


WHONET

Laboratory-based surveillance of infectious diseases and antimicrobial resistance

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The Complete Laboratory Information System

- Clinical reporting
 - return results to clinicians
 - permanent record
 - Laboratory management system
 - preliminary and final results
 - guide technologists through needed laboratory tests
 - billing and financial accounting
 - Data analysis
- 

Uses of Microbiology Data

- Laboratory quality improvement
 - Laboratory testing
 - Utilization of laboratory services by clinical staff
- Infection control and outbreak preparedness
 - Identification of new and problem pathogens
 - Identification and investigation of outbreaks
- Antimicrobial policy
 - Trends in infections and resistance
 - Characterization of cross-resistance
 - Development of treatment guidelines
- Research
 - New resistance mechanisms
 - Risk factors for resistance
- Evaluation of interventions

WHONET: A Microbiology Data Management Tool

- Enhance the use of locally-generated data
 - Antimicrobial policy, infection control
 - Laboratory quality assurance
- Promote collaborations
 - National and international networks

WHONET around the World

- WHONET is currently used in approximately 110 countries, managing data from over 1500 laboratories.
 - Hospital and public health laboratories
 - Food and veterinary laboratories
 - Reference and research laboratories
- Data collections
 - Routine laboratory data
 - Special surveys and research protocols

WHONET Use in the World

- **African Regional Office of WHO (AFRO)**
 - Algeria, Kenya, Namibia, South Africa, Tanzania, Zambia
- **Eastern Mediterranean Regional Office of WHO (EMRO)**
 - Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Saudi Arabia, Tunisia
- **European Regional Office of WHO (EURO)**
 - Austria, Belgium, Bosnia, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Iceland, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Ukraine, United Kingdom
- **Pan-American Health Organization (PAHO)**
 - Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, United States, Uruguay, Venezuela
- **South-East Asian Regional Office of WHO (SEARO)**
 - India, Indonesia, Sri Lanka, Thailand
- **Western Pacific Regional Office of WHO (WPRO)**
 - China, Hong Kong (China), Japan, Republic of Korea, Malaysia, Philippines, Singapore, Taiwan, Viet Nam



Analysis type

Study = RIS and test measurements
All antibiotics

Options

One per patient

Organisms

pae Pseudomonas aeruginosa

Isolates

Data files

w2004bwh.dbf

Output to:

Screen

Macros

Begin analysis

Exit

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)	
										<input type="checkbox"/> 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	

Isolate Summary:

Number of patients with MRSA by location and month

Resultados del Análisis

Archivo Edición

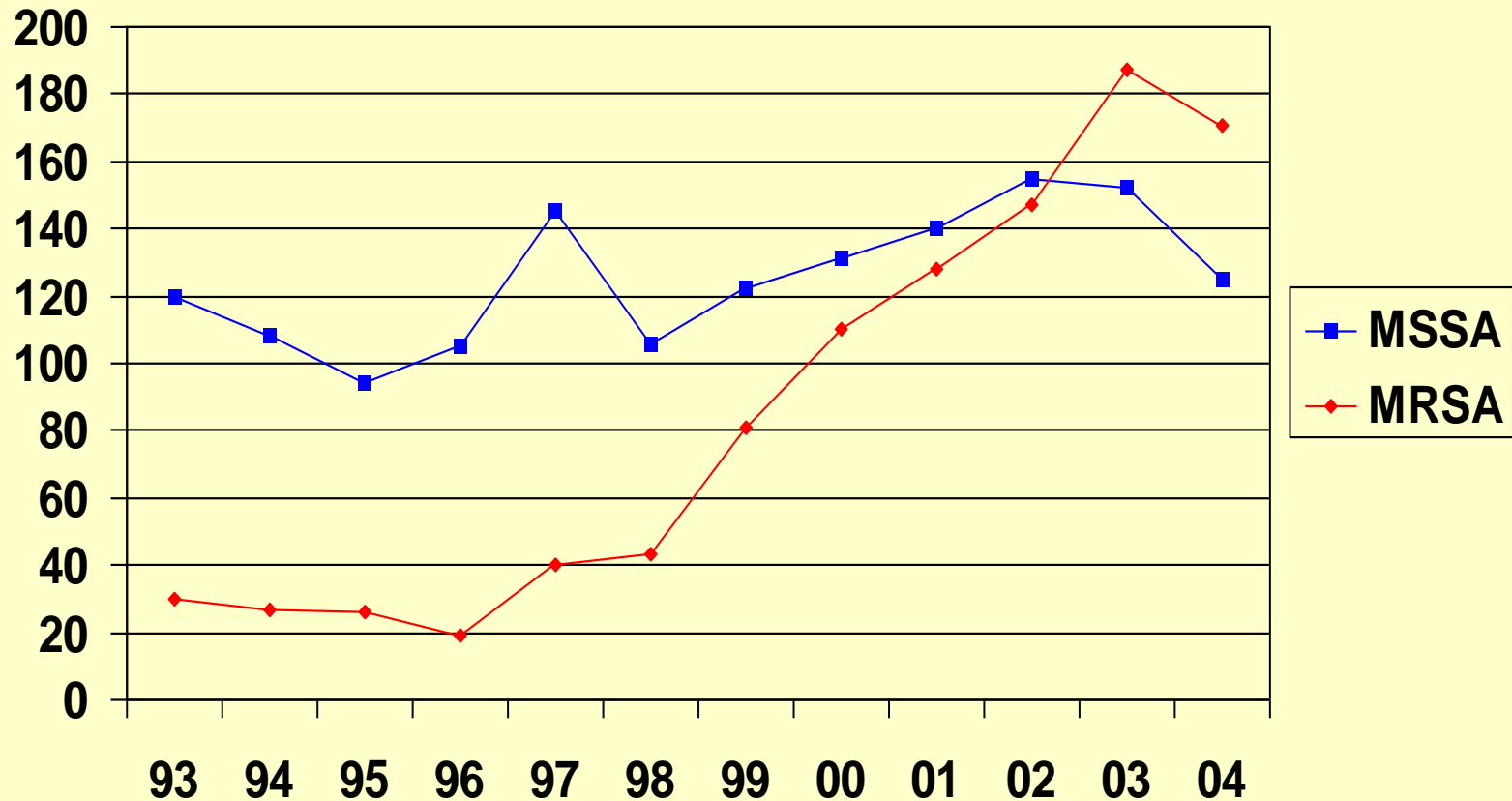
Copiar tabla Copiar gráfico Imprimir tabla Imprimir gráfico Continuar

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

Blood isolates of *Staphylococcus aureus* at a U.S. Hospital, 1993-2004



%RIS and histograms: *Pseudomonas aeruginosa*

Analysis Results

File Edit Data

Copy table Copy graph Print table Print graph Continue Organism = *Pseudomonas aeruginosa* (n=356 isolates)

Show hidden columns

Code	Antibiotic name	Breakpoints	Number	%R	%I	%S	??	%R 95%
AMK_ND30	Amikacin	15 - 16	336	3	4.5	92.6		
ATM_ND30	Aztreonam	16 - 21	336	13.1	18.5	68.5		9
FEP_ND30	Cefepime	15 - 17	2	0	0	100		0
CTX_ND30	Cefotaxime	15 - 22	336	33.3	58.6	8		28
CAZ_ND30	Ceftazidime	15 - 17	336	5.7	3	91.4		
CIP_ND5	Ciprofloxacin	16 - 20	336	31.2	6.8	61.9		26
COL_ND10	Colistin		336	0	0	100		
GEN_ND10	Gentamicin	13 - 14	336	18.2	3.3	78.6		14
IPM_ND10	Imipenem	14 - 15	336	20.2	3	76.8		16
LVX_ND5	Levofloxacin	14 - 16	336	37.2	3.9	58.9		32
MEZ_ND75	Mezlocillin	S >= 16	336	25.3	0	74.7		20
PIP_ND100	Piperacillin	S >= 18	336	10.1	0	89.9		7
TOB_ND10	Tobramycin	13 - 14	336	15.5	0.6	83.9		11
AMP_NM	Ampicillin	S >= 18	1	100	0	0		0

Gentamicin

Zone of inhibition (mm)

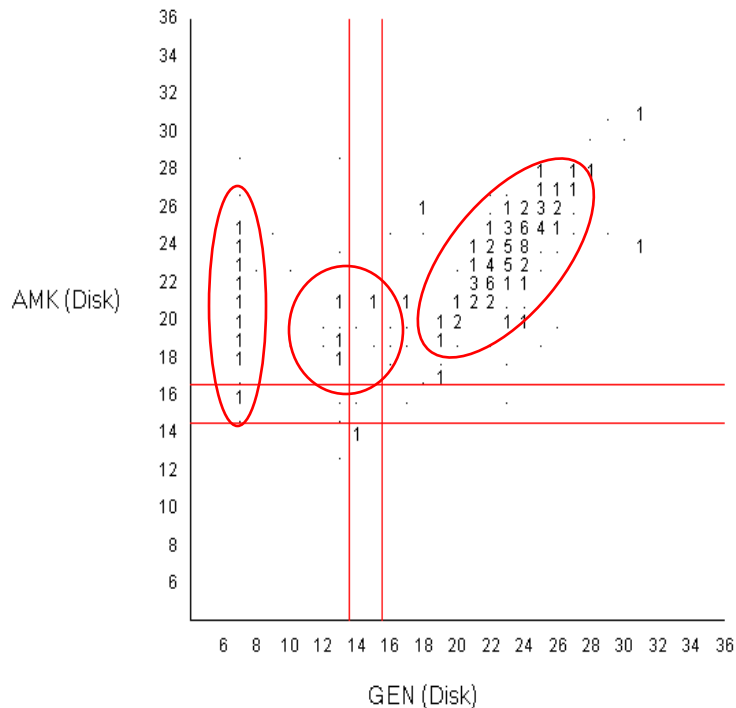
RIS

- Resistant
- Intermediate
- Susceptible
- Unknown
- Number tested

Test measurements

- Ciprofloxacin
- Colistin
- Gentamicin**
- Imipenem
- Levofloxacin
- Mezlocillin
- Piperacillin
- Tobramycin

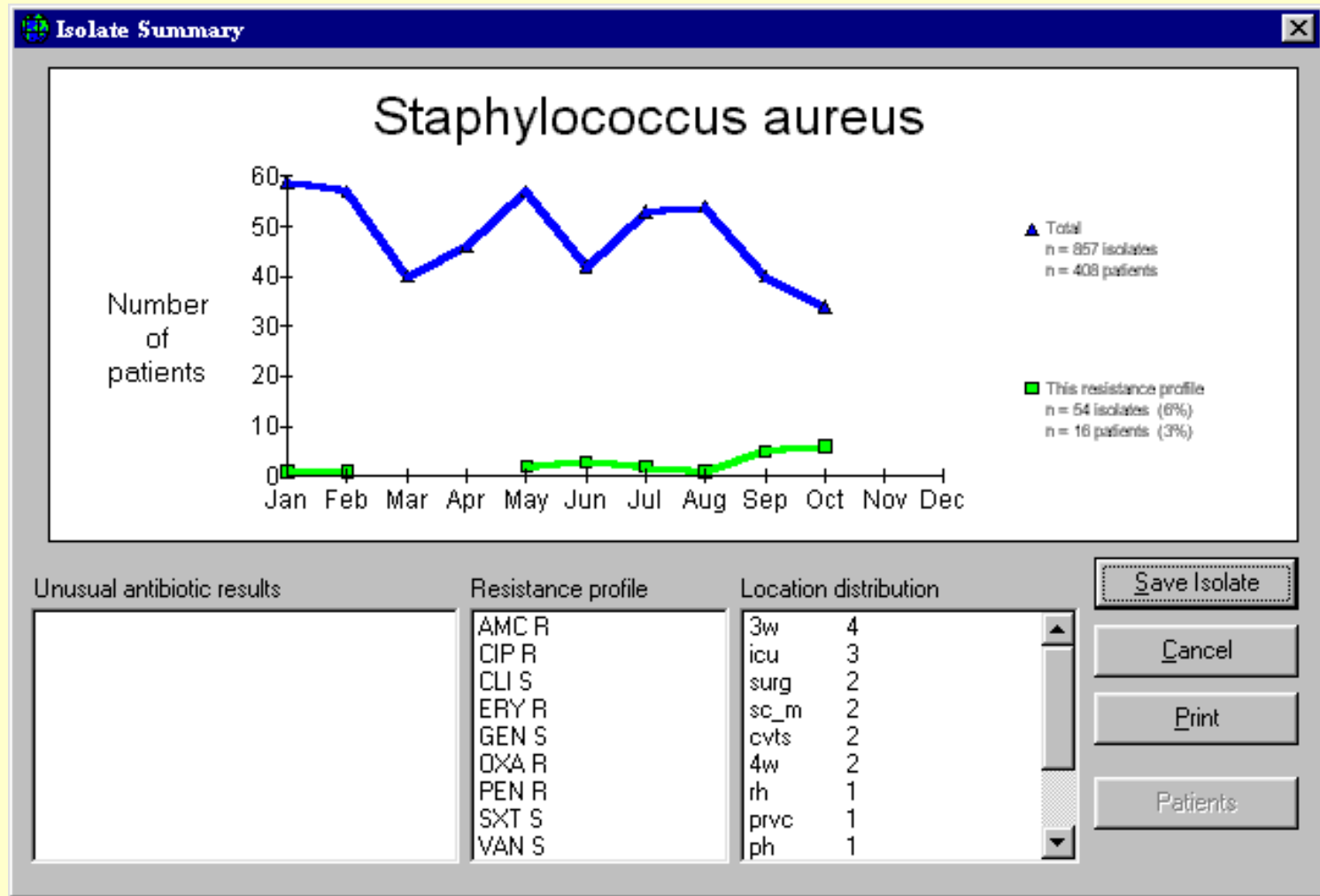
Scatterplot - *Klebsiella pneumoniae* Amikacin vs. Gentamicin



S	10%	1.1%	85.9%
I	1.4%	0.3%	0.5%
R	0.3%	0.5%	
	R	I	S
	GEN (Disk)		

Staphylococcus aureus

Total and by Resistance Profile



Resistance profiles: *Klebsiella pneumoniae*

Multi-resistant clone beginning in July 1991

Resultados del Análisis														
Archivo Edición														
Copiar tabla		Copiar gráfico		Imprimir tabla		Imprimir gráfico		Continuar		Microorganismo = <i>Klebsiella pneumoniae</i> ss. <i>pneumoniae</i>				
<input type="checkbox"/> Mostrar columnas ocultas														
letra = Resistente			A = AMP 11 - 16			M = AMK 15 - 16								
O Intermedio			T = TCY 17 - 18			F = CAZ 15 - 20								
Espacio = Sensible			C = CHL 19 - 22			G = GEN 14 - 15								
- = No probado			B = TOB 14 - 15			X = CTX 15 - 20								
Org	Perfil	Ene	Feb	Mar	Abr	Mayo	Jun	Jul	Ago	Sep	Oct	Nov	Dic	
kpn	A CG			1										
	ATC	3	5	3		4	2	3		3	5	2	3	
	A GB X	2	1											
	A C B F							2			2			
	A CGB	1		1	1					1				
	AT B F													
	AT GB			1										
	ATC F											1		
	ATC B						1			1				
	ATCG			1		1								
	A C B FX	1												
	A CGB X							1						
	AT B FX								1					
	ATC B F						1	2			1			
	ATCGB			1				3	1		1	1		
	A C BMFX		1											
	A CGB FX	2	1											
	A CGBMF	1												
	ATC B FX		1					1	1	1		2		
	ATCGB F							1						
	A CGBMFX		1					1						
	ATC BMFX								1					
	ATCGB FX				1		2	1	1		1		2	
	ATCGBMFX							1	1	1	1		2	

BacTrack Expert System

Isolate alerts

Analysis Results

File Edit Data

Copy table Copy graph Print table Print graph Continue Organism = All organisms (n=3 Isolates)
 Show hidden columns

Specimen date: 14-01-2005 -- 15-01-2005

Identification number	CTT	CAZ	CEP	CHL	CIP	CLI	COL	ERY	GEN	IPM	LVX	MEZ	NIT
▶ 19458645	R	R	R	S	R		?			R*	R	R	R
	R	R	R	S	R		?			R*	R	R	R
19819879				I*		R		R	S		R		

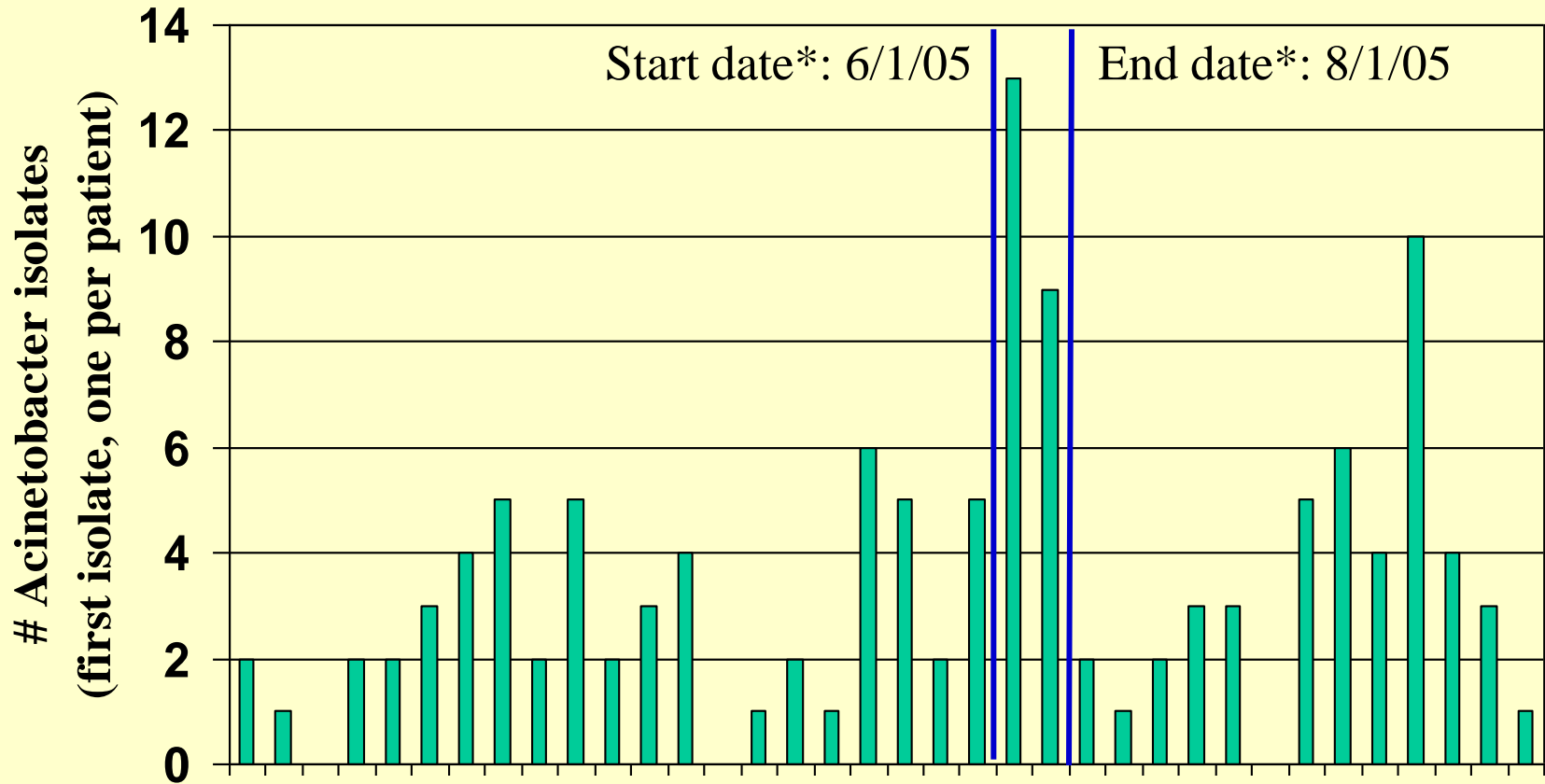
Windows taskbar: Start | WHONET 5.3 | Brigha... | C:\Documents and Settin... | Microsoft PowerPoint - [H... | 5:12 PM

Example WHONET Clusters

Clusters	Alert Type	Recur Interval	Start Date*	End Date*	Initial Obs	Initial Exp	Total Obs	Total Exp
<i>A. baumannii</i>	Hospital	625	6/1/05	8/1/05	6	0.7	20	8
<i>S. aureus</i>	Unit	667	6/1/04	6/20/04	5	0.4	7	1.1
<i>E. faecalis</i>	Service	1,429	1/1/05	1/25/05	3	0.3	4	0.6
<i>S. marcescens</i>	Abx Profile	10,000	1/1/04	5/1/04	2	0.1	11	1.4

*Dates are fictitious

Acinetobacter baumannii Isolates



*Dates are fictitious

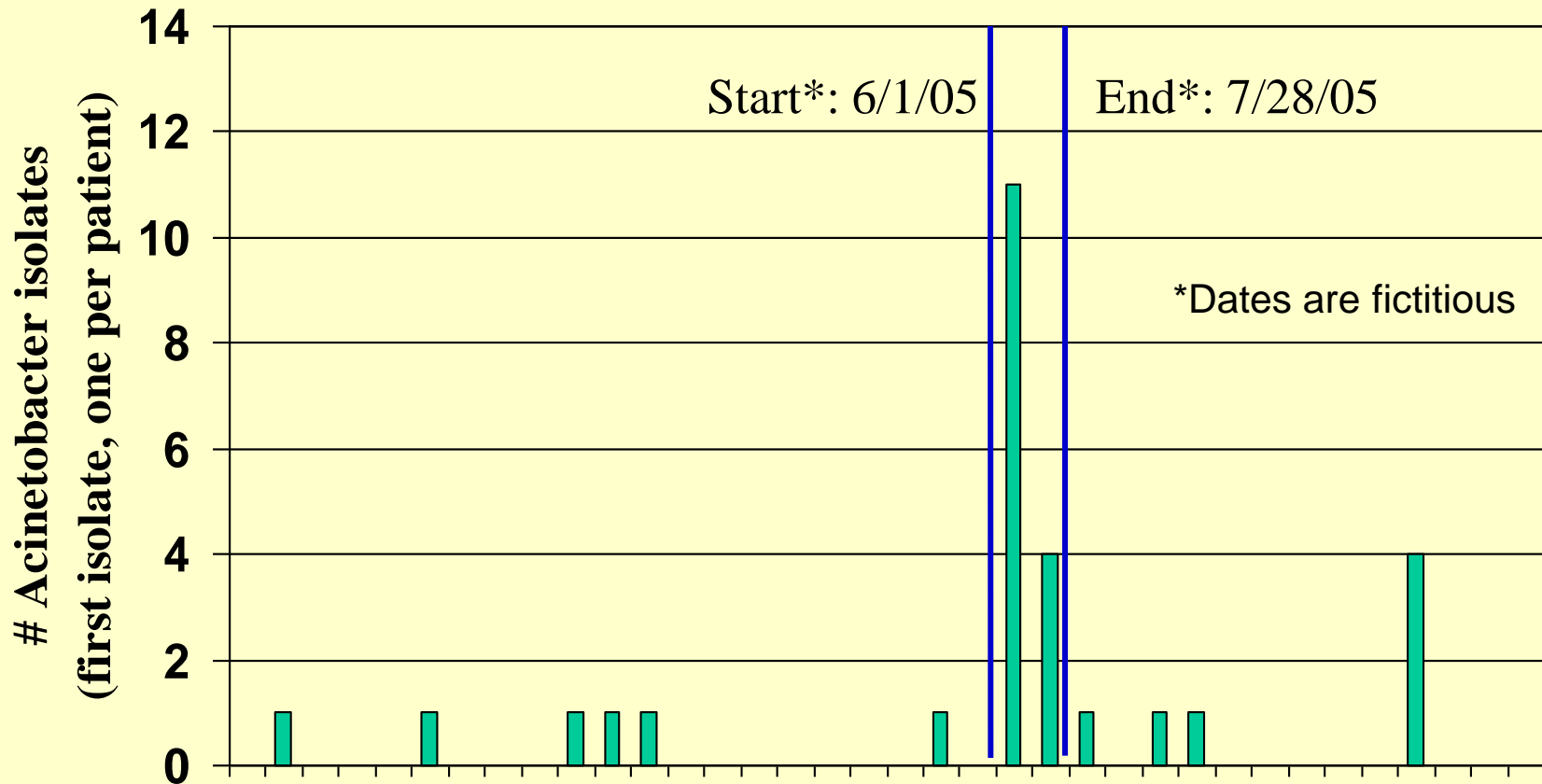
Acinetobacter baumannii Clusters

Clusters	Alert Type	Recur Interval	Start Date*	End Date*	Initial Obs	Initial Exp	Total Obs	Total Exp
<i>A. baumannii</i>	Hospital	625	6/1/05	8/1/05	6	0.7	20	8.3
<i>A. baumannii</i>	Unit	2,000	6/1/05	7/10/05	3	0.3	4	0.6
<i>A. baumannii</i>	Abx Profile	10,000	6/1/05	7/28/05	6	1.7	15	7.5

***Dates are fictitious**

Acinetobacter baumannii

Suspicious Susceptibility Pattern



Non-susceptible to 7 antibiotics: Ampicillin, Cefotaxime, Ceftazidime, Levofloxacin, Nitrofurantoin, Gentamicin, Trimethoprim/Sulfamethoxazole

Hospital Alerts - 2002-2006

- **Median 12 annual alerts (7-16)**
- **Organisms**
 - GP: 36%; GN 53%; Fungi 12%
- **Outbreak Type**
 - Antibiotic Profile 26 (41%)
 - Unit 18 (29%)
 - Hospital-wide 11 (18%)
 - Service 8 (13%)
- **Outbreak Size**
 - 2 patients 12 (20%)
 - 3-5 patients 27 (46%)
 - 6-10 patients 11 (19%)
 - >10 patients 9 (15%)

Advantages to the hospital

- Detected all important known outbreaks
 - but at an earlier dates
- Detected outbreaks with organisms not under routine surveillance
 - Gram negatives, fungi, infrequent organisms
- Improved detection of MRSA and VRE outbreaks through the use of resistance phenotypes
 - Decreased noise in signals improves both specificity and sensitivity

BacLink 2

Microbiology data conversion utility

- Many laboratories in the world have already computerized their microbiology laboratory systems
- This presents an obstacle and an opportunity

Desktop softwares

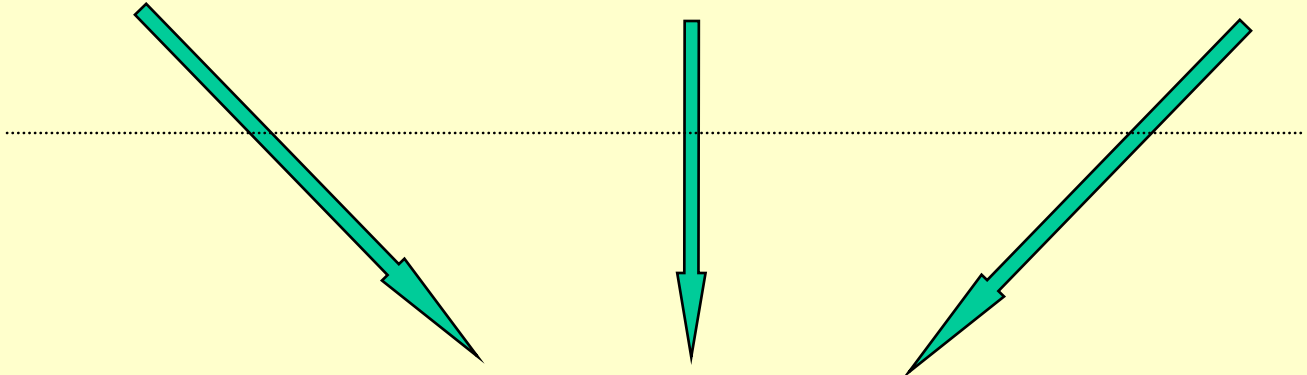
Excel
Access
EpiInfo

Laboratory systems

Mysis
MEDITECH
ADBakt

Laboratory instruments

MIC systems
Disk diffusion readers



BacLink

Data conversion

WHONET

Data analysis

Susceptibility Test Instruments

Microdilution systems

ATB	Pasco	Vitek
Mast Scan	Phoenix	Wider
MIC 2000	Sceptor	
Microscan	Sensititre	

Disk diffusion readers

Aura	SirScan
Biomic	Videobac
Mast Radius	Wider
Osiris	

Laboratory Information Systems and Other Formats

- Laboratory Information Systems
 - ADBakt (Sweden)
 - Cerner Classic
 - Cerner Millennium
 - MADS (Denmark)
 - MEDITECH Client/Server
 - MEDITECH Magic
 - Medicom
 - MYSIS
 - Oman Laboratory Information System
 - SCC SoftLab
 - Sunquest
 - WinPath
- Other formats
 - CDC ELR format*
 - EARSS (European Union)
 - JIAQA (Japan)
 - NARMS (United States)
 - NORM (Norway)
 - WHO-AFRO Bacteriology Lab (Africa)