g. midnight).

If a ward participates in MRE/CDI surveillance and infection surveillance in ITS-KISS or ward KISS at the same time, the data from the monthly questionnaire in webKess only needs to be entered once for the ward

4.3 MRE/CDI case sheet

If there is a patient on the ward who is known to be colonised or infected with an MRE under surveillance or who meets the definition for CDI, the patient is documented as an MRE case or CDI case and certain data must be recorded for this case.

An MRE case must also be documented if the patient has an already reported nosocomial infection during the same stay on the ward as part of infection recording, e.g. in ITS-KISS with the MRE. In this case, the basic data already created for this stay (patient ID, admission and discharge date, gender and year of birth) can be used for the documentation of the new MRE/CDI case.

The diagnosis of a CDI case is made if one or more criteria for CDI are present (for CDI criteria, see "Information on documenting a CDI case").

The distinction between MRE colonisations or MRE infections and CDI brought onto the ward and MRE or MRE infections and CDI acquired on the ward is made in MRE surveillance according to fixed time intervals and is made in relation to the MRE surveillance ward, not for the hospital.

The day on which the patient is admitted to the ward is considered day 1 of the stay.

Differentiation between MRE surveillance *brought to the ward* versus *acquired on the ward*

MRE to the ward

A pathogen is assumed to have been brought in if the pathogen was already detected **before admission** to the ward **or if the material** in which the pathogen **is** detected was **taken on day 1 or 2 of the stay**.

MRE on ward

If the test material in which the MRE is detected for the first time is taken **from day 3 of the stay** or later, the pathogen is assumed to have been acquired on the ward.

Figure 1: Classification of pathogens into "brought-in" and "ward-acquired" MREs

<table>
<tr><th>Admission to the ward</th><th></th><th></th><th></th><th></th><th></th><th>Discharge/transfer from the ward</th></tr>
<tr><td>Day 1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td colspan="2">Acceptance of the material from which the MRE is detected before admission or on days 1-2</td><td colspan="5">Acceptance of the material from which the MRE is detected, from day 3</td></tr>
<tr><td colspan="2">MRE brought along</td><td colspan="5">MRE acquired as an inpatient</td></tr>
</table>

It is documented whether the pathogen was already detected prior to admission to the ward or the date of material collection if detected after admission to the ward. The categorisation into "brought in" or "acquired" is carried out according to the above scheme.

Differentiation between infections brought to the ward versus acquired on the ward in the surveillance of infections with MRE involvement

The assignment of an infection with MRE involvement in "brought in/acquired on ward" is independent of the assignment of the MRE in "brought in/acquired on ward", see also specifications for documentation p. 22.

MRE infection brought to the ward

The infection is considered to be an acquired infection if there are already indications that the infection is present on admission to the ward (first symptoms, signs of infection before or on admission).

MRE involvement may already be present in the infections brought in on admission or may only be added during the stay on the ward (e.g. change of pathogen in the case of an existing infection).

The MRE infection is classified as brought in if the case definition for an infection is fulfilled and the first symptoms were already described prior to admission or first appear on day 1 or 2 of the stay.

MRE infection acquired on ward

The infection is considered to have been acquired on the ward if there is no evidence that the infection was already present on admission to the ward.

The MRE infection is classified as acquired if the case definition for an infection is fulfilled and the first symptoms appeared from day 3 of the stay or later.

Figure 2: Classification of infections with MRE involvement into "brought in" and "acquired on the ward"

Admission to the ward						Discharge/transfer from the station
Day 1	2	3	4	5	6	7
First symptoms before admission or on days		First symptoms from day 3				
Infection brought along		**Infection acquired in hospital**				

It is documented whether the first symptoms of the infection already existed before admission to the ward or the date of the material collection at the onset of symptoms after admission to the ward. The categorisation into "brought in" or "acquired" is carried out according to the above scheme.

Distinction between *brought on ward* versus *acquired on ward* for CDI surveillance

CDI to the station

CDI is classified as brought in if the case definition for CDI is fulfilled and the first symptoms were already described **prior to admission or first** appear **on day 1 or 2 of the stay**

CDI on station

CDI is classified as acquired on the ward if the case definition for CDI is met and the **first symptoms occur on day 3 or later of the stay** on the ward.

Figure 3: Classification of CDI into "brought in" and "acquired on the ward"

Admission to the ward						Discharge/transfer from the station
Day 1	2	3	4	5	6	7
First symptoms already before admission or on days		First symptoms from day 3				
CDI brought along		**Stationary acquired CDI**				

MRE surveillance should be recorded by the hygiene specialist or other persons familiar with the specifications of the MRE surveillance protocol.

(Examples of data entry forms are shown in the appendix)

Master data of the MRE surveillance station

The following information is required when registering a station in webKess (fields marked with * only if data is not already available via another KISS module):

Master data:	
Hospital	The hospital abbreviation is assigned by the NRZ.
Station	The station abbreviation is assigned by the NRZ.
Number of beds*	Specify the number of beds in the MRE surveillance ward
Type of ward* (intensive care unit/non-intensive care unit)	Indication of whether the ward is an intensive care unit or a peripheral non-intensive care unit.
Type of station*	Various ward types can be selected in webKess. The assignment is not based on the speciality that manages the ward, but should correspond to the majority of patients treated. Select "surgical" for predominantly surgical patients (even if they come from different specialities, e.g. traumatology, ENT and general surgery). Select "internal" for patients receiving predominantly conservative care. If the proportion of patients treated conservatively and surgically is approximately the same, select "interdisciplinary". Select "geriatric", "rehabilitation", "paediatric" or another of the specified options. Wards that do not fit into the given scheme select "other" and enter the relevant ward in the associated text field.

Surveillance plan for the MRE surveillance station

The surveillance components under Surveillance and the corresponding surveillance periods must be selected.

Selection of surveillance components	Indication for which of the MRE/CDI a surveillance of cases is carried out. Selection of at least one of the following MRE/CDI: o MRSA o Resistant enterococci o MRGN o CDI
period	The surveillance period is configured by the user per surveillance component per month at the beginning of a calendar year (in webKess under the menu item "Administration"). It is important that surveillance is actually carried out for the selected components within the specified months, as otherwise the results data will be falsified.

The following information must be provided per calendar year of MRE surveillance participation when selecting an MRE as a surveillance component

Electronic warning system	Indication of whether an electronic warning system (e.g. labelling of the electronic patient file) has been established on the ward for the admission of known MRE cases.
Type of MRE with electronic warning system	Indication for which of the MREs such a warning system has been established.
Routine admission screening for MRE	Indication of whether routine admission screening (for defined risk patients, e.g. contact patients or all patients) for MRE is established on the ward in general or on an ad hoc/time-limited basis.
Type of MRE with admission screening	Indication for which of the MREs such an admission screening has been established.
Routine screening for MRE during the course of the stay	Indication of whether routine screening for MRE is established on the ward in general or on an ad hoc/limited basis, even without suspicion of infection (for defined risk patients, e.g. contact patients or all patients).
Type of MRE with screening in the course	Indication of the MRE for which such screening is established during the course of a patient's inpatient stay.

Specifications and instructions for documenting an MRE case

The following information is required when documenting an MRE case:

MRE case

An MRE case is a patient on an MRE surveillance ward with an MRE recorded in MRE surveillance.

Patients with the following MRE can be documented in MRE surveillance.

- MRSA
- Resistant enterococci
- MRGN

MRE cases are counted, i.e. if an MRE patient is admitted again, it is considered a new case.

If a patient has more than one MRE under surveillance (e.g. MRSA and MRGN) or two different MRGN (e.g. ESBL *E.coli* and KPC-Klebsiella *pneumoniae*), a separate MRE case sheet must be created for each MRE

Definition of MRE

MRSA Methicillin-resistant *Staphylococcus aureus*

Resistant enterococci *Enterococcus faecium* and *Enterococcus faecalis* with one of the following resistance types:

- Vancomycin resistance
- Linezolid and vancomycin resistance
- Linezolid resistance

MRGN All multi-resistant Gram-negative bacteria (e.g. *Pseudomonas aeruginosa, E. coli, Klebsiella pneumoniae*) that are only sensitive/susceptible (S) to one (**3MRGN**) or none (**4MRGN**) of the following bactericidal antibiotic substance classes:

- Penicillins (also with beta-lactamase inhibitor)
- Cephalosporins
- Carbapenems
- Fluoroquinolones

Sensitivity to aminoglycosides, fosfomycin, colistin, tigecycline is not taken into account.

The MRGN include the 3-class multi-resistant gram-negative bacteria (**3MRGN)** and the 4-class multi-resistant gram-negative bacteria (**4MRGN**).

If the above definition of MRGN (sensitive/susceptible (S) to only one or no antibiotic substance classes with a bactericidal effect) is fulfilled, this also includes, for example, the

- **ESBL (**extended-spectrum beta-lactamase) producing bacteria (e.g. *Klebsiella pneumoniae*, *E. coli*, *Proteus mirabilis*, etc.),
- Carbapenamase-producing gram-negative rods (**CPGN**) (e.g. in *Klebsiella pneumoniae, E. coli, Pseudomonas aeruginosa*)
- Multi-resistant *Acinetobacter baumannii* (**MACI**)

.

For paediatric patients, **2MRGN NeoPaed** is also considered, as fluoroquinolones are not a therapeutic option for this patient group.

Type of MRE

Indicate the type of MRE known/detected in the patient

- MRSA
- Resistant enterococci
- MRGN

MRSA

No further specification required

Resistant enterococci

Resistance type

- **VRE** (resistance to vancomycin)
- **LVRE** (resistance to linezolid and vancomycin)
- **LRE** (resistance to linezolid)

Bacterial species

The bacterial species must also be specified for all resistant enterococci

- *Enterococcus*
- *Enterococcus faecalis*.

MRGN

MRGN class

the case of MRGN, the MRGN class must also be specified:

- **2MRGN NeoPäd** [only sensitive/sensitive (S) to one bactericidal antibiotic substance class (penicillins - also with beta-lactamase inhibitor, cephalosporins, carbapenems), fluoroquinolones are ignored],
- **3MRGN** [only sensitive to one antibiotic substance class with bactericidal effect (penicillins - also with beta-lactamase inhibitor, cephalosporins, carbapenems, fluoroquinolones) (S)],
- **4MRGN** [not sensitive/sensitive to any antibiotic substance class with a bactericidal effect (penicillins - also with beta-lactamase inhibitor, cephalosporins, carbapenems, fluoroquinolones) (S)], and/or detection of carbapenemase

- **3MRGN or 4MRGN not differentiated** (e.g. ESBL detected on selective media without available antibiogram, this could also include pathogens that are classified as ESBL based on the detection method, but for which the definition for 3MRGN or 4MRGN is not fulfilled)

For bacteria that fulfil the definition of a 4MRGN, the simultaneously applicable classification as a 3MRGN must be ignored.

For patients who have two different MRGN (e.g. a 3MRGN ESBL-E. coli and a 4MRGN *Klebisiella pneumoniae*), a separate MRE case sheet must be created for each MRGN.

Bacterial species

For MRGN, the bacterial species must be specified. The species of the MRGN detected must be stated in accordance with the table in the appendix. If only the genus of the pathogen is known (e.g. *Klebsiella spp*.), without further differentiation, this must be stated accordingly. If a species is detected that is not listed in the table, this must be indicated under the corresponding genus under "Other" or, if the genus is not listed in the table, as "Other MRGN".

Carbapenemase tested

Indication of whether the MRGN has been tested for the presence of carbapenemase and whether the result is already available.

Type of carbapenemase

If carbapenemase is detected, indicate the type of carbapenemase (multiple entries possible):

- KPC-like
- OXA-48-like
- VIM-like
- NDM-like
- IMP-like
- OXA-23-like
- OXA-24/40-like
- OXA-58-like
- Other

Station date

Day, month and year of the patient's admission to this ward.

Discharge date

Day, month and year of discharge from this ward.

Gender

Enter female or male.

Year of birth

Year of birth of the patient.

Acquisition

Indication of whether the MRE was detected before admission to the ward.

If MRE is detected after admission to the ward, state the date (date

of material collection) on which the MRE was first detected.

MRE colonisation was already known on admission (even if only communicated verbally) or evidence from a material taken on day 1 of stay (day of admission) or day 2 of stay on the ward.

MRE is isolated for the first time from an examination material taken on day 3 or later on this ward .

This also applies if it cannot be ruled out that colonisation with MRE may already have been present on admission, but no test material was taken in the first three days and no evidence is available from pre-treatment hospitals/wards/doctors.

Special case Pseudomonas aeruginosa

In Pseudomonas aeruginosa carriers, "resistance progression" is often observed during treatment. In order to differentiate between newly identified, hospital-acquired MRGN and mutations/selections under ongoing antibiotic therapy, it is also indicated whether a less resistant variant of the pathogen was already known. For example, if a patient with 3MRGN-Pseudomonas *aeruginosa* is admitted and a *4MRGN-Pseudomonas aeruginosa* is detected during the inpatient stay, it must be labelled as "hospital-acquired". In addition, the field

- Less resistant variant of the pathogen already known

marked.

Clinical relevance of MRE colonisation

This question is intended to allow statements on the therapeutic consequences of MRE colonisation during the entire stay on the ward. Only one selection is permitted.
An MRE infection resulting from a previous MRE colonisation is indicated as an MRE infection. The clinical relevance can therefore only be conclusively assessed upon discharge/transfer from the ward

During the ward stay...

...patient was only colonised with the MRE

Patient is only colonised with the MRE during the stay on the ward and has no infection with the MRE.

...there was an MRE Infection before

The decision on the presence of an MRE infection is made on the basis of clinical findings and the results of laboratory medicine/microbiology in combination with a therapy for infection.

Patient has an MRE infection according to the following definition:

Local or systemic signs of infection are present in response to the presence of microorganisms or their toxins

AND

MRE involvement is clinically probable and/or microbiologically confirmed

AND

treatment (antimicrobial therapy or surgical intervention) is carried out due to infection.

Pure sanitising measures (e.g. Mupirocin nasal ointment) are not

considered therapy.

Additional information for MRE infections

Type of MRE infection

Indicate the type of infection in which MRE involvement is clinically probable and/or microbiologically confirmed. Multiple selection is possible.

Allocation of infection to brought in/acquired on ward

For each MRE infection, it must be stated whether the first symptoms of the infection already existed before admission.

If the first symptoms of infection appear after admission to the ward, state the date.

Infection brought to the ward

The infection is considered to be an acquired infection if there are already indications that the infection is present on admission to the ward (first symptoms, signs of infection before or on admission).

MRE involvement may already be present in the infections brought in on admission or may only be added during the stay on the ward.

Infection acquired on ward

The infection is considered to have been acquired on the ward if there is no evidence that the infection was already present on admission to the ward.

Notes on documentation MRE brought in/acquired on ward and infection brought in/acquired on ward

This allocation of an infection with MRE involvement to "brought in/acquired on ward" is independent of the allocation of the MRE to "brought in/acquired on ward". The following examples are intended to illustrate this:

Example 1:

Epicrisis: A patient is admitted to the ward with pneumonia. The pathogen identified on admission is *Streptococcus pneumoniae* . On day 6, an ESBL-producing *Klebsiella pneumoniae* is detected for the first time in deep airway secretions, which fulfils the definition of a 3MRGN.

Documentation in MRE surveillance: In MRE surveillance, this would be an MRGN case in which the MRGN would have to be classified as "MRE acquired on ward" with an MRE infection of the infection type "pneumonia" to be documented, which would have to be documented as a brought-in infection.

Example 2:

Epicrisis: A known MRSA patient is admitted to the ward. All signs of infection are unremarkable on admission. On day 2, the patient receives a hip replacement. On the 4th postoperative day, the patient develops a wound infection. MRSA is isolated from the wound swab.

Documentation in MRE surveillance: In MRE surveillance, this would be an MRSA case in which the MRSA would have to be classified as "brought-in MRE" with an MRE infection of the infection type "post-operative wound infection" to be documented, which would have to be documented as an infection acquired on the ward

Other:

Secondary sepsis:	Marking if secondary sepsis occurs as a complication of the MRE infection on the ward. Secondary sepsis is defined as sepsis confirmed by a blood culture with evidence of MRE originating from an MRE infection with the same MRE elsewhere.
Patient deceased	Mark if the MRE patient died on the ward (regardless of the cause of death).

Information on the documentation of a CDI case

The following information is required when documenting a CDI case:

CDI case	A CDI case must fulfil one or more of the following criteria: **1.** diarrhoea or toxic megacolon, and detection of *C. difficile* toxins or cultural detection of toxin-producing *C. difficile* in the stool or nucleic acid detection (e.g. PCR) of the *C. difficile* toxin A or B gene; **2.** pseudomembranous colitis proven by endoscopy**;** **3.** histopathological evidence of *C. difficile* infection (with or without diarrhoea) in an endoscopy, colectomy or autopsy. Asymptomatic patients with positive culture or toxin detection **do not** fulfil the case definition. CDI cases are counted, i.e. if a CDI patient is re-admitted, it is counted as a new case.
Station date	Day, month and year of the patient's admission to this ward.
Discharge date	Day, month and year of discharge from this ward.
Gender	Enter female or male.
Year of birth	Year of birth of the patient.
CDI acquisition	For each CDI, it must be stated whether the first symptoms already existed before admission. If the first symptoms of CDI occur after admission to the ward, state the date of symptom onset.
CDI was brought along	Symptoms of CDI already present on admission or on day 1 (day of admission) or 2 of stay on the ward.
CDI was acquired on station	First symptoms of CDI on day 3 of stay or later
CDI infection date	Date of the first symptoms of CDI. If the CDI is brought along, the date of the first proof is therefore before the date of admission up to a maximum of day 2 of the stay. In the case of CDI acquired on the ward, the date of first detection is usually after day 2 of the stay, but before the date of admission or on day 1, 2 in the case of recurrent infection.
CDI relapse	Indicate whether the CDI is a first-time episode or whether the patient has already had a CDI within the last 2 months. • First episode • Relapse (the patient already had a manifest CDI within the last 2 months) • Not known
Clinical relevance	Determining whether the CDI fulfils the definition of a serious case

CDI

Serious CDI case Indicate whether at least one criterion for a severe CDI case applies and name the applicable criterion(s).

Criteria for a severe CDI case:

- Admission or transfer to an intensive care unit due to CDI or its complications.
- Surgical intervention (e.g. colectomy) due to megacolon, intestinal perforation or therapy-refractory colitis.
- Death≤ 30 days after diagnosis and CDI as cause or disease contributing to death.

5. Analyses of MRE surveillance

The MRE evaluation provides an overview of the frequency with which patients on the ward are colonised or infected with MRE (MRSA/resistant enterococci/MRGN) or have a CDI disease and serves to describe the problem. The evaluation in MRE surveillance is stratified according to the type of MRE. The following data per MRE or CDI is generated or rates are calculated for the analysis (the values shown in red are calculated):

5.1 MRE evaluation

MRE station data

Patients with (MRSA or VRE or MRGN) (MRE brought along + acquired on the ward) **Value A**
Quantity

Patients with MRE brought along **Value B**	**Patients with MRE acquired on the ward** **Value C**
Quantity	Quantity

Patients colonised with MRE brought along **Value D**	**With MRE brought along Infected patients** **Value E**	**Patients colonised with MRE acquired on the ward** **Value F**	**With MRE acquired on the ward Infected patients** **Value G**
Quantity	Quantity	Quantity	Quantity

Including infection brought along **Value H**	**Including infection acquired on the ward** **Value I**
Quantity	Quantity

Including infection brought along **Value J**	**Including infection acquired on the ward** **Value K**
Quantity	Quantity

MRE rates

Proportion of inpatients with MRE Indicates the proportion of MRE patients among the patients on the ward			
Overall MRE prevalence	=	$\frac{\text{Number of cases (value A)}}{\text{Number of patients admitted}}$	x 100

Proportion of admitted patients with MRE Allows statements on MRE entry to the ward			
MRE admission prevalence	=	$\frac{\text{Number of MRE cases brought in (value B)}}{\text{Number of patients admitted}}$	x 100

New MRE acquisition rate on the ward Allows statements on the transmission/selection frequency of MRE on the ward			
Incidence density of MRE acquired on the ward	=	$\frac{\text{Number of MRE cases acquired on the ward (value C)}}{\text{Number of patient days}}$	x 1.000

Infection rate with MRE Indicates the proportion of patients for whom the MRE is therapeutically relevant			
Prevalence of MRE infections	=	$\frac{\text{Number of patients with MRE infection (value E + value G)}}{\text{Number of patients admitted}}$	x 100

New infection rate during the inpatient stay with the MRE Allows an assessment of the efficiency of infection control measures on the ward			
Incidence density of MRE infections acquired on the ward	=	$\frac{\text{Number of MRE infections acquired on the ward (value I + value K)}}{\text{Number of patient days}}$	x 1.000

New acquisition rate of MRE with subsequent MRE infection Allows an assessment of potential MRE infections to be avoided			
Incidence density of infections acquired on the ward with MRE acquired on the ward	=	$\frac{\text{Number of cases with MRE infection acquired on the ward with MRE acquired on the ward (value K)}}{\text{Number of patient days}}$	x 1.000

5.2 CDI evaluation

CDI station data

Patients with CDI (CDI brought along + CDI purchased on the ward) **Value A**
Quantity

Patients with CDI brought along **Value B**	**Patients with CDI acquired on the ward** **Value C**
Quantity	Quantity

CDI rates

Proportion of inpatients with CDI Indicates the proportion of CDI patients in the ward			
Overall CDI prevalence	=	$\frac{\text{Number of patients with (value A)}}{\text{Number of patients admitted}}$	x 100

Proportion of admitted patients with CDI Allows statements about the CDI entry on the station			
CDI uptake prevalence	=	$\frac{\text{Number of cases with CDI brought along (value B)}}{\text{Number of patients admitted}}$	x 100

New CDI acquisition rate on the ward Allows statements on the selection/transmission frequency of CDI on the ward			
Incidence density of CDI acquired on the ward	=	$\frac{\text{Number of cases with CDI acquired on the ward (value C)}}{\text{Number of patient days}}$	x 1.000

5.3 Example evaluation of a station

One ward with a selection of the surveillance components "resistant enterococci" and CDI has conducted surveillance for 10 months and has so far submitted the following data MRE surveillance:

Patients: 1716

Patient days: 7332

Resistant enterococci: 15 VRE cases

Serial no.	VRE brought along/acquired on ward	Colonised/infected with VRE	Infection with VRE
1	brought along	Infection	Infection acquired on ward
2	brought along	colonised	
3	brought along	Infection	Infection brought along
4	acquired on ward	Infection	Infection acquired on ward
5	acquired on ward	colonised	
6	brought along	colonised	
7	acquired on ward	colonised	
8	brought along	Infection	Infection brought along
9	brought along	colonised	
10	acquired on ward	colonised	
11	acquired on ward	colonised	
12	acquired on ward	Infection	Infection brought along
13	brought along	colonised	
14	brought along	Infection	Infection brought along
15	brought along	colonised	

CDI: 8 cases

Serial no.	CDI brought along/acquired on ward	Serious case
1	acquired on ward	Yes
2	brought along	Yes
3	acquired on ward	No
4	acquired on ward	No
5	brought along	No
6	acquired on ward	No
7	brought along	Yes
8	acquired on ward	No

MRE rates (VRE/resistant enterococci; example ward)

Patients with (AER brought along + AER acquired on the ward) **Value A** Quantity
15

Patients with VRE brought along **Value** Number (per cent of value A)	**Patients with VRE acquired on the ward** **Value** Number (per cent of value A)
9 (60%)	6 (40%)

Patients colonised with brought-in VRE **Value** Number (per cent of value B)	**With VRE brought along Infected patients** **Value** Number (per cent of value B)	**Patients colonised with VRE acquired on the ward** **Value** Number (per cent of value C)	**With VRE acquired on the ward Infected patients** **Value** Number (per cent of value C)
5 (56%)	4 (44%)	4 (67%)	2 (33%)

Including infection brought along **Value** Number (per cent of value E)	**Including infection acquired on the ward** **Value I** Number (per cent of value E)
3 (75%)	1 (25%)

Including infection brought along **Value J** Number (per cent of value G)	**Including infection acquired on the ward** **Value K** Number (per cent of value G)
1 (50%)	1 (50%)

MRE rates (VRE/resistant enterococci; example ward)

Proportion of inpatients with VRE Indicates the proportion of VRE patients among the patients on the ward					
Overall VRE prevalence	=	15 (value A) / 1.716 (patients)	x 100	=	**0,87**

Proportion of admitted patients with VRE Allows statements on VRE entry to the ward					
VRE uptake prevalence	=	9 (value B) / 1.716 (patients)	x 100	=	**0,52**

New acquisition rate of VRE on the ward Allows statements on the transmission/selection frequency of VRE on the ward					
Incidence density of VRE acquired on the ward	=	6 (value C) / 7.332 (patient days)	x 1.000	=	**0,82**

Infection rate with VRE Indicates the proportion of patients for whom AER has therapeutic relevance					
Prevalence of VRE infections	=	6 (value E + value G) / 1.716 (patients)	x 100	=	**0,35**

New infection rate during hospitalisation with VRE Allows an assessment of the efficiency of infection control measures on the ward					
Incidence density of infections with VRE acquired on the ward	=	2 (value I + value K) / 7.332 (patient days)	x 1.000	=	**0,27**

New acquisition rate of MRE with subsequent VRE infection Allows an assessment of potentially avoidable VRE infections					
Incidence density of infections acquired on the ward with VRE acquired on the ward	=	1 (value K) / 7.332 (patient days)	x 1.000	=	**0,14**

CDI station data (example station)

Patients with CDI (CDI brought along + CDI purchased on the ward)
Value Quantity
8

Patients with CDI brought along	Patients with CDI acquired on the ward
Value Number (per cent of value A)	**Value** Number (per cent of value A)
3 (37%)	5 (63%)

CDI rates (example station)

Proportion of inpatients with CDI Indicates the proportion of CDI patients in the ward						
Overall CDI prevalence	=	(value A) / 1.716 (patients)	x 100	=	**0,47**

Proportion of admitted patients with CDI Allows statements about the CDI entry on the station						
CDI uptake prevalence	=	3 (value B) / 1.716 (patients)	x 100	=	**0,17**

New CDI acquisition rate on the ward Allows statements on the selection/transmission frequency of CDI on the ward						
Incidence density of CDI acquired on the ward	=	5 (value C) / 7.332 (patient days)	x 1.000	=	**0,68**

5.4 Comparison of MRE/CDI rates

- An MRE/CDI evaluation can be created for the participating stations.
- In addition, the rates of all stations are summarised over the entire period and made available as reference data for comparison. The pooled arithmetic mean and, if sufficient data is available, the 25% quantile, the median and the 75% quantile are given for the MRE/CDI rates. (The 25% quantile is the value below which 25% of the participating stations lie with their rates. Accordingly, the median and the 75% quantile represent the values below which the rates of 50% and 75% of the stations are located).
- In addition, the rates are stratified according to the type of ward: Intensive care unit, non-intensive care unit, speciality if applicable

6. Imprint

National Reference Centre (NRC) for Surveillance of Nosocomial Infections

at the Institute of Hygiene and Environmental Medicine
(Director: Prof Dr Christine Geffers)
Charité-Universitätsmedizin Berlin
Hindenburgdamm 27
12203 Berlin
Tel.: 030/450577612
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Robert Koch Institute (RKI)
Department of Infectious Diseases,
FG 14: Applied Infection and Hospital Hygiene
Nordufer 20
13353 Berlin
Phone: 030/4547 2233
Fax: 030/4547 2612

KISS Contact:

Contact persons and addresses are listed on the NRZ homepage (www.nrz-hygiene.de)**.**

7. Appendix

The following forms (monthly form, MRE case form, CDI case form) can be used internally on the MRE surveillance wards to document the required data. The information on patient identification on the case forms is also used exclusively for internal documentation and should enable patients to be located in the event of queries. These forms, including the patient identification details, remain with the KISS participant and are not sent to the NRC.

The data to the NRZ is entered in webKess and forwarded electronically

Monthly sheet for MRE surveillance stations
(only to be completed if the ward is participating in ITS or ward KISS that month)

Hospital: _____

Month / Year: _____ Station: _____ Type of station: _____

Intensive care unit☐ care unit ☐

Day	Number of newly admitted patients	Number of patients
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		

Σ _____ _____

Number: **(patients)** **(patient days**

MRE case sheet

KISS - Hospital Infection Surveillance System

(Only to be completed for patients with MRE. Only one MRE per sheet)

MRSA ☐

VRE ☐
species:
E. faecium ☐
E. faecalis ☐

MRGN ☐

Specify MRGN class

2MRGN NeoPedagogy ☐ 3MRGN ☐ 4MRGN ☐ 3/4MRGN not differentiated ☐

Species:.....

Carbapenemase test initiated, result available ☐☐

Carbapenemase not detected ☐

Carbapenemase detected ☐

If a carbapenemase was detected, specify the type of carbapenemase (multiple entries permitted)

KPC-like ☐ OXA-48like ☐ NDM-like ☐ VIM-like ☐ Other ☐

.....

KRH abbreviation:..... **Ward abbreviation** ..... **Patient identifier**: .....

Ward admission date (first day on ward):: ☐☐. .☐☐☐☐☐☐

Ward discharge date (last day on ward): ☐☐. .☐☐☐☐☐☐
(specify date in the format: DD.MM.YYYY)

Gender: **w m**☐ ☐ **Year of birth** ☐☐☐☐

(only one selection allowed)

Proof of MRE **before** admission to the ward ☐

Proof of MRE **after** admission to the ward on ☐☐. .☐☐☐☐☐☐
(specify date in the format: DD.MM.YYYY)

During the ward stay (only one selection allowed)

...patient was **only colonised** with the MRE ☐

...an **MRE infection** was present ☐

If an MRE infection occurred during the inpatient stay, the following additional information is required:

	Type of MRE infection (multiple entries allowed)	First symptoms of this infection before admission to the ward	First symptoms after admission to the ward on (specify date in the format: DD.MM.YYYY)
Pneumonia	☐	☐	☐☐. .☐☐☐☐☐☐
Bronchitis	☐	☐	☐☐. .☐☐☐☐☐☐
Sepsis, primary	☐	☐	☐☐. .☐☐☐☐☐☐
Postoperative wound infection	☐	☐	☐☐. .☐☐☐☐☐☐
Skin infection (e.g. ulcer, decubitus)	☐	☐	☐☐. .☐☐☐☐☐☐
Urinary tract infection	☐	☐	☐☐. .☐☐☐☐☐☐
Other	☐	☐	☐☐. .☐☐☐☐☐☐

If "Other", specify type of infection

Miscellaneous

Secondary sepsis Yes ☐ ☐

Death	Yes ☐	☐

CDI case sheet

KISS - Hospital Infection Surveillance System

(Only to be completed for patients with *Clostridioides difficile* associated diarrhoea (CDI). Only one CDI case per form)

KRH abbreviation:..... **Ward abbreviation** ..... **Patient identifier**: .....

Ward admission date (first day on ward):: ☐☐. .☐☐☐☐☐☐

Ward discharge date (last day on ward): ☐☐. .☐☐☐☐☐☐
(specify date in the format: DD.MM.YYYY)

Gender: **w m**☐ ☐ **Year of birth** ☐☐☐☐

(only one selection allowed)

First CDI symptoms even **before** admission to the ward ☐

First CDI symptoms after admission to the ward on ☐☐. .☐☐☐☐☐☐
(specify date in the format: DD.MM.YYYY)

CDI relapse

First known episode	☐
Relapse within the last 2 months	☐
Unknown	☐

Clinical relevance of CDI

During the ward stay (only one selection allowed)

...met the definition of a severe CDI case **NOT** to	☐
...met the definition of a **severe CDI case**	☐

If there was a severe case of CDI during the inpatient stay, the following information is also required:

Applicable criterion for severe CDI case (multiple entries permitted)	
	☐
Admission/transfer to an intensive care unit for treatment of CDI or its complications.	☐
Surgical intervention (colectomy) due to megacolon, perforation or refractory colitis.	☐
Death <30 days after diagnosis and CDI as cause or disease contributing to death.	☐

Pathogen list (species to be selected for MRGN)

Genus	Species
Acinetobacter	*Acinetobacter* spp. (not further differentiated)
	Acinetobacter baumanii
	Acinetobacter calcoaceticus
	Acinetobacter lwoffii
	Acinetobacter haemolyticus
	Acinetobacter other (specify species)
Citrobacter	*Citrobacter spp.* (not further differentiated)
	Citrobacter freundii
	Citrobacter koseri
	Citrobacter other (specify species)
Escherichia	*Escherichia spp.* (not further differentiated)
	Escherichia coli
	Escherichia other (specify species)
	Enterobacter spp. (not further differentiated)
	Enterobacter cloacae
	Enterobacter aerogenes
	Enterobacter sakazakii
	Enterobacter other (specify species)
Klebsiella	*Klebsiella* spp. (not further differentiated)
	Klebsiella pneumoniae
	Klebsiella oxytoca
	Klebsiella other (specify species)
Salmonella	*Salmonella spp.* (not further differentiated)
	Salmonella enterica
	Salmonella bongori
	Salmonella subterranea
	Salmonella other (specify species)
	Serratia spp. (not further differentiated)
	Serratia marcescens
	Serratia other (specify species)
Proteus	*Proteus spp.* (not further differentiated)
	Proteus mirabilis
	Proteus vulgaris
	Proteus other (specify species)
Pseudomonas	*Pseudomonas spp.* (not further differentiated)
	Pseudomonas aeruginosa
	Pseudomonas other (specify species)
Other MRGN	Specification of the species