

Concise Antibiogram Toolkit

How to Enter Data Manually Into an Antibiogram Template

Once you've printed your results from WHONET, you're ready to enter the percent (%) susceptibilities into the antibiogram template.

First, find the needed data on the WHONET printout. Note the "Number of patients" column (see red arrow in Figure 1 below). This column contains the number of patients who had cultures from which each organism was isolated at least once. The percent (%) susceptibilities for each organism are based on susceptibility results from the number of isolates noted in the "Number of patients" column. Some of these numbers may be quite low, which could give unreliable percent (%) susceptibilities. For example, in Figure 1 you can see there is a "2" in the "Number of patients" column next to "*Enterobacter cloacae*" (see blue arrow). This means the percent (%) susceptibilities for *E. cloacae* are only based on two isolates and, as you can see, will all be 0 percent, 50 percent, or 100 percent. These numbers are clearly not very helpful, as even one more isolate with a different susceptibility pattern could change the percent (%) susceptibilities significantly.

Use the following standards while making your antibiogram:

- 1. Include an organism in your antibiogram if it has been isolated from thirty or more residents. You may use additional months or years of data to reach that number.**

The CLSI standard for the minimum number of diagnostic isolates to include in an antibiogram is 30. Note that this standard may change from time to time. If you are creating your own antibiogram, you should review the standard periodically to see if there have been changes. The threshold of 30 isolates per year will be difficult for many nursing homes to reach and the CLSI indicates that it is permissible to include additional months or years of data to achieve this number. The antibiogram should always clearly indicate when this has been done.

- 2. Because of the difficulty nursing homes may have in reaching 30 isolates even when using multiple years of data, we recommend that you include an organism in your antibiogram if it has been isolated from at least 20 patients and clearly indicate this in the antibiogram.**

This lower number of isolates should be interpreted with caution. Percent (%) susceptibilities based on 20 isolates should still give a general idea of how effective various antibiotics are against those organisms, but organisms with more isolates will likely produce more accurate results in which the prescriber can have greater confidence.

Additionally, a higher number of isolates implies that that organism is infecting more people in your facility. For this reason, it is critical to indicate the time period covered when additional years of data are needed to reach 20 isolates.

If you decide to include organisms for which a minimum of 20 isolates are not available, this should be prominently and clearly indicated on the antibiogram by, for example, highlighting those rows or by placing these organisms together in a separate section. You should also include a note on the antibiogram advising caution in using these less reliable results.

Title: Figure 1. Top section of the WHONET percent (%) susceptibilities printout.

Headings: Number of patients, Organism

Description: This figure shows the top section of the WHONET percent (%) susceptibilities printout. The red arrow points out the “number of patients” column which contains the number of patients who had cultures from which each organism was isolated at least once. The percent (%) susceptibilities for each organism are based on susceptibility results from the number of isolates noted in the “number of patients” column, as indicated by the blue arrow. It is recommended that only organisms with at least four isolates be included in the antibiogram.

Org	Organism	Number of patients	AMK %S	AMP %S	SAM %S	ATM %S	CZO %S	FEP %S	CTX %S	CAZ %S	CRO %S	CHL %S	CIP %S
ecl	Enterobacter cloacae	2	100	0	0	0	50.0			0	0		50.0
eco	Escherichia coli	28	100	42.9	50.0		78.6	0		66.7	66.7		53.6
ent	Enterococcus sp.	17		70.6									
kl-	Klebsiella sp.	10	0	0	60.0		60.0	0		50.0	50.0		70.0
pml	Proteus mirabilis	21	100	76.2	0	100	85.7		100	75.0	100	100	52.4

Number of isolates = 78

Org	COL %S	DAP %S	ETP %S	GEN %S	IPM %S	LVX %S	LNZ %S	MPX %S	NIT %S	TZP %S	QDA %S	RIP %S	STR %S	TCY %S	TOC %S	TOB %S	SXT %S	VAN %S	AMK Number
ecl			50.0	50.0	100	50.0				0				0	0		50.0		1
eco	100		100	92.9	100	53.6			88.2	92.9				67.9	100		64.3		2
ent		100		88.2		36.4	83.3	50.0	100		100		82.4	27.3				58.8	
kl-			90.0	90.0	100	80.0			33.3	90.0				80.0			80.0		1
pml	0		100	100	100	57.1			0	90.5		100		0	100	100	81.0		1

3. Only include percent (%) susceptibilities for antibiotics where at least 70 percent of the isolates were tested against that antibiotic:

If you look toward the bottom of your printout, you will see that after the percent (%) susceptibilities, numbers are listed for each organism under each antibiotic (e.g., “AMP Number,” “SAM Number,” etc.; see Figure 2). These numbers indicate the number of isolates of each organism that were tested against a given antibiotic. For a given organism, this could be any number from 0 (blank) up to the total number of isolates included (listed in the “Number of patients” column). Different isolates of an organism are not always tested for susceptibilities to the exact same antibiotics. For example, in Figure 1 above you can see a “28” next to *Escherichia coli* in the “Number of patients” column, indicating that this nursing home had 28 first isolates of *E. coli* contributing susceptibility data to their antibiogram. However, you can see in Figure 2 below that there is a “27” under the “IPM Number” column next to *E. coli* (abbreviated “eco;” see red arrow). This indicates that only 27 of the *E. coli* isolates were tested against imipenem.

Title: Figure 2. Lower section of the WHONET percent (%) susceptibilities printout.

Headings: Org, CAZ Number, IPM Number

Description: This figure shows the lower section of the WHONET percent (%) susceptibilities printout. The red and blue arrows in the figure note the number of isolates of each organism that were tested against a given antibiotic. For example, there is a “27” under the “IPM Number” column next to *E. coli* (abbreviated “eco,” see red arrow). This indicates that only 27 of the *E. coli* isolates were tested against imipenem.

Number of isolates = 78

Org	AMP Number	SAM Number	ATM Number	CSO Number	FEP Number	CTX Number	CAZ Number	CRO Number	CHL Number	CIP Number	COL Number	DAP Number	ETP Number
ecl	2	2		2	2		2	2		2			2
eco	28	28		28	2		6	6		28	1	15	28
ent	17												
kl-	10	10		10	2		4	4	1	10			10
pmi	21	1	1	21		1	4	4		21	1		20

Number of isolates = 78

Org	GEN Number	IPM Number	LVX Number	LNZ Number	MPX Number	MIT Number	TZP Number	QDA Number	RIP Number	STR Number	TCY Number	TGC Number	TOB Number
ecl	2	2	2				2				2	1	
eco	28	27	28			17	28				28	1	
ent	17		11	6	4	10		3		17	11		
kl-	10	9	10			6	10				10		
pmi	21	2	21			12	21		1		21	1	1

Number of isolates = 78

Org	SXT Number	VAN Number
ecl	2	
eco	28	
ent		17
kl-	10	
pmi	21	

Number of isolates = 78

Similar to how a low number of overall isolates may lead to unreliable or misleading data, a low number of an organism’s isolates tested against a given antibiotic may lead to an inaccurate interpretation of susceptibility patterns. For example, while 27 out of 28 *E. coli* isolates tested against imipenem likely gives a fairly accurate idea of the overall percent (%) susceptibility of *E. coli* to imipenem in a facility, imagine if only six of the isolates were tested against an antibiotic. This would make it much harder to gauge *E. coli*’s actual overall percent (%) susceptibility to imipenem. Although you can see in Figure 1 that 66.7 percent (or 4/6) of the *E. coli* isolates tested were susceptible to ceftazidime, imagine all 22 of those not tested happened to be resistant. In this case, the apparent susceptibility of 66.7 percent would in reality be much lower (only 14.3%). Because of this uncertainty, we recommend you **only include percent (%) susceptibilities for antibiotics where at least 70 percent of the isolates were tested against that antibiotic**. So, in the example, percent (%) susceptibilities for antibiotics which about 20 or more *E. coli* isolates were tested against should be included in the antibiogram.

Taking these two critical points into account, you can begin to enter the percent (%) susceptibilities from your WHONET printout into the cells of the antibiogram template. For each percent (%) susceptibility which you are going to include, find the cell in the template which corresponds to that organism and antibiotic and enter the value. A key for the antibiotic abbreviations is listed at the bottom of the printout (see Figure 3). Color any empty cells grey to make the antibiogram easier to read. Also, fill in the “Number of patients” column for each organism based on the numbers from the corresponding column on the WHONET printout. Add

notes to indicate variations in time period covered by the analysis and warnings about insufficient numbers of isolates as needed.

Title: Figure 3. WHONET Percent (%) Susceptibilities Printout

Headings: Organism, Number of patients

Description: This figure illustrates an example of the full printout of percent (%) susceptibilities using the WHONET software.

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Toolkit Test                                     Page 1
Organism = eco,ent,pmi,kl-,ecl                 3-May-2012 13:52

Data files = gshosp-nhcombined cultures for whonet-48h-enterococcus sp.tkt
One per patient -- First isolate only
Use expert interpretation rules
Number of isolates = 78

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Org Organism                                     Number of patients  AMK  AMP  SAM  ATM  CZO  FEP  CTX  CAZ  CRO  CHL  CIP
                                     %S  %S
-----
ecl Enterobacter cloacae                       2  100  0  0  0  0  50.0  0  0  0  50.0
eco Escherichia coli                           28  100  42.9  50.0  78.6  0  0  66.7  66.7  0  0
ent Enterococcus sp.                          17  0  70.6  0  0  0  0  0  0  0  0
kl- Klebsiella sp.                            10  0  0  60.0  60.0  0  0  50.0  50.0  0  70.0
pmi Proteus mirabilis                         21  100  76.2  0  100  85.7  0  100  75.0  100  100  52.4
-----
Number of isolates = 78

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Org          COL  DAP  ETP  GEN  IPM  LVX  LNZ  MPX  NIT  TEP  QDA  RIF  STR  TCY  TGC  TOB  SXT  VAN  AMK
          %S  Number
-----
ecl          50.0  50.0  100  50.0  50.0  0  0  0  0  0  0  0  0  50.0  0  0  0  0  0  1
eco  100  100  100  92.9  100  53.6  88.2  92.9  100  100  67.9  100  64.3  58.8  0  0  0  0  0  2
ent          88.2  36.4  83.3  50.0  100  100  82.4  27.3  100  80.0  80.0  80.0  81.0  0  0  0  0  0  1
kl-          90.0  90.0  100  80.0  100  100  57.1  0  90.5  100  0  100  100  81.0  0  0  0  0  1
pmi  0  100  100  100  100  57.1  0  90.5  100  0  100  100  81.0  0  0  0  0  0  1
-----
Number of isolates = 78

-----
Org          AMP  SAM  ATM  CZO  FEP  CTX  CAZ  CRO  CHL  CIP  COL  DAP  ETP
          Number Number
-----
ecl          2  2  2  2  2  2  2  2  2  2  2  2  2
eco  28  28  28  28  28  28  6  6  6  28  1  15  28
ent  17  17  17  17  17  17  4  4  4  10  1  15  10
kl-  10  10  10  10  10  10  4  4  4  10  1  15  10
pmi  21  1  1  21  2  1  4  4  1  21  1  21  20
-----
Number of isolates = 78

-----
Org          GEN  IPM  LVX  LNZ  MPX  NIT  TEP  QDA  RIF  STR  TCY  TGC  TOB
          Number Number
-----
ecl          2  2  2  2  2  2  2  2  2  2  2  2  1
eco  28  27  28  6  4  17  28  3  17  28  11  1  1
ent  17  17  11  6  4  10  10  3  17  11  11  1  1
kl-  10  9  10  6  4  6  10  3  17  11  11  1  1
pmi  21  2  21  12  21  12  21  1  21  21  21  1  1
-----
Number of isolates = 78

-----
Org          SXT  VAN
          Number Number
-----
ecl          2  2
eco  28  28
ent  17  17
kl-  10  10
pmi  21  21
-----
Number of isolates = 78

AMK Amikacin
AMC Amoxicillin/Clavulanic acid
AMP Ampicillin
SAM Ampicillin/Sulbactam
ATM Aztreonam
CZO Cefazolin
FEP Cefepime
CTT Cefotetan
CTX Cefotaxime
POX Cefoxitin
CPR Cefprozil
CAZ Ceftazidime
CRO Ceftriaxone
CHL Chloramphenicol
CIP Ciprofloxacin
CLI Clindamycin
COL Colistin
DAP Daptomycin
DOX Doxycycline
ETP Ertapenem
ERY Erythromycin
GAT Gatifloxacin

GEN Gentamicin
IPM Imipenem
LVX Levofloxacin
LNZ Linezolid
MEM Meropenem
MET Methicillin
MFX Moxifloxacin
NAP Nafcillin
NIT Nitrofurantoin
OXA Oxacillin
PEN Penicillin G
TEP Piperacillin/Tazobactam
POL Polymixin B
QDA Quinupristin/Dalfopristin
RIF Rifampin
STR Streptomycin
TCY Tetracycline
TIC Ticarcillin
TGC Tigecycline
TOB Tobramycin
SXT Trimethoprim/Sulfamethoxazole
VAN Vancomycin
    
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