WHONET for EARS-Net Manual

John Stelling
Brigham and Women's Hospital
WHO Collaborating Centre for Surveillance of Antimicrobial Resistance
Boston, Massachusetts
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1. Introduction

This manual is written for national EARS-Net data managers. It can also be used by data managers of laboratories that participate in EARS-Net. It describes how to use WHONET in handling data for EARS-Net. WHONET supports output of data to TESSy / EARS-Net exchange format. This is not a complete manual for WHONET, which can be downloaded from the WHONET home page at www.whonet.org.

The EARS-Net management team recommends*:*

1. The use of WHONET, because:
   - it is freeware, downloadable from the WHONET Home Page, www.whonet.org.
   - it allows for quick and comprehensive data analysis, and may thus stimulate a laboratory to study its own data.
   - WHONET supports the output to EARS-Net data exchange format.

2. WHONET includes a Data Check Feedback Report, jointly developed by Dr. Stelling and the RIVM EARSS Management Team:
   - it gives **direct feedback** to participating laboratories on microbiological aspects (alert on MRSA, PNSP, GISA) to come to **possible interventions**.
   - it **checks validity** and **completeness** of collected data, producing a report indicating clearly if it is necessary to correct data or to make them complete.

Document revision history

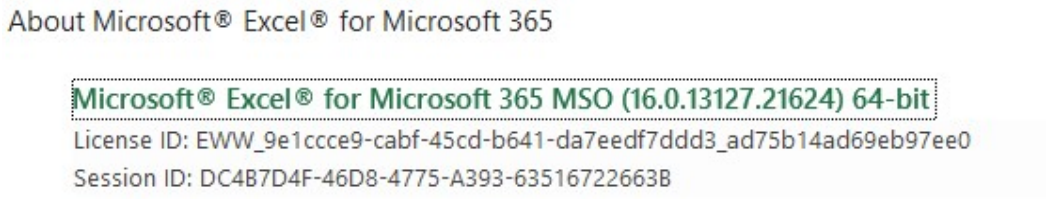
Date	Comments
June 5, 2021	Review of the 2015 manual based on WHONET 5.6. Updated guidance on software installation Updated screen grabs from WHONET 5.6 to WHONET 2017+
April 25, 2022	Review conducted of the 2021 manual. There were no relevant protocol or software modifications.

For comments and questions you may contact:

John Stelling, MD, MPH
Co-Director, WHO Collaborating Centre for Surveillance of Antimicrobial Resistance
Brigham and Women's Hospital
Microbiology laboratory
75 Francis Street
Boston, Massachusetts 02115
United States
E-mail: jstelling@whonet.org
Phone: +1 617 935 9407

2. Downloading and installing WHONET

The software is available from the WHONET Home Page at www.whonet.org. From this page, you have the option of downloading either the 32-bit or 64-bit version of WHONET. For most users, there should be no difference in performance between the two versions, but for those who encounter compatibility issues when saving to Excel, we would recommend downloading the WHONET that corresponds with the locally-installed version of Excel (32-bit or 64-bit). You can find the version when you open Excel, choose "Account" from the main side menu, and click on "About Excel" as in the below screen from Excel 64-bit version.



WHONET needs a computer running Microsoft Windows, versions 95 or later. After downloading the software, then double-click on the downloaded file, and follow the instructions on the screen ("Run", "OK", *etc.*). If you receive a message about "insufficient administrative rights" to install the software, then you will need to contact your facility's system administrator to install the software for you or to give you the needed local administration rights.

The default location for the WHONET installation is c:\WHONET. You may change this as you wish. For example, if you would like to use WHONET on a network drive to permit shared use by multiple staff members, then you can install the software to a common drive, such as T:\WHONET. You will need to repeat this process on each of the computers from which you would like to use WHONET.

In case you already have older versions of WHONET on your PC, then install the updated WHONET to the same directory as the older version. This will overwrite all of the WHONET program files, but it will leave your own configuration, data, and user files untouched. In this way, you can continue using WHONET just as you did before the software update.

After installing the program you will find the WHONET and BacLink icons on your PC.

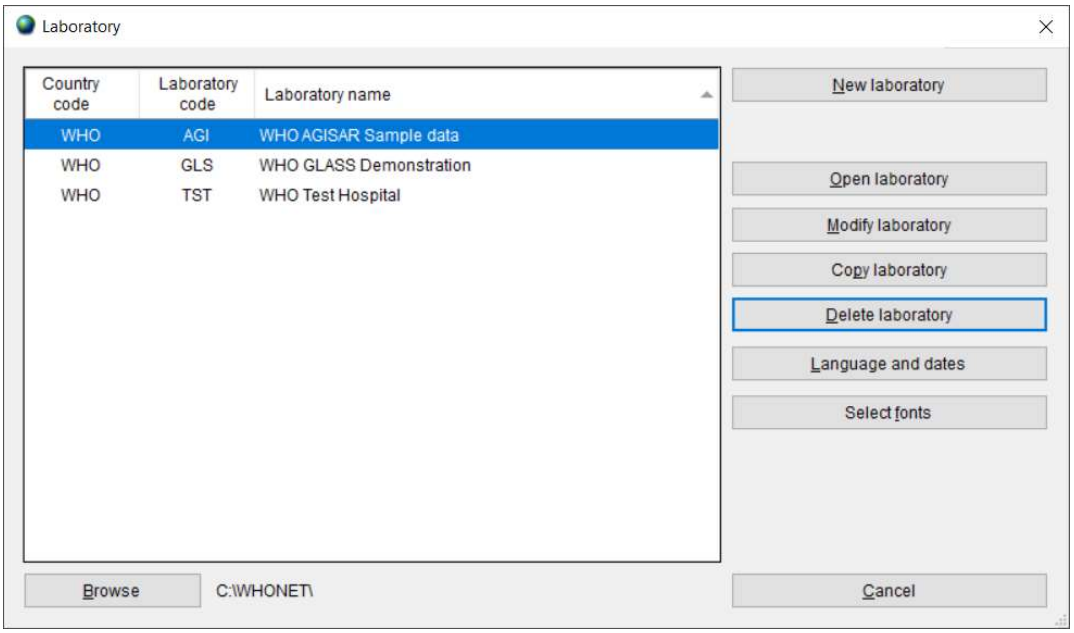
3. Laboratory configuration

3.1 Creating a New Laboratory Configuration

In WHONET, there are three principle ways to create a new laboratory configuration: 1. New laboratory; 2. Create a laboratory from a data file (especially useful for users of BacLink); and 3. Create a new TESSy laboratory. The purpose of this third option is to create a new laboratory configuration consistent with the EARS-Net data entry protocol. It is especially useful if you plan to enter results for the optional EARS-Net fields.

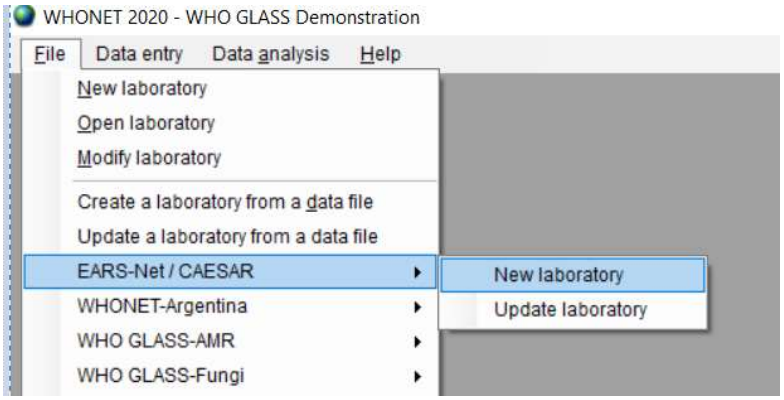
To use this third option for configuring a TESSy / EARS-Net laboratory:

- Start WHONET, the below screen appears, hit 'Cancel'



Then the main WHONET screen appears.

- Click "File", "EARS-Net / CAESAR" and "New laboratory", as in the below screen.



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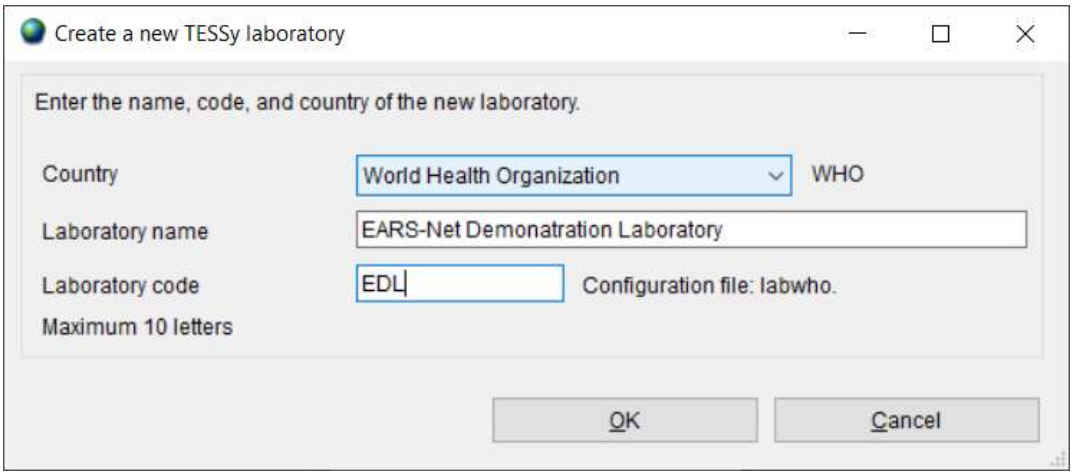
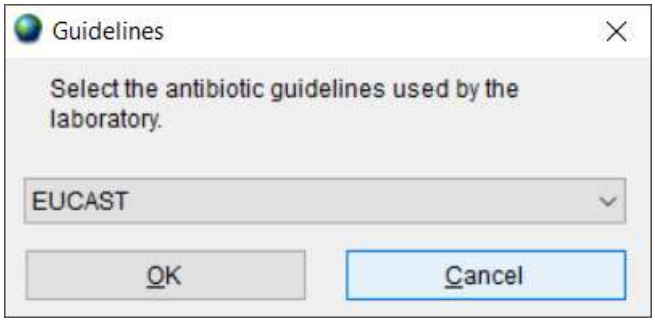
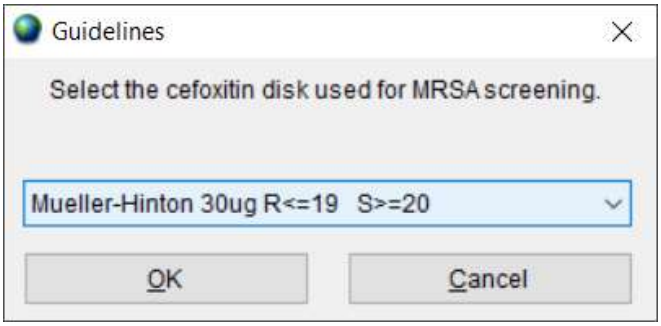
- Choose your country ("World Health Organization" in the below example), and enter a laboratory name ("EARS-Net Demonstration Laboratory") and a short laboratory code (EDL). In most EARS-Net countries, laboratories are identified by a numeric code, such as 008. Then click OK.



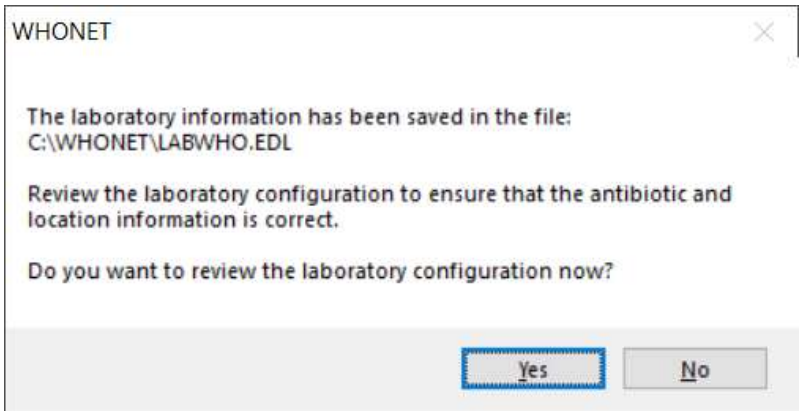
- Select "EUCAST" from the list of guidelines provided



- Select the cefoxitin disk potency used for MRSA detection, which is typically 30 micrograms for EUCAST, and click "OK". Or "Not tested" if not cefoxitin disk is used.



WHONET will create a new laboratory with the recommended set of EARS-Net antibiotics, data fields, and codes. You will then be prompted with the following screen.



- If you want to review the configuration and make any additional modifications, select "Yes". Otherwise, select "No" to proceed directly with WHONET Data entry and analysis.

Before you start with data entry we recommend that you review to check if it is necessary to make changes to the antibiotic interpretative breakpoints. For details how to make any additional changes we refer to the next section (3.2).

If you are responsible for working with multiple facilities, you may use the "Copy laboratory" feature to clone this first EARS-Net laboratory to new ones, assigning a new name and code to each additional facility that you create. This is described in further detail in Section 3.8. You may also wish to create a "national" laboratory configuration, for example "All laboratories" which could be utilized for analysing and managing data from any of the contributing laboratories in the country.

3.2 Modifying Laboratory Configuration

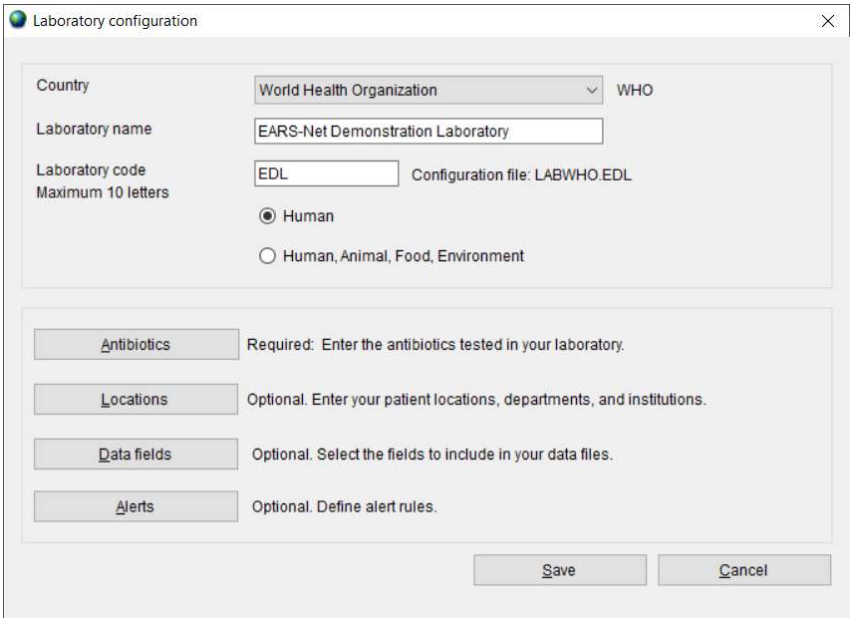
You may want to create or modify a specific 'laboratory configuration' for each laboratory that participates in EARS-Net. The steps in making or modifying a configuration of a laboratory are: giving or changing a name and code to the laboratory corresponding to the EARS-Net laboratory code[1]; entering the antibiotic list and corresponding breakpoints; and modifying the list of WHONET data fields for EARS-Net.

If you have used the feature "EARS-Net / CAESAR", "New laboratory" feature, then the below steps are generally not required. But you may wish to remove antibiotics and data fields that you do not feel are needed, and you may wish to add additional antibiotics and data fields, even though they are not requested by EARS-Net.

3.3 General laboratory information

STEP 1 Collect information on antibiotics, test methods and breakpoints specific for the participating laboratory.

STEP 2 Start WHONET by double clicking on the WHONET icon. When you enter '*New Laboratory*' the Laboratory Configuration screen appears.



STEP 3 Describe *Laboratory (Required)* : Choose the country, and enter the name of the laboratory. Enter the Laboratory code, use the corresponding three-characters of the code for the laboratory assigned by the national representative for EARS-Net.

Note: after entering this information WHONET will automatically create a corresponding laboratory configuration file name with the name labccc.xxx, where ccc = 3-letter ISO country code and xxx = 3 characters of EARS-Net laboratory code. In the above example, the file name would be LABWHO.EDL.

STEP 4 Antibiotic Configuration, Initial (Required): Click on 'Antibiotics' to configure the antibiotics. Enter the list of antibiotics that are being used by the laboratory and click 'Close' when finished to return to the main Laboratory Configuration screen. For details see 3.4 'Antibiotics (Antibiotic Configuration)'.

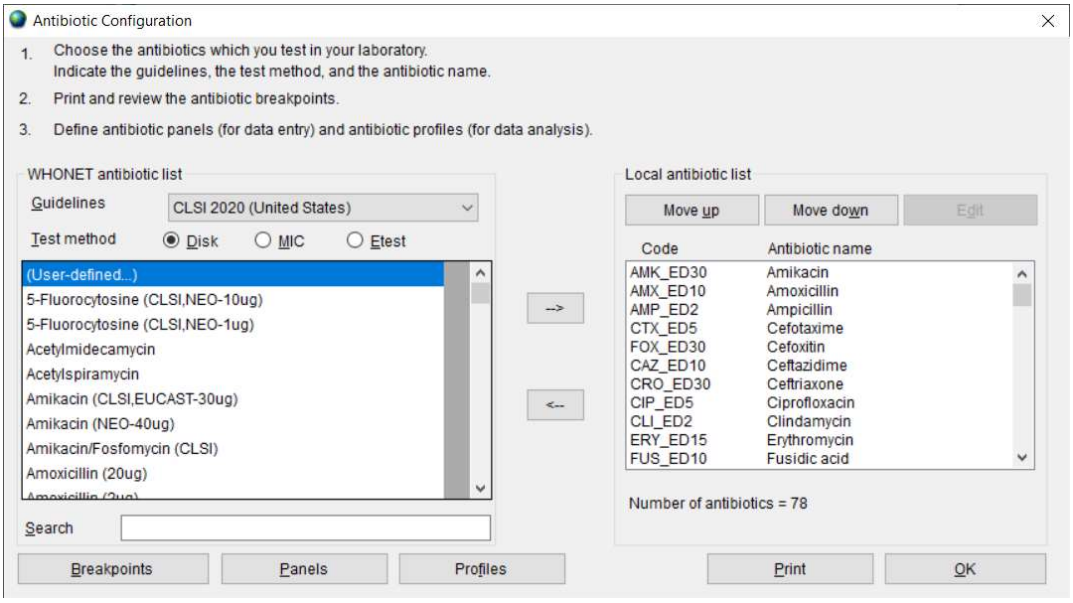
[1] The national data manager or national representative assigns laboratory codes to the EARS-Net participant with three characters to identify the laboratory.

3.4 Antibiotics (Antibiotic Configuration)

To indicate which antibiotics, methods and breakpoints are being used in the participating laboratory you have to enter Antibiotic Configuration. Note: during data entry the software performs automatic interpretation based on the breakpoints entered in this configuration.

INSTRUCTIONS

STEP 1 From the main Laboratory Configuration screen, click on 'Antibiotics'. You will see the below screen. The 'WHONET Antibiotic List' appears to the left, while the antibiotics that you select will appear to the right under 'Local Antibiotic List'. The list on the right is already filled with EARS-Net antibiotics.



STEP 2 For each combination of antibiotic, method and testing guidelines:

- select the correct testing guidelines (CLSI, EUCAST, *etc.*)
- AND click on the correct test method (disk diffusion, MIC, ETest®)
- AND select the correct antibiotic (and disk potency for disk diffusion testing)

You can select an antibiotic by double-clicking on it or, alternatively by clicking on it once and then clicking the right arrow button '-->'.

When you finish entering your antibiotics, review the list and make any needed corrections. To remove an antibiotic from the list, double-click on the antibiotic or single-click on the antibiotic and hit the left arrow button '<--'. You may change the sequence of the antibiotics with 'Move Up' and 'Move Down' buttons.

NOTE: Each antibiotic test is given a code (up to nine letters) consisting of: the three-letter antibiotic code, a one-letter code indicating the guideline reference (*e.g.* N=CLSI, formerly NCCLS, E=EUCAST), a one-letter code indicating the test method (D=disk diffusion, M=MIC, E=ETest®), and a disk potency for drugs tested by disk diffusion. For MIC or ETest you only have to select the correct antibiotic and correct guideline – the disk potency indicated is not relevant. For example, the code GEN_ND10 represents: gentamicin, CLSI (NCCLS), disk diffusion, 10 µg, while GEN_EM is: gentamicin, EUCAST, MIC.

STEP 3 When you are satisfied with the list, you have the following options:

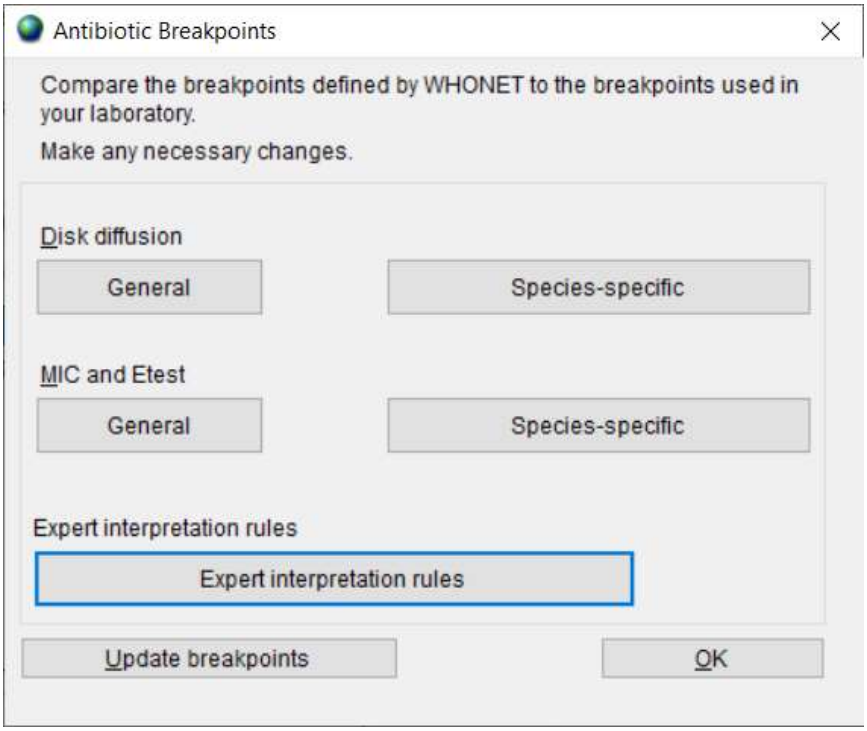
- 'OK' to return to main Laboratory Configuration screen. Note the information has to be saved by clicking on 'Save' in the main Laboratory Configuration screen.
- 'Panels' and 'Profiles' are optional; to facilitate data entry, you may wish to use 'Panels' to indicate which antibiotics are tested for each kind of organism. For details refer to WHONET manual.
- 'Print': obtain a printout of your antibiotics and their breakpoints. It is recommended that you print out your breakpoints for your review and reference before you start data entry.
- 'Breakpoints' to review, modify, and update the antibiotic breakpoints. See 3.5 below:

3.5 Antibiotic Breakpoints

WHONET will automatically load the most recent breakpoints for the antibiotics which you have indicated. Although not recommended for most users, it may happen that a laboratory uses other breakpoints than standard reference breakpoints, and for these situations you can edit the WHONET-provided standard breakpoints.

INSTRUCTIONS

STEP 1 From the Antibiotic Configuration screen, click on 'Breakpoints...'. The following screen should appear.



STEP 2 You have the following options:
'General': review and edit the list of general disk diffusion or MIC breakpoints. For details, see *STEP 3A*.
'Species-specific': review and edit the list of species-specific disk diffusion or MIC breakpoints. For details, see *STEP 3B*.

'Update breakpoints': The WHONET antibiotic definition files are updated annually as new recommendations from the reference authorities become available. When you download WHONET on an annual basis, the download will include the new breakpoints. WHONET will not automatically use these new breakpoints for your existing antibiotic list until you click on 'Update breakpoints' to replace the breakpoints currently set for your laboratory with the antibiotic breakpoints to be found in the most recent antibiotic definition files.

'Expert rules': These are not required for EARS-Net data management. Refer to the WNONET manual for further details.

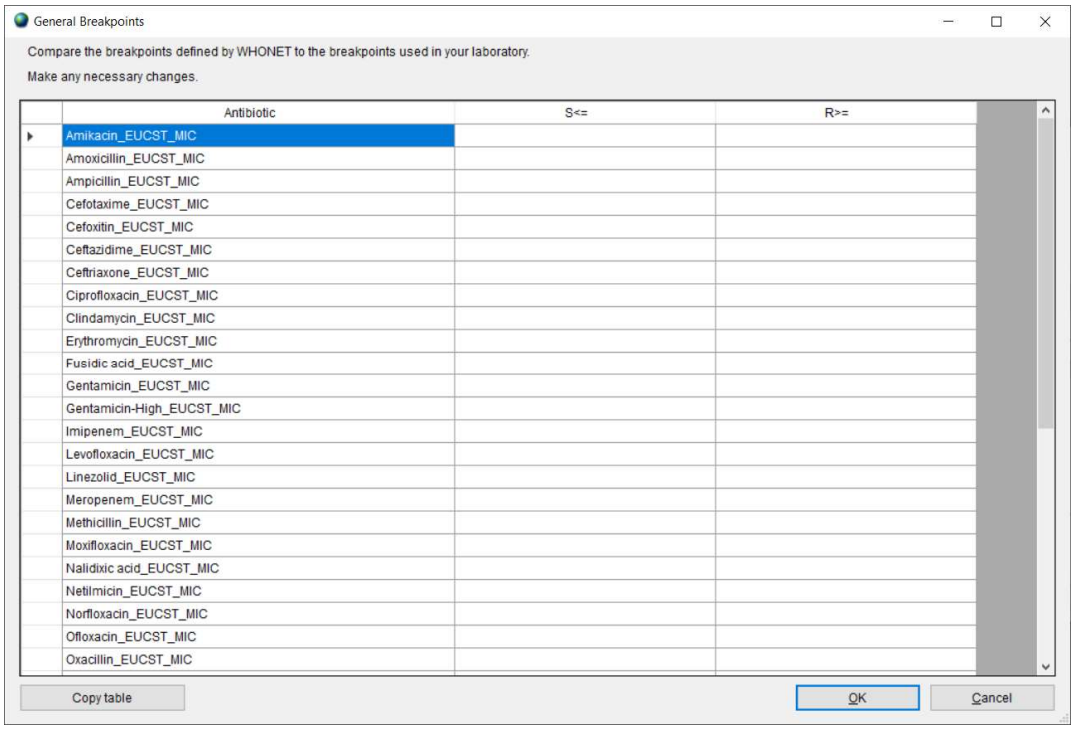
'OK': When you finish reviewing and/or modifying the antibiotic breakpoints, selecting 'OK' will return you to the Antibiotic Configuration screen.

This example illustrates the procedure:

STEP 3A
Editing General breakpoints: Click on Disk diffusion *'General'* breakpoints. You will see the below screen. (If you select this option for MIC and ETest® breakpoints you will see the same sort of

screen). Note: Since 2013, WHONET no longer defines “General” breakpoints for EUCAST. Instead all breakpoints are associated with specific species and can be found under “Species-specific breakpoints”.

Click on any breakpoint values which you would like to change. You may edit the relevant values under ‘R’, ‘I’, or ‘S’. Note: if you change a value e.g. for I, the other values change accordingly.



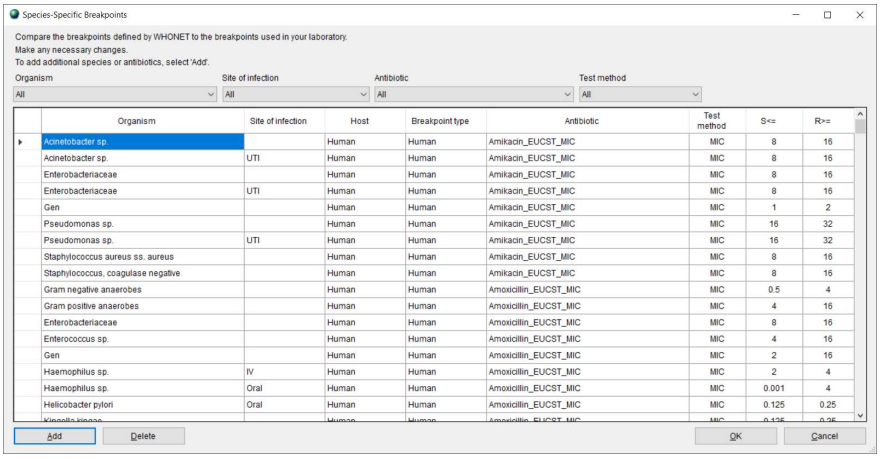
Antibiotic	S<=	R>=
Amikacin_EUCST_MIC		
Amoxicillin_EUCST_MIC		
Ampicillin_EUCST_MIC		
Cefotaxime_EUCST_MIC		
Cefoxitin_EUCST_MIC		
Ceftazidime_EUCST_MIC		
Ceftriaxone_EUCST_MIC		
Ciprofloxacin_EUCST_MIC		
Clindamycin_EUCST_MIC		
Erythromycin_EUCST_MIC		
Fusidic acid_EUCST_MIC		
Gentamicin_EUCST_MIC		
Gentamicin-High_EUCST_MIC		
Imipenem_EUCST_MIC		
Levofloxacin_EUCST_MIC		
Linezolid_EUCST_MIC		
Meropenem_EUCST_MIC		
Methicillin_EUCST_MIC		
Moxifloxacin_EUCST_MIC		
Nalidixic acid_EUCST_MIC		
Netilmicin_EUCST_MIC		
Norfloxacin_EUCST_MIC		
Ofloxacin_EUCST_MIC		
Oxacillin_EUCST_MIC		

When you have no more changes, click ‘OK’ to return to the previous screen.

NOTE: When entering the MIC breakpoints for antibiotic combinations, such as trimethoprim/sulfamethoxazole, enter the concentration of the first constituent. These dilutions usually follow the standard 1, 2, 4 µg/ml, *etc.* series.

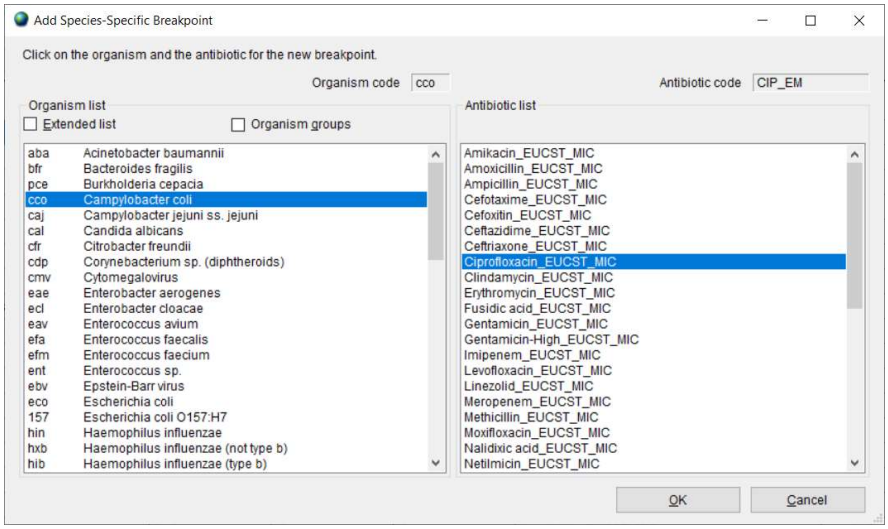
STEP 3B

Editing Species-Specific Antibiotic Breakpoints. You will see a screen similar to the one below. In most countries, changes to these WHONET-provided reference breakpoints are not required. But if you wish to make modifications to the breakpoints, you may make changes to the below table breakpoints using the same procedure as described in *STEP 3A*.



Organism	Site of infection	Host	Breakpoint type	Antibiotic	Test method	S<=	R>=
Acinetobacter sp.		Human	Human	Amikacin_EUCST_MIC	MIC	8	16
Acinetobacter sp.	UTI	Human	Human	Amikacin_EUCST_MIC	MIC	8	16
Enterobacteriaceae		Human	Human	Amikacin_EUCST_MIC	MIC	8	16
Enterobacteriaceae	UTI	Human	Human	Amikacin_EUCST_MIC	MIC	8	16
Gen		Human	Human	Amikacin_EUCST_MIC	MIC	1	2
Pseudomonas sp.		Human	Human	Amikacin_EUCST_MIC	MIC	16	32
Pseudomonas sp.	UTI	Human	Human	Amikacin_EUCST_MIC	MIC	16	32
Staphylococcus aureus ss. aureus		Human	Human	Amikacin_EUCST_MIC	MIC	8	16
Staphylococcus, coagulase negative		Human	Human	Amikacin_EUCST_MIC	MIC	8	16
Gram negative anaerobes		Human	Human	Amoxicillin_EUCST_MIC	MIC	0.5	4
Gram positive anaerobes		Human	Human	Amoxicillin_EUCST_MIC	MIC	4	16
Enterobacteriaceae		Human	Human	Amoxicillin_EUCST_MIC	MIC	8	16
Enterococcus sp.		Human	Human	Amoxicillin_EUCST_MIC	MIC	4	16
Gen		Human	Human	Amoxicillin_EUCST_MIC	MIC	2	16
Haemophilus sp.	IV	Human	Human	Amoxicillin_EUCST_MIC	MIC	2	4
Haemophilus sp.	Oral	Human	Human	Amoxicillin_EUCST_MIC	MIC	0.001	4
Helicobacter pylori	Oral	Human	Human	Amoxicillin_EUCST_MIC	MIC	0.125	0.25

Adding Species-Specific Antibiotic Breakpoints. If you need to enter additional species -specific breakpoints, select 'Add', and the below screen will appear. Indicate the organism-antibiotic combination for which you want to define breakpoints by clicking on the desired organism and the desired antibiotic. When finished, select 'OK' to return to the previous screen where you may enter the breakpoints.



Deleting Species-Specific Antibiotic Breakpoints. To delete a species-specific breakpoint, click on the relevant row of the table and click 'Delete'.

After completing your changes to the breakpoints, select 'OK' to return to the Antibiotic Breakpoints screen. You may then select 'OK' again to return to the Antibiotic Configuration screen.

3.6 Locations

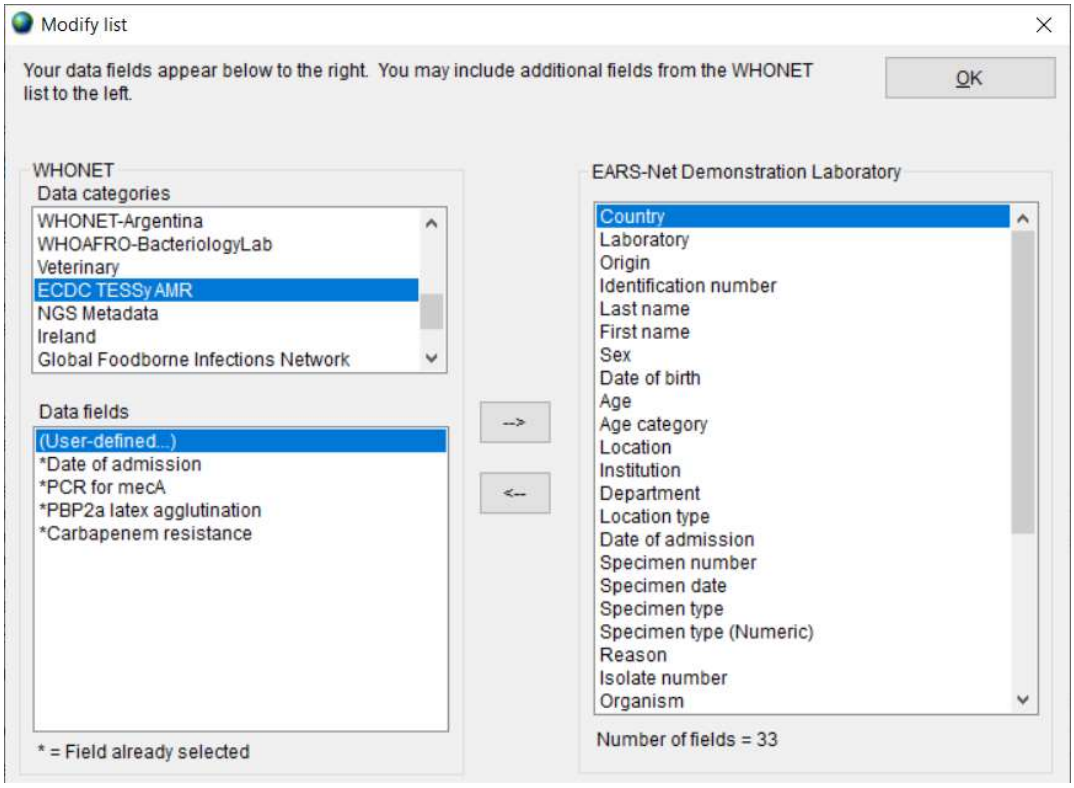
This option from the main screen 'Laboratory Configuration' is optional but is of value if you would like to keep track of the patient locations and medical services from which samples are taken. A detailed description is found in the main WHONET manual.

3.7 Modifying Data Field Configuration for EARS-Net

A set of 'standard' data fields is defined automatically by WHONET. 'Standard' fields include such routine information as: patient ID, patient ward, specimen date, specimen type, organism, antibiotic results, *etc.* Most of these 'standard' fields can be removed. To combine other surveillance activities with the EARS-Net data collection, you may want to add some 'additional' data fields, see instructions below. If you created your laboratory configuration using "Create a new TESSy laboratory", then the additional required and optional EARS-Net data fields have already been added to your configuration.

INSTRUCTIONS

STEP 1 From the main Laboratory Configuration screen, select 'Data Fields' and click on 'Modify list'. You will see a screen similar to the one below. The lists of WHONET data categories (clinical, infection control, *etc.*) and data fields (diagnosis, admission date, *etc.*) from which you may select appear to the left. If you select "ECDC TESSy AMR", this will show the EARS-Net data fields in the box 'Data fields'. Select them all and click the right arrow. They will be added to the list of data fields that appear to the right (also containing the standard data fields).



STEP 2 If you would like to include more additional fields in your data files, then you may select them here as well.

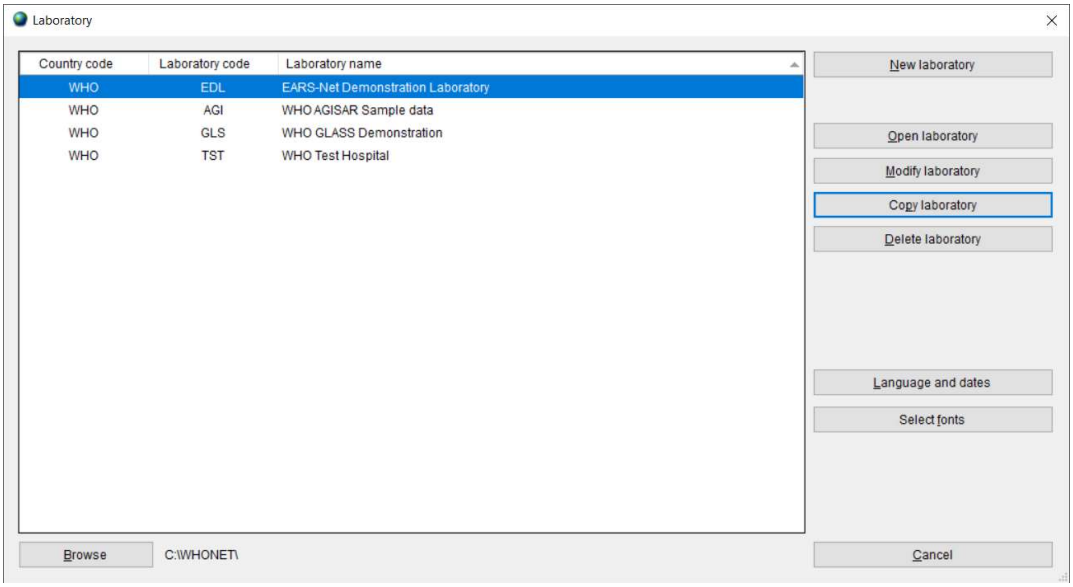
Note: By default, WHONET will check the validity of EARS-Net codes entered during data entry.

STEP 3 Leave this screen, by clicking on 'OK' twice and click on 'Save' to save this lab configuration.

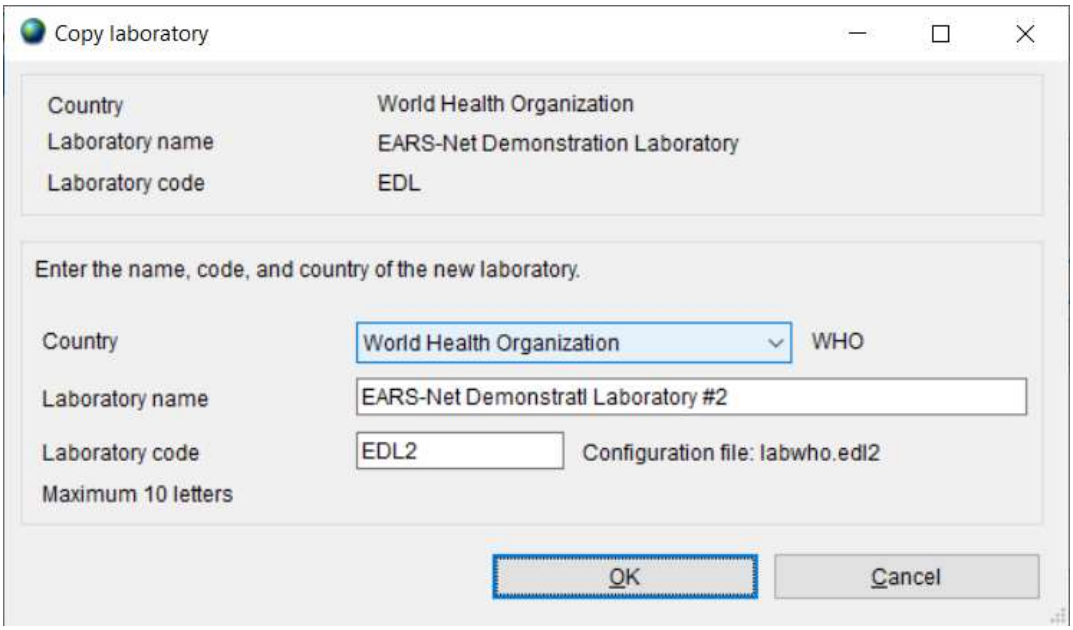
3.8 Copy an existing laboratory configuration

Introduction: if you have created a laboratory configuration for one of the EARS-Net participating laboratories, this option could be useful to create additional copies to be used for the other laboratories in the network.

- Choose from main menu, File, Open laboratory.
- In case you want to copy an existing laboratory configuration, select the laboratory configuration that you would like to copy, for example from the "WHO, EDL" laboratory, and click on 'Copy laboratory'.



The below screen will appear:



- Enter the country, laboratory name and laboratory code (numbers) and click on 'OK'.

4. WHONET Data entry for EARS-Net

4.1 General

Before you start 'Data entry' you have to open the corresponding laboratory configuration.

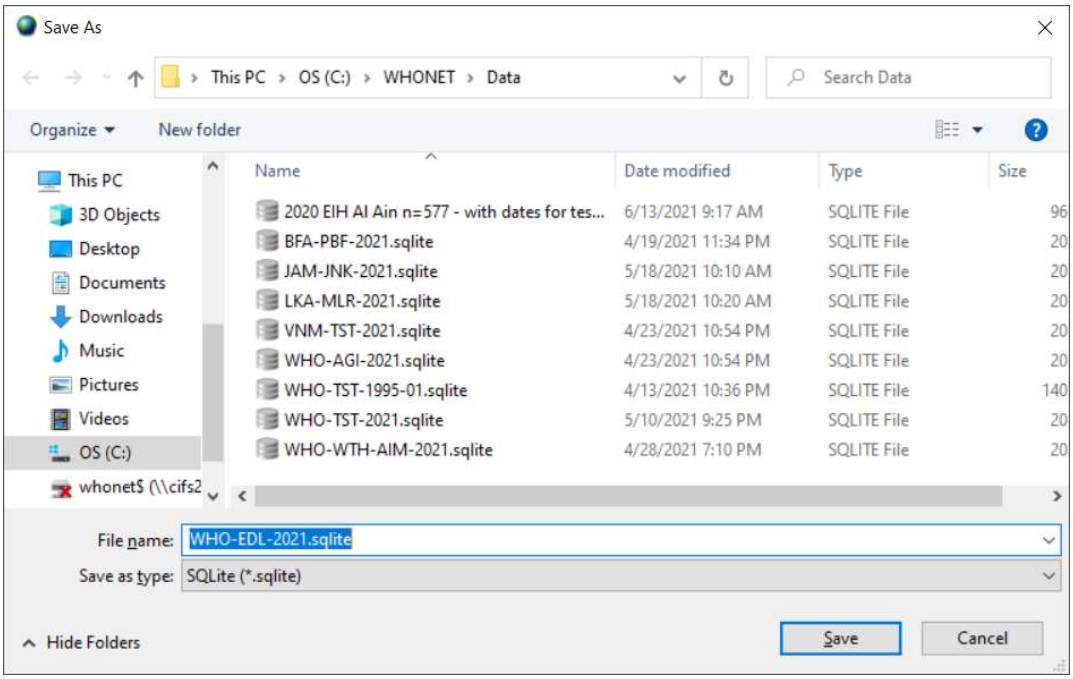
- Click on main menu, File, Open laboratory. Select lab and click on 'Open laboratory'.

WHONET uses the data structure defined in the current laboratory configuration and will use the breakpoints as defined in the laboratory configuration.

- You can create a "New data file", or you can "Open" an existing file. When you want to make a new file, Click from menu on '*Data Entry'* menu and then select '*New data file'*.

The below screen will permit you to give a "file name" and "file location" for your new data file. WHONET automatically suggests the default location of C:\WHONET with the default filename indicating the country, laboratory, and year, e.g. WHO-EDL-2021.sqlite in the below, but you can change this to your preferred file name.

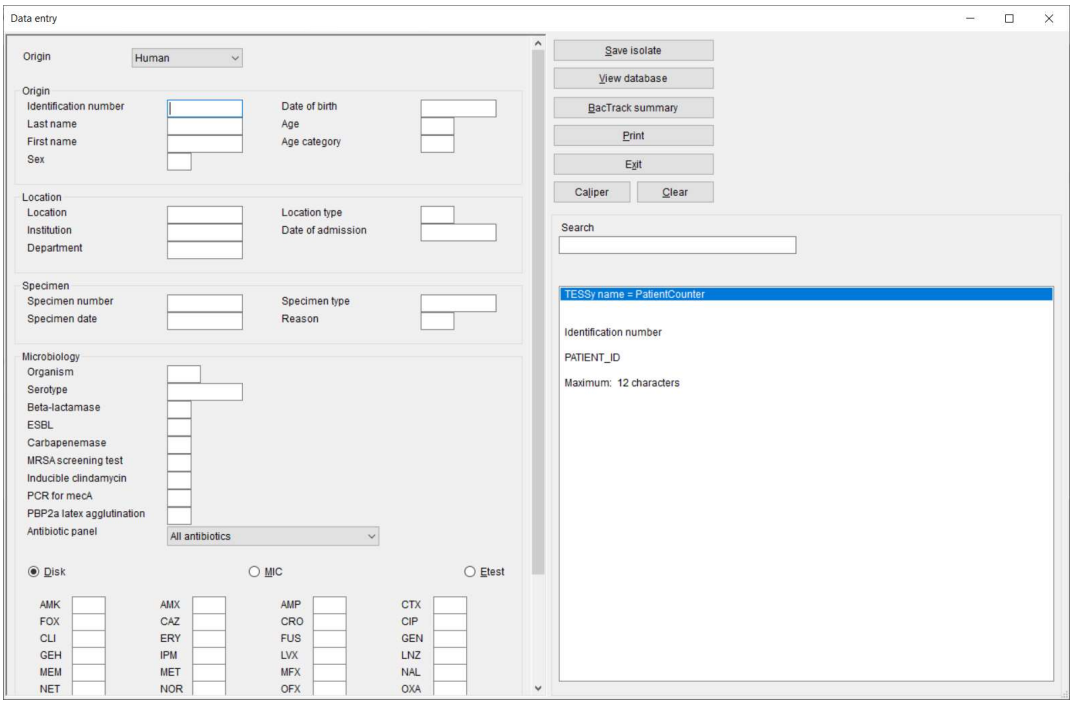
For the past twenty years, WHONET has used data files with the very simple dBASE file structure, and this option remains available. However, the default is now SQLite, which offers many advantages in terms of compatibility, speed, security, file sizes, multiuser support, and number of data columns.



By default, data files are stored in the c:\WHONET\Data folder, but the user may browse to other file locations on the local hard drive or any available network drive.

- Click on *OK* to proceed with data entry.

After you have opened or created a data file, the Data Entry screen (below) will appear.
Data are entered in the fields on the left half of the screen. The standard WHONET fields appear first, followed by the antibiotic fields and then the additional EARS-Net data fields that you have selected during laboratory configuration.



General explanation for data entry:

When the cursor jumps to a field for data entry, brief instructions and recommended data codes for that field appear at the lower right of the screen.

After entering data in one field, you have four ways of moving to the next field:

- press the <Enter> key; or
- press the <Tab> key; or
- press the arrow keys; or
- use the mouse.

Regarding the entry of “dates”, the default format is “Day-Month-Year”, but this is configurable by the user from the main WHONET menu option “File”, “Language and dates” options. When you have entered a date and moved to the next field, check that the date has been interpreted correctly – WHONET automatically converts the numeric date to the name of the month. When entering a date, the year can be entered as a 2- or 4-digit date. The numbers indicating day, month and year must be separated by a ‘/’ or a ‘–‘ or a space.

4.2 Field specific comments:

Patient age
You have the option of entering the patient's age. However, if you have entered the patient's date of birth, his/her age will automatically be calculated and inserted in the age field when you enter the specimen date.

Organism codes
The 3-character WHONET organism code should be entered here, or selected from the list on the right half of the screen. By default, only the most common organism codes are listed. To view the extended list, click on the *Extended Organism List* box.

Susceptibility results and the list of antibiotics
To enter susceptibility results, first click on the appropriate test method – disk diffusion, MIC or ETest. The list of antibiotics which you defined for that test method should appear. Each time you enter a result and press <Enter>, the cursor jumps to the next antibiotic in the antibiotic panel for the organism tested. For example, if you are entering results for *Staphylococcus aureus* (organism code 'sau'), you will be asked for the Gram-positive drugs only. If you change the panel to "All antibiotics", then you may select from any of the antibiotics in the laboratory's antibiotic list.

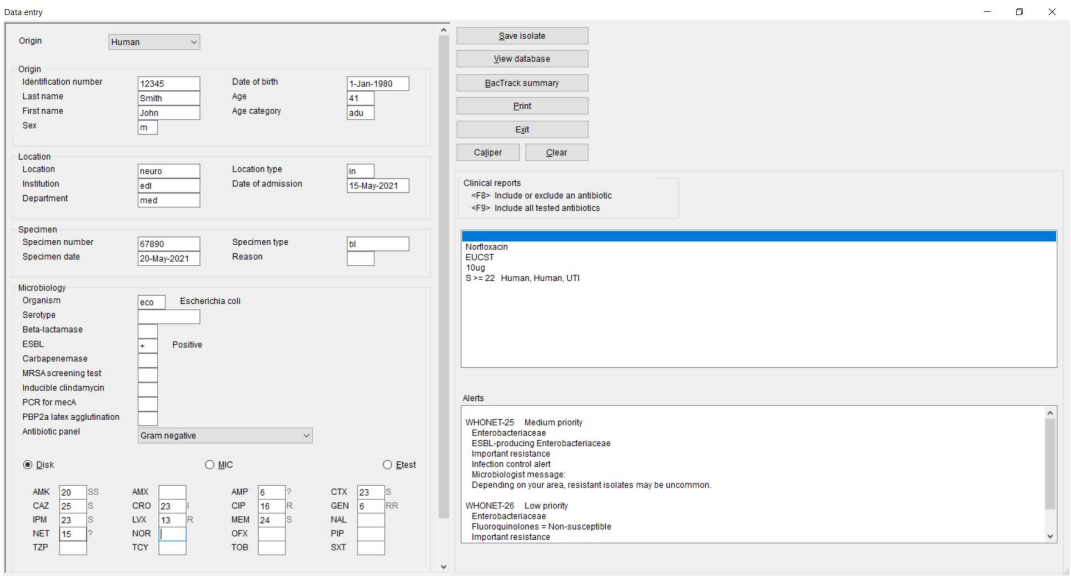
Entering susceptibility results
WHONET allows the entry of quantitative results (e.g. 13 mm, 64 µg/ml) or the entry of qualitative results (R = resistant, I = Susceptible, increased exposure, S = Susceptible, standard dosing regimen).

The lowest possible zone diameter is 6 mm. If you enter 0 mm (indicating no inhibition), WHONET will automatically change this to 6 mm.

For off-scale MIC values you may enter, for example, <=.5, >64.

If you are entering MIC results from the test of a drug combination (e.g. trimethoprim/sulfamethoxazole, piperacillin/tazobactam), enter the result of the first or principal agent. These concentrations usually follow the 1, 2, 4, 8 … doubling-dilution series.

A final completed sample should look similar to the below.



Saving the isolate information
When you have entered all the data for an isolate, click on *Save Isolate* (or press Alt-S). The data will be saved to disk and the Data Entry screen will be cleared so that the data for the next isolate can be entered.

WHONET will ask you whether you want to:

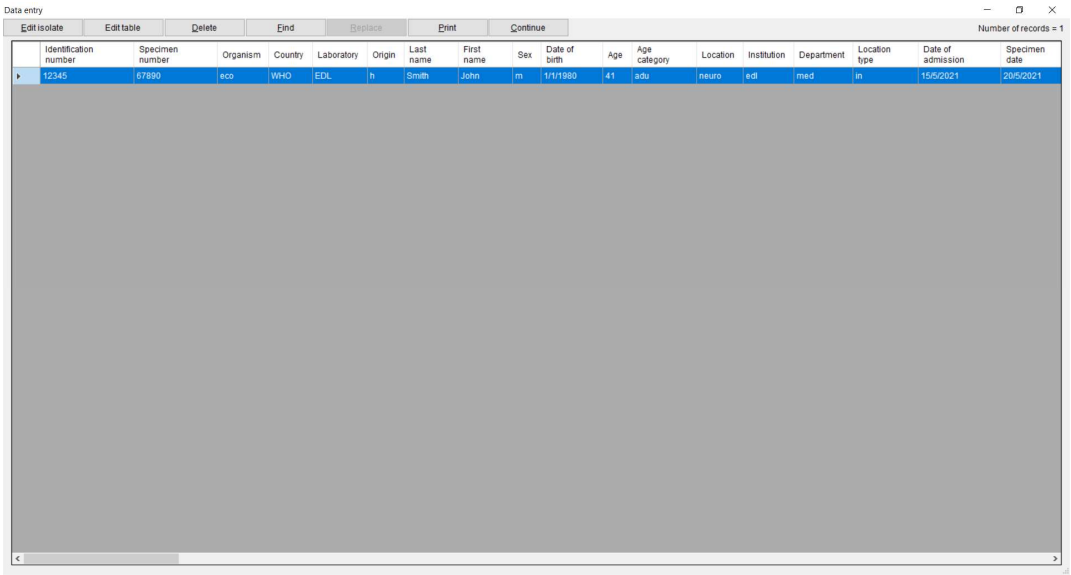
Save the isolate
Save and continue with the same isolate
Save and continue with the same patient

click on one of these options to save or on *Cancel,* if you decide not to save the record.

Exit data entry
When you have finished entering data, click on *Exit* to return to the main WHONET screen.

4.3 View database

- From menu choose, ‘Data entry’, ‘Open data file’, select data file and click on ‘Open’.
- To check the records after you performed data entry click on ‘*View database*’, the screen below appears.
- In case you want to make changes, select the record you want to change and *EDIT ISOLATE*. You will get the data entry screen again, and you can enter the changes. *Save Isolate* to save these changes.



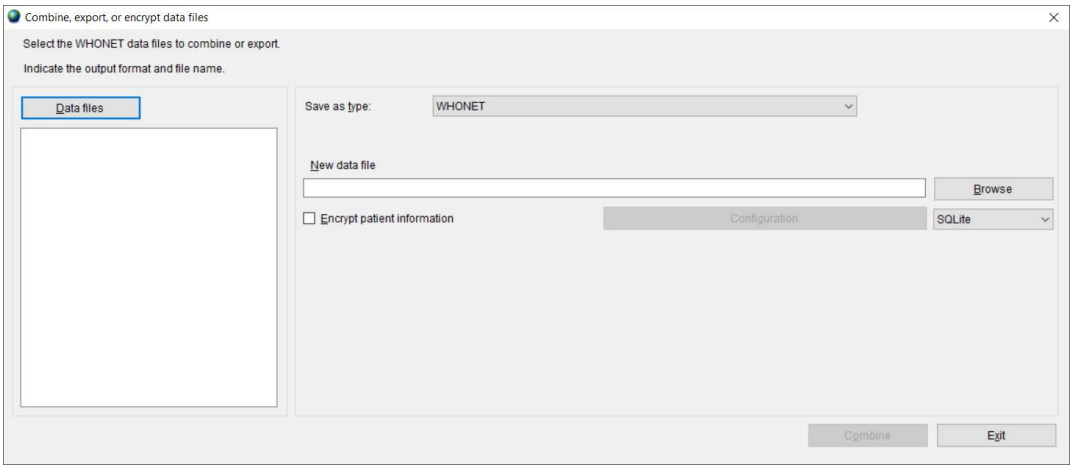
- For leaving this screen above, click on Continue and Exit.

5. Exporting WHONET files to the EARS-Net exchange format

Introduction: after data entry the files are saved in WHONET format. Before uploading them to TESSy, they must be exported to the TESSy/EARS-Net data exchange format. It is possible that you may have WHONET data from your country stored in a single large WHONET file, or alternatively you may have separate WHONET files representing your various facilities, organisms, and time periods. If you have multiple files, you may wish to combine them together into a single export file using the below procedure to simplify the upload of data to TESSy.

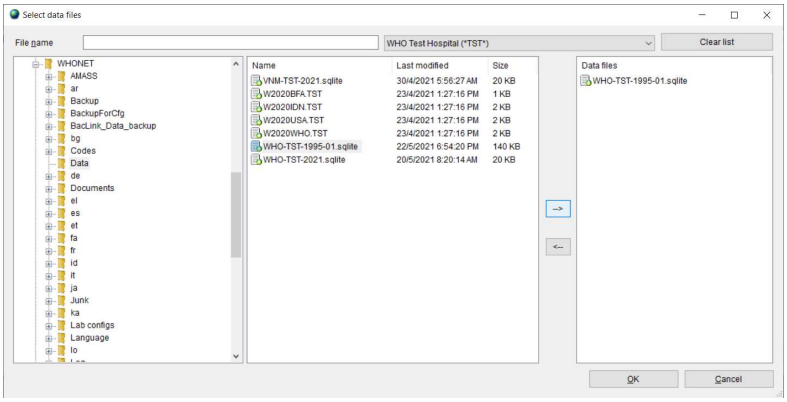
Note: Frequently, you may want to combine data files from more than one laboratory into a larger EARS-Net file. If the laboratories test exactly the same antibiotics with the same set of breakpoints, you can combine the data files together using any one of the corresponding laboratory configurations. On the other hand, if the laboratories test different antibiotics or use different breakpoints, you should create a new "national" laboratory configuration which includes a list of all antibiotics tested (with the corresponding breakpoints), as mentioned earlier in Section 3.1.

- From the main WHONET menu, select "Data entry", "Combine, export, or encrypt data files".



- Click on "Data files".

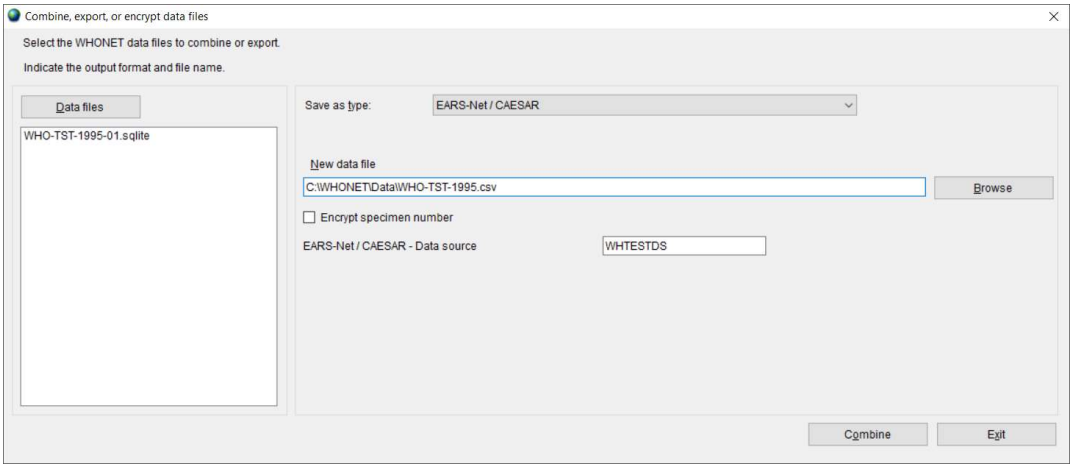
The next screen will appear. One file has been selected for export, but as many files as the user wishes can be included.



- Choose ‘All files (*.*)’ to get a list.
- Using the “-->” button, select the data files that you wish to export to the EARS-Net data exchange format.
- Click “OK”. You will return to the previous screen.
- Indicate a name for the new combined, export file.
- Under “Save as type”, change the export format from “WHONET” to “TESSy (CSV)”.

In the example below, we combine data from the 2015 from several Swedish laboratories into an EARS-Net file named SE2015.CSV. By default, WHONET will save the new file in the c:\whonet5\data folder, though you can change this if desired.

- Ensure that the WHONET proposed “Data source” is correct for your country.



- Click on “Combine” to begin the export.

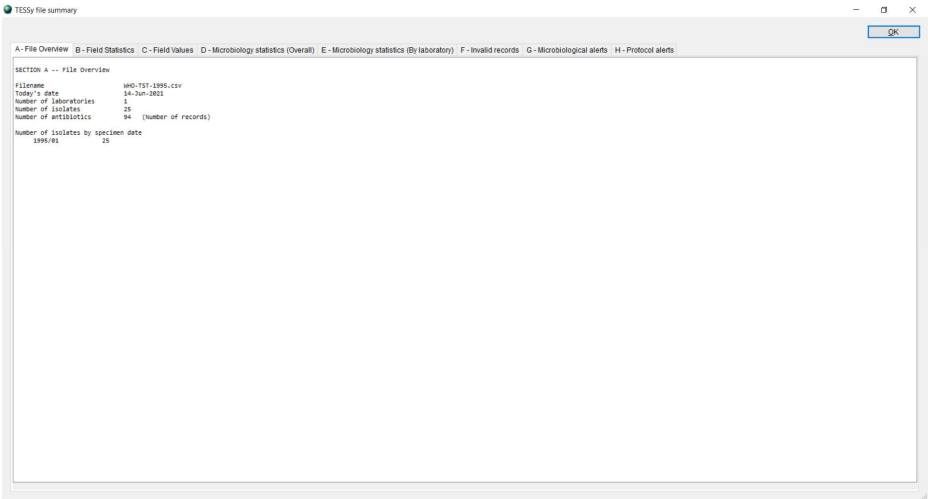
WHONET will read the selected data files and export all blood and CSF isolates of *S. aureus*, *E. coli*, *S. pneumoniae*, *E. faecalis*, *E. faecium*, *P. aeruginosa*, *K. pneumoniae*, and *Acinetobacter* spp.

- After completion of the data export, WHONET will indicate the number of isolates included in the export file, followed by the Data Check Feedback report, as described in the next section.

- Click on Exit.

6. EARS-Net Data Check and Feedback Report

- After completion of the data file export, the EARS-Net Data Check and Feedback Report will load automatically including the following sections:
  - Data file summary
  - Data field statistics
  - Data field values
  - Microbiology statistics (Overall)
  - Microbiology statistics (By laboratory)
  - Invalid records
  - Microbiological alerts
  - EARS-Net protocol alerts



- You can *Print* the report. Note: it is possible to open the report in Word.
- Perform a visual inspection of the complete report:
- Check the contents of the file (alert in section C microbiological statistics?)
- Check if there are any invalid fields
- Check if there are required or mandatory fields missing
- etc…
- Make corrections to the original data files as needed
- Collect additional information if needed
- Re-combine and export your data and review the Data Check and Feedback report again until you feel that they are suitable for upload to TESSy.

7. Upload the EARS-Net data file to TESSy.

Instructions for uploading and reviewing data on the TESSy website are provided by EARS-Net and TESSy support staff.