WHONET

Introduction

WHO Collaborating Centre for
Surveillance of Antimicrobial Resistance

Boston, July 2022

WHONET – Introduction

This tutorial includes the following sections.

Part 1. What is WHONET?
Part 2. What can WHONET do?
Part 3. What is BacLink?
Part 4. What's next?

Part 1. What is WHONET?

WHONET is a free software developed by the WHO Collaborating Centre for Surveillance of Antimicrobial Resistance for laboratory-based surveillance of infectious diseases and antimicrobial resistance.

The principal goals of the software are:
- to enhance local use of laboratory data; and
- to promote national and international collaboration through the exchange of data.

WHONET can be used by individual laboratories or as part of a national and international surveillance network. At present, the software, available in 44 languages, is used in over 130 countries around the world managing data from over 2300 clinical, public health, veterinary, and food laboratories.

WHONET analytical tools facilitate:
- the understanding of the local epidemiology of microbial populations;
- the selection of antimicrobial agents;
- the identification of hospital and community outbreaks; and
- the recognition of quality assurance problems in laboratory testing.

Note: At present, WHONET can handle results from the testing of bacteria, fungi, and parasites. WHONET does not yet have virological tests incorporated, but this is a priority area of programming in the upcoming year.

Part 2. What can WHONET do?

WHONET has three main components.

- Laboratory configuration
  WHONET permits the customization of the software for use in your institution. You can indicate which antimicrobials you test in the laboratory, patient care areas served, data fields that you want to include in the surveillance program, and microbiological alerts of unusual or important organisms and resistance phenotypes.

- Data entry and clinical reporting
  WHONET allows the routine entry of susceptibility test results as well as the retrieval, correction and printing of clinical records. During data entry, WHONET can provide immediate feedback to technicians on important strain phenotypes.

- Data analysis
  WHONET has a user-friendly interface permitting many types of analysis. Options include isolate line-listings and summaries, such as organism frequencies over time, antimicrobial susceptibility test statistics, zone diameter and MIC histograms, antibiotic scatterplots and regression curves, and antibiotic resistance profile line-listings and summaries. WHONET also has a number of alert features which permit the detection of unlikely or important results as well as possible hospital or community outbreaks of bacterial or non-bacterial species.

Examples of some of the WHONET analysis options are shown below.

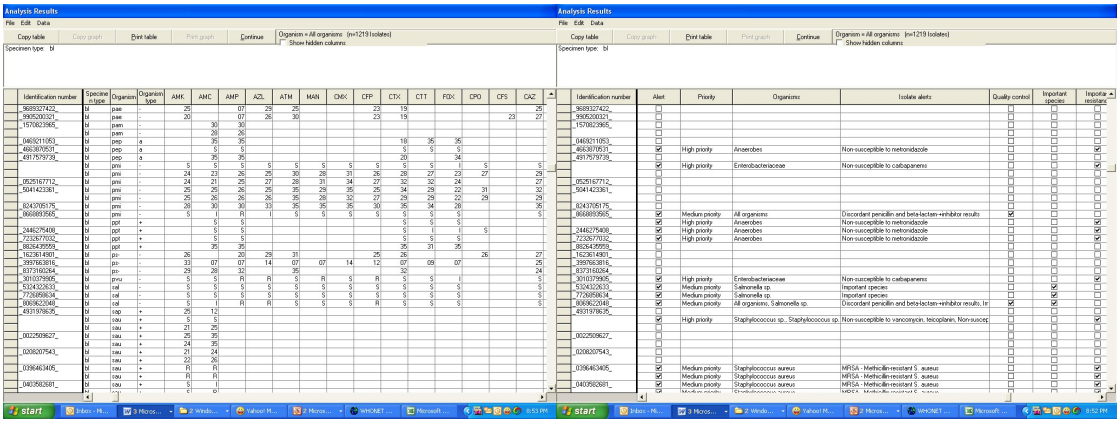


Figure 1. Portion of an isolate listing for positive blood cultures. The left portion of the listing includes patient demographic data followed by the antibiotic results. The right portion of the listing includes microbiological alerts about important resistance findings or possible laboratory errors. Then underscore "_" around the patient identifier indicates that the original patient identifiers have been encrypted.

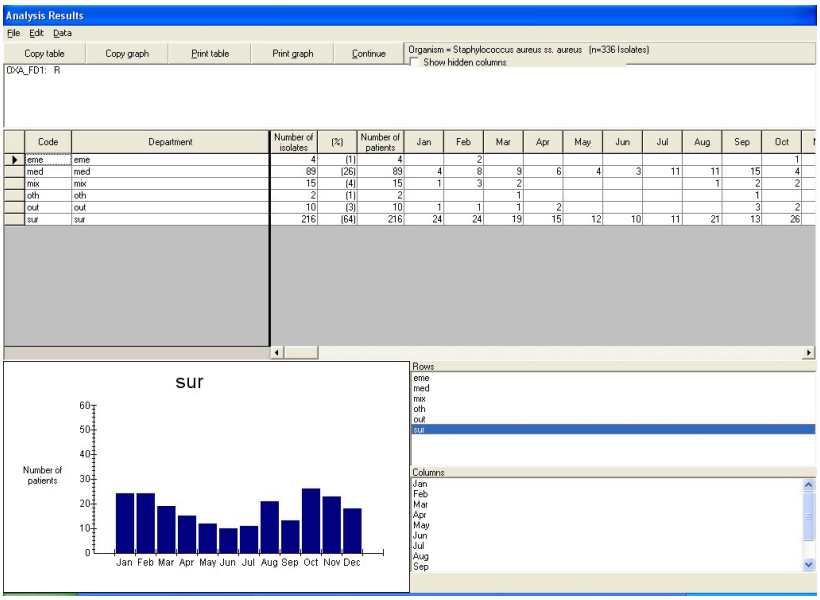


Figure 2. Distribution of MRSA isolates by department. Only the first isolate per patient is included. The graph depicts the graph for the department of medicine.

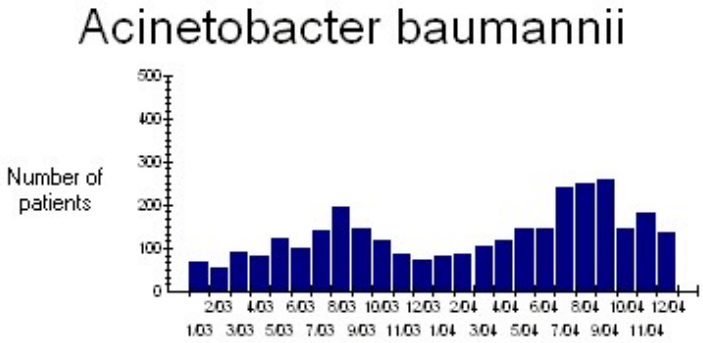


Figure 3. Monthly distribution of patients with *Acinetobacter baumannii* over a two year period.

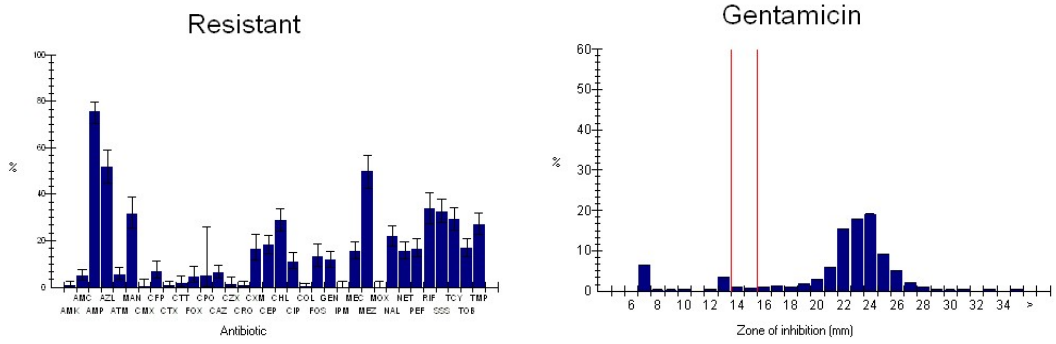


Figure 4. %RIS and test measurement statistics for *K. pneumoniae*. %Resistant results are shown to the left for all antimicrobials, including the 95% confidence interval. The graph to the right depicts the distribution of disk diffusion zone diameters around the gentamicin disk.

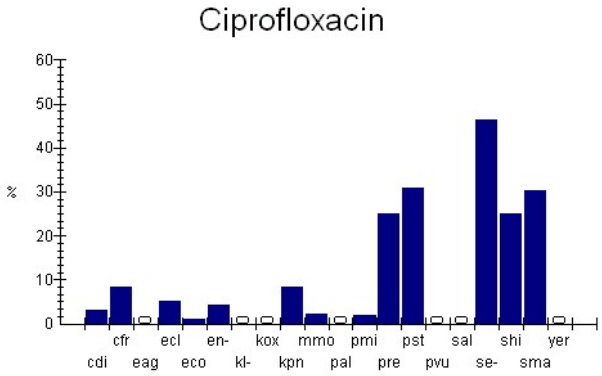


Figure 5. Ciprofloxacin %Resistant results for all *Enterobacteriaceae.*

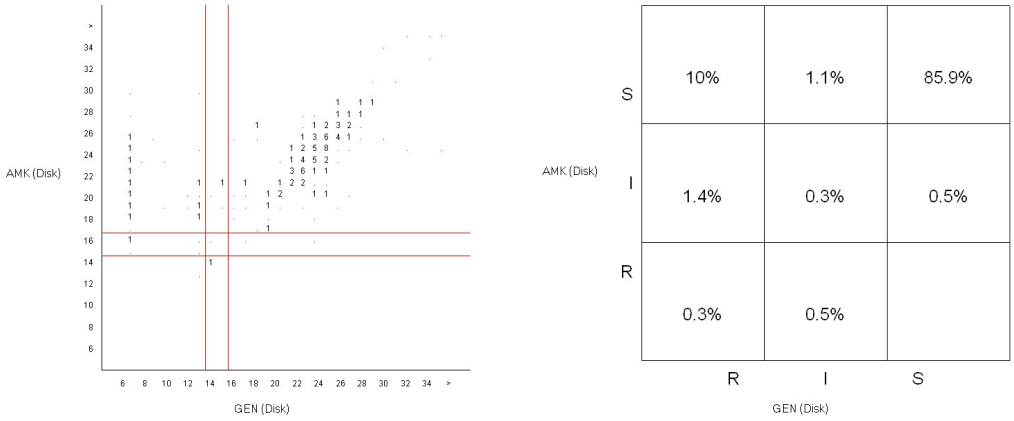


Figure 5. Scatterplot comparison of gentamicin and amikacin results for *K. pneumoniae*. To the left is a comparison of the disk diffusion zone diameter results. To the right is the comparison using the test interpretations – resistance, intermediate, and susceptible.

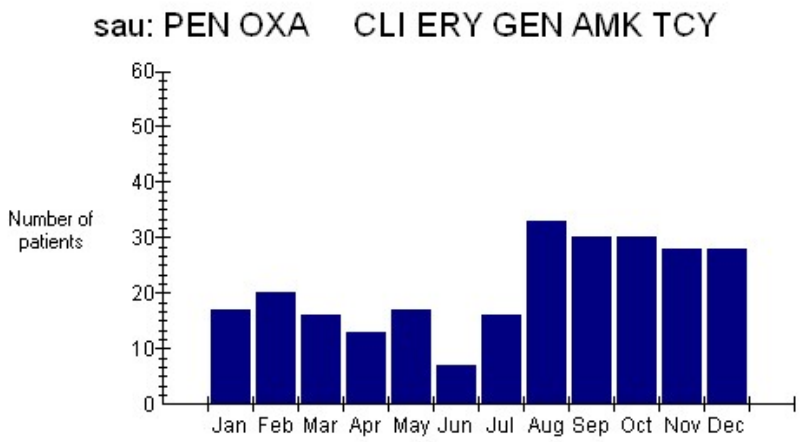
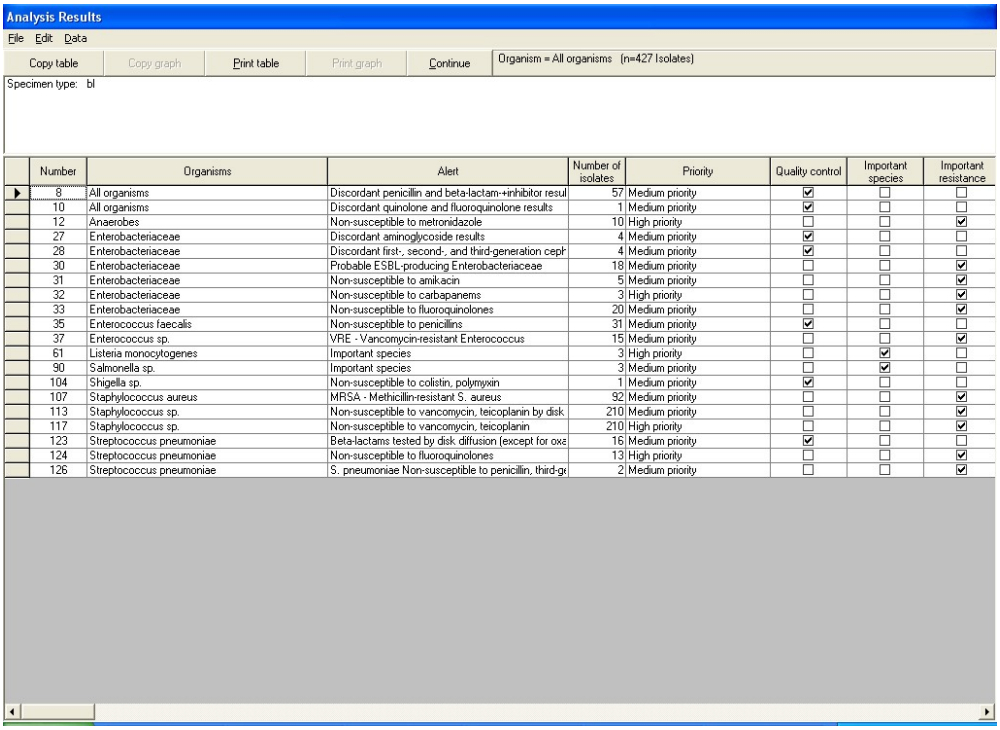


Figure 6. Resistance profiles. Monthly distribution of patients with isolates of *S. aureus* of the indicated resistance phenotype. The isolates are non-susceptible to PEN, OXA, CLI, ERY, GEN, AMK, and TCY, but susceptible to CHL and VAN.



Analysis Results

File Edit Data

Copy table | Copy graph | Print table | Print graph | Continue | Organism = All organisms (n=427 isolates)

Specimen type: bl

Number	Organisms	Alert	Number of isolates	Priority	Quality control	Important species	Important resistance
8	All organisms	Discordant penicillin and beta-lactam-+inhibitor resul	57	Medium priority	☑	☐	☐
10	All organisms	Discordant quinolone and fluoroquinolone results	1	Medium priority	☑	☐	☐
12	Anaerobes	Non-susceptible to metronidazole	10	High priority	☐	☐	☑
27	Enterobacteriaceae	Discordant aminoglycoside results	4	Medium priority	☑	☐	☐
28	Enterobacteriaceae	Discordant first-, second-, and third-generation cepl	4	Medium priority	☑	☐	☐
30	Enterobacteriaceae	Probable ESBL-producing Enterobacteriaceae	18	Medium priority	☐	☐	☑
31	Enterobacteriaceae	Non-susceptible to amikacin	5	Medium priority	☐	☐	☑
32	Enterobacteriaceae	Non-susceptible to carbapanems	3	High priority	☐	☐	☑
33	Enterobacteriaceae	Non-susceptible to fluoroquinolones	20	Medium priority	☐	☐	☑
35	Enterococcus faecalis	Non-susceptible to penicillins	31	Medium priority	☑	☐	☐
37	Enterococcus sp.	VRE - Vancomycin-resistant Enterococcus	15	Medium priority	☐	☐	☑
61	Listeria monocytogenes	Important species	3	High priority	☐	☑	☐
90	Salmonella sp.	Important species	3	Medium priority	☐	☑	☐
104	Shigella sp.	Non-susceptible to colistin, polymyxin	1	Medium priority	☑	☐	☐
107	Staphylococcus aureus	MRSA - Methicillin-resistant S. aureus	92	Medium priority	☐	☐	☑
113	Staphylococcus sp.	Non-susceptible to vancomycin, teicoplanin by disk	210	Medium priority	☐	☐	☑
117	Staphylococcus sp.	Non-susceptible to vancomycin, teicoplanin	210	High priority	☐	☐	☑
123	Streptococcus pneumoniae	Beta-lactams tested by disk diffusion (except for oxa	16	Medium priority	☑	☐	☐
124	Streptococcus pneumoniae	Non-susceptible to fluoroquinolones	13	High priority	☐	☐	☑
126	Streptococcus pneumoniae	S. pneumoniae Non-susceptible to penicillin, third-ge	2	Medium priority	☐	☐	☑

Figure 7. A summary of the microbiological alerts observed in the analyzed data. Categories of alert include “Quality control”, “Important species”, “Important resistance”, “Send to a reference laboratory”, and “Alert the infection control” among others.

Part 3. What is BacLink?

Many laboratories in the world already have computer systems for managing microbiological data. Examples include:

1. Simple desktop softwares such as Microsoft Excel, Access, or EpiInfo
2. Laboratory test instruments, such as Vitek, MicroScan, and SensiTitre
3. Commercial or in-house laboratory information systems.

Most of these systems were developed for purposes of clinical reporting, billing, and day-to-day specimen processing needs. Unfortunately, most systems have limited capabilities for analyzing data. This is where WHONET can be a valuable add-on to your existing system.

One way of getting data from your computer system into WHONET is through the manual re-entry of results directly into WHONET. But this can be a significant waste of valuable staff time and is subject to typing errors during the reentry of results.

To avoid reentering results into WHONET, we have developed the BacLink software. The purpose of the BacLink software is to facilitate the conversion of data from your computer system into WHONET. You could do this interactively on a weekly, monthly, or *ad hoc* basis. In a number of institutions, it has also been possible to automate and schedule the entire process. BacLink is available free-of-charge from the World Health Organization as part of the WHONET package.

By using BacLink, you can thus avoid the manual entry of results into WHONET. A related benefit in the context of multi-center collaborations is the standardization of data from a number of incompatible data sources into one common structure that can be analyzed with WHONET.

To learn more about BacLink and its use, go through the “BacLink – Getting Started”.

Part 4. What’s next?

Now that you have installed WHONET, you are ready for the next steps.

If you plan on using WHONET for manual data entry, proceed with the WHONET tutorial on “Laboratory Configuration” followed by the tutorial on “Data Entry”.

If you want to download and convert data from an existing computer system, then it would be useful to continue with “BacLink – Getting Started”.

If you want to explore WHONET’s data analysis features using the sample data that comes with WHONET or if you already have some WHONET data of your own, you may wish to skip directly to the tutorial “Data Analysis 1”.