



National Department of Health

Title: Data analysis using WHONET

ID: G_90_SOP_27_A

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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

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Version	
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Signed	
Date	

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Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 2

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 (surveillance site laboratory)	Export CSV file from SENAITE 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.



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 3

6. Equipment/Materials

- Computer or laptop
- WHONET 2021 software
- AMR data file(s)



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

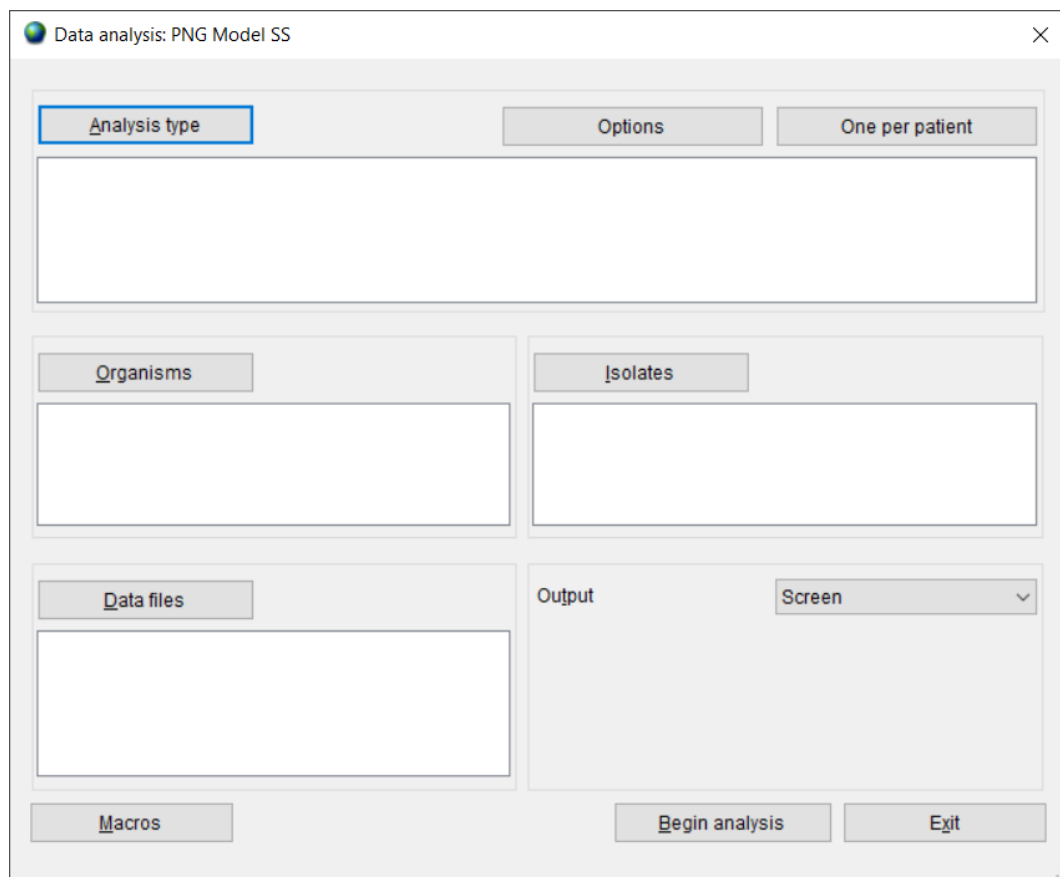
Issue date: 28/2/22

Page 4

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'.





Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 5

- 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'.

Analysis selection - Isolate listing and summary

Use the buttons below to select and configure the analysis.

Isolate listing and summary | %RIS and test measurements | Scatterplot | Resistance profiles | Isolate alerts | Cluster alerts

Report format

1. Listing

2. Summary

Tables

Graphs

3. Both

Options

Listing

Include isolate alerts

Options

Summary

Include cluster alerts

Options

Rows

1 Organism

2 (None)

3 (None)

Columns

Specimen date

Month

OK

- 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 patient

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

Number of days since first isolation 30

Consider resistance phenotype

Consider only major differences in interpretation (R, S)

Consider both major and minor differences in interpretation (R, I, S)

Consider all antibiotics

Select antibiotics

Browse

OK Cancel



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 6

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

Organisms

Select the organisms that you would like to include in the analysis.
Make your selections by double-clicking or by typing the codes and pressing <Enter> after each one.

WHONET organism list
Code

Extended list Organism groups

aba	Acinetobacter baumannii
bfr	Bacteroides fragilis
pce	Burkholderia cepacia
cco	Campylobacter coli
caj	Campylobacter jejuni ss. jejuni
cal	Candida albicans
cf	Citrobacter freundii
cdp	Corynebacterium sp. (diphtheroids)
cmv	Cytomegalovirus
eae	Enterobacter aerogenes
eci	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
hin	Haemophilus influenzae
hxb	Haemophilus influenzae (not type b)
hib	Haemophilus influenzae (type b)

Search

Analysis organism list
 Analyze as one organism

Clear list

eco	Escherichia coli
-----	------------------

OK

d) 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
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 OK



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 7

Isolates

Make your selections by double-clicking or by typing the codes and pressing <Enter> after each one.

SPEC_TYPE
Specimen type

Code

an	Abdomen
ab	Abdominal fluid
as	Abscess
ad	Abscess, abdominal
de	Abscess, dental
ac	Abscess, perirectal
pt	Abscess, peritonsillar
ak	Abscess, skin

Search

bl Blood

Include Exclude

OK Cancel

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

Select data files

File name PNG Model SS ("MOD") Clear list

Name	Last modified	Size
PNG-MOD-2021.sqlite	9/12/2021 11:23:21 AM	20 KB

Data files

PNG-MOD-2021.sqlite

Separate analysis for each file

OK Cancel



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 8

f) Click 'Begin analysis'.

Data analysis: PNG Model SS

Analysis type Options One per patient

Study = Isolate listing and summary
Rows = Organism
Columns = Specimen date

Organisms Isolates

eco Escherichia coli Specimen type: bl

Data files Output Screen

PNG-MOD-2021.sqlite

Macros Begin analysis Exit

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

Analysis results - Organism = Escherichia coli (n=33 isolates)

File Edit

Copy table Copy graph Save table Print graph Continue Show Hidden columns

Specimen type: bl Include

#	Accession number	Specimen date	Specimen type	Isolate number	Organism	Organism type	AMP	FEP	FOX	ORO	CAZ	CIP	GEN	IFM	MEM	SXT	AMC	CHL
1	H149	27/02/2021	bl		eco	-	6	37	27	35	30	40	6	30	33	6	20	
2	H051	17/1/2021	bl		eco	-	6	24	21	12	24	6	20	30	30	6	21	
3	H053	23/1/2021	bl		eco	-	6	31	25	30	28	40	6	29	33	22	13	
4	H393	25/5/2021	bl		eco	-	23	35	27	35	30	33	20	30	30	30	26	
5	H599	21/0/2021	bl		eco	-	6	35	24	31	25	21	20	30	33	28	16	
6	H455	22/7/2021	bl		eco	-	6	34	19	20	17	6	6	30	30	6	10	
7	H905	31/0/2021	bl		eco	-	18	28	23	25	22	35	20	25	27	28	20	
8	H088	4/2/2021	bl		eco	-	6	20	23	10	16	40	25	31	30	6	20	
9	H429	12/7/2021	bl		eco	-	6	24	25	14	23	27	25	34	33	17	24	
10	H072	28/1/2021	bl		eco	-	6	20	28	12	25	6	6	36	21	6	18	
11	H274	29/4/2021	bl		eco	-	6	23	25	14	21	6	26	31	34	6	35	
12	H353	11/6/2021	bl		eco	-	6	37	6	35	30	38	23	27	30	28	6	
13	H087	4/2/2021	bl		eco	-	6	35	25	33	28	6	6	33	31	30	15	
14	H214	23/3/2021	bl		eco	-	6	26	28	13	23	32	20	32	32	6	25	
15	H285	8/5/2021	bl		eco	-	6	35	25	33		25	20	30	30	6	20	
16	H581	13/9/2021	bl		eco	-	12	35	25	30	27	25	6	30	30	6	25	
17	H184	19/3/2021	bl		eco	-	6	23	29	13	23	39	23	31	31	24	22	
18	H593	25/9/2021	bl		eco	-	20	35	25	32	30	35	20	30	32	30	20	
19	H341	5/6/2021	bl		eco	-	6	33	25	32	29	35	21	31	30	17	19	
20	H165	5/3/2021	bl		eco	-	6	35	25	32	25	24	23	30	32	25	15	
21	H123	17/2/2021	bl		eco	-	6	34	26	34	28	25	20	30	33	6	19	
22	H223	28/3/2021	bl		eco	-	17	35	25	32	28	35	21	30	30	30	22	
23	H172	17/2/2021	bl		eco	-	20	35	25	35	30	35	21	30	31	10	21	



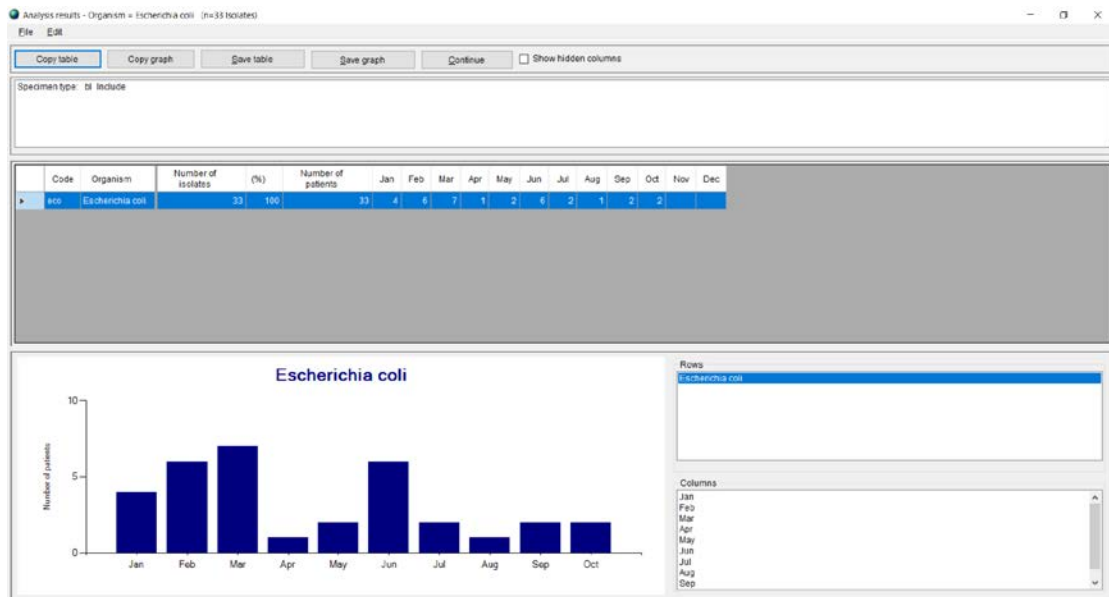
Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 9



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

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





Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 10

Data analysis: PNG Model SS

Analysis type Options One per patient

Organisms Isolates

Data files Output Screen

Macros Begin analysis Exit

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

Analysis selection - %RIS and test measurements

Use the buttons below to select and configure the analysis.

Isolate listing and summary %RIS and test measurements Scatterplot Resistance profiles Isolate alerts Cluster alerts

Report format

1. %RIS and test measurements

Tables Graphs

2. Summary

Tables Graphs

Antibiotics

All antibiotics Select antibiotics

Browse

Rows	Summary
1	Antibiotic
2	(None)
3	(None)
4	(None)

OK



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 11

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 isolate

By patient

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

Number of days since first isolation 30

Consider resistance phenotype

Consider only major differences in interpretation (R, S)

Consider both major and minor differences in interpretation (R, I, S)

Consider all antibiotics

Select antibiotics

Browse

OK Cancel

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

Organisms

Select the organisms that you would like to include in the analysis.
Make your selections by double-clicking or by typing the codes and pressing <Enter> after each one.

WHONET organism list

Code

Extended list Organism groups

aba	Acinetobacter baumannii
bfr	Bacteroides fragilis
pce	Burkholderia cepacia
cco	Campylobacter coli
caj	Campylobacter jejuni ss. jejuni
cal	Candida albicans
ctr	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
hin	Haemophilus influenzae
hxb	Haemophilus influenzae (not type b)
hib	Haemophilus influenzae (type b)

Search

Analysis organism list

Analyze as one organism

Clear list

eco Escherichia coli

OK



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 12

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**
- 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 OK

Isolates

Make your selections by double-clicking or by typing the codes and pressing <Enter> after each one.

SPEC_TYPE
Specimen type

Code

an	Abdomen
ab	Abdominal fluid
as	Abscess
ad	Abscess, abdominal
de	Abscess, dental
ac	Abscess, perirectal
pt	Abscess, peritonsillar
ak	Abscess, skin

Search

bl Blood

Include Exclude

OK Cancel



Title: Data analysis using WHONET

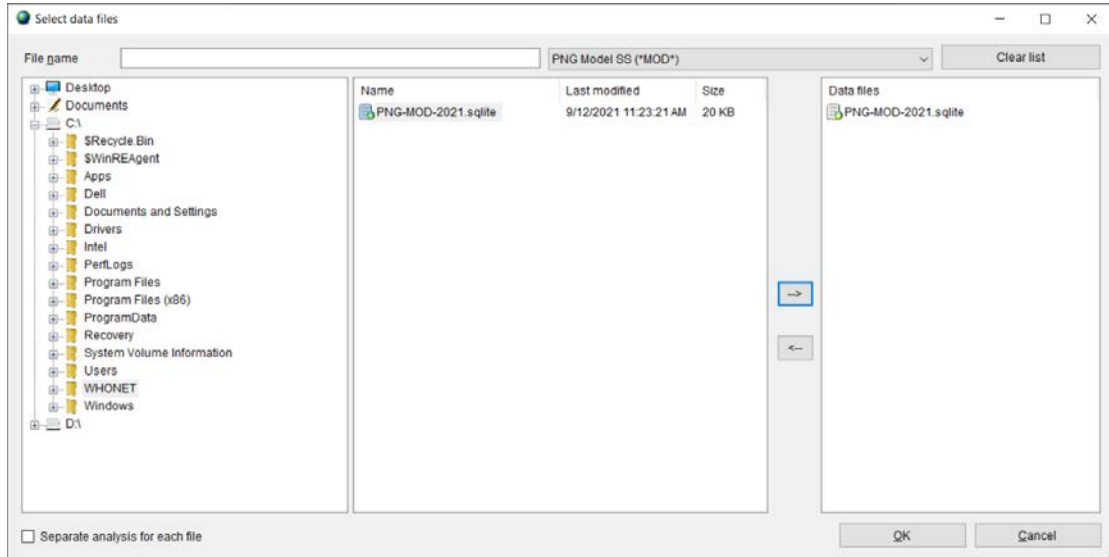
ID: G_90_SOP_27_A

Revision Number: A

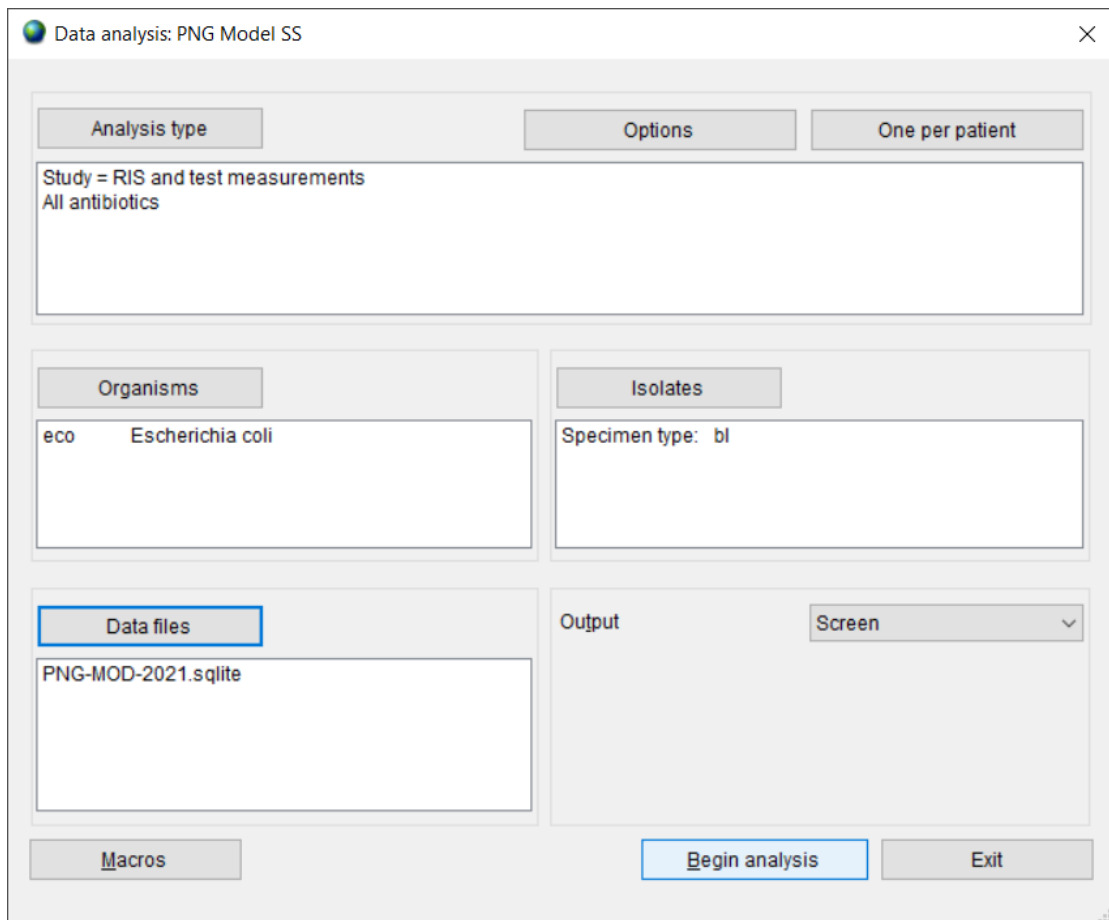
Issue date: 28/2/22

Page 13

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



g) Click 'Begin analysis'.





Title: Data analysis using WHONET

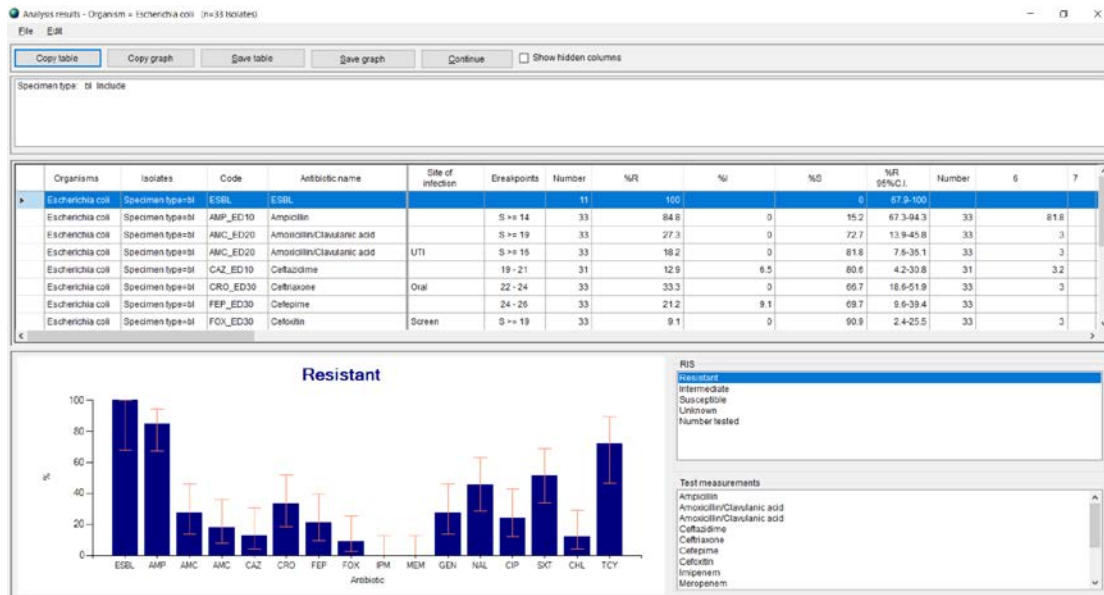
ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 14

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



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'.





Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 15

Data analysis: PNG Model SS

Analysis type Options One per patient

Organisms Isolates

Data files Output Screen

Macros Begin analysis Exit

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

Data analysis: Setthathirath Hospital

Analysis type Options One per patient

Study = Susceptibility summary
All antibiotics

Organisms Isolates

Data files Output Screen

Macros Begin analysis Exit



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 16

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 isolate

By patient

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

Number of days since first isolation 30

Consider resistance phenotype

Consider only major differences in interpretation (R, S)

Consider both major and minor differences in interpretation (R, I, S)

Consider all antibiotics

Select antibiotics

Browse

OK Cancel

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

Organisms

Select the organisms that you would like to include in the analysis.
Make your selections by double-clicking or by typing the codes and pressing <Enter> after each one.

WHONET organism list

Code ALL

Extended list Organism groups

ALL	All organisms
GM+	Gram positive organisms
GM-	Gram negative organisms
ANA	Anaerobes
MYC	Mycobacteria
FUN	Fungi
PAR	Parasites
OTB	Other bacteria
OTH	Other organisms
EBC	All Enterobacteriaceae
NFR	All non-fermenting gram negative rods
AC-	Acinetobacter sp.
AEC	Aerococcus sp.
AER	Aeromonas sp.
BCS	Bacillus sp.
BAC	Bacteroides sp.
BUK	Burkholderia sp.
CAM	Campylobacter sp.
CAN	Candida sp.
CI-	Citrobacter sp.
CDF	Clostridium difficile

Search

Analysis organism list

Clear list

Analyze as one organism

EBC	All Enterobacteriaceae
-----	------------------------

-->

<--

OK



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 17

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**
- 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 OK

Isolates

Make your selections by double-clicking or by typing the codes and pressing <Enter> after each one.

SPEC_TYPE
Specimen type

Code

an	Abdomen
ab	Abdominal fluid
as	Abscess
ad	Abscess, abdominal
de	Abscess, dental
ac	Abscess, perirectal
pt	Abscess, peritonsillar
ak	Abscess, skin

Search

bl Blood

Include Exclude

OK Cancel



Title: Data analysis using WHONET

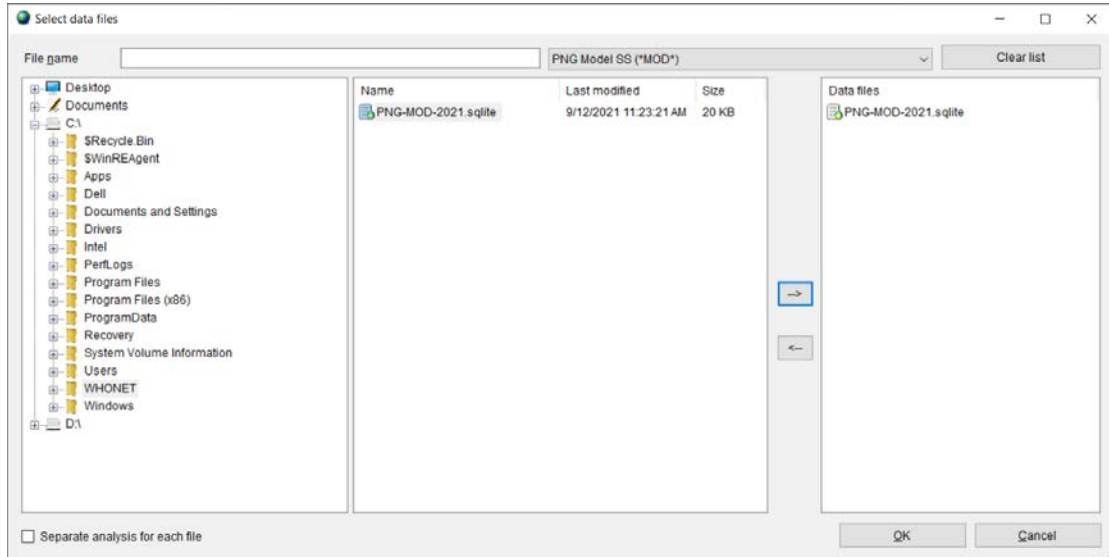
ID: G_90_SOP_27_A

Revision Number: A

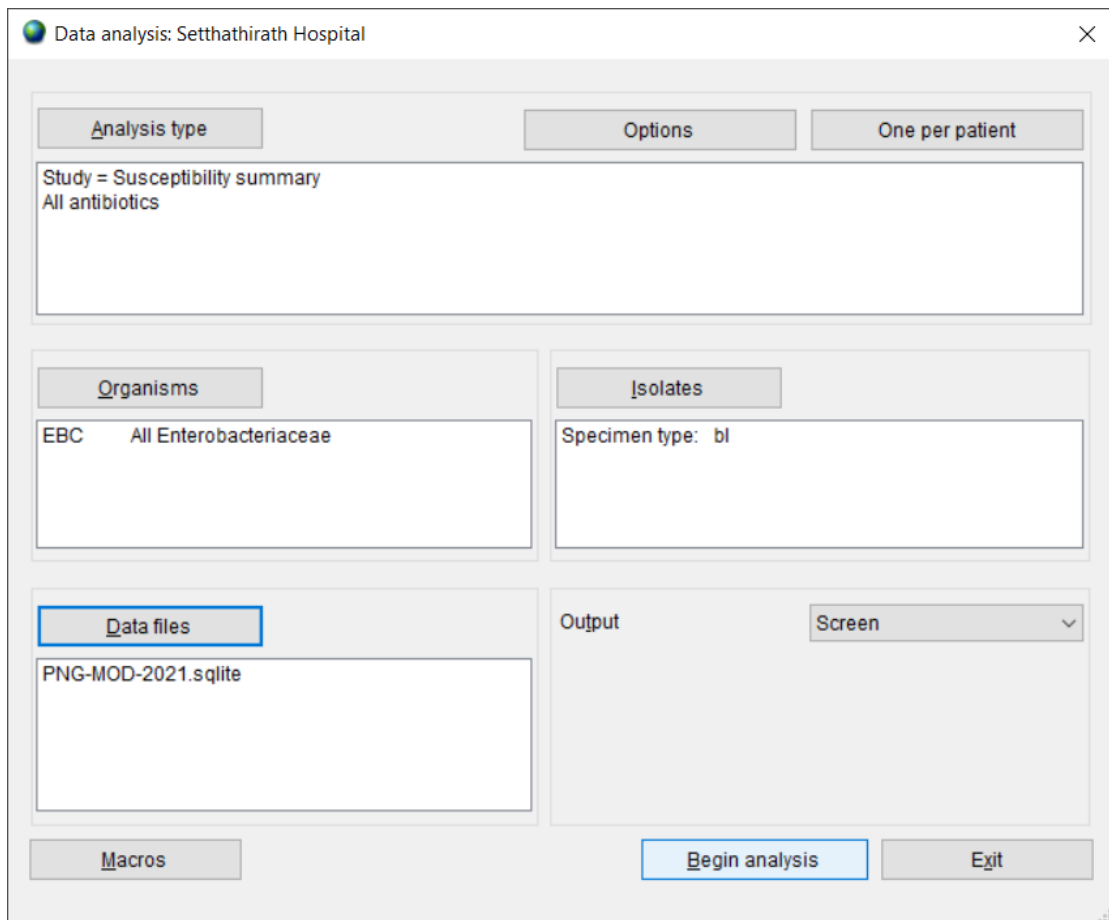
Issue date: 28/2/22

Page 18

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



g) Click 'Begin analysis'.





Title: Data analysis using WHONET

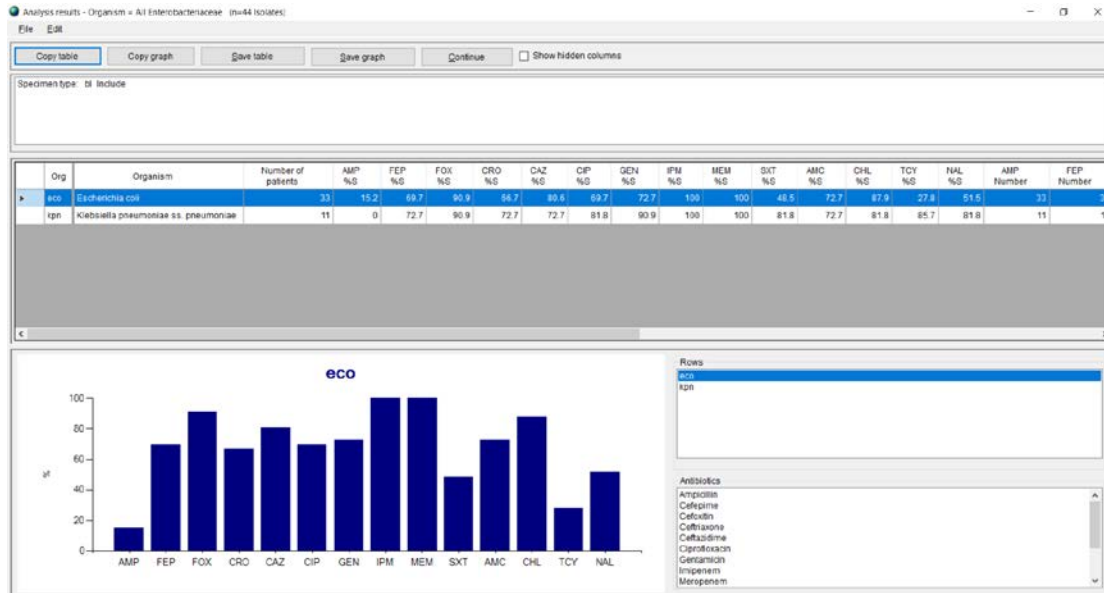
ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 19

The output screen for susceptibility summary looks like this:



7.4 Scatterplots: to compare activity of two antibiotics

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





Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 20

Data analysis: PNG Model SS

Analysis type Options One per patient

Organisms Isolates

Data files Output Screen

Macros Begin analysis Exit

- 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'.

Analysis selection - Scatterplot

Use the buttons below to select and configure the analysis.

Isolate listing and summary %RIS and test measurements Scatterplot Resistance profiles Isolate alerts Cluster alerts

Report format

1. with test measurements
 2. with test interpretations

Antibiotics

X-Axis Ceftriaxone_EUCST_Disk_30µg

Y-Axis Ciprofloxacin_EUCST_Disk_5µg

OK



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 21

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

The dialog box is titled "One isolate of species by patient". It contains several sections of options:

- Include which results in the analysis of each species?**
 - By isolate
 - By patient
 - By time interval or resistance phenotype
- 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 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)
 - Consider both major and minor differences in interpretation (R, I, S)
 - Consider all antibiotics
 - Select antibiotics (with a "Browse" button)

Buttons at the bottom: OK, Cancel.

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

The dialog box is titled "Organisms". It contains two main lists:

- WHONET organism list**: A list of organism codes and names. The "ALL" code is selected. The "Organism groups" checkbox is checked. A search box is at the bottom.
- Analysis organism list**: A list of selected organisms for analysis. The "EBC All Enterobacteriaceae" code is selected. A "Clear list" button is at the top right.

Navigation buttons: --> and <--.

Buttons at the bottom: OK.



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 22

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**
- 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 OK

Isolates

Make your selections by double-clicking or by typing the codes and pressing <Enter> after each one.

SPEC_TYPE
Specimen type

Code

an	Abdomen
ab	Abdominal fluid
as	Abscess
ad	Abscess, abdominal
de	Abscess, dental
ac	Abscess, perirectal
pt	Abscess, peritonsillar
ak	Abscess, skin

Search

bl Blood

Include Exclude

OK Cancel



Title: Data analysis using WHONET

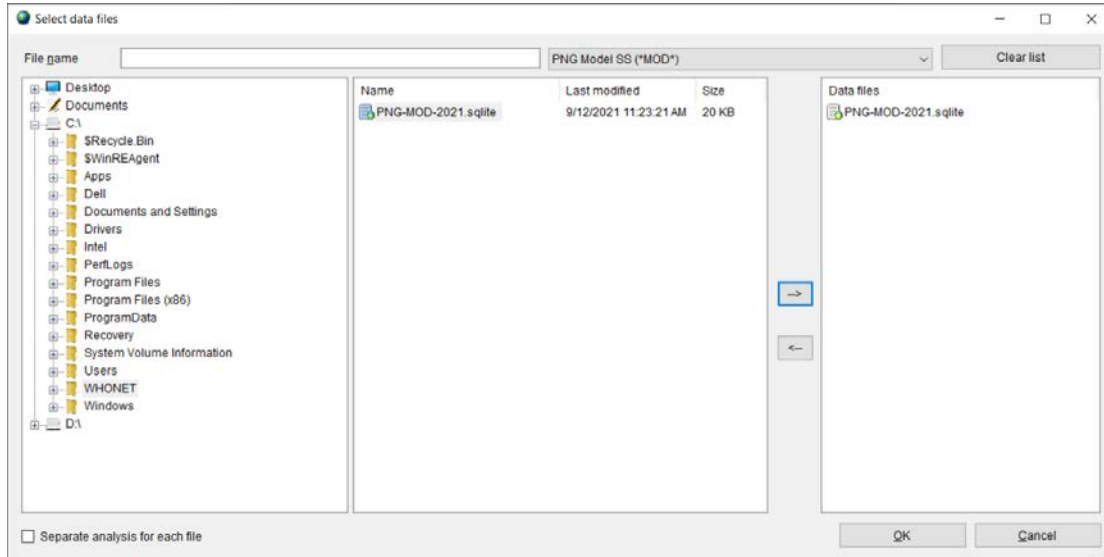
ID: G_90_SOP_27_A

Revision Number: A

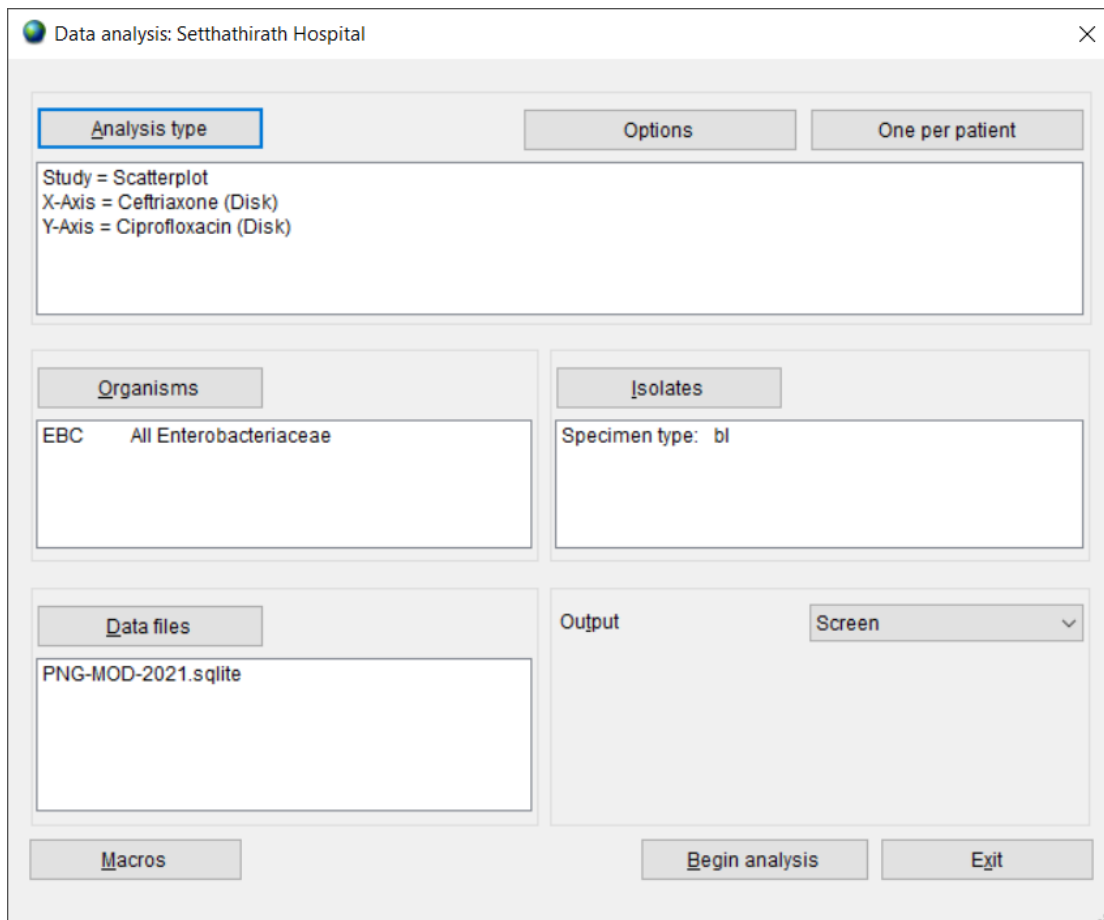
Issue date: 28/2/22

Page 23

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



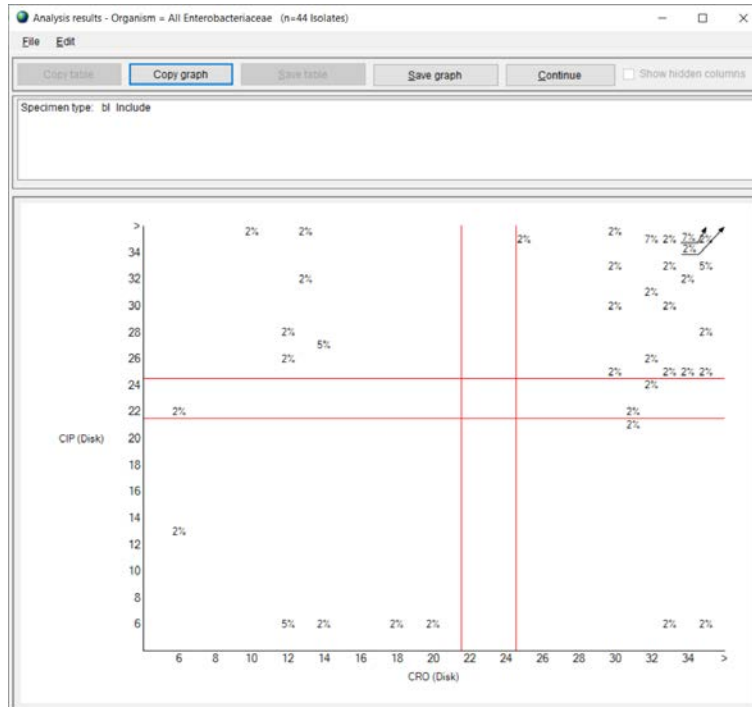
g) Click 'Begin analysis'.





The output screen for scatterplots looks like this:

(i) With test measurements



(ii) With test interpretations:

Analysis results - Organism = All Enterobacteriaceae (n=44 Isolates)

Specimen type: bf Include

		CRO (Disk)		
		R	I	S
CIP (Disk)	S	15.9%		56.8%
	I	2.3%		4.5%
	R	13.6%		6.8%



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

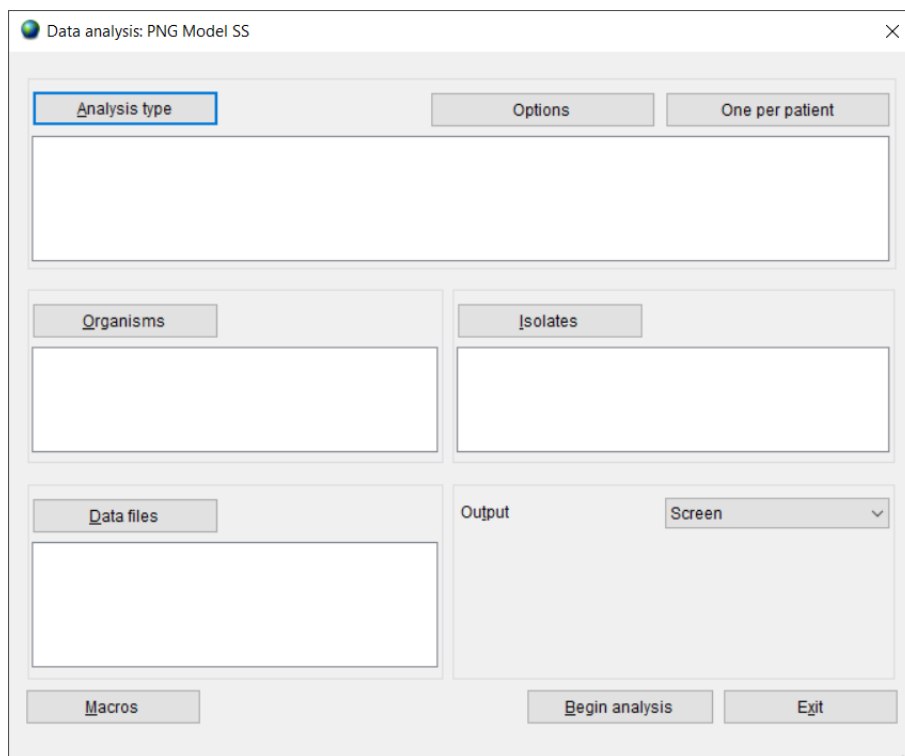
Revision Number: A

Issue date: 28/2/22

Page 25

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'.





Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 26

- 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'.

Analysis selection - Resistance profiles

Use the buttons below to select and configure the analysis.

Isolate listing and summary | %RIS and test measurements | Scatterplot | Resistance profiles | Isolate alerts | Cluster alerts

Report format

1. Listing

2. Summary

Tables

Graphs

3. Both

Antibiotics

Resistance profile

Automatic

Edit Profiles

Summary

Rows

1 Resistance profile

2 (None)

3 (None)

Columns

Specimen date

Month

Summary

Include cluster alerts

Options

OK

- 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 isolate

By patient

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

Number of days since first isolation 30

Consider resistance phenotype

Consider only major differences in interpretation (R, S)

Consider both major and minor differences in interpretation (R, I, S)

Consider all antibiotics

Select antibiotics

Browse

OK Cancel



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 27

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

Organisms

Select the organisms that you would like to include in the analysis.
Make your selections by double-clicking or by typing the codes and pressing <Enter> after each one.

WHONET organism list
Code

Extended list Organism groups

aba	Acinetobacter baumannii
bfr	Bacteroides fragilis
pce	Burkholderia cepacia
cco	Campylobacter coli
caj	Campylobacter jejuni ss. jejuni
cal	Candida albicans
cf	Citrobacter freundii
cdp	Corynebacterium sp. (diphtheroids)
cmv	Cytomegalovirus
eae	Enterobacter aerogenes
eci	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
hin	Haemophilus influenzae
hxb	Haemophilus influenzae (not type b)
hib	Haemophilus influenzae (type b)

Search

Analysis organism list
 Analyze as one organism

Clear list

eco	Escherichia coli
-----	------------------

OK

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
Specimen type (Numeric)
Reason
Isolate number
Organism
Organism type
Serotype
Beta-lactamase

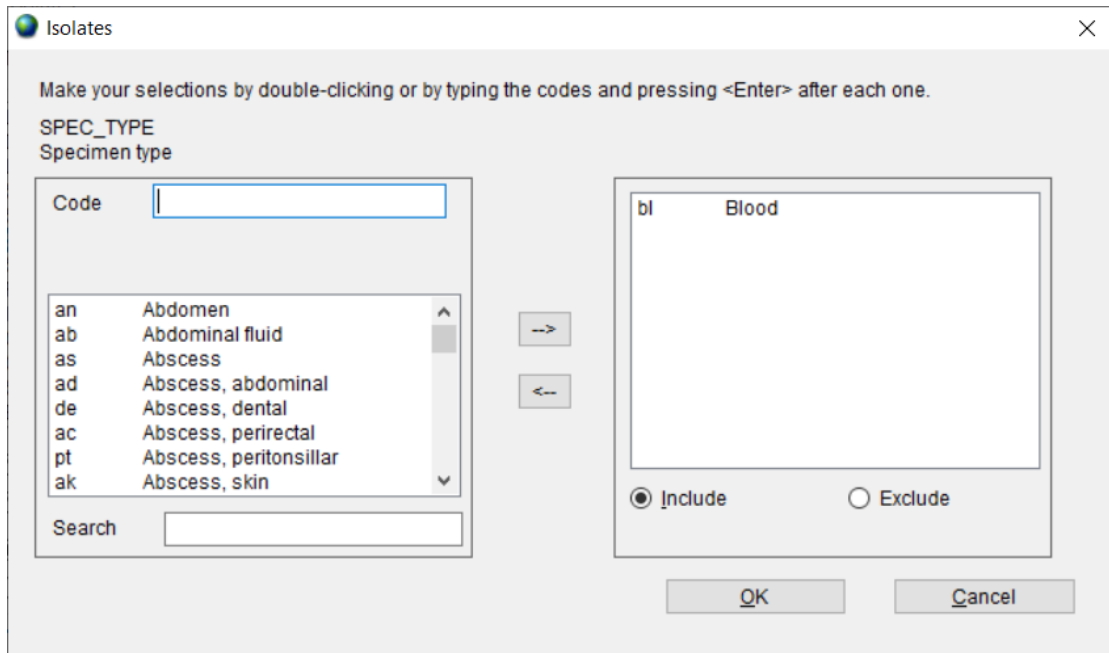
Exclude laboratory isolates: Specimen type = 'qc', 'la', 'ex', 'Department = 'lab'

Exclude screening isolates: Specimen type = 'sc', 'mr', 'vr', 'cd'

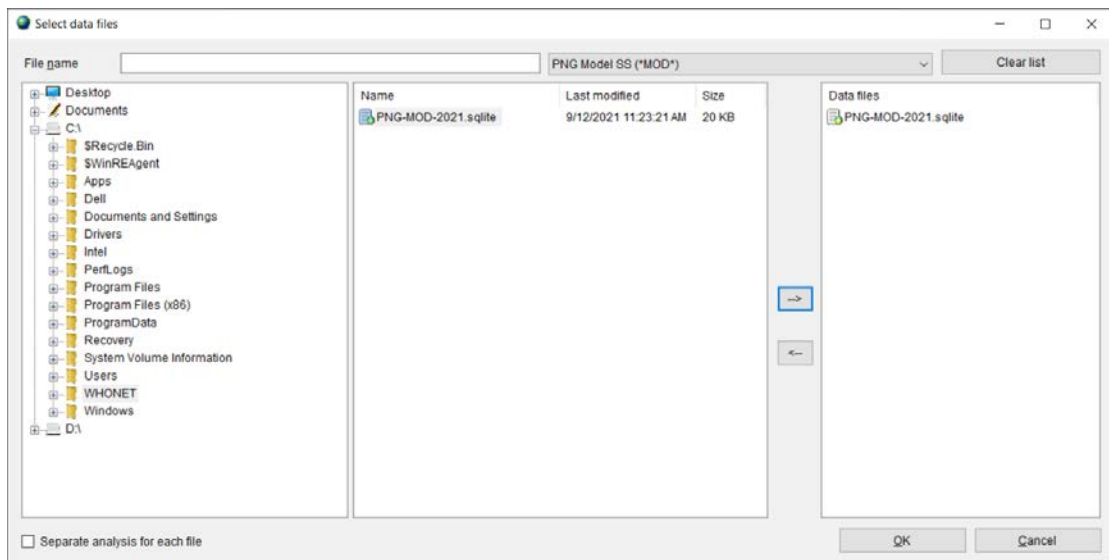
Include isolates that satisfy all of the selection criteria.

Include isolates that satisfy at least one of the selection criteria.

Define criteria Clear this criterion Clear all criteria OK



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





Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 29

g) Click 'Begin analysis'.

Data analysis: Setthathirath Hospital

Analysis type Options One per patient

Study = Resistance profiles listing and summary
Profile antibiotics = Automatic

Organisms Isolates

eco Escherichia coli Specimen type: bl

Data files Output Screen

PNG-MOD-2021.sqlite

Macros Begin analysis Exit

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

Analysis results - Organism = Escherichia coli (n=33 isolates)

File Edit

Copy table Copy graph Save table Save graph Continue Show hidden columns

Specimen type: bl Include

A = AMP S = 14
C = CIP 24 = 25
F = CRD 22 = 24
T = OAG 19 = 21
P = CIP 22 = 24
B = IPM 17 = 21

#C	Specimen number	Specimen date	Specimen type	Isolate number	Organism	Organism type	Profile	Resistance profile	MDR	XDR	POR	Number of classes tested	Number of classes non-susceptible	AMI
1	H103	26/2/2021	bl		eco	-						5	0	
2	H656	9/10/2021	bl		eco	-						5	0	
3	H593	26/9/2021	bl		eco	-						5	0	
4	H223	28/3/2021	bl		eco	-						5	0	
5	H122	17/2/2021	bl		eco	-						5	0	
6	H149	27/2/2021	bl		eco	-	A	AMP			MDR	5	1	
7	H063	23/1/2021	bl		eco	-	A	AMP			MDR	5	1	
8	H353	11/9/2021	bl		eco	-	A	AMP				5	1	
9	H581	13/9/2021	bl		eco	-	A	AMP				5	1	
10	H041	5/8/2021	bl		eco	-	A	AMP				5	1	
11	H123	17/2/2021	bl		eco	-	A	AMP				5	1	
12	H129	19/2/2021	bl		eco	-	A	AMP			MDR	5	1	
13	H172	7/3/2021	bl		eco	-	A	AMP				5	1	
14	H018	9/1/2021	bl		eco	-	A	AMP				5	1	
15	H329	31/5/2021	bl		eco	-	A	AMP				5	1	
16	H208	22/3/2021	bl		eco	-	A	AMP			MDR	5	1	
17	H285	8/5/2021	bl		eco	-	A	AMP				5	1	
18	H599	21/9/2021	bl		eco	-	A	AMP			CIP	5	2	
19	H087	4/2/2021	bl		eco	-	A	AMP			CIP	5	2	
20	H166	5/3/2021	bl		eco	-	A	AMP			CIP	5	2	
21	H339	3/6/2021	bl		eco	-	A	AMP			CIP	5	2	
22	H562	28/8/2021	bl		eco	-	A	AMP			CIP	5	2	
23	H479	17/7/2021	bl		ana	-	A	AMP			CIP	5	2	

English (United States) US keyboard
To switch input methods, press Windows key+Space.



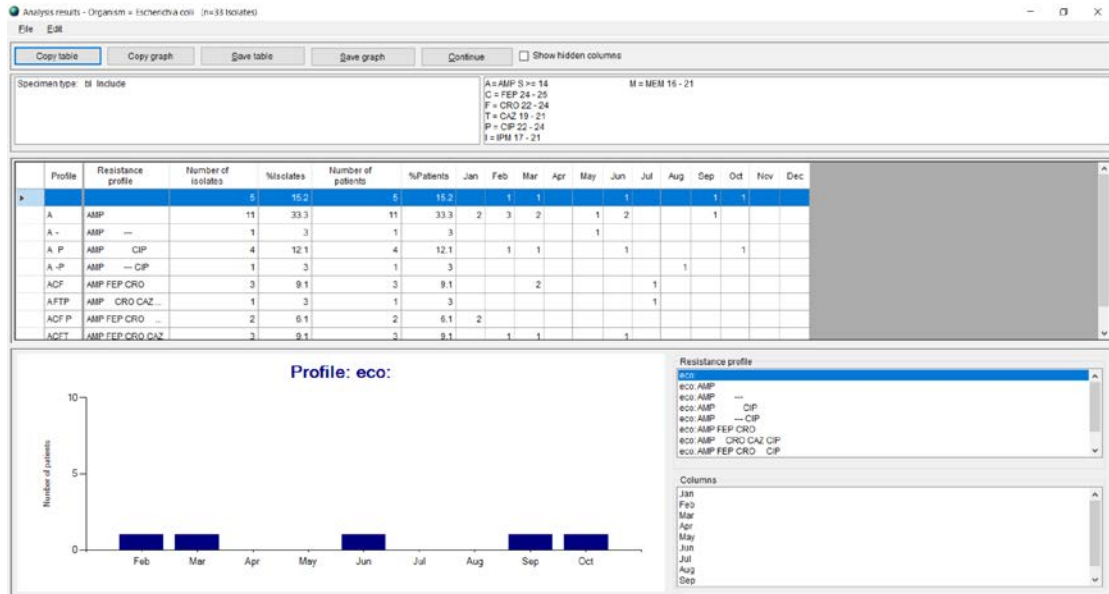
Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 30



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'.





Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 31

- 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'.



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 32

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 isolate

By patient

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

Number of days since first isolation 30

Consider resistance phenotype

Consider only major differences in interpretation (R, S)

Consider both major and minor differences in interpretation (R, I, S)

Consider all antibiotics

Select antibiotics

Browse

OK Cancel

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

Organisms

Select the organisms that you would like to include in the analysis.
Make your selections by double-clicking or by typing the codes and pressing <Enter> after each one.

WHONET organism list

Code ALL

Extended list Organism groups

ALL All organisms

GM+ Gram positive organisms

GM- Gram negative organisms

ANA Anaerobes

MYC Mycobacteria

FUN Fungi

PAR Parasites

OTB Other bacteria

OTH Other organisms

EBC All Enterobacteriaceae

NFR All non-fermenting gram negative rods

AC- Acinetobacter sp.

AEC Aerococcus sp.

AER Aeromonas sp.

BCS Bacillus sp.

BAC Bacteroides sp.

BUK Burkholderia sp.

CAM Campylobacter sp.

CAN Candida sp.

CI- Citrobacter sp.

CDF Clostridium difficile

Search

Analysis organism list

Clear list

Analyze as one organism

EBC All Enterobacteriaceae

OK



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 33

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**
- 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 OK

Isolates

Make your selections by double-clicking or by typing the codes and pressing <Enter> after each one.

SPEC_TYPE
Specimen type

Code

an	Abdomen
ab	Abdominal fluid
as	Abscess
ad	Abscess, abdominal
de	Abscess, dental
ac	Abscess, perirectal
pt	Abscess, peritonsillar
ak	Abscess, skin

Search

bl Blood

Include Exclude

OK Cancel



Title: Data analysis using WHONET

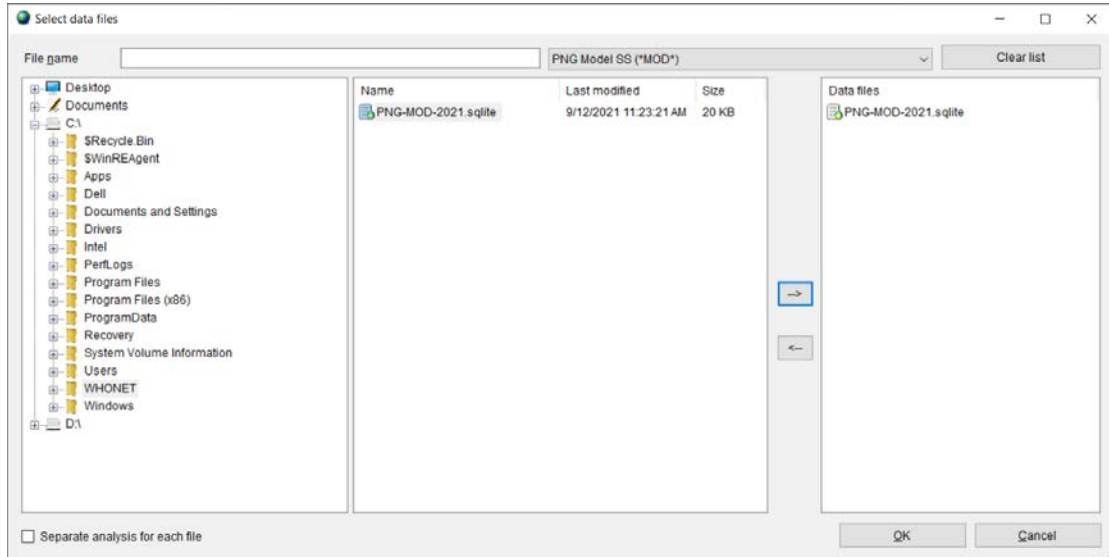
ID: G_90_SOP_27_A

Revision Number: A

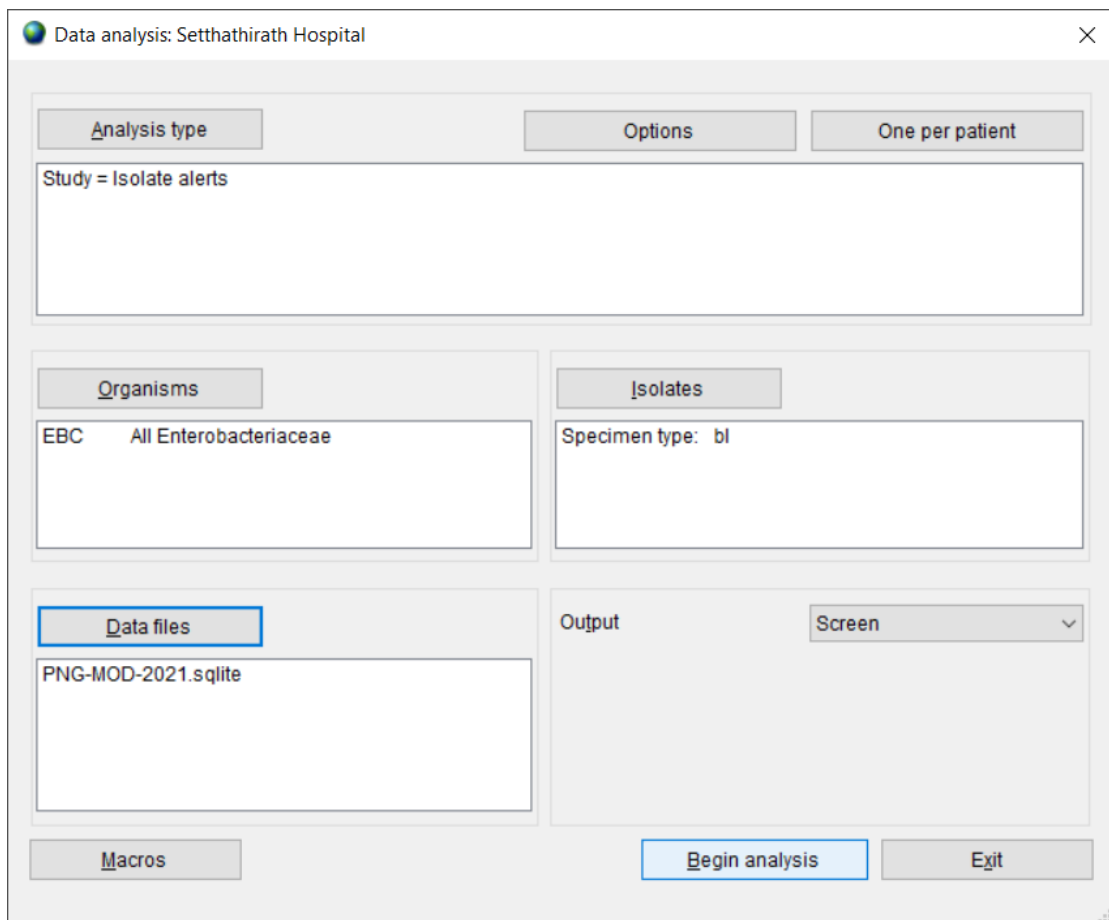
Issue date: 28/2/22

Page 34

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



g) Click 'Begin analysis'.





Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 35

The output screen for isolate alerts summary looks like this:

Analyst results - Organism = All Enterobacteriaceae (n=16 isolates)

File Edit

Copy table Copy graph Save table Save graph Continue Show hidden columns

Specimen type: All Include

Stical rmb	Specimen number	Specimen date	Specimen type	Isolate number	Organism	Organism type	AMP	FEP	FOX	CRO	CAZ	DIP	GEN	IPM	MEM	SXT	AMC	CHL
u...	H051	17/1/2021	bl		eco	-	R	I	S	R	S	R	S	S	S	R	S	S
u...	H599	2/10/2021	bl		eco	-	R	S	S	R	S	R	S	S	S	R	S	S
u...	H456	22/1/2021	bl		eco	-	R	S	R	R	R	R	R	S	S	R	R	H
u...	H088	4/2/2021	bl		eco	-	R	R	S	R	R	S	S	S	S	R	S	S
u...	H429	12/7/2021	bl		eco	-	R	I	S	R	S	S	S	S	S	S	S	S
u...	H072	28/1/2021	bl		eco	-	R	R	S	R	S	R	R	S	S	R	R	S
u...	H274	29/4/2021	bl		eco	-	R	R	S	R	I	R	S	S	S	R	S	S
u...	H214	23/3/2021	bl		eco	-	R	R	S	R	S	S	S	S	S	R	S	S
u...	H194	19/3/2021	bl		eco	-	R	R	S	R	S	S	S	S	S	S	S	S
u...	H376	2/10/2021	bl		eco	-	R	R	R	R	R	R	R	S	S	S	R	R
u...	H552	29/8/2021	bl		eco	-	R	S	S	S	S	R	S	S	S	R	S	S
u...	H212	23/3/2021	bl		eco	-	R	R	S	R	R	S	R	S	S	S	S	S
u...	H342	6/6/2021	bl		eco	-	R	R	S	R	I	S	S	S	S	R	S	S
u...	H366	17/8/2021	bl		tpn	-	R	R	R	R	R	S	S	S	S	R	R	H
u...	H528	10/8/2021	bl		tpn	-	R	R	S	R	R	S	S	S	S	R	R	S
u...	H073	29/1/2021	bl		tpn	-	R	I	S	R	R	R	R	S	S	R	R	H

Analyst results - Organism = All Enterobacteriaceae (n=16 isolates)

File Edit

Copy table Copy graph Save table Save graph Continue Show hidden columns

Specimen type: All Include

Stical rmb	NAL	Alert	Priority	Organisms	Isolate alerts	Quality control	Important species	Important resistance	Save
u...	R	■	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac...	■	■	■	■
u...	R	■	Medium priority	All organisms	Quinolones and Fluoroquinolones = Discordant results	■	■	■	■
u...	R	■	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac...	■	■	■	■
u...	S	■	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac...	■	■	■	■
u...	R	■	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac...	■	■	■	■
u...	R	■	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac...	■	■	■	■
u...	R	■	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac...	■	■	■	■
u...	S	■	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac...	■	■	■	■
u...	S	■	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac...	■	■	■	■
u...	R	■	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac...	■	■	■	■
u...	R	■	Medium priority	All organisms	Quinolones and Fluoroquinolones = Discordant results	■	■	■	■
u...	R	■	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac...	■	■	■	■
u...	R	■	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac...	■	■	■	■
u...	S	■	Medium priority	Enterobacteriaceae, Enterobacteriaceae	Possible ESBL-producing Enterobacteriaceae	■	■	■	■
u...	R	■	Medium priority	All organisms, Enterobacteriaceae, Enterobacteriaceae	Quinolones and Fluoroquinolones = Discordant results, ESBL-producing...	■	■	■	■
u...	R	■	Medium priority	Enterobacteriaceae, Enterobacteriaceae	ESBL-producing Enterobacteriaceae, Possible ESBL-producing Enterobac...	■	■	■	■



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 36

Rule number	Organisms	Alert	Number of isolates	Priority	003	Quality control	Important species	Important resistance	Save the isolate	Send to a reference laboratory
6	All organisms	Carbapenems and Fluoroquinolones - Discordant results	2	Medium priority	3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
23	Enterobacteriaceae	ESBL-producing Enterobacteriaceae	13	Medium priority	13	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	Enterobacteriaceae	Possible ESBL-producing Enterobacteriaceae	14	Medium priority	14	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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'.





Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 37

Data analysis: PNG Model SS

Analysis type Options One per patient

Organisms Isolates

Data files Output Screen

Macros Begin analysis Exit

- 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 alerts

Use the buttons below to select and configure the analysis.

Isolate listing and summary %RIS and test measurements Scatterplot Resistance profiles Isolate alerts Cluster alerts

Report format

- Daily signals
 - Tables
 - Graphs
- Signal summary
 - Tables
 - Graphs
- Isolate listing

Cluster alerts

Options

Space-Time Permutation

Summary

Rows	1	Organism
	2	(None)
	3	(None)
Columns	Specimen date	Month

SaTScan™

OK



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 38

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 isolate

By patient

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

Number of days since first isolation 30

Consider resistance phenotype

Consider only major differences in interpretation (R, S)

Consider both major and minor differences in interpretation (R, I, S)

Consider all antibiotics

Select antibiotics

Browse

OK Cancel

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

Organisms

Select the organisms that you would like to include in the analysis.
Make your selections by double-clicking or by typing the codes and pressing <Enter> after each one.

WHONET organism list

Code

Extended list Organism groups

aba	Acinetobacter baumannii
bfr	Bacteroides fragilis
pce	Burkholderia cepacia
cco	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
hin	Haemophilus influenzae
hxb	Haemophilus influenzae (not type b)
hib	Haemophilus influenzae (type b)

Search

Analysis organism list

Analyze as one organism

ALL All organisms

Clear list

-->

<--

OK



Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 39

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**
- 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 OK

Isolates

Make your selections by double-clicking or by typing the codes and pressing <Enter> after each one.

SPEC_TYPE
Specimen type

Code

- an Abdomen
- ab Abdominal fluid
- as Abscess
- ad Abscess, abdominal
- de Abscess, dental
- ac Abscess, perirectal
- pt Abscess, peritonsillar
- ak Abscess, skin

Search

bl Blood

Include Exclude

OK Cancel



Title: Data analysis using WHONET

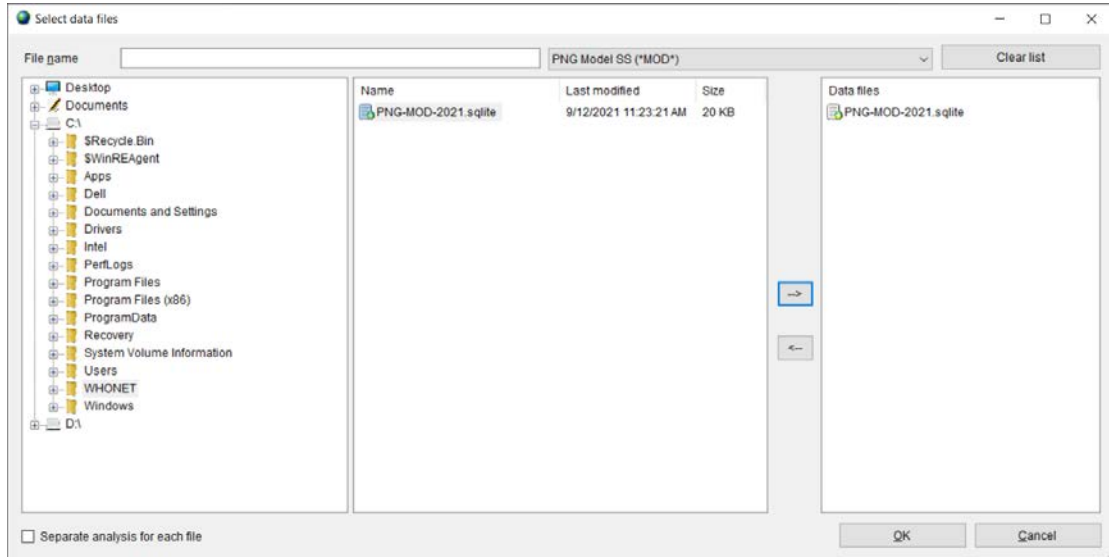
ID: G_90_SOP_27_A

Revision Number: A

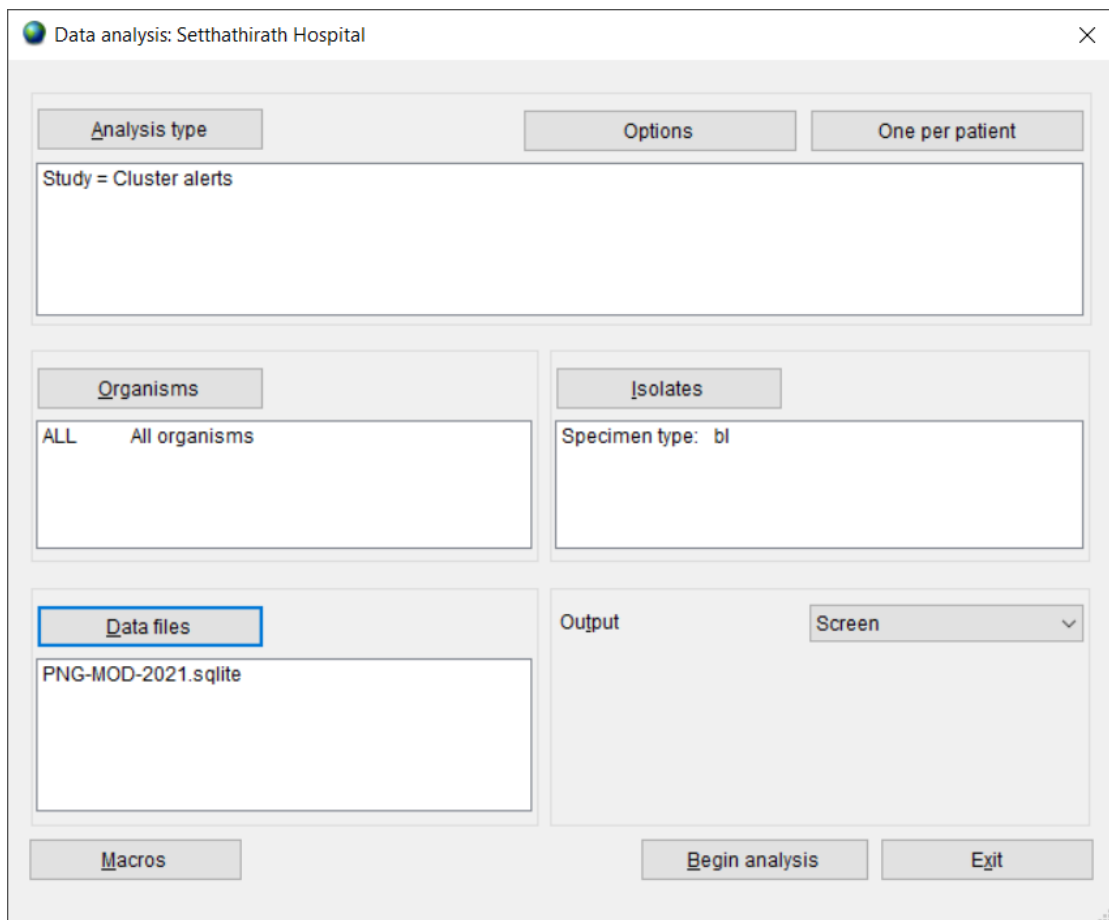
Issue date: 28/2/22

Page 40

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

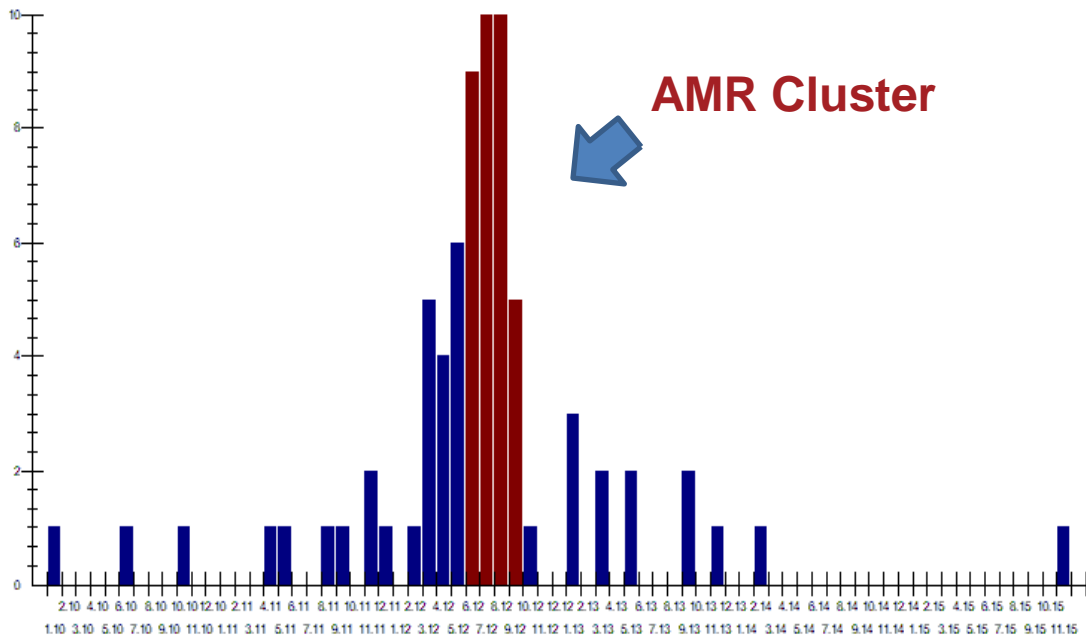


g) Click 'Begin analysis'.





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:

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





Title: Data analysis using WHONET

ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 42

Data analysis: PNG Model SS

Analysis type Options One per patient

Organisms Isolates

Data files Output Screen

Macros Begin analysis Exit

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

Data analysis: Setthathirath Hospital

Analysis type Options One per patient

Study = RIS and test measurements
All antibiotics

Organisms Isolates


eco Escherichia coli
sau Staphylococcus aureus ss. aureus

Specimen type: bl, ur

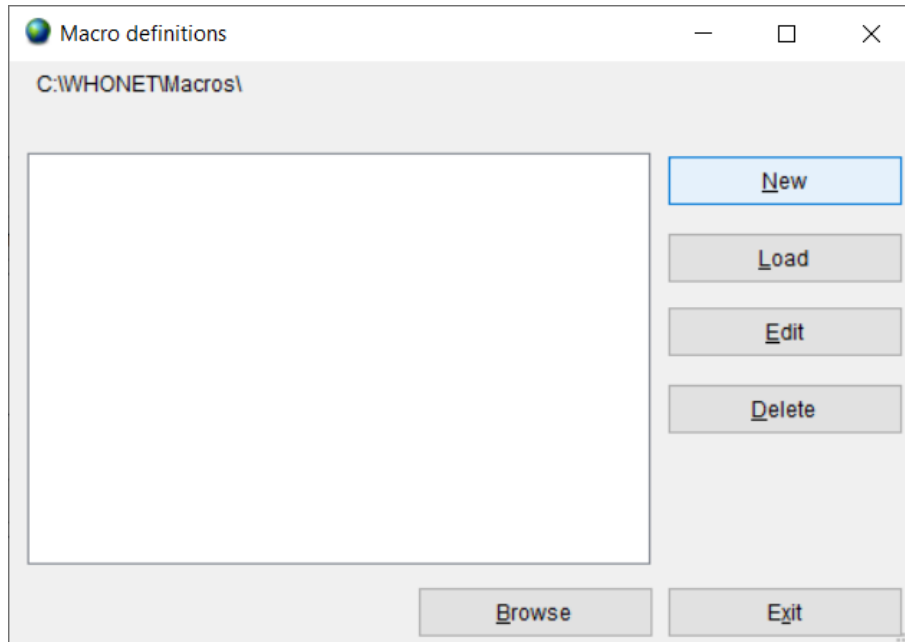
Data files Output Screen

PNG-MOD-2021.sqlite

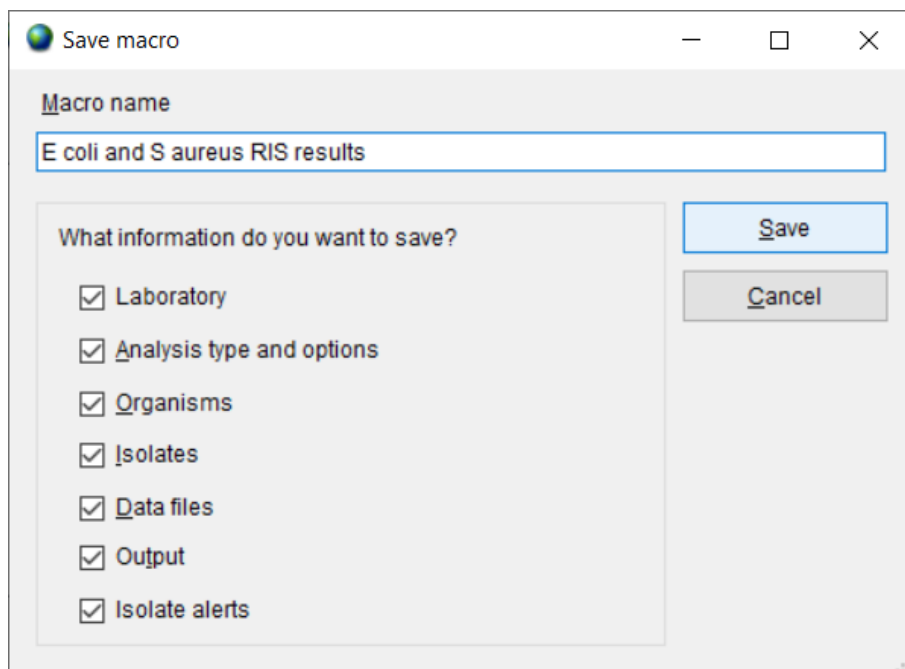
Macros Begin analysis Exit

	Title: Data analysis using WHONET	
	ID: G_90_SOP_27_A	Revision Number: A
	Issue date: 28/2/22	Page 43

c) Select Macros and click 'New'.



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





Title: Data analysis using WHONET

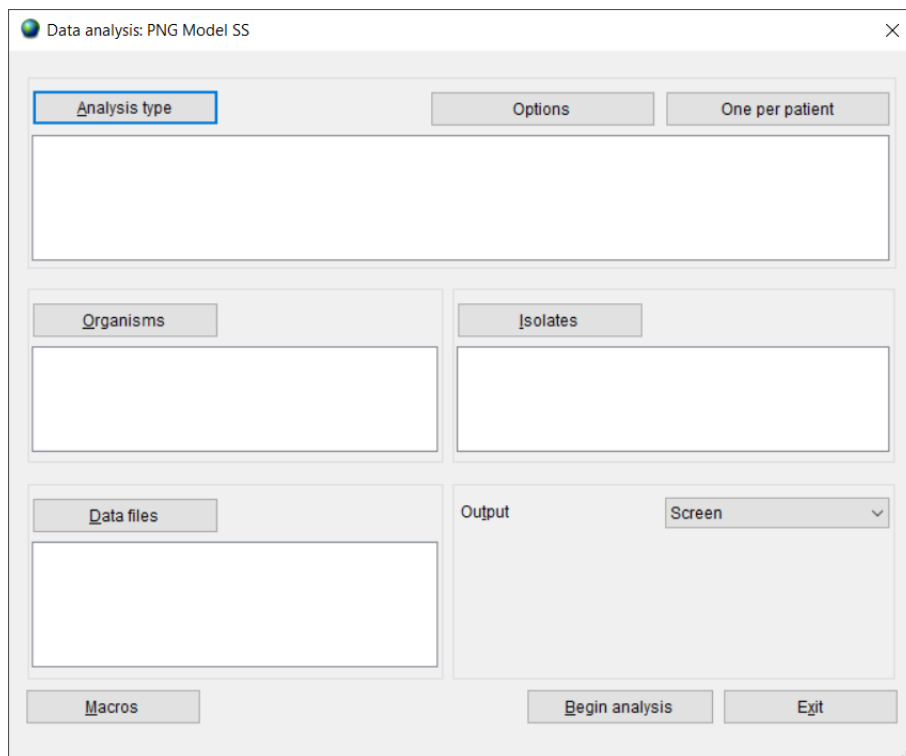
ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 44

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





Title: Data analysis using WHONET

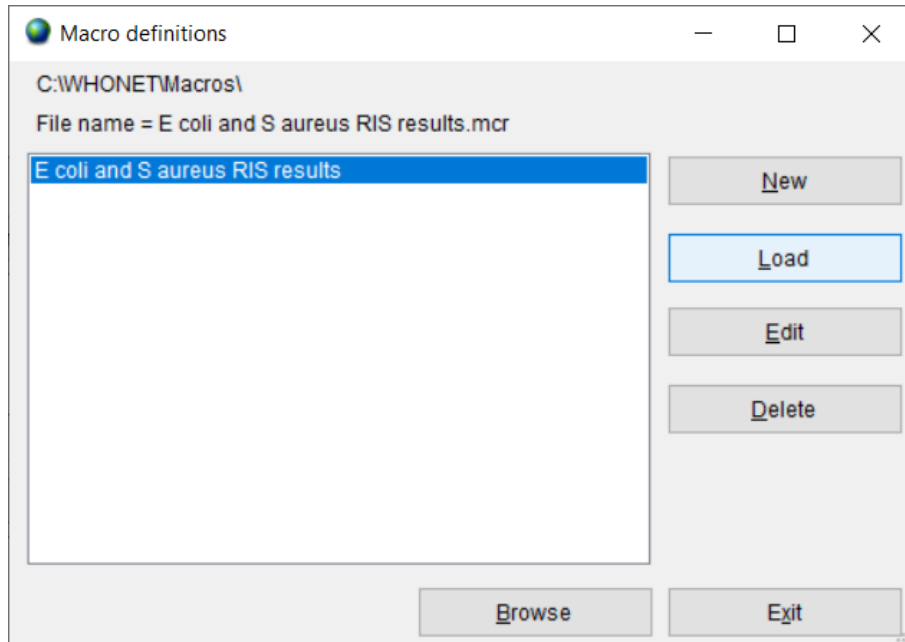
ID: G_90_SOP_27_A

Revision Number: A

Issue date: 28/2/22

Page 45

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



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, <https://whonet.org/documentation.html>

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