Antibiotic resistance in Lebanon

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introduction

- Antibiotic Resistance:
  - One of the biggest threats to global health, food security, and development today.
  - Can affect anyone, of any age, in any country.
  - Occurs naturally, but misuse of antibiotics is accelerating the process.
  - leads to longer hospital stays, higher medical costs and increased mortality.

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The essential daily briefing

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FRIDAY
16 MARCH 2012
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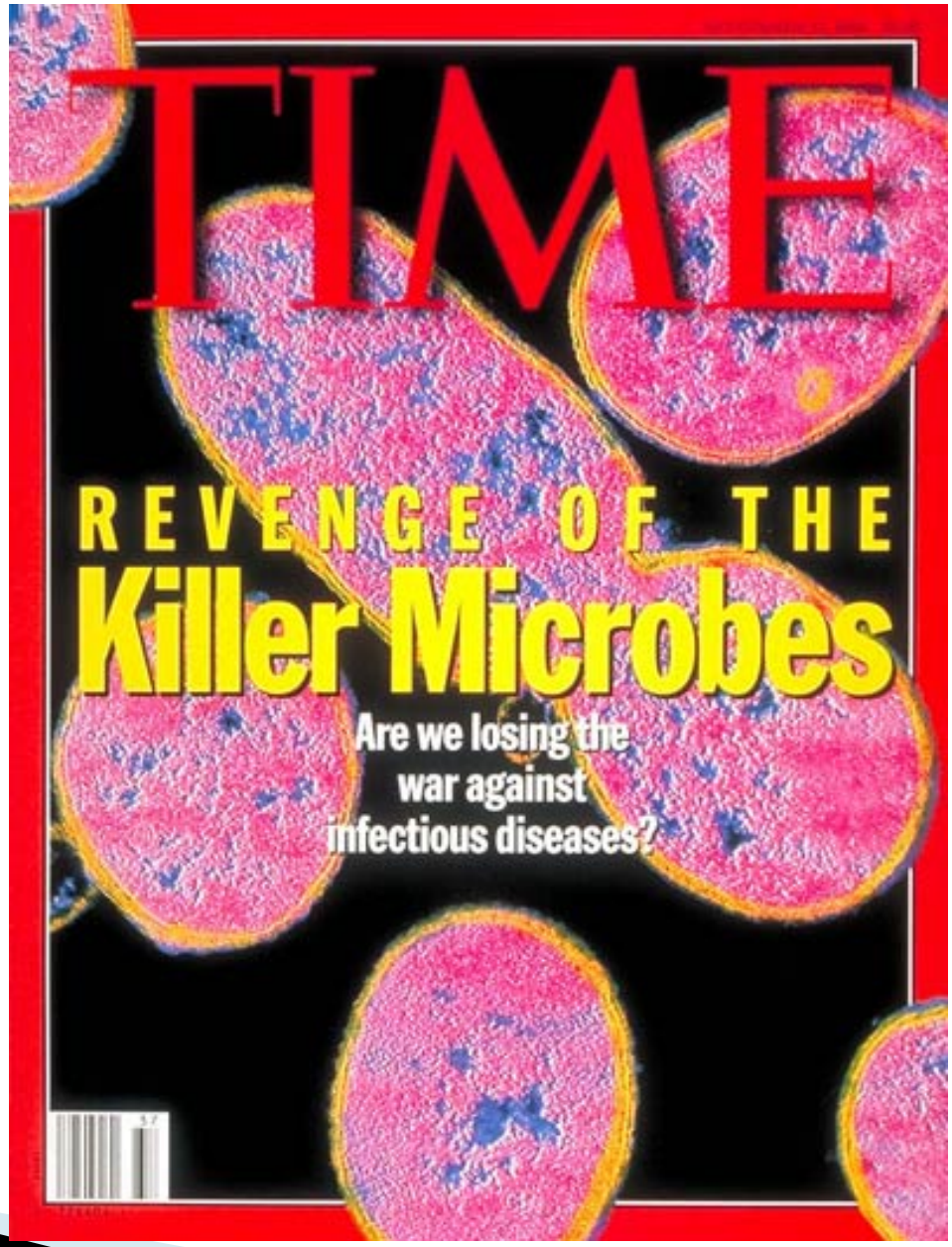
INSIDE TODAY

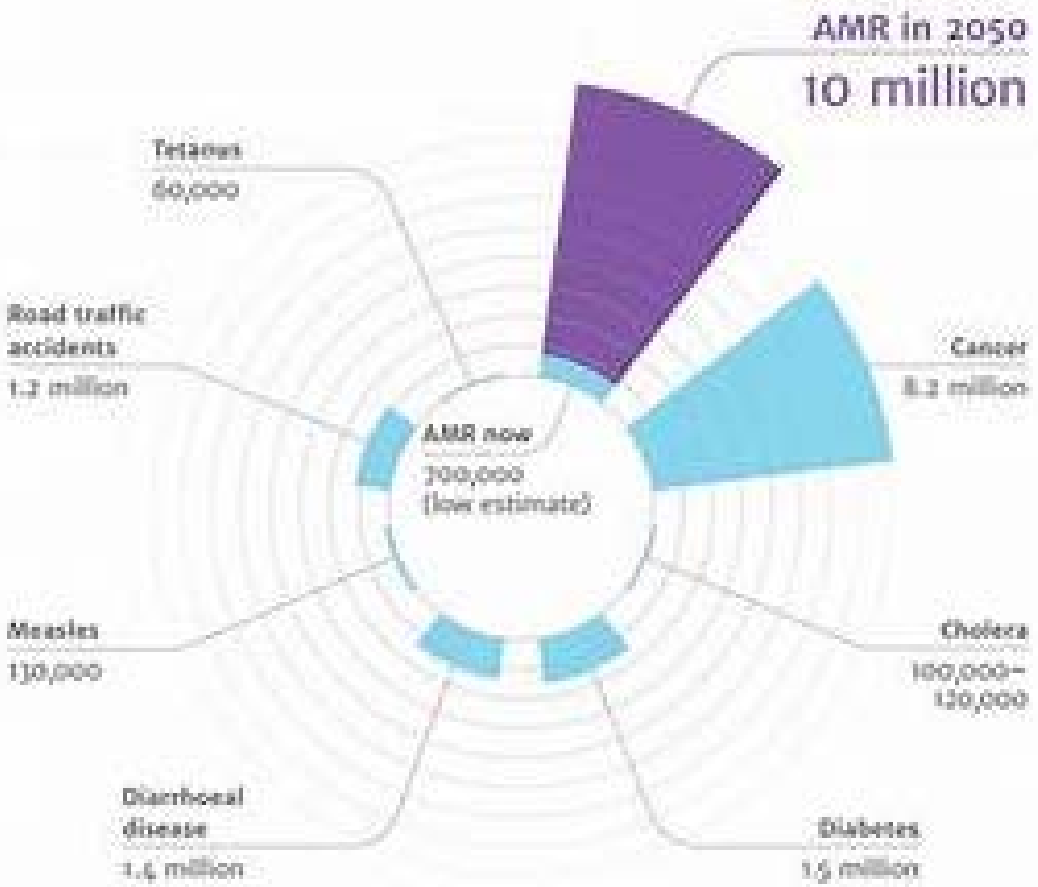
'An end to modern medicine as we know it'

Margaret Chan
Director-General
World Health Organisation,
speaking in Copenhagen

- WHO chief's stark warning about danger of resistance to antibiotics
- 'Growing crisis' may 'turn commo infections into untreatable disease
- Calls for restrictions on use in animals to halt the spread of E.coli

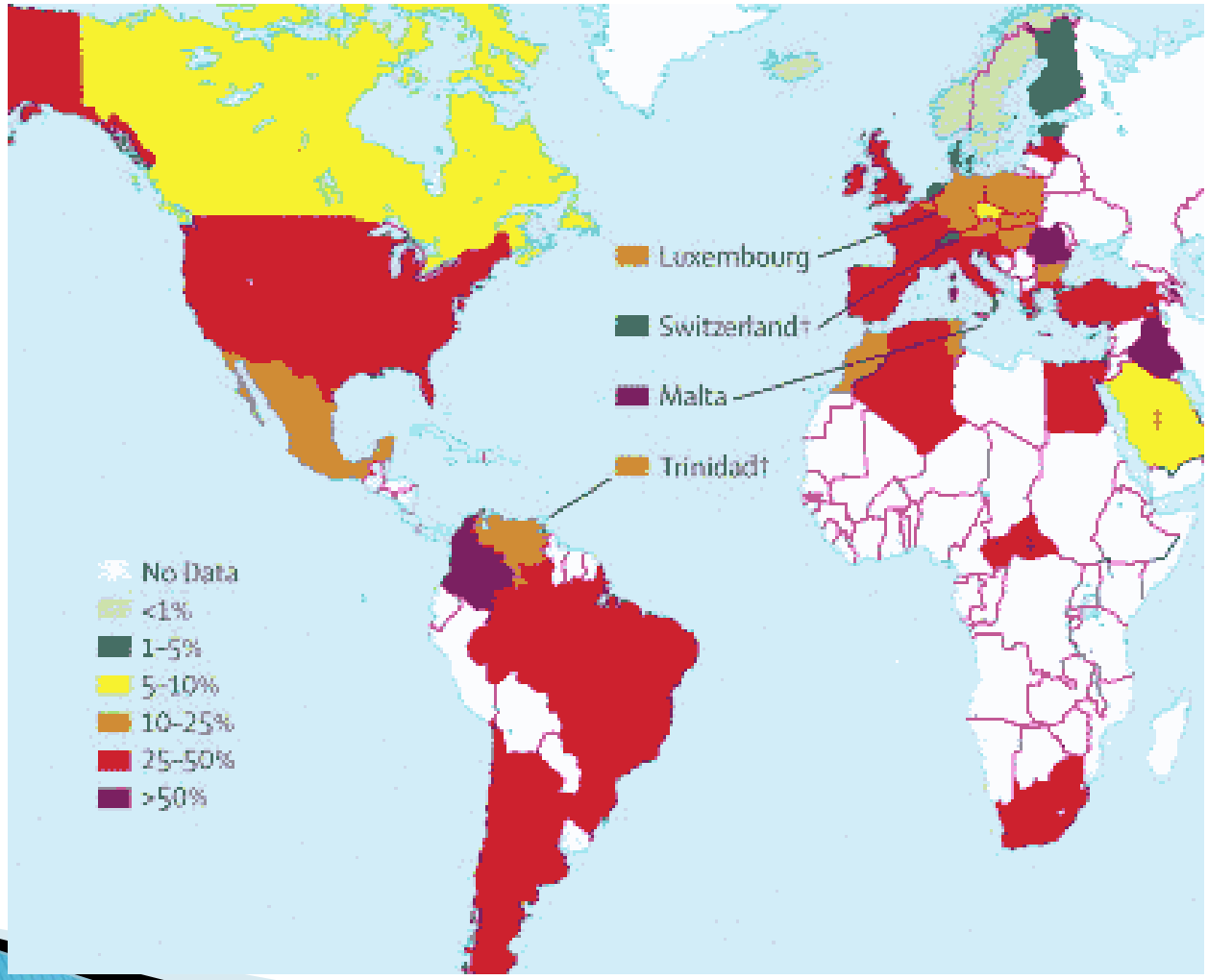

TIME
REVENGE OF THE
Killer Microbes
Are we losing the
war against
infectious diseases?

DEATHS ATTRIBUTABLE TO AMR EVERY YEAR



- When we talk about resistance we should know what is our prevalence locally
- Usually using other countries data and guidelines could be suboptimal
- Unlike other diseases guidelines and therapeutic courses should be tailored in infectious diseases toward our epidemiology.

MRSA prevalence



What about lebanon

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Surveillance of antimicrobial resistance in Lebanese hospitals: retrospective nationwide compiled data

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Table 1
Demographics and testing guidelines related to the participating hospitals

Hospital	Region	Type	Beds	Method[a]	Guidelines
Abou Jaoude	Mount Lebanon	Community	110	DD	CLSI
AUBMC	Beirut	University	350	DD	CLSI
BMC	Mount Lebanon	University	110	DD	SFM
CHN	North Lebanon	University	200	DD	CLSI
Hammoud	South Lebanon	University	500	Automated	CLSI
HDF	Beirut	University	450	Automated	EUCAST
UMCRH	Beirut	University	90	DD	CLSI
Makassed	Beirut	University	200	DD	CLSI
Mazloum	North Lebanon	Community	180	DD	CLSI
				+ automated	+ EUCAST
MEIH	Mount Lebanon	University	200	DD	SFM
MLH	Mount Lebanon	University	240	Automated	CLSI
NDS	Mount Lebanon	University	250	Automated	CLSI
NINI	North Lebanon	Community	120	DD	EUCAST
RHUH	Beirut	University	350	Automated	CLSI
SCH	Mount Lebanon	University	200	DD	EUCAST
SGH	Beirut	University	400	DD	CLSI

AUBMC, American University of Beirut Medical Center; BMC, Bellevue Medical Center; CHN, Centre Hospitalier du Nord; HDF, Hotel Dieu de France; UMCRH, University Medical Center Rizk Hospital; MEIH, Middle East Institute of Health; MLH, Mount Lebanon Hospital; NDS, Notre Dame des Secours; NINI; RHUH, Rafik Hariri University Hospital; SCH, Sacré Coeur Hospital; SGH, Saint Georges Hospital; DD, disc diffusion; CLSI, Clinical and Laboratory Standards Institute; SFM, Societé Française de Microbiologie; EUCAST, European Committee on Antimicrobial Susceptibility Testing.

[a] Automated microbial identification system: Vitek, BD Phoenix.

Table 2
Gram-positive and Gram-negative isolates

Gram-positive isolates	Total number collected	Proportion (Gram-positive)
Coagulase-negative Staphylococcus	8194	39.6%
Staphylococcus aureus	4890	23.6%
Enterococcus spp	4145	20%
Streptococcus agalactiae	1386	6.7%
Streptococcus pyogenes	1059	5.1%
Streptococcus pneumoniae	648	3.1%
Streptococcus viridans group	362	1.8%
Total Gram-positive	20684	100%
Gram-negative isolates	**Total number collected**	**Proportion (Gram-negative)**
Escherichia coli	30411	54.7%
Pseudomonas aeruginosa	7897	14.2%
Klebsiella spp	7883	14.2%
Acinetobacter spp	3409	6.1%
Enterobacter spp	2207	4.0%
Salmonella spp	877	1.6%
Citrobacter spp	738	1.3%
Morganella morganii	675	1.2%
Haemophilus influenzae	552	1.0%
Serratia spp	480	0.9%
Shigella spp	164	0.3%
Proteus spp	162	0.3%
Moraxella catarrhalis	139	0.2%
Total Gram-negative	55594	100%
Total Gram-positive and Gram-negative isolates	76278	

Table 3
Susceptibility rates of Gram-positive organisms obtained from 16 Lebanese hospitals

	Percentage susceptibility to the antimicrobial agents (number of isolates)									
	Staphylococcus aureus					*Streptococcus pneumoniae*				
	2011 (790)	2012 (1717)	2013 (2383)	All years (4890)	*p*-Value	2011 (102)	2012 (230)	2013 (316)	All years (648)	*p*-Value
Oxacillin	76.4 (790)	72.1 (1717)	72.9 (2245)	73.3	0.066	50.5 (61)	44.3 (201)	46.7 (239)	46.2	0.205
Ceftriaxone						94.5 (94)	92.4 (92)	97.5 (81)	94.7	<0.05[a]
Tigecycline	100 (12)	98.8 (236)	100 (244)	99.4	<0.05[a,b]					
TMP–SMX	91.1 (595)	91.6 (1679)	90.5 (2330)	90.9	0.475	52.9 (17)	52.2 (160)	53.3 (119)	52.6	0.654
Levofloxacin	88.3 (300)	83.0 (1213)	84.0 (784)	84	<0.05[a]	98.5 (70)	96.6 (210)	99.6 (203)	98.1	<0.05[b]
Erythromycin	76.2 (790)	76.0 (1717)	75.9 (2383)	76	0.986	69.4 (102)	64.6 (230)	58.7 (212)	63.2	<0.05[b]
Clindamycin	85.8 (759)	81.5 (1535)	83.7 (2065)	83.2	<0.05[a]	82.0 (94)	73.0 (212)	76.4 (282)	76	0.183
Vancomycin	100 (790)	99.1 (1717)	100 (2383)	99.7	<0.05[a,b]					
	Streptococcus pyogenes					*Enterococcus spp*				
	2011 (60)	2012 (459)	2013 (467)	All years (986)	*p*-Value	2011 (538)	2012 (1666)	2013 (1941)	All years (4145)	*p*-Value
Penicillin	100 (60)	100 (459)	100 (160)	100						
Ampicillin						91.1 (518)	85.5 (1415)	81.6 (1914)	84.4	<0.05[a,b]
Tigecycline						100 (67)	99.0 (388)	100 (268)	99.4	<0.05[a,b]
Erythromycin	88.4 (60)	93.7 (459)	94.9 (467)	94	<0.05[a]					
Clindamycin	83.3 (30)	95.4 (450)	96.1 (419)	95.3	<0.05[a]					
Vancomycin						100 (538)	99.0 (1666)	98.8 (1941)	99	<0.05[a]
Teicoplanin						100 (538)	97.7 (1400)	98.8 (1941)	98.6	<0.05[a,b]

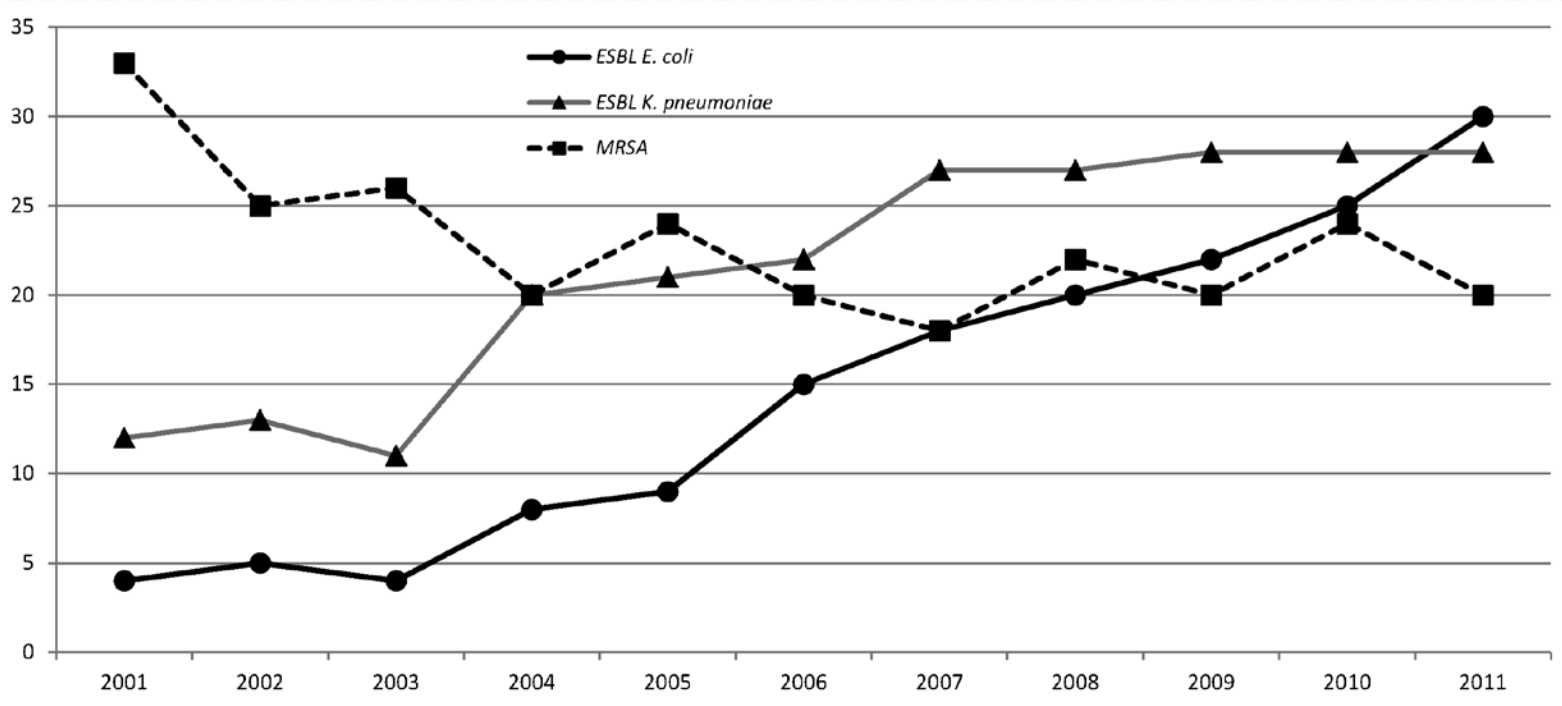
TMP–SMX, trimethoprim–sulfamethoxazole.

Table 5
Susceptibility rate of *Escherichia coli* and *Klebsiella spp* obtained from 16 Lebanese hospitals

	Percentage susceptibility to the antimicrobial agents (number of isolates)									
	Escherichia coli					*Klebsiella spp*				
	2011 (4035)	2012 (12003)	2013 (14373)	*p*-Value	All years (30411)	2011 (963)	2012 (3222)	2013 (3698)	*p*-Value	All years (7883)
Ampicillin	29.1 (1737)	23.6 (8704)	22.6 (12 544)	<0.05[a,b]	23.1	0.0 (227)	0.0 (1973)	0.0 (2366)		0
Amox–Clav	66.7 (4035)	63.3 (12003)	58.5 (14 373)	<0.05[a,b]	61.4	71.1 (963)	68.2 (3222)	64.6 (3698)	<0.05[a,b]	66.8
Pip–Taz	89.2 (3466)	86.8 (11437)	78.9 (13 836)	<0.05[a,b]	83.3	83.4 (872)	80.7 (3147)	79.5 (3599)	<0.05[a,b]	80.5
Cefoxitin	82.7 (2306)	88.7 (10917)	86.8 (10635)	<0.05[a,b]	87.3	81.0 (467)	88.0 (2754)	90.4 (2632)	<0.05[a,b]	88.5
Ceftriaxone	69.5 (3591)	62.0 (11572)	57.5 (9499)	<0.05[a,b]	59.2	71.4 (794)	63.1 (3074)	63.9 (2648)	<0.05[a]	64.4
Cefotaxime	73.6 (1390)	66.1 (8569)	61.5 (10100)	<0.05[a,b]	64.3	75.9 (240)	65.0 (2113)	63.6 (2397)	<0.05[a,b]	64.8
Ceftazidime	75.6 (3591)	70.5 (11572)	69.1 (13 567)	<0.05[a,b]	70.5	78.9 (794)	70.3 (3074)	68.7 (3467)	<0.05[a,b]	70.5
Cefixime	77.8 (821)	66.5 (5844)	68.7 (5798)	<0.05[a,b]	68.3					
Cefepime	85.2 (2278)	70.8 (11006)	74.1 (13 030)	<0.05[a,b]	73.7					
Aztreonam	75.5 (2847)	63.3 (10807)	66.7 (13 567)	<0.05[a,b]	66.3	80.3 (679)	66.7 (2938)	68.3 (3403)	<0.05[a,b]	68.8
Imipenem	99.5 (4035)	99.3 (12003)	99.2 (14 373)	0.145	99.3	98.6 (963)	98.6 (3222)	97.3 (3698)	<0.05[b]	98
Gentamicin	66.7 (4035)	72.7 (11491)	72.2 (13 801)	<0.05[a,b]	71.7	68.8 (963)	75.2 (3089)	75.6 (3549)	<0.05[a]	74.6
Amikacin	96.7 (3291)	97.5 (12003)	97.0 (14373)	<0.05[a]	97.2	94.2 (848)	96.7 (3222)	95.1 (3698)	<0.05[a,b]	95.7
TMP–SMX	49.4 (4035)	48.0 (12003)	49.8 (13 651)	<0.05[a,b]	49	54.5 (963)	58.1 (3222)	55.8 (3524)	<0.05[a,b]	56.6
Ciprofloxacin	57.4 (3035)	57.0 (12003)	52.0 (14373)	<0.05[b]	54.7	72.2 (963)	71.8 (3222)	73.1 (3698)	0.372	72.5
Nitrofurantoin	95.4 (2306)	96.6 (7406)	95.8 (8710)	<0.05[a,b]	96	61.6 (467)	54.1 (1789)	48.4 (2100)	<0.05[a,b]	52.2
Tigecycline	100 (821)	97.3 (3795)	98.5 (5100)	<0.05[a,b]	98.2	100 (149)	84.9 (883)	86.9 (1211)	<0.05[a,b]	87
ESBL production rate	32	30.8	33.6	<0.05[a,b]	32.3	30.2	28.1	29.9	0.191	29.2

Amox–Clav, amoxicillin–clavulanic acid; Pip–Taz, piperacillin–tazobactam; TMP–SMX, trimethoprim–sulfamethoxazole; ESBL, extended-spectrum beta-lactamase.
p-Value reports significant difference between any percentages.
[a] *p*-value <0.05 between 2011 and 2012.
[b] *p*-value <0.05 between 2012 and 2013.

Evolution of resistance over the years



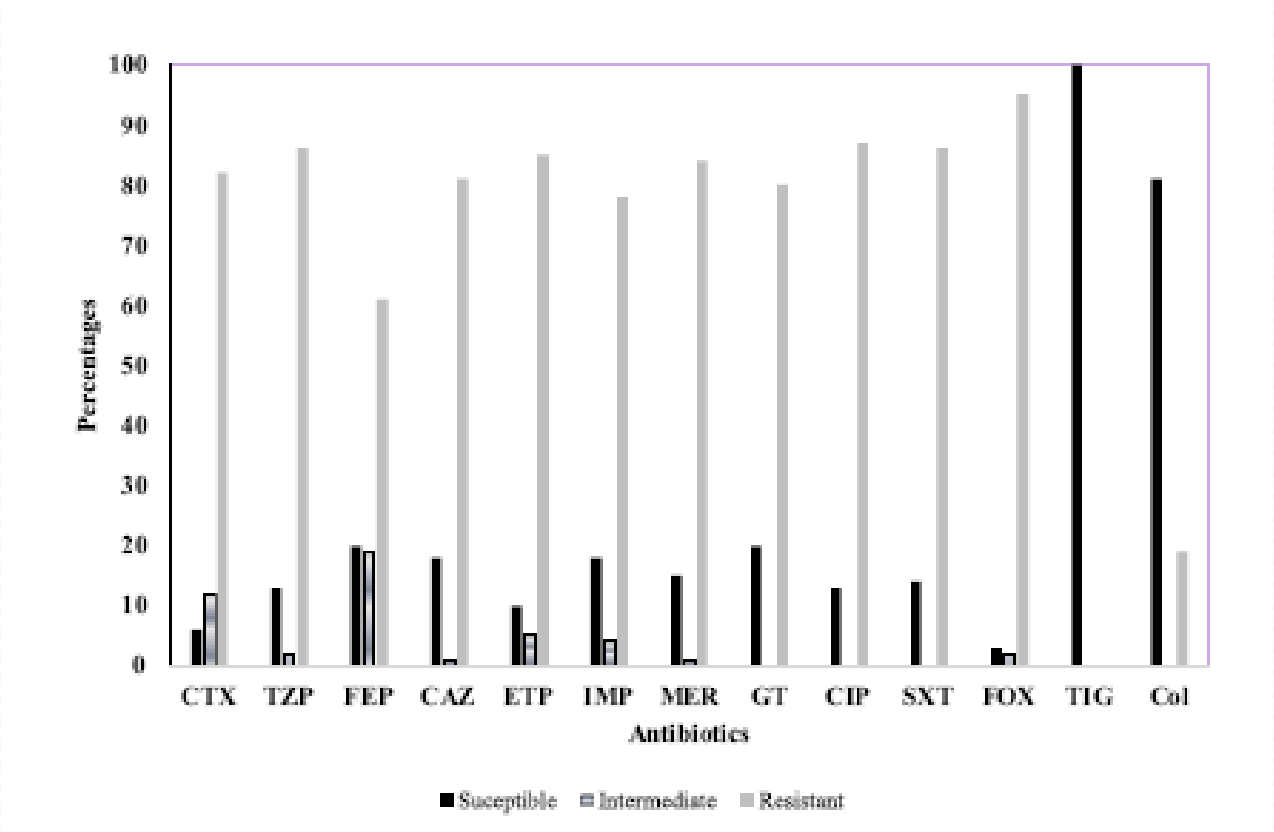
Araj et al 2012

Table 6
Susceptibility rate of *Acinetobacter spp* and *Pseudomonas spp* obtained from 16 Lebanese hospitals.

	Percentage susceptibility to the antimicrobial agents (number of isolates)									
	Acinetobacter spp					*Pseudomonas spp*				
	2011 (242)	2012 (1704)	2013 (1463)	*p*-Value	All years (3343)	2011 (1105)	2012 (3294)	2013 (3498)	*p*-Value	All years (7897)
Pip–Taz	30.6 (242)	11.8 (1704)	11.1 (1397)	<0.05[a]	12.9	80.5 (1105)	78.1 (3294)	80.7 (3498)	<0.05[b]	79.6
Ceftazidime	24.7 (242)	11.6 (1704)	10.0 (1397)	<0.05[a]	11.8	78.4 (1105)	81.4 (3294)	83.3 (3498)	<0.05[a]	81.8
Cefepime	30.5 (242)	11.8 (1704)	12.5 (1463)	<0.05[a]	13.4	78.7 (1105)	82.6 (3294)	84.3 (3498)	<0.05[a]	82.8
Aztreonam	17.0 (219)	3.4 (1242)	9.0 (855)	<0.05[a,b]	6.7	71.5 (1059)	76.2 (3173)	77.9 (3251)	<0.05[a]	76.3
Imipenem	49.2 (242)	15.2 (1704)	15.1 (1463)	<0.05[a]	17.6	79.6 (1105)	70.9 (3294)	72.5 (3498)	<0.05[a]	72.8
Gentamicin	42.4 (242)	17.8 (1692)	15.5 (1450)	<0.05[a]	18.6	81.9 (1105)	82.5 (3210)	82.7 (3407)	0.673	82.5
Amikacin	33.3 (228)	14.0 (1704)	15.4 (1397)	<0.05[a]	15.9	89.2 (883)	87.1 (3294)	90.5 (3498)	<0.05[b]	88.9
TMP–SMX	35.5 (228)	17.2 (1440)	15.3 (1231)	<0.05[a]	17.8					
Ciprofloxacin	24.0 (242)	10.6 (1704)	10.5 (1433)	<0.05[a]	11.5	75.5 (1105)	74.8 (3294)	80.3 (3498)	<0.05[b]	77.3
Colistin	N/A	77.1 (552)	95.6 (254)	<0.05[b]	82.9					

Pip–Taz, piperacillin–tazobactam; TMP–SMX, trimethoprim–sulfamethoxazole.
p-Value reports significant difference between any percentages.
[a] *p*-value <0.05 between 2011 and 2012.
[b] *p*-value <0.05 between 2012 and 2013.

Acinetobacter resistance



Soudeiha et al 2018

Local data is essential

Antibiotic	Gram-negative bacterial isolates (n= 71)																	
	P. aeruginosa (n=31)			*H. influenza* (n=13)			*S. marcescens* (n=9)			*E. coli* (n=8)			*Moraxella* spp. (n=6)			*N. gonorrhoeae* (n= 4)		
	S	I	R	S	I	R	S	I	R	S	I	R	S	I	R	S	I	R
AK	30 (96.8)	1 (3.2)	0	10 (76.9)	3 (23.0)	0	9 (100)	0	0	8 (100)	0	0	6 (100)	0	0	4 (100)	0	0
C	16 (51.6)	3 (9.7)	12 (38.7)	8 (61.6)	2 (15.4)	3 (23.0)	7 (77.8)	0	2 (22.2)	2 (25.0)	0	6 (75.0)	6 (100)	0	0	3 (75.0)	0	1 (25.0)
CN	27 (87.1)	4 (12.9)	0	13 (100)	0	0	5 (55.6)	0	4 (44.4)	3 (37.5)	2 (25.0)	5 (37.5)	5 (83.3)	1 (16.7)	0	3 (75.0)	0	1 (25.0)
CIP	26 (83.9)	3 (9.7)	2 (6.4)	12 (92.3)	0	1 (7.7)	9 (100)	0	0	3 (37.5)	0	5 (62.5)	6 (100)	0	0	4 (100)	0	0
SXT	7 (22.6)	1 (3.2)	23 (74.2)	1 (7.7)	0	12 (92.3)	5 (55.6)	0	4 (44.4)	1 (12.5)	0	7 (87.5)	1 (16.7)	0	5 (83.3)	1 (25.0)	0	3 (75.0)
TE	8 (25.8)	1 (3.2)	22 (71.0)	9 (69.2)	1 (7.7)	2 (15.4)	4 (44.4)	0	5 (55.5)	7 (87.5)	0	1 (12.5)	5 (83.3)	0	1 (16.7)	3 (75.0)	0	1 (25.0)
DO	17 (54.8)	0	14 (45.1)	10 (77.0)	2 (15.3)	1 (7.7)	6 (66.7)	3 (33.3)	1 (11.1)	5 (62.5)	1 (12.5)	2 (25.0)	6 (100)	0	0	2 (50.0)	1 (25.0)	1 (25.0)
CRO	21 (67.7)	4 (12.9)	6 (19.4)	11 (84.6)	0	2 (15.3)	2 (22.2)	0	7 (77.8)	1 (12.5)	2 (25.0)	5 (62.5)	5 (83.3)	0	1 (16.7)	4 (100)	0	0
E	NT	NT	NT	11 (84.6)	0 (0)	2 (15.4)	NT	NT	NT	NT	NT	NT	NT	NT	NT	4 (100)	0	0
P	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	3 (75.0)	0 (0)	1 (25.0)

P-Penicillin (10 U), AK-Amikacin (30 µg), C- Chloroamphenicol (30 µg,) CN- Gentamicin (10 µg), VA-Vancomycin (30 µg), E- Erthromycin (15 µg), SXT-Trimethoprim-sulphamethoxazole (1.25/23.75 µg), TE-Tetracycline (30 µg), DO-Doxycycline (30 µg), CRO-Ceftriaxone (30 µg), NT= Not tested

Take home messages

- Antibiotic resistance is a major health issue
- In Lebanon as everywhere resistance is on the rise
- Local data (hospital level or even ward level is essential)

Thank you