UAE National
Surveillance System for Antimicrobial Resistance

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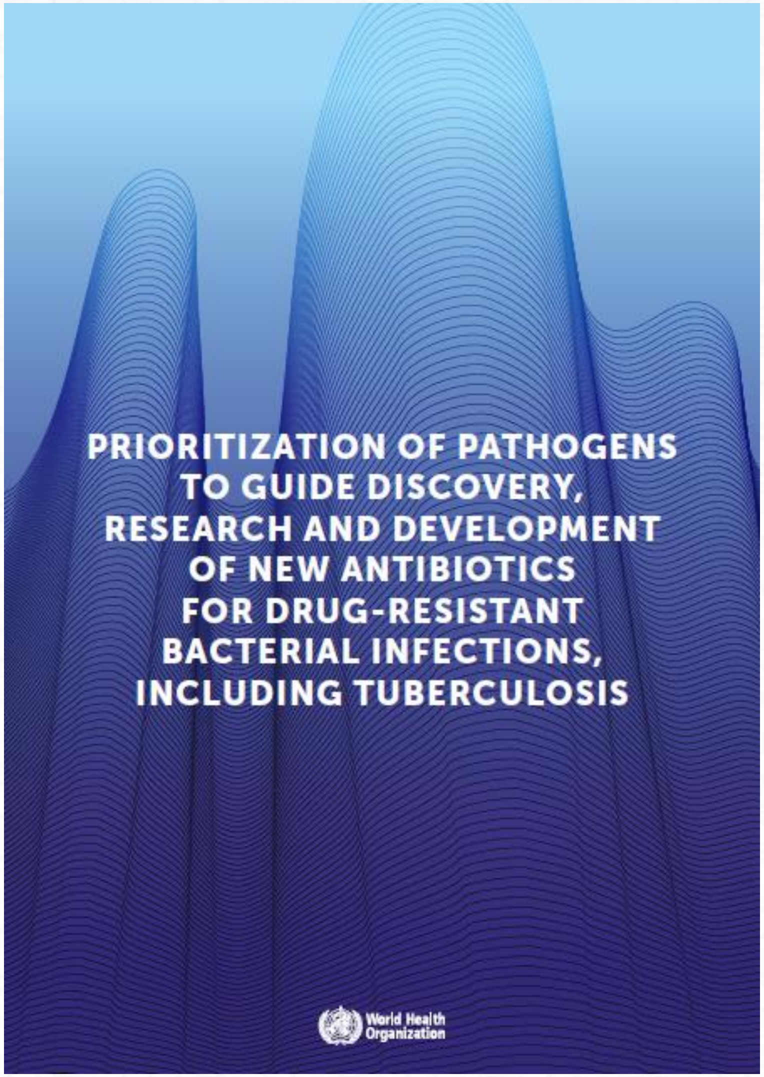
Learning Objectives and Presentation outline

To describe:

1. **UAE National Surveillance System for AMR**
   - Concepts and methods
   - Surveillance sites
   - Data collection and analysis
2. **Epidemiology of AMR in the UAE**
   - Cumulative antibiogram
   - Patterns and Trends of AMR
   - Reporting of AMR data
3. **How can AMR surveillance data support Infection Control?**
   - Line listings
   - Epi curves
   - Isolate alerts
   - Resistance profiles
   - Detection of clusters and potential HAI outbreaks

1. **UAE National Surveillance System for AMR**
   - What are the threats?
   - WHO Global Action Plan and WHO-GLASS
   - AMR Surveillance – concepts and methods
   - AMR Committees and Sub-Committees in the UAE
   - AMR Surveillance Sites – By Emirate/Region
   - Data collection and analysis

What are the Threats?



Priority 1: CRITICAL*

Acinetobacter baumannii, carbapenem-resistant

Pseudomonas aeruginosa, carbapenem-resistant

Enterobacteriaceae*, carbapenem-resistant, 3rd generation cephalosporin-resistant

Priority 2: HIGH*

Enterococcus faecium, vancomycin-resistant

Staphylococcus aureus, methicillin-resistant, vancomycin intermediate and resistant

Helicobacter pylori, clarithromycin-resistant

Campylobacter, fluoroquinolone-resistant

Salmonella *spp.*, fluoroquinolone-resistant

Neisseria gonorrhoeae, 3rd generation cephalosporin-resistant, fluoroquinolone-resistant

Priority 3: MEDIUM*

Streptococcus pneumoniae, penicillin-non-susceptible

Haemophilus influenzae, ampicillin-resistant

Shigella *spp.*, fluoroquinolone-resistant

World Health Organization, 2017 [1]. Tacconelli E et al. [2]

Meet The Superbugs

Gram-positive Superbugs	Gram-negative Superbugs
MRSA / VISA / VRSA VRE	Enterobacteriaceae, Acinetobacter, Pseudomonas (CPO: resistant to Carbapenems)
Active Drugs	**Active Drugs**
Vancomycin, Linezolid, Dalbavancin, Daptomycin, etc.	Few to none

Adapted from Kenneth Thomson, Louisville, KY, USA, 2018 [3]

Global Action Plan on AMR: Key Objectives

GLOBAL ACTION PLAN ON ANTIMICROBIAL RESISTANCE

1. Improve awareness and understanding of AMR	2. Strengthen knowledge through surveillance and research	3. Reduce the incidence of infection through effective hygiene & IPC	4. Optimize the use of antimicrobial medicines in human & animal health	5. Ensure sustainable investment through research & development
Risk Communi-cation	National AMR surveillance	IPC in health care	Access to qualified antimicrobial medicines, regulation, AMS	Measuring the burden of AMR
Education	Laboratory capacities	Community level prevention	Use in veterinary and agriculture	Assessing investment needs
	Research and development	Animal health: prevention and control		Establishing procedures for participation

Focus on National AMR Surveillance and Microbiology Lab Capacity

WHO Global Action Plan on AMR, 2015 [4]

Core Components for National AMR Surveillance Systems

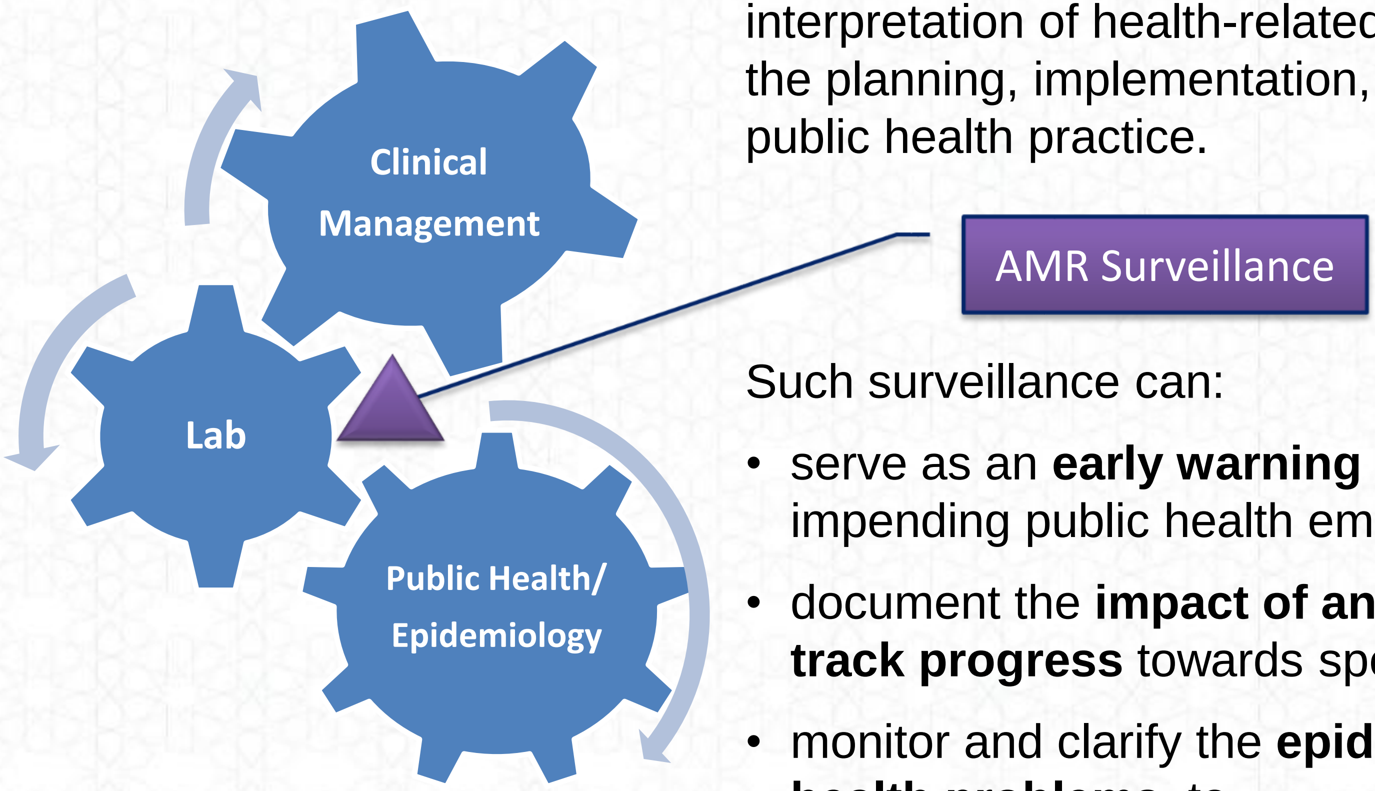
Surveillance sites

National reference laboratory (NRL)

National Coordinating Centre to report to the national body in charge of strategies to contain AMR

 WHO GLASS, 2015 [5]

What is Surveillance? WHO definition:



Public health surveillance is the continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation, and evaluation of public health practice.

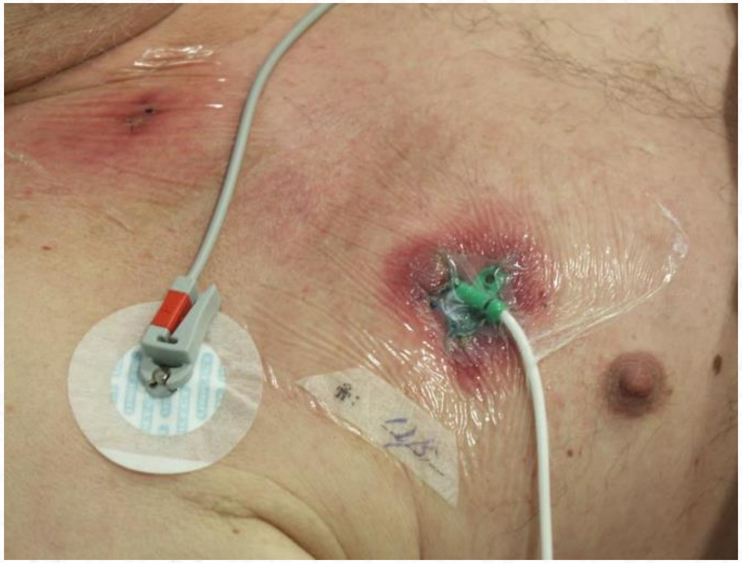
Such surveillance can:

- serve as an **early warning system** for impending public health emergencies;
- document the **impact of an intervention**, or **track progress** towards specified goals; and
- monitor and clarify the **epidemiology of health problems**, to
- allow **priorities to be set** and to
- **inform public health policy and strategies**.

WHO. Public Health Surveillance, 2018 [6]

Why AMR Surveillance?

- **Ultimately, to inform treatment guidelines and guide patient management**



But also to

- **Understand the problem**
- **Guide interventions**
- **Assess the burden, and epidemiology of AMR**

Relationship between Individual Care and AMR Surveillance

Clinical Team

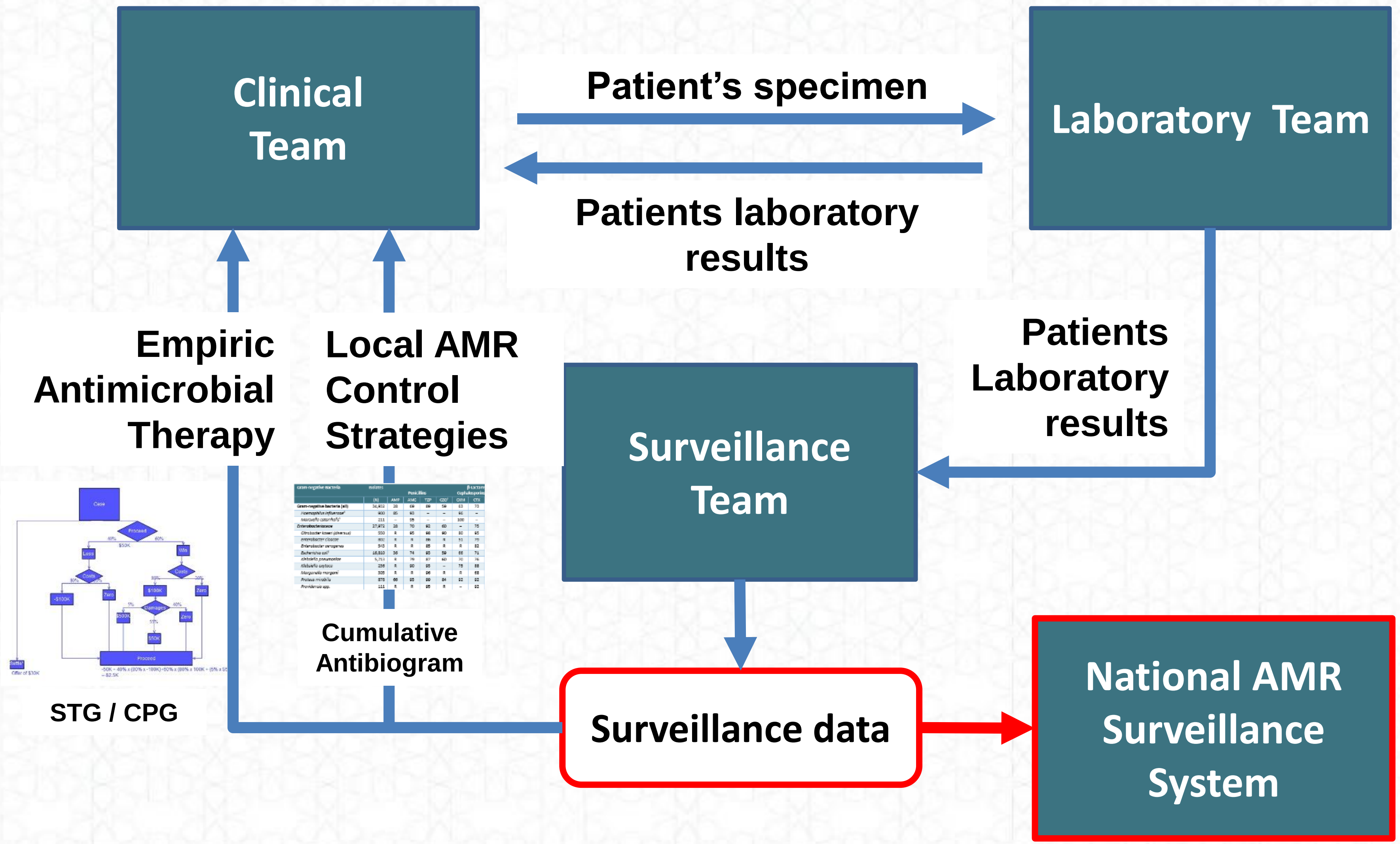
Patient’s specimen →

← Patients laboratory results

Laboratory Team

Adapted from WHO GLASS Diagnostic Stewardship Guideline 2016 [7]

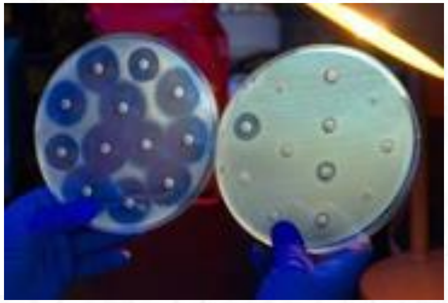
Relationship between Individual Care and AMR Surveillance

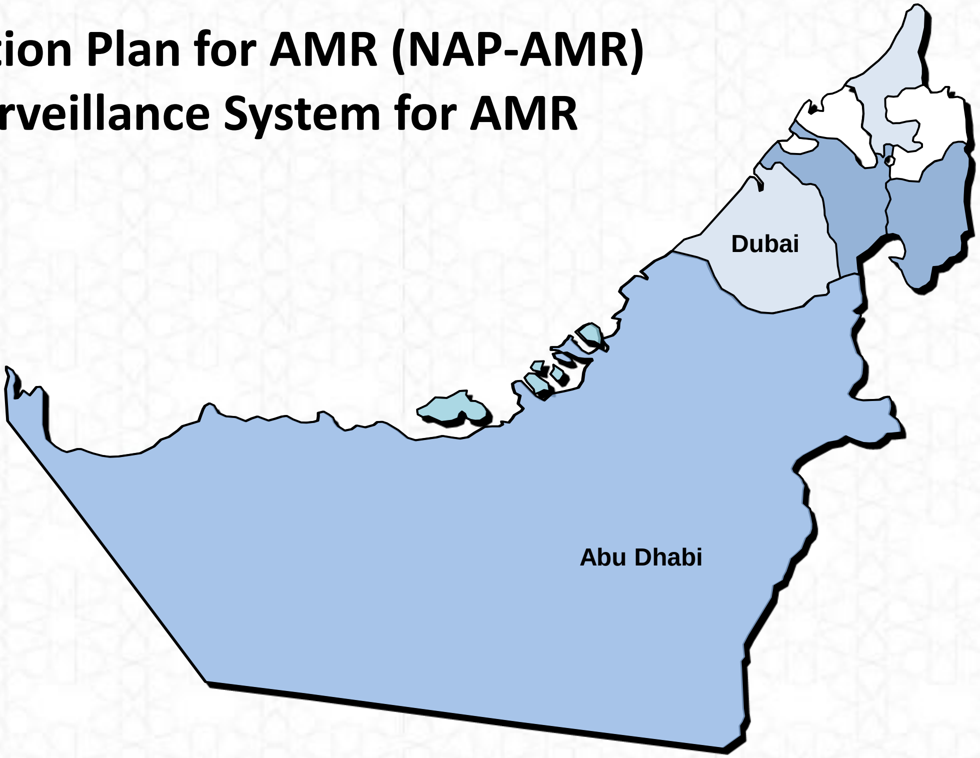


Adapted from WHO GLASS Diagnostic Stewardship Guideline 2016 [7]

UAE National AMR Surveillance System: History

- **2014:** MOHAP Decision to establish UAE Higher Committee for Antimicrobial Resistance (AMR)
- **2015:** UAE Higher Committee for AMR decided to implement the WHO GAP-AMR, including:
  - **Develop UAE National Action Plan for AMR (NAP-AMR)**
  - **Establish UAE National Surveillance System for AMR**





How to develop an UAE National Surveillance System for Antimicrobial Resistance?

UAE Committees on AMR (2019)

Higher Committee

Higher AMR Committee

- Chair/Co-Chair
  - Dr. Hussain Al Rand
  - Dr. Najiba Abdulrazzaq
- NFP-AMR
  - Dr. Najiba Abdulrazzaq (Human Health)
  - Ms. Kaltham Ali Kayaf (Animal Health)

Technical (Sub-) Committees

AMR Surveillance

- Chair/Co-Chair
  - Dr. Jens Thomsen
  - Prof. Hala Fouad

Antibiotic Stewardship (ASP)

- Chair
  - Dr. Laila Al-Dabal

Infection Prevention and Control (IPC)

- Chair/Co-Chair
  - Dr. Ashraf Elhoufi
  - Dr. Nawal Alkaabi

GLASS Global AMR Surveillance System

- WHO GLASS Focal Points:
  - Dr. Jens Thomsen
  - Dr. Mubarak Alfaresi

National Sub-Committee for AMR Surveillance – Functions

- **Functions:**
  - Serve as interim National Coordination Center for AMR Surveillance (NCC)
  - Report to UAE Higher Committee for AMR
  - Oversee National AMR Surveillance Strategies and Activities
  - Provide input into National AMR Strategy and Action Plan, national AMR policies and guidelines, and laws and regulations
  - Conduct capacity building and technical training activities for AMR Surveillance, including WHONET training
  - Collect & analyze AMR data from national surveillance sites/labs
  - Develop and publish AMR Surveillance reports
  - Report UAE national AMR data annually to WHO-GLASS
  - Cooperate with local, national, and international stakeholders, and across sectors

National Sub-Committee for AMR Surveillance – Members

Ministry of Health and Prevention (MOHAP)/Purehealth

1. **Dr. Manal al Fattah** — MF — Specialist Microbiology, Saqr hospital/purehealth, RAK
2. **Dr. Najiba Abdulrazzaq** (NFP) — NA — Consultant Internist, Al Baraha Hospital, Dubai
3. **Prof. Hala Fouad** (Co-Chair) — HF — Consultant Microbiology, Al Baraha hospital/purehealth, Dubai

Department of Health Abu Dhabi (DoH)

4. **Dr. Jens Thomsen** (Chair) — JT — Section Head, Environmental Health
5. **Dr. Bashir Aden** — BA — Advisor, Quality Monitoring
6. **Yousuf Naqvi** — YN — Regulation Officer, Drug and Medical Product Regulation

Dubai Health Authority (DHA)

7. **Dr. Anju Nabi** — AN — Head Microbiology & Infection Control Unit, Rashid Hospital, Dubai
8. **Dr. Maya Habous** — MH — Specialist Registrar (MD), Rashid Hospital

Ministry of Presidential Affairs (MOPA)

9. **Dr. Mubarak Alfaresi** — MA — Consultant Medical Microbiologist & ID Epidemiologist, SKGH, UAQ
10. **Dr. Duckjin Hong** — DH — Consultant Clinical Pathologist, Laboratory Medicine, SKSH, RAK
11. **Dr. Fouzia Jabeen** — FJ — Consultant Microbiologist, SKMC, Ajman

Universities:

12. **Prof. Tibor Pal** — TP — Professor of Microbiology, Consultant Clinical Microbiologist, UAEU
13. **Prof. Agnes Sonnevend** — AS — Associate Professor, Consultant Clinical Microbiologist, UAEU
14. **Prof. Palat Menon** — PM — Medical Director and Chief Operating Officer, Thumbay Labs, UAE
15. **Dr. Godfred Menezes** — GM — Associate Professor, RAKMHSU, Ras Al Khaimah

Hospitals:

16. **Dr. Stefan Weber** — SW — Public Sector: Consultant Microbiology, SKMC, Abu Dhabi
17. **Dr. Adnan Alatoom** — AA — Semi-Governmental: Consultant Microbiology, CCAD, Abu Dhabi
18. **Dr. Somansu Basu** — SB — Private Sector: Medical Microbiologist, NMC Specialty Hospital Al Ain

Core Components for National AMR Surveillance Systems

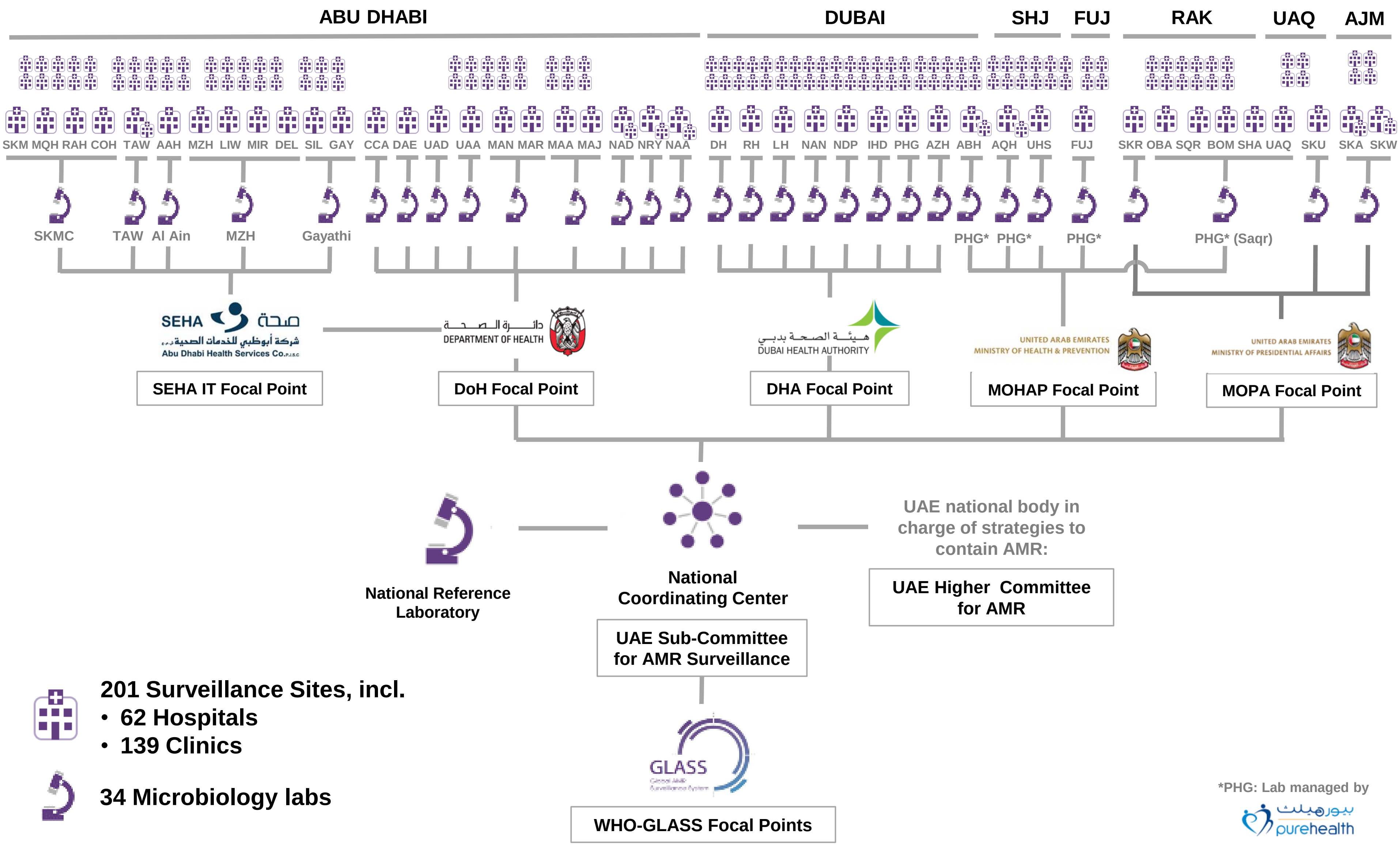
Surveillance sites

National reference laboratory (NRL)

National Coordinating Centre to report to the national body in charge of strategies to contain AMR

WHO GLASS, 2015 [5]

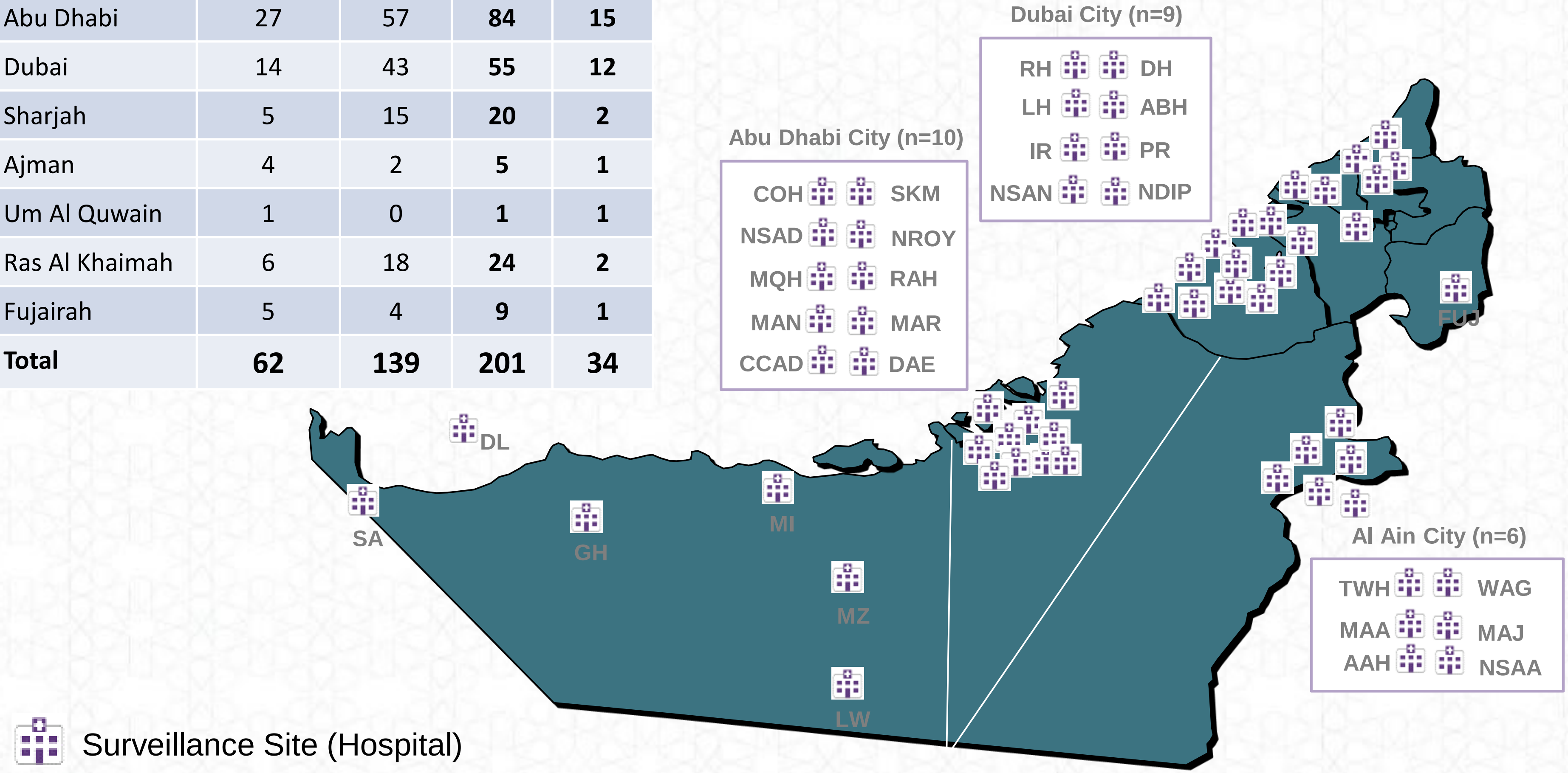
National AMR Surveillance System – Structure



UAE National AMR Surveillance System, 2019 [8]

National AMR Surveillance Sites – By Emirate/Region

Emirate	Hospitals	Clinics	Total Sites	Labs
Abu Dhabi	27	57	**84**	**15**
Dubai	14	43	**55**	**12**
Sharjah	5	15	**20**	**2**
Ajman	4	2	**5**	**1**
Um Al Quwain	1	0	**1**	**1**
Ras Al Khaimah	6	18	**24**	**2**
Fujairah	5	4	**9**	**1**
Total	**62**	**139**	**201**	**34**

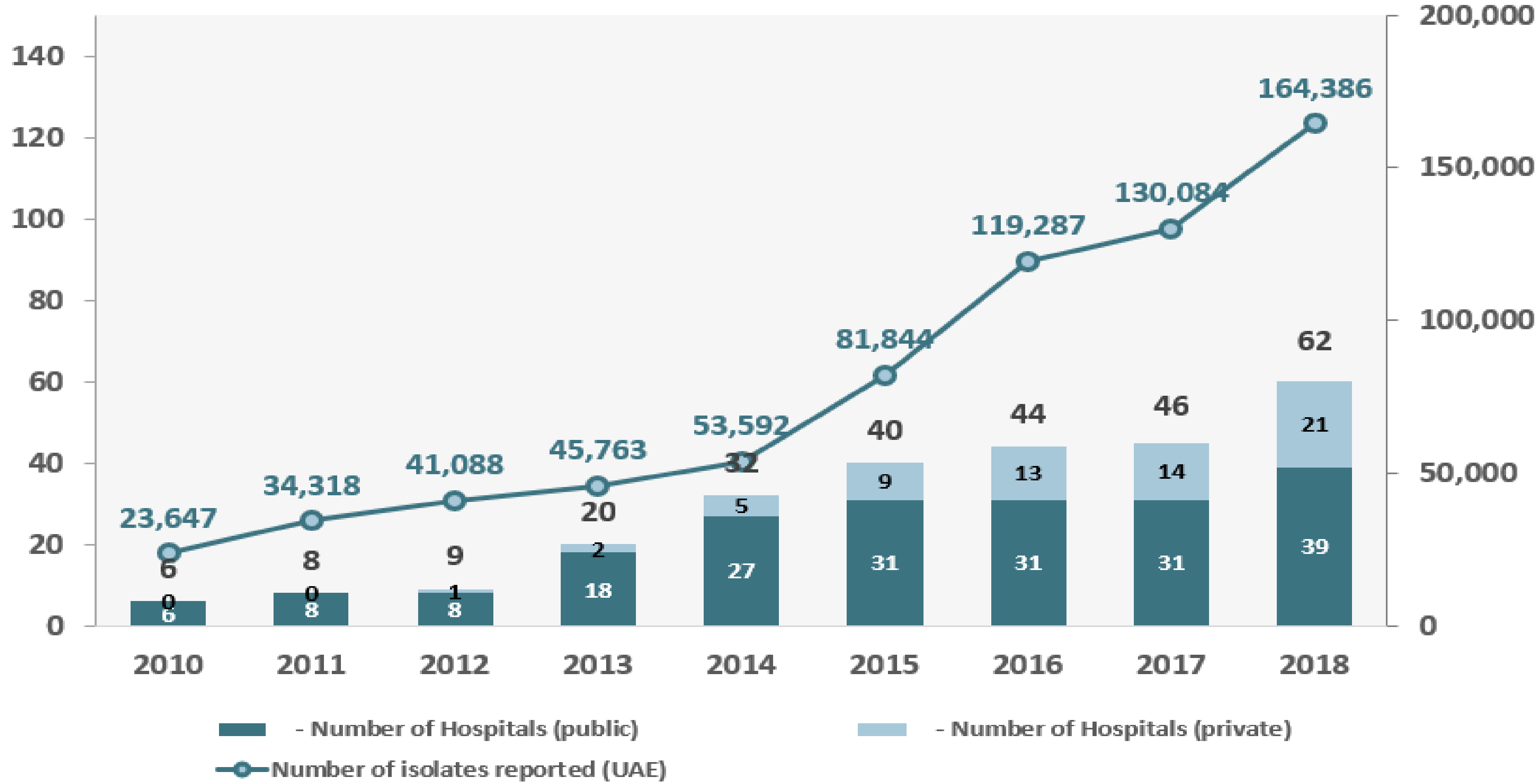


- All seven Emirates are represented

National AMR Surveillance System – Data collection

Number of Hospitals participating

Number of Isolates reported



UAE National AMR Surveillance System, 2019 [8]

National AMR Surveillance System – Data Analysis

Inclusion criteria:

- **Diagnostic isolates**
  (non-duplicate/first isolate per patient)

Exclusion criteria:

- Copy strains/multiple isolates
- Screening isolates (e.g. MRSA)
- Isolates from nose/axilla/groin
- Internal QC isolates (ATCC)
- External QC isolates (EQAS)
- Small sample size (N<10 isolates)
- Antibiotics not routinely tested

Isolates reported by Surveillance Sites (All isolates)

100%

- Quality control isolates
- Screening isolates
- Multiple isolates
- Environmental isolates
- …

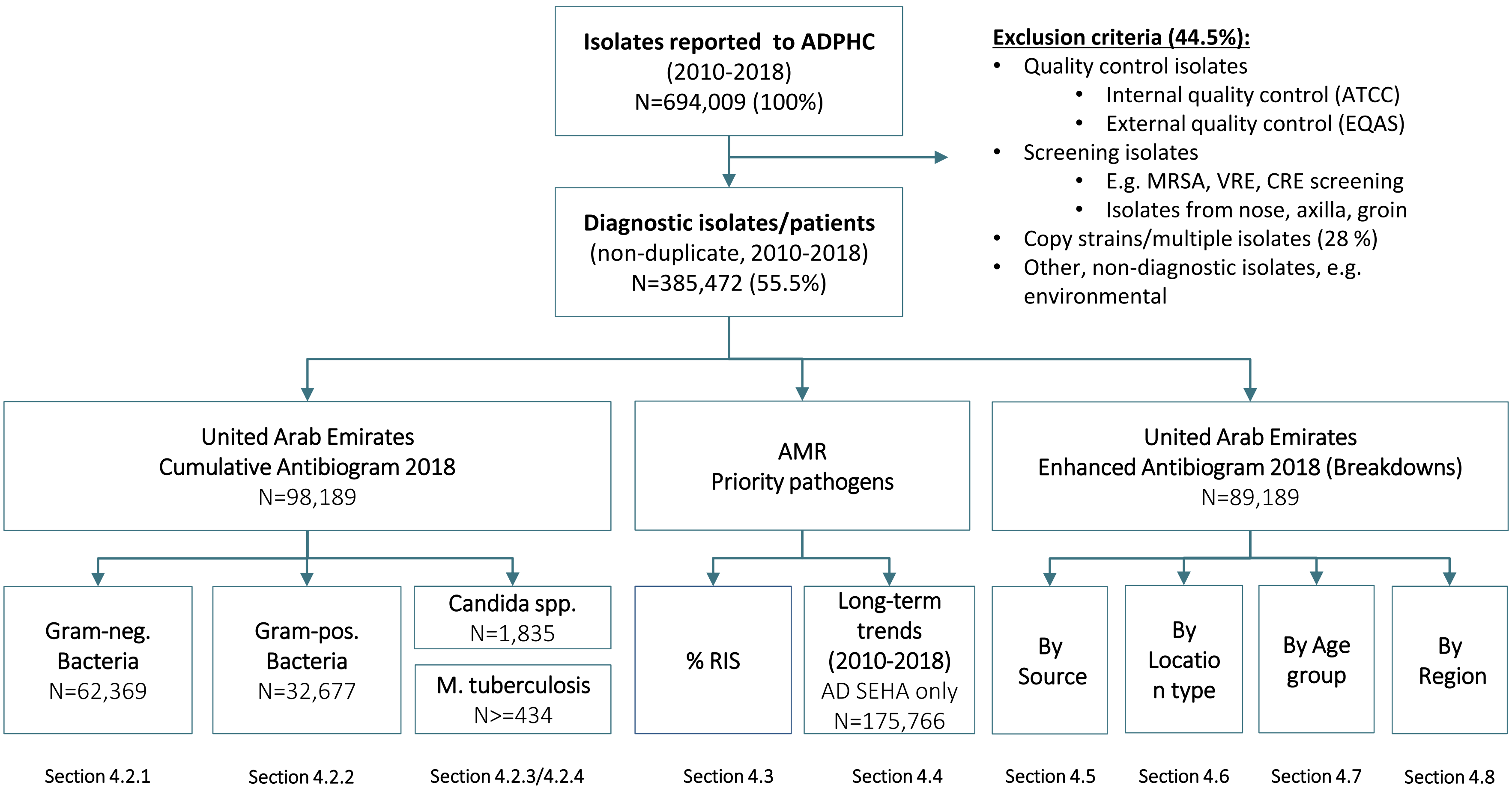
Diagnostic isolates (non-duplicate)

Data Analysis and Surveillance Reports

56%

UAE National AMR Surveillance System, 2019 [8]

UAE National AMR Surveillance System – Data Analysis and Reports

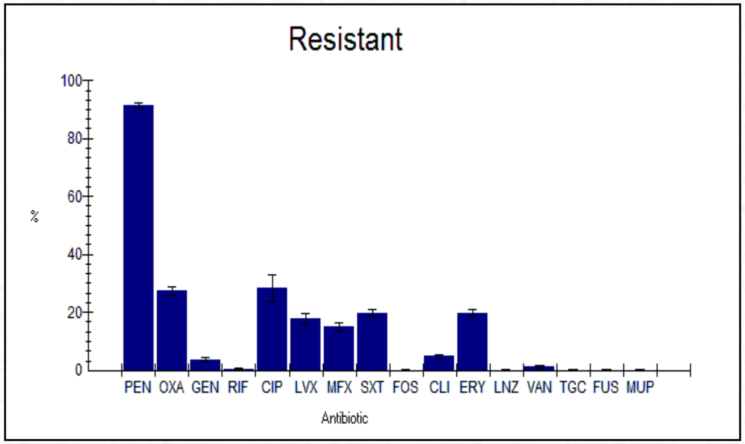


UAE National AMR Surveillance System, 2019 [8]

WHONET – Software for AMR Surveillance

WHONET 2019:

- Specialized software for AMR surveillance
- Developed by the **WHO Collaborating Center for AMR Surveillance**, Boston, USA
- Widely used:
  > 2,300 laboratories in
  > 120 countries
- Target audience:
  - Lab, Pharmacy, IPC, ID, Quality, PH/Epi
- Endorsed by WHO
- Free of charge
- Download: www.whonet.org
- Technical support & training:
  jthomsen@doh.gov.ae



WHONET, www.whonet.org [9]

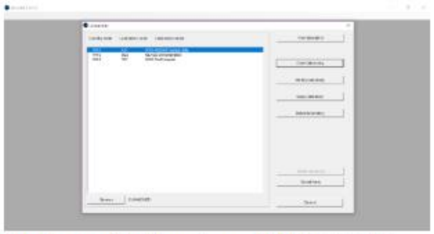
WHONET Home Page – www.whonet.org

WHONET

Software Documentation About Calendar Contact

The microbiology laboratory database software.

WHONET 2019



This is our NEW version of WHONET. It is a modernized version of WHONET 5.6. In addition to the standard WHONET 5.6 features, this version supports 26 languages and includes new features for exporting to the **WHO GLASS** data

WHONET WEB

This version of WHONET is still in development. In addition to the standard features of the desktop softwares, For U.S. facilities, WHONET WEB also supports monthly reporting to the CDC's NHSN project MDRO-CDI reporting module.

WHONET 5.6

This is the version of WHONET used in over 120 countries and 2,300 laboratories around the world. WHONET 5.6 is a desktop application written in Visual Basic 6 with support for 24 languages and 2019 CLSI and EUCAST breakpoints.

2. Epidemiology of AMR in the UAE

1. **UAE National Surveillance System for AMR**

2. **Epidemiology of AMR in the UAE**
   - **AMR Priority Pathogens**
   - **UAE National Antibiogram 2018**
   - **Long-term AMR trends**
   - **Breakdowns** (by Emirate/region, location type, …)
   - **Reporting** of AMR Data and statistics
   - How can Healthcare facilities participate?

3. **How can AMR surveillance data support Infection Control?**

UAE AMR Surveillance: AMR Priority Pathogens, 2018

Priority 1: CRITICAL*

Acinetobacter baumannii, carbapenem-resistant

Pseudomonas aeruginosa, carbapenem-resistant

*Enterobacteriaceae**, carbapenem-resistant, 3rd generation cephalosporin-resistant

Priority 2: HIGH*

Enterococcus faecium, vancomycin-resistant

Staphylococcus aureus, methicillin-resistant, vancomycin intermediate and resistant

Helicobacter pylori, clarithromycin-resistant

Campylobacter, fluoroquinolone-resistant

Salmonella spp., fluoroquinolone-resistant

Neisseria gonorrhoeae, 3rd generation cephalosporin-resistant, fluoroquinolone-resistant

Priority 3: MEDIUM*

Streptococcus pneumoniae, penicillin-non-susceptible

Haemophilus influenzae, ampicillin-resistant

Shigella spp., fluoroquinolone-resistant

[1]Salmonella spp.: non-typhoidal, non-stool isolates

United Arab Emirates (2018)**

Priority 1: CRITICAL

Organism	Antibiotic	N (patients)	% Res
A. baumannii	IPM or MEM	1,567	**32.8**
P. aeruginosa	IPM or MEM	6,427	**16.2**
Enterobacteriaceae	IPM or MEM	42,935	**4.4**
Enterobacteriaceae	ESBL	18,216	**34.3**

Priority: 2 HIGH

Organism	Antibiotic	N (patients)	% Res
Enterococcus faecium	Vancomycin	393	**11.5**
S. aureus	MRSA	14,952	**36.3**
Salmonella spp.[1]	Fluoroquinolones (CIP)	157	**39.5**
Neisseria gonorrhoeae	3rd gen. Ceph. (CRO)	129	**0**
Neisseria gonorrhoeae	Fluoroquinolones (CIP)	154	**81.2**

Priority 3: MEDIUM

Organism	Antibiotic	N (patients)	% Res
S. pneumoniae (oral)	Penicillin G, non-susc. (I+R)	1,081	**50.7**
S. pneumoniae (inv.)	Penicillin G, non-susc. (I+R)	1,081	**5.6**
H. influenzae	Ampicillin	983	**14.9**
Shigella spp.	Fluoroquinolones (CIP)	133	**42.9**

***WHO, 2017 [1]/Tacconelli 2017 [2] **UAE National AMR Surveillance, 2018. %Res = percent of isolates fully resistant**

UAE Cumulative Antibiogram, 2018: Gram-neg. Bacteria (%Susceptible)

High resistance to 3rd-gen. Cephalosporins

***K. pneumoniae* MEM-R: 6%**

***E. coli* Cipro-R: 36%**

High resistance to Cotrimoxazole

Gram-negative Bacteria	Isolates	β-Lactams												Aminoglycosides			FQ		Other				
		Penicillins				Cephalosporins					Carbapenems												
	(N)	AMP	AMC	SAM	TZP	FOX	CXM	CTX	CAZ	FEP	IPM	MEM	ETP	AMK	GEN	TOB	[illegible]	CIP	ATM	SXT	NIT	MNO	TCY
Gram-negative bacteria (all)	48,929	25	67	48	86	78	59	66	80	82	88	93	93	95	87	83		55	68	65	64	51	60
Haemophilus influenzae[1]	1,172	84	94	–	–	–	95	–	–	–	–	–	–	–	–	–	–	96	–	87	–	–	85
Enterobacteriaceae	37,472	25	68	–	90	81	63	69	–	83	92	97	96	98	88	84	–	71	77	65	66	54	55
Citrobacter koseri (diversus)	842	R	93	–	97	91	73	94	–	97	98	98	98	100	99	98	–	83	96	97	82	–	95
Enterobacter cloacae	1,240	R	R	R	83	R	R	76	–	90	89	98	91	99	93	92	–	72	84	85	38	–	90
Enterobacter aerogenes	796	R	R	R	83	R	R	79	–	95	62	97	97	100	96	93	–	94	89	100	18	–	88
Escherichia coli	20,846	33	74	–	92	89	64	64	–	80	99	99	98	99	87	84	–	44	73	57	93	–	55
Klebsiella pneumoniae	8,514	R	75	–	83	86	68	70	–	82	93	94	93	94	88	82	–	59	74	72	28	–	74
Klebsiella oxytoca	324	R	84	–	88	95	77	85	–	90	94	95	96	96	90	83	–	65	90	83	79	–	76
Morganella morganii	486	R	R	–	96	47	R	64	–	92	45	98	99	99	78	78	–	40	83	62	R	–	R
Proteus mirabilis	1,425	61	88	–	99	94	91	88	–	92	14	98	95	97	77	85	–	50	92	56	R	–	R
Providencia spp.	186	R	R	–	97	90	66	91	–	97	48	96	91	99	81	73	–	59	–	86	R	–	R
Salmonella spp. (non-typhoid)	668	87	95	–	98	–	–	96	–	99	–	–	–	–	–	–	–	?	–	94	59	–	–
Salmonella Typhi/Paratyphi	92	72	81	–	91	–	–	89	–	83	–	–	–	–	–	–	–	?	–	76	67	–	–
Serratia marcescens	982	R	R	R	93	R	R	90	–	97	84	97	97	100	97	89	–	79	96	96	R	–	57
Shigella spp.	108	41	72	–	98	–	–	65	–	88	–	–	–	–	–	–	–	51	–	49	95	–	–
Non-fermenting Gram-neg. rods	9,688	R	R	–	72	–	–	–	79	78	75	75	R	83	81	80	–	71	55	64	–	51	49
Acinetobacter baumannii	1,540	R	R	–	61	–	–	–	58	60	65	65	R	84	68	68	–	60	R	72	–	69	76
Pseudomonas aeruginosa	6,209	R	R	R	87	–	R	R	87	89	83	83	R	95	91	94	–	82	68	R	R	R	R
Stenotrophomonas maltophilia	803	R	R	R	R	–	–	R	65	17	R	R	R	R	R	R	–	2	R	87	–	95	R

[1] *H. influenzae*: LVX: 96 %S, CRO: 91 %S, AZM: 99 %S, CLR: 88 %S.

Pip/Taz still highly effective for Enterobacteriaceae and *P. aeruginosa*

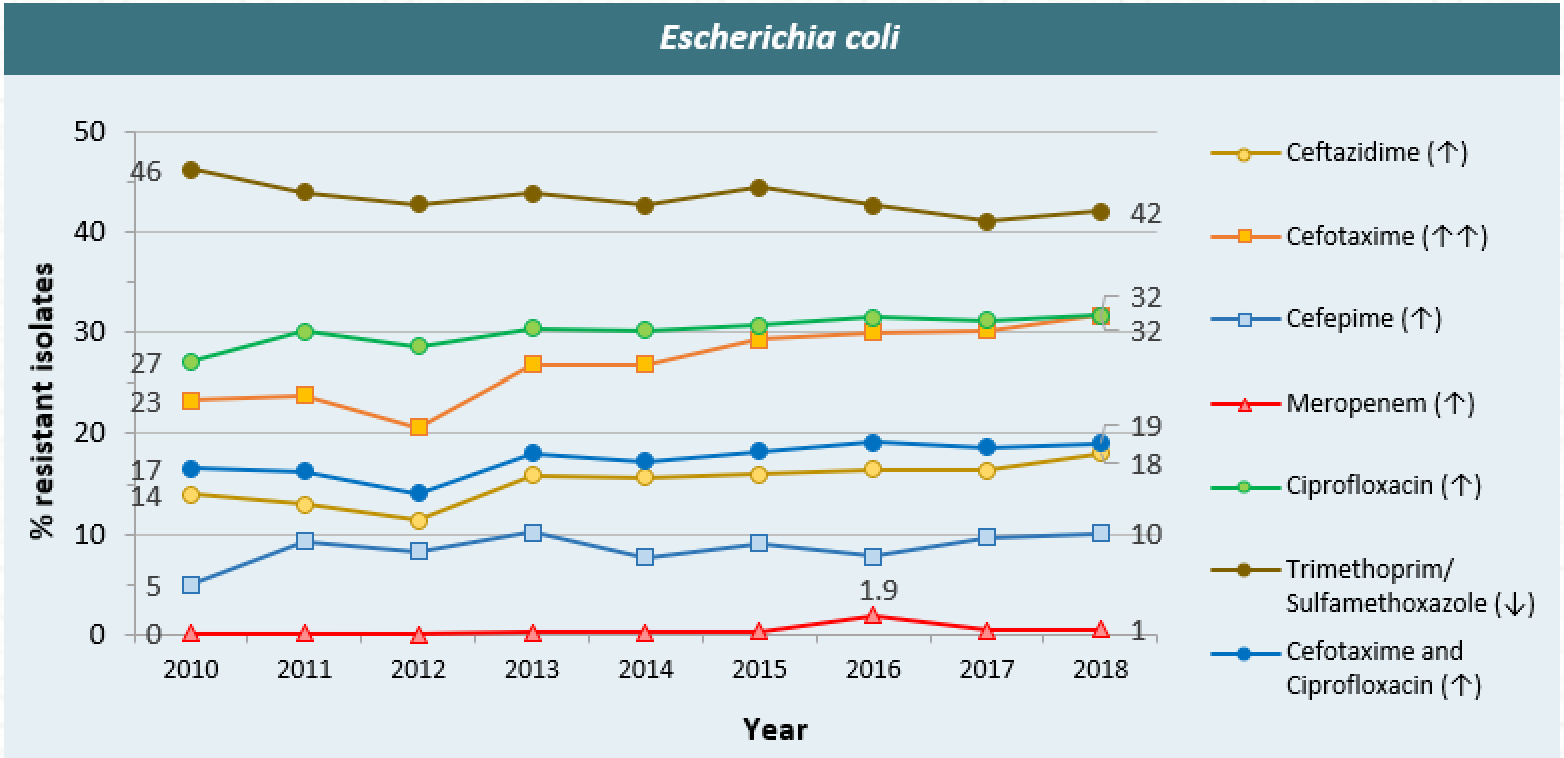
***A. baumannii* MEM-R: 35%**

	≥ 80% Susceptible
	70 to 79% Susceptible
	≤69% Susceptible
–	No data/not indicated
R	Intrinsic resistance (R)

UAE National AMR Surveillance System (2018) [8] n=48,929 isolates.
Note: preliminary data (53 out of 58 hospitals)

E. coli: Trend of Percentage Resistant Isolates (%R) Abu Dhabi, 2010-2018

Trend for percentage of resistance (%R) for *E. coli*, Abu Dhabi Emirate, 2010 – 2018



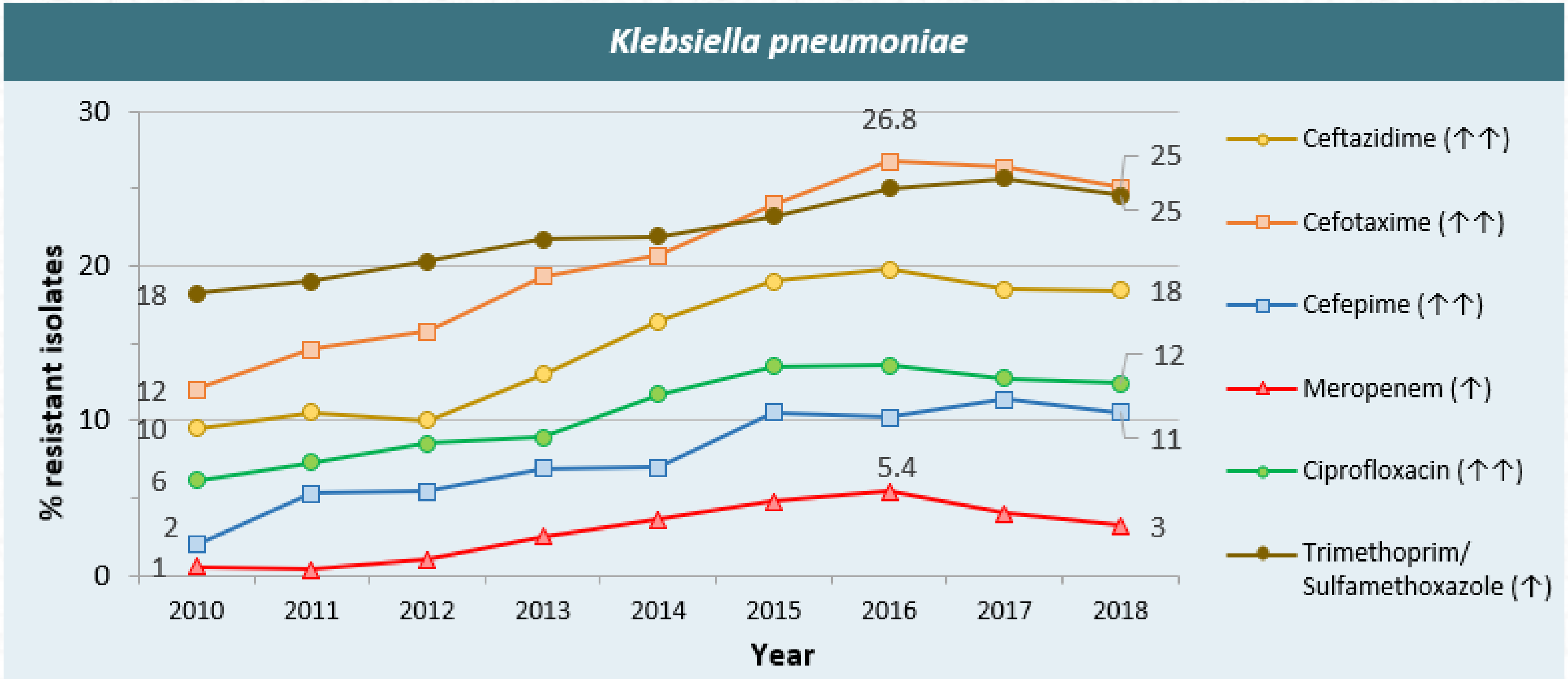
Increasing resistance trends:
- **3rd-gen. cephalosporins (CAZ ↑, CTX ↑)**
- **4th- gen. cephalosporins (FEP ↑)**
- **Carbapenems (IPM ↑, MEM ↑)**
- **Fluoroquinolones (CIP ↑)**

Decreasing resistance trends:
- **Trimethoprim-Sulfamethoxazole (SXT ↓↓)**

K. pneumoniae: Trend of Percentage Resistant Isolates (%R) Abu Dhabi, 2010-2018

دائـــرة الـصـحـة
DEPARTMENT OF HEALTH

Trend for percentage of resistance (%R) for *K. pneumoniae*, Abu Dhabi Emirate, 2010 – 2018



Increasing resistance trends:

- **3rd-gen. cephalosporins (CAZ ↑, CTX ↑)**
- **4th- gen. cephalosporins (FEP ↑)**
- **Carbapenems (IPM ↑, MEM ↑)**
- **Fluoroquinolones (CIP ↑)**
- **Trimethoprim-sulfamethoxazole (↑)**

Decreasing resistance trends:

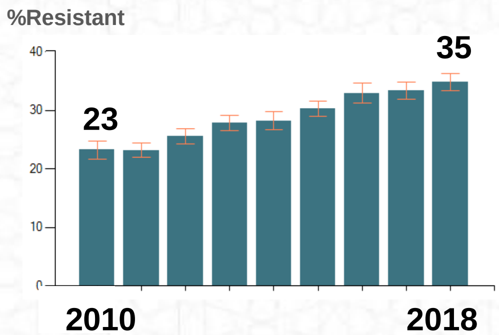
- **None**

Enterobacteriaceae: Trend of Resistance to Cephalosporins
Abu Dhabi Emirate (SEHA), 2010-2018

Percent of *Enterobacteriaceae* Isolates resistant to 2rd, 3rd, 4th generation Cephalosporins (%R), By Year, Abu Dhabi Emirate (SEHA), 2010-2018, N=91,866

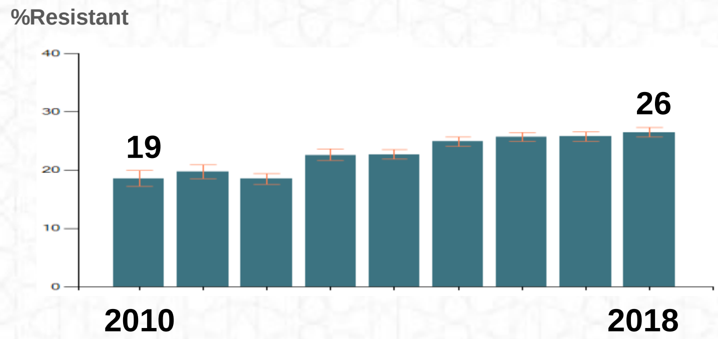
2nd gen.

Cefuroxime

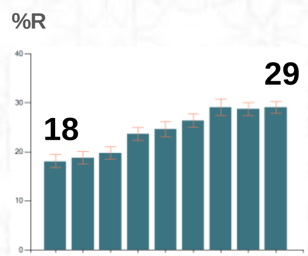


3rd gen.

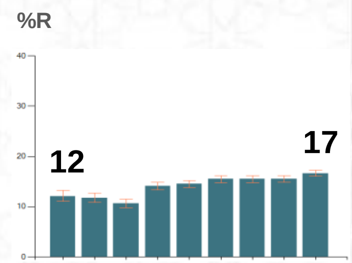
Cefotaxime / Ceftriaxone



Cefpodoxime

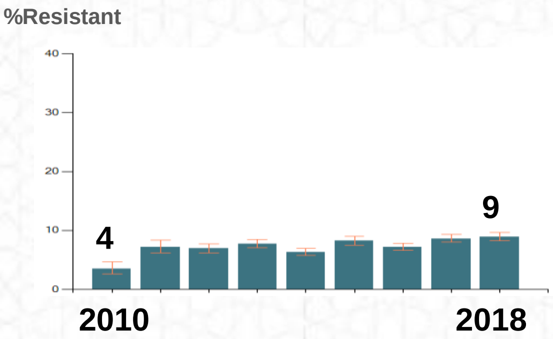


Ceftazidime



4th gen.

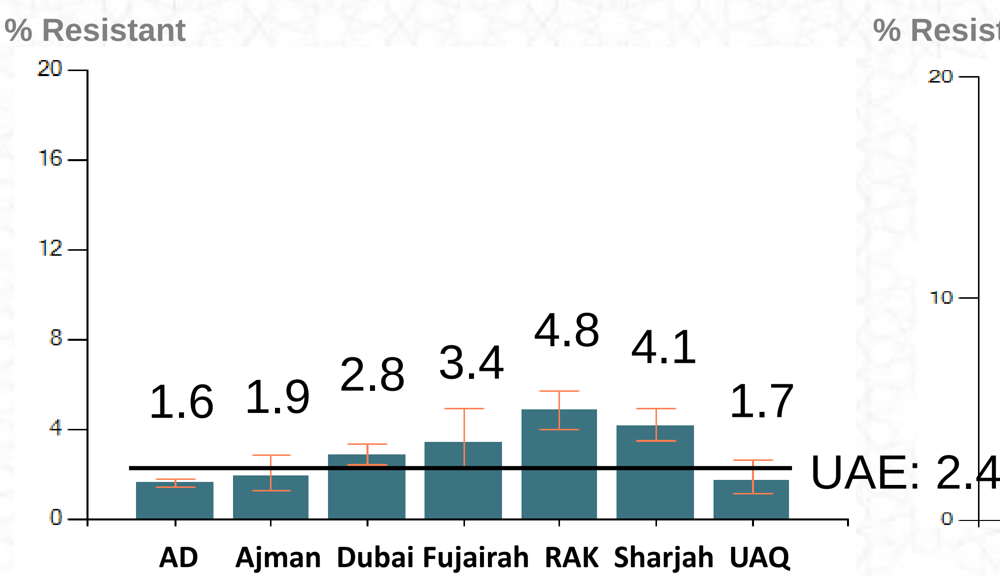
Cefepime



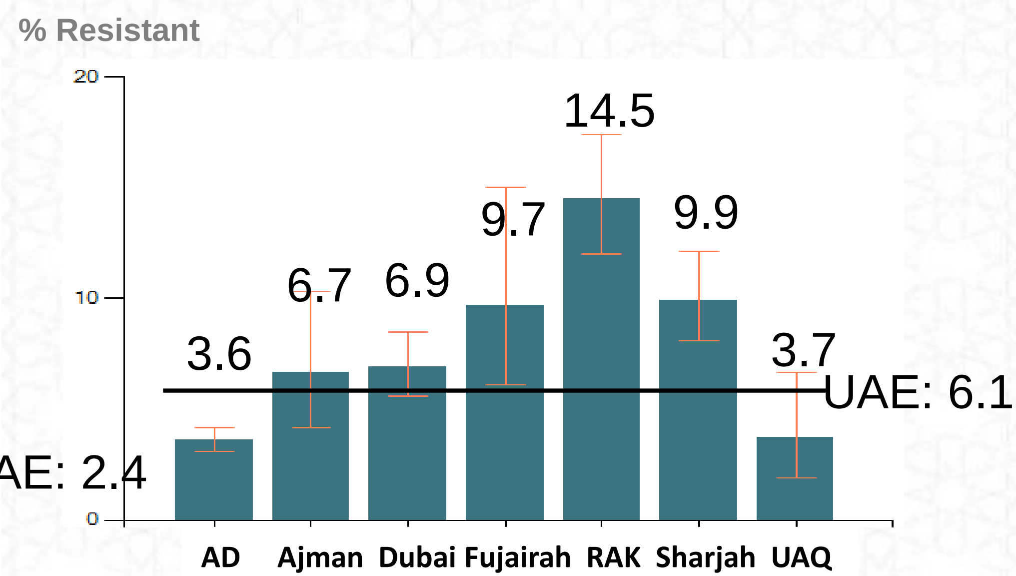
UAE National AMR Surveillance System, 2018 [8]

Enterobacteriaceae, Percent of Isolates resistant to Meropenem (CRE)
United Arab Emirates, 2018 - By Emirate

Enterobacteriaceae (All)



Klebsiella pneumoniae



Emergence of Carbapenem-resistant Enterobacteriaceae (CRE) Abu Dhabi Emirate (SEHA), 2010-2018

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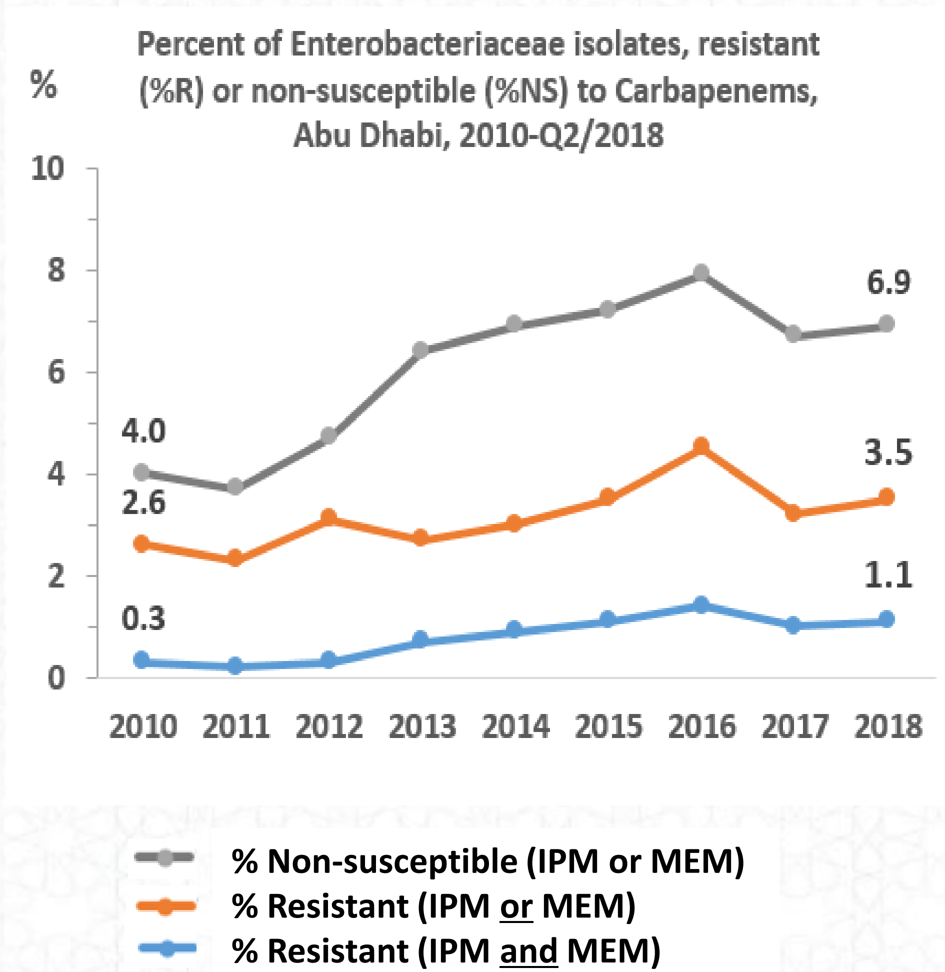
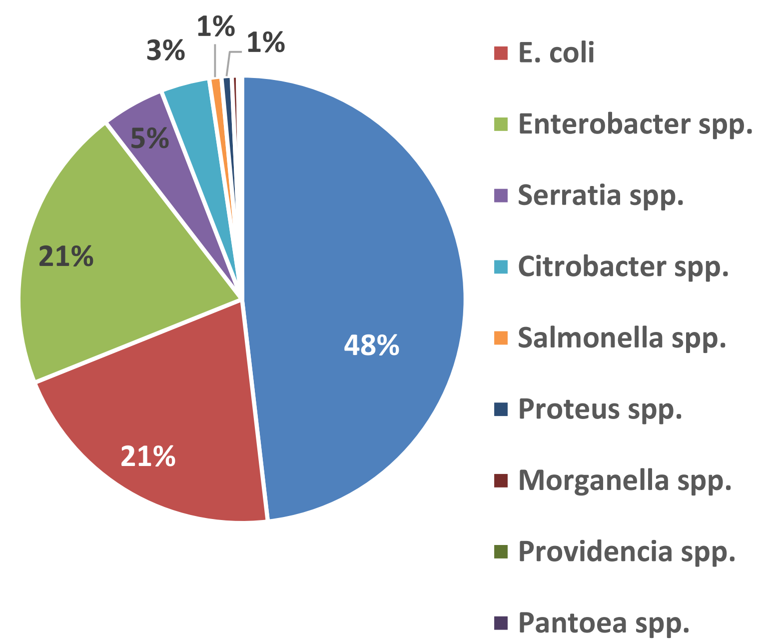
% CRE



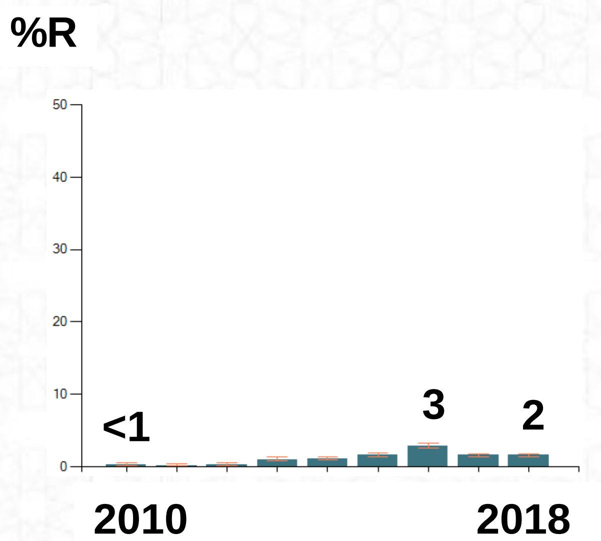
CRE, by species



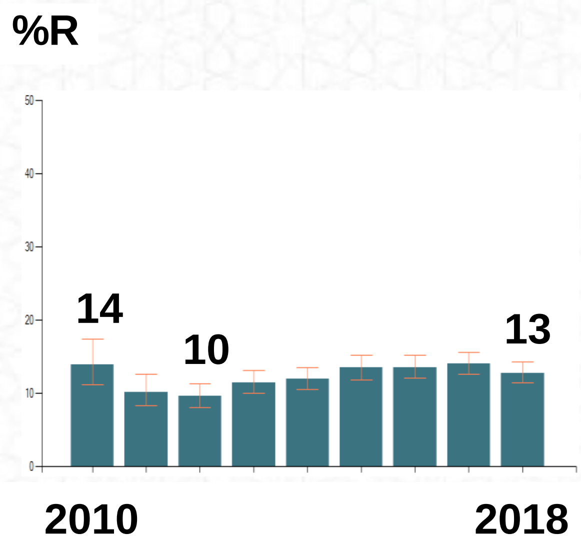
UAE National AMR Surveillance System, 2018 [8]

Enterobacteriaceae, *P. aeruginosa*, *A. baumannii*: Trend of Resistance to Carbapenems (Meropenem), Abu Dhabi Emirate (SEHA), 2010-2018

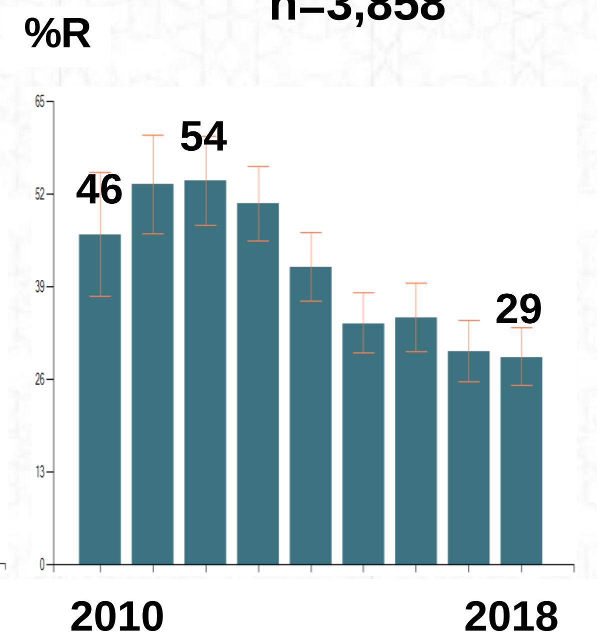
All Enterobacteriaceae
(%R, Meropenem)
n=91,866



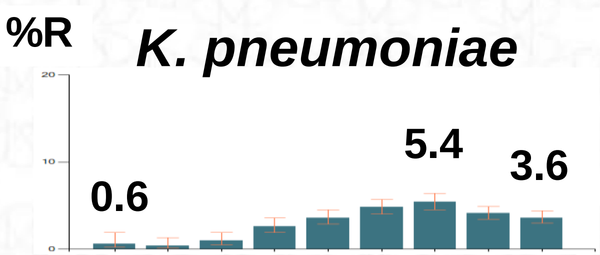
P. aeruginosa
(%R, Meropenem)
n=16,491



A. baumannii
(%R, Meropenem)
n=3,858



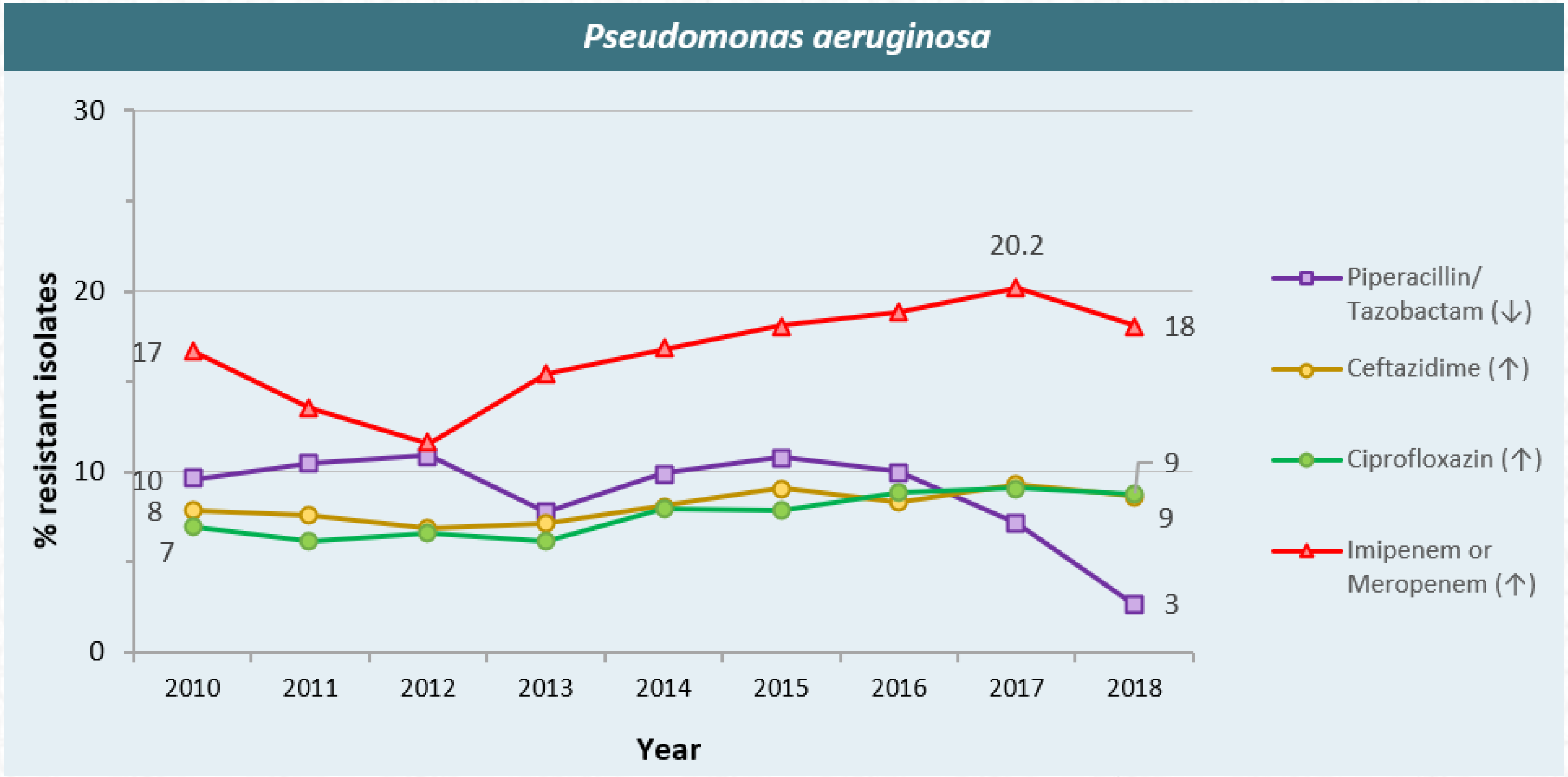
K. pneumoniae



UAE National AMR Surveillance System, 2018 [8]

P. aeruginosa: Trend of percentage resistant Isolates (%R) Abu Dhabi Emirate (SEHA), 2010-2018

Trend for percentage of resistance (%R) for *P. aeruginosa*, Abu Dhabi Emirate, 2010 – 2018



Increasing resistance trends:

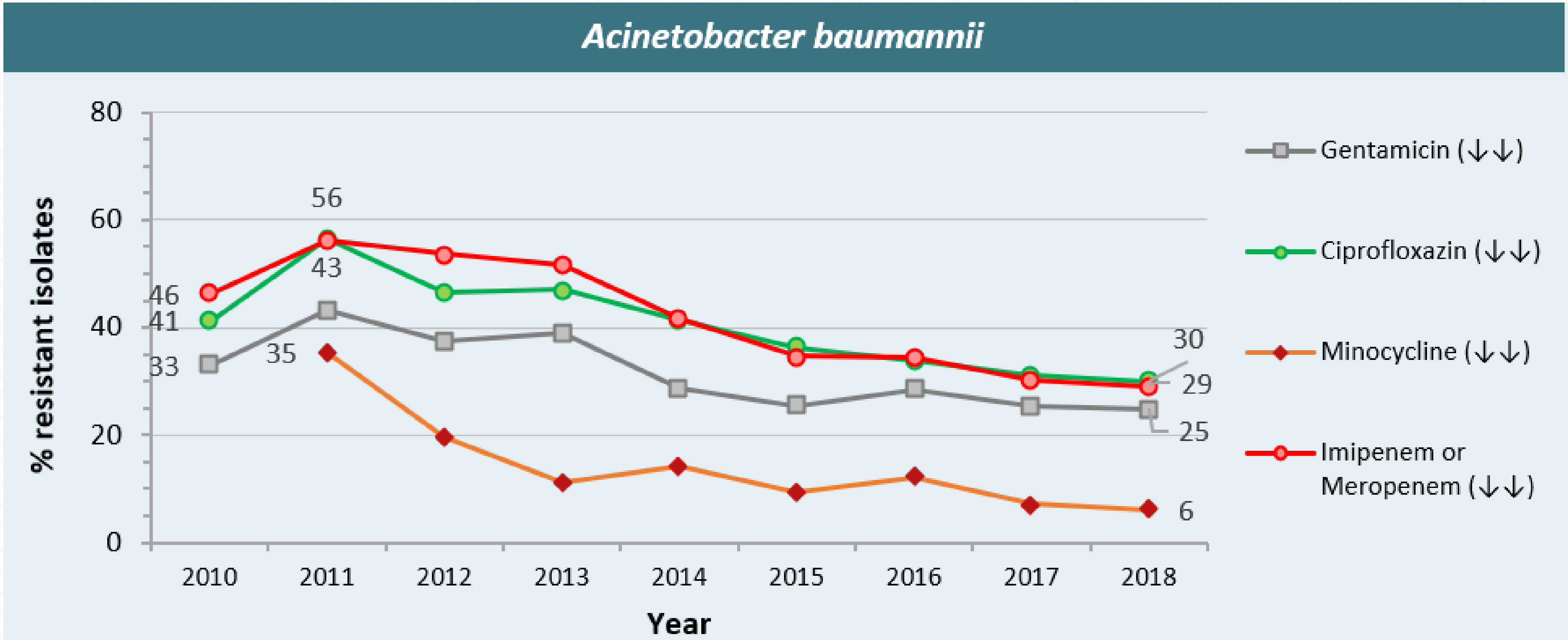
- **3rd-gen. cephalosporins (CAZ ↑)**
- **Carbapenems (IPM ↑↑, MEM ↑)**
- **Fluoroquinolones (CIP ↑)**

Decreasing resistance trends:

- **Piperacillin-Tazobactam (TZP ↓)**

A. baumannii: Trend of percentage resistant Isolates (%R) Abu Dhabi Emirate (SEHA), 2010-2018

Trend for percentage of resistance (%R) for *A. baumannii*, Abu Dhabi Emirate, 2010 – 2018



Increasing resistance trends:

- **None**

Decreasing resistance trends:

- **Aminoglycosides (AMK↓↓, GEN ↓↓)**
- **Fluoroquinolones (CIP ↓↓)**
- **Carbapenems (IPM/MEM ↓ ↓)**
- **Tetracyclines (TCY ↓↓, MNO ↓↓)**

UAE Cumulative Antibiogram, 2018: Gram-pos. Bacteria (%Susceptible)

MRSA 36%

Erythromycin highly resistant

Staph. spp. and Enterococcus spp.: High resistance to fluoroquinolones

Gram-positive Bacteria	Isolates	β-Lactams						Macrolides		AG	FQ		Glycopept.		Other					
	(N)	AMP	PEN	AMC	OXA	CRO	CTX	ERY	CLI	GEN	LVX	MFX	VAN	TEC	SXT	NIT	LNZ	TCY	RIF	QDA
Gram-positive organisms (all)	29,191	86	39	–	55	–	–	52	80	86	74	61	99	98	66	97	99	64	98	72
Enterococcus spp.	3,764	90	–	–	–	R	R	8	R	R	67	60	98	98	R	90	97	–	–	–
Enterococcus faecalis	3,140	99	–	–	–	R	R	7	R	R	72	64	99	99	R	98	97	–	–	R
Enterococcus faecium	406	22	–	–	–	R	R	4	R	R	16	18	89	89	R	29	98	–	–	89
Staphylococcus aureus	11,579	–	–	64[2]	64	–	–	72	89	89	66	68	100	100	75	99	100	87	100	83
MSSA	7,933	–	–	100[4]	100	–	–	78	92	93	70	72	100	100	77	100	100	88	100	86
MRSA	3,758	–	–	–	–	–	–	60	84	80	58	60	100	100	70	98	100	84	99	70
Coagulase-neg. staphylococci (CNS)	3,197	–	–	27[2]	27	–	–	30	68	75	58	59	100	100	76	98	98	80	94	89
Streptococcus pneumoniae	1,331	–	97[3]	–	–	98[3]	98[3]	52	73	–	94	98	100	–	61	–	100	58	100	99
Streptococcus pyogenes (GAS)	1,988	100[4]	100	–	–	93	96	65	90	–	89	–	100	–	–	–	100	82	–	–
Streptococcus agalactiae (GBS)	4,215	99	98	–	–	100	98	47	74	–	87	–	99	–	–	96	100	13	–	99
Streptococcus spp. (viridans group)	674	–	62	–	–	88	89	50	76	–	85	–	98	–	–	–	99	60	–	–

[2]Extrapolated, based on oxacillin. [3]Pen G (non-meningitis breakpoints). Pen G (meningitis breakpoints): 43.8 %S. Pen G (oral breakpoints): 43.8 %S). [4]Extrapolated, based on penicillin.

(green)	≥ 80% Susceptible
(yellow)	70 to 79% Susceptible
(red)	≤69% Susceptible
–	No data/not indicated
R	Intrinsic resistance (R)

S. pneumoniae 97 % susceptible to PEN

Vancomycin-resistant E. faecium (VRE): 11%

Linezolide highly effective

UAE National AMR Surveillance System (2018) [8], n=29,191 isolates.
Note: preliminary data (53 out of 58 hospitals)

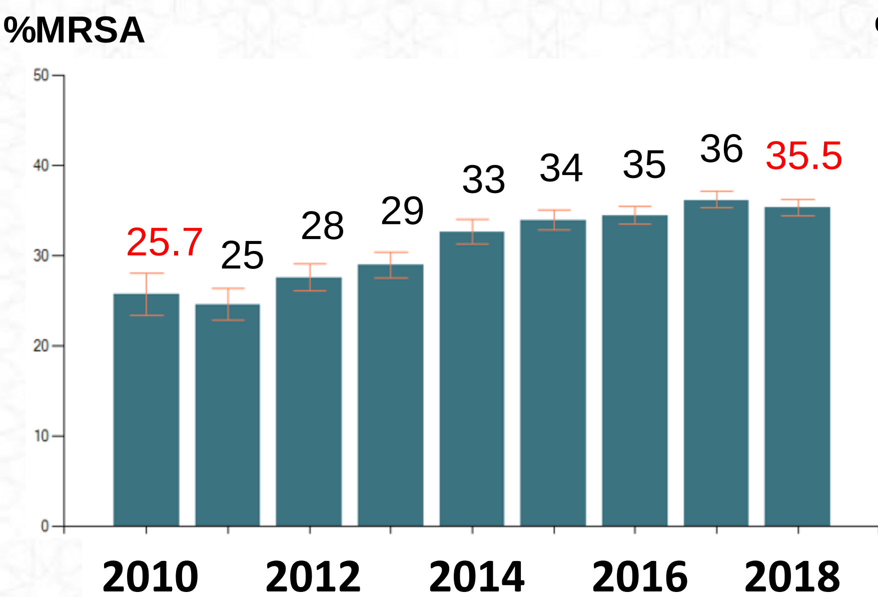
S. aureus (%MRSA), United Arab Emirates, 2010-2018

Staph. aureus, Percent of Isolates resistant to Oxacillin (%MRSA)

Trend, By Year, 2010-2018

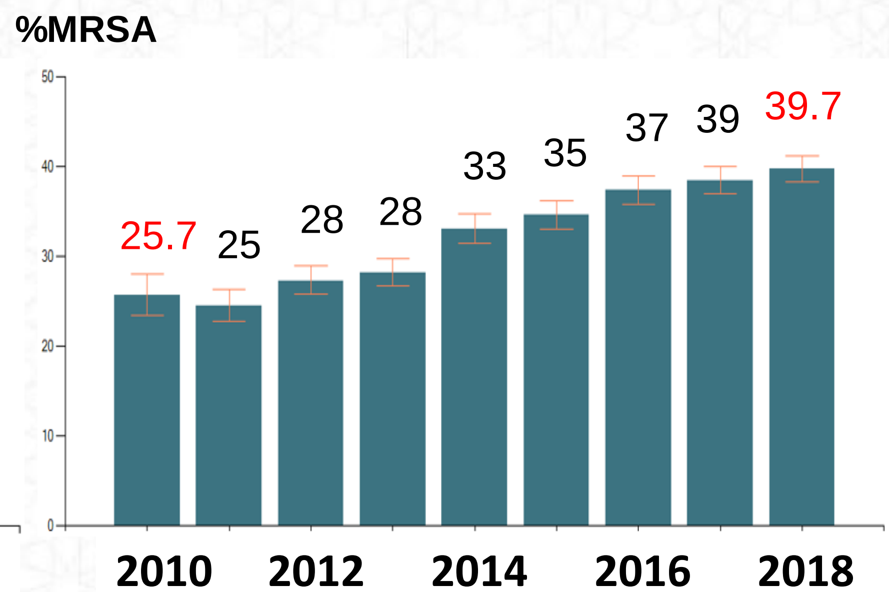
United Arab Emirates

n=56,448

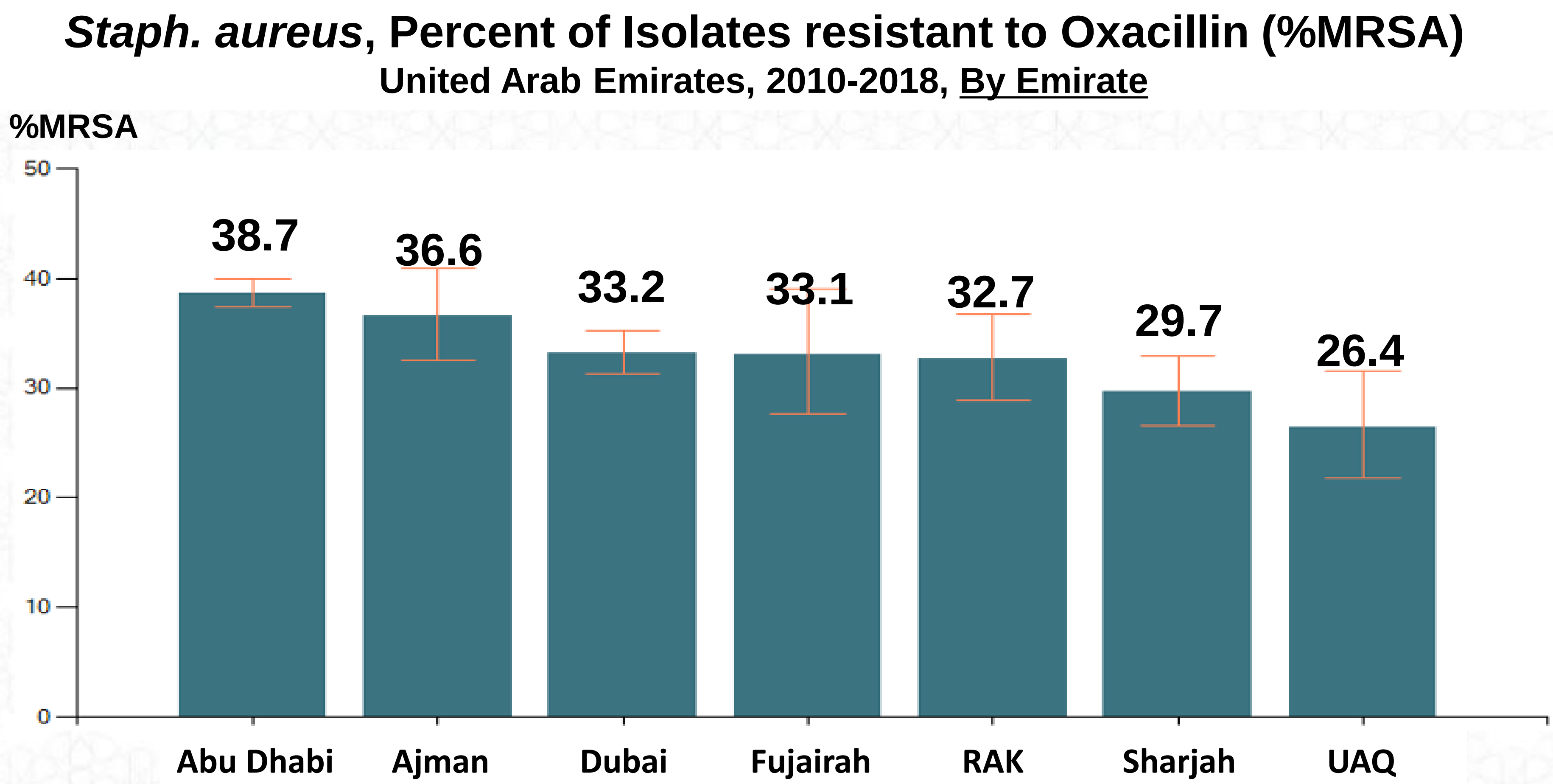


Abu Dhabi Emirate (SEHA only)

n=30,196



S. aureus: Percentage (%) MRSA, UAE, 2018 – by Emirate



UAE National AMR Surveillance System, 2018 [8]

S. aureus: Trend of percentage resistant Isolates (%R) Abu Dhabi Emirate (SEHA), 2010-2018

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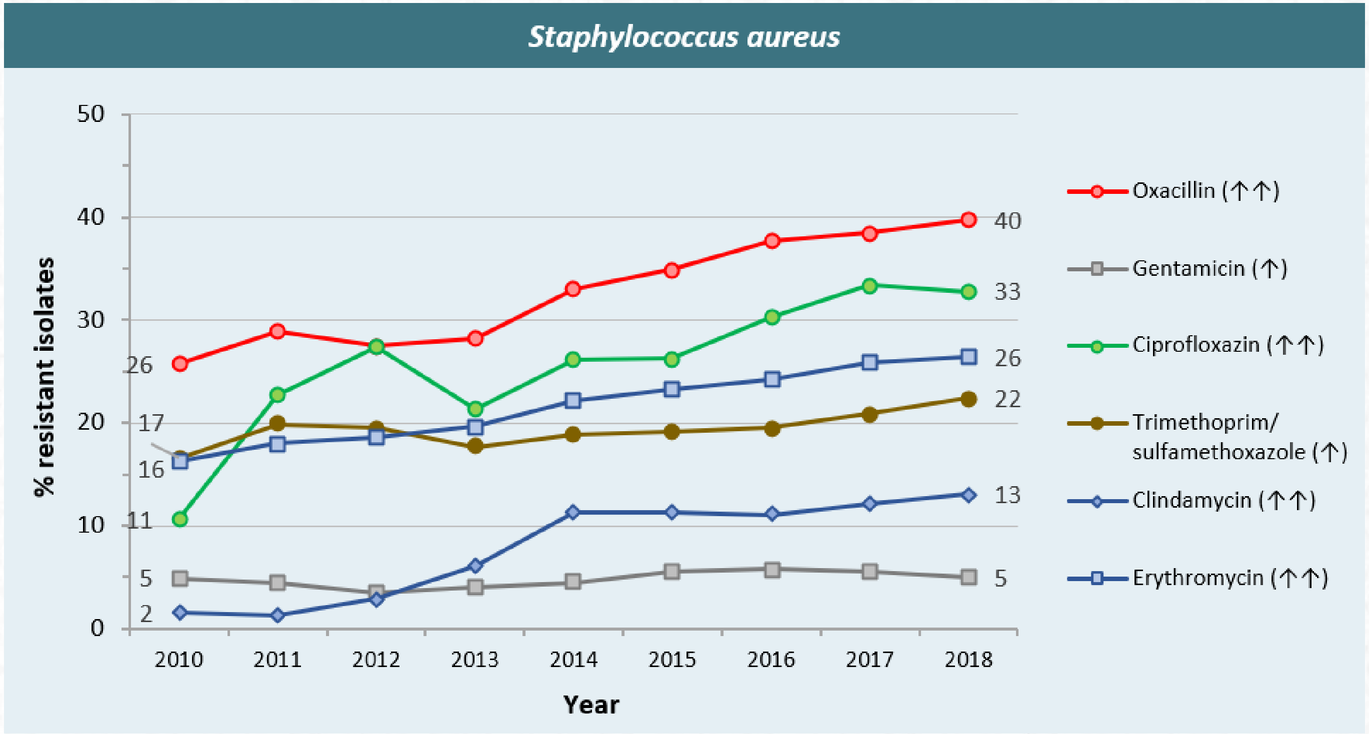
Trend for percentage of resistance (%R) for *S. aureus*, Abu Dhabi Emirate, 2010 – 2018



Increasing resistance trends:

- **All beta-lactam antibiotics (MRSA ↑↑)**
- **Aminoglycosides (GEN ↑)**
- **Fluoroquinolones (CIP ↑)**
- **Trimethoprim-sulfamethoxazole (SXT ↑)**
- **Macrolides (ERY ↑)**
- **Lincosamides (CLI ↑)**

Decreasing resistance trends:

- **None**

S. pneumoniae: Trend of percentage resistant Isolates (%R) Abu Dhabi Emirate, 2010-2018

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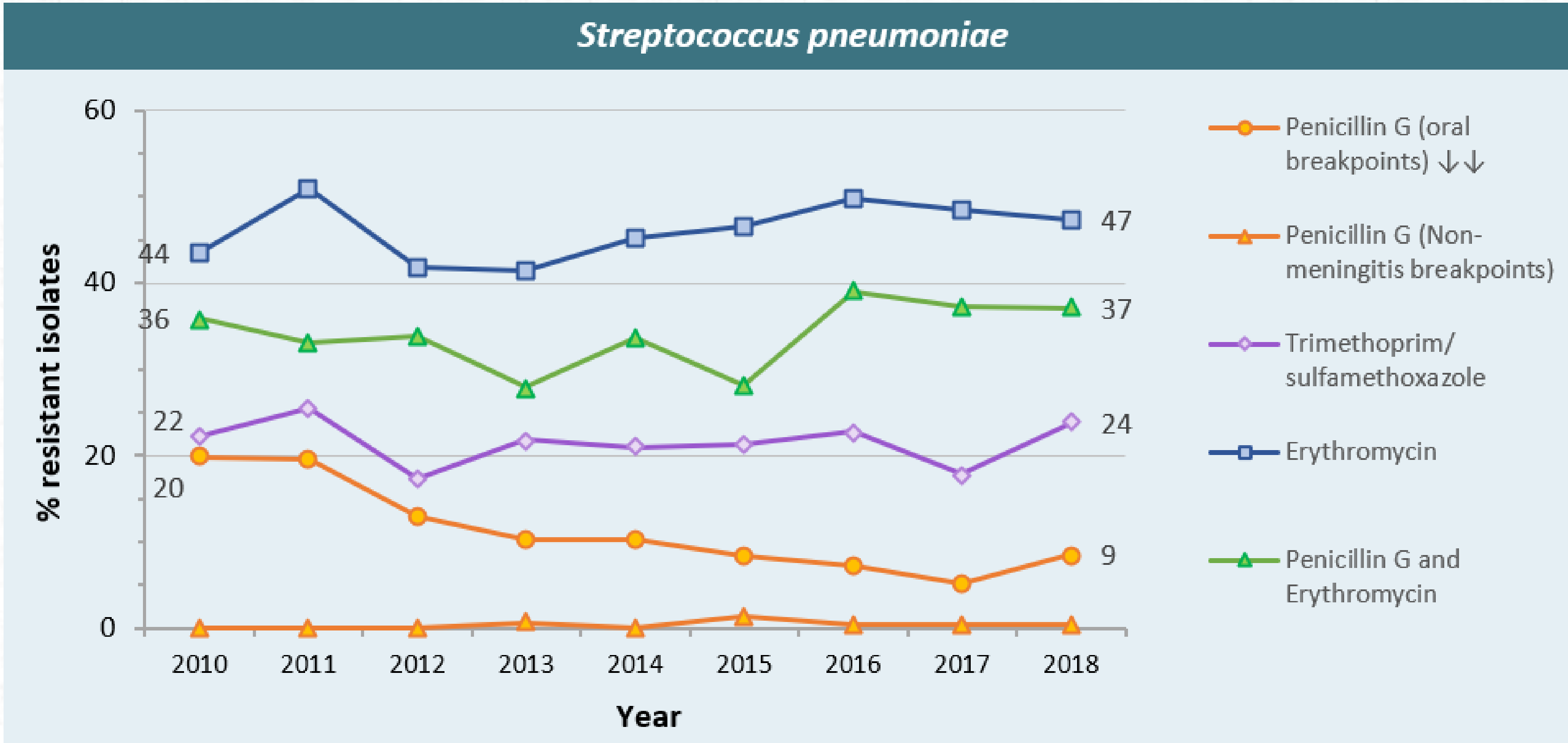
Trend for percentage of resistance (%R) for *S. pneumoniae*, Abu Dhabi Emirate, 2010 – 2018



Increasing resistance trends:

- **None**

Decreasing resistance trends:

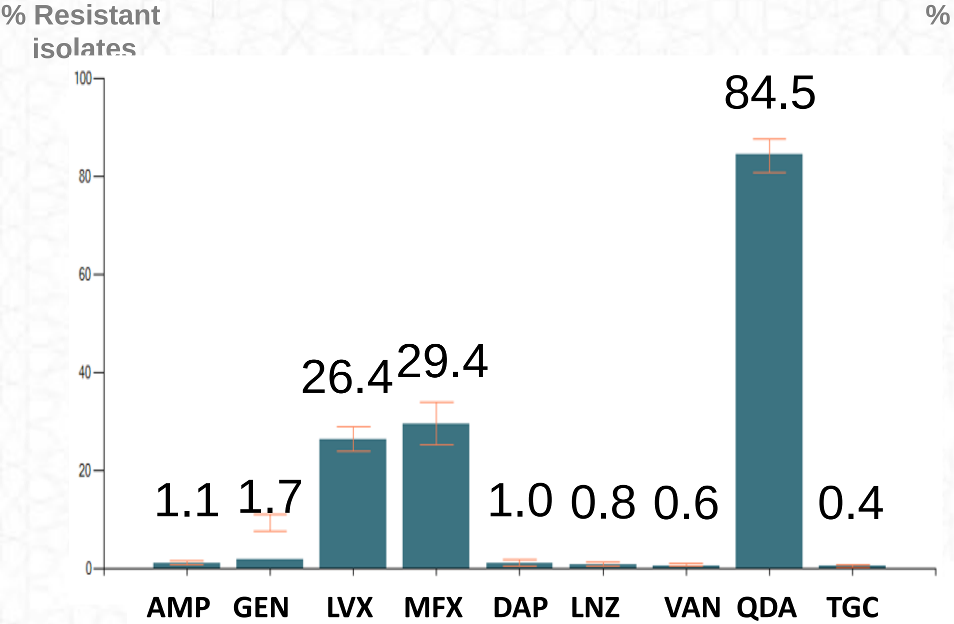
- **Penicillin (PEN ↓↓)**

E. faecalis and faecium, Percent of Isolates resistant

United Arab Emirates, 2018, n=3,546

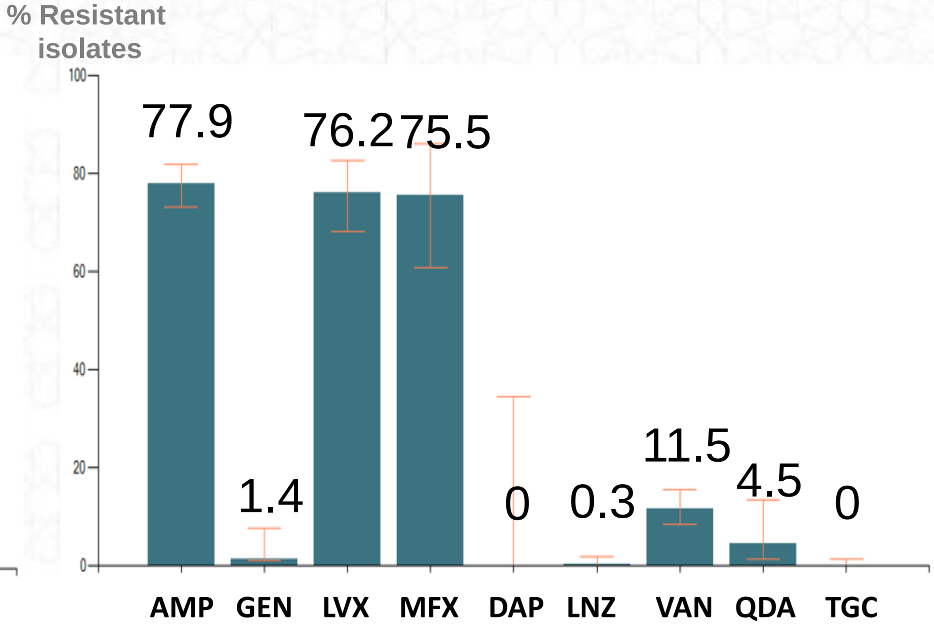
Enterococcus faecalis

n=3,140



Enterococcus faecium

n=406



Note: preliminary data (53 out of 58 hospitals)

UAE Cumulative Antibiogram, 2018: Candida spp.

Candida spp., Percent of Isolates Susceptible (%S)
United Arab Emirates, 2018

	Isolates (N)	Isolates (%)	Triazoles		Polyenes	Echinocandins		Other
			FLU	VOR	AMB [a]	CAS [b]	MIF	FCT
Candida spp.	1,814	100	76	71	–	81	89	96
Candida albicans	880	49	87	89	–	97	99	98
Candida spp. (non-albicans)	934	51	66	55	–	–	–	94
Candida tropicalis	353	19	96	96	–	100	100	97
Candida parapsilosis	174	10	58	73	–	100	100	100
Candida glabrata	161	9	–	– [c]	–	–	100	100
Candida lusitaniae	56	3	96	–	–	–	–	–
Candida krusei	42	2	R [d]	100	–	91	100	–
Candida dubliniensis	23	1	91	–	–	–	–	–
Candida haemulonii	10	1	0	–	–	–	–	–
Candida kefyr (pseudotropicalis)	10	1	90	–	–	–	–	–
Other	105	11	–	–	–	–	–	–

	≥ 80% Susceptible
	70 to 79% Susceptible
	≤69% Susceptible
–	No data/not indicated
R	Intrinsic resistance (R)

UAE National AMR Surveillance System (2018) [8], n=1,814 Candida spp. isolates.
Note: preliminary data (53 out of 58 hospitals)

Reporting of UAE AMR Data – Public Health Surveillance Reports

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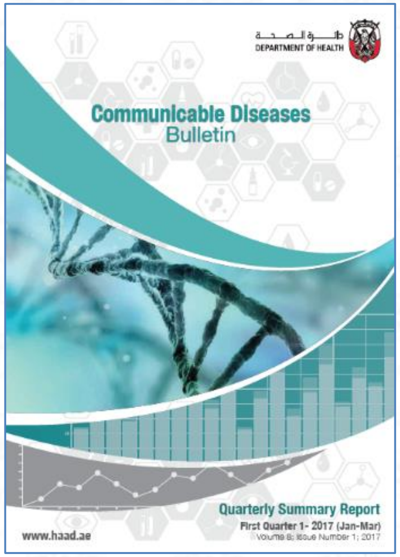
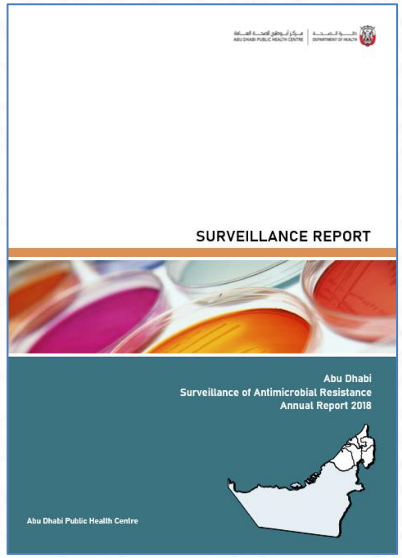
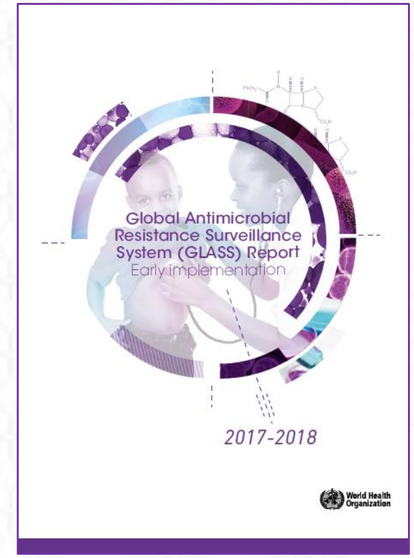




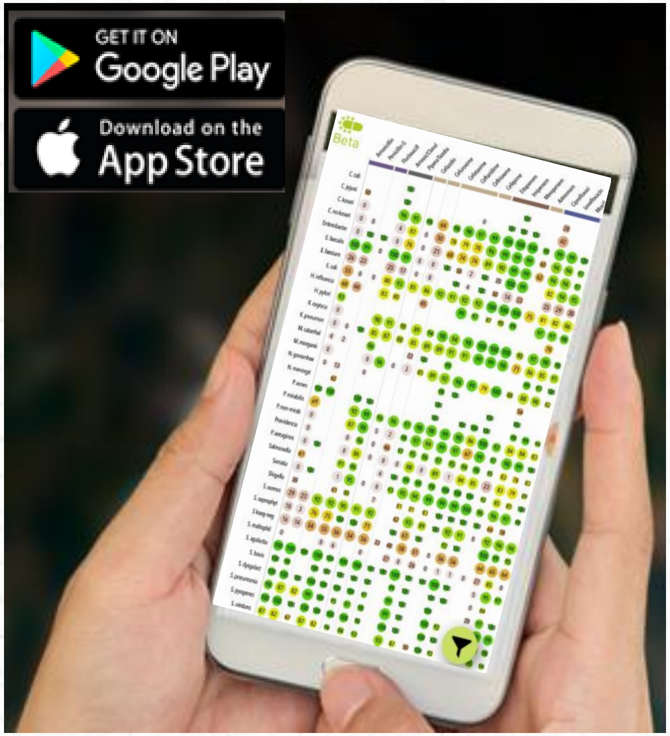


	Abu Dhabi	Abu Dhabi	UAE	WHO GLASS
Level:	Emirate	Emirate	National	Global
Frequency:	Quarterly	Annual	Annual	Annual
Status:	Published	Draft	Draft	Published
Available at:	www.doh.gov.ae			www.who.int/glass

UAE Cumulative Antibiogram
Interactive, ‘Open data‘ reporting

Website

Mobile App



UAE National AMR Surveillance System, 2019 [8]

How can UAE Healthcare Facilities participate in National AMR Surveillance?

- By invitation
- By expression of interest

Requests on participating Surveillance Site Laboratories:

- Facility management approval and nomination of focal points
- Availability of AMR data (lab+clinical), in electronic format
- Facility uses a recognized quality management (QM) system
- Laboratory participates in a **proficiency testing** scheme that covers antimicrobial susceptibility testing

UAE National AMR Surveillance: Requirements / Benefits for participating Facilities

Reasons to participate / expected benefits:

- Supporting the Health Authorities and the UAE Higher Committee for AMR
- Membership in the official UAE AMR surveillance network
- Receiving support and guidance on local AMR surveillance, cumulative antibiograms etc.
- Receiving technical training on WHONET software
- Benchmarking local data with national AMR data
- *"Being part of the solution, not of the problem only"*
- Prestige / 'feather in the cap'

2. Epidemiology of AMR in the UAE

1. UAE National Surveillance System for AMR
2. Epidemiology of AMR in the UAE

3. How can AMR surveillance data support IPC?
   - Line listings
   - Epi curves
   - Isolate alerts
   - Resistance profiles
   - Detection of clusters and potential HAI outbreaks

Line listings (Example: MRSA – by Location and Date)

Line Listing (Example: MRSA – by Location and Date)

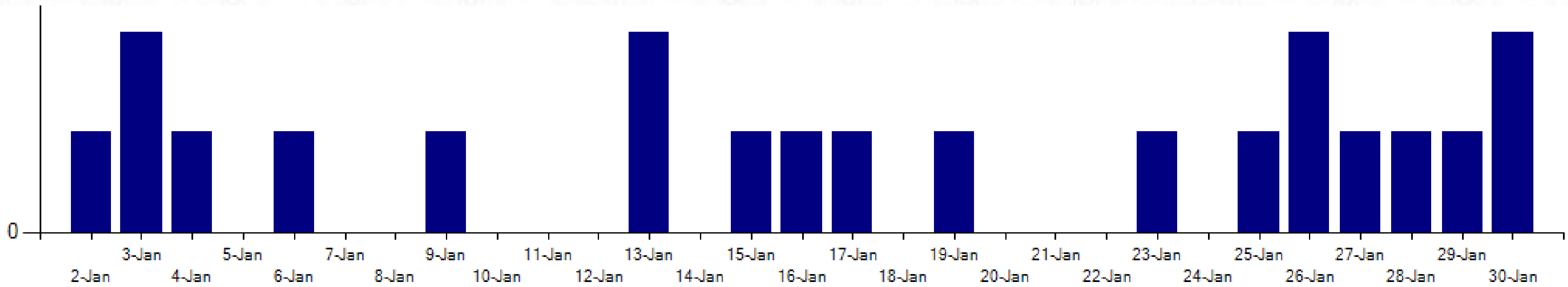
Location (Ward) **Specimen date** **Organism: S. aureus** **Oxacillin: Resistant**

Identification number	Location	Specimen number	Specimen date	Specimen type	Organism	PEN	ERY	NIT	CLI	OXA	GEN	VAN	SXT	AMC	CIP
_0448084085_	id	_5863219246_	1/27/1995	wd	sau	R	S		S	R	S	?	S	R	S
_0844575655_	med2	_0160995773_	1/25/1995	sp	sau	R	R		R	R	S	?	S	R	R
_0844575655_	op	_0160995773_	1/25/1995	ur	sau	R	R	S	S	R	I	?	R	R	R
_1013605973_	op	_9165335901_	1/30/1995	sp	sau	R	S		S	R	S	?	S	R	S
_1137685856_	op	_5108867058_	1/13/1995	ur	sau	R	R	S	R	R	R	?	R	R	R
_1238843072_	op	_4268300617_	1/26/1995	wd	sau	R	S		S	R	S	?	S	R	S
_1238843072_	op	_4268300617_	1/26/1995	ur	sau	R	R	S	R	R	R	?	R	R	R
_1346406050_	oncol	_2253236234_	1/6/1995	ur	sau	R	R	S	R	R	R	?	R	R	R
_1363680930_	other	_7947819653_	1/26/1995	th	sau	R	S		S	R	S	?	S	R	I
_1412374929_	oncol	_9806413557_	1/17/1995	wd	sau	R	R		R	R	S	?	S	R	S
_1608132686_	card	_7019045586_	1/9/1995	sp	sau	R	R		R	R	S	?	S	R	R
_2109398192_	med1	_9565564435_	1/4/1995	wd	sau	R	R		S	R	S	?	S	R	I
_2232381088_	neuro	_5196466391_	1/23/1995	bf	sau	R	I		S	R	S	?	S	R	I
_2935800012_	er	_4096729397_	1/30/1995	wd	sau	R	S		S	R	S	?	S	R	S
_3394747373_	csurg	_5308772735_	1/3/1995	wd	sau	R	R		S	R	S	?	S	R	S
_3517258939_	er	_9598120009_	1/15/1995	ur	sau	R	I	I	S	R	S	?	S	R	I
_4025261715_	icu1	_4933799159_	1/19/1995	sp	sau	R	R		R	R	S	?	S	R	S
_5068601306_	oncol	_2749692996_	1/13/1995	sp	sau	R	R		R	R	R	?	R	R	R
_6349570905_	er	_0933629741_	1/2/1995	wd	sau	R	S		S	R	S	?	S	R	S
_6986161054_	card	_4461109465_	1/16/1995	ur	sau	R	I	S	S	R	S	?	S	R	S
_7300786709_	med2	_0426656102_	1/28/1995	sp	sau	R	R		R	R	S	?	S	R	R
_9131310861_	er	_3862228385_	1/29/1995	ur	sau	R	S	S	S	R	S	?	S	R	R
_9876786254_	med1	_3984609303_	1/3/1995	wd	sau	R	R		R	R	S	?	S	R	R

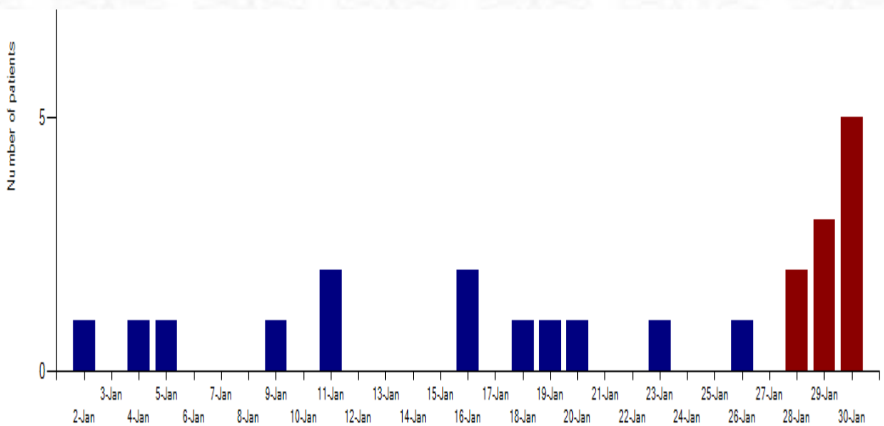
WHONET, www.whonet.org [9]

Epi Curves, obtained from AMR Surveillance data

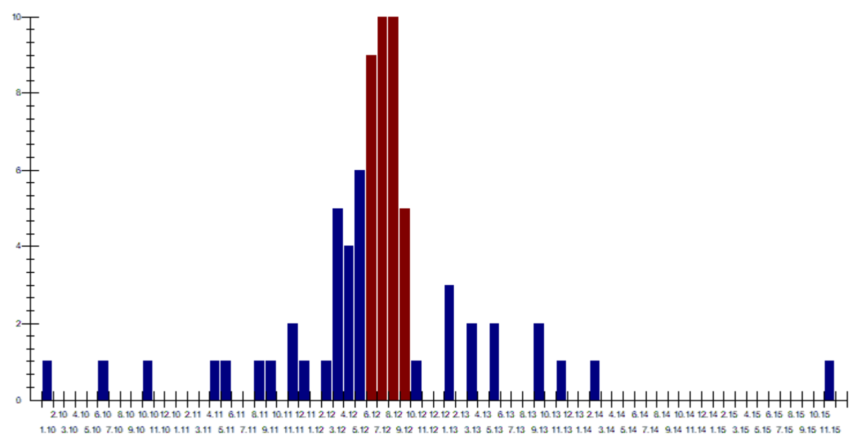
Outbreak visualization / Epi Curves (Example: MRSA – by Day)



A cluster of K. pneumoniae



An outbreak?



WHONET, www.whonet.org [9]

Isolate Alerts: VRE, MRSA, CRE, …

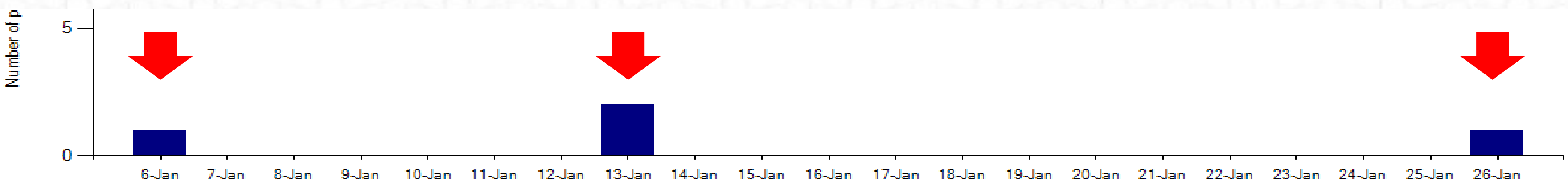
VAN	SXT	FOX	CTX	PIP	CAZ	IPM	AMC	CXM	MEZ	Alert	Priority	Organisms	Isolate alerts
	S		S			S	!	S	S!	☑	Medium priority	All organisms	Penicillins and Beta-lactam+Inhibitor = Disc...
S	?									☑	Medium priority	All organisms	Penicillins = Discordant results
	S		S			S	R!	S	S!	☑	Medium priority	All organisms	Penicillins and Beta-lactam+Inhibitor = Disc...
	S	R	!	S		S		S!	S	☑	Medium priority	Enterobacteriaceae	Cephems = Discordant results
	S	R	R!	R		S		R	R	☑	Medium priority	Enterobacteriaceae	Possible ESBL-producing Enterobacteriac...
	S	R	R!	I		S		R	I	☑	Medium priority	Enterobacteriaceae	Possible ESBL-producing Enterobacteriac...
	S	R	R!	R		S		R	R	☑	Medium priority	Enterobacteriaceae	Possible ESBL-producing Enterobacteriac...
	S	R	R!	I		S		R	I	☑	Medium priority	Enterobacteriaceae	Possible ESBL-producing Enterobacteriac...
	S		!			S	S	S!	S	☑	Medium priority	Enterobacteriaceae	Cephems = Discordant results
	S		S			S	!	S	S!	☑	Medium priority	All organisms	Penicillins and Beta-lactam+Inhibitor = Disc...
	S		!			S	S	S!	S	☑	Medium priority	Enterobacteriaceae	Cephems = Discordant results
!										☑	Medium priority	Enterococcus sp.	Vancomycin-resistant Enterococcus
!										☑	Medium priority	Enterococcus sp.	Vancomycin-resistant Enterococcus
!										☑	Medium priority	Enterococcus sp.	Vancomycin-resistant Enterococcus
!										☑	Medium priority	Enterococcus sp.	Vancomycin-resistant Enterococcus
!										☑	Medium priority	Enterococcus sp.	Vancomycin-resistant Enterococcus
!										☑	Medium priority	Enterococcus sp.	Vancomycin-resistant Enterococcus
!										☑	Medium priority	Enterococcus sp.	Vancomycin-resistant Enterococcus
!										☑	Medium priority	Enterococcus sp.	Vancomycin-resistant Enterococcus
!										☑	Medium priority	Enterococcus sp.	Vancomycin-resistant Enterococcus
!										☑	Medium priority	Enterococcus sp.	Vancomycin-resistant Enterococcus
!										☑	Medium priority	Enterococcus sp.	Vancomycin-resistant Enterococcus

WHONET, www.whonet.org [9]

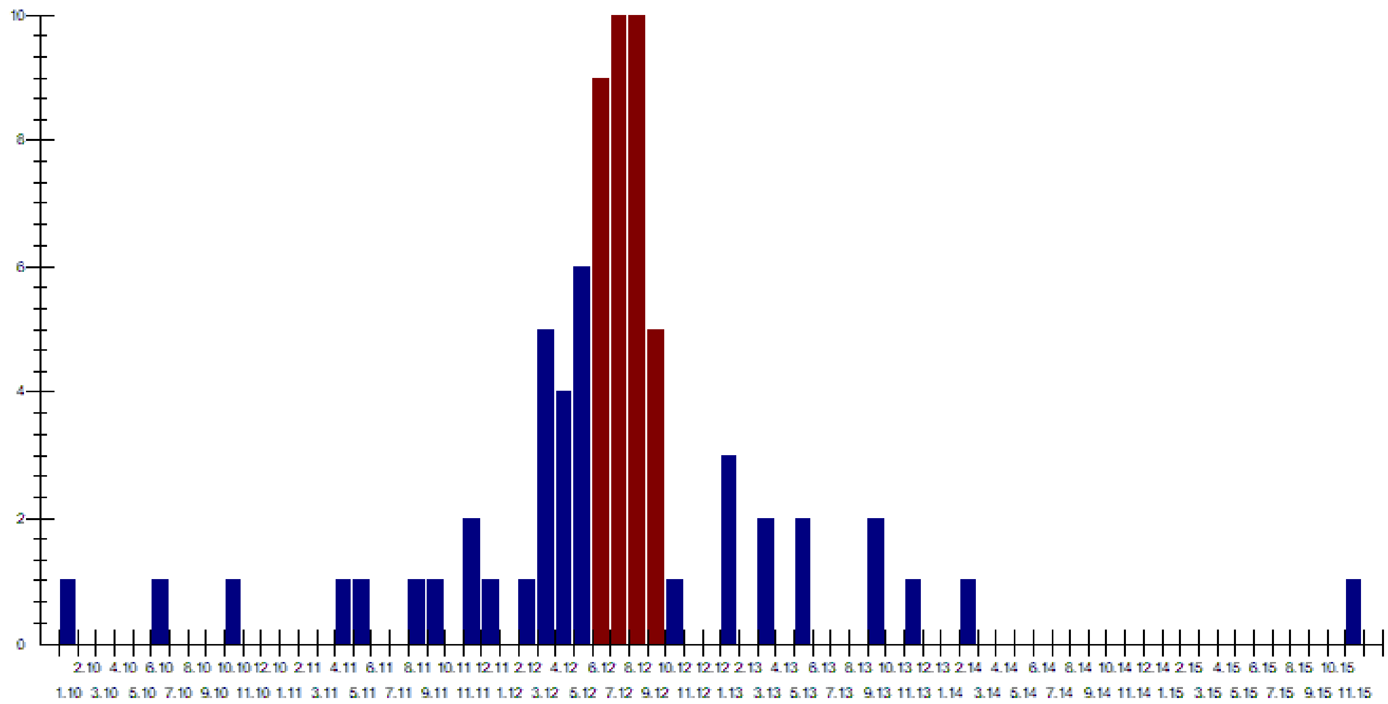
Resistance profiles and MDR/XDR/PDR:
Allows detection of clusters and tracking of outbreaks

Resistance Profiles (Example: S. aureus)

Profile	Resistance profile	Number of isolates	%Isolates	Number of patients	%Patients
		9	10.5	9	11.8
E	ERY	4	4.7	4	5.3
P	PEN	23	26.7	22	28.9
E R	ERY CIP	4	4.7	4	5.3
P R	PEN CIP	1	1.2	1	1.3
PE	PEN ERY	17	19.8	17	22.4
P O A	PEN OXA AMC	5	5.8	5	6.6
PE R	PEN ERY CIP	2	2.3	2	2.6
PE - R	PEN ERY --- CIP	1	1.2	1	1.3
P O AR	PEN OXA AMC CIP	2	2.3	2	2.6
PE O A	PEN ERY OXA AMC	2	2.3	2	2.6
PEC R	PEN ERY CLI CIP	1	1.2	1	1.3
PE O AR	PEN ERY OXA AMC CIP	3	3.5	3	3.9
PECO A	PEN ERY CLI OXA AMC	2	2.3	2	2.6
PEC GT R	PEN ERY CLI GEN SXT CIP	1	1.2	1	1.3
PECO AR	PEN ERY CLI OXA AMC CIP	4	4.7	4	5.3
PE OGTAR	PEN ERY OXA GEN SXT AMC CIP	1	1.2	1	1.3
PECOGTAR	PEN ERY CLI OXA GEN SXT AMC CIP	4	4.7	4	5.3



Utilizing AMR Surveillance Data for Automated Detection of Clusters and potential Outbreaks (HAI and/or community)



2011: MDRO outbreak in an NICU the UAE, caused by multidrug-resistant Klebsiella pneumoniae (ESBL)

Priority 1: CRITICAL

Acinetobacter baumannii, carbapenem-resistant

Pseudomonas aeruginosa, carbapenem-resistant

Enterobacteriaceae*, carbapenem-resistant, 3rd generation cephalosporin-resistant **(ESBL)**

2011, over a 5 month period:

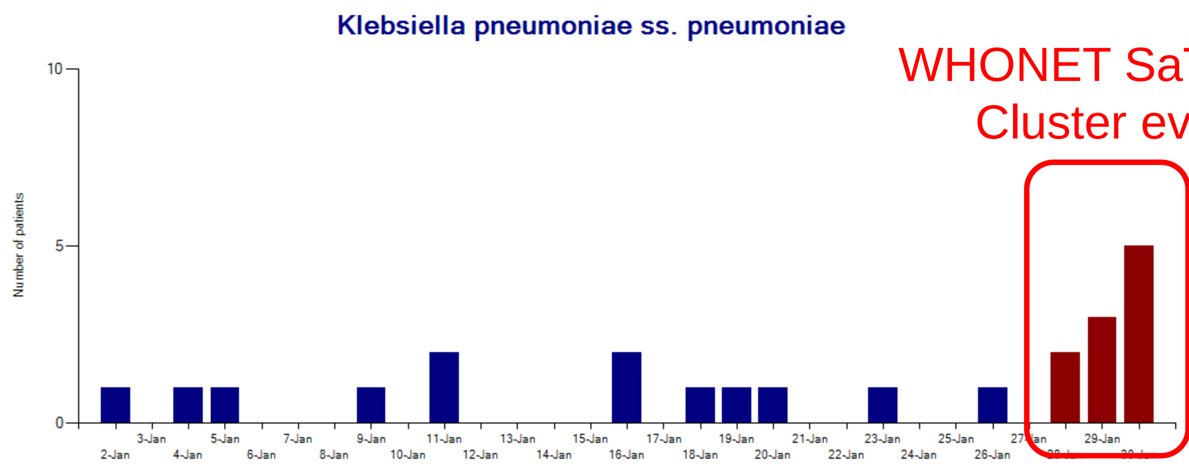
- Large outbreak of ESBL-*K. pneumoniae* in NICU in UAE with a high mortality rate:
  - 31 infants were colonized
  - **10 invasive infections**
  - **5 infants died**
- A point source could not be identified
- Overcrowding and understaffing may have been contributing factors

Tamma PD et al. Infect Control Hosp Epidemiol (2012) [10]

SaTScan-Cluster detection with 'Isolate Listing and Summary' Analysis

- Example: *Klebsiella pneumoniae* cluster, 28-30 Jan 1995 (not related to the UAE outbreak on the previous slide)

Organism	Cluster number	Recurrence interval	p-value	Cluster dates	Start date	End date	Number observed	Number expected
Enterococcus sp.								
Escherichia coli								
Haemophilus influenzae								
Klebsiella oxytoca								
Klebsiella pneumoniae ss. pneum...	1	47	0,0212	28.01.1995:30.01.1995	28.01.1995	30.01.1995	10	2,34
Moraxella (Branh.) catarrhalis								
Morganella morganii ss. morganii								

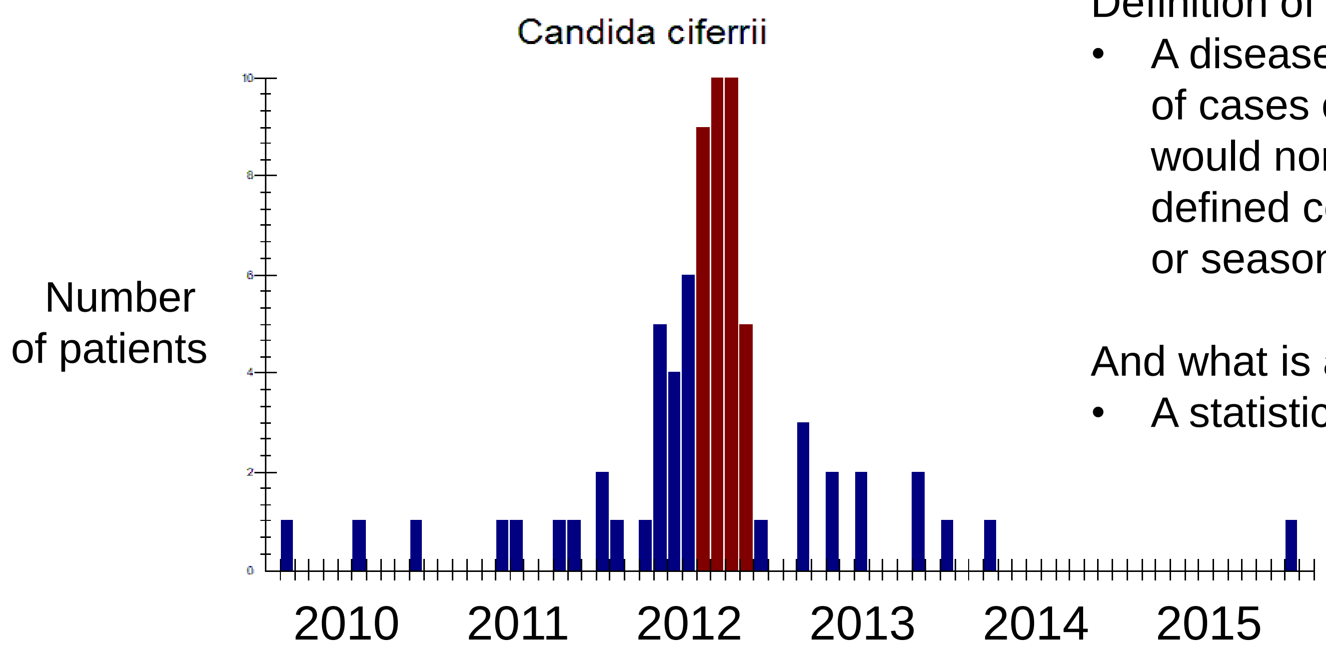


- Conclusion: There seems to be a rise in the number of patients with *Klebsiella pneumoniae* at the end of the month of January

Semi-automated detection of Clusters and potential HAI outbreaks

SaTScan-Cluster detection with 'Isolate Listing and Summary' Analysis
Example: *Candida ciferrii* cluster (UAE, 2012)

Organism	Number of isolates	(%)	Number of patients	Cluster number	Recurrence interval	p-value	Cluster dates	Number observed	Number expected
Candida albicans	1602	(45)	1602	5	67	0,015	24.06.2010:30.09.2010	92	53,2
Candida ciferrii	73	(2)	73	1	1E+17	1E-17	16.06.2012:19.09.2012	33	2,53
Candida dubliniensis	96	(3)	96						
Candida famata	34	(1)	34						
Candida glabrata	271	(8)	271						
Candida guilliermondii	19	(1)	19						
Candida haemulonii	40	(1)	40	4	714	0,0014	21.05.2016:06.08.2016	9	0,77
Candida intermedia	2	(0)	2						
Candida kefyr (pseudotropicalis)	15	(0)	15						



Definition of **outbreak**:

- A disease outbreak is the occurrence of cases of disease in excess of what would normally be expected in a defined community, geographical area or season*

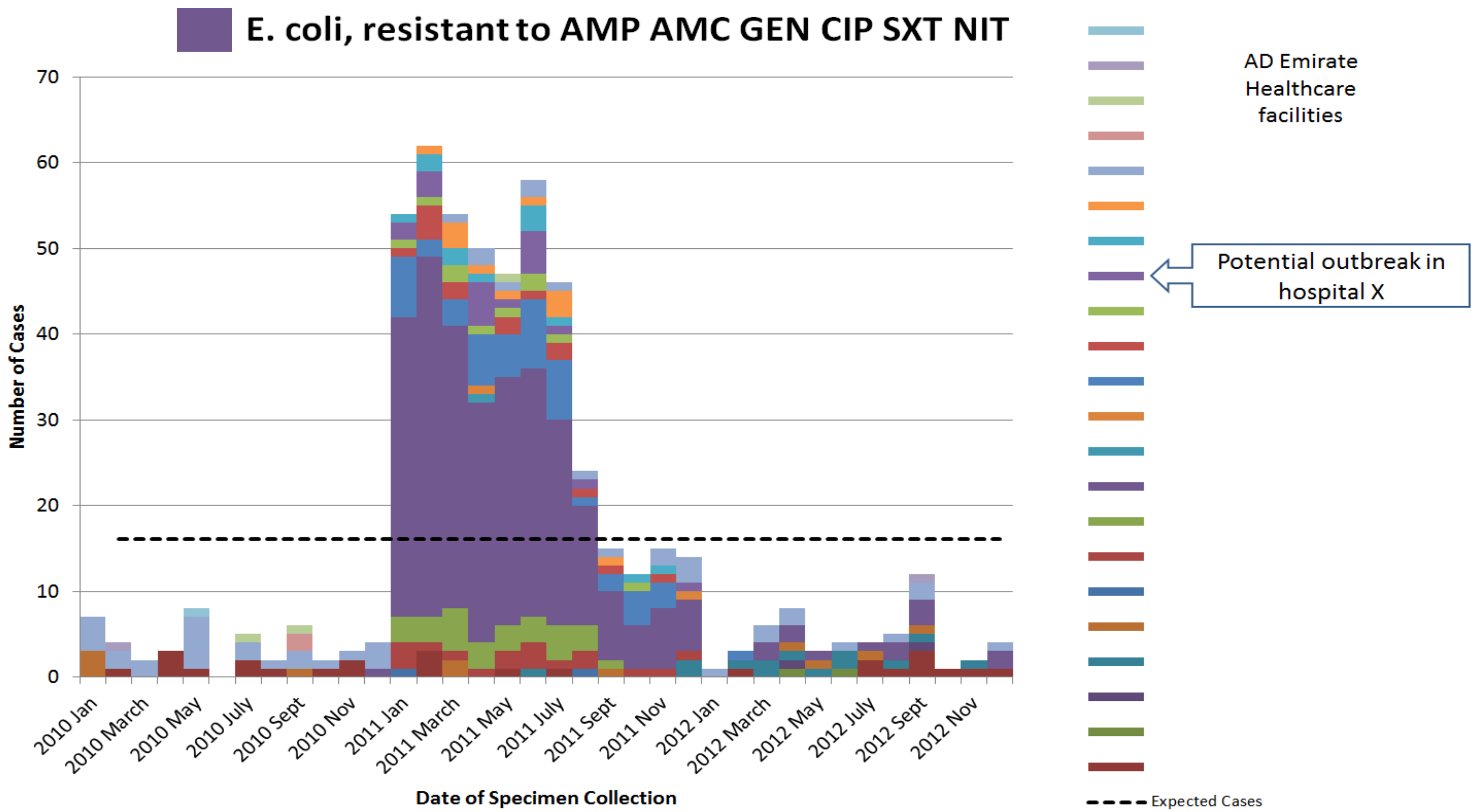
And what is a **cluster**?

- A statistically unusual event!

UAE National AMR Surveillance System, 2019 [8], *WHO 2019 [11]

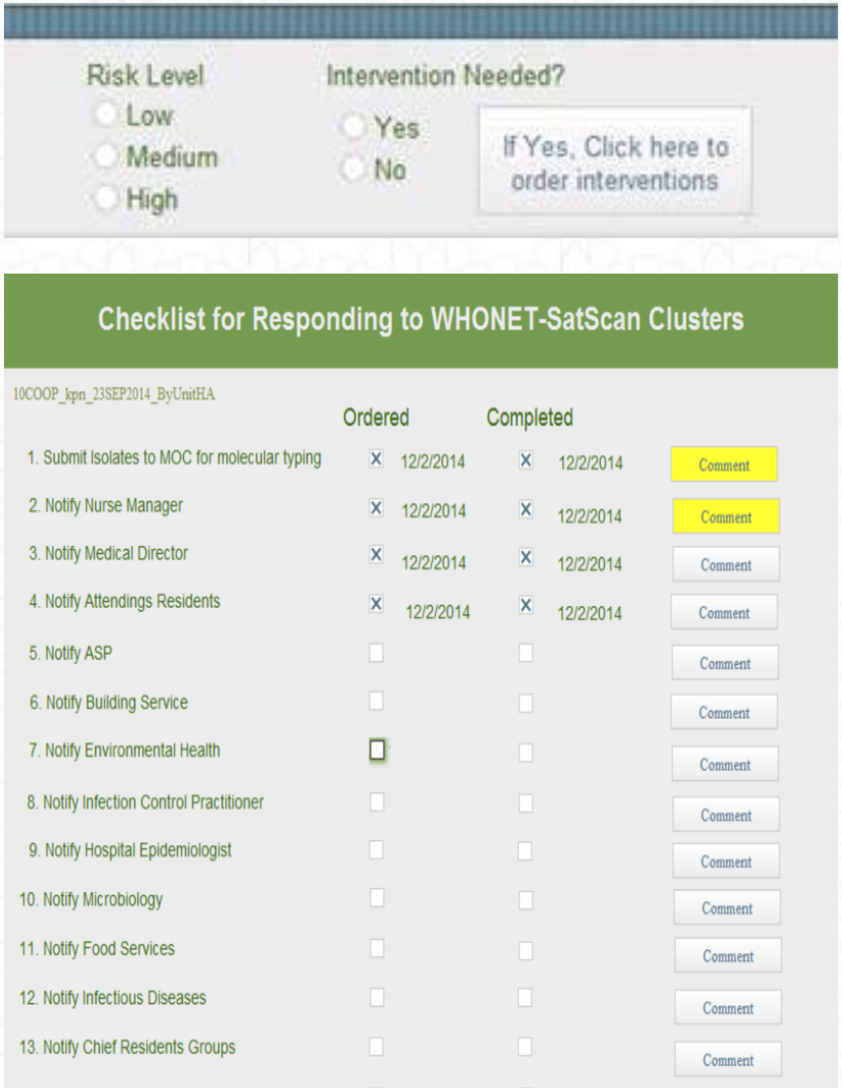
UAE Experience with WHONET SaTScan

WHONET-SaTScan™ identified a potential outbreak of a MDR E. coli at one hospital in Abu Dhabi in 2011 (non-ESBL/non-CRE)



You found a statistical signal (Cluster)... What comes next?

1. Review
   - Biochemical phenotype
   - Resistance phenotype
2. Determine:
   - Risk level low /medium / high?
   - Intervention needed: Yes / No?
3. Consider possible interventions
   - Submit isolates for **molecular typing**
   - Notify Nurse Manager
   - Notify Medical Director
   - Notify ASP team
   - Notify Building Service
   - Notify Environmental Health
   - Notify Hospital Epidemiologist
   - Notify …



Risk Level
Low
Medium
High

Intervention Needed?
Yes
No

If Yes, Click here to order interventions

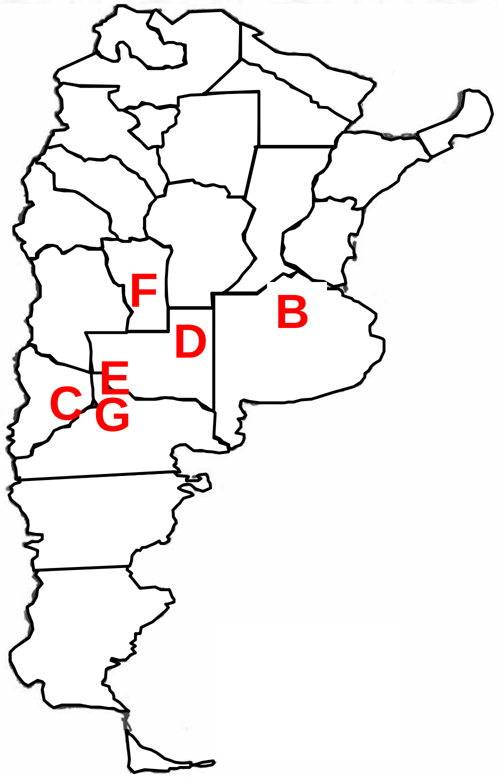
Checklist for Responding to WHONET-SatScan Clusters

10COOP_kpn_23SEP2014_ByUnitHA

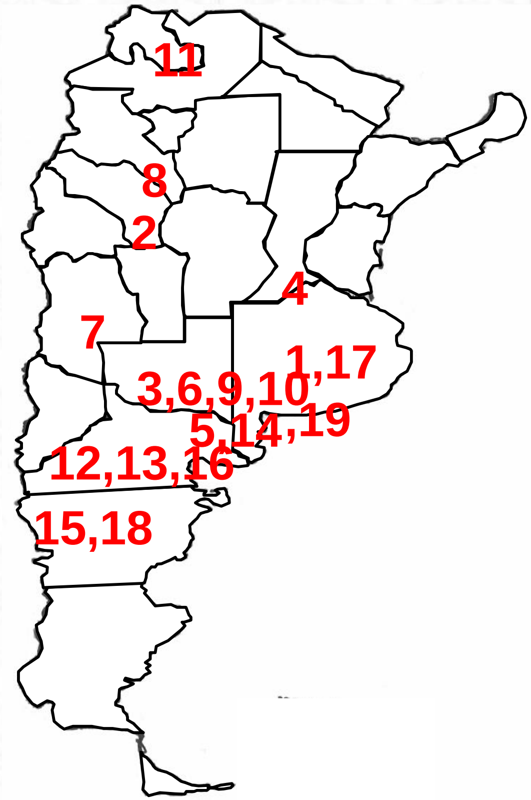
	Ordered		Completed		
1. Submit Isolates to MOC for molecular typing	X	12/2/2014	X	12/2/2014	Comment
2. Notify Nurse Manager	X	12/2/2014	X	12/2/2014	Comment
3. Notify Medical Director	X	12/2/2014	X	12/2/2014	Comment
4. Notify Attendings Residents	X	12/2/2014	X	12/2/2014	Comment
5. Notify ASP					Comment
6. Notify Building Service					Comment
7. Notify Environmental Health					Comment
8. Notify Infection Control Practitioner					Comment
9. Notify Hospital Epidemiologist					Comment
10. Notify Microbiology					Comment
11. Notify Food Services					Comment
12. Notify Infectious Diseases					Comment
13. Notify Chief Residents Groups					Comment

Shigellosis in Argentina – Retrospective Study

Six outbreaks as reported to Ministry of Health



Nineteen clusters as suggested by WHONET-SaTScan

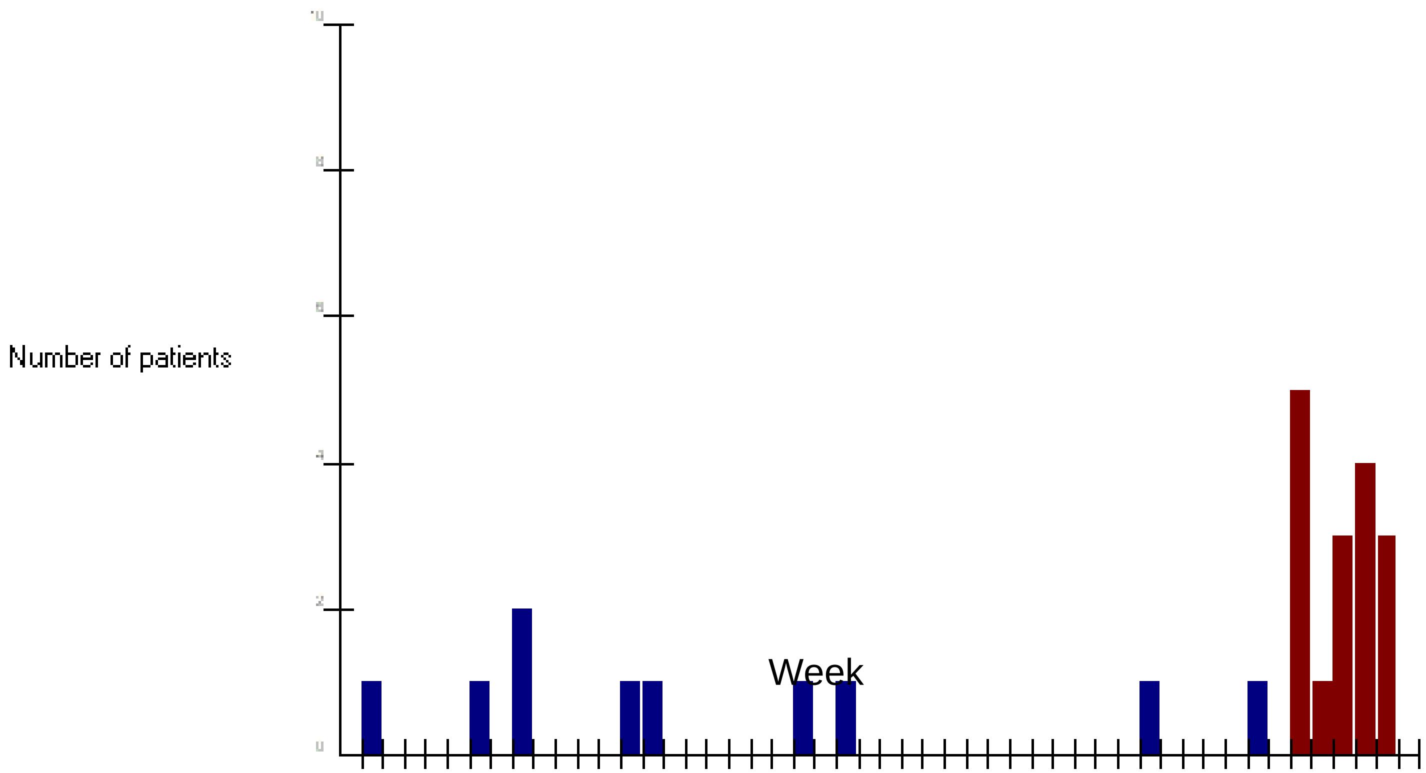


Conclusion: Electronic lab-based Disease surveillance incorporating statistical cluster detection methods can enhance Infectious disease outbreak detection and response

Stelling J et al. Automated Use of WHONET and SaTScan to detect outbreaks of Shigella spp. using antimicrobial resistance phenotypes. Epidemiol Infect (2010), 138:873-883

Use of resistance profiles to improve detection

S. sonnei non-susceptible to SXT from a single laboratory in La Pampa



Frequency distribution of S. sonnei isolates non-susceptible to SXT by week for the laboratory in La Pampa. Isolates contributing to the SaTScan event are indicated by solid bars

Stelling J et al. Automated Use of WHONET and SaTScan to detect outbreaks of Shigella spp. using antimicrobial resistance phenotypes. Epidemiol Infect (2010), 138:873-883

Shigellosis in Argentina – Prospective study
PFGE confirmation of WHONET-SaTScan signals detected by resistance phenotype

Stelling J et al. Automated Use of WHONET and SaTScan to detect outbreaks of Shigella spp. using antimicrobial resistance phenotypes. Epidemiol Infect (2010), 138:873-883 [15]

Summary and Conclusions

- AMR is a Global, and Local Threat to Public Health
- UAE National AMR Surveillance
  - 187 surveillance sites, including 59 hospitals and 128 clinics, and 30 microbiology labs, across all 7 Emirates, are providing high-quality AMR surveillance data
  - Overall, antimicrobial resistance (AMR) is increasing in the UAE
- In the UAE, AMR is in particular increasing for:
  - *Staph aureus*: MRSA ↑, Macrolides ↑, Clindamycin ↑, AG ↑, CIP ↑, SXT ↑
  - *K. pneumoniae*: ESBL ↑, Carbapenems ↑, Fluoroquinolones ↑, SXT ↑
  - *P. aeruginosa*: 3rd-gen. Cephalosporins ↑, Carbapenems ↑, FQs ↑
- Routine AMR surveillance data can support infection control by
  - Line listings, epi curves, isolate alerts, resistance profiles, and
  - Automated detection of clusters and potential outbreaks

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