Twenty-year report of Nosocomial Antibiotic Resistance in Shiraz

گزارش بیست ساله مقاومت های آنتی بیوتیکی بیمارستانی در شیراز

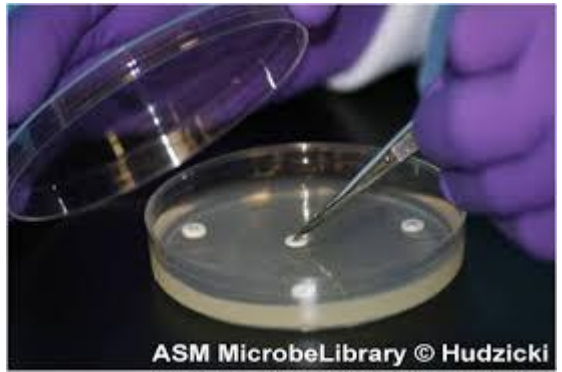
Presenter:

Gholamreza Pouladfar

Isolation & identification

Antimicrobial resistance surveillance

- Isolates were recovered from blood samples incubated in the BACTEC™
- After Gram staining, isolates were inoculated on appropriate media and incubated at 37 °C overnight
- Identification of bacteria was done by biochemical differentiation
  - API bioMérieux & Phoenix BD Instrument
- Susceptibility testing was performed by disk diffusion according to CLSI criteria & Phoenix BD



Biobank

Antimicrobial resistance surveillance

lyophilizer

Biobank

Antimicrobial resistance surveillance

1396

No.	*Bacterial species*	Total
1	*Staphylococcus aureus*	1500
2	*Escherichia coli*	1150
3	*Enterococcus spp.*	760
4	*Pseudomonas spp.*	790
5	*Pseudomonas aeruginosa*	82
6	*Acinetobacter baumanii*	305
8	*Klebsiella pneumoniae*	370
9	*Enterobacter spp.*	285
10	*Stenotrophomonas matophilia*	810
13	*Serratia spp.*	108
14	*Achromobacter ssp.*	80
15	*Moraxella spp.*	23
16	*Brusella spp.*	25
17	*Streptococcus Group B Non-Enterococci*	32
18	*Candida spp.*	240
19	*Streptococcus pneumoniae*	150
20	*Cirtobacter spp.*	43

Microbiology laboratory information registration system

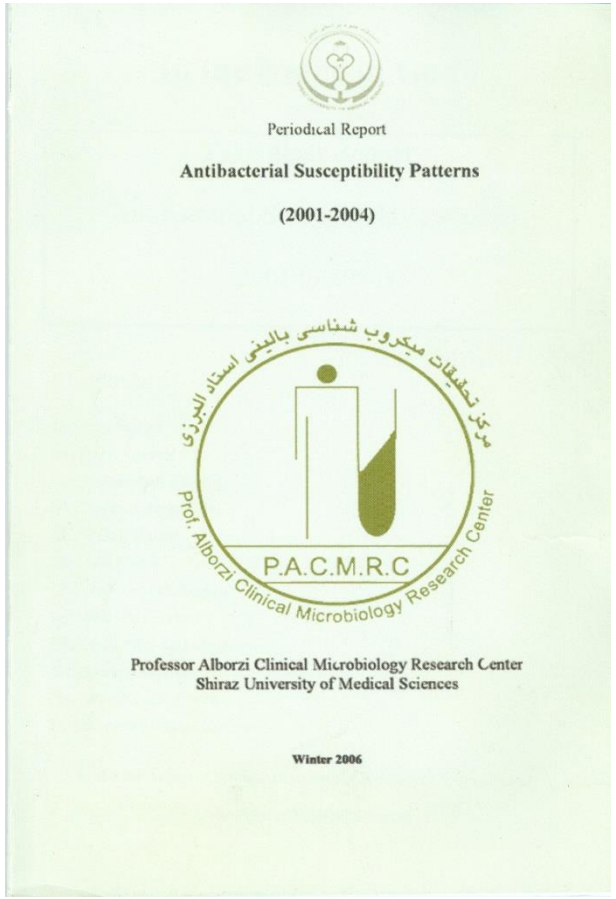
Antimicrobial resistance surveillance

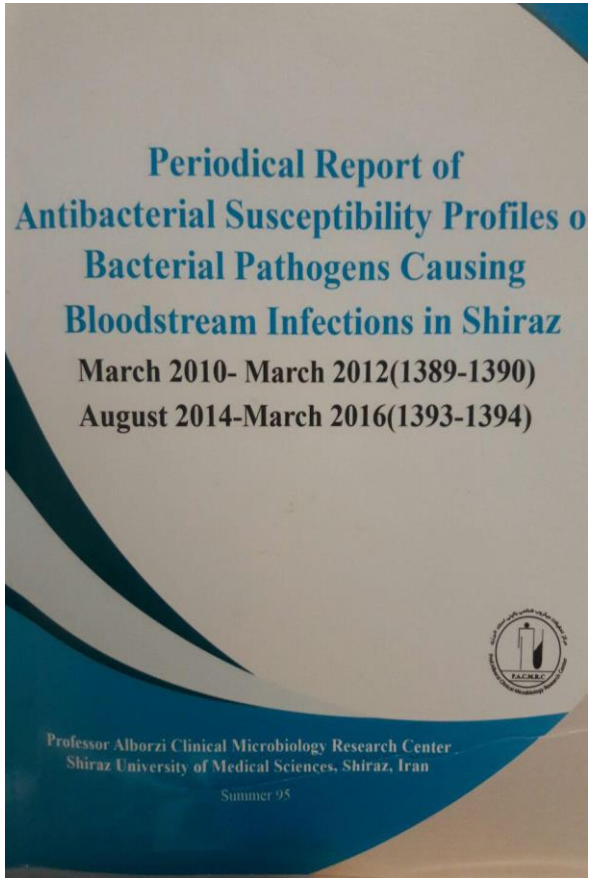
The microbiology laboratory database software.

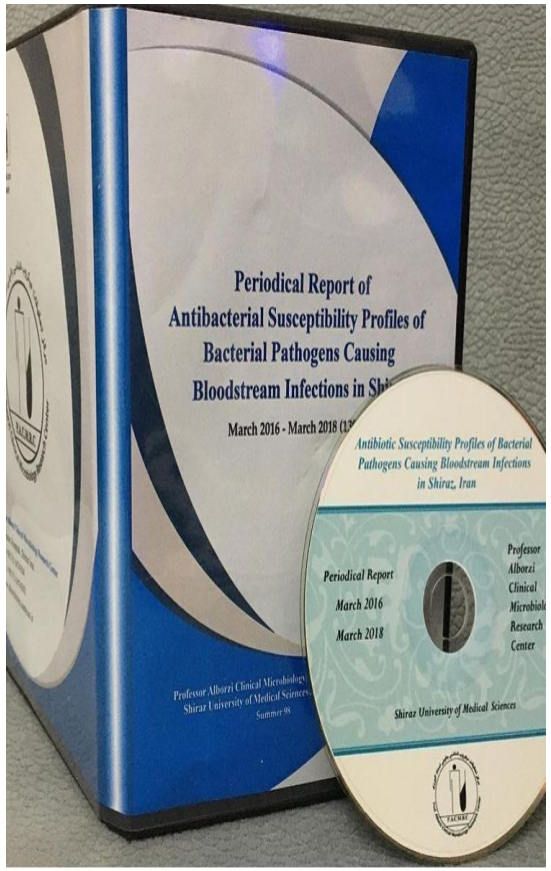
Publish Surveillance Results

Antimicrobial resistance surveillance

Periodical Report of Antimicrobial Susceptibility in Shiraz







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Misdiagnosis in lab

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Nosocomial Infections: Multicenter surveillance of antimicrobial resistance profile of *Staphylococcus aureus* and Gram negative rods isolated from blood and other sterile body fluids in Iran

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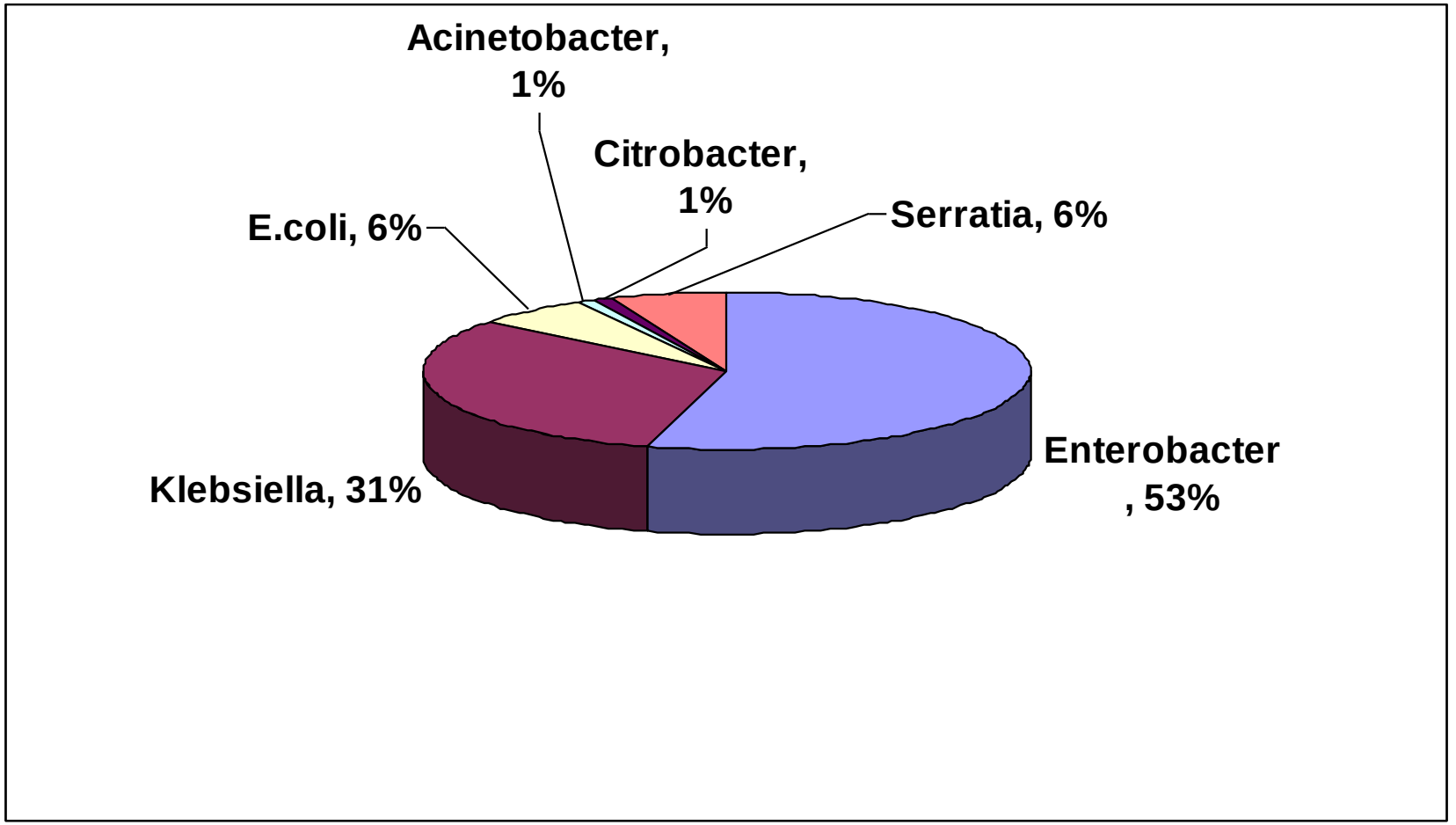
Seven major teaching hospitals located in different geographic areas of Iran (Shiraz, Tabriz, Sari, Mashhad, Sababdah, Ahwaz, Isfahan) in collaboration with the professor Alborzi clinical Microbiology Center (PACMRC), participated in this multicentre collaborative study over the period

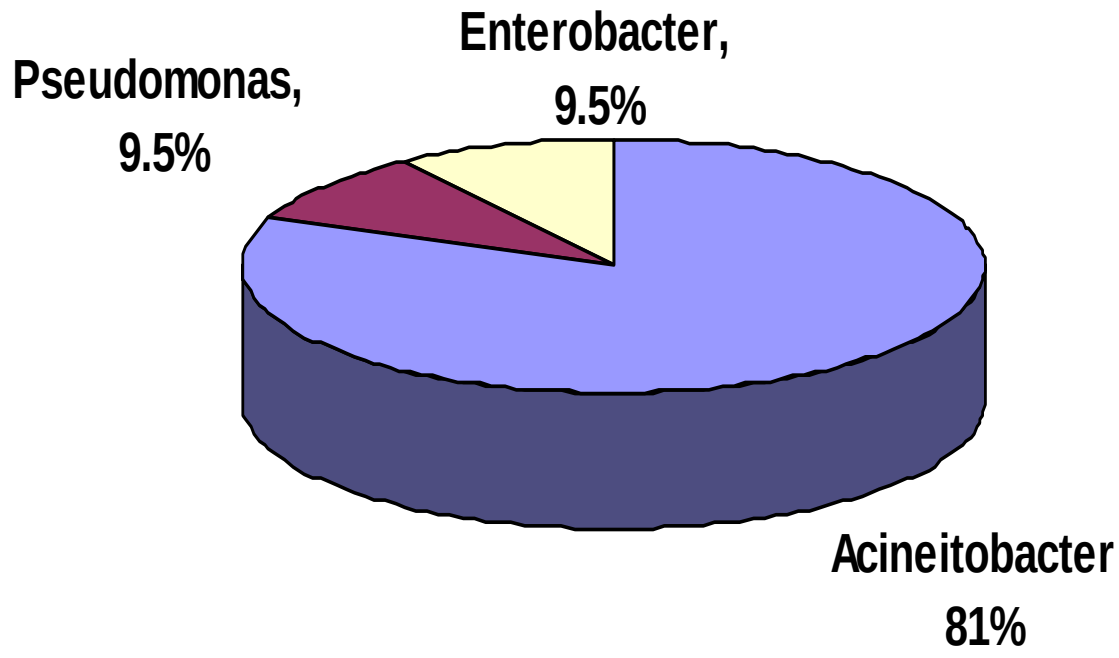
Table 1. Frequencies of isolates obtained from positive sterile body fluid cultures in different cities (N=858).

	City							
	Shiraz	Sari	Tabriz	Mashhad	Sanandaj	Ahwaz	Esfahan	Total
Gram positive cocci (N=224)								
S. aureus	54(24%)	11(5%)	35(15.5%)	1(0.5%)	36(16%)	85(38%)	2(1%)	224
Gram negative bacilli (N=634)								
Klebsiella spp.	22(15%)	47(32%)	12(8%)	31(21%)	16(11%)	8(5%)	12(8%)	148
E. coli	36(24.5%)	39(27%)	13(9%)	25(17%)	21(14.5%)	2(1%)	10(7%)	146
Serratia spp.	11(10.5%)	17(16%)	5(5%)	16(15%)	33(31.5%)	22(21%)	1(1%)	105
Enterobacter spp.	8(21%)	14(37%)	2(5%)	2(5%)	5(13.5%)	4(10.5%)	3(8%)	38
Pseudomonas spp.	19(20%)	45(47.5%)	5(5.3%)	16(16.8%)	4(4.1%)	3(3.2%)	3(3.2%)	95
Acinetobacter spp.	20(30%)	4(6%)	1(1.5%)	24(35.5%)	5(7.5%)	3(4.5%)	10(15%)	67
Stenotrophomonas spp.	5(14%)	10(28.5%)	1(3%)	14(40%)	1(3%)	3(8.5%)	1(3%)	35
Total	175	187	74	129	121	130	42	

Misdiagnosis!!
Serratia Isolated
(No= 105)



Misdiagnosis
Stenotrophomonas isolated (No=35)



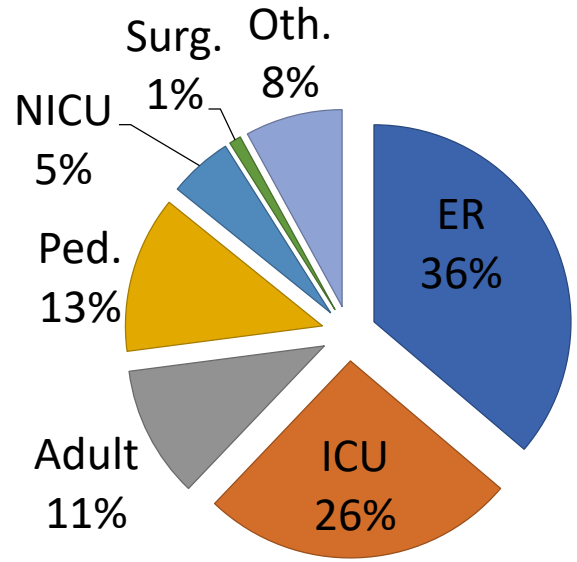
Twenty-year report of Nosocomial Antibiotic Resistance in Shiraz

Frequency of pathogenic bacteria isolated from blood Culture based on hospitals in Shiraz

March 2016 – March 2017 (1395)

Hospital	Number (%)
Nemazee	907(80.5)
Shahid Dastgheib	53 (4.7)
Ghadir	30 (2.7)
Central hospital (MRI)	24 (2.1)
Shahid Rajaee	15(1.3)
Dena	14 (1.2)
Amir	13 (1.1)
Ordibehesht	11 (1)
Hafez	11 (1)
Others	49(4.4)
Total	**1127**

Number (%)	Ward
408(36.2)	Emergency
292 (25.9)	ICU
122 (10.8)	Adult medical
145 (12.9)	Pediatric medical
59 (5.2)	Neonatal ICU
11 (1)	Surgery
90 (8)	Others
1127	Total

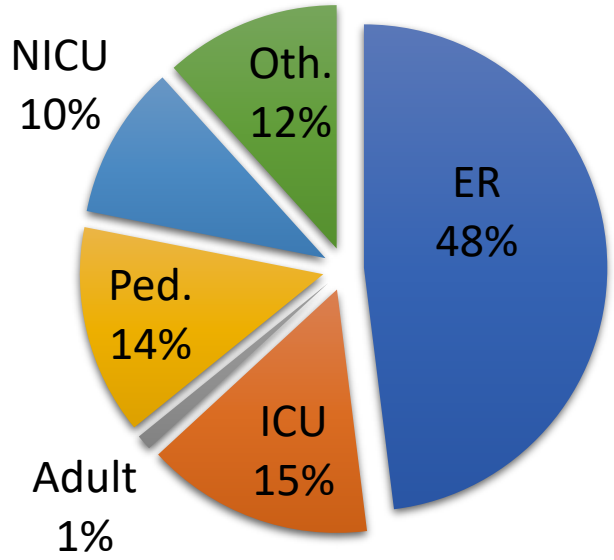


Frequency of pathogenic bacteria isolated from blood Culture based on hospitals in Shiraz

March 2017 – March 2018 (1396)

Hospital	Number (%)
Nemazee	1160(84.7)
Al-zahra	19 (1.4)
Central hospital (MRI)	18 (1.3)
Ghadir	16 (1.2)
Dena	15(1.1)
Shahid Rajaee	10 (0.7)
Hafez	10(0.7)
Ordibehesht	9 (0.6)
Others	113 (8.3)
Total	**1370**

Number (%)	Ward
658(48)	Emergency
207(15)	ICU
14(1)	Adult medical
191(14)	Pediatric medical
140(10)	Neonatal ICU
160(12)	Surgery
1370	Total



Frequency of pathogenic bacteria isolated from blood Culture based on hospitals in Shiraz

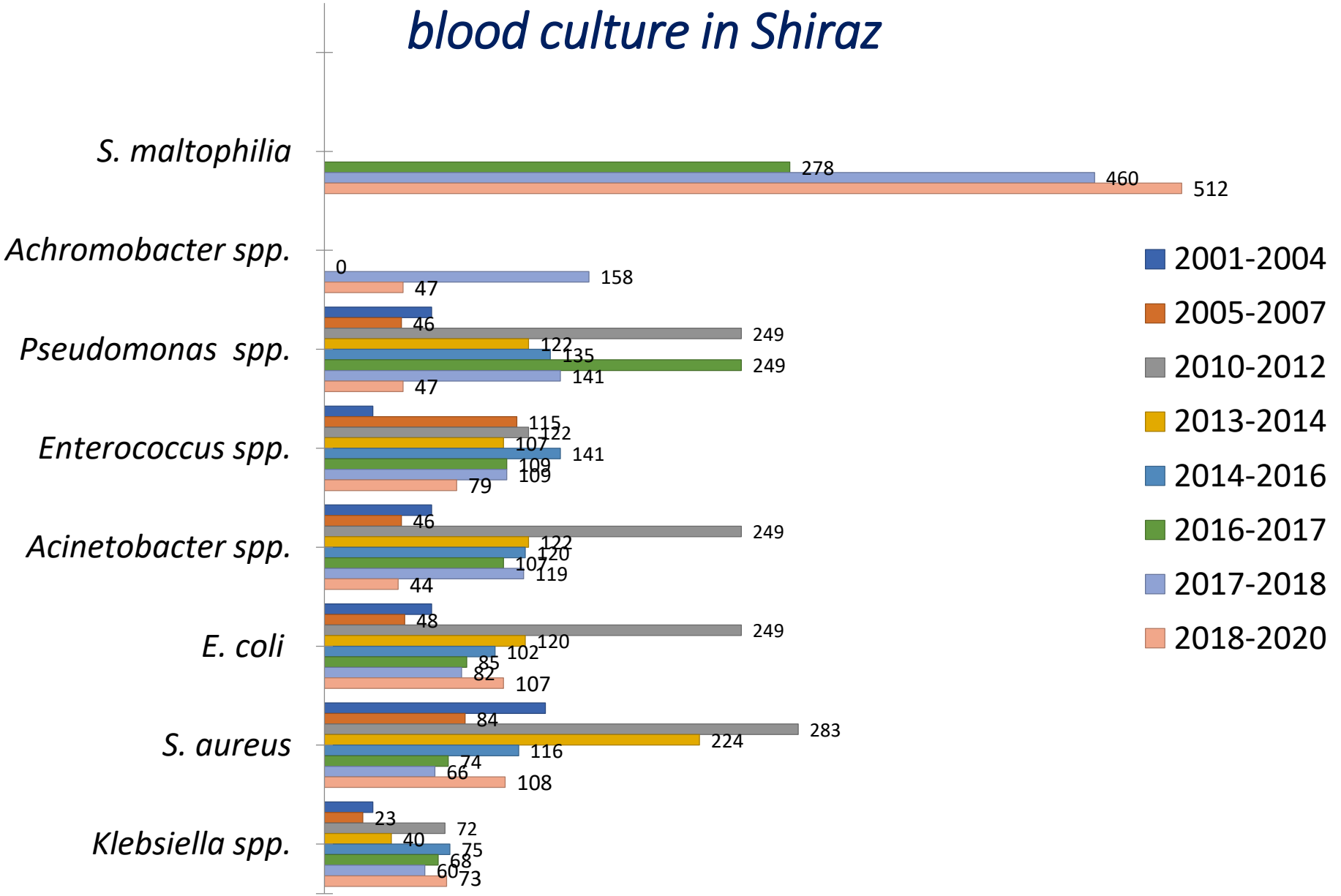
March 2018 – March 2019 (1397)

Hospital	Number (%)
Nemazee	1219(86.8)
Shahid Dastgheib	86 (6.1)
Central hospital (MRI)	29 (2.1)
Dena	29 (2.1)
Alzahra	16(1.1)
Others	25(1.8)
Total	**1404**

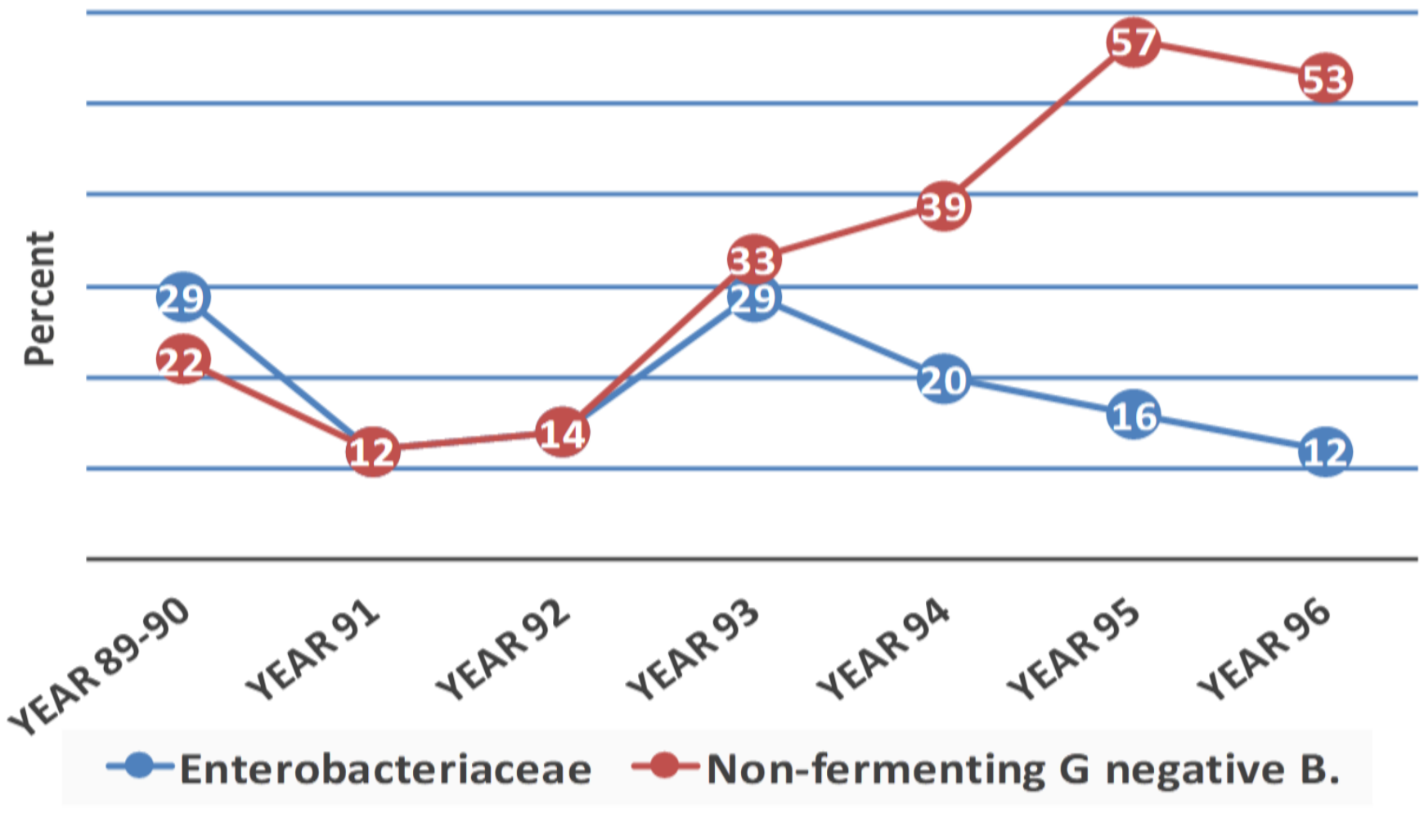
Time Periods

1380-1383	2001-2004
1384-1385	2005-2007
1389-1390	2010-2012
1392	2013-2014
1393-1394	2014-2015
1395-1396	2016-2018
1397-1398	2018-2020

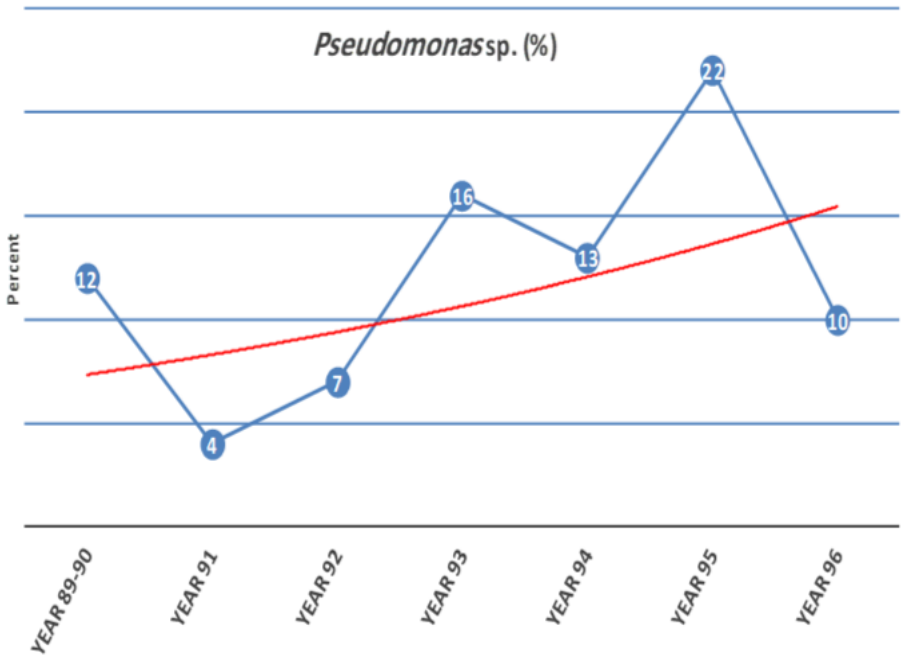
The most common pathogenic bacteria isolated from blood culture in Shiraz

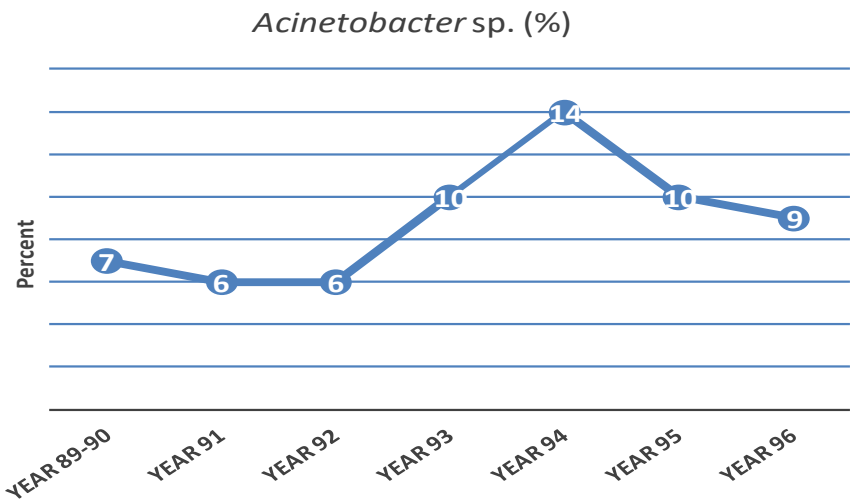


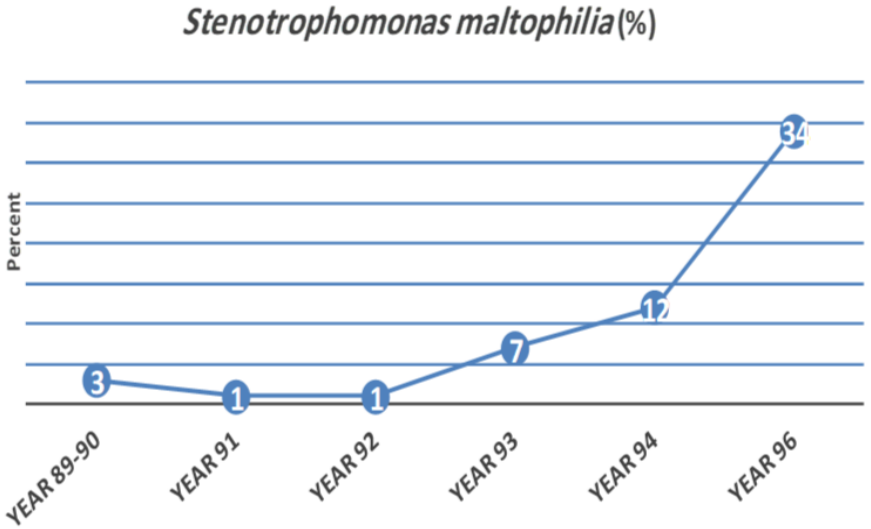
THE TREND OF BLOOD STREAM INFECTIONS CAUSED BY GRAM-NEGATIVE BACILLI, SHIRAZ IN 8 YEARS



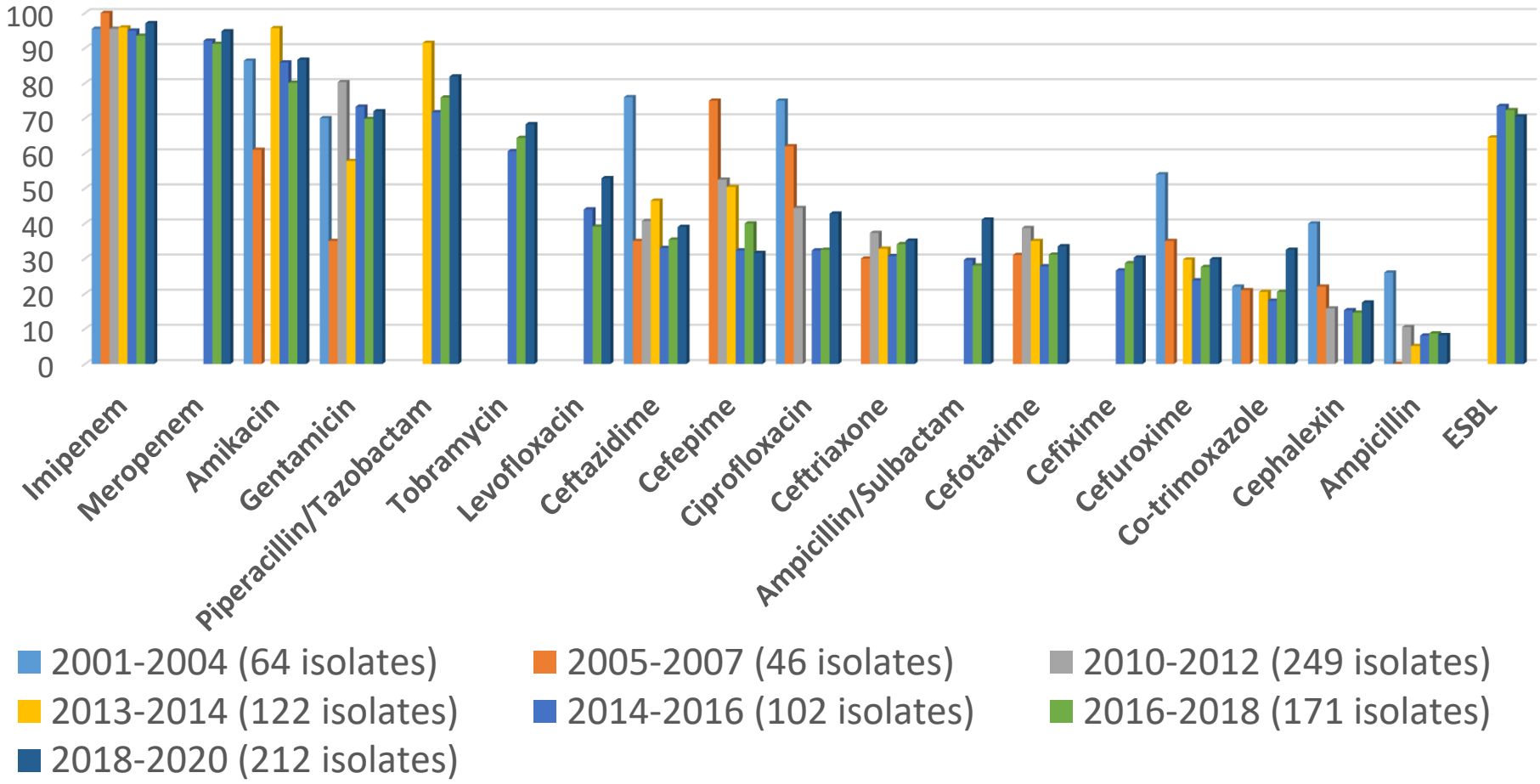
The Trend of Blood Stream Infections Caused by Non-fermenting Gram Negative Bacilli, Shiraz, During 8 Years







Rates of Sensitivity to Different Antibiotics Tested against 924 Escherichia coli Strains Isolated from Bloodstream Infections, in Seven Episodes, Shiraz, Iran



Result of a blood culture

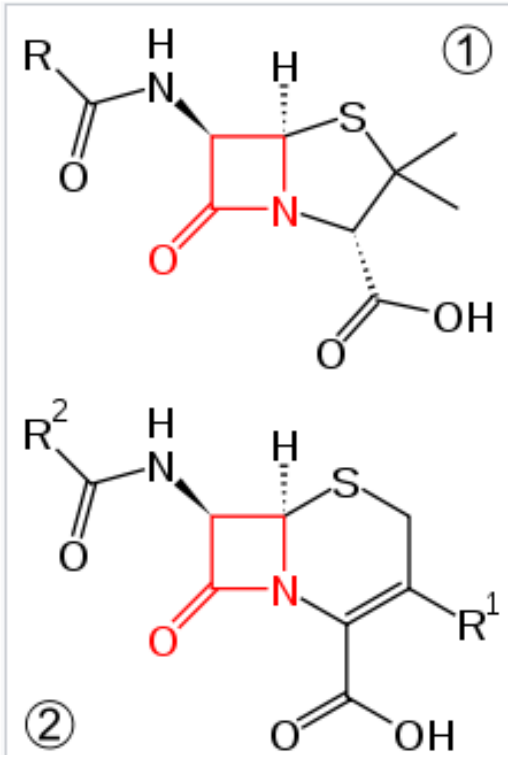
- ***E coli*** is grown
- ESBL positive
- Susceptible:
  - Meropenem, Gentamycin, **ceftriaxone**, Piperacillin/tazobactam, Amikacin
- Intermediate:
  - Ciprofloxacin, nitrofurantoin
- Resistant:
  - cefixime, Co-trimoxazole, **cefotaxime**

Point 1:
Extended-spectrum beta-lactamases (ESBLs)

- **enzymes that confer resistance to most beta-lactam antibiotics**, including
  1) Penicillins
  2) Cephalosporins
  3) monobactam aztreonam.

- Infections with ESBL-producing organisms have been associated with poor outcomes.

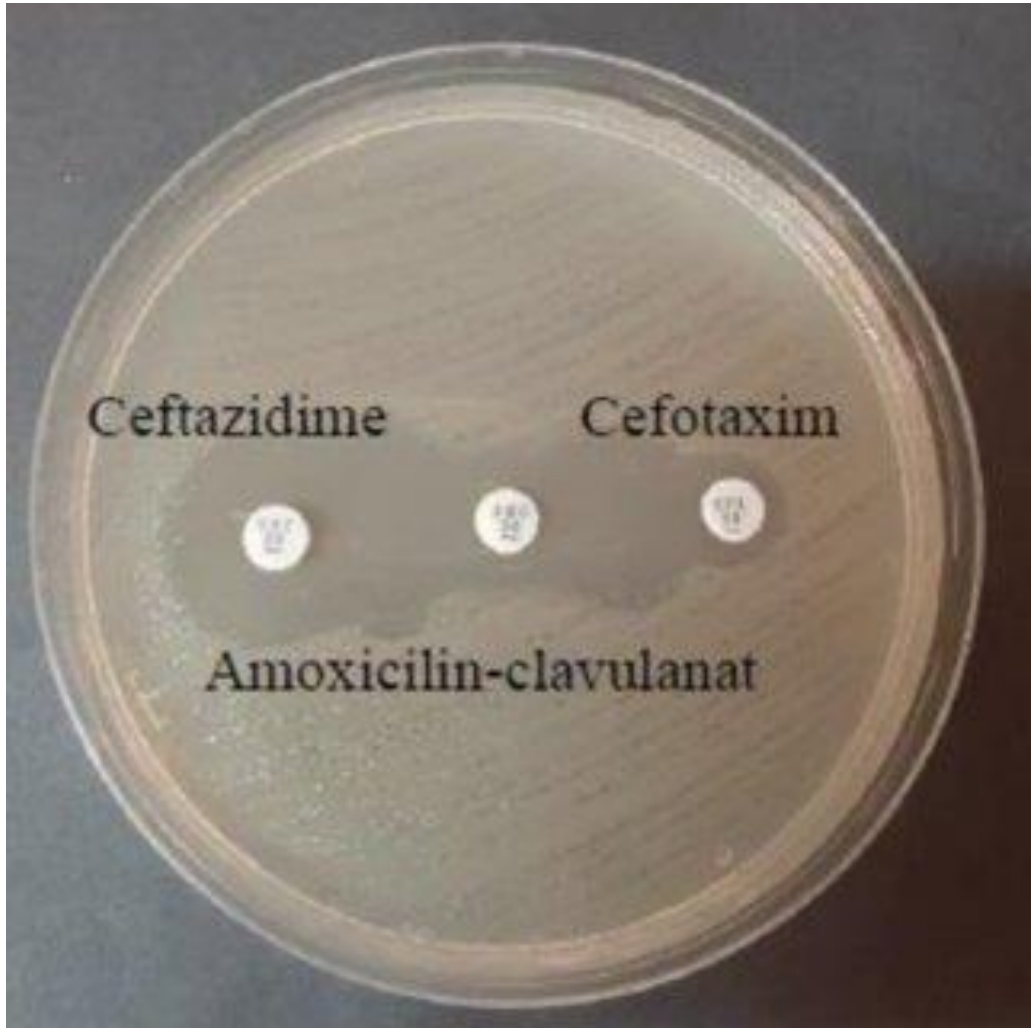
Beta-lactam ring



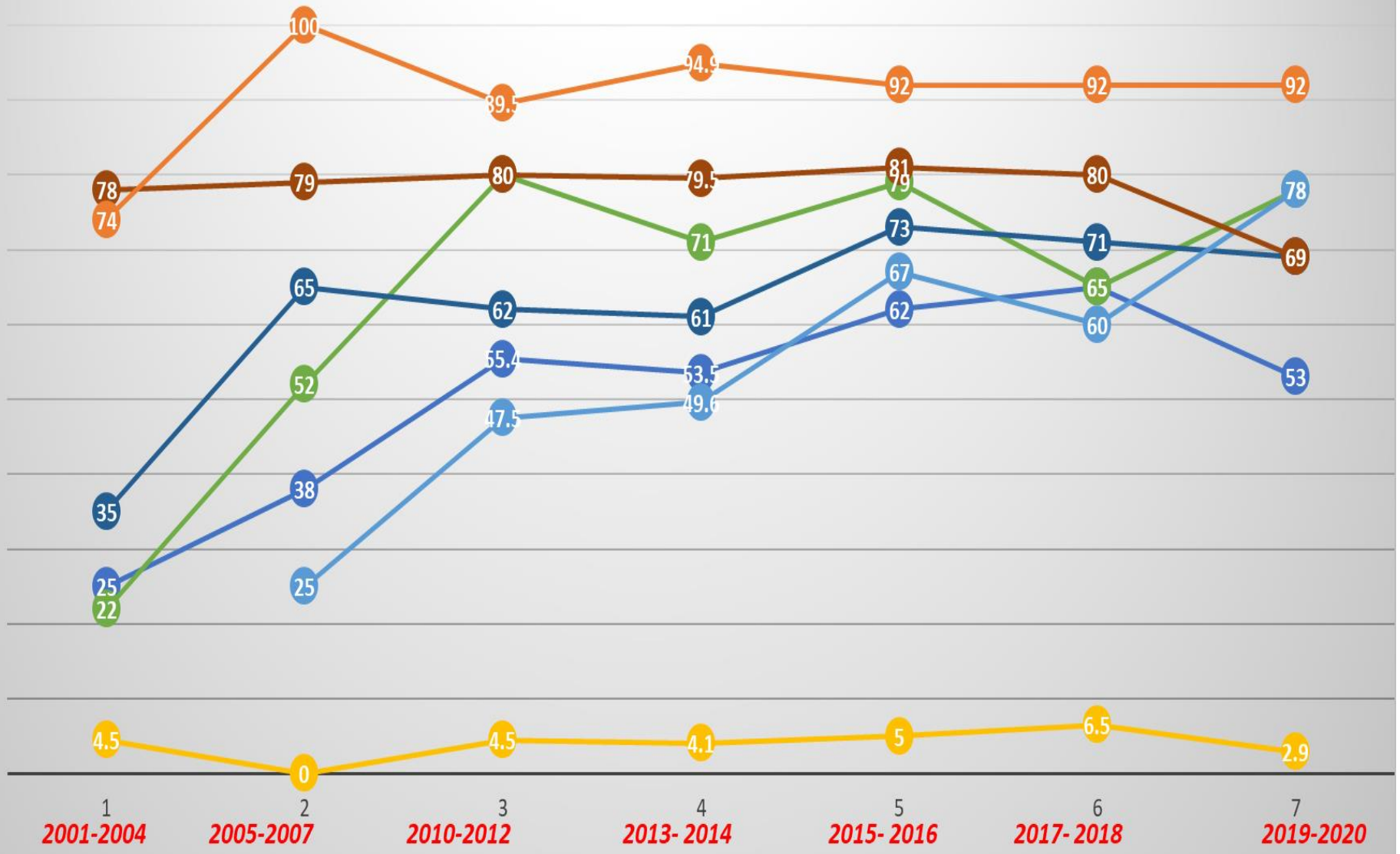
- Core structure of penicillins
- Core structure of Cephalosporins

Lab diagnosis:
The double disk test

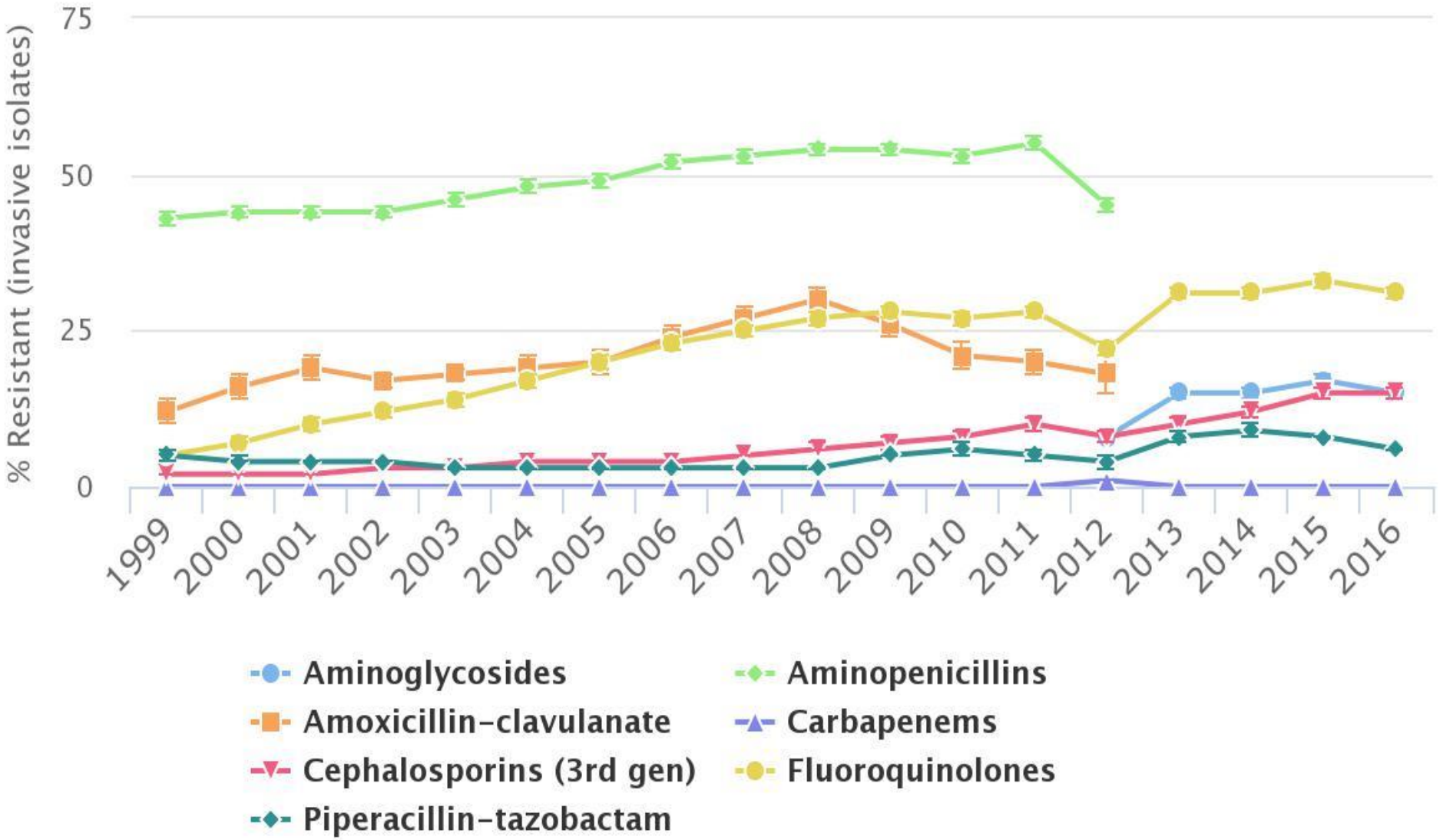
- A disk with clavulanate placed near a disk with an oxyimino-beta-lactam enhances susceptibility to the latter compound



THE TEREND OF *E. COLI* ANTIBIOTIC RESISTANCE IN SHIRAZ



Antibiotic Resistance of *Escherichia coli* in United States



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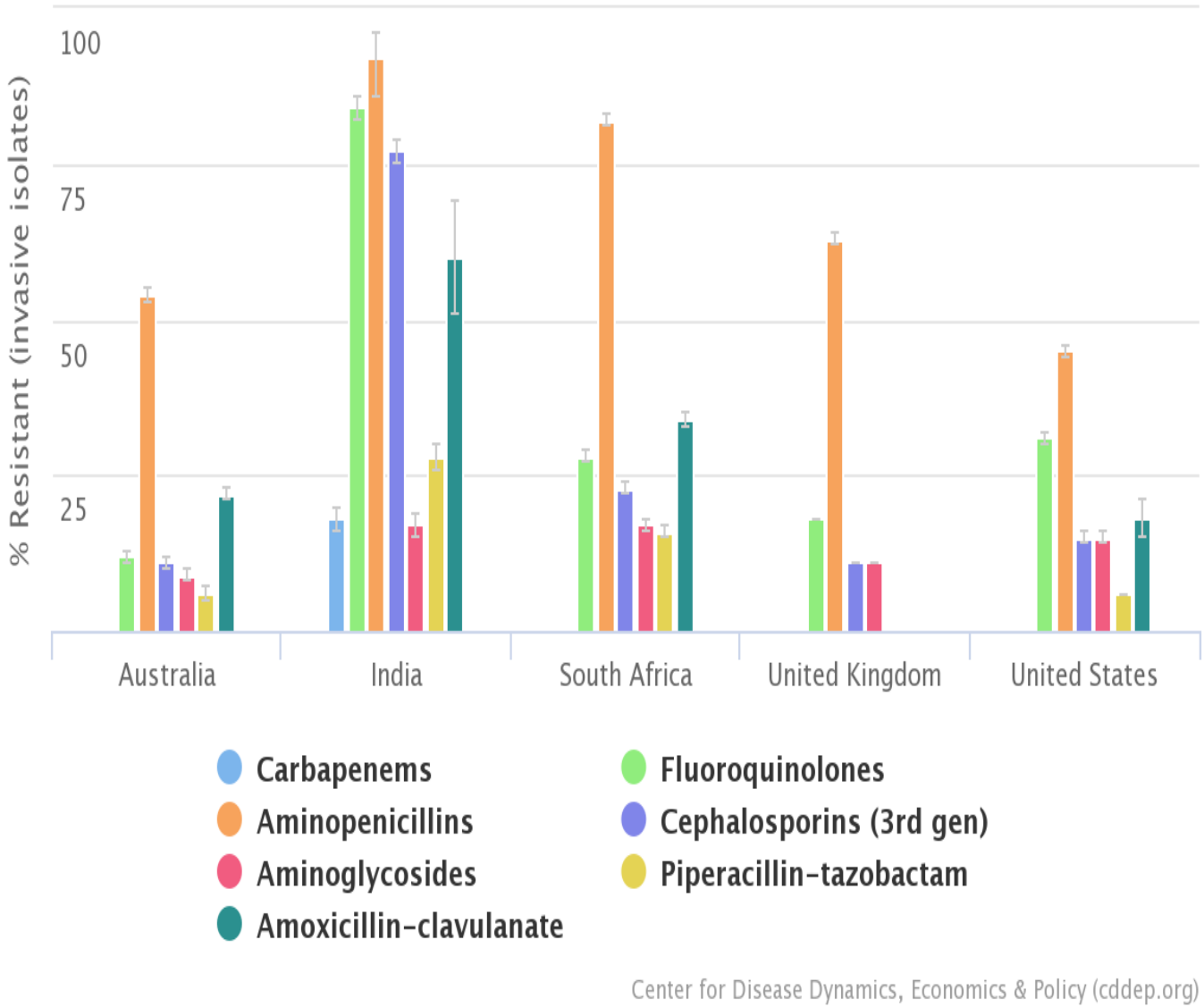
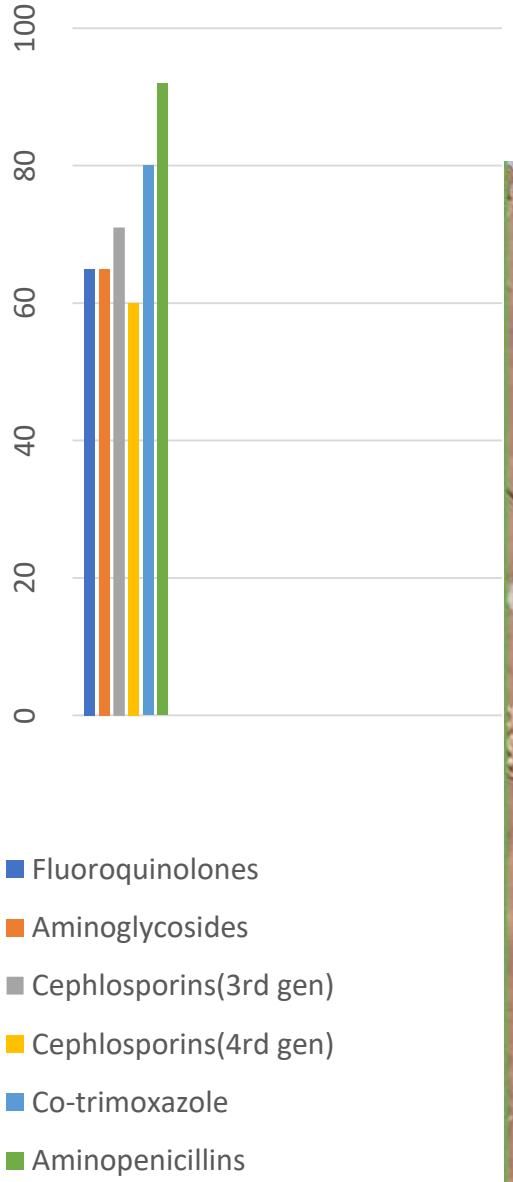
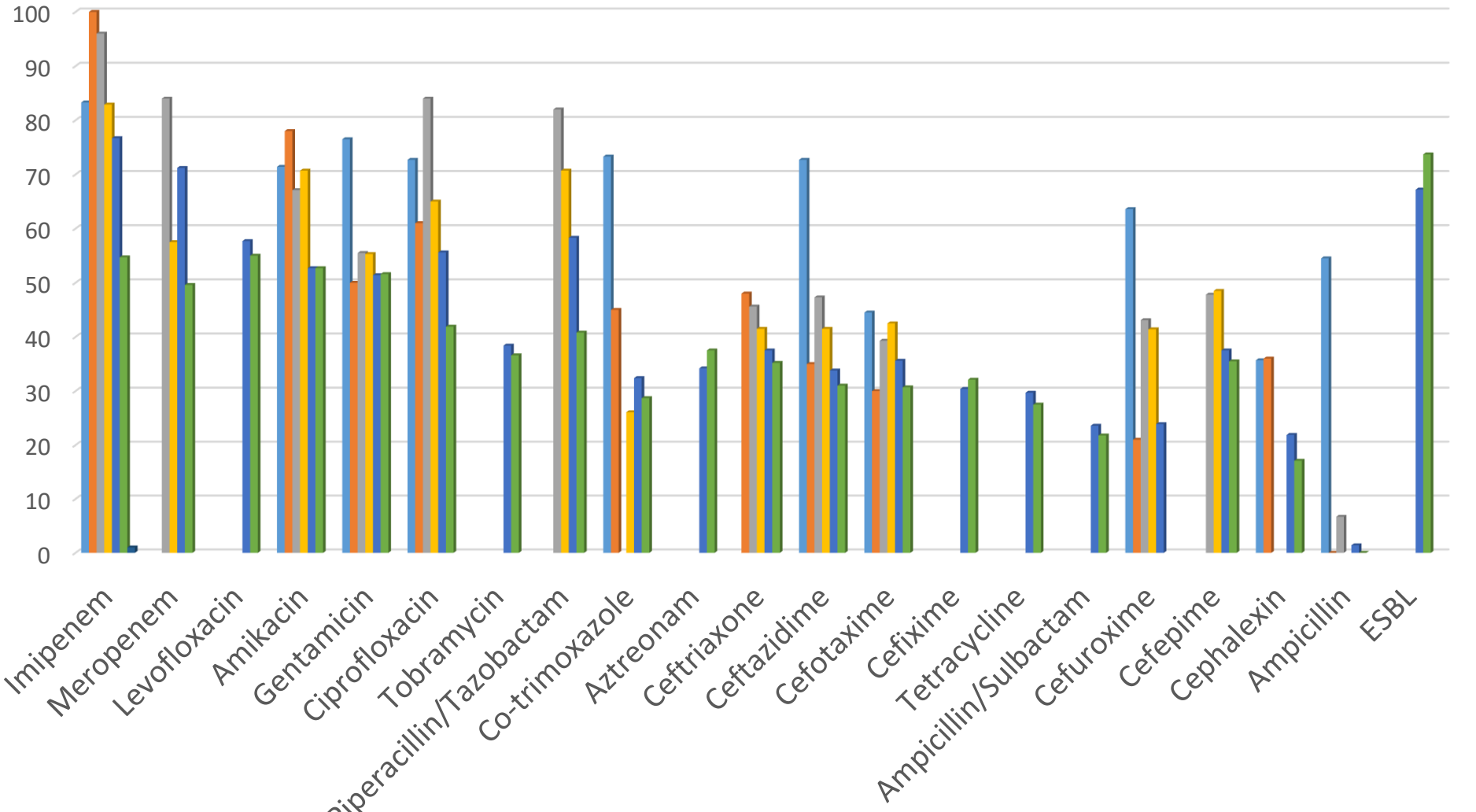
Antibiotic Resistance of *Escherichia coli*

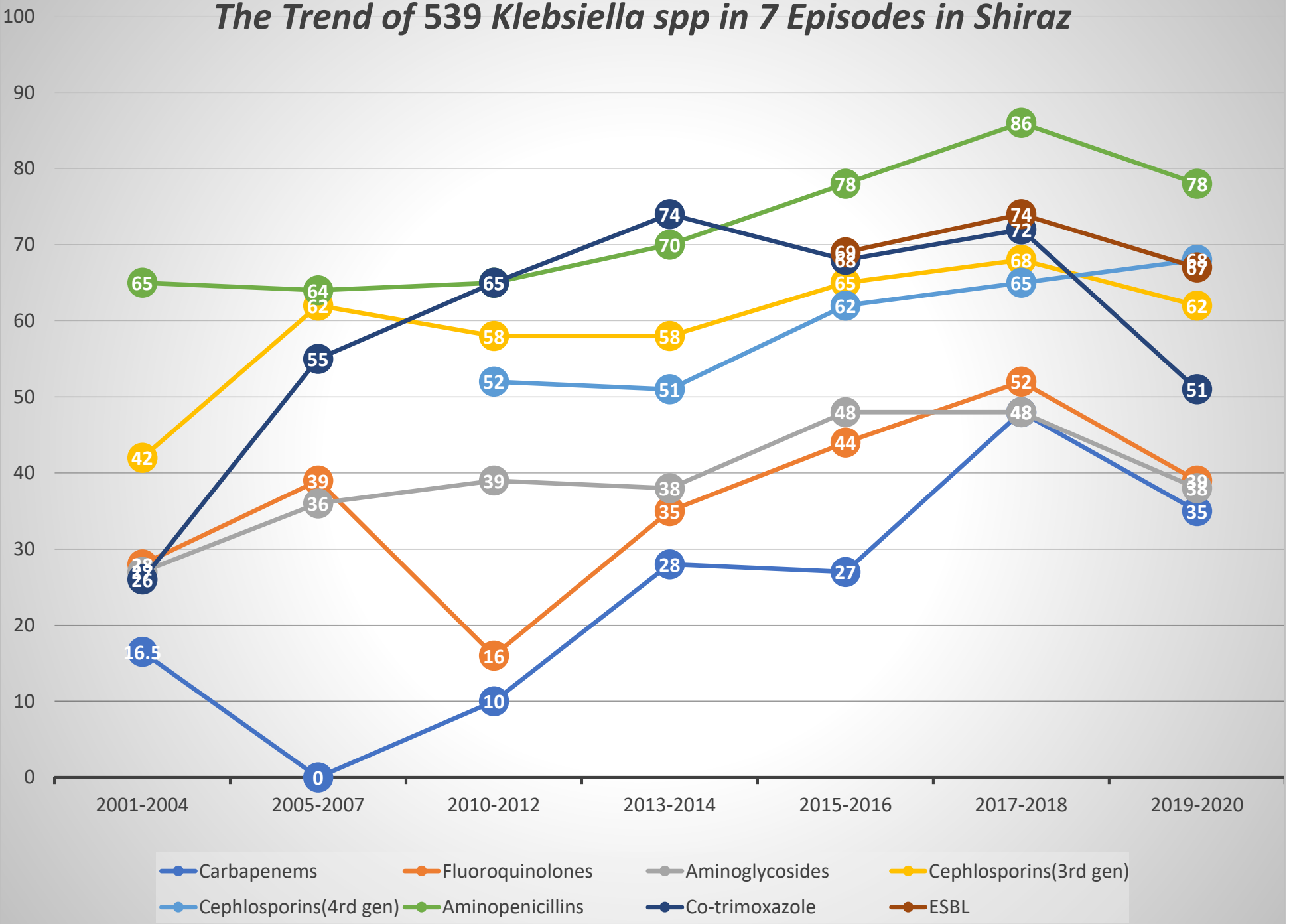




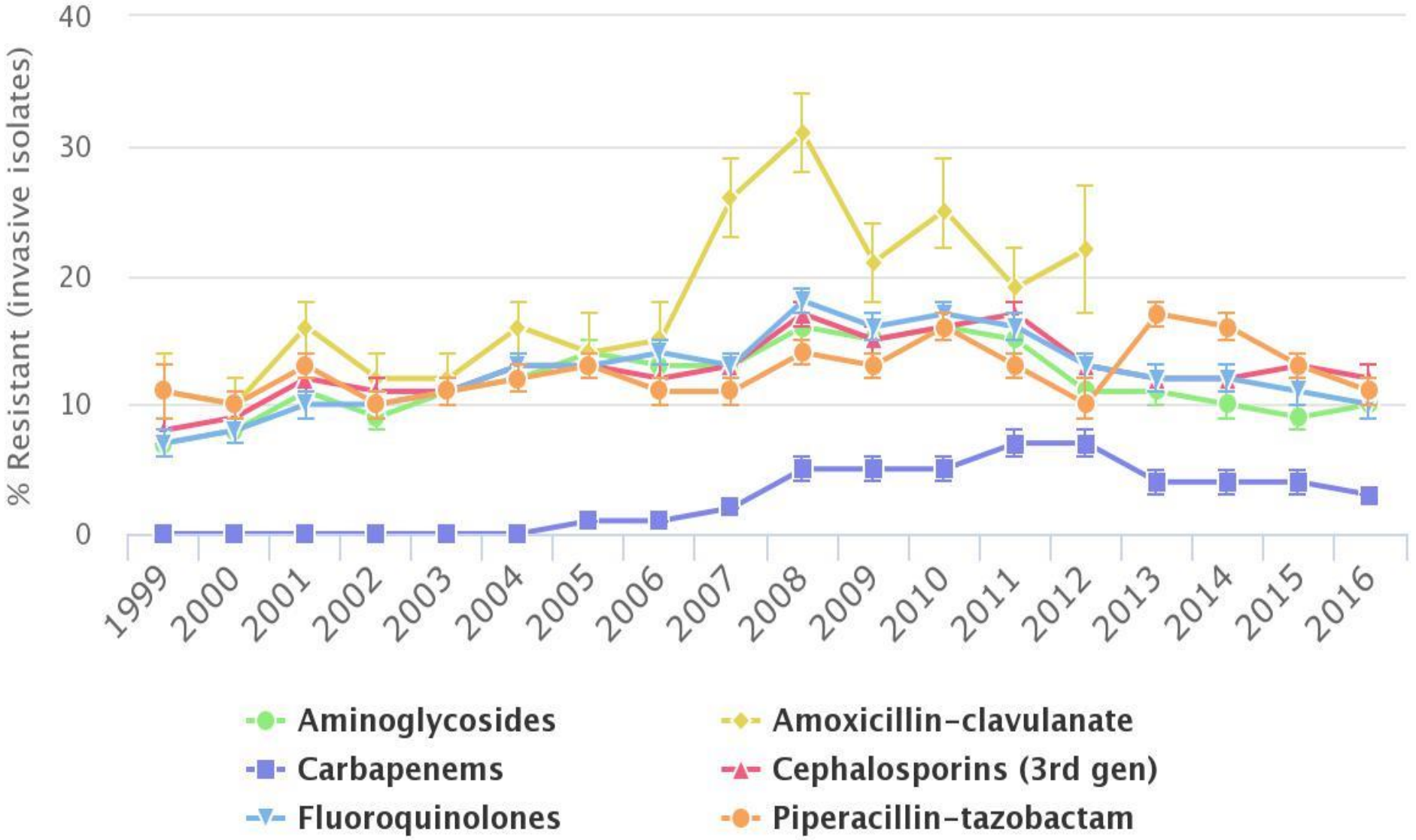
Rates of Sensitivity to Different Antibiotics against 539 *Klebsiella spp*. Strains Isolated from Bloodstream Infections, in Seven Episodes, Shiraz, Iran



The Trend of 539 Klebsiella spp in 7 Episodes in Shiraz



Antibiotic Resistance of *Klebsiella pneumoniae* in United States



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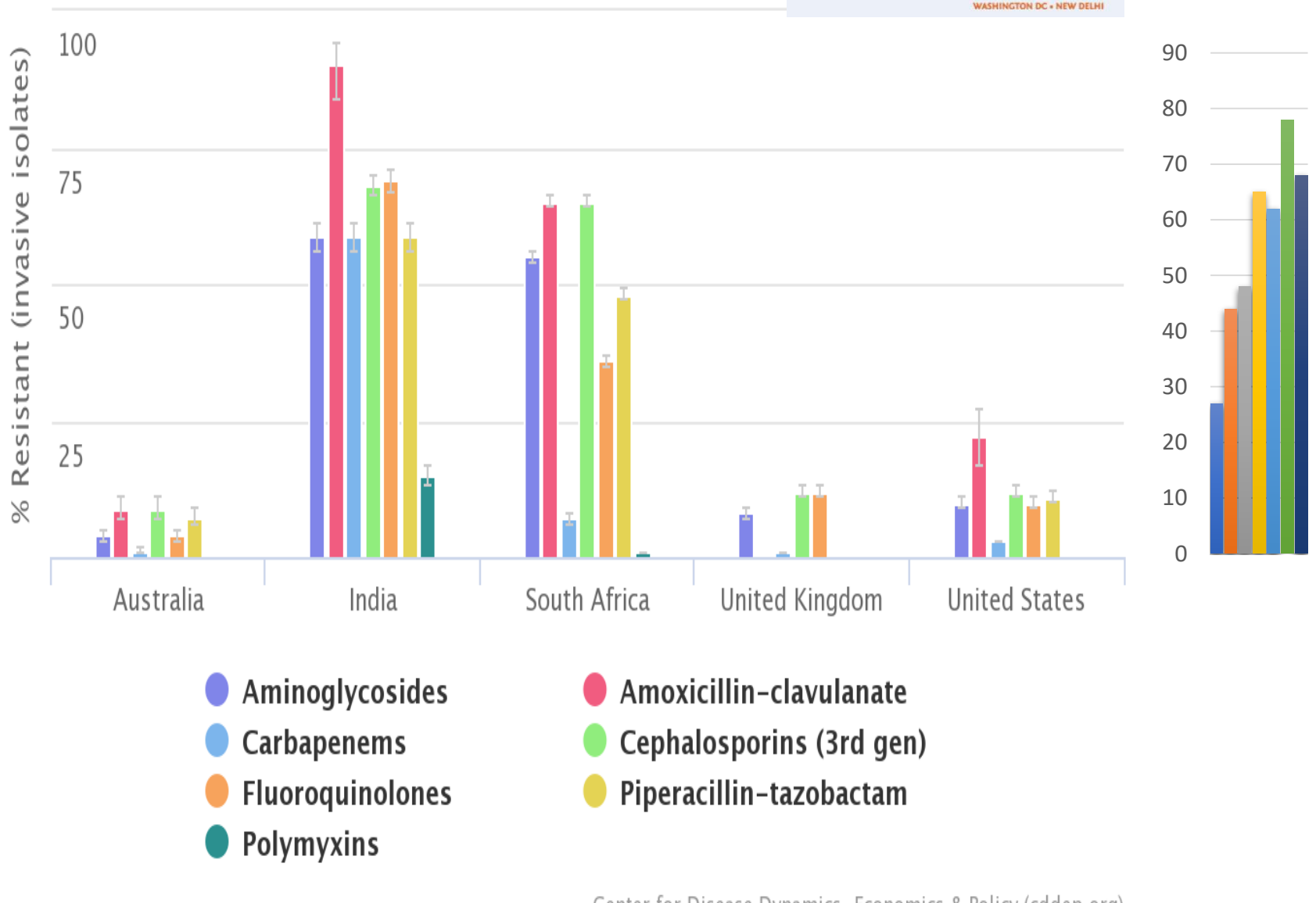
Antibiotic Resistance of *Klebsiella pneumoniae*



Comparison of Resistance Rates to Antibiotics Between Carbapenem-Resistant Klebsiella pneumoniae and Carbapenem-Susceptible Klebsiella pneumoniae in 72 Isolates(1398)

ANTIBIOTIC	IMP-Resistance N=33(46%)	IMP-Sensitive N=39(54%)
Chloramphenicol	21(63.6%)	4(10.3%)
Ciprofloxacin	27(81.8%)	7(17.9%)
Gentamicin	24(72.7%)	3(7.7%)
Tetracycline	31(93.9%)	21(53.8%)
Tobramycin	27(81.8%)	4(10.3%)
Trimethoprim/Sulfamethoxazole	26(78.8%)	11(28.2%)
Amikacin	17(51.5%)	5(12.8%)
Amoxicillin/Clavulanic acid	33(100%)	19(48.7%)
Ampicillin	33(100%)	37(94.9%)
Aztreonam	29(87.9%)	10(25.6%)
Cefotaxime	30(90.9%)	11(28.2%)
Ceftazidime	31(93.9%)	11(28.2%)
Cefuroxime	30(90.9%)	15(38.5%)

Point 1:
Multidrug-resistant (MDR)

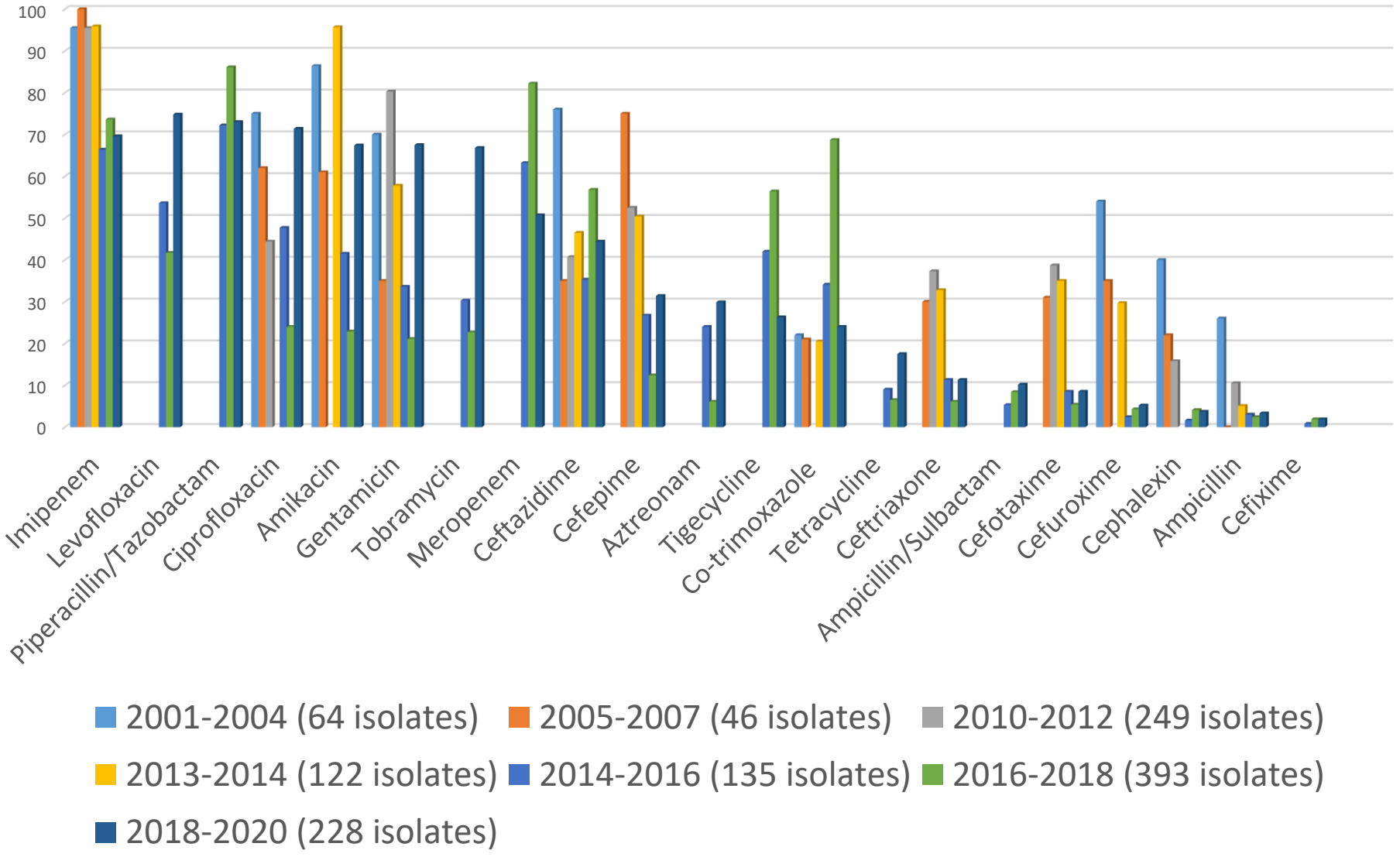
- Lack of susceptibility to at least one agent in three or more chemical classes of antibiotic (e.g. a beta-lactam, an aminoglycoside, a macrolide).

1) ***Pseudomonas spp.***

2) ***Acinetobacter baumannii***

3) ***Stenotrophomonas maltophilia***

Rates of Sensitivity to Different Antibiotics Tested against 1237 Strains of *Pseudomonas* Species Isolated from Bloodstream Infections, in Seven Episodes, Shiraz, Iran



Anti-pseudomonas antibiotics

Antibiotic	Class
Ticarcillin Ticarcillin / Clavulanic acid Piperacillin Piperacillin / Tazobactam	Extended spectrum penicillins
Ceftazidim Cefepime Aztreonam	Monobactams and Cephalosporins
Imipenem Meropenem	Carbapenems
Gentamicin Amikacin Netilmicin Tobramycin	Aminoglycosides
Ciprofloxacin	Fluoroquinolones

Antibiotic Resistance of *Pseudomonas aeruginosa*

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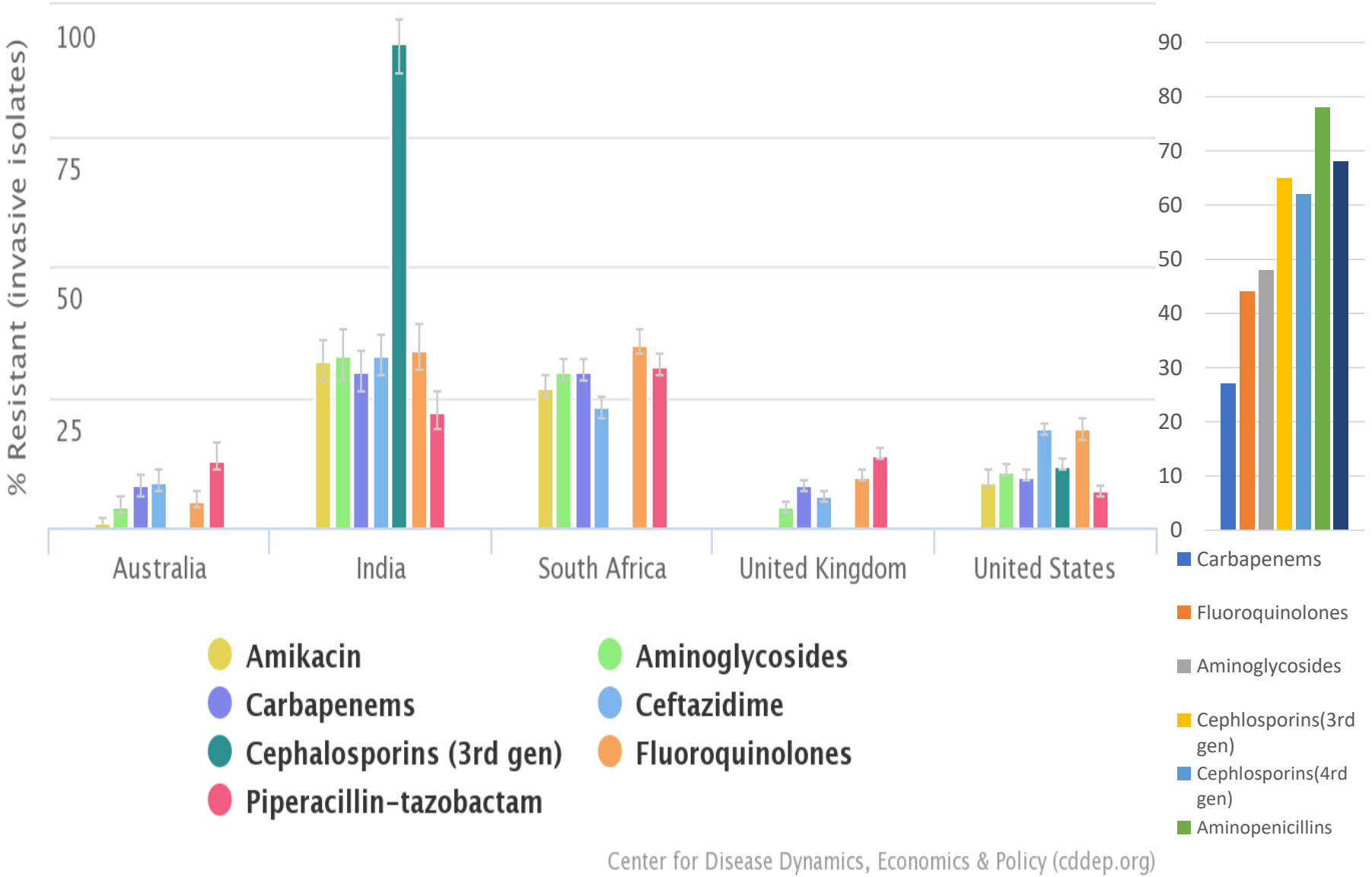
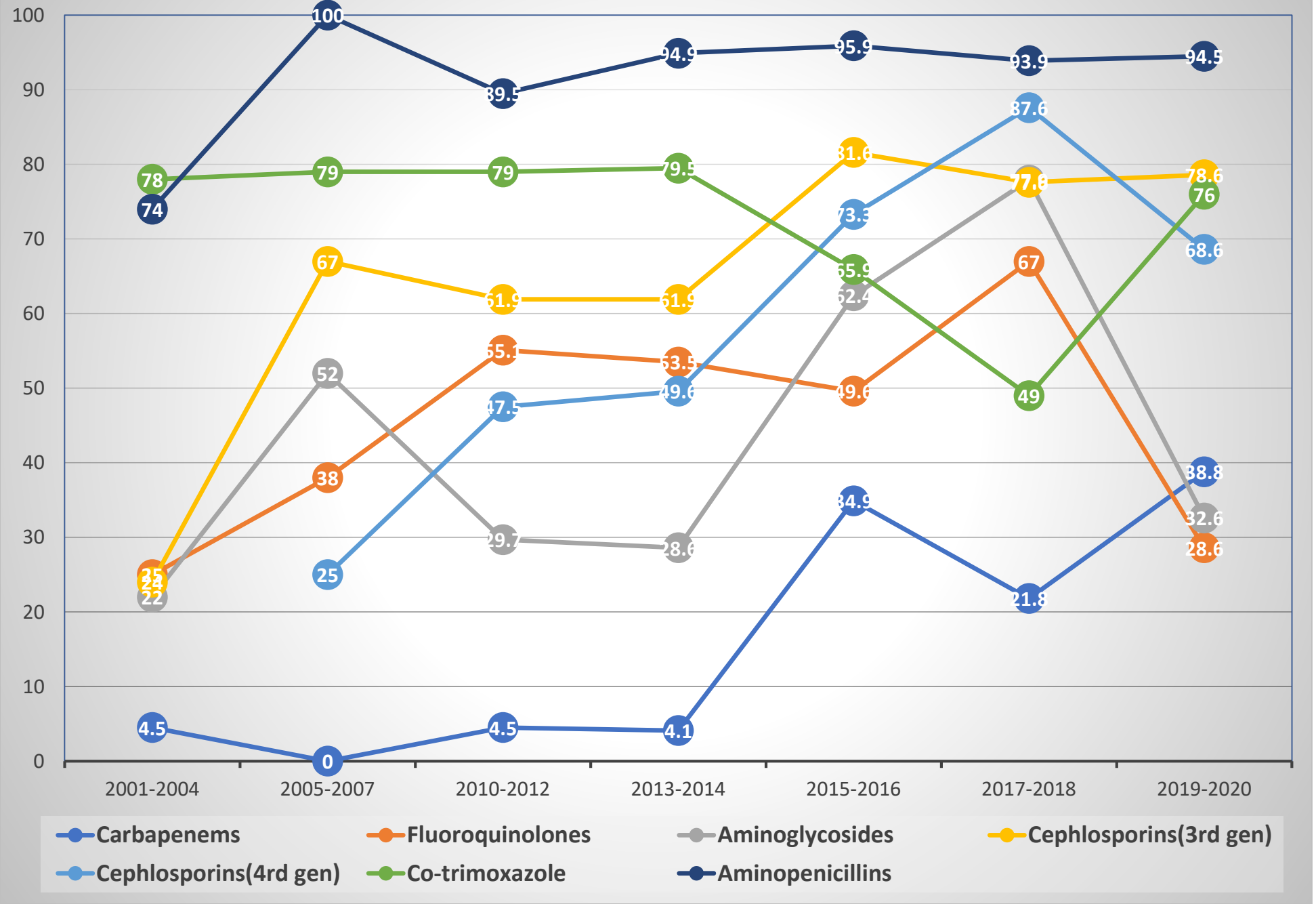
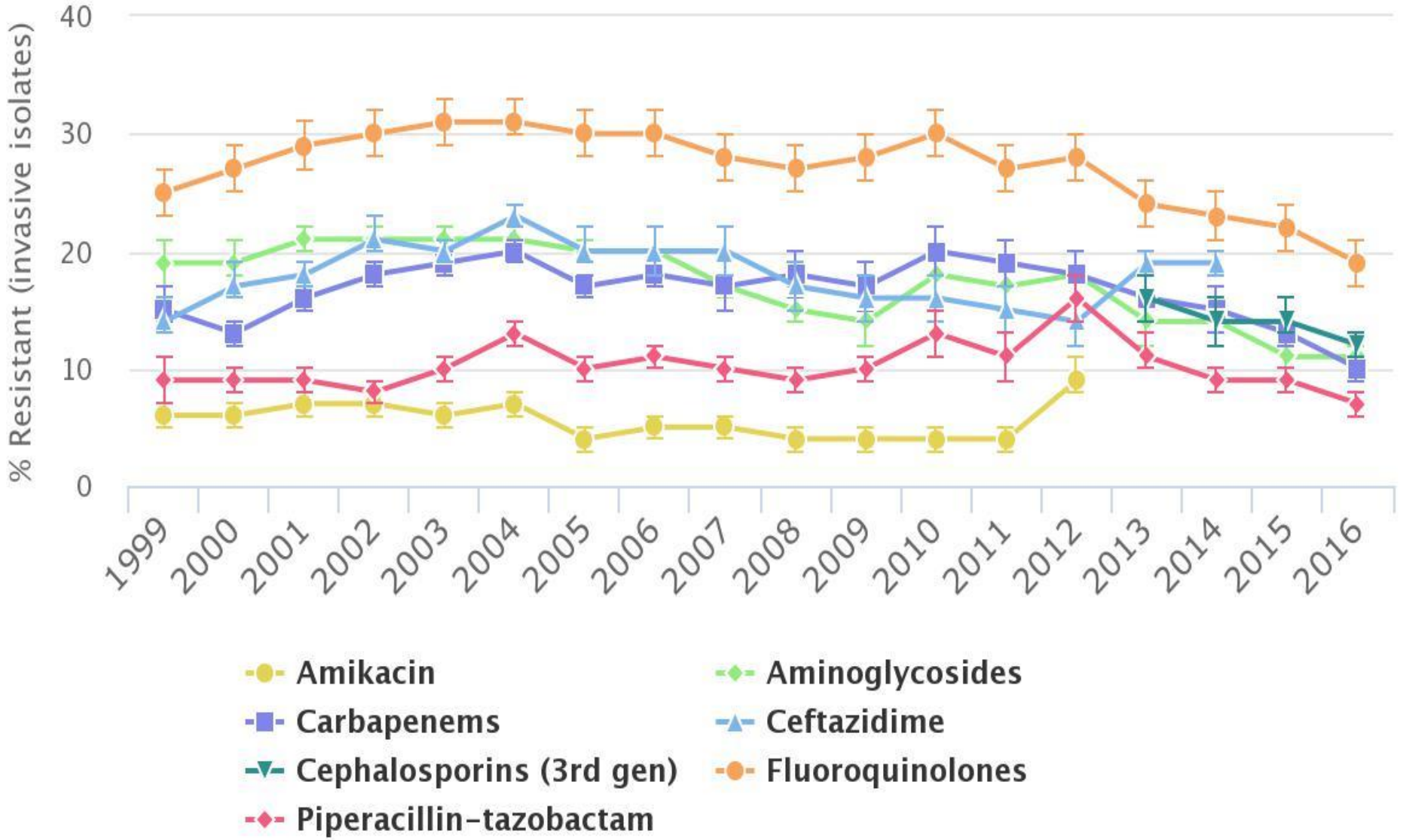


مرکز تحقیقات میکروب شناسی بالینی استاد البرزی
Prof. Alborzi Clinical Microbiology Research Center
P.A.C.M.R.C

The Trend of 1237 Pseudomonas Species in 7 Episodes in Shiraz



Antibiotic Resistance of *Pseudomonas aeruginosa* in United States



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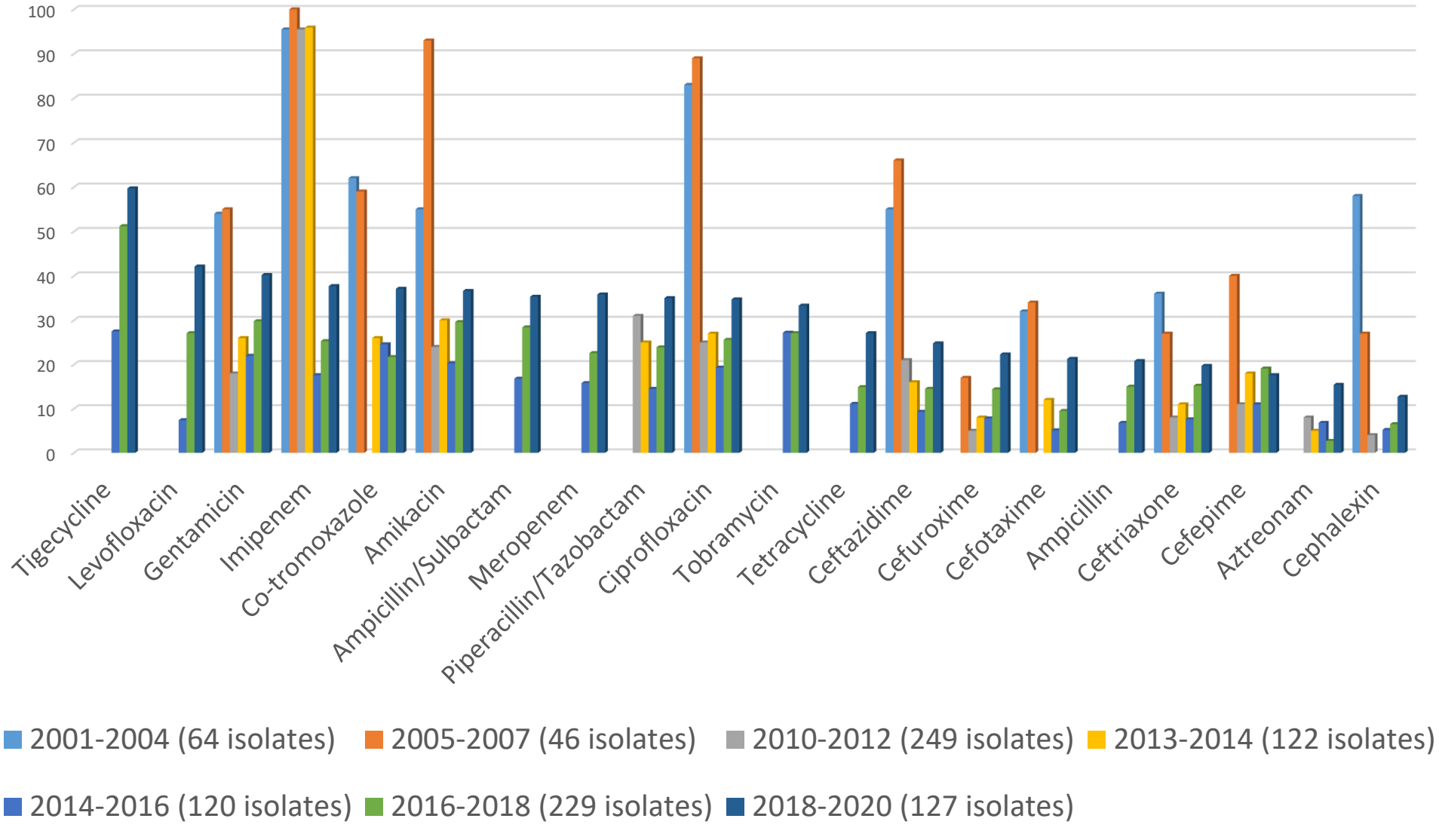
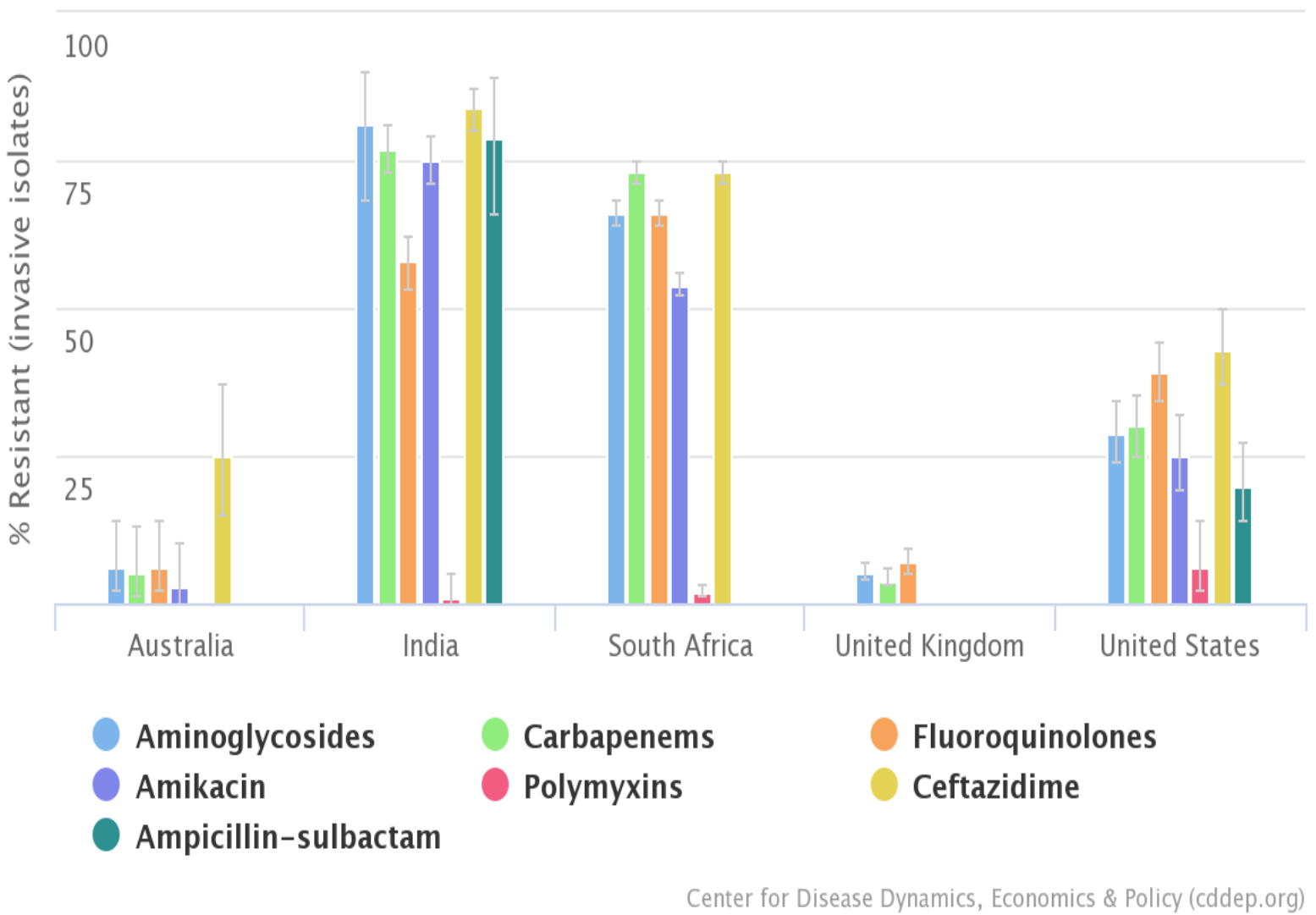
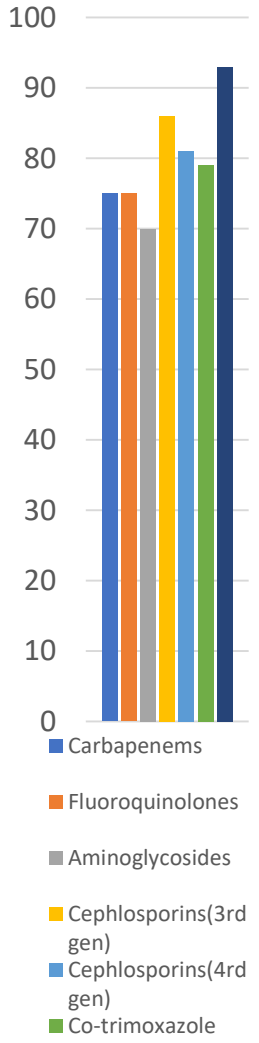
Rates of Sensitivity to Different Antibiotics Tested against 1084 Strains of *Acinetobacter* Species Isolated from Bloodstream Infections, in Seven Episodes, Shiraz, Iran

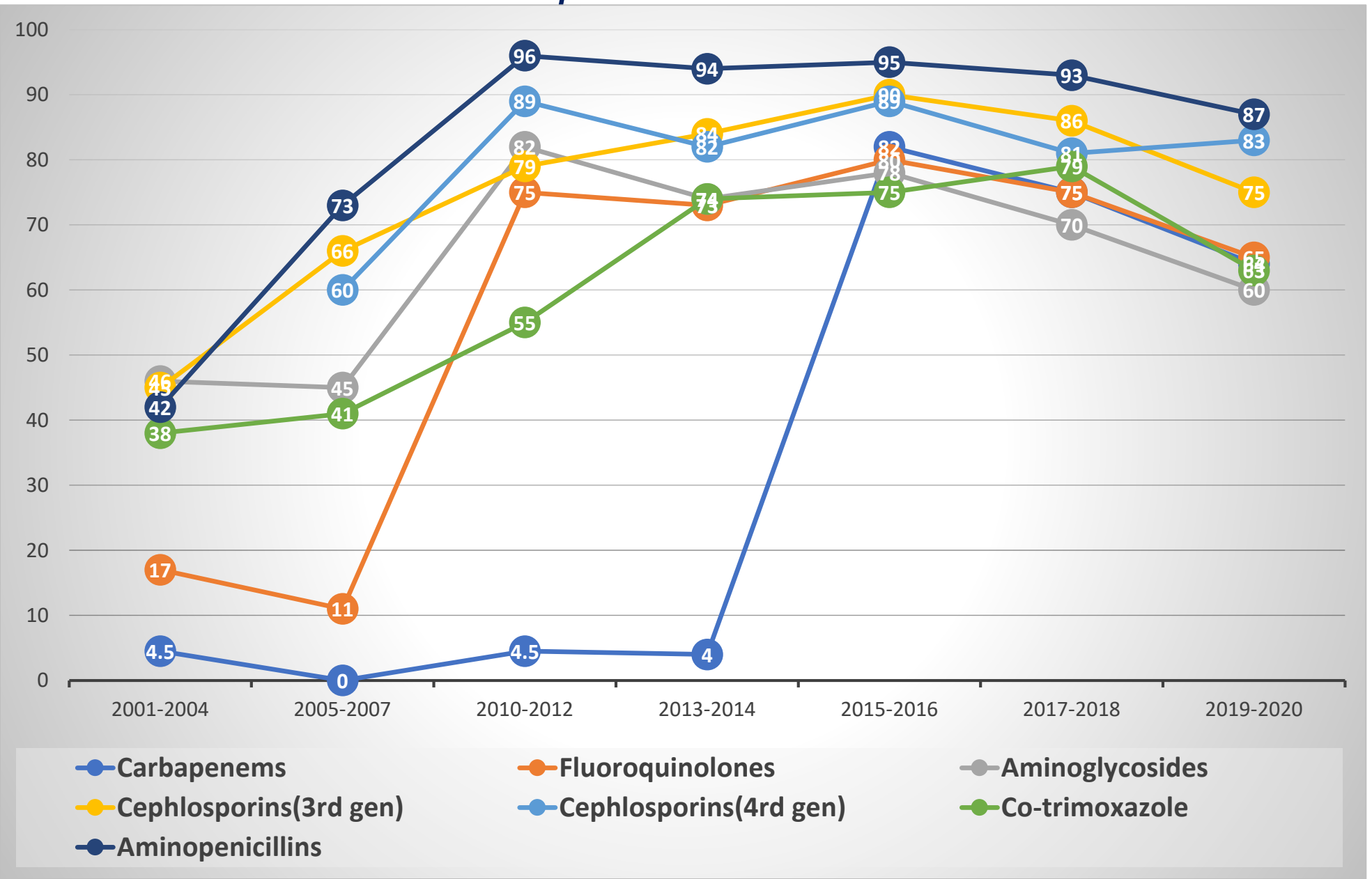


Antibiotic Resistance of *Acinetobacter baumannii*

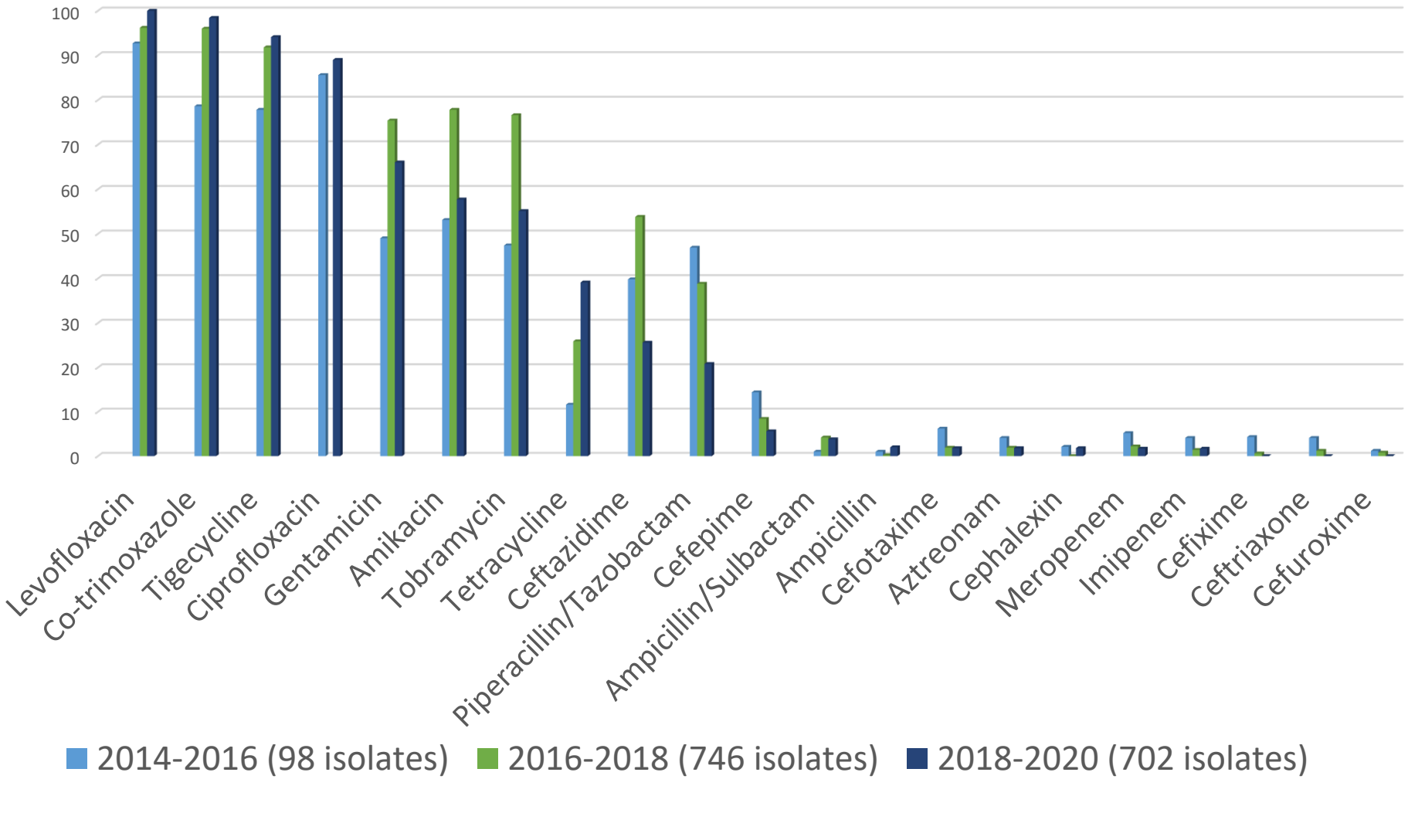




The Trend of 1084 Strains of *Acinetobacter* Species *in 7 Episodes in Shiraz*



Rates of Sensitivity to Different Antibiotics Tested against 1546 Stenotrophomonas maltophilia Strains Isolated from Bloodstream Infections, in Three Episodes, Shiraz, Iran



S. maltophilia

- *Stenotrophomonas maltophilia* is a significant nosocomial pathogen and is commonly isolated in the hospital environment, including disposable nebulizers, tracheal suction catheters and respirator circuits, handwashing soap, tap water, faucet aerator, and chlorhexidine solutions and hands of HCWs.

- The bacteria's frequent colonization of fluids used in the hospital settings, irrigation solution, and/or invasive medical devices

- It is responsible for various infectious diseases in hospitalized patients especially among the immunosuppressed, immunocompromised as well as those with medical implants.

- *S maltophilia* infection, colonization, and outbreaks have been previously reported.

Pseudo-outbreak

- Pseudobacteremia may be defined as the presence of bacteria in the blood culture in the absence of clinical or other bacteriologic evidence of bloodstream infection.

- Pseudobacteremia was suspected since majority of these patients have no clinical and laboratory findings of sepsis and consecutive blood cultures were negative.

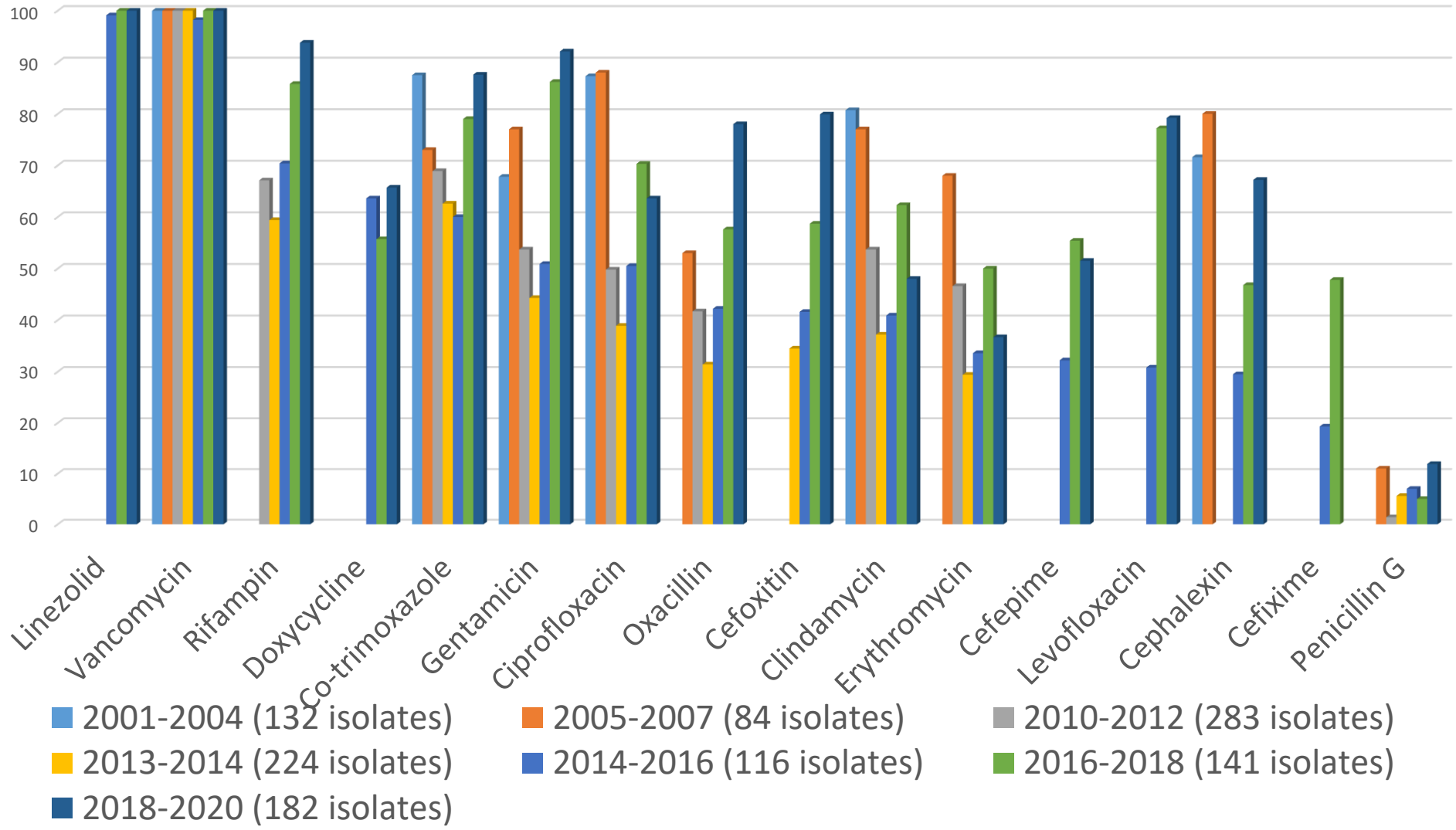
- The combination of multiple lapses in infection control and the blood-collecting behavior of a HCW might have been the cause of the **pseudo-outbreak** of *S. maltophilia*, and it was possibly from an environmental source.

S. Maltophilia in Shiraz-2016

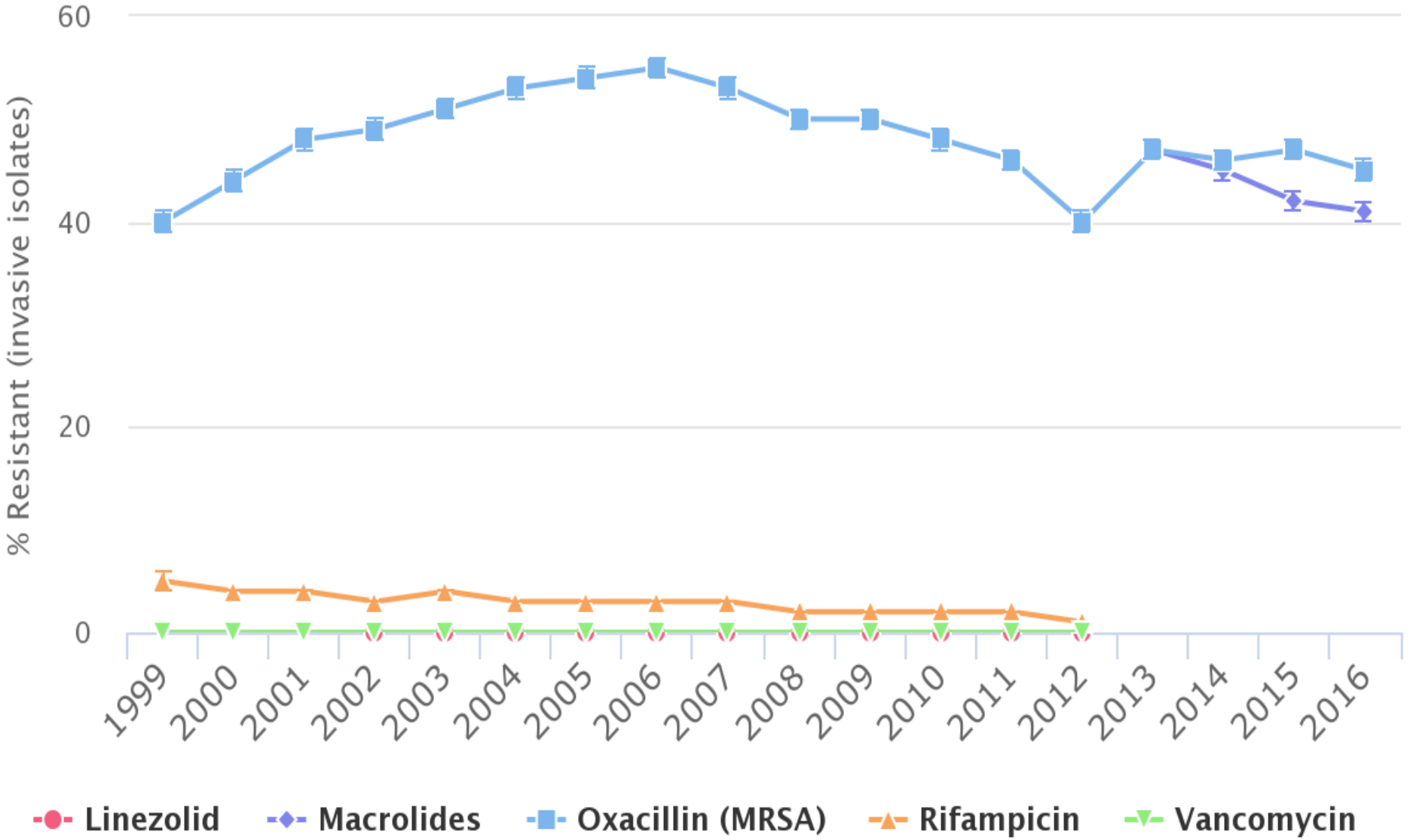
- From 100 *S. maltophilia* blood isolates
  - 52 samples pure Isolates in culture
  - 12 polymicrobial culture with *Pseudomonas*
  - 35 polymicrobial culture with *achromobacter*
  - 1 polymicrobial culture with *E. coli*

* *Staphylococcus aureus*
* *Enterococci spp.*

Rates of Sensitivity to Different Antibiotics Tested against 1135 *Staphylococcus aureus* Strains Isolated from Bloodstream Infections, in Seven Episodes, Shiraz, Iran

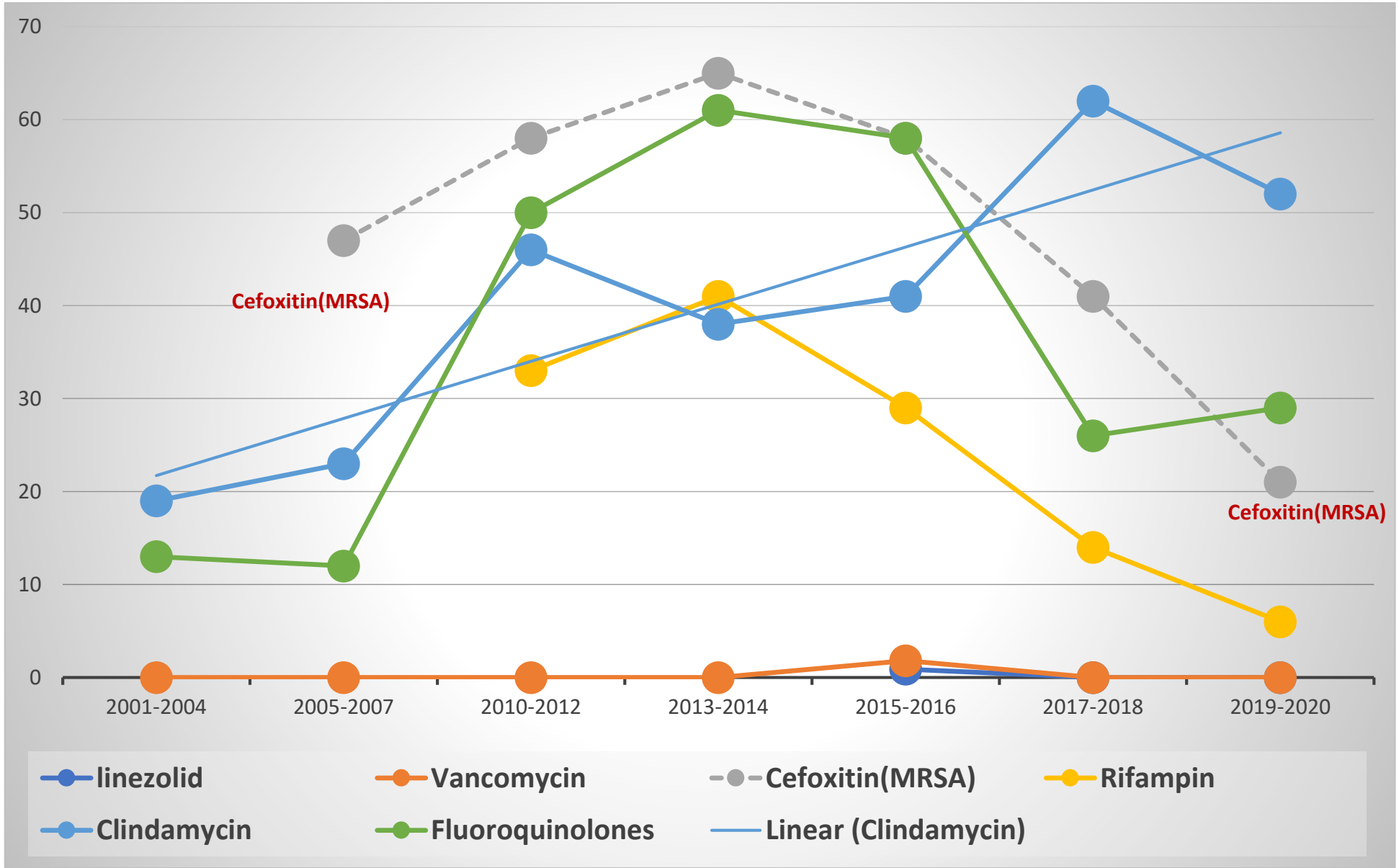


Antibiotic Resistance of *Staphylococcus aureus* in United States

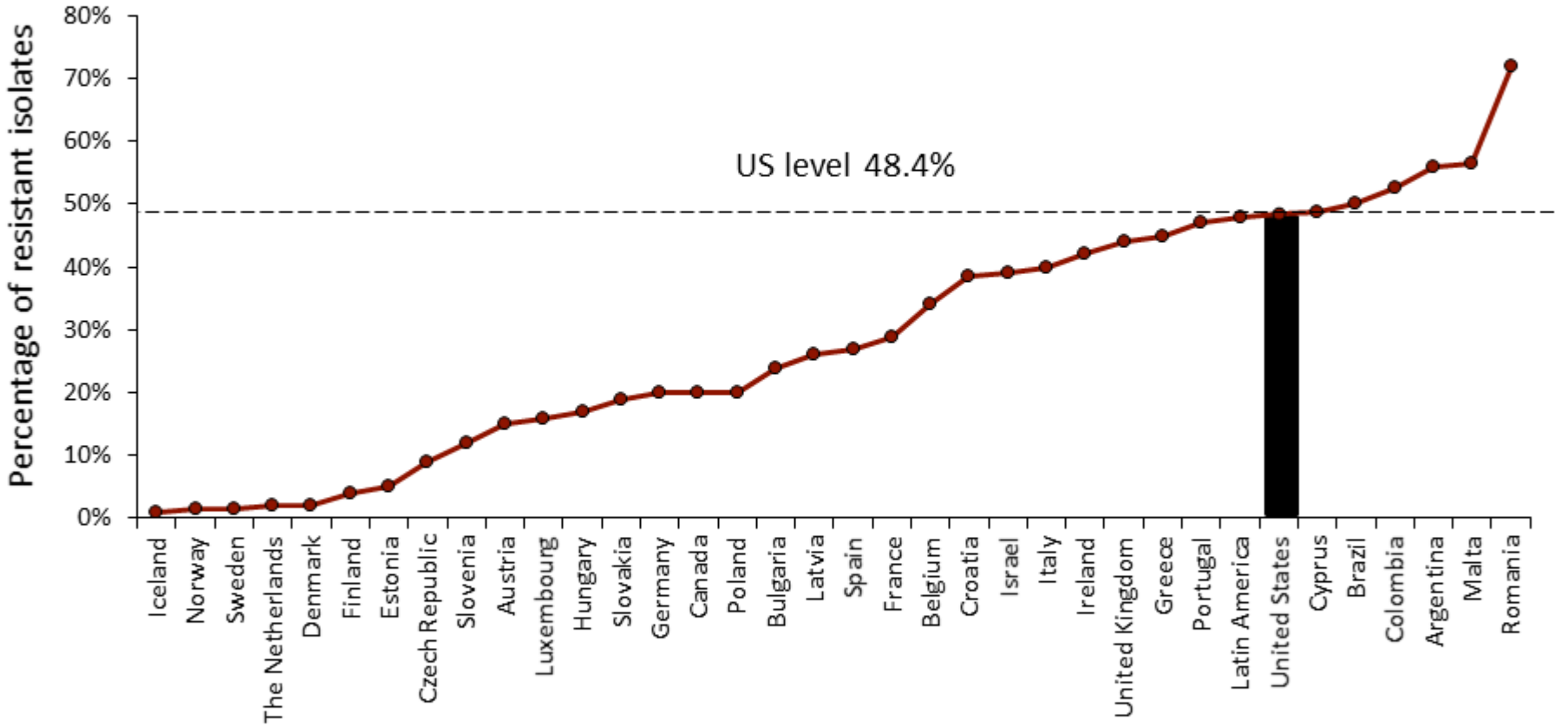


Center for Disease Dynamics, Economics & Policy (cddep.org)

The Trend of 1135 Staphylococcus aureus in 7 Episodes in Shiraz



MRSA Infection Rates by Country



Center for Disease Dynamics, Economics & Policy
CDDEP 2015. Retrieved from, http://www.cddep.org/tool/mrsa_infection_rates_country

Result of a blood culture

- ***Staphylococcus aureus*** is grown

- Susceptible:
  - Vancomycin, **Clindamycin**, Rifampin, Chloramphenicol, Gentamycin, **cephalexin**

- Intermediate:
  - Ciprofloxacin, Co-trimoxazole

- Resistant:
  - methicillin, **cefoxitin**, **erythromycin**

POINT 1:
methicillin-resistant Staphylococcus aureus (*MRSA)*

- A superbug

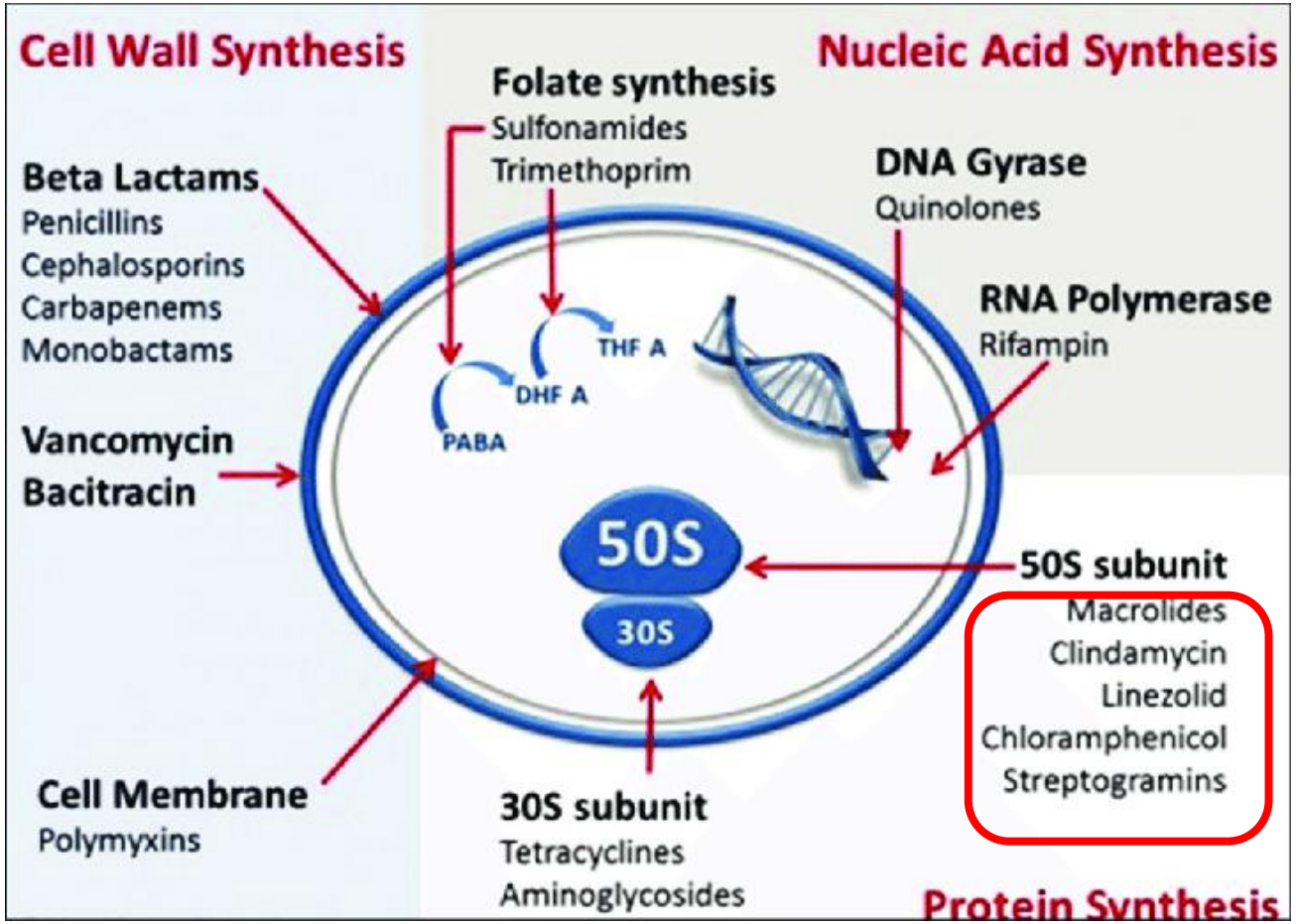
- The **cefoxitin disk** diffusion

- Oxacillin vs. cefoxitin disk:
  - Cefoxitin is known as the agent of choice for disk diffusion tests
  - a second-generation cephamycin antibiotic

Cephalexin
should only be used to **treat** infections caused by MRSA.

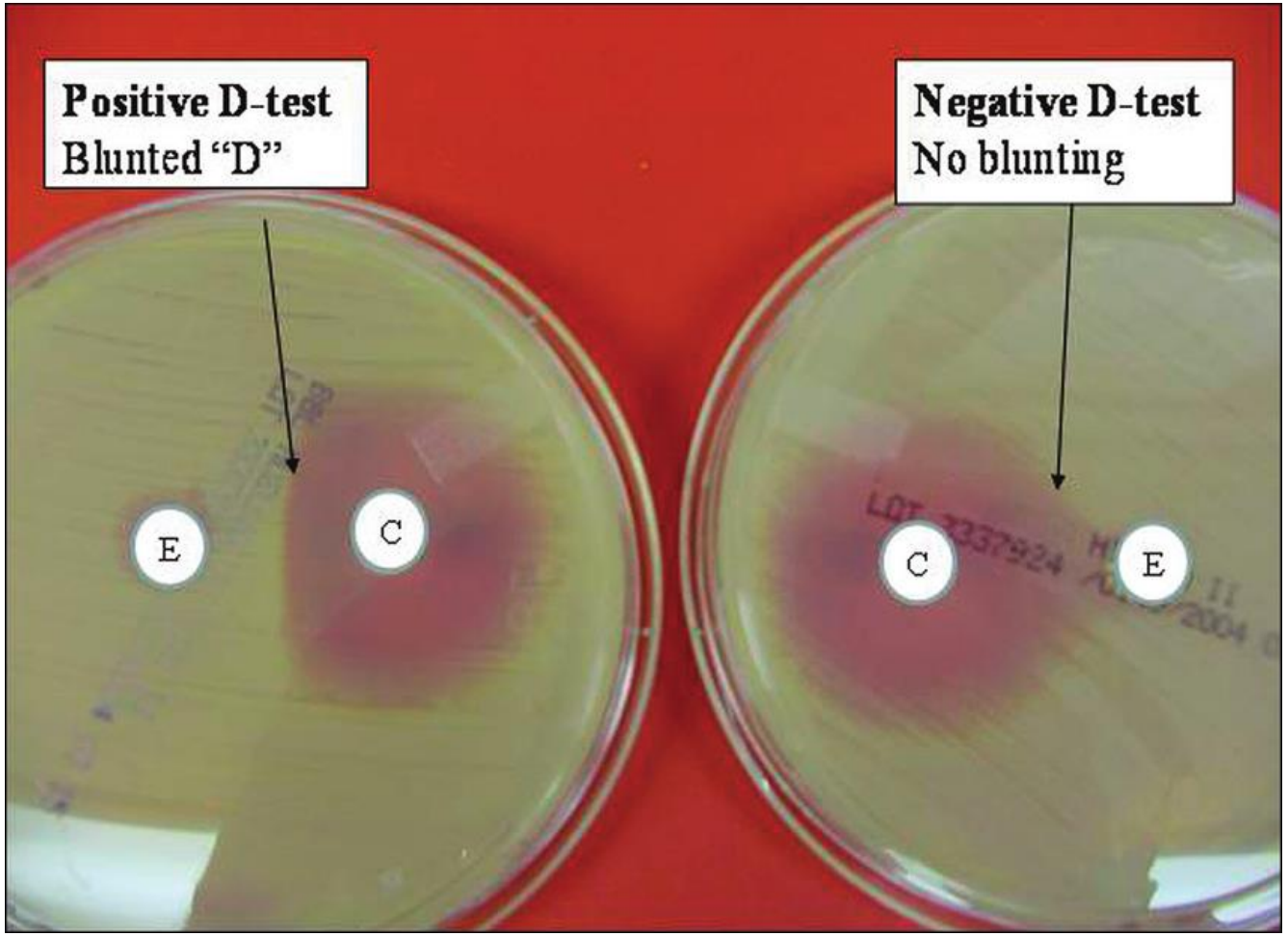
Point 2: Cross-resistance

Resistance to macrolides-lincosamides and streptogramins B (MLS_B antibiotics)



Inducible clindamycin resistance

A simple disk approximation test



Point 3: monotherapy of MRSA with Gentamycin and rifampin

- A high risk of treatment failure

Result of a blood culture

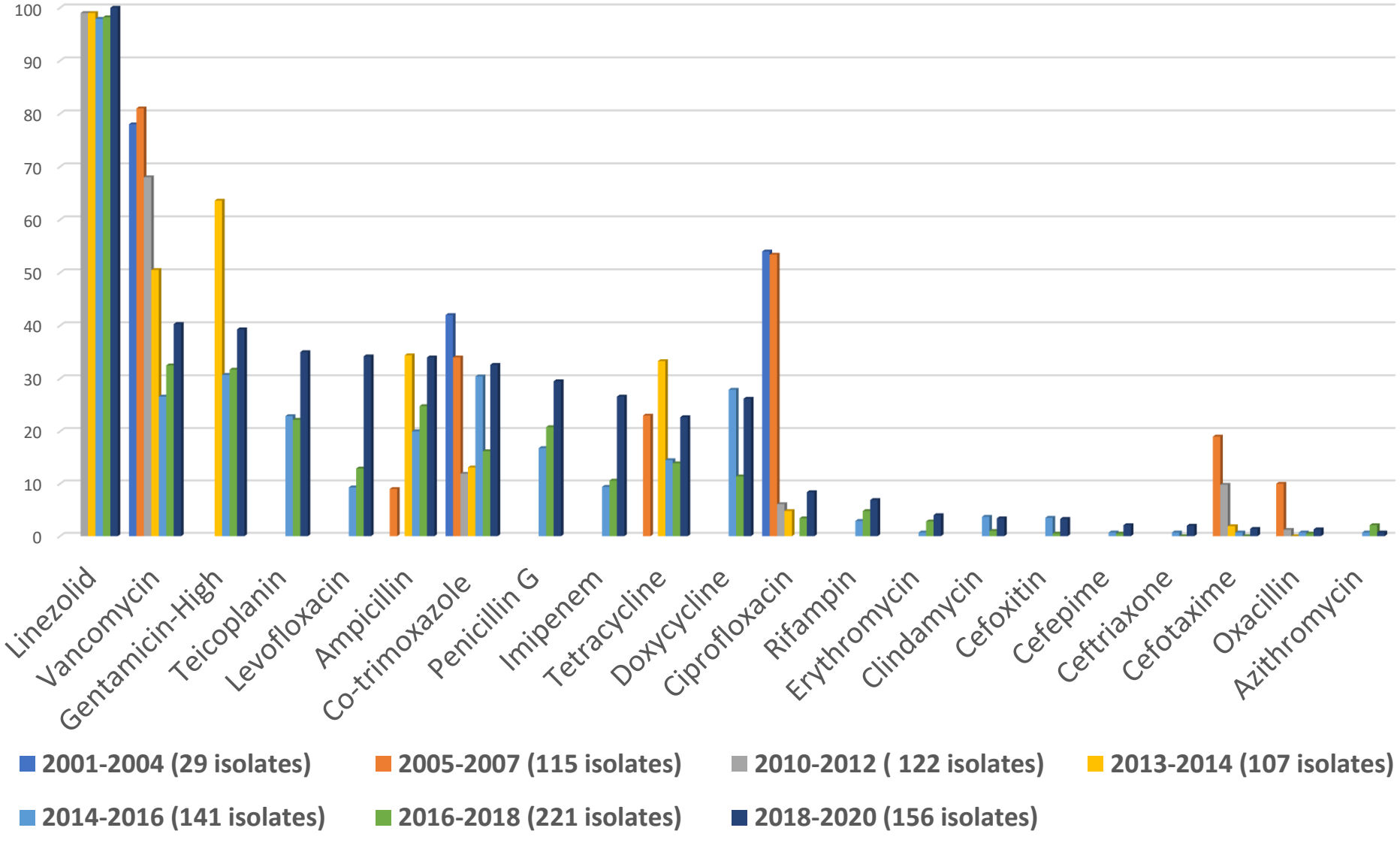
- ***Staphylococcus aureus*** is grown

- Susceptible:
  - Vancomycin, **Clindamycin**, Rifampin, Chloramphenicol, Gentamycin, **cephalexin**

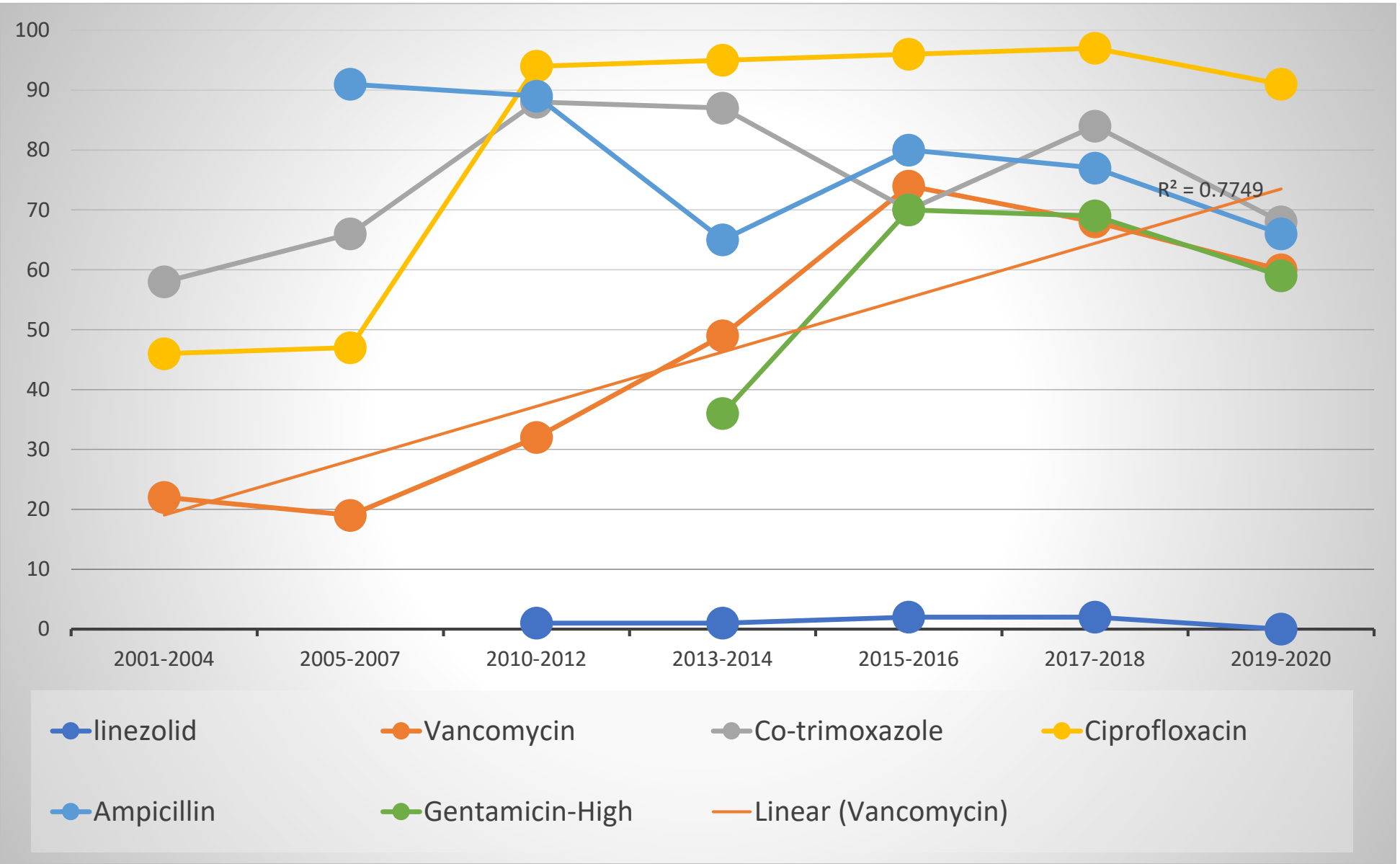
- Intermediate:
  - Ciprofloxacin, Co-trimoxazole

- Resistant:
  - methicillin, **cefoxitin**, **erythromycin**

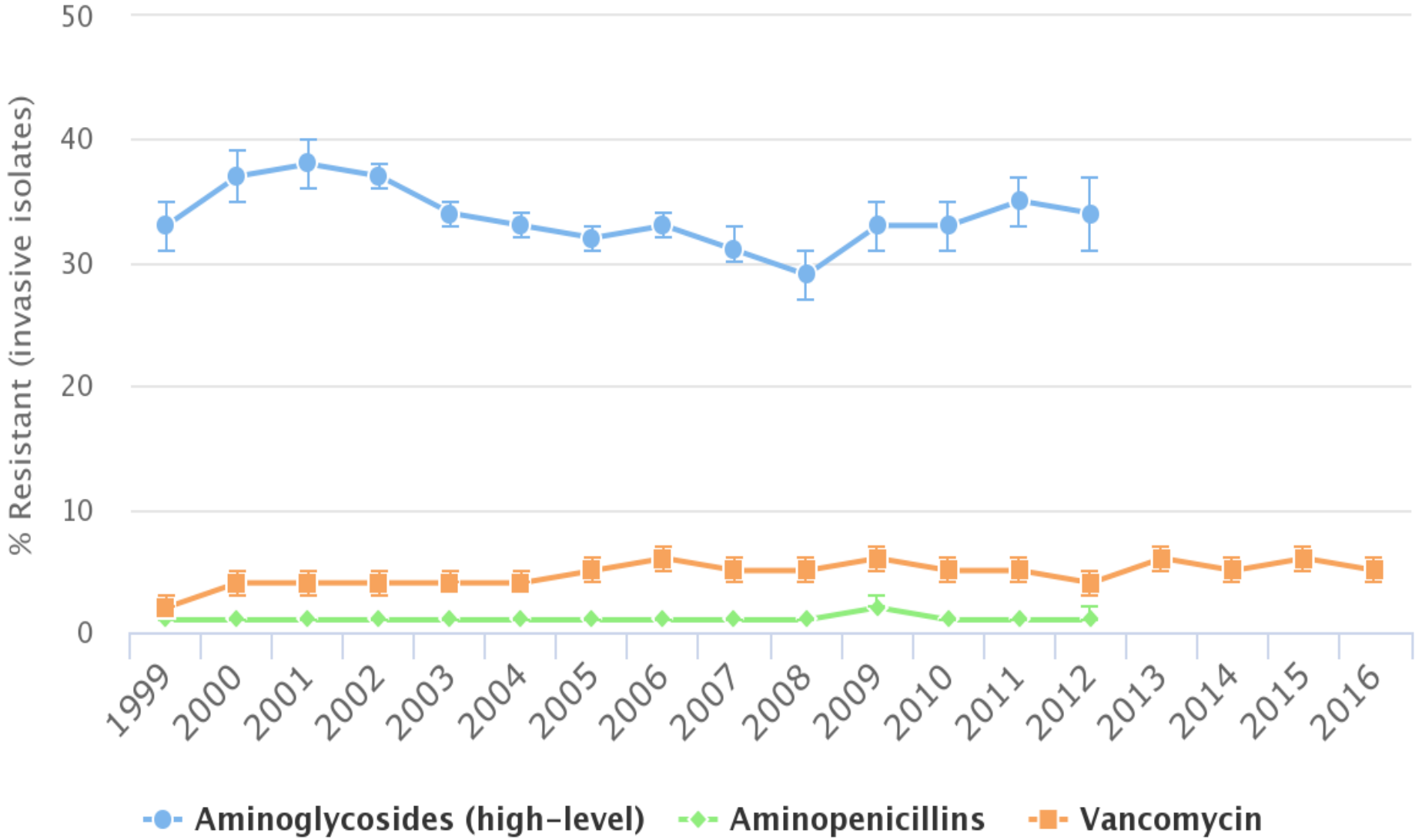
Rates of Sensitivity to Different Antibiotics Tested against 891 strains of Enterococci Species Isolated from Bloodstream Infections, in Seven Episodes, Shiraz, Iran



The Trend of Resistance of 891 strains of Enterococci in 7 Episodes in Shiraz



Antibiotic Resistance of *Enterococcus faecalis* in United States



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Enterococcal Infections Treatment

- Ampicillin
  - the drug of choice for monotherapy of susceptible *E faecalis infection*.
- Vancomycin
  - Patients with a penicillin allergy or resistant strains
- Nitrofurantoin:
  - Enterococcal cystitis
- Linezolid
  - VRE
- Combination therapy
  - a cell wall–active agent (eg, **ampicillin, vancomycin**) and an aminoglycoside (eg, **gentamicin**, streptomycin)

E. faecalis and E. faecium are naturally (intrinsically) resistant to cephalosporins

THANK YOU

مرکز تحقیقات میکروب شناسی بالینی استاد البرزی

P.A.C.M.R.C

Prof. Alborzi Clinical Microbiology Research Center