WHONET

Software for surveillance of microbial populations and antimicrobial resistance

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The Vision of WHONET

Clinical microbiology laboratories generate routine data daily that could be utilized to provide a detailed view of evolving microbial populations in real-time.

Yet this resource remains largely untapped and underutilized.

The use of a common software supports local, national, regional, and global collaboration and analyses to support:

- recognition, tracking, and containment of emerging threats
- cost-effective care and treatment guidelines
- public health policy, interventions, advocacy, and research
- laboratory capacity-building

WHONET Objectives

- Improve the use of local data for local purposes
- Promote national and international collaborations

WHONET Users

- Human, animal, food, environmental sectors
- Microbiologists, pharmacists, infection control practitioners, infectious disease specialists, clinicians, IT staff, epidemiologists

Types of data collection

- Surveillance for advocacy
- Surveillance of policy and treatment guidelines
- Surveillance for resistance containment
- Surveys for public health research
- Data collection for improving diagnostic laboratory capacity

WHONET Registrations around the world - 2013

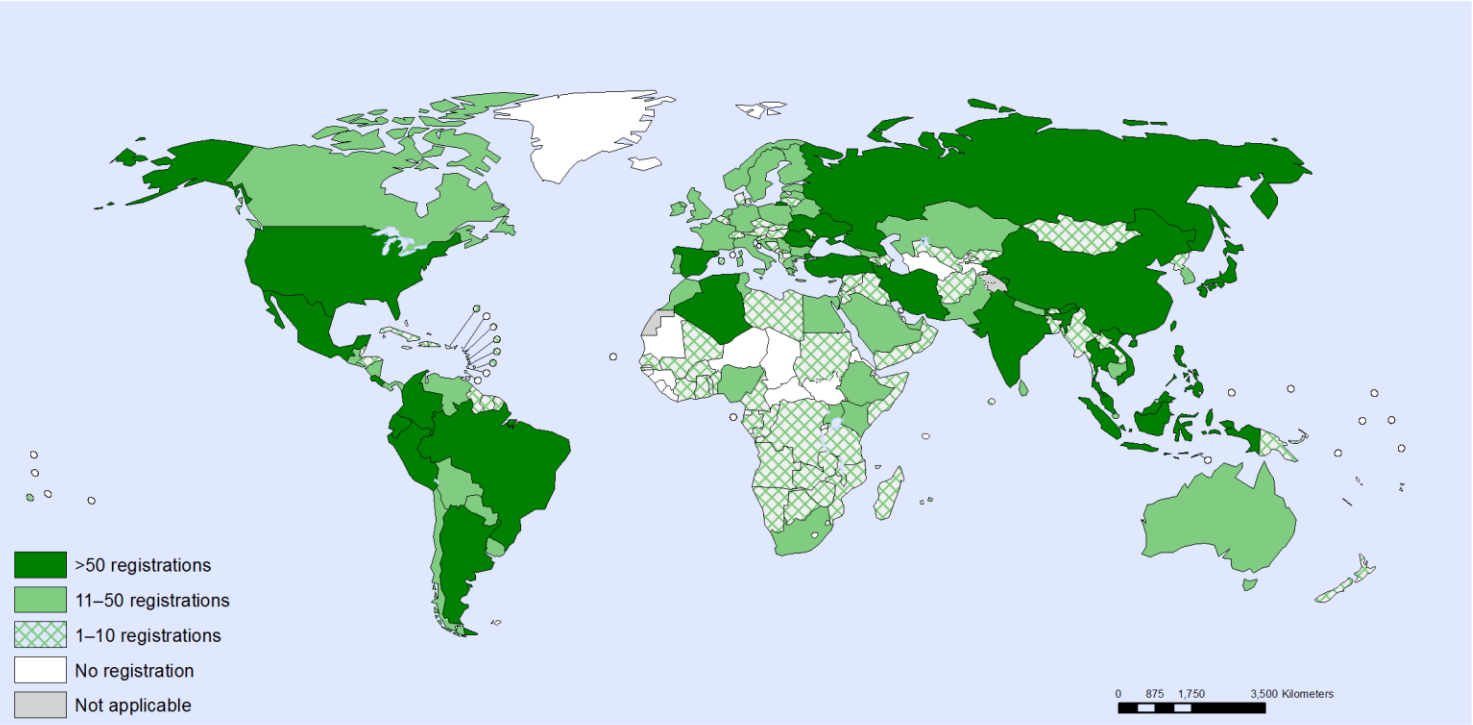
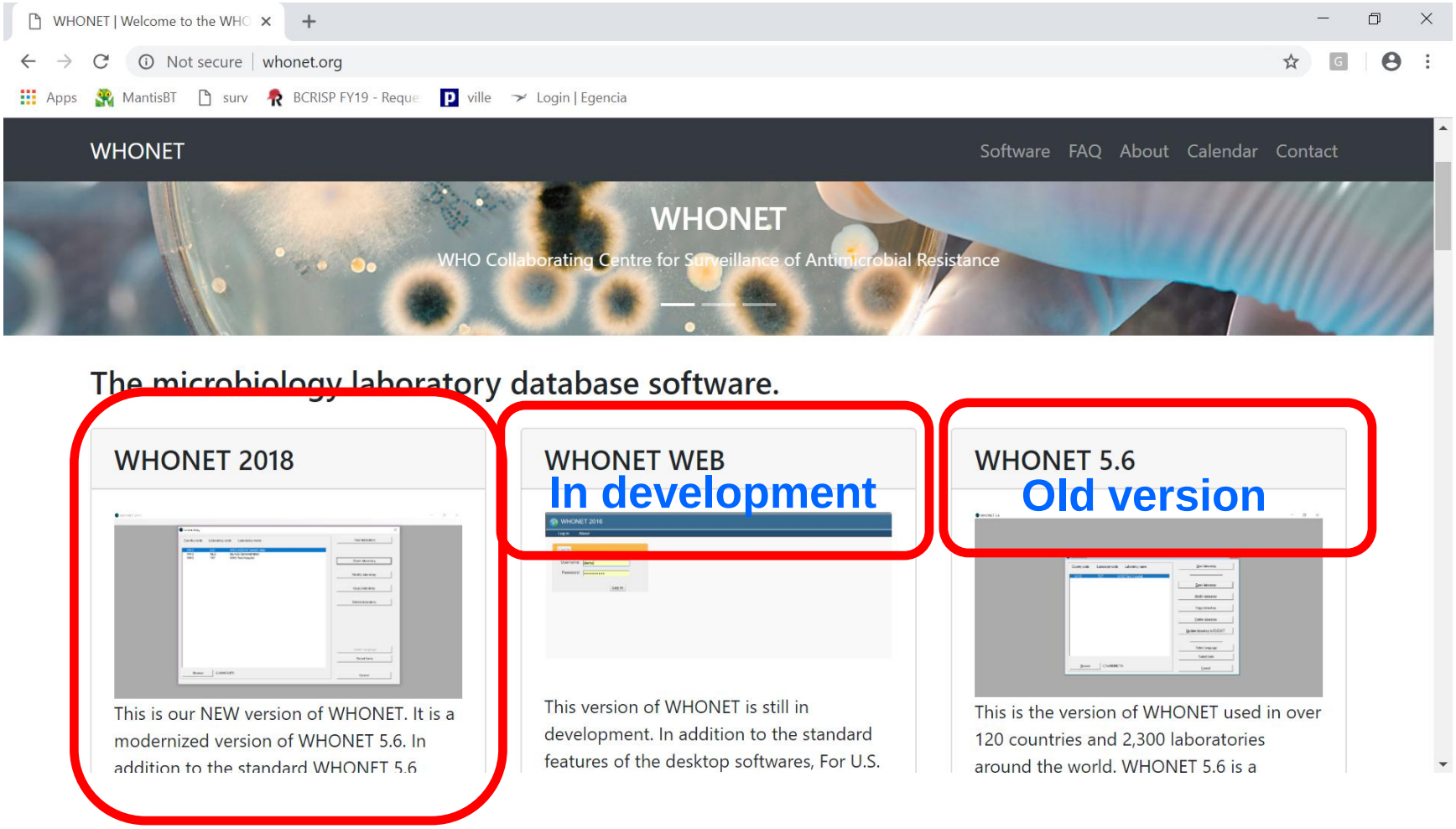


Table 1
Estimate of WHONET software use by WHO region. **2010 Estimates**

WHO region	Number of countries	Number of laboratories[a]
AFRO = WHO Regional Office for Africa	13	69
EMRO = WHO Regional Office for the Eastern Mediterranean	15	64
EURO = WHO Regional Office for Europe	39	505
AMRO/PAHO = WHO Regional Office for the Americas/Pan American Health Organization	25	466
SEARO = WHO Regional Office for South-East Asia	6	105
WPRO = WHO Regional Office for the Western Pacific	13	568
Total	111	1777

[a] In some countries, figures reflect the estimated number of laboratories which use the WHONET software, while in others figures reflect the estimated number of laboratories managed with WHONET at the national level.

WHONET Installation – www.whonet.org



WHONET Data entry

Patient/Animal/Food

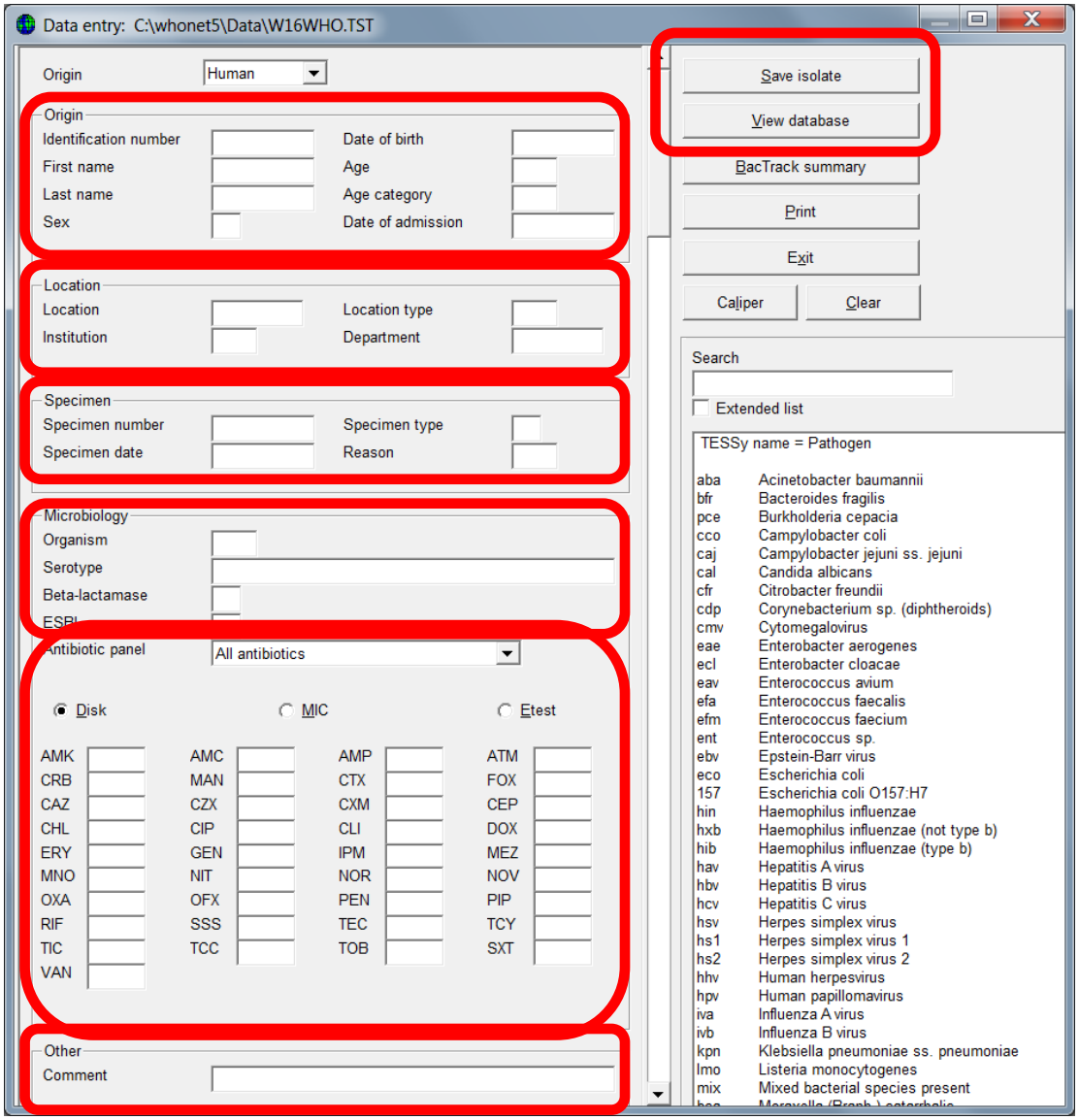
Location

Specimen

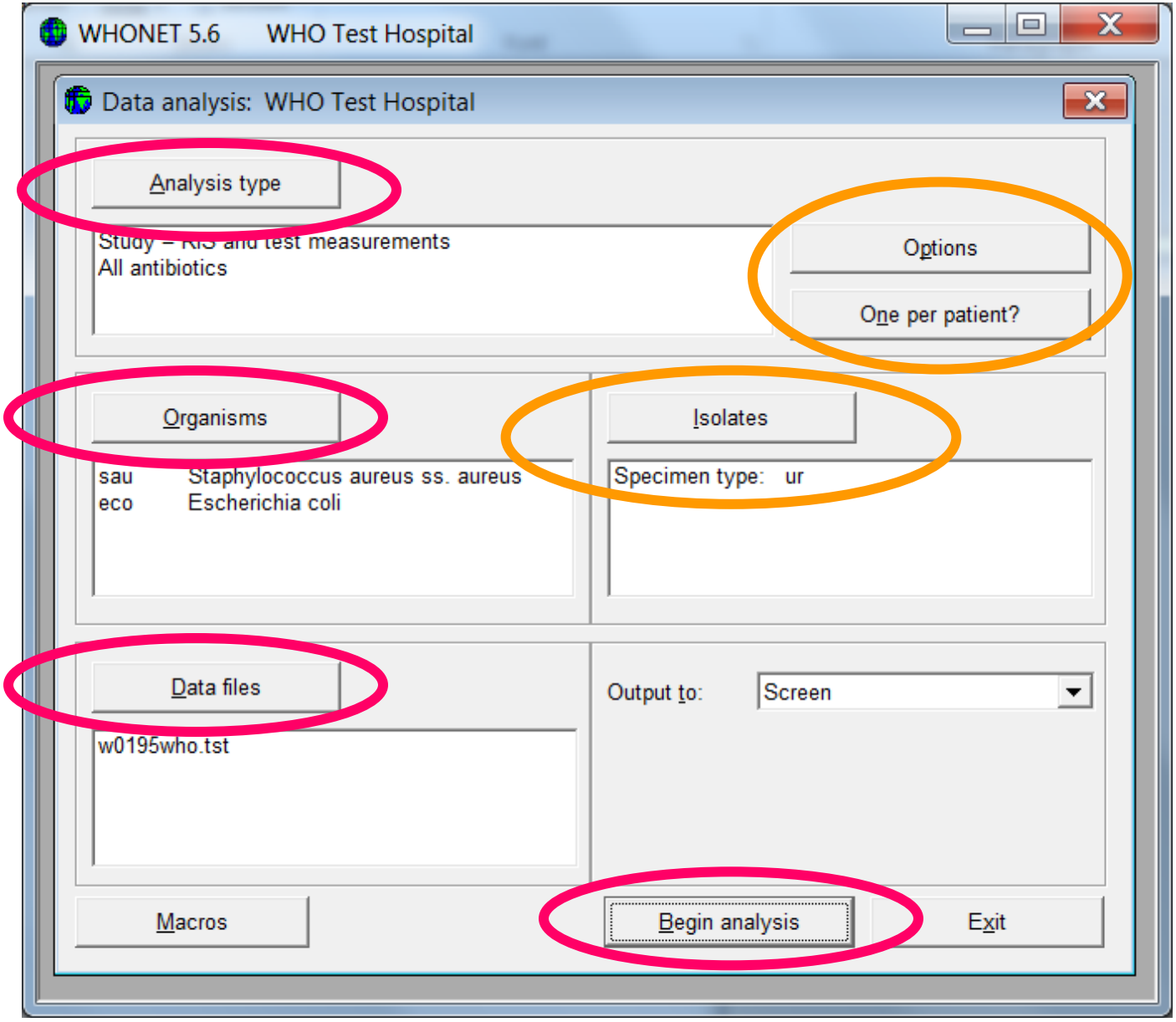
Organism

Antibiotics
Disk, MIC, Etest

Other

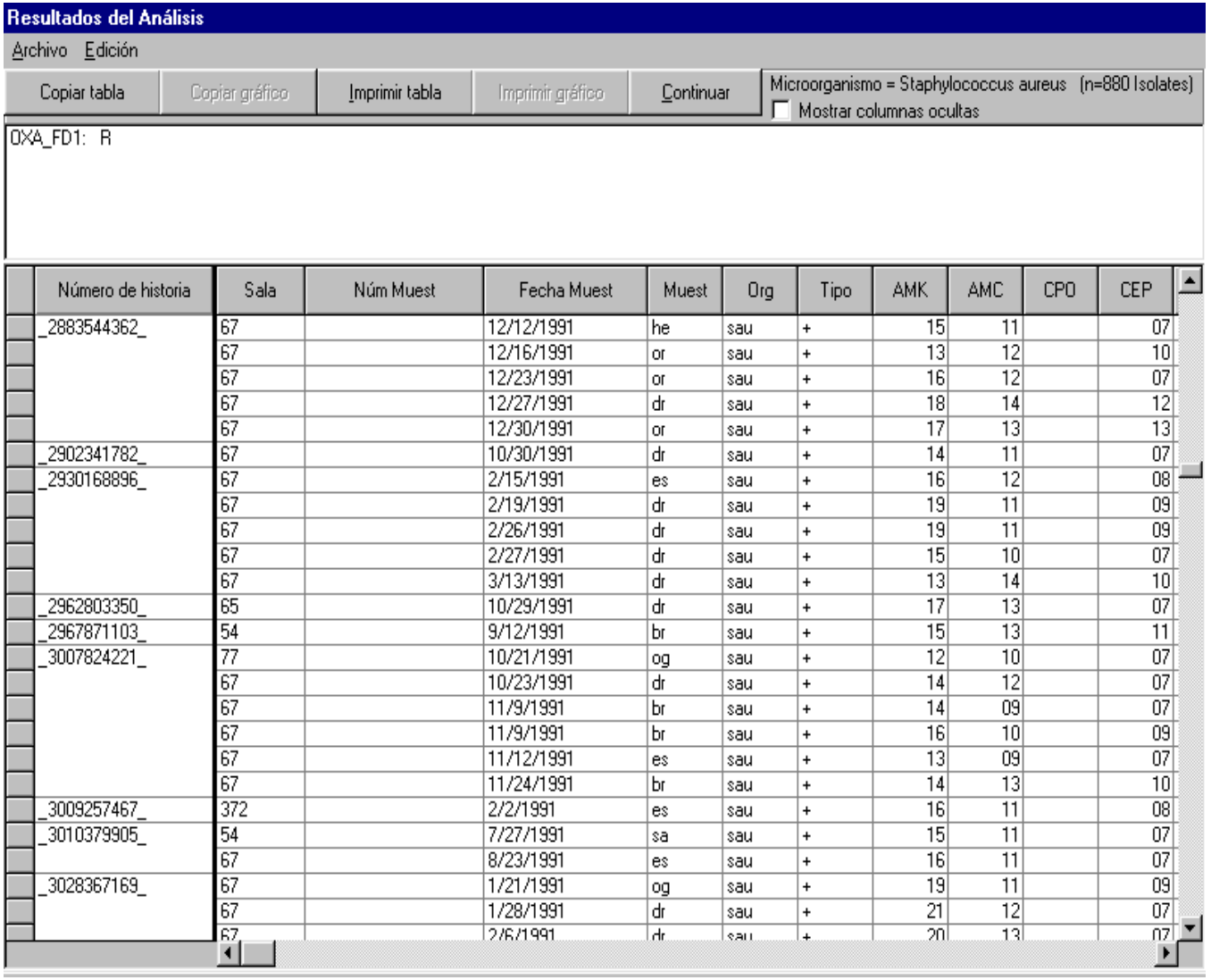


Data analysis



Isolate listing

List of patients with MRSA



Resultados del Análisis

Archivo Edición

Copiar tabla | Copiar gráfico | Imprimir tabla | Imprimir gráfico | Continuar

Microorganismo = Staphylococcus aureus (n=880 Isolates)

Mostrar columnas ocultas

OXA_FD1: R

Número de historia	Sala	Núm Muest	Fecha Muest	Muest	Org	Tipo	AMK	AMC	CPO	CEP
_2883544362_	67		12/12/1991	he	sau	+	15	11		07
	67		12/16/1991	or	sau	+	13	12		10
	67		12/23/1991	or	sau	+	16	12		07
	67		12/27/1991	dr	sau	+	18	14		12
	67		12/30/1991	or	sau	+	17	13		13
_2902341782_	67		10/30/1991	dr	sau	+	14	11		07
_2930168896_	67		2/15/1991	es	sau	+	16	12		08
	67		2/19/1991	dr	sau	+	19	11		09
	67		2/26/1991	dr	sau	+	19	11		09
	67		2/27/1991	dr	sau	+	15	10		07
	67		3/13/1991	dr	sau	+	13	14		10
_2962803350_	65		10/29/1991	dr	sau	+	17	13		07
_2967871103_	54		9/12/1991	br	sau	+	15	13		11
_3007824221_	77		10/21/1991	og	sau	+	12	10		07
	67		10/23/1991	dr	sau	+	14	12		07
	67		11/9/1991	br	sau	+	14	09		07
	67		11/9/1991	br	sau	+	16	10		09
	67		11/12/1991	es	sau	+	13	09		07
	67		11/24/1991	br	sau	+	14	13		10
_3009257467_	372		2/2/1991	es	sau	+	16	11		08
_3010379905_	54		7/27/1991	sa	sau	+	15	11		07
	67		8/23/1991	es	sau	+	16	11		07
_3028367169_	67		1/21/1991	og	sau	+	19	11		09
	67		1/28/1991	dr	sau	+	21	12		07
	67		2/6/1991	dr	sau	+	20	13		07

Summary of the isolate listing

Number of patients with MRSA by location and month

Resultados del Análisis

Archivo Edición

Copiar tabla | Copiar gráfico | Imprimir tabla | Imprimir gráfico | Continuar

Microorganismo = Staphylococcus aureus (n=880 Isolates)

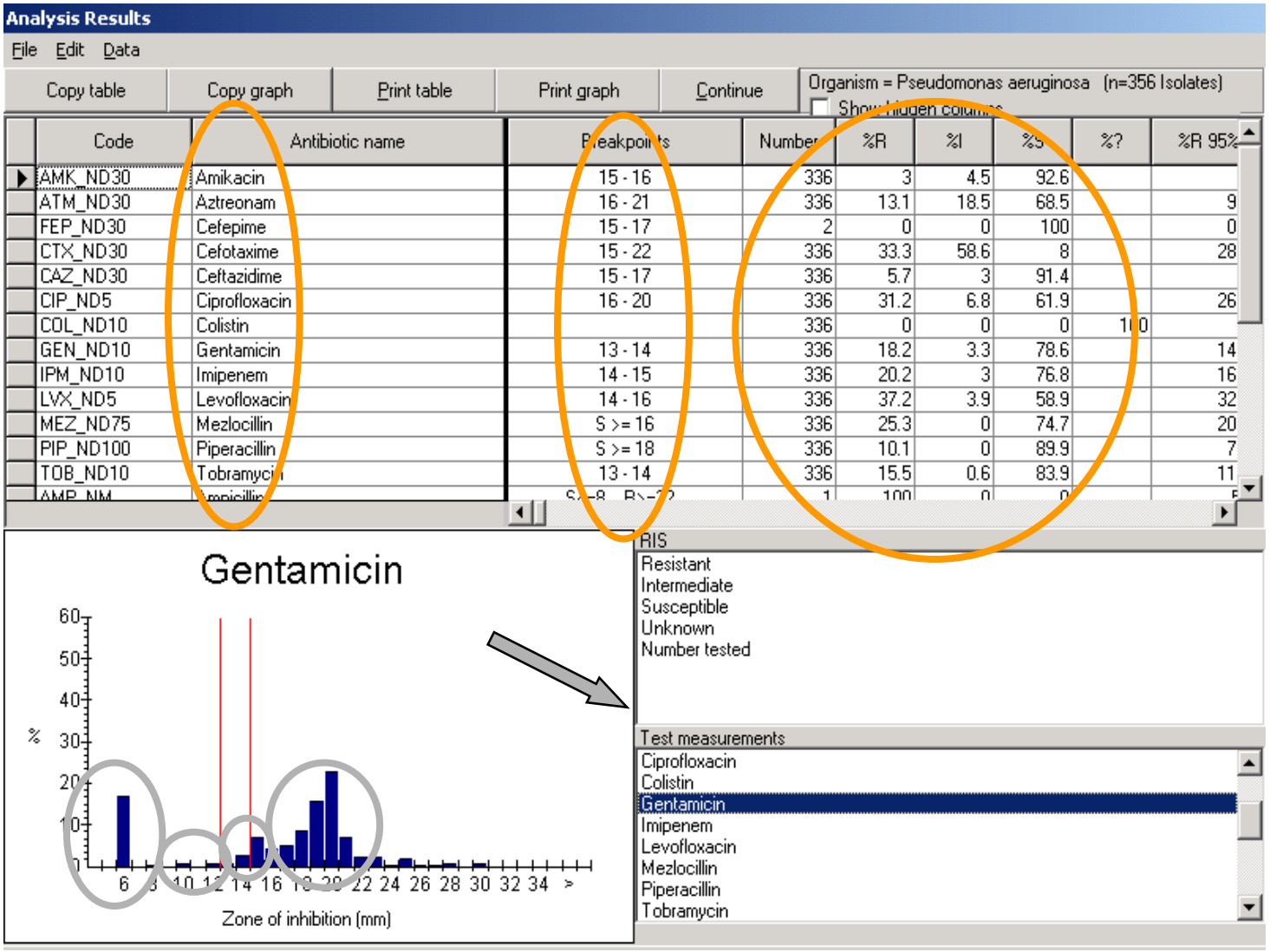
Mostrar columnas ocultas

OXA_FD1: R

Código	Sala	Ene	Feb	Mar	Abr	Mayo	Jun	Jul	Ago	Sep	Oct
38	38			1	1	1	1	2			
39	39									1	
40	40						1			1	
41	41	1	1			1		3	2	1	
42	42		1	3			2	1		1	1
501	501	4	4	2	1				2	1	1
502	502	2	1	2	1		2				2
51	51									1	
52	52										1
54	54	2	2	5	5	5	5	3	8	7	5
55	55		2		3	2	1	1	2		
58	58	4	3	3	1	1		1			1
59	59		2								1
65	65	6	1	5	3	3	1	2	1	3	4
66	66	5	3	1	3	3	2	2	4	4	4
67	67	7	13	8	8	10	5	10	15	10	17
70	70	1			1			1	1		
76	76			1						1	
77	77		1	1	1	1		2	1	1	2
79	79	1	3	3	1		1		1	3	2
80	80				1						
81	81		2	1							
c29	c29	1								2	
c65	c65										1

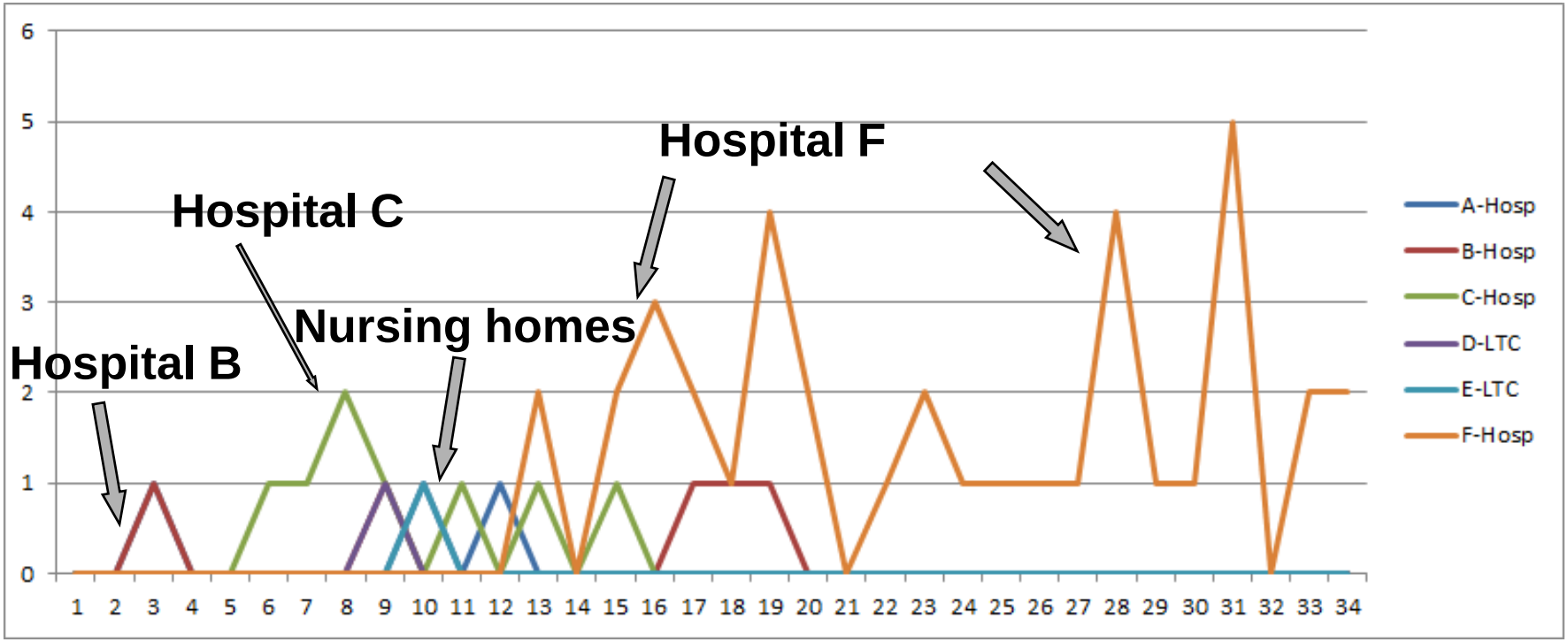
%RIS and histograms

Pseudomonas aeruginosa



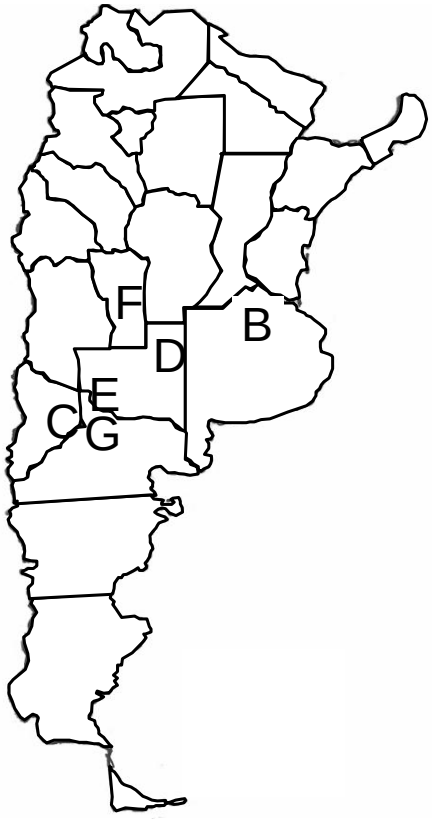
Multi-resistance profiles

Multiple facilities in a U.S. state - isolates resistant to cefotaxime and ciprofloxacin, but susceptible to ceftazidime.

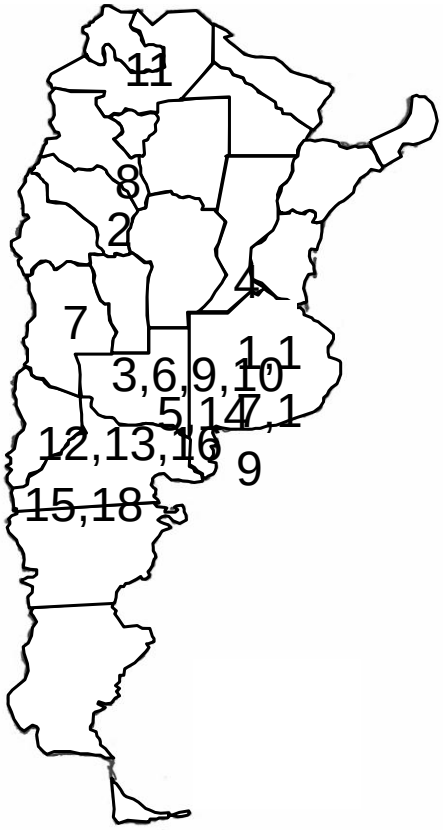


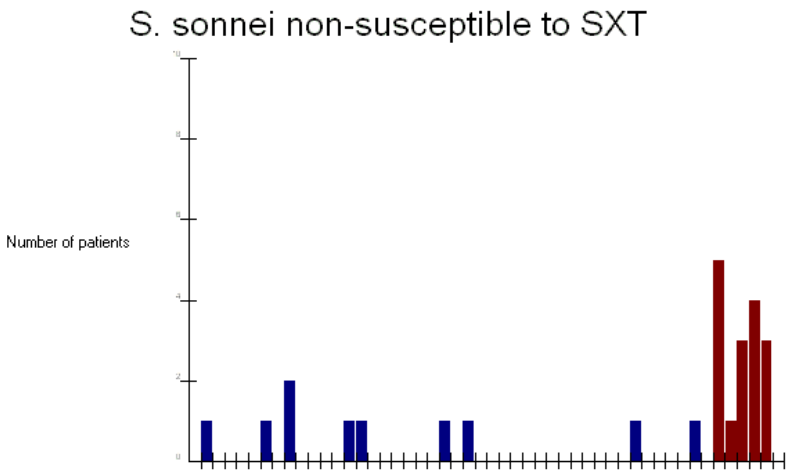
Shigellosis in Argentina
Cluster detection by automated algorithms

Reported to MOH



Suggested by SaTScan





Conclusions

- WHONET is for the surveillance of evolving microbial populations
  - One focus is on annual surveillance of priority resistance trends
  - But there are many other applications needed in real-time to support the recognition and containment of emerging threats at local, national, regional, and global levels

Interpretation of AST results in food, animal, and environmental sectors

Comparison of CLSI and EUCAST

EUCAST *vs.* CLSI - Timeline

EUCAST

- 1960s-1990s – Establishment of national AST committees (UK, FR, NL, SE, NO, DE, EE, CH)
- 1997 – Establishment of EUCAST and beginning of process to harmonize
- ~2002 – EUCAST MIC breakpoints
- ~2006 – EUCAST Disk breakpoints
- 2019 – Veterinary breakpoints in development

CLSI

- 1968 – Established as the National Committee for Clinical Laboratory Standards
- 1975 – Accredited by ANSI
- ~2003 – Veterinary breakpoints
- 2005 – renamed to Clinical and Laboratory Standards Institute
- 2010 – formal accord with FDA

EUCAST *vs.* CLSI - Scope

EUCAST

- Antimicrobial susceptibility testing
  - Human (now)
  - Veterinary (in development)

CLSI

- Automation and informatics
- Clinical chemistry and toxicology
- General laboratory
- Hematology
- Immunology and ligand assay
- Method evaluation
- Microbiology (including AST)
  - Human, veterinary
- Molecular methods
- Newborn screening
- Point-of-care testing
- Quality management systems
- Miscellaneous

EUCAST and VetCAST – www.eucast.org

EUCAST EUROPEAN COMMITTEE ON ANTIMICROBIAL SUSCEPTIBILITY TESTING

European Society of Clinical Microbiology and Infectious Diseases

Veterinary Susceptibility Testing

- Organization
- EUCAST News
- New definitions of S, I and R
- Clinical breakpoints and dosing
- Rapid AST in blood cultures
- Expert rules and intrinsic resistance
- Resistance mechanisms
- Guidance documents
- Consultations - New!
- MIC and zone distributions and ECOFFs
- AST of bacteria
- AST of mycobacteria
- AST of fungi
- **AST of veterinary pathogens**

Veterinary Committee on Antimicrobial Susceptibility Testing (VetCAST)

VetCAST is a EUCAST subcommittee dealing with all aspects of antimicrobial susceptibility testing of bacterial pathogens of animal origin and animal bacteria with zoonotic potential. The subcommittee will operate within the format and structure of EUCAST (The European Committee on Antimicrobial Susceptibility Testing).

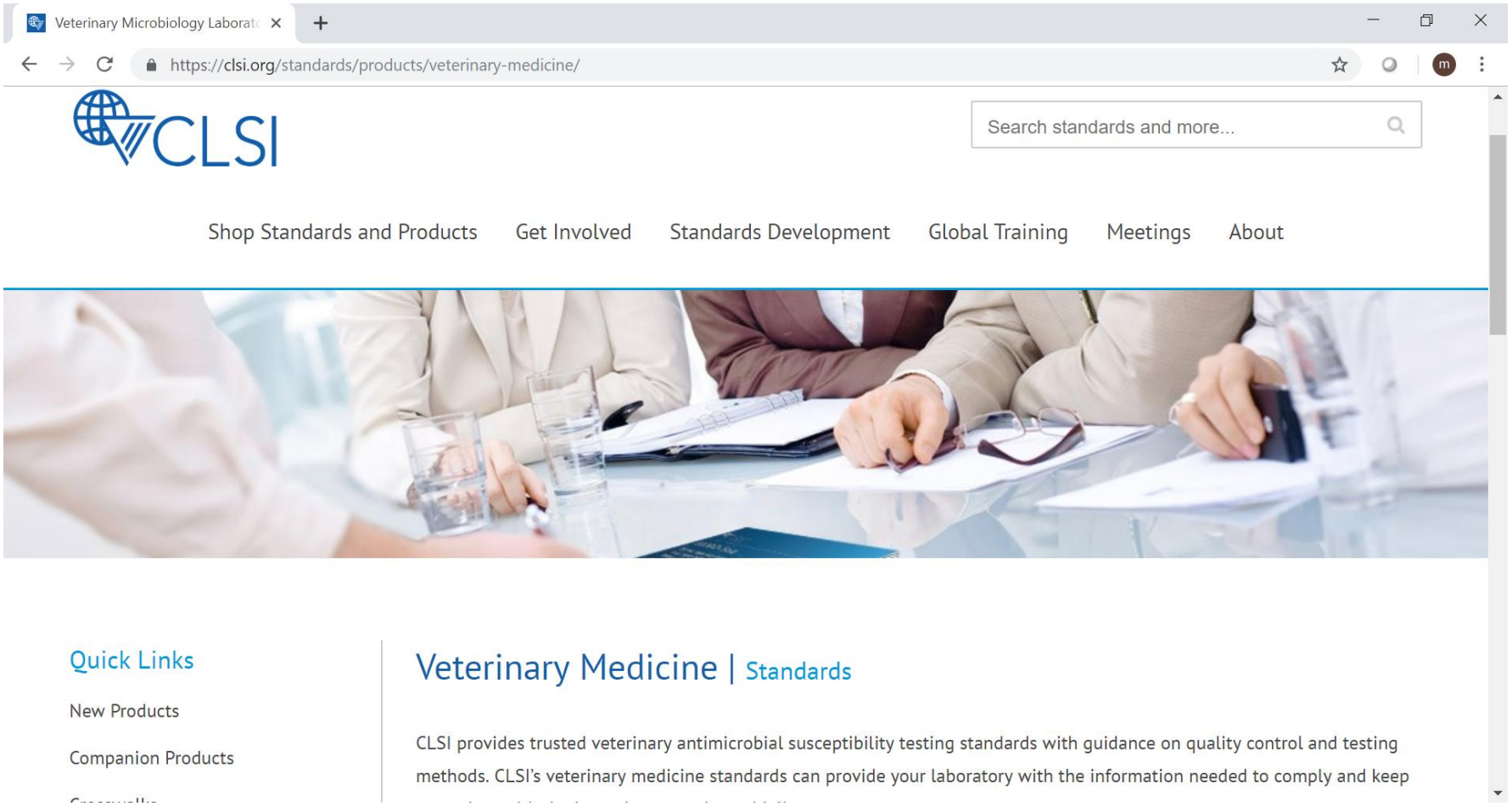
VetCAST Newsletter, December 2017.

VetCAST Newsletter, December 2016.

VetCAST vision, strategy, remits, Steering committee and members.

VetCAST Guidance on how to collect and handle PK data (April 2018)

CLSI – www.clsi.org



Or… Google "CLSI Free" to find M100, M60, and VET08

EUCAST and CLSI are different

EUCAST

- Committee of representatives of national breakpoint committees and the medical profession in European countries.
- In dialogue with regulatory authorities (ECDC, EMEA)
- In consultation with industry.
- Consensus decisions , no vote

CLSI

- Committee of representatives from the medical profession, science, industry and regulatory authorities
- Decisions by vote

Slide from Olga Perovic – "CLSI vs. EUCAST", NICD, South Africa, 2014 presentation

EUCAST vs. CLSI

EUCAST

- Funded by ESCMID, ECDC and nationals breakpoint committees
- Industry consultative role
- Five meetings per year
- EUCAST functions as the breakpoint committee of EMEA
- Rationale documents published on EUCAST website for free
- Clinical breakpoints and epidemiological cut-offs

CLSI

- Funded by member-national (industry, government institutions, societies, laboratories) and sale of documents
- Industry part of decision process
- Two meetings per year
- FDA determines breakpoints
- CLSI was recognized by FDA from 2010
- Breakpoints determined by FDA may be amended by CLSI after 2 yrs
- Rationale for decisions not published in an organized fashion and for sale
- Clinical breakpoints

Slide from Olga Perovic – "CLSI vs. EUCAST", NICD, South Africa, 2014 presentation

Disc tests from EUCAST and CLSI

EUCAST

- Mueller Hinton Inoculum 0.5 McF
- Incubation 18 +/-2 h (24h for some organisms)
- MH+5% Horse Blood and 20 mg β-NAD for streptococci, pneumococci & *H. influenzae*
- Disk strengths
- QC strains and reference ranges

CLSI

- Mueller Hinton Inoculum 0.5 McF
- Incubation 18 +/-2 h (24h for some organisms)
- Two different plates for fastidious organisms
- Disk strengths
- QC strains and reference ranges

Slide from Olga Perovic – "CLSI vs. EUCAST", NICD, South Africa, 2014 presentation

Breakpoint documents

- EUCAST
  - Human clinical breakpoints
  - Animal clinical breakpoints –in development
  - Epidemiological Cut-off Values (ECOFF) - many
- CLSI
  - Human: M100 (routine), M45 (rare and fastidious), M60 (yeast), M61 (mold), M62 (Nocardia, etc.),
  - Animal: VET08 (routine), VET06 (rare and fastidious), VET03/04 (aquatic)
  - Epidemiological Cut-off Values (ECV) – few

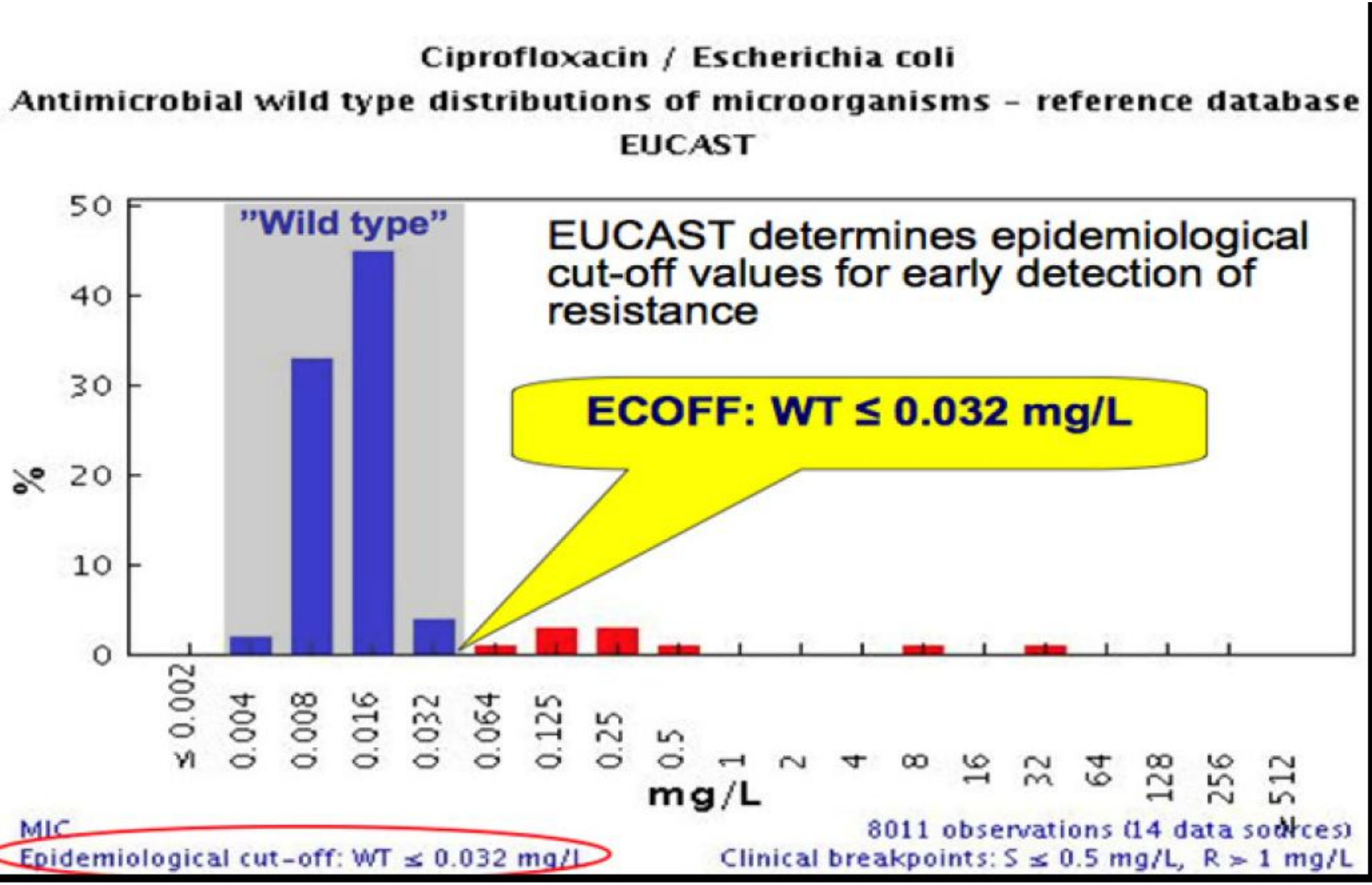
Over time, EUCAST and CLSI clinical breakpoints have become closer

A common misperception

- The purpose of routine antimicrobial susceptibility testing is NOT to find "resistant" bacteria.
- The purpose of CLSI and EUCAST clinical breakpoints is to predict treatment outcome in a sick human or animal patient
  - Is the antibiotic a reasonable choice for treating a sick patient?
- The purpose of Epidemiological Cut-off values (ECOFF or ECV) is to recognize microbes with some degree of resistance irrespective of treatment outcome. Until 2007, usually referred to as "Microbiological Breakpoints"

Interpretation categories

- CLSI clinical breakpoints
  - Usual: Resistant (R), Intermediate (I), Susceptible (S)
  - Others: Non-susceptible (NS), Susceptible-Dose Dependent (SDD)
  - Historical: Indeterminate, Moderately Susceptible
- EUCAST clinical breakpoints
  - Usual: Resistant (R), Susceptible with Increased Exposure (I) since 2019, Susceptible (S)
  - Other: Area of Technical Uncertainty (ATU)
  - Historical: Intermediate (prior to 2019)
- Epidemiological Cut-off Values (ECOFF/ECV)
  - Wild Type (WT), Non-Wild Type (NWT)



Slide from Olga Perovic – "CLSI vs. EUCAST", NICD, South Africa, 2014 presentation

So what "breakpoints" should we use for non-human microbial isolates? It depends on your objective.

- Treatment of sick animals
  - CLSI veterinary breakpoints
  - EUCAST human breakpoints until VetCAST progresses
- Exploring the impact of resistance on human populations
  - Human clinical breakpoints
    - Especially zoonotic pathogens to predict clinical outcome
    - Comparisons with AMR surveillance results from human programs
  - Epidemiological cut-off values, especially to recognize the presence and transfer of resistance genes

Please record your zone diameter and MIC measurements!!!

- To provide the clinician with the correct results. No more “eyenometer”, “oculometer”, “eyeball”
- Breakpoints may change over time and you need the measurements to compare the old and new results. The method hasn’t changed! Only our understanding of patient outcomes.
- Flexible selection of breakpoints depending on the objective
- Assessing data quality (disks, media, inoculum, etc.)
- Epidemiological recognition and tracking of distinct microbial populations