TESSy The European Surveillance System

Antimicrobial resistance (AMR) reporting protocol 2024

European Antimicrobial Resistance Surveillance Network (EARS-Net) surveillance data for 2023

Contents

Introduction

This reporting protocol is for the 2024 data call for antimicrobial resistance (AMR) surveillance data, collected by the European Antimicrobial Resistance Surveillance Network (EARS-Net) for 2023.
Reporting protocols are data collection guidelines for the data managers of reporting countries and the protocol design is intended to improve user-friendliness by:

- introducing a uniform structure to make it easier for data managers to find data collection information across different subjects;
- removing information which is irrelevant for data managers.

The reporting protocols are supplemented by the TESSy (The European Surveillance System) User Guide.

The surveillance protocol will also contain some of the generic information previously contained in the reporting protocols.

Since the data managers in reporting countries often have multiple roles, subject-specific material is sometimes distributed together with a reporting protocol. To maintain the uniform structure, this type of material is now included in Annex 2.

How to use this document

This reporting protocol provides information for the data managers of reporting countries in three main sections:

- Reporting to TESSy under EpiPulse which contains guidelines on how to prepare data for submission to TESSy, deadlines, subject-specific information (e.g. new changes to metadata), and links to further information.
- Annex 1 which contains:
  - the metadata set for the subject(s) covered by this reporting protocol.
  - a history of metadata changes for the subject(s) covered by this reporting protocol.
- Annex 2 which contains subject-specific material relevant for distribution with the reporting protocol.

Finding further information

Updated links to all the schedules, documentation and training materials mentioned in this reporting protocol are included in the Documentation and Help pages, including links to:

- Metadata sets and history
- Tutorials for data transformation using Excel and Access
- TESSy user documentation
- CSV and XML transport protocols.

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Reporting to TESSy under EpiPulse

In July 2023, TESSy migrated into the EpiPulse portal. The application remains the same but it is now accessible via the EpiPulse URL, and with new menu names.

This section provides both an overview of the TESSy reporting process and tips on where you can find useful information.

The overall process is as follows:

- Familiarise yourself with the data collection deadlines.
- Prepare (export and transform) your data.
- Check that your data complies with the metadata.
- Check that your data source profile is up-to-date.
- Submit your file(s) to TESSy.
- Finalise and approve your submission.

Checking the data collection schedule

A link to the current data collections schedule can be found in the Communication section of the 'Documentation and Help' pages.

Preparing data

After you have exported the data from your national database, you need to ensure that the data are in a format that TESSy can accept. This applies both to the type of file submitted to TESSy (only CSV and XML files can be submitted) and to the format of the data in certain fields.

A User Guide on how to transform data to the correct TESSy format is available in the 'Guides and Training' section of the 'Documentation and Help' pages. Information on the file formats is available in the CSV Transport Protocol and XML Transport Protocol which can be found in the Technical Guidelines & Tools section of the 'Documentation and Help' pages.

AMR-specific guidelines for data collection and preparation for TESSy are provided in Annex 1 and Annex 2.

Checking metadata

The metadata defines the fields and data formats that are valid as input to TESSy for a given subject.

As the requirements for data to be shared among TESSy users can change, the data changes needed to support the new requirements are identified and agreed upon between the National Surveillance Contact Points, the Network Coordination Groups and ECDC's Disease Experts. These changes are then implemented to the TESSy metadata.

In order to ensure that your data can be saved correctly in TESSy, it is important to check that the formatting is correct and in accordance with the most recent metadata set.

Changes to the metadata for the subject of this reporting protocol are described in:

- Changes to current metadata – changes since the last reporting protocol.
- Annex 1 – previous changes.

It is especially important to focus on:

- **Field formats**
  Many fields require the data to be formatted in a specific way. For example, dates must be in the YYYY-MM-DD format; dates in the DD/MM/YYYY format will be rejected.
- **Coded values**
  Some fields only permit the use of specific values (coded values). For example, **M**, **F**, **UNK**, or **Other** are the coded values for 'Gender' and any other value in a 'Gender' field will be rejected.

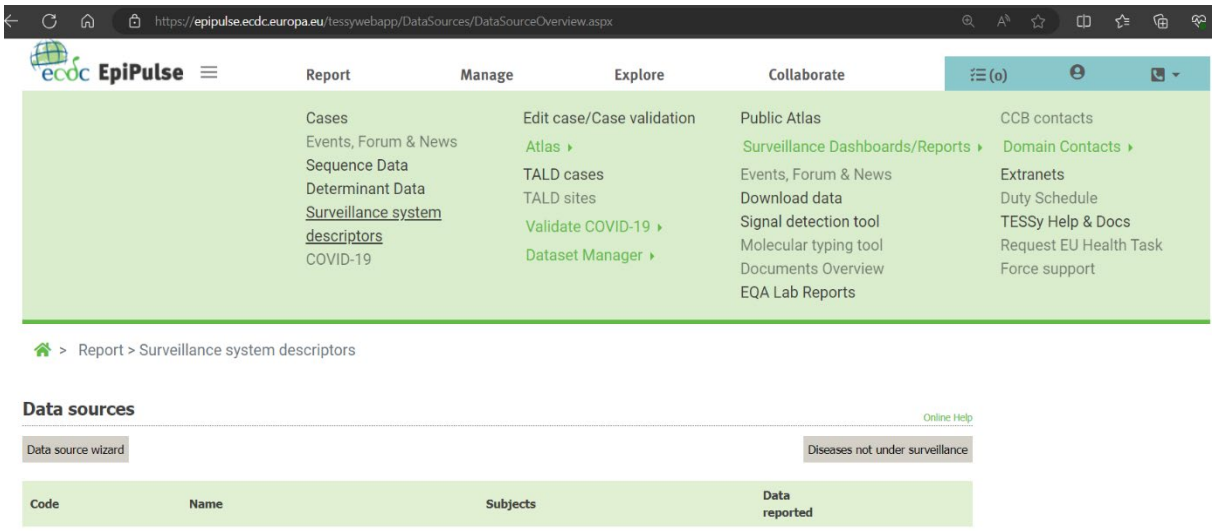
The TESSy metadata contains all the definitions and rules necessary to format data correctly for every subject (usually a disease). This can be downloaded as an Excel file from the Technical Guidelines & Tools section of the 'Documentation and Help' pages.

Filtering the fields in the file by subject will enable you to see the fields required for your subject and the rules that apply to these fields.

The User Guide provides an overview of how you work with the metadata file.

Checking your data source profile

Before submitting your file(s), please review your data source(s) in EpiPulse (in the menu, go to 'Report' -> 'Surveillance systems descriptors') and update the information as necessary.



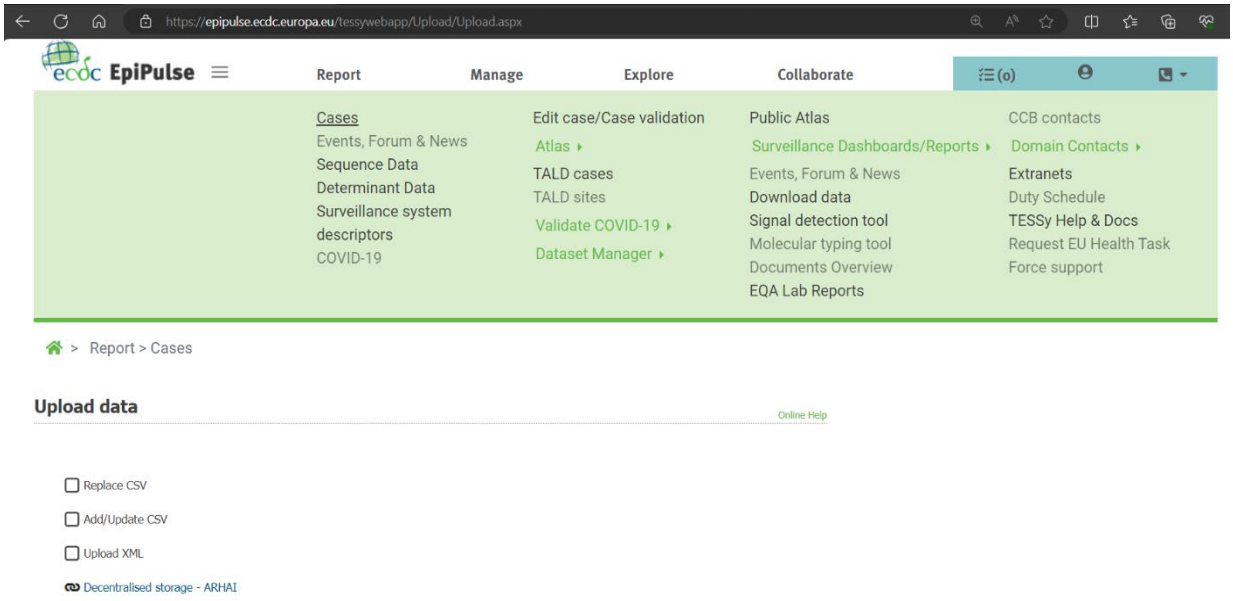
Complete and up-to-date data source information for each subject is important for improving the interpretation of data - each surveillance system has different features that need to be taken into account when comparing data at an international level.

If your data source information is out-of-date and you do not have access rights to update it, please ask your National Focal Point for Surveillance or National Coordinator to do so.

Information on data sources is available in the TESSy User Guide.

Submitting your data

Data are submitted through the EpiPulse web interface (in the menu, go to Report -> Cases).



The User Guide provides an overview of how to submit files to TESSy and in-depth descriptions of all the methods for uploading.

Finalising your submission

The compliance of your data with the validation rules in the metadata is checked automatically during the data upload process.

The result of your upload – i.e. rejected or validated – is displayed immediately after the check is concluded on the 'Validation details' webpage. Please check the result carefully.

- If your file has been rejected, there will be a message explaining each instance of non-compliance with the metadata that needs correcting.
- If your file has been validated, there might be warnings and remarks relating to possible data quality issues or potential overwriting of existing records that you should consider.

When your file has been validated and you are satisfied that all corrections have been made, please ensure prompt approval – unapproved uploads can block the approval of other uploads.

The TESSy User Guide provides information on reviewing validation results and adjusting reporting periods to avoid overwriting existing records.

TESSy Helpdesk

Email: TESSy@ecdc.europa.eu

Telephone number: +46-(0)8-5860 1601

Availability: 09:00–16:00 Stockholm time, Monday to Friday (with the exception of ECDC holidays).

Changes to current AMR metadata

AMRTEST: The coded value list for Serotype was updated and now also contains: 15B/C: Type 15B/C.

AMRTEST: The coded value list for Antibiotic was updated and now also contains: FDC: cefiderocol; CZT: ceftolozane-tazobactam; IMR: imipenem-relebactam; MEV: meropenem-vaborbactam.

AMRTEST: The validation rule was adjusted for *E. coli*, *K. pneumoniae, P. aeruginosa* and *Acinetobacter* spp. to allow reporting of resistance to cefiderocol, ceftazidime-avibactam, ceftolozane-tazobactam, imipenem-relebactam, and meropenem-vaborbactam.

Metadata changes to AMRTEST and AMRCOVER are described in Annex 1.

Note: information on changes to the metadata for other subjects is available on the TESSy documentation website.

Annex 1. AMR metadata

This section describes:

- The AMR metadata set
- Changes to the AMR metadata.

AMR metadata set

The AMR metadata is described in three sections:

- Overview of EARS-Net AMR surveillance metadata
- Isolate-based reporting
- Coverage and representativeness.

Overview of EARS-Net AMR surveillance metadata

The metadata set for **isolate-based AMR reporting** (RecordType **AMRTEST**) consists of eight technical variables and 28 epidemiological variables, which are further classified as variables at the patient/isolate level and variables at the AMR test level. The first level includes data referring to the isolate which are repeated in all records reporting the antimicrobial susceptibility tests performed for that isolate (Tables 2, 3 and 4).

The variables used for **reporting coverage and representativeness** (RecordType **AMRCOVER**) according to aggregated format include: RecordType; RecordTypeVersion; Subject; DataSource; ReportingCountry; DateUsedForStatistics; SameMicrSampleCov; Pathogen; PropPopulationLabCov; PopGeoReprCov; NumBedsHospCov; NumPatDaysHospCov; HospitalReprCov; NumCultureSetsHospCov; NumPatDaysForRateCov; IsolateMicroRepr.

The variables of AMRTEST and AMRCOVER RecordTypes are described in more detail, including the validation rules, in the sections 'Isolate-based reporting' and 'Coverage and representativeness'.

Current record type versions

Table 1 shows the record type versions to be used when reporting 2023 AMR surveillance data to TESSy.

Table 1. AMR record version types for 2023 data

Record type	Record type version
AMRCOVER	AMRCOVER.v2
AMRTEST	AMRTEST.3

Isolate-based reporting

The following set of variables applies for isolate-based reporting of AMR. The dataset is sub-divided into a common set of system-related variables (technical variables) and epidemiological variables. The epidemiological variables can be classified into two levels: isolate information and susceptibility test information. The first level includes data referring to the specific isolate which are repeated for each antimicrobial agent where the susceptibility of that isolate has been tested.

The variables are described in the following tables:

- Table 2: Technical variables
- Table 3: Epidemiological variables at isolate level
- Table 4. Epidemiological variables at AMR test level.

Variables 1,2,4,5,6,7,9,10,11,18,25,26 are technically mandatory; TESSy will not accept the data submission unless these fields have been completed.

When data are entered that fail to meet the requested combination for both 'Pathogen' and 'Antibiotic', the individual record is ignored, while the batch itself is NOT rejected. When a record is ignored, TESSy does not insert its data into the database. Consequently, these ignored records will not be accessible for analysis or download.

Table 2. Technical variables

VariableName	1 – RecordID
Description	Unique anonymised identifier for each record within and across the national surveillance system and subject – selected and generated by reporting country. Recommended format: '[ReportingCountry][LaboratoryCode] [Patient Counter][Pathogen] [Specimen][Antibiotic][DateUsedForStatistics]'
Required (what happens if not submitted)	Yes (Error)
Data type	String (max length: 80)
VariableName	**2 - RecordType**
Description	Structure and format of the data.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	AMRTEST
VariableName	**3 – RecordTypeVersion**
Description	There may be more than one version of a RecordType. This element indicates which version the sender uses when generating the message. Required when no metadata set is provided at upload.
Required	No
Data type	Numeric
Code	See metadata
VariableName	**4 - Subject**
Description	Subject of the data to report.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	AMR
VariableName	**5 – DataSource**
Description	The data source (surveillance system) that the record originates from.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	See metadata
VariableName	**6 – ReportingCountry**
Description	The country reporting the record.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	See metadata
VariableName	**7 – DateUsedForStatistics**
Description	The reference date used for standard reports that is compared to the reporting period. Recommended: date when sample was taken.
Required (what happens if not submitted)	Yes (Error)
Data type	Date
Code	Exact date only: 'YYYY-MM-DD'
VariableName	**8 – Status**
Description	Status of reporting NEW/UPDATE or DELETE (inactivate). Default if left out: NEW/UPDATE. If set to DELETE, the record with the given RecordID will be deleted from the TESSy database (or rather invalidated). If set to NEW/UPDATE or left empty, the record will be entered into the database as new.
Required	No
Data type	Coded value
Code	NEW/UPDATE or DELETE.

Table 3. Epidemiological variables at isolate level

VariableName	9 - LaboratoryCode
Description	Laboratory code unique for each laboratory within the country.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	See metadata If a country has a need for additional codes in the list, they must contact TESSy Helpdesk to get the codes added. Recommended format: [ReportingCountry]-[code of three characters]
VariableName	**10 – Specimen**
Description	Isolate source The source of the isolate (i.e. blood or cerebrospinal fluid)
Required	Yes (Error)
Data type	Coded value
Code	BLOOD = blood CSF = Cerebrospinal fluid
VariableName	**11 – PatientCounter**
Description	Numeric code for each patient, unique for lab. Anonymous code by lab to specify patient.
Required (what happens if not submitted)	Yes (Error)
Data type	Numeric
Code	Requires labs to anonymise the PatientCounter.
VariableName	**12 – Gender**
Description	Gender
Required (what happens if not submitted)	Yes (Warning)
Data type	Coded value
Code	M = Male F = Female O = Other UNK = Unknown
VariableName	**13 - Age**
Description	Age of the patient when the sample was taken.
Required (what happens if not submitted)	Yes (Warning)
Data type	Numeric
Code	Integer
VariableName	**14 – IsolateId**
Description	Isolate ID; code for each isolate, unique for lab and year. Text code assigned by lab to specify isolate.
Required (what happens if not submitted)	Yes (Warning)
Data type	Text
VariableName	**15 – HospitalId**
Description	Unique identifier for the hospital within each laboratory.
Required (what happens if not submitted)	Yes (Warning)
Data type	Text
Code	Unique identifier for the hospital within each laboratory. Recommended format: [LaboratoryCode]-[letter assigned to a hospital – starting from A, B, C, etc.]

VariableName	16 – PatientType
Description	Origin of patient. Was the patient admitted to a hospital at the time the sample was taken (inpatient), or not (outpatient). Patients that go to hospital for dialysis or other types of day hospital care should be classified as 'O' for the field 'PatientType'. All other patients admitted to the hospital as inpatients should be classified as 'INPAT'.
Required (what happens if not submitted)	Yes (Warning)
Data type	Coded value
Code	INPAT=Admitted (Inpatient) OUTPAT=Outpatient (e.g. emergency room) O=Other UNK=Unknown
VariableName	**17 – HospitalUnitType**
Description	Hospital department (at the time of sample collection)
Required (what happens if not submitted)	Yes (Warning)
Data type	Coded value
Code	INTMED=Internal Medicine PEDS=Paediatrics/neonatal PEDSICU=Paediatrics/neonatal ICU SURG=Surgery ONCOL=Haematology/Oncology OBGYN=Obstetrics/Gynaecology ICU=Intensive Care Unit ED=Emergency Department URO=Urology Ward INFECT=Infectious Disease Ward O=Other UNK=Unknown
VariableName	**18 – Pathogen**
Description	Pathogen Species and genus of the pathogen which has been isolated from the sample.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	STRPNE=*Streptococcus pneumoniae* STAAUR=*Staphylococcus aureus* ENCFAE=*Enterococcus faecalis* ENCFAI=*Enterococcus faecium* ESCCOL=*Escherichia coli* KLEPNE=*Klebsiella pneumoniae* PSEAER=*Pseudomonas aeruginosa* ACISPP=*Acinetobacter* species
VariableName	**19 - DateOfHospitalisation**
Description	Date of admission to hospital
Required	No
Data type	Date
Code	Exact date only: 'YYYY-MM-DD'
VariableName	**20 – ResultPCRmec**
Description	Detection of PCR *mecA* gene
Required	No
Data type	Coded value
Code	POS=positive NEG=negative UNK=unknown
Validation rule	To be reported only if Pathogen=STAAUR.

VariableName	21 - ResultPbp2aAggl
Description	Detection of PBP2a-agglutination
Required	No
Data type	Coded value
Code	POS=positive NEG=negative UNK=unknown
Validation rule	To be reported only if Pathogen=STAAUR.
VariableName	**22 – Serotype**
Description	Serotype/group of the pathogen isolated from the sample.
Required	No
Data type	Coded value
Code	See metadata
Validation rule	To be reported only if Pathogen=STRPNE.
VariableName	**23 – ESBL**
Description	Detection of Extended-Spectrum Beta-Lactamase
Required	No
Data type	Coded value
Code	POS=positive NEG=negative UNK=unknown
Validation rule	To be reported only if Pathogen=ESCCOL or KLEPNE.
VariableName	**24 – ResultCarbapenemases**
Description	Detection of Carbapenemase
Required	No
Data type	Coded value
Code	POS=positive NEG=negative UNK=unknown
Validation rule	To be reported only if Pathogen=ESCCOL or KLEPNE or PSEAER or ACISPP

Table 4. Epidemiological variables at AMR test level

VariableName	25 – Antibiotic
Description	Antimicrobial code
Required	Yes (Ignore): data entry is required. However, if you enter data that does not meet the requested combination of 'Pathogen' and 'Antibiotic', the record is ignored but the batch is NOT rejected. By ignored, we mean that TESSy does not insert the data for this record into the database. The ignored records are kept as original data but are not available for analysis or report.
Data type	Coded Value
Code	See 'Implementation of AMR case definitions for TESSy' where a list of all antimicrobial agent codes is provided
VariableName	**26 – SIR**
Description	Final result of interpretation of all different susceptibility tests performed, based on EUCAST[1] breakpoints. Starting with data collected for 2019, the updated EUCAST definitions of susceptibility testing categories are used: S - Susceptible, standard dosing regimen: a microorganism is categorised as 'Susceptible, standard dosing regimen' when there is a high likelihood of therapeutic success using a standard dosing regimen of the agent. I – Susceptible, increased exposure: a microorganism is categorised as 'Susceptible, increased exposure' when there is a high likelihood of therapeutic success because exposure to the agent is increased by adjusting the dosing regimen, or by its concentration at the site of infection. R - Resistant: a microorganism is categorised as 'Resistant' when there is a high likelihood of therapeutic failure, even when there is increased exposure.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	S=Susceptible, standard dosing regimen I=Susceptible, increased exposure R=Resistant
VariableName	**27 – ResultZoneValue**
Description	Zone (Value in mm)
Required	No
Data type	Numeric
Code	Integer
VariableName	**28 – ResultZoneSIR**
Description	Interpretation of the zone test.
Required	No
Data type	Coded value
Code	S=Susceptible, standard dosing regimen I=Susceptible, increased exposure R=Resistant
VariableName	**29 – ResultMICSign**
Description	Minimum inhibitory concentration (MIC) (> < =) This field can indicate if a MIC-value of the exact value is 'equal to' (=); 'equal to or less than' the value (<=value); 'greater than' the value (>value); or 'equal to or greater than' the value (>=value). The value is indicated in the subsequent field.
Required	No
Data type	Coded value
Code	<= = >= >

[1] EUCAST - European Committee on Antimicrobial Susceptibility Testing

VariableName	30 – ResultMICValue
Description	MIC (Value in mg/L)
Required	No
Data type	Text
Code	If <1 then float, if >=1 then integer
VariableName	**31 – ResultMICSIR**
Description	Interpretation of the MIC test.
Required	No
Data type	Coded value
Code	S=Susceptible, standard dosing regimen I=Susceptible, increased exposure R=Resistant
VariableName	**32 – ResultGradSign**
Description	Gradient strip (> < =) This field can indicate if a value of the zone diameter of the gradient strip is the exact value 'equal to' (=); 'equal to or less than' the value (<= value); 'greater than' the value (>value); or 'equal to or greater than' the value (>=value). The value is indicated in the subsequent field.
Required	No
Data type	Coded value
Code	<= = >= >
VariableName	**33 - ResultGradValue**
Description	Gradient strip value (value in mg/L)
Required	No
Data type	Text
Code	If <1 then float, if >=1 then integer. The value 1.5 is also allowed.
VariableName	**34 – ResultGradSIR**
Description	Interpretation of the gradient strip test.
Required	No
Data type	Coded value
Code	S=Susceptible, standard dosing regimen I=Susceptible, increased exposure R=Resistant
VariableName	**35 – DiskLoad**
Description	Disk content (only if zone) This field can be used to mention the load of the antimicrobial disk used. Please mention the value and the units (e.g. mcg, units or IU).
Required	No
Data type	Text
Code	Value and units: i.e. UI, mcg.
VariableName	**36 - ReferenceGuidelinesSIR**
Description	Starting with data collected for 2019, only EUCAST clinical guidelines are accepted. The variable is kept to enable data validation.
Required	No
Data type	Coded value
Code	EUCAST=European Committee on Antimicrobial Susceptibility Testing CLSI=Clinical and Laboratory Standards Institute NAT=National O=Other.

Coverage and representativeness

The following set of variables applies for country aggregate reporting of coverage and representativeness of laboratories participating in EARS-Net. The dataset is sub-divided into a common set of system related variables (technical variables) and epidemiological variables. If coverage and representativeness differs by species the epidemiological variables must be provided at microorganism level. Otherwise, if coverage and representativeness are the same for all species, one AMRCOVER record per DataSource and year is expected.

The variables are described in the following tables:

- Table 5: Technical variables
- Table 6: Epidemiological variables

Variables 1,3,4,5,6,7,8,9,10,13,16 are technically mandatory. TESSy will not accept the data submission unless these fields have been completed.

Table 5. Technical variables

VariableName	1 – RecordType
Description	Structure and format of the data.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	AMRCOVER
VariableName	**2 – RecordTypeVersion**
Description	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.
Required	No
Data type	Numeric
Code	See metadata
VariableName	**3 – Subject**
Description	Subject of data to report.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	AMRCOVER
VariableName	**4 – DataSource**
Description	The data source (surveillance system) that the record originates from.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	See metadata
VariableName	**5 – ReportingCountry**
Description	The country reporting the record.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	See metadata
VariableName	**6 – DateUsedForStatistics**
Description	The reference year for which the data are valid.
Required (what happens if not submitted)	Yes (Error)
Data type	Date
Code	'YYYY'.

Table 6. Epidemiological variables

VariableName	7 - SameMicrSampleCov
Description	Estimated coverage and representativeness are the same for all microorganism species under surveillance. If coverage and representativeness are the same for all microorganism species, one AMRCOVER record per DataSource and year is expected (the code 'PATAMR' should be used for the variable 'Pathogen'). If coverage and representativeness differ by species, eight AMRCOVER records per DataSource and year are expected (all codes other than 'PATAMR' should be used for the variable 'Pathogen').
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	Y=Yes N=No
VariableName	**8 – Pathogen**
Description	Pathogen. The code 'PATAMR' should be used if coverage is the same for all pathogens. The other eight codes are specific for each microorganism under surveillance.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	PATAMR=All EARS-Net pathogens (to be used if coverage is the same for all pathogens) STRPNE=*Streptococcus pneumoniae* STAAUR=*Staphylococcus aureus* ENCFAE=*Enterococcus faecalis* ENCFAI=*Enterococcus faecium* ESCCOL=*Escherichia coli* KLEPNE=*Klebsiella pneumoniae* PSEAER=*Pseudomonas aeruginosa* ACISPP=*Acinetobacter* species.
VariableName	**9 – PropPopulationLabCov**
Description	Best available estimate for the proportion of the national population covered by the laboratories reporting to EARS-Net in the specific year. Use '.' as decimal delimiter: e.g. 0.32.
Required (what happens if not submitted)	Yes (Error)
Data type	Text
Code	Float
VariableName	**10 – PopGeoReprCov**
Description	Population sample geographical representativeness.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	HIGH = all main geographical regions of the country are covered MEDIUM = most geographical regions of the country are covered LOW = only a few geographical areas of the country are covered.
VariableName	**11 – NumBedsHospCov**
Description	Total number of beds for hospitals served by laboratories reporting to EARS-Net.
Required (what happens if not submitted)	No
Data type	Numeric
Code	Integer

VariableName	12 – NumPatDaysHospCov
Description	Total number of patient-days for hospitals served by laboratories reporting to EARS-Net.
Required (what happens if not submitted)	Yes (Warning)
Data type	Numeric
Code	Integer
VariableName	**13 – HospitalReprCov**
Description	Hospital sample representativeness.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	HIGH = the hospital sample is representative of the acute care hospital distribution in the country; MEDIUM = the hospital sample is partly representative of the acute care hospital distribution in the country; LOW = the hospital sample is insufficiently representative of the acute care hospital distribution in the country.
VariableName	**14 – NumCultureSetsHospCov**
Description	Total number of blood culture sets taken in hospitals served by laboratories reporting to EARS-Net and sent to these laboratories. The provided data should be suitable for calculating the blood culture rate in the specific year: number of sets refers to the hospital sample for which the aggregated denominator (NumPatDaysForRateCov) is provided.
Required (what happens if not submitted)	Yes (Warning)
Data type	Numeric
Code	Integer
VariableName	**15 – NumPatDaysForRateCov**
Description	Total number of patient-days for hospitals served by laboratories which provided the number of blood culture sets taken. This number can be equal to 'NumPatDaysHospCov' or lower if only some of the laboratories provided the number of blood culture sets taken in hospitals served by laboratories reporting to EARS-Net and sent to these laboratories.
Required (what happens if not submitted)	Yes (Warning)
Data type	Numeric
Code	Integer
VariableName	**16 – IsolateMicroRepr**
Description	Isolate sample invasive infection causing microorganism representativeness.
Required (what happens if not submitted)	Yes (Error)
Data type	Coded value
Code	HIGH = the isolate sample is representative of microorganisms causing invasive infections in the included hospitals; MEDIUM = the isolate sample is partly representative of microorganisms causing invasive infections in the included hospitals; LOW = the isolate sample is insufficiently representative of microorganisms causing invasive infections in the included hospitals.

AMR metadata change history

Previous metadata changes

Metadata changes prior to 2014 can be found on the TESSy documents website.

Table 7. Summary of implemented changes in AMRTEST and AMRCOVER record types for Antimicrobial Resistance (AMR), 2014-2024

Year	Subject	Description
2024	**AMRTEST**	The coded value list for Serotype was updated to also contain: 15B/C: Type 15B/C. The coded value list for Antibiotic was updated and now also contains: FDC: cefiderocol; CZT: ceftolozane-tazobactam; IMR: imipenem-relebactam; MEV: meropenem-vaborbactam. The validation rule was adjusted for *E. coli, K. pneumoniae, P. aeruginosa* and *Acinetobacter* spp. to allow reporting of resistance to cefiderocol, ceftazidime-avibactam, ceftolozane-tazobactam, imipenem-relebactam, and meropenem-vaborbactam.
2023	**AMRTEST**	The coded value list for ResultMICSign, and ResultEtestSign was updated to only contain: <= : Less than or equal; = : Equal; > : Greater than; >= : Greater than or equal. The variable ResultZoneSign, was removed from reporting. A validation rule was added to the variable ResultZoneValue; Acceptable values: 0-50. The variable ResultEtestSign was renamed ResultGradSign. The variable ResultEtestValue was renamed ResultGradValue. The variable ResultEtestSIR was renamed ResultGradSIR.
2022	**AMRCOVER**	Variables PopulationReprCov and IsolateReprCov were replaced by PopGeoReprCov and IsolateMicroRepr respectively. PopGeoReprCov, IsolateMicroRepr and HospitalReprCov were given the following value options: High, Medium, Low. The descriptions of variables NumCultureSetsHospCov and NumPatDaysForRateCov were changed.
2021	**AMRTEST**	AMRTEST validation rules were updated in 2021. The validation rules were adjusted to ignore the following combinations: for *E. coli*, NET and POL; for *K. pneumoniae*, NET, POL and TGC; for *P. aeruginosa*, NET, GEN and POL; for *Acinetobacter* spp., NET and POL. 14 July 2021: these changes were retracted in a TESSy metadata to allow for full reporting of data from before 2020.
	AMRTEST	AMRTEST description of the SIR variable was updated in the metadata set. S = Susceptible, standard dosing regimen; and I = Susceptible increased exposure.
2020	**AMRTEST**	Update of validation rules associated to the requested combination of 'Pathogen' and 'Antibiotic'.
	AMRTEST	Update of validation rules associated to the requested combination of 'Pathogen' and 'Specimen'.
2019	**AMRCOVER**	The new metadata subject was introduced in place of AMRDENOM.
2018	**AMRDENOM**	The metadata subject was discontinued.
2014	**AMRTEST**	Addition of new codes to coded value list for antibiotics.
	AMRTEST	Update of validation rules associated with these new antibiotics.
	All	Update NUTS codes according to the NUTS Codes 2010 classification from EUROSTAT.

Annex 2. AMR-specific material

Contacts

Questions regarding coding, upload of data etc. should be directed to the TESSy helpdesk at TESSy@ecdc.europa.eu

Questions regarding the AMR reporting and content will be dealt with by the ECDC EARS-Net contact:
E-mail: EARS-Net@ecdc.europa.eu

Questions regarding the use of WHONET to prepare data for TESSy upload can be directed to ECDC contractor John Stelling: E-mail jstelling@whonet.org (please copy EARS-Net@ecdc.europa.eu).

Microbiological guidelines for EARS-Net

EARS-Net requires the use of the European Committee on Antimicrobial Susceptibility Testing (EUCAST) guidelines and breakpoints to determine clinical antimicrobial susceptibility (available at http://www.eucast.org/). Until 2019, laboratories using other guidelines were also welcome to report data to EARS-Net however, since 2020 the use of EUCAST has become an essential requirement for participation.

In 2012, the EUCAST steering committee established a sub-committee for detection of resistance mechanisms and specific resistances of clinical and/or epidemiological importance. The sub-committee was established partly in response to frequently-asked questions from users of EUCAST guidelines on this issue, and partly at ECDC's request, as expert microbiology guidance was needed for EARS-Net participants.

The remit of the sub-committee was to develop practical guidelines for the detection of specific antimicrobial resistance mechanisms of clinical and/or epidemiological importance. The document was developed by conducting systematic literature searches, and most recommendations are based on multi-centre studies, as these provide the best measure of robustness of the methods. Prior to publication of these guidelines, they were subjected to wide consultation through the EUCAST consultation contact lists, the EUCAST website and ECDC focal point contacts. An updated version of the results of this work can be found in the EUCAST guidelines for detection of resistance mechanisms and specific resistances of clinical and/or epidemiological importance[2].

The guidelines describe the definition of the mechanisms of resistances, recommended methods of detection and references to detailed descriptions of the methods for:

1. Carbapenemase-producing Enterobacteriaceae
2. Extended-spectrum β-lactamase (ESBL)-producing Enterobacteriaceae
3. Acquired AmpC β-lactamase-producing Enterobacteriaceae
4. Polymyxin resistance in gram-negative bacilli
5. Carbapenem resistance in *Pseudomonas aeruginosa* and *Acinetobacter*
6. Meticillin-resistant *Staphylococcus aureus* (MRSA)
7. Glycopeptide non-susceptible *Staphylococcus aureus*
8. Vancomycin resistant *Enterococcus faecium* and *Enterococcus faecalis*
9. Penicillin non-wild-type *Streptococcus pneumoniae.*

[2] EUCAST. 2017. EUCAST guidelines for detection of resistance mechanisms and specific resistances of clinical and/or epidemiological importance. Version 2.0, July 2017 Available at: https://www.eucast.org/fileadmin/src/media/PDFs/EUCAST_files/Resistance_mechanisms/EUCAST_detection_of_resistance_mechanisms_170711.pdf

Implementation of AMR case definitions for TESSy

Given the typology of data for AMR surveillance, which refers to laboratory isolates rather than cases of disease, the following case definition has been implemented in the RecordType 'AMRTEST' for reporting to TESSy under the EpiPulse platform:

The bacterial species under surveillance are:

- *Streptococcus pneumoniae* (STRPNE)
- *Staphylococcus aureus* (STAAUR)
- *Enterococcus faecalis* (ENCFAE)
- *Enterococcus faecium* (ENCFAI)
- *Escherichia coli* (ESCCOL)
- *Klebsiella pneumoniae* (KLEPNE)
- *Pseudomonas aeruginosa* (PSEAER)
- *Acinetobacter* species (ACISPP).

All isolates from blood and/or cerebrospinal fluid for which a susceptibility test has been performed must be included.

The generic case definition of antibiotic resistance is defined in the Commission Implementing Decision stipulating case definitions for reporting communicable diseases to the Community network.[3] EARS-Net requires the use of EUCAST clinical breakpoints in line with the EU case definitions. As of 2020 (2019 data), countries and laboratories using other guidelines are not eligible to participate in EARS-Net surveillance. Reporting of quantitative susceptibility data is strongly encouraged.

Duplicates from the same patients should be eliminated, taking only the first sample by date of collection and isolate source. Table 8 lists all microorganism and antibiotic agent combinations under EARS-Net surveillance. According to the EUCAST guidelines, when a specific type of test is to be used, the method is indicated next to the antimicrobial.

If records referring to additional combinations are uploaded, they will be filtered out by the system - see TESSy Filter 1.

Table 8. Microorganism and antimicrobial agent combinations under surveillance by EARS-Net (isolates from blood and/or cerebrospinal fluid)

Microorganism	Antimicrobial agent
***Streptococcus pneumoniae* (STRPNE)**	Oxacillin (OXA) – Disk diffusion Penicillin (PEN) – MIC test Clarithromycin (CLR) – MIC test Erythromycin (ERY) Azithromycin (AZM) – MIC test Levofloxacin (LVX) Moxifloxacin (MFX) Norfloxacin (NOR) – Disk diffusion Cefotaxime (CTX) – MIC test Ceftriaxone (CRO) – MIC test
***Staphylococcus aureus* (STAAUR)**	Cefoxitin (FOX) – Disk diffusion Oxacillin (OXA)* – MIC test Levofloxacin (LVX) Ciprofloxacin (CIP) Norfloxacin (NOR) – Disk diffusion Vancomycin (VAN) – MIC test Rifampin (RIF) Linezolid (LNZ) Daptomycin (DAP) – MIC test

Microorganism	Antimicrobial agent
***Enterococcus faecalis* (ENCFAE)**	Ampicillin (AMP) Amoxicillin (AMX) – MIC test Gentamicin-High (GEH) Vancomycin (VAN) Teicoplanin (TEC) Linezolid (LNZ)
***Enterococcus faecium* (ENCFAI)**	Ampicillin (AMP)

3. Commission Implementing Decision on the communicable diseases and related special health issues to be covered by epidemiological surveillance – Annex 1 (replacing Commission Decision No 2000/96/EC). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018D0945&from=EN

Microorganism	Antimicrobial agent
	Amoxicillin (AMX) – MIC test Gentamicin-High (GEH) Vancomycin (VAN) Teicoplanin (TEC) Linezolid (LNZ)
Escherichia coli **(ESCCOL)**	Ampicillin (AMP) Amoxicillin (AMX) – MIC test Amoxicillin-clavulanic acid (AMC) Piperacillin-tazobactam (TZP) Cefotaxime (CTX) Ceftazidime (CAZ) Ceftazidime-avibactam (CZA) Ceftriaxone (CRO) Cefepime (FEP) Cefiderocol (FDC) Ceftolozane-tazobactam (CZT) Gentamicin (GEN) Tobramycin (TOB) Amikacin (AMK) Ciprofloxacin (CIP) Levofloxacin (LVX) Ofloxacin (OFX) Moxifloxacin (MFX) Imipenem (IPM) Imipenem-relebactam (IMR) Meropenem (MEM) Meropenem-vaborbactam (MEV) Ertapenem (ETP) Tigecycline (TGC) Colistin (COL) - Broth microdilution
Klebsiella pneumoniae **(KLEPNE)**	Amoxicillin-clavulanic acid (AMC) Piperacillin-tazobactam (TZP) Cefotaxime (CTX) Ceftazidime (CAZ) Ceftazidime-avibactam (CZA) Ceftriaxone (CRO) Cefepime (FEP) Cefiderocol (FDC) Ceftolozane-tazobactam (CZT) Gentamicin (GEN) Tobramycin (TOB) Amikacin (AMK) Ciprofloxacin (CIP) Levofloxacin (LVX) Ofloxacin (OFX) Moxifloxacin (MFX) Imipenem (IPM) Imipenem-relebactam (IMR) Meropenem (MEM) Meropenem-vaborbactam (MEV) Ertapenem (ETP) Colistin (COL) - Broth microdilution
Pseudomonas aeruginosa **(PSEAER)**	Piperacillin/Tazobactam (TZP) Piperacillin (PIP) Ceftazidime (CAZ) Ceftazidime-avibactam (CZA) Cefepime (FEP) Cefiderocol (FDC) Ceftolozane-tazobactam (CZT)

Microorganism	Antimicrobial agent
	Tobramycin (TOB) Amikacin (AMK) Ciprofloxacin (CIP) Levofloxacin (LVX) Imipenem (IPM) Imipenem-relebactam (IMR) Meropenem (MEM) Meropenem-vaborbactam (MEV) Colistin (COL) - Broth microdilution
***Acinetobacter* species (ACISPP)**	Ceftazidime-avibactam (CZA) Cefiderocol (FDC) Ceftolozane-tazobactam (CZT) Gentamicin (GEN) Tobramycin (TOB) Amikacin (AMK) Ciprofloxacin (CIP) Levofloxacin (LVX) Imipenem (IPM) Imipenem-relebactam (IMR) Meropenem (MEM) Meropenem-vaborbactam (MEV) Colistin (COL) - Broth microdilution

** Meticillin (MET), flucloxacillin (FLC), cloxacillin (CLO) or dicloxacillin (DIC) are accepted as markers for oxacillin (OXA) resistance if oxacillin is not reported.*

Objectives for AMR surveillance

Surveillance of AMR within the European Union (EU) is assured by European law. AMR is listed as a special health issue in the Commission Implementing Decision (EU) 2018/945 of 22 June 2018 on the communicable diseases and related special health issues to be covered by epidemiological surveillance, as well as relevant case definitions.[4]

EARS-Net is based on a network of representatives from European Union/European Economic Area (EU/EEA) countries collecting routine clinical antimicrobial susceptibility data from national AMR surveillance initiatives. Scientific guidance and support to the network is provided by the EARS-Net Coordination Committee. This group is composed of individual experts selected from among the nominated disease-specific contact points and experts from other organisations that are involved in surveillance of antimicrobial resistance.

The objective of EARS-Net is to collect, analyse and report data on AMR across EU/EEA countries and as defined in the EARS-Net protocol, to enable action to address AMR. In 2024, EARS-Net will collect and analyse 2023 data from the EU/EEA countries.

Preparing national AMR datasets

The data collection at laboratory level can be performed both electronically and manually by filling out the corresponding Isolate Records Forms for each pathogen (see Isolate Record forms). If the data collection at laboratory level has been performed manually by filling out the Isolate Records, the Country Data Manager should create the fields 'Age' and 'PatientCounter', based on the information available in the paper forms ('Year of birth' and 'Patient ID/Code').

The data collection for EARS-Net is supported by WHONET (Microbiology Laboratory Database Software) which is a useful tool for processing and analysing antimicrobial resistance data. It provides a routine procedure to perform data entry and export data in EARS-Net exchange format and can be used locally by participating laboratories and centrally by country data managers. The software and manual can be downloaded from http://www.whonet.org/.

If a new laboratory joins the surveillance network the country disease-specific contact points must communicate the new code of the new laboratory to the Helpdesk at tessy@ecdc.europa.eu by e-mail before uploading data; otherwise, the system will not recognise the new code and will reject the entire file.

Checking for duplicate records

Before uploading a file to TESSy under the EpiPulse platform, the country data manager should revise the laboratory data and check for duplicates (records with the same RecordId). If there are duplicates, TESSy will reject the upload. Duplicates should be eliminated by merging/selecting records.

Recommendations for selecting records:

- In the TESSy metadata, the recommended format of the RecordId is a combination of the following fields: ReportingCountry; LaboratoryCode; PatientCounter; Pathogen; Specimen; Antibiotic and DateUsedForStatistics.
- According to the metadata set specifications, two or more records with the same RecordId are considered as **duplicates and will generate an error** in the uploading process to TESSy, with the subsequent rejection of the entire batch of records.
- To avoid rejection of the batch, it is important to identify multiple isolates within the same day (DateUsedForStatistics) and select one of them according to the following priority:
  - If there are duplicates with the same 'Pathogen' and 'Antibiotic' combination but different microbiological tests, select the proper one according to EUCAST guidelines.
  - If there are duplicates with the same 'Pathogen' , 'Antibiotic' , and microbiological test, but different SIR, select the first in this order R→I→S (thereby selecting the most resistant).
  - If there are duplicates with the same 'Pathogen', 'Antibiotic', microbiological test, and SIR (true duplicates), just select one of them, taking into account the completeness of the other variables.

[4] Commission Implementing Decision (EU) 2018/945 of 22 June 2018 on the communicable diseases and related special health issues to be covered by epidemiological surveillance, as well as relevant case definitions. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018D0945&from=EN

Data management and analysis

TESSy filter 1 (case definition) and validation report

TESSy filters the uploaded records according to the list of microorganism/antimicrobial agent combinations included in the AMR surveillance (the EARS-Net case definition for TESSy is described in more detail in 'Implementation of AMR case definitions for TESSy'). Records referring to additional microorganism/antimicrobial agent combinations are discharged.

Shortly after the data are uploaded, TESSy provides a validation report which should be assessed by the country user. The report shows summary statistics of the validated data from the uploaded batch.

TESSy filter 2 (preparing dataset for analysis)

This filter aims to obtain one record per patient/microorganism/specimen/antimicrobial agent combination and year.

STEP 1	Select all records that belong to the **first date** within the considered YEAR for each patient/microorganism combination.	Fields to identify the date: • DateUsedForStatistics Fields to identify the patient/microorganism combination: • ReportingCountry • LaboratoryCode • PatientCounter • Pathogen
STEP 2	If more than **one source** (BLOOD, CSF) is reported within the first date, select only one, giving priority to the CSF.	Field to identify the **source**: • Specimen
STEP 3	If the same antimicrobial is still reported in more than one record, make a selection according to the **final interpretation of the susceptibility test** (priority sequence R→I→S).	Field to identify the **final interpretation of the susceptibility test**: • SIR
STEP 4	If the same antimicrobial is still reported in more than one record, select the first one.	

Data analysis and presentation

For the analysis, an isolate is considered resistant to an antimicrobial agent when tested and interpreted as resistant (R) according to the EUCAST clinical breakpoint. An isolate of *Streptococcus pneumoniae* is considered penicillin non-wild-type when testing results show oxacillin inhibition zone < 20 mm or benzylpenicillin MIC > 0.06 mg/L. Since 2020 (2019 AMR data), results based on interpretive criteria other than EUCAST criteria have not been accepted in EARS-Net.

As a general rule, data are expressed as a resistance percentage (i.e. the percentage of R isolates of all isolates with antimicrobial susceptibility testing (AST) information on that specific microorganism–antimicrobial agent combination), or as an estimated incidence of resistance (i.e. the number of cases with R isolates from the population covered.)

In most cases, the percentage resistance or estimated incidence of resistance is calculated considering an antimicrobial group (instead of a single antimicrobial agent), which means that other specifications are needed to perform the analysis. Often, but not always, the group represents an antimicrobial class. An example of an antimicrobial group is the aminopenicillins for *E. coli*. This group contains two antimicrobial agents: ampicillin (AMP) and amoxicillin (AMX). If two or more antimicrobials (records) are reported for the same 'microorganism/antimicrobial group' combination, count only one of them; the choice has to be made in accordance with the final interpretations of the susceptibility test (field=SIR; priority sequence R→I→S).

Specific rule for *Streptococcus pneumoniae* and penicillin non-wild-type

The antimicrobials considered for this phenotype are penicillin (PEN) and oxacillin (OXA). If both are reported, give priority to penicillin.

Specific rule for *Streptococcus pneumoniae* and fluoroquinolones

The antimicrobials considered for this resistance are norfloxacin (NOR), levofloxacin (LVX) and moxifloxacin (MFX). Priority is given to levofloxacin and moxifloxacin AST results over norfloxacin results.

Specific rule to define Meticillin-resistant *Staphylococcus aureus* (MRSA)

The antimicrobials considered for this resistance are cefoxitin (FOX) and oxacillin (OXA), with priority given to cefoxitin (FOX). AST results for meticillin (MET), flucloxacillin (FLC), cloxacillin (CLO) or dicloxacillin (DIC) are accepted as a marker for oxacillin (OXA) resistance if oxacillin is not reported. Other tests are also considered: PCR *mecA* or PBP2a detection.

Hierarchical levels to assess the MRSA:

- SIR result of FOX
- SIR result of OXA
- SIR result of MET, FLC, CLO, DIC
- Other test (PCR mecA and PBP2a).

When SIR results for FOX, OXA or markers of OXA are not reported, the definition of MRSA is based on the following criteria:

- if at least one from ResultPCRmec and ResultPbp2aAggl is positive, then MRSA;
- if at least one from ResultPCRmec and ResultPbp2aAggl is negative, and the other is not positive then MSSA (Meticillin-sensitive *Staphylococcus aureus*).

Specific rule for *Staphylococcus aureus* and fluoroquinolones

The antimicrobials considered for this resistance are norfloxacin (NOR), ciprofloxacin (CIP) and levofloxacin (LVX). Priority is given to ciprofloxacin, and/or levofloxacin AST results over norfloxacin results.

The full set of microorganism/antimicrobial group combinations under regular surveillance by EARS-Net (routinely presented in an annual report or the ECDC Surveillance Atlas of Infectious Diseases) is displayed in Table 9. Additional analysis of other single or groups of antimicrobial agents will be performed on an ad hoc basis.

If fewer than 20 isolates are reported for a specific organism–antimicrobial agent combination in a country, the results for this country are not displayed on the maps presented in the Annual Report and the interactive database.

The methodology to estimate incidence (cases per 100 000 population) at country level:

$$\frac{Cases}{National\ population * Coverage} * 100\ 000 = estimated\ incidence$$

Cases – cases reported as R.
Coverage – estimated national population coverage. The most recently reported coverage for the respective year is used – either the coverage reported for the respective year or the one either preceding or following it, whichever came first.
National population – as reported to Eurostat.

at EU/EEA level:
the sum of all the estimated cases for the reporting EU/EEA countries included is calculated and divided by the total EU/EEA population.

Estimated cases – cases reported as R by a country, divided by the coverage.

The statistical significance of temporal trends in antimicrobial resistance is calculated based on data from the last five years. For antimicrobial resistance percentages by country, countries reporting fewer than 20 isolates per year, where a significant change in data source occurred during the period, or countries that did not provide data for all years within the considered period, are not included in the analysis. The statistical significance of trends in resistance percentages is assessed by a chi-square test for trend. An additional sensitivity analysis is performed by repeating the test including only laboratories which consistently reported for the full five-year period, in order to exclude selection bias when assessing the significance of the trends. For estimated incidence of resistance by country, countries that did not provide data for all years within the considered period are not included in the analysis, nor is it possible to calculate the trend if the estimated incidence of resistance is 0 for most years. Statistical significance of trends is assessed with negative binomial regression.

Table 9. Microorganism and antimicrobial group combinations under regular EARS-Net surveillance, routinely presented in an annual report or the ECDC Surveillance Atlas of Infectious Diseases 2024

Microorganism	Antimicrobial group	Antimicrobial agents
Streptococcus pneumoniae **(STRPNE)**	Penicillins	PEN, OXA*
	Macrolides	ERY, CLR, AZM
	Fluoroquinolones	NOR, LVX, MFX**
	Third-generation cephalosporins	CTX, CRO
Staphylococcus aureus **(STAAUR)**	MRSA	FOX, OXA***
	Rifampicin	RIF
	Fluoroquinolones	NOR, CIP, LVX****
Enterococcus faecalis **(ENCFAE)**	High-level aminoglycoside resistance	GEH
	Aminopenicillins	AMX, AMP
	Vancomycin	VAN
Enterococcus faecium **(ENCFAI)**	Aminopenicillins	AMX, AMP
	High-level aminoglycoside resistance	GEH
	Vancomycin	VAN
Escherichia coli **(ESCCOL)**	Aminopenicillins	AMX, AMP
	Fluoroquinolones	CIP, OFX, LVX
	Third-generation cephalosporins	CTX, CRO, CAZ
	Aminoglycosides	GEN, TOB
	Carbapenems	IPM, MEM
	(New antibiotics and combinations)	(FDC, CZA, CZT, IMR, MEV)
Klebsiella pneumoniae **(KLEPNE)**	Fluoroquinolones	CIP, OFX, LVX
	Third-generation cephalosporins	CTX, CRO, CAZ
	Aminoglycosides	GEN, TOB
	Carbapenems	IPM, MEM
	(New antibiotics and combinations)	(FDC, CZA, CZT, IMR, MEV)
Pseudomonas aeruginosa **(PSEAER)**	Piperacillin-tazobactam	TZP
	Ceftazidime	CAZ
	Fluoroquinolones	CIP, LVX
	Aminoglycosides	TOB
	Carbapenems	IPM, MEM
	(New antibiotics and combinations)	(FDC, CZA, CZT, IMR, MEV)
Acinetobacter **species (ACISPP)**	Fluoroquinolones	CIP, LVX
	Aminoglycosides	GEN, TOB
	Carbapenems	IPM, MEM
	(New antibiotics and combinations)	(FDC, CZA, CZT, IMR, MEV)

** Priority is given to penicillin susceptibility test over oxacillin results.*
*** Priority is given to levofloxacin and moxifloxacin susceptibility results over norfloxacin results.*
**** Meticillin (MET), flucloxacillin (FLC), cloxacillin (CLO) or dicloxacillin (DIC) susceptibility results are accepted as markers for oxacillin (OXA) resistance if oxacillin is not reported.*
***** Priority is given to ciprofloxacin and levofloxacin susceptibility results over norfloxacin results.*

Parentheses indicate that these are new additions to EARS-Net and additional considerations may be necessary when analysing AST results reported for these 'new' antibiotics and combinations and deciding how they should be reported in ECDC outputs.

Isolate record forms

These isolate record forms should be filled in by laboratories without electronic systems.

The following isolate record forms are included:

- Isolate Record Form *Streptococcus pneumoniae*
- Isolate Record Form *Staphylococcus aureus*
- Isolate Record Form *Enterococcus faecium/Enterococcus faecalis*
- Isolate Record Form *Escherichia coli*
- Isolate Record Form *Klebsiella pneumoniae*
- Isolate Record Form *Pseudomonas aeruginosa*
- Isolate Record Form *Acinetobacter spp.*

Isolate Record Form *Streptococcus pneumoniae*

Instructions: Please send data for the first blood and/or cerebrospinal fluid isolate of every patient with an invasive *S. pneumoniae* infection. Send data on resistant and susceptible isolates; use one form per isolate. [n] Indicates variable number in reporting protocol.

[9] Laboratory Code		
[14] Isolate Id	**[10] Specimen** ☐ Blood ☐ CSF	**[7] Date of sample collection** (yyyy-mm-dd)
[11] Patient counter	**[12] Gender** ☐ Male ☐ Female ☐ Other ☐ Unknown	**[13] Age** (years)
[15] Hospital Id	**[16] Patient type** ☐ Inpatient ☐ Outpatient ☐ Other ☐ Unknown	**[19] Date of hospitalisation** (yyyy-mm-dd)
[17] Hospital Unit Type ☐ Internal medicine ☐ Paediatrics/neonatal ☐ Paediatrics/neonatal ICU ☐ Surgery ☐ Haematology/Oncology ☐ Obstetrics/Gynaecology ☐ Intensive care unit ☐ Emergency department ☐ Urology ward ☐ Infectious disease ward ☐ Other ☐ Unknown		

Antibiotic susceptibility testing (S/I/R, zone and/or MIC)

[25] Antibiotic	**[26] SIR** (final interpretation result of all different susceptibility tests performed)	**Zone diameter**			**MIC**		**Gradient strip results**		**[36] Reference guidelines**
		[27] Result (mm)	**[28] Interpretation** (SIR)	**[35] Disk load** (specify unit)	**[30] Result** (mg/L)	**[31] Interpretation** (SIR)	**[33] Result** (mg/L)	**[34] Interpretation** (SIR)	Only EUCAST breakpoints accepted
Oxacillin									
Penicillin									
Erythromycin									
Clarithromycin									
Azithromycin									
Cefotaxime									
Ceftriaxone									
Norfloxacin									
Levofloxacin									
Moxifloxacin									
[22] Serotype:									

Send this form to: [Name/Institute/Contact details]

Isolate Record Form *Staphylococcus aureus*

Instructions: Please send data for the first blood and/or cerebrospinal fluid isolate of every patient with an invasive *S. aureus* infection. Send data on resistant and susceptible isolates; use one form per isolate.
[n] Indicates variable number in reporting protocol.

[9] Laboratory Code		
[14] Isolate Id	**[10] Specimen** ☐ Blood ☐ CSF	**[7] Date of sample collection** (yyyy-mm-dd)
[11] Patient counter	**[12] Gender** ☐ Male ☐ Female ☐ Other ☐ Unknown	**[13] Age** (years)
[15] Hospital Id	**[16] Patient type** ☐ Inpatient ☐ Outpatient ☐ Other ☐ Unknown	**[19] Date of hospitalisation** (yyyy-mm-dd)
[17] Hospital Unit Type ☐ Internal medicine ☐ Paediatrics/neonatal ☐ Paediatrics/neonatal ICU ☐ Surgery ☐ Haematology/Oncology ☐ Obstetrics/Gynaecology ☐ Intensive care unit ☐ Emergency department ☐ Urology ward ☐ Infectious disease ward ☐ Other ☐ Unknown		

MRSA confirmation tests

[20] PCR mec	☐ **Positive** ☐ **Negative** ☐ **Unknown**
[21] Pbp2a agglutination	☐ **Positive** ☐ **Negative** ☐ **Unknown**

Antibiotic susceptibility testing (S/I/R, zone and/or MIC)

[25] Antibiotic	**[26] SIR** (final interpretation result of all different susceptibility tests performed)	**Zone diameter**			**MIC**		**Gradient strip results**		**[36] Reference guidelines**
		[27] Result (mm)	**[28] Interpretation** (SIR)	**[35] Disk load** (specify unit)	**[30] Result** (mg/L)	**[31] Interpretation** (SIR)	**[33] Result** (mg/L)	**[34] Interpretation** (SIR)	Only EUCAST breakpoints accepted
Cefoxitin									
Oxacillin									
Ciprofloxacin									
Levofloxacin									
Norfloxacin									
Rifampicin									
Linezolid									
Vancomycin									
Daptomycin									

Send this form to: [Name/Institute/Contact details]

Isolate Record Form

□ *Enterococcus faecium*

□ *Enterococcus faecalis*

Instructions: Please send data for the first blood and/or cerebrospinal fluid isolate of every patient with an invasive *E. faecium/E. faecalis* infection. Send data on resistant and susceptible isolates; use one form per isolate. [n] Indicates variable number in reporting protocol.

[9] Laboratory Code		
[14] Isolate Id	**[10] Specimen** ☐ Blood ☐ CSF	**[7] Date of sample collection** (yyyy-mm-dd)
[11] Patient counter	**[12] Gender** ☐ Male ☐ Female ☐ Other ☐ Unknown	**[13] Age** (years)
[15] Hospital Id	**[16] Patient type** ☐ Inpatient ☐ Outpatient ☐ Other ☐ Unknown	**[19] Date of hospitalisation** (yyyy-mm-dd)
[17] Hospital Unit Type ☐ Internal medicine ☐ Paediatrics/neonatal ☐ Paediatrics/neonatal ICU ☐ Surgery ☐ Haematology/Oncology ☐ Obstetrics/Gynaecology ☐ Intensive care unit ☐ Emergency department ☐ Urology ward ☐ Infectious disease ward ☐ Other ☐ Unknown		

Antibiotic susceptibility testing (S/I/R, zone and/or MIC)

[25] Antibiotic	**[26] SIR** (final interpretation result of all different susceptibility tests performed)	**Zone diameter**			**MIC**		**Gradient strip results**		**[36] Reference guidelines**
		[27] Result (mm)	**[28] Interpretation** (SIR)	**[35] Disk load** (specify unit)	**[30] Result** (mg/L)	**[31] Interpretation** (SIR)	**[33] Result** (mg/L)	**[34] Interpretation** (SIR)	Only EUCAST breakpoints accepted
Amoxicillin									
Ampicillin									
Gentamicin - High									
Vancomycin									
Teicoplanin									
Linezolid									

Send this form to: [Name/Institute/Contact details]

Isolate Record Form *Escherichia coli*

Instructions: Please send data for the first blood and/or cerebrospinal fluid isolate of every patient with an invasive *E. coli* infection. Send data on resistant and susceptible isolates; use one form per isolate.
[n] Indicates variable number in reporting protocol.

[9] Laboratory Code		
[14] Isolate Id	**[10] Specimen** ☐ Blood ☐ CSF	**[7] Date of sample collection** (yyyy-mm-dd)
[11] Patient counter	**[12] Gender** ☐ Male ☐ Female ☐ Other ☐ Unknown	**[13] Age** (years)
[15] Hospital Id	**[16] Patient type** ☐ Inpatient ☐ Outpatient ☐ Other ☐ Unknown	**[19] Date of hospitalisation** (yyyy-mm-dd)
[17] Hospital Unit Type ☐ Internal medicine ☐ Paediatrics/neonatal ☐ Paediatrics/neonatal ICU ☐ Surgery ☐ Haematology/Oncology ☐ Obstetrics/Gynaecology ☐ Intensive care unit ☐ Emergency department ☐ Urology ward ☐ Infectious disease ward ☐ Other ☐ Unknown		

Phenotypic detection of resistance

[23] ESBL	☐ **Positive** ☐ **Negative** ☐ **Unknown**
[24] Carbapenemase	☐ **Positive** ☐ **Negative** ☐ **Unknown**

Antibiotic susceptibility testing (S/I/R, zone and/or MIC)

[25] Antibiotic	**[26] SIR** (final interpretation result of all different susceptibility tests performed)	**Zone diameter**			**MIC**		**Gradient strip results**		**[36] Reference guidelines**
		[27] Result (mm)	**[28] Interpretation** (SIR)	**[35] Disk load** (specify unit)	**[30] Result** (mg/L)	**[31] Interpretation** (SIR)	**[33] Result** (mg/L)	**[34] Interpretation** (SIR)	Only EUCAST breakpoints accepted
Amoxicillin									
Ampicillin									
Amoxicillin-clavulanic acid									
Piperacillin – tazobactam									
Gentamicin									
Tobramycin									
Amikacin									
Ciprofloxacin									
Ofloxacin									
Levofloxacin									
Moxifloxacin									
Cefotaxime									
Ceftriaxone									
Ceftazidime									
Ceftazidime-avibactam									
Cefepime									
Cefiderocol									
Ceftolozane-tazobactam									
Imipenem									
Imipenem-relebactam									
Meropenem									
Meropenem-vaborbactam									
Ertapenem									
Colistin									
Tigecycline									

Send this form to: [Name/Institute/Contact details].

Isolate Record Form *Klebsiella pneumoniae*

Instructions: Please send data for the first blood and/or cerebrospinal fluid isolate of every patient with an invasive *K. pneumoniae* infection. Send data on resistant and susceptible isolates; use one form per isolate. [n] Indicates variable number in reporting protocol.

[9] Laboratory Code		
[14] Isolate Id	**[10] Specimen** ☐ Blood ☐ CSF	**[7] Date of sample collection** (yyyy-mm-dd)
[11] Patient counter	**[12] Gender** ☐ Male ☐ Female ☐ Other ☐ Unknown	**[13] Age** (years)
[15] Hospital Id	**[16] Patient type** ☐ Inpatient ☐ Outpatient ☐ Other ☐ Unknown	**[19] Date of hospitalisation** (yyyy-mm-dd)
[17] Hospital Unit Type ☐ Internal medicine ☐ Paediatrics/neonatal ☐ Paediatrics/neonatal ICU ☐ Surgery ☐ Haematology/Oncology ☐ Obstetrics/Gynaecology ☐ Intensive care unit ☐ Emergency department ☐ Urology ward ☐ Infectious disease ward ☐ Other ☐ Unknown		

Phenotypic detection of resistance

[23] ESBL	☐ Positive ☐ Negative ☐ Unknown
[24] Carbapenemase	☐ Positive ☐ Negative ☐ Unknown

Antibiotic susceptibility testing (S/I/R, zone and/or MIC)

[25] Antibiotic	**[26] SIR** (final interpretation result of all different susceptibility tests performed)	**Zone diameter**			**MIC**		**Gradient strip results**		**[36] Reference guidelines**
		[27] Result (mm)	**[28] Interpretation** (SIR)	**[35] Disk load** (specify unit)	**[30] Result** (mg/L)	**[31] Interpretation** (SIR)	**[33] Result** (mg/L)	**[34] Interpretation** (SIR)	Only EUCAST breakpoints accepted
Amoxicillin clavulanic acid									
Piperacillin – tazobactam									
Gentamicin									
Tobramycin									
Amikacin									
Ciprofloxacin									
Ofloxacin									
Levofloxacin									
Moxifloxacin									
Cefotaxime									
Ceftriaxone									
Ceftazidime									
Ceftazidime-avibactam									
Cefepime									
Cefiderocol									
Ceftolozane-tazobactam									
Imipenem									
Imipenem-relebactam									
Meropenem									
Meropenem-vaborbactam									
Ertapenem									
Colistin									

Send this form to: [Name/Institute/Contact details]

Isolate Record Form *Pseudomonas aeruginosa*

Instructions: Please send data for the first blood and/or cerebrospinal fluid isolate of every patient with an invasive *P. aeruginosa* infection. Send data on resistant and susceptible isolates; use one form per isolate. [n] Indicates variable number in reporting protocol.

[9] Laboratory Code		
[14] Isolate Id	**[10] Specimen** ☐ Blood ☐ CSF	**[7] Date of sample collection** (yyyy-mm-dd)
[11] Patient counter	**[12] Gender** ☐ Male ☐ Female ☐ Other ☐ Unknown	**[13] Age** (years)
[15] Hospital Id	**[16] Patient type** ☐ Inpatient ☐ Outpatient ☐ Other ☐ Unknown	**[19] Date of hospitalisation** (yyyy-mm-dd)
[17] Hospital Unit Type ☐ Internal medicine ☐ Paediatrics/neonatal ☐ Paediatrics/neonatal ICU ☐ Surgery ☐ Haematology/Oncology ☐ Obstetrics/Gynaecology ☐ Intensive care unit ☐ Emergency department ☐ Urology ward ☐ Infectious disease ward ☐ Other ☐ Unknown		

Phenotypic detection of resistance

[24] Carbapenemase	☐ **Positive** ☐ **Negative** ☐ **Unknown**

Antibiotic susceptibility testing (S/I/R, zone and/or MIC)

[25] Antibiotic	**[26] SIR** (final interpretation result of all different susceptibility tests performed)	**Zone diameter**			**MIC**		**Gradient strip results**		**[36] Reference guidelines**
		[27] Result (mm)	**[28] Interpretation** (SIR)	**[35] Disk load** (specify unit)	**[30] Result** (mg/L)	**[31] Interpretation** (SIR)	**[33] Result** (mg/L)	**[34] Interpretation** (SIR)	Only EUCAST breakpoints accepted
Piperacillin									
Piperacillin-tazobactam									
Tobramycin									
Amikacin									
Ciprofloxacin									
Levofloxacin									
Ceftazidime									
Ceftazidime-avibactam									
Cefepime									
Cefiderocol									
Ceftolozane-tazobactam									
Imipenem									
Imipenem-relebactam									
Meropenem									
Meropenem-vaborbactam									
Colistin									

Send this form to: [Name/Institute/Contact details]

Isolate Record Form *Acinetobacter* species

Instructions: Please send data for the first blood and/or cerebrospinal fluid isolate of every patient with an invasive *Acinetobacter* spp. infection. Send data on resistant and susceptible isolates; use one form per isolate. [n] Indicates variable number in reporting protocol.

[9] Laboratory Code		
[14] Isolate Id	**[10] Specimen** ☐ Blood ☐ CSF	**[7] Date of sample collection** (yyyy-mm-dd)
[11] Patient counter	**[12] Gender** ☐ Male ☐ Female ☐ Other ☐ Unknown	**[13] Age** (years)
[15] Hospital Id	**[16] Patient type** ☐ Inpatient ☐ Outpatient ☐ Other ☐ Unknown	**[19] Date of hospitalisation** (yyyy-mm-dd)
[17] Hospital Unit Type ☐ Internal medicine ☐ Paediatrics/neonatal ☐ Paediatrics/neonatal ICU ☐ Surgery ☐ Haematology/Oncology ☐ Obstetrics/Gynaecology ☐ Intensive care unit ☐ Emergency department ☐ Urology ward ☐ Infectious disease ward ☐ Other ☐ Unknown		

Phenotypic detection of resistance

[24] Carbapenemase	☐ **Positive** ☐ **Negative** ☐ **Unknown**

Antibiotic susceptibility testing (S/I/R, zone and/or MIC)

[25] Antibiotic	**[26] SIR** (final interpretation result of all different susceptibility tests performed)	**Zone diameter**			**MIC**		**Gradient strip results**		**[36] Reference guidelines**
		[27] Result (mm)	**[28] Interpretation** (SIR)	**[35] Disk load** (specify unit)	**[30] Result** (mg/L)	**[31] Interpretation** (SIR)	**[33] Result** (mg/L)	**[34] Interpretation** (SIR)	Only EUCAST breakpoints accepted
Ceftazidime-avibactam									
Cefiderocol									
Ceftolozane-tazobactam									
Ciprofloxacin									
Levofloxacin									
Gentamicin									
Tobramycin									
Amikacin									
Imipenem									
Imipenem-relebactam									
Meropenem									
Meropenem-vaborbactam									
Colistin									

Send this form to: [Name/Institute/Contact details].