

National Department of Health

Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Developed by: May Varasmaite-Keket & Deborah Tong

Reviewed by: J Ferguson

Authorized by: W Porau

Issue date: 28/2/22

Review Period: 2 years

Changes to the last Authorized Version:

Version	Date issued	Changes
G_90_SOP_27_A	28/2/22	This version

Certification of printed copy:

Version	
Authorised by (name)	
Signed	
Date	

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1. Purpose

WHONET is a free desktop Windows application for the management and analysis of microbiology laboratory data with a particular focus on AMR surveillance. In PNG, AMR data is exported from the SENAITE laboratory information management system as a comma-separated values (CSV) file, and converted using BacLink into a WHONET file for data analysis at the facility and national levels. The various analysis types on WHONET are used to make sense of the data.

2. Scope

This procedure applies to AMR data management and analysis within the National AMR Steering Committee as the national coordinating centre, CPHL as the national reference laboratory and AMR surveillance sites. It is also applicable to animal health laboratories using WHONET for AMR data analysis.

3. Principle/Clinical application

AMR data should be analysed and reported to relevant stakeholders at the surveillance site level (clinicians, hospital management), nationally (relevant government departments and committees, development partners) and globally (Global AMR Surveillance and Use System [GLASS]) to drive policy and action.

4. Responsibilities

Role	Responsibility
Quality officer	Export CSV file from SENAITE
(surveillance site	Convert to WHONET file using BacLink
	Perform data analysis using WHONET
	Provide feedback to Medicines and Therapeutics Committee
	Share data files and reports with CPHL
National AMR data officer (CPHL)	Provide support to surveillance sites on AMR data management
	Support development and provide feedback on AMR surveillance reports developed by surveillance sites
	Compile, analyse and report on AMR data from all surveillance sites

5. Data file

The starting point for data analysis using WHONET is a data file containing AMR data from the surveillance site(s) derived from the laboratory information management system SENAITE.

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6. Equipment/Materials

- Computer or laptopWHONET 2021 software
- AMR data file(s)

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7. Procedure

7.1 Isolate listing and summary: for analysis of individual isolate results

a) From the main WHONET screen, click on 'Data analysis' and 'Data analysis'.



Data analysis: PNG Model SS		:	\times
Analysis type	Options	One per patient	
Organisms	Isolates		
Data files	Ouţput	Screen ~]
Macros	<u>B</u> egin analys	sis E <u>x</u> it]

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a) Select 'Analysis type'. By default, WHONET selects '%RIS and test measurements'. To the left of this heading, click 'Isolate listing and summary' and click 'OK'.

Report format Summary 1. Listing Summary 2. Summary Rows 1 Tables 2 (None) Graphs 3 (None) 0. 3. Both Columns Specimen date Options Summary Listing Summary	port format 1. Listing 2. Summary 2. Summary 3. Tables 3. (None) 3. Both Columns Columns Specimen date tons ting Include isolate alerts Options Include cluster alerts Options Include cluster alerts Options Include cluster alerts Options Include cluster alerts Include clust	solate listing and summary	%RIS and test measurements	Scatterplot	Resistance profiles	Isolate ale	rts	Cluster alerts			
O 1. Listing Summary Q. Summary Rows 1 ☑ Tables 2 (None) ☑ Graphs 3 (None) ③ 3. Both Columns Specimen date Options Listing Summary	1. Listing Summary 2. Summary Rows 1 ① Tables 2 (None) ☑ Graphs 3 (None) 3. Both Columns Specimen date tons ting Include isolate alerts Summary Options Options	Report format					_				
Q 2. Summary Rows 1 Organism ✓ ☑ Tables 2 (None) ✓ ☑ Graphs 3 (None) ✓ ● 3. Both Columns Specimen date ✓ Options	2. Summary Rows 1 Organism I Tables 2 (None) I Tables 3 (None) I Graphs 3 (None) 3. Both Columns Specimen date Columns Specimen date Month tions Summary Include cluster alerts Options Options Options	O 1. Listing						Summary			
☑ Tables 2 (None) ✓ ☑ Graphs 3 (None) ✓ ④ 3. Both Columns Specimen date ✓ Options	☑ Tables 2 (None) ☑ Graphs 3 (None) 질 Both Columns Specimen date Month tions ting Include isolate alerts Summary Include cluster alerts Options	🔿 🧕 Summary				Rows	1	Organism	~		
☑ Graphs 3 (None) ③ 3. Both Columns Specimen date Month Options Listing Summary	Image: Construction of the second of the	Tables					2	(None)	~		
3 Both Columns Specimen date Month Options Listing Summary	3. Both Columns Specimen date V Month V tions titing Summary Include isolate alerts Include cluster alerts Options	Graphs					3	(None)	~		
Columns Specimen date Month Options Listing Summary	Columns Specimen date Month tions Summary iting Summary Include isolate alerts Include duster alerts Options Options	④ 3. Both									
Options Listing Summary	tions ting Summary Include isolate alerts Include duster alerts Options Options Options					Columns		Specimen date	×	Month	~
Listing Summary	ting Summary Include isolate alerts Include cluster alerts Options	Options									
	Include isolate alerts Include cluster alerts Options	Listing						Summary			
include isolate alerts	Options Options	Include isolate alerts						Includ	e cluster alerts		
Options Options		Options									

b) Select 'One per patient', select 'By patient' and click 'OK'.

One isolate of species by patient		
Include which results in the analysis of each species?		
) By isolate		
By <u>p</u> atient		
 By time interval or resistance phenotype 		
First isolate only		
 First isolate with antibiotic results 		
The following options are only available for %RIS calculations.		
Average resistance result for each antibiotic		
Most resistant result for each antibiotic		
Most susceptible result for each antibiotic		
One result for each antibiotic interpretation		
Consider time interval		
Number of days since previous isolation	30 ‡	
O Number of days since first isolation	30 🗘	
Consider resistance phenotype		
Consider only major differences in interpretation (R, S)		
O Consider both major and minor differences in interpretation	n (R, I, S)	
Consider all antibiotics		
 Select antibiotics 	Browse	
	ок	Cancel

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c) Select organism(s) for analysis and click 'OK'.

VHONET organism list			Analysis organism list	
ode			Enclose organism not	Clear list
] <u>E</u> xtended list	Organism groups		Analyze as one organism	n
ba Acinetobacter ba fr Bacteroides frag ce Burkholderia ceg co Campylobacter c aj Campylobacter c al Candida albican fr Citrobacter freun fr Citrobacter freun mv Cytomegalovirus ae Enterobacter aer cl Enterobacter aer cl Enterobacter clo av Enterococcus fa fm Enterococcus fa nt Enterococcus fa fm Enterococcus fa nt Enterococcus fa nt Enterococcus fa nt Enterococcus fa fm Enterococcus fa nt Enterococcus fa haemophilus int xb Haemophilus int b	umannii ilis vacia ejuni ss. jejuni s dii s sp. (diphtheroids) acae lum ecalis ecium s 0157:H7 luenzae luenzae (not type b) luenzae (type b)	~	eco Escherichia coli	

d) Define isolate selection criteria and click 'OK'.

Solates	×
To define selection criteria, choose a data field and click on 'Define criteria'.	
Location Department Location type Specimen number Specimen date Specimen type	^
Specimen type (Numeric) Reason Isolate number Organism Organism type Serotype Beta-lactamase	~
 Exclude laboratory isolates: Specimen type = 'qc', 'la', 'ex', 'Department = 'lab' Exclude screening isolates: Specimen type = 'sc', 'mr', 'vr', 'cd' Include isolates that satisfy all of the selection criteria. Include isolates that satisfy at least one of the selection criteria. 	
Define criteria Clear this criterion Clear all criteria	<u>о</u> к

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SPEC_TYPE Specimen typ	e							
Code				bl	Blood			
an Al ab Al as Al ad Al de Al ac Al pt Al ak Al Search	odomen odominal fluid oscess oscess, abdominal oscess, dental oscess, perirectal oscess, peritonsillar oscess, skin	*	>	Includ	e) Exclud	de	

e) Select data file(s) for analysis and click 'OK'.

Daaldan						
Coursensop Coursents Coursents Secycle Bin SwinREAgent Apps Dell Documents and Settings Drivers Intel Program Files Program Files Recovery System Volume Information System Volume Information WHONET Son Dot	Name	Last modified 9/12/2021 11:23:21 AM	Size 20 KB	1	Data files	2

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f) Click 'Begin analysis'.

Data analysis: PNG Model SS				×
<u>A</u> nalysis type	0	ptions	One	per patient
Study = Isolate listing and summary Rows = Organism Columns = Specimen date				
<u>O</u> rganisms	ļ	solates		
eco Escherichia coli	Specime	n type: bl		
Data files	Output		Screen	~
PNG-MOD-2021.sqlite				
Macros		<u>B</u> egin analys	is	Exit

The output screens for isolate listing and summary looks like this:

opy ta	ble da	gav gath	e table		Qor	tinue	Show hidden	columns										
nen ty	pe bi include																	
tifica Jmb	Specimen number	Specimen date	Specimen type	isolate number	Örganism	Organism type	AMP	FEP	FOX	CRO	CAZ	CIP	GEN	IPM	мем	SXT	ANC	Cł
Mr.,	H149	27/2/2021	- H		900		6	37	27	15	30	40	6	30	30	6	20	ł
ut	H051	17/1/2021	61		ec0	-	6	24	21	12	24	6	20	30	30	6	21	
194.	H063	23/1/2021	DI .		eco		6	31	28	30	28	40	6	29	33	22	13	
α9	H393	25/5/2021	0I		eco	•	23	35	27	35	30	33	20	30	30	30	26	
U8	H599	2/10/2021	5i		eco	•	6	35	24	31	26	21	20	30	33	28	16	1
U1	H455	22/7/2021	DI .		ec0		0	34	10	20	17	6	6	30	30	6	10	
U1	H605	9/10/2021	ы		eco		18	28	23	25	22	35	20	25	27	28	20	
¥7,	H088	4/2/2021	bi		eco		6	20	23	10	18	40	25	31	30	6	20	
ut	H429	12/7/2021	ы		000		6	24	25	14	23	27	25	34	33	17	24	
U1	H072	28/1/2021	bi		000		6	20	28	12	25	6	6	36	31	6	18	
W1	H274	29/4/2021	ы		000		6	23	25	14	21	6	26	31	34	6	35	
đη	H353	11/6/2021	ы		009		6	37	6	35	30	38	23	27	30	28	6	
đł	H087	4/2/2021	6		800		6	35	25	33	28	5	6	33	31	30	15	
da.	H214	23/3/2021	CA .		800		6	26	28	13	23	32	20	32	32	6	25	
ιšι	H285	8/5/2021	DI I		eco		6	35	25	33		25	20	30	30	6	20	
úi	H581	13/9/2021	ы		eco		12	35	25	30	27	25	6	30	30	6	25	
úh	H194	19/3/2021	bi		eco		6	23	29	13	23	39	23	31	31	24	22	
Jt	H593	26/9/2021	51		eco	•	20	35	25	32	30	35	20	30	32	30	20	1
4	H341	5/6/2021	61		eco	 	6	33	25	32	29	35	21	31	30	17	19	đ.
4	H165	5/3/2021	bl		eco		6	35	25	32	29	24	23	30	32	29	15	
4.	H123	17/2/2021	bi		800		6	34	26	34	28	25	20	30	33	6	19	
95-	H223	28/3/2021	ы		000		17	35	25	32	28	35	21	30	30	30	22	ŧ.
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Code Organism Humber of isolates Jan Fe Mar Apr May Jan Aug See Oct Nov Dec col Excharchia coli 33 100 33 4 6 7 1 2 6 2 1 2 2 1 Escherichia coli Fescherichia coli Colimna	
Code Organism Number of (N) Number of Jan Feo Mar Apr Mar Jun Ju Au Arg Seo Oct Nov Dec to Stateronis col 20 100 20 4 6 7 1 2 6 2 1 2 2 1 2 2 1 1 2 2 1 1 2 2 1 1 2 2 1 1 2 2 1 1 2 2 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
No Lipschröhligter Ju No Ju Lipschröhligter 10 5 - - - - 10 - - -	
Escherichia coli	
Escherichia coli	
Escherichia coli Escherichia coli Columns Columns	
Escherichia coli	
Escherichia coli Columna Col	
10 5Columns	
5- Columns	
5- Columns	
5- Columns	
0-Jan Feb Mar Apr May Jun Jul Aug Sep Oct Jul	

7.2 % RIS and test measurement: for preparation of cumulative antibiograms

a) From the main WHONET screen, click on 'Data analysis' and 'Data analysis'.



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Data analysis: PNG Model SS		×
<u>A</u> nalysis type	Options	One per patient
Organisms	<u>I</u> solates	
<u>D</u> ata files	Output	Screen ~
Macros	<u>B</u> egin analys	is E <u>x</u> it

b) Select 'Analysis type'. By default, WHONET selects '%RIS and test measurements'. Click 'OK'.

late listing and summary %RIS and test measurements Scatterplot Resistance profiles	Isolate alerts	Clust	er alerts		
Report format					
1, %RIS and test measurements			Summary		
☑ Tables	Rows	1	Antibiotic	×.	
☑ Graphs		2	(None)	· •	
) 2. Summary		3	(None)	~	
🖸 Tables		4	(None)	~	
C Graphs			Administra P.		
Antibiotics					
All antibiotics					
) Select antibiotics					
Browse					

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c) Select 'One per patient', select 'By patient' and click 'OK'.

 One isolate of species by patient Include which results in the analysis of each species? By jaolate By gatient By fime interval or resistance phenotype First isolate only First isolate with antibiotic results The following options are only available for %RIS calculations. Average resistance result for each antibiotic Most resistant result for each antibiotic One result for each antibiotic Number of days since previous isolation 30 ‡ Number of days since first isolation 30 ‡ Onsider resistance phenotype Consider resistance phenotype Consider resistance phenotype Consider only major differences in interpretation (R, S) 	
Include which results in the analysis of each species? By jsolate First isolate only First isolate only First isolate with antibiotic results The following options are only available for %RIS calculations. Average resistance result for each antibiotic Most resistant result for each antibiotic Most susceptible result for each antibiotic One result for each antibiotic Consider time interval Number of days since previous isolation Consider resistance phenotype Consider resistance phenotype Consider only major differences in interpretation (R, S)	×
 By gatient By time interval or resistance phenotype First isolate only First isolate with antibiotic results The following options are only available for %RIS calculations. Average resistance result for each antibiotic Most resistant result for each antibiotic Most susceptible result for each antibiotic One result for each antibiotic interpretation Consider time interval Number of days since previous isolation Number of days since first isolation Consider resistance phenotype Consider only major differences in interpretation (R, S) 	
 By time interval or resistance phenotype First isolate only First isolate with antibiotic results The following options are only available for %RIS calculations. Average resistance result for each antibiotic Most resistant result for each antibiotic Most susceptible result for each antibiotic One result for each antibiotic One result for each antibiotic interpretation Consider time interval Number of days since previous isolation Number of days since first isolation Consider resistance phenotype Consider only major differences in interpretation (R, S) 	
 First isolate only First isolate with antibiotic results The following options are only available for %RIS calculations. Average resistance result for each antibiotic Most resistant result for each antibiotic Most susceptible result for each antibiotic One result for each antibiotic interpretation Consider time interval Number of days since previous isolation 30 ÷ Consider resistance phenotype Consider only major differences in interpretation (R, S) 	
 First isolate with antibiotic results The following options are only available for %RIS calculations. Average resistance result for each antibiotic Most resistant result for each antibiotic Most susceptible result for each antibiotic One result for each antibiotic interpretation Consider time interval Number of days since first isolation 30 ÷ Number of days since first isolation 30 ÷ 	
The following options are only available for %RIS calculations. Average resistance result for each antibiotic Most resistant result for each antibiotic One result for each antibiotic One result for each antibiotic interpretation Consider time interval Number of days since previous isolation Number of days since first isolation Consider resistance phenotype © Consider only major differences in interpretation (R, S)	
 Average resistance result for each antibiotic Most resistant result for each antibiotic Most susceptible result for each antibiotic One result for each antibiotic interpretation Consider time interval Number of days since previous isolation Number of days since first isolation \$30 \$\$ Consider resistance phenotype Consider only major differences in interpretation (R, S) 	
 Most resistant result for each antibiotic Most susceptible result for each antibiotic One result for each antibiotic interpretation Consider time interval Number of days since previous isolation Number of days since first isolation 30 ÷ Consider resistance phenotype Consider only major differences in interpretation (R, S) 	
Most susceptible result for each antibiotic One result for each antibiotic interpretation Consider time interval Number of days since previous isolation Number of days since first isolation Number of days since first isolation Consider resistance phenotype	
 One result for each antibiotic interpretation Consider time interval Number of days since previous isolation Number of days since first isolation 30 ÷ Consider resistance phenotype Consider resistance phenotype Consider only major differences in interpretation (R, S) 	
Consider time interval Number of days since previous isolation Number of days since first isolation Consider resistance phenotype Consider only major differences in interpretation (R, S)	
 Number of days since previous isolation Number of days since first isolation 30 + Consider resistance phenotype Consider only major differences in interpretation (R, S) 	
Number of days since first isolation	
Consider resistance phenotype Ornsider only major differences in interpretation (R, S)	
Consider only major differences in interpretation (R, S)	
O Consider both major and minor differences in interpretation (R, I, S)	
Consider all antibiotics	
O Select antibiotics Browse	
<u>Q</u> K <u>C</u> ancel	7

d) Select organism(s) for analysis and click 'OK'.

Make your	r selections by double-clicking or by typing the codes and p	ressing <	Enter> afte	r each on	ie.	
Code				Analys	is organism list	Clearlist
<u>Extenc</u>	ded list Organism groups			Anal	lyze as one organism	Glear hist
aba bfr pce ccaj cal cfr cdp cdp eav eav efa efa efm ent ebv eco 157 hin hxb hib	Acinetobacter baumannii Bacteroides fragilis Burkholderia cepacia Campylobacter coli Campylobacter jejuni ss. jejuni Candida albicans Citrobacter freundii Corynebacterium sp. (diphtheroids) Cytomegalovirus Enterobacter aerogenes Enterobacter cloacae Enterococcus faecalis Enterococcus faecalis Enterococcus faecium Enterococcus faecium Enterococcus faecium Enterococcus faecium Escherichia coli Escherichia coli O157:H7 Haemophilus influenzae Haemophilus influenzae (tot type b)	~	->	eco	Escherichia coli	

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e) Define isolate selection criteria and click 'OK'.

Isolates			×
To define selection criteria,	choose a data field and click on	Define criteria'.	
Location Department Location type Specimen number Specimen date Specimen type Reason Isolate number Organism Organism type Serotype Beta-lactamase			~
 Exclude laboratory isolat Exclude screening isolat Include isolates that sat Include isolates that sat 	es: Specimen type = 'qc', 'la', 'ex es: Specimen type = 'sc', 'mr', 'v isfy all of the selection criteria. isfy at least one of the selection c	', 'Department = 'lab' r', 'cd' riteria.	
<u>D</u> efine criteria	Clear this criterion	Clear <u>a</u> ll criteria	<u>0</u> K

Isolates								\times
Make you SPEC_TY Specimer	r selections by double-clickin /PE n type	g or by typing	the codes a	nd pressing) <enter> af</enter>	ter each or	ie.	
Code				bl	Blood			
an ab as ad de ac	Abdomen Abdominal fluid Abscess Abscess, abdominal Abscess, dental Abscess, perirectal	^	>					
pt ak Search	Abscess, peritonsillar Abscess, skin	~		Include	le	⊖ Exc	lude	
					<u>о</u> к		<u>C</u> ancel	

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f) Select data file(s) for analysis and click 'OK'.

Select data files						>
File name		PNG Model SS (*MOD*)			~	Clear list
Desktop Documents Occuments Cri SWinREAgent Apps Dell Documents and Settings Drivers Intel PerfLogs Program Files Porgram Files Porgram Files Postimume Information Verts System Volume Information Vertows WHONET Windows Di Dol	Name	Last modified 9/12/2021 11:23:21 AM	Size 20 KB	1	Data files	2
Separate analysis for each file					QK	Cancel

g) Click 'Begin analysis'.

Data analysis: PNG Model SS		×
Analysis type Study = RIS and test measurements All antibiotics	Options	One per patient
Organisms eco Escherichia coli	Isolates Specimen type: bl	
Data files PNG-MOD-2021.sqlite	Outຼput	Screen ~
Macros	<u>B</u> egin analys	sis Exit

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The output screen for %RIS and test measurement looks like this:

while where	Copy graph	gave to	bie gave graph	Contin	ue 🗌 Sh	ow hidden colu	mine						
mentype: bi indi	ude												
Organisma	isolates	Code	Antibiotic name	Site of infection	Ereakpoints	Number	%R		w	% 8	%R 95%C.I.	Number	6
Escherichia coli	Specimen type=bl	ESAL	ESOL	19		11		60		0	67.9-100		
Escherichia coli	Specimen type=bl	AMP_ED10	Ampiollin		S >≡ 14	33	8	4.8	0	15.2	67.3-94.3	33	81.8
Escherichia coli	Specimen type=bl	AMC_ED20	Amostolitin/Clavusanic acid		S ≥= 19	33	2	7.3	0	72.7	13.9-45.8	33	3
Escherichia coli	Specimen type=bl	AMC_ED20	Amoxicillin/Clavulanic acid	UTI	S >= 15	33	1	82	0	81.8	7.6-35.1	33	3
Eacherichta coli	Specimen type=bl	CAZ_ED10	Cettazicime		19-21	31	1	2.9	6.5	80.6	4.2-30.8	31	3.2
Escherichia coli	Specimen type+bl	CRO_ED30	Cettriaxone	Oral	22-24	33	3	3.3	0	66.7	18.6-51.9	33	3
Escherichia coli	Specimen type=bl	FEP_ED30	Cefepime		24-26	33	2	1.2	9.1	69.7	9.6-39.4	33	
Escherichia coli	Specimen type=bl	FOX_ED30	Celoxitin	Screen	S ≻= 19	33	1	P.1	D	90.9	2.4-25.5	33	3
100 80 60 8 ² 40	I T T	Τ	Resistant	Т	T T		I	RIS Record Interne Suscep Unknov Numbe	srd cdate cdate cdate state wn er bested ieasurements iiin dirwClassianic acid				

7.3 Susceptibility summary: to give an overview of possible treatment options and for preparation of cumulative antibiograms

a) From the main WHONET screen, click on 'Data analysis' and 'Data analysis'.



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Data analysis: PNG Model SS			×
<u>A</u> nalysis type	Options	On	e per patient
Organisms	Isolates		
Data files	Output	Screen	~
Macros	<u>B</u> egin	analysis	E <u>x</u> it

b) Select 'Analysis type'. By default, WHONET selects '%RIS and test measurements'. Select '2. Summary' and click 'OK'.

Data analysis: Setthathirath Hospital		×
Analysis type Study = Susceptibility summary All antibiotics	Options	One per patient
<u>O</u> rganisms	Isolates	
<u>D</u> ata files	Ouţput	Screen ~
Macros	<u>B</u> egin analys	sis E <u>x</u> it

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c) Select 'One per patient', select 'By patient' and click 'OK'.

One isolate of species by patient		×
Include which results in the analysis of each species?		
O By Isolate		
By patient		
O By time interval or resistance phenotype		
First isolate only		
O First isolate with antibiotic results		
The following options are only available for %RIS calculations.		
O Average resistance result for each antibiotic		
O Most resistant result for each antibiotic		
O Most susceptible result for each antibiotic		
O One result for each antibiotic interpretation		
Consider time interval		
Number of days since previous isolation	30 ‡	
O Number of days since first isolation	30 🜲	
Consider resistance phenotype		
Consider only major differences in interpretation (R, S)		
O Consider both major and minor differences in interpretation (F	R, I, S)	
Consider all antibiotics		
O Select antibiotics	Browse	
	ОК	ancel
	20	

d) Select organism(s) for analysis and click 'OK'.

Organis	ms				
Select th	e organisms that you w	ould like to include in the analysis.			
Make you	ur selections by double-	-clicking or by typing the codes and	pressing <enter></enter>	after each one.	
WHONE	ET organism list			Analysis organism list	
Code	ALL				Clear list
Exten	nded list	✓ Organism groups		Analyze as one organism	
ALL	All organisms		^	EBC All Enterobacteriaceae	
GM+	Gram positive organi	sms			
GM-	Gram negative organ	lisms			
	Anaeropes Mycobacteria				
FUN	Fungi				
PAR	Parasites				
OTB	Other bacteria				
отн	Other organisms			•	
EBC	All Enterobacteriacea	ie			
NFR	All non-fermenting gr	am negative rods	<-	-	
AC-	Acinetobacter sp.				
AEC	Aerococcus sp.				
AER	Aeromonas sp.				
BCS	Bacillus sp.				
BAC	Bacteroides sp.				
	Compylobactor on				
	Campyiobacter sp. Candida sn				
CI-	Citrobacter sp				
CDF	Clostridium difficile		~		
Search					OK
Gearch					QR

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e) Define isolate selection criteria and click 'OK'.

Isolates		X
To define selection criteria, choose a data fie	ld and click on 'Define criteria'.	
Location Department Location type Specimen number Specimen date Specimen type Specimen type (Numeric) Reason Isolate number Organism Organism type Serotype Beta-lactamase		
 Exclude laboratory isolates: Specimen typ Exclude screening isolates: Specimen typ Include isolates that satisfy all of the selection Include isolates that satisfy at least one of 	e = 'qc' , 'la' , 'ex' , 'Department = 'lab' e = 'sc' , 'mr' , 'vr' , 'cd' ction criteria. f the selection criteria.	
Define criteria Clear this	criterion Clear <u>a</u> ll criteria	<u>O</u> K

Isolates	3					×
Make yo SPEC_1 Specim	our selections by double-clickin TYPE en type	ig or by typing th	e codes a	nd pressing <enter< td=""><td>r> after each one.</td><td></td></enter<>	r> after each one.	
Code				bl Blood		
an ab as ad de	Abdomen Abdominal fluid Abscess Abscess, abdominal Abscess, dental	^	>			
ac pt ak Search	Abscess, perirectal Abscess, peritonsillar Abscess, skin	~		Include	O Exclude	
L				<u>0</u> K	<u>C</u> ancel	

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f) Select data file(s) for analysis and click 'OK'.

Select data files						- 🗆 ×
File game		PNG Model SS (*MOD*)			Ý	Clearlist
Desitop Documents Co. SWinREAgent Apps Dell Occuments and Settings Drivers Intel Program Files Program Files Program Files Program Files System Volume Information Users Windows Dol	Name	Last modified 9/12/2021 11:23:21 AM	Size 20 KB	→ €-	Data files	te
Separate analysis for each file					QK	Cancel

g) Click 'Begin analysis'.

Data analysis: Setthathirath Hospital		×
Analysis type Study = Susceptibility summary All antibiotics	Options	One per patient
<u>O</u> rganisms EBC All Enterobacteriaceae	Isolates Specimen type: bl	
Data files PNG-MOD-2021.sqlite	Output	Screen ~
Macros	<u>B</u> egin analysi	is E <u>x</u> it

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The output screen for susceptibility summary looks like this:

For																			
opy table	Copy graph Sc	ve table		Save grap	;h	Contin	ue (Show hid	iden colum	ns -									
ventype: bl	Indude																		
Org	Organism	Number of patients		AMP %S	FEP %S	FOX %S	CRO NS	CAZ %S	CIP %S	GEN %S	IPM %S	MEM NS	SXT NS	AMC %S	CHL NS	TCY NS	NAL %S	AMP Number	N
aco Esch	herichia coli		23	152	69.7	90.9	56.7	20.6	697	727	100	100	48.5	727	87.9	27.8	51.5 01.0		23
			e	co							Rows								
100 -			e	co							Rows 650 Rph								
100 -	-	_	e	co			_	_			Rows eco tipn								
100 - 80 - 60 -			e	co					_		Rows eco spn								
100 - 80 - 60 -			e	со							Rows Rom Rom Rom Rom Rom	9Kcs							
100 - 80 - 60 - 40 -	d		e	со							Antibia Antibia	olica min me							
100 - 80 - 60 - 7 40 - 20 -	.1		e	co							Antibi Antibi Antipi Cefep Cefep Cefer	olica min time tim totone sistme							
100 - 80 - 8 ⁴ 40 - 20 - 0 -			e	CO							Rows Ron Ron Antibie Ampic Cetra Cetra Cetra Cetra Conta	olics min time tin xxone dome locacin micin							

7.4 Scatterplots: to compare activity of two antibiotics

a) From the main WHONET screen, click on 'Data analysis' and 'Data analysis'.



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Data analysis: PNG Model SS			×
Analysis type	Option	IS	One per patient
Organisms	Isola	tes	
Data files	Output	Scre	en v
	1		
Macros		Begin analysis	Exit
		<u>_</u> ogin analysia	- <u>-</u> 2*

b) Select 'Analysis type'. By default, WHONET selects '%RIS and test measurements'. To the right of this heading, click 'Scatterplot', select antibiotics to compare and click 'OK'.

e the buttons t	below to select and configure the analysis.	
olate listing an	nd summary %RIS and test measurements Scatterplot Resistance profiles Isolate alerts Cluster alerts	
Report format	U	
1. with test	t measurements	
2. with test	t interpretations	
Intibiotics		
{-Axis	Ceftriaxone_EUCST_Disk_30µg ~	
(-Axis	Ciprofloxacin_EUCST_Disk_5µg ~	

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c) Select 'One per patient', select 'By patient' and click 'OK'.

One isolate of species by patient		×
Include which results in the analysis of each species?		
O By isolate		
By patient		
O By time interval or resistance phenotype		
First isolate only		
O First isolate with antibiotic results		
The following options are only available for %RIS calculations		
Average resistance result for each antibiotic		
O Most resistant result for each antibiotic		
O Most susceptible result for each antibiotic		
○ One result for each antibiotic interpretation		
Consider time interval		
Number of days since previous isolation	30 🗘	
O Number of days since first isolation	30 🜲	
Consider resistance phenotype		
Consider only major differences in interpretation (R, S)		
O Consider both major and minor differences in interpretation (R	, I, S)	
Consider all antibiotics		
O Select antibiotics	Browse	
	OK Ca	ncel
	20	

d) Select organism(s) for analysis and click 'OK'.

Organis	ms				
Select th	e organisms that you w	ould like to include in the analysis.			
Make you	ur selections by double-	-clicking or by typing the codes and	pressing <enter></enter>	after each one.	
WHONE	ET organism list			Analysis organism list	
Code	ALL				Clear list
Exten	nded list	✓ Organism groups		Analyze as one organism	
ALL	All organisms		^	EBC All Enterobacteriaceae	
GM+	Gram positive organi	sms			
GM-	Gram negative organ	iisms			
	Anaeropes Mycobacteria				
FUN	Fungi				
PAR	Parasites				
OTB	Other bacteria				
отн	Other organisms			•	
EBC	All Enterobacteriacea	ie			
NFR	All non-fermenting gr	am negative rods	<-	-	
AC-	Acinetobacter sp.				
AEC	Aerococcus sp.				
AER	Aeromonas sp.				
BCS	Bacillus sp.				
BAC	Bacteroides sp.				
	Compylobactor on				
	Campyiobacter sp. Candida sn				
CI-	Citrobacter sp				
CDF	Clostridium difficile		~		
Search					OK
Gearch					QR

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e) Define isolate selection criteria and click 'OK'.

Isolates			×
To define selection criteria, ch	oose a data field and click on '	Define criteria'.	
Location Department Location type Specimen number Specimen date Specimen type Specimen type (Numeric) Reason Isolate number Organism Organism type Serotype Beta-lactamase			~
 Exclude laboratory isolates: Exclude screening isolates: Include isolates that satisfy Include isolates that satisfy 	Specimen type = 'qc', 'la', 'ex' Specimen type = 'sc', 'mr', 'vr all of the selection criteria. at least one of the selection c	, 'Department = 'lab' ', 'cd' riteria.	
Define criteria	Clear this criterion	Clear <u>a</u> ll criteria	<u>О</u> К

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Solates		×
Make your selections by double-clicking or by typing SPEC_TYPE Specimen type	g the codes and pressing <enter> after each one.</enter>	
Code	> <	
Search	<u>O</u> K <u>C</u> ancel	

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f) Select data file(s) for analysis and click 'OK'.

Select data files						
File name		PNG Model SS (*MOD*)			×	Clear list
Desitop Documents Ocuments Cri Skecycle Bin SWIREKagent SWIREKagent Dell Documents and Settings Dell Documents and Settings Drivers Dell PerfLogs Intel PerfLogs Program Files (986) Program Files (986) Recovery System Volume Information Vindows DI	Name	Last modified 9/12/2021 11:23:21 AM	Size 20 KB	1	Data files	te
Separate analysis for each file					QK	Gancel

g) Click 'Begin analysis'.

🔮 Data analysis: Setthathirath Hospital		×
<u>A</u> nalysis type	Options	One per patient
Study = Scatterplot X-Axis = Ceftriaxone (Disk) Y-Axis = Ciprofloxacin (Disk)		
Organisms EBC All Enterobacteriaceae	Isolates Specimen type: bl	
Data files PNG-MOD-2021.sqlite	Output	Screen ~
Macros	<u>B</u> egin analys	is E <u>x</u> it



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The output screen for scatterplots looks like this:

(i) With test measurements



(ii) With test interpretations:

	Copy graph	Save table	Save graph	Continue	Show hidden column
ecimen type: bi ir	nclude				
	s	15.9%			56.8%
CIP (Disk) I	2.3%			4.5%
	R	13.6%			6.8%
		R	J		S

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7.5 Resistance profiles: for characterisation of isolate populations and multidrug resistance profiles

a) From the main WHONET screen, click on 'Data analysis' and 'Data analysis'.



Data analysis: PNG Model SS		×
<u>A</u> nalysis type	Options	One per patient
Qrganisms	Isolates	
<u>D</u> ata files	Output	Screen ~
Macros	<u>B</u> egin analys	sis E <u>x</u> it

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b) Select 'Analysis type'. By default, WHONET selects '%RIS and test measurements'. Two headings to the right of this, click 'Resistance profiles' and click 'OK'.

eport format						
) <u>1</u> . Listing			Summary			
) <u>2</u> . Summary	Rows	1	Resistance profile	~		
I Tables		2	(None)	~		
Graphs		3	(None)	~		
) <u>3</u> . Both	Columns		Specimen date	~	Month	~
ntibiotics			A			
desistance profile			Summary			
contaile -				r.		
Edit Profiles			Options	l		

c) Select 'One per patient', select 'By patient' and click 'OK'.

One isolate of species by patient		×
Include which results in the analysis of each species?		
O By isolate		
By patient		
O By time interval or resistance phenotype		
First isolate only		
O First isolate with antibiotic results		
The following options are only available for %RIS calculations.		
○ Average resistance result for each antibiotic		
O Most resistant result for each antibiotic		
O Most susceptible result for each antibiotic		
O One result for each antibiotic interpretation		
Consider time interval		
Number of days since previous isolation	30 🗘	
 Number of days since first isolation 	30 🗘	
Consider resistance phenotype		
Consider only major differences in interpretation (R, S)		
O Consider both major and minor differences in interpretation	n (R, I, S)	
Consider all antibiotics		
 Select antibiotics 	Browse	
	QK	Cancel
	_	

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d) Select organism(s) for analysis and click 'OK'.

	ar selections by double-clicking of by typing the codes	and pressing <enters< th=""><th>alter each one.</th><th></th></enters<>	alter each one.	
WHON	ET organism list		<u>Analysis organism li</u>	st
Code				Clearlist
<u>Exte</u>	nded list Organism groups		Analyze as one or	ganism
aba	Acinetobacter baumannii	^	eco Escherichi	a coli
ofr	Bacteroides fragilis			
oce	Burkholderia cepacia			
000	Campylobacter coli			
caj	Campylobacter jejuni ss. jejuni			
cal	Candida albicans			
cfr	Citrobacter freundii			
cdp	Corynebacterium sp. (diphtheroids)			
cmv	Cytomegalovirus		>	
eae	Enterobacter aerogenes			
ecl	Enterobacter cloacae	<.	-	
eav	Enterococcus avium			
efa	Enterococcus faecalis			
efm	Enterococcus faecium			
ent	Enterococcus sp.			
ebv	Epstein-Barr virus			
eco	Escherichia coli			
157	Escherichia coli O157:H7			
nin	Haemophilus influenzae			
dxr	Haemophilus influenzae (not type b)			
hih	Haemophilus influenzae (type b)	~		

e) Define isolate selection criteria and click 'OK'.

Solates	Х
To define selection criteria, choose a data field and click on 'Define criteria'.	
Location Department Location type Specimen number Specimen date	^
Specimen type Specimen type (Numeric) Reason Isolate number Organism Organism type Serotype Beta-lactamase	~
 Exclude laboratory isolates: Specimen type = 'qc', 'la', 'ex', 'Department = 'lab' Exclude screening isolates: Specimen type = 'sc', 'mr', 'vr', 'cd' Include isolates that satisfy all of the selection criteria. Include isolates that satisfy at least one of the selection criteria. 	
Define criteria Clear this criterion Clear all criteria	<u>0</u> K

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PEC_TYPE	e						
Code				bl Bl	ood		
an At ab At as At ad At de At ac At pt At ak At Search	idomen idominal fluid iscess iscess, abdominal iscess, dental iscess, perirectal iscess, peritonsillar iscess, skin	~	->	 Include) Exclude	

f) Select data file(s) for analysis and click 'OK'.

e <u>n</u> ame		PNG Model SS (*MOD*)			~	Clear list
Desktop Documents C\ SRecycle.Bin SwinREAgent SwinREAgent Dell Dell Documents and Settings Dirvers Intel PerfLogs Program Files Program Files System Volume Information Users Windows D\	Name	Last modified 9/12/2021 11:23:21 AM	Size 20 KB	•• >	Data files	



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g) Click 'Begin analysis'.

Data analysis: Setthathirath Hospital		×
<u>A</u> nalysis type	Options	One per patient
Study = Resistance profiles listing and summary Profile antibiotics = Automatic		
L		
<u>O</u> rganisms	<u>I</u> solates	
eco Escherichia coli	Specimen type: bl	
	Output	Correct of the second s
Data files		Screen
PNG-MOD-2021.sqlite		
Macros	<u>B</u> egin analys	is E <u>x</u> it

The output screen for resistance profiles listing and summary looks like this:

Cop	ny table	Carry grash	gave table		Q	ontinue	Show hi	dden columns						
ecime	entype: bi indu	ide				A = AMP C = FEP F = CRC T = CA2 P = CIP I = IPN 1	S >= 14 24 - 25 22 - 24 19 - 21 22 - 24 7 - 21	M = NEA	116-21					
1	fic Specime mb number	n Specimen dat	e Specimen type	isolate number	Organism	Organism type	Profile	Resistance profile	MDR	XDR	PDR	Number of classes tested	Number of classes nonsusceptible	AM
	H393	25/6/2021												
1		9/10/2021	ы		909							5	0	
1	H593	26/9/2021	DI		eco	•						5	0	
4	H223	28/3/2021	DI		eco							5	0	
4	H122	17/2/2021	bi		eco							5	0	
4	4. H149	27/2/2021	ы		eco		A	AMP	MDR			5	1	
	H063	23/1/2021	ы		eco		A	AMP	MDR			5	1	
1	H353	11/5/2021	ы		eco		A	AMP				5	1	
4	H581	13/9/2021	ы		eco	+	A	AMP				5	1	
	4. H341	5/6/2021	bi		800	÷.	A	AMP				5	1	
	H123	17/2/2021	bi		800		A	AMP				6	1	
	H129	19/2/2021	ы		eco		A	AMP	MDR			5	1	
	L H172	7/3/2021	Di		eco	+	A	AMP				5	1	
	6. H018	6/1/2021	DI		eco		A	AMP				5	1	
	4. H329	31/5/2021	DI		809		A	AMP				5	1	
	6 H208	22/3/2021	DI		eco		A	AMP	MDR			5	1	
4	H285	8/5/2021	bi		eco		A -	AMP				5	1	
1	H099	2/10/2021	bi		eco	+	AP	AMP CIP				5	2	
4	H087	4/2/2021	bl		eco		AP	AMP CIP	MDR			5	2	
	4 H165	5/3/2021	bl		800		A P	AMP CIP	MDR			6	2	
	H339	3/6/2021	bl		000		A P	AMP CIP				6	English (United States)	7
	4. H652	29/8/2021	bi		800	÷	A-P	AMP CIP				5	US keyboard	
	. H420	12/7/2021	ni		800		ACE	AMP FEP CRO				6	To switch input methods, pre	-17

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Copy tab	ie –	Copy graph	gave to	able	gave graph	Q	ontinue		0 Sh	ow hide	den colu	mns							
ecimen typ	e: bilm	dude						A = AMP C = FEP F = CRC T = CA2 P = CIP I = IPM 1	S >= 1 24-2 22-2 19-2 22-24 17-21	4 5 4		1	1 = NEA	116-3	21				
Proš	e R	esistance profile	Number of isolates	Nisclates	Number of patients	%Patients	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
			5	152	5	15.2		1	1		й <u>—</u> —	- 1			1	1			
A	AMP		11	33.3	11	33.3	2	3	2		1	2			1				
A -	AMP	-	1	3	1	3					1								
AP	AMP	CIP	4	12.1	4	12.1		1	1			1				1			
A -P	AMP	CIP	1	3	1	3								1	1				
ACF	AMP	FEPCRO	3	9.1	3	9.1			2	2			1		_			-	
AFTP	AMP	CR0 CAZ	1	3	1	3		_	_	_		_	1		-	_	_		
ACF P	AMP	FEP CR0	2	6.1	2	6.1	2		_	_					-		_		
ACET	LAMP	FEP CRO CAZ	2	9.1	3	9.1	_	1	1	-		1		-			_		
patients				Pro	file: eco:									R	co AMP co AMP co AMP co AMP co AMP co AMP co AMP co AMP	CI CI EP CRI CRO C EP CRI	P IP) AZ CIP) CIP		
Number of	0	Eab	Mar An	May	-	M	Aut		Sec		Oct		-	CLEMANLL	columns an eb lar pr lay un ul				

7.6 Isolate alerts: for quality assurance and detection of emerging resistances

a) From the main WHONET screen, click on 'Data analysis' and 'Data analysis'.



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Data analysis: PNG Model SS		×
<u>A</u> nalysis type	Options	One per patient
Organisms	Isolates	
<u>D</u> ata files	Ouţput	Screen v
Macros	<u>B</u> egin analy	sis E <u>x</u> it

b) Select 'Analysis type'. By default, WHONET selects '%RIS and test measurements'. Three headings to the right of this, click 'Isolate alerts', select '2. Isolate alerts' and click 'OK'.

the buttons below to sele	ct and configure the analysis.						
late listing and summary	%RIS and test measurements	Scatterplot	Resistance profiles	Isolate alerts	Cluster alerts		
Report format							
1. Create dictionary							
2. Isolate alerts							
Listing							
Summary							
lerts							
isting							
Options							

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c) Select 'One per patient', select 'By patient' and click 'OK'.

One isolate of species by patient		×
Include which results in the analysis of each species?		
O By isolate		
By patient		
O By time interval or resistance phenotype		
First isolate only		
O First isolate with antibiotic results		
The following options are only available for %RIS calculations		
Average resistance result for each antibiotic		
O Most resistant result for each antibiotic		
O Most susceptible result for each antibiotic		
○ One result for each antibiotic interpretation		
Consider time interval		
Number of days since previous isolation	30 🗘	
O Number of days since first isolation	30 🜲	
Consider resistance phenotype		
Consider only major differences in interpretation (R, S)		
O Consider both major and minor differences in interpretation (R	, I, S)	
Consider all antibiotics		
O Select antibiotics	Browse	
	OK Ca	ncel
	20	

d) Select organism(s) for analysis and click 'OK'.

Organis	ms				
Select th	e organisms that you w	ould like to include in the analysis.			
Make you	ur selections by double-	-clicking or by typing the codes and	pressing <enter></enter>	after each one.	
WHONE	ET organism list			Analysis organism list	
Code	ALL				Clear list
Exten	nded list	✓ Organism groups		Analyze as one organism	
ALL	All organisms		^	EBC All Enterobacteriaceae	
GM+	Gram positive organi	sms			
GM-	Gram negative organ	iisms			
	Anaeropes Mycobacteria				
FUN	Fungi				
PAR	Parasites				
OTB	Other bacteria				
отн	Other organisms			•	
EBC	All Enterobacteriacea	ie			
NFR	All non-fermenting gr	am negative rods	<-	-	
AC-	Acinetobacter sp.				
AEC	Aerococcus sp.				
AER	Aeromonas sp.				
BCS	Bacillus sp.				
BAC	Bacteroides sp.				
	Compylobactor on				
	Campyiobacter sp. Candida sn				
CI-	Citrobacter sp				
CDF	Clostridium difficile		~		
Search					OK
Gearch					QR

The Data analysis using whomen	
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e) Define isolate selection criteria and click 'OK'.

Isolates			×
To define selection criteria,	choose a data field and click on '	Define criteria'.	
Location Department Location type Specimen number Specimen date Specimen type Reason Isolate number Organism Organism type Serotype Beta-lactamase			~
 Exclude laboratory isolate Exclude screening isolate Include isolates that sate O Include isolates that sate 	es: Specimen type = 'qc', 'la', 'ex' es: Specimen type = 'sc', 'mr', 'vr isfy all of the selection criteria. isfy at least one of the selection c	, 'Department = 'lab' ' , 'cd' riteria.	
<u>D</u> efine criteria	Clear this criterion	Clear <u>a</u> ll criteria	<u>0</u> K

Isolates								\times
Make you SPEC_TY Specimer	r selections by double-clickin /PE n type	g or by typing	the codes a	nd pressing) <enter> af</enter>	ter each or	ie.	
Code				bl	Blood			
an ab as ad de ac	Abdomen Abdominal fluid Abscess Abscess, abdominal Abscess, dental Abscess, perirectal	^	>					
pt ak Search	Abscess, peritonsillar Abscess, skin	~		Include	le	⊖ Exc	lude	
					<u>о</u> к		<u>C</u> ancel	

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f) Select data file(s) for analysis and click 'OK'.

e <u>n</u> ame		PNG Model SS (*MOD*)			~	Clear list
Desktop Documents Ci SRecycle Bin SWinREAgent SWinREAgent Dell Dell Documents and Settings Drives Intel PerfLogs Program Files Program Files System Volume Information System Volume Information WHONET Windows Di	Name	Last modified 9/12/2021 11:23:21 AM	Size 20 KB	4	Data files	te
Separate analysis for each file					OK	Cancel

g) Click 'Begin analysis'.

Data analysis: Setthathirath Hospital		×
Analysis type Study = Isolate alerts	Options	One per patient
Organisms EBC All Enterobacteriaceae	Isolates Specimen type: bl	
Data files PNG-MOD-2021.sqlite	Ouţput	Screen ~
Macros	<u>B</u> egin analys	sis E <u>x</u> it

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The output screen for isolate alerts summary looks like this:

xopy s	able	ga gath ga	ve table	Dave graph	Qo	ntinue	Show hidde	o columns										
umentipe: bl induce																		
55ci imb	Specimen number	Specimen date	Specimen type	Isolate number	Organism	Organiam type	AMP	FEP	FOX	CRO	CAZ	CIP	GEN	IPM	NEM	SXT	AMC	CH
n	H051	17/1/2021	bi .	2	400	-	R	8 1	\$		1 9		\$	5			R	S
υ_	H599	2/10/2021	bi -		eco	-	R	S	S	1	s s	R	S	S	5	\$	s	R
U.	H456	22/7/2021	04		eco	-	R	8	R		e en	R	R	S	5	5	R	R
υ.,	H088	4/2/2021	04		eco	-	R	R	s		e (1)	S	S	s	5	5	R	s
υ	H429	12/7/2021	54		eco	-	R	1	S		S	S	S	S	5	5	s	s
0	H072	28/1/2021	54		eco	÷	R	R	3		8	R	R	3	5	3	R	R
υ	H274	29/4/2021	64		eco	-	R	R	5		1	R	S	3	5	3	R	5
đ.,	H214	23/3/2021	ы		eco		R	1	S		3	3	9	5	6	3	R	3
J.,	H194	19/3/2021	bi		eco	-	R	R	S	- P	8	9	S	S	6	5	s	s
q.,	H376	21/6/2021	61		600		R	R	R	6	f 61	R	S	s	5	3	R	R
H.,	H552	29/8/2021	ы		eco	-	R	S	S		5		S	S	5	5 1	R	s
46	H212	23/3/2021	54		eco		R	R	S		t Al	S	R	s	1	3	s	s
lq.	H342	6/5/2021	ы		#C0		R	R	S			S	S	9	5	3	R	s
1	H366	17/6/2021	08		kpn		R	R	R		e	s	5	5	1	5	5	R
u_	H528	10/8/2021	54		kpn	-	R	R	S		1 H		s	s	5	5	R	R
0.	H073	29/1/2021	DI		kpn	-	R	1	S		1 81	R	R	S	5	5	R	R

	y table			gave table	Drie graph Continue	Show hidden columns				
ecime	ntype b	i Indude								
11	mbe P	14L	Alert	Priority	Organisms	Isolate alerts	Quality control	Important species	Important resistance	3
	a_	R		Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac.			2	
0	19	20	N	Medium priority	All organisms	Quinclones and Fluoroquinolones = Discordant results				
U	9	R		Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESEL-producing Enterobacteriaceae, Possible ESEL-producing Enterobac				
U	12.	s		Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae. Possible ESBL-producing Enterobac.				
υ	M.	R		Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESEL-producing Enterobacteriaceae. Possible ESEL-producing Enterobac				
v	12.	R		Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae. Possible ESBL-producing Enterobac				Г
v	12.	R		Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac				
3		R	Ø	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESEL-producing Enterobacteriaceae. Possible ESBL-producing Enterobac				
3		s	2	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESEL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac.				
2	192	R	2	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESEL-producing Enterobacteriaceae. Possible ESBL-producing Enterobac		ä		F
-	J.,	9	2	Medium priority	All organisms	Quinclones and Flucroguinolones = Discordant results	Pl			
-	di.	R	R	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae. Possible ESBL-producing Enterobac.			R	-
le		R	2	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac.	-	-		t
1	10	5	2	Medium priority	Enterobacteriaceae	Possible ESBL-producing Enterobacteriaceae				
				Medium priority	All organisms, Enterobacteriaceae, Enterobacteriaceae	Quinciones and Flucroguinolones = Discordant results. ESBL-producing	52		M	
	m. 1	R	M	Medium priority	Enterobacteriaceae. Enterobacteriaceae	ESEL-producing Enterobacteriaceae. Possible ESBL-producing Enterobac			R	1

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ntype bi Induc	de										
Rule		dimentipe bi induce									
number	Organisms	Ker		Number of isolates	Priority	003	Guality control	Important species	Important resistance	Save the isolate	Send to a reference laborate
U A	Ul organisms	Quinclones and Fluoroquino	iones = Discordant results	3	Medium priority	3	2				
23 E	Interobacteriaceae	ESBL-producing Enterobacte	riaceae	13	Medium priority	13			Ø		
25 E	interobacteriaceae	Possible ESBL-producing Er	terobacteriaceae	14	Medium priority	14					

7.7 Cluster alerts: for detection of possible clusters and outbreaks

WHONET may assist in the detect of cluster events through the integrated Satscan software. Options include retrospective or prospective cluster detection; purely temporal, pure spatial, or space-time clusters; and flexible parameter selection for space and time variables.

a) From the main WHONET screen, click on 'Data analysis' and 'Data analysis'.



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Data analysis: PNG Model SS			×
Analysis type	Option	IS	One per patient
Organisms	Isola	tes	
Data files	Output	Scre	en v
	1		
Macros		Begin analysis	Exit
		<u>_</u> ogin analysia	- <u>-</u> 2*

b) Select 'Analysis type'. By default, WHONET selects '%RIS and test measurements'. Four headings to the right of this, click 'Cluster alerts' and click 'OK'.

Analysis selection - Cluster al	erts								
se the buttons below to sele	ct and configure the analysis.								
solate listing and summary	%RIS and test measurements	Scatterplot F	Resistance profiles	Isolate ale	rts	Cluster alerts			
Report format									
Daily signals						Summary			
🖂 Tables				Rows	1	Organism	~		
Graphs					2	(None)	×		
Signal summary					3	(None)	~		
Z Tables				O					
Graphs				Columns		Specimen date	×	Month	×
Isolate listing									
Cluster alerts									
Options									
Space-Time Permutation									
<u>SaTScan™</u>									
								1	
								1	<u>o</u> k

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c) Select 'One per patient', select 'By patient' and click 'OK'.

One isolate of species by patient		×
Include which results in the analysis of each species?		
O By isolate		
By patient		
O By time interval or resistance phenotype		
First isolate only		
O First isolate with antibiotic results		
The following options are only available for %RIS calculations.		
O Average resistance result for each antibiotic		
O Most resistant result for each antibiotic		
O Most susceptible result for each antibiotic		
○ One result for each antibiotic interpretation		
Consider time interval		
Number of days since previous isolation	30 \$	
O Number of days since first isolation	30 🗘	
Consider resistance phenotype		
Consider only major differences in interpretation (R, S)		
O Consider both major and minor differences in interpretation	(R, I, S)	
Consider all antibiotics		
O Select antibiotics	Browse	
	ок	ancel

d) Select organism(s) for analysis and click 'OK'.

WHONET or	ganism list			Analysi	is organism list	
Code				- Criaile		Clear list
<u>Extended</u>	list Organism groups			🗌 Anal	yze as one organism	L
aba Aci bfr Ba pce Bu cco Ca caj Ca cal Ca cal Ca cfr Cit cdp Co cmv Cyl eae En ecl En eav En efa En eff En eff En et et e	netobacter baumannii cteroides fragilis rkholderia cepacia mpylobacter coli mpylobacter jejuni ss. jejuni ndida albicans robacter freundii nynebacterium sp. (diphtheroids) tomegalovirus terobacter cloacae terobacter cloacae terobacter cloacae terococcus faecalis terococcus faecalis terococcus faecium terococcus faecium terococcus sp. stein-Barr virus cherichia coli cherichia coli 0157:H7 emophilus influenzae (not type b)	^	->	ALL	All organisms	

Title: D	Data an	alysis	using	WHONET
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e) Define isolate selection criteria and click 'OK'.

Isolates			×
To define selection criteria,	choose a data field and click on	Define criteria'.	
Location Department Location type Specimen number Specimen date Specimen type Reason Isolate number Organism Organism type Serotype Beta-lactamase			~
 Exclude laboratory isolat Exclude screening isolat Include isolates that sat Include isolates that sat 	es: Specimen type = 'qc', 'la', 'ex es: Specimen type = 'sc', 'mr', 'v isfy all of the selection criteria. isfy at least one of the selection c	', 'Department = 'lab' r', 'cd' riteria.	
<u>D</u> efine criteria	Clear this criterion	Clear <u>a</u> ll criteria	<u>0</u> K

Isolates							Х
Make you SPEC_TY Specimer	r selections by double-clickin /PE n type	g or by typing ti	he codes a	nd pressing <ent< td=""><td>er> after each (</td><td>one.</td><td></td></ent<>	er> after each (one.	
Code				bl Bloo	d		
an ab as ad de	Abdomen Abdominal fluid Abscess Abscess, abdominal Abscess, dental	^	>				
ac pt ak Search	Abscess, peritonsillar Abscess, peritonsillar Abscess, skin	~		Include	() E	xclude	
	L			<u>O</u> K	[<u>C</u> ancel	

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f) Select data file(s) for analysis and click 'OK'.

le name		PNG Model SS (*MOD*)			Ý	Clear list	
Desitop Decuments C1 SRecycle Bin SWinREAgent Apps Documents and Settings Drivers Dell Documents and Settings Drivers Perfl.ogs Program Files Program Files System Volume Information Users Windows Dt	Name	Last modified 9/12/2021 11:23:21 AM	Size 20 KB	**	Data files	qite	
Separate analysis for each file					QK	Cancel	l.

g) Click 'Begin analysis'.

Data analysis: Setthathirath Hospital		×
Analysis type Study = Cluster alerts	Options	One per patient
<u>O</u> rganisms ALL All organisms	Isolates Specimen type: bl	
Data files PNG-MOD-2021.sqlite	Ouţput	Screen ~
Macros	<u>B</u> egin analys	is E <u>x</u> it

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The output screen for cluster alerts looks like this:



7.8 Macros: to bundle frequent analyses

Macros 'remember' and quickly retrieve the data analysis types and selection criteria for regular data analyses conducted using WHONET. To set up a macro:

a) From the main WHONET screen, click on 'Data analysis' and 'Data analysis'.



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Data analysis: PNG Model SS		×
<u>A</u> natysis type	Options	One per patient
Qrganisms	Isolates	
Data files	Output	Screen v
Macros	<u>B</u> egin analys	sis E <u>x</u> it

b) Define the analysis type, one per patient, organisms, isolates and data files for the data analysis.

Data analysis: Setthathirath Hospital		×
<u>A</u> nalysis type	Options	One per patient
Study = RIS and test measurements All antibiotics		
Qrganisms eco Escherichia coli sau Staphylococcus aureus ss. aureus	Isolates Specimen type: bl, ur	
Data files PNG-MOD-2021.sqlite	Output	Screen ~
Macros	Begin analys	sis Exit



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c) Select Macros and click 'New'.

Macro definitions	_		×
C:\WHONET\Macros\			
		<u>N</u> ew	
		Land	
		<u>r</u> oad	
		<u>E</u> dit	
		Dalata	
		Delete	
Browse		E <u>x</u> it	

d) Give the macro a name, click 'Save' and select the location you want to save it in.

Save macro	-	-		×
Macro name				
E coli and S aureus RIS results				
What information do you want to save?	[<u>S</u> ave	
Laboratory			<u>C</u> ancel	
Analysis type and options				
☑ Organisms				
✓ Isolates				
☑ Data files				
✓ Output				
✓ Isolate alerts				

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e) Next time you would like to run the same data analysis, on the main WHONET screen, click on 'Data analysis' and 'Data analysis'.



Data analysis: PNG Model SS		×
Analysis type	Options	One per patient
<u>O</u> rganisms	Isolates	
<u>D</u> ata files	Ouţput	Screen V
Macros	<u>B</u> egin analys	is E <u>x</u> it

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f) Click on 'Macros', select the macro you wish to run, and click 'Load'.

Macro definitions	_		×
C:\WHONET\Macros\			
File name = E coli and S aureus RIS results.mcr			
E coli and S aureus RIS results		<u>N</u> ew	
		Land	
		<u>L</u> oad	
		<u>E</u> dit	
		<u>D</u> elete	
Browse		E <u>x</u> it	

g) Click 'Begin analysis'.

8. Safety

N/A

9. Quality Control

Data quality should be verified by checking for accuracy and completeness prior to data analysis.

10. Reference and related documents

WHO Collaborating Centre for Surveillance of AMR 2006, *WHONET: Data analysis 1*, accessed 15 November 2021, <u>https://whonet.org/documentation.html</u>

WHO Collaborating Centre for Surveillance of AMR 2006, *WHONET: Data analysis 2*, accessed 17 November 2021, <u>https://whonet.org/documentation.html</u>