Health-Care Associated Infection, Multi-Drug Resistant Organisms (MDRO) and Ageing

BIUCGM
SBGG

With the support:
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BICS
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Fondation Chaire DCF

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Geriatric Medicine
Institute of Health and Society, UCL
CHU UCL Namur

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What should be known by the students ?

1. HAI
    1. Impact of HAI on LOS, survival and costs ?
    2. Prevalence of HAI in Belgium ?
    3. What are the 4 most frequent HAI ?
2. MDRO
    1. Outcomes of MDRO carriage/infection ?
    2. How to access to epidemiological data ?
    3. Risk factors of MDRO carriage ?
    4. Prevalence of MDRO carriage in Belgian healthcare facilities ?
    5. Value of a clinical scoring system to detect MDRO carriers ?
3. How to control HAI ?

HAI ?

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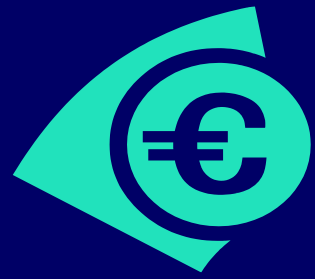
Globally, in Belgium…

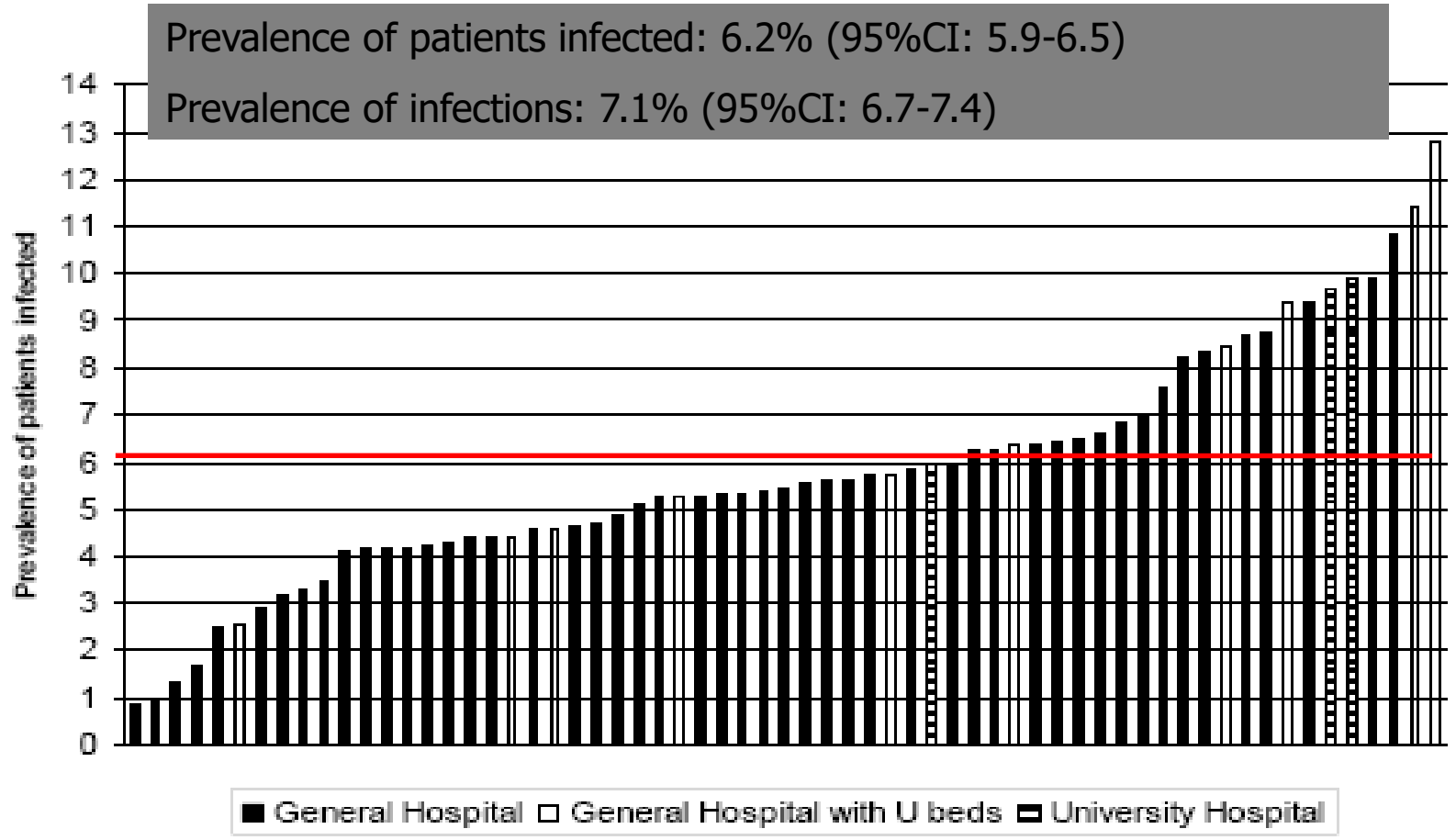


- Annual Incidence of HAI 100 000 cases/y
  - 17500 DEATHS (17%)
- Increase LOS of 7 days
- Increase of costs 400 000 000 € / YEAR

KCE reports vol 102 B, 2009

The Belgian National Nosocomial Infection Study 2007

Figure 3.2: Prevalence of patient infected in all participating hospitals



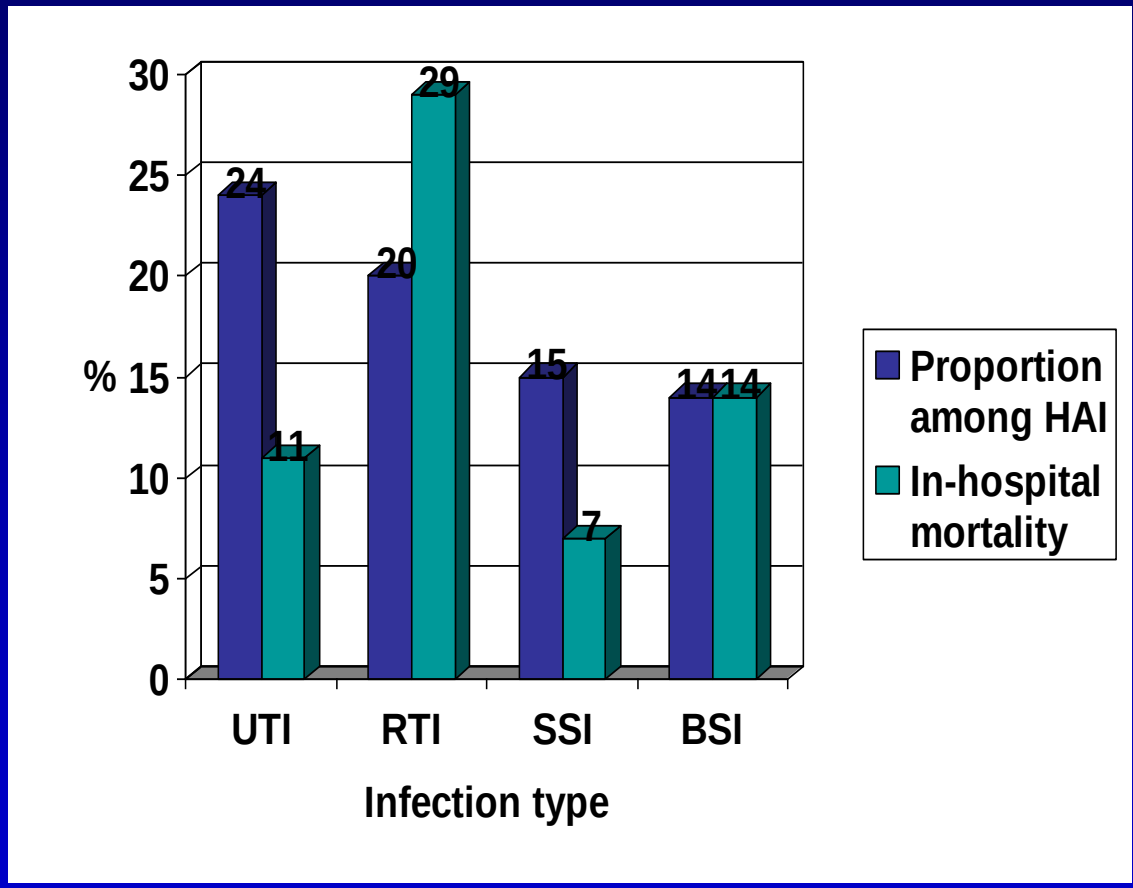
The Prevalence of Health-Care Associated Infection in Belgium

Bed type	% ward in the survey [n=543]	N patients surveyed [n=17 343]	N patient infected	Prevalence of infections	Prevalence of patients infected
C bed	11%	5473	323	6.7	5.9
D bed	10%	6256	327	5.9	5.2
G bed	10%	2747	202	8.8	7.4
I bed	11%	855	216	31.3	25.3

Gordts B. Journal of Hospital Infection 2010; 75:163-167

The 2007 Belgian National Prevalence Survey for Hospital-acquired Infections

	Prevalence
Urinary tract infection (UTI)	1.69%
Lower respiratory infection (RTI)	1.42%
Surgical Site Infection (SSI)	1.04%
Bloodstream Infection (BSI)	0.96%



Gordts B. Journal of Hospital Infection 2010; 75:163-167

HALT-3: Results 2016

Prevalence evolutions

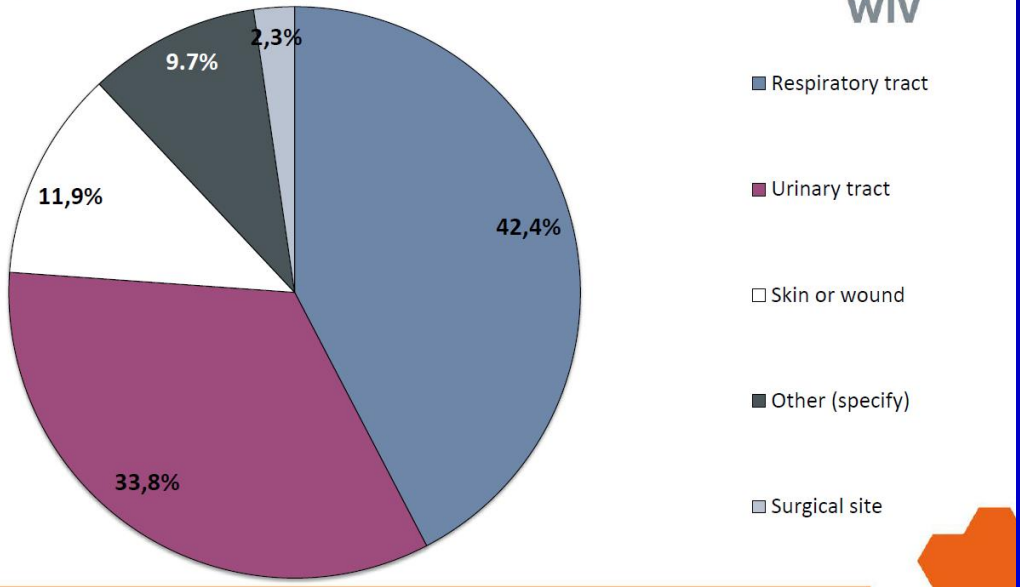
	2016	2013		2010	
	BE	BE	EU	BE	EU
Prevalence of residents with at least one antimicrobial (%)	5.4	5.1	4.4	4.3	4.3
Prevalence of residents with at least one HAI (%)	3.5	3.6	3.4	2.7	2.4

HEALTHCARE-ASSOCIATED INFECTIONS AND ANTIMICROBIAL USE IN ACUTE CARE HOSPITALS and LONG-TERM CARE FACILITIES

ECDC PPS - HALT-3

NSIH SYMPOSIUM – APRIL 2017

Figure 6. Distribution of Belgian HAI infection site



MDRO: definition, history and impact

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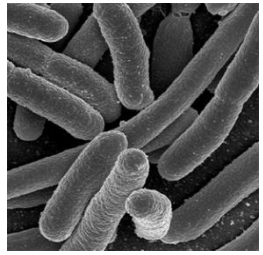
Emerging Issues in Antibiotic Resistant Infections in Long-Term Care Facilities

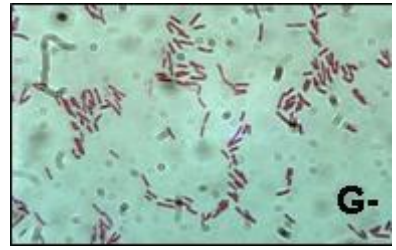
Robert A. Bonomo[1] and Louis B. Rice[2]

E coli

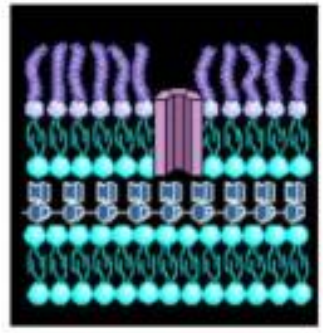


C3-R E coli

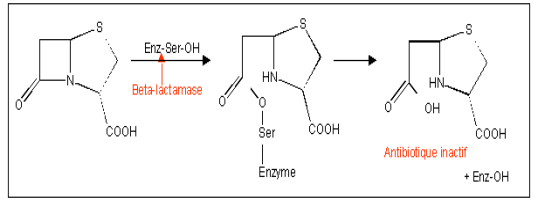
Les Grams négatifs



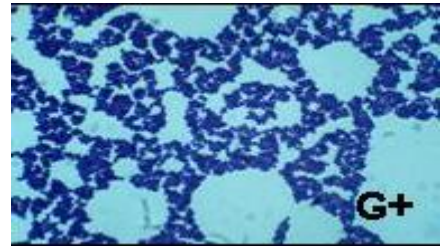
A



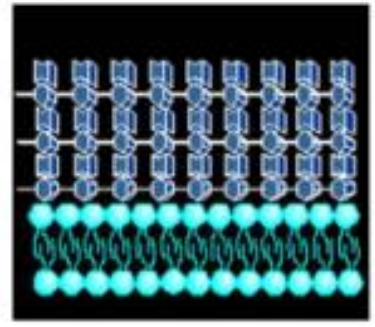
Les β-lactamases à spectres étendus
1983



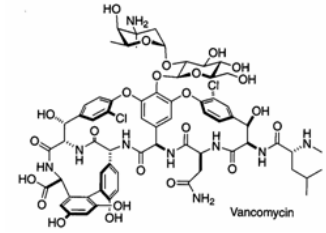
Les Grams Positifs



B

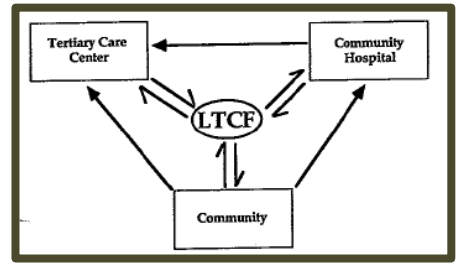


La résistance à la vancomycine
1960



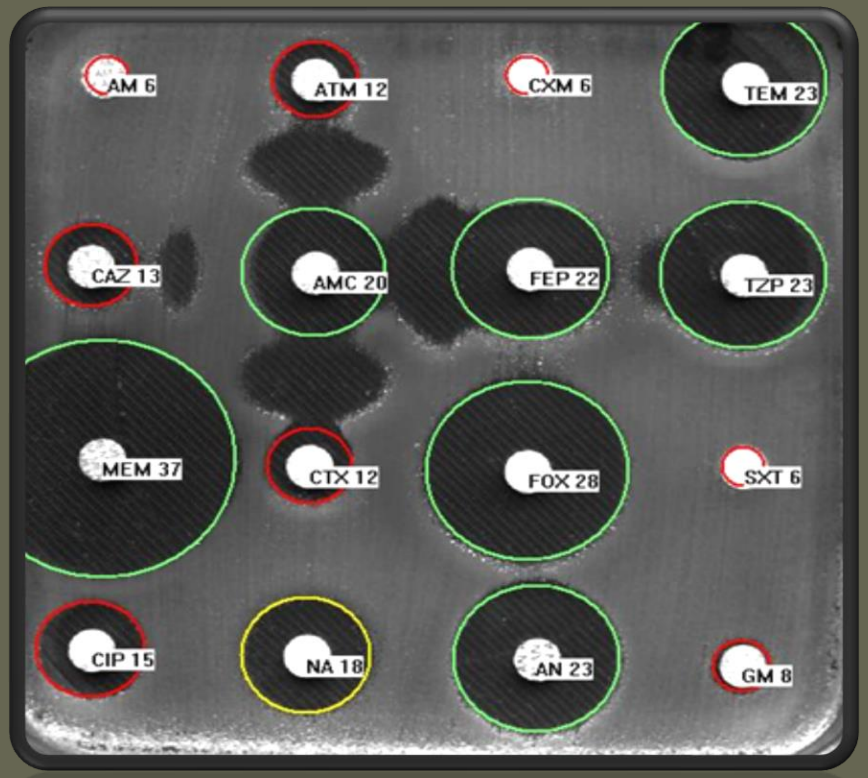
Staphylococcus aureus

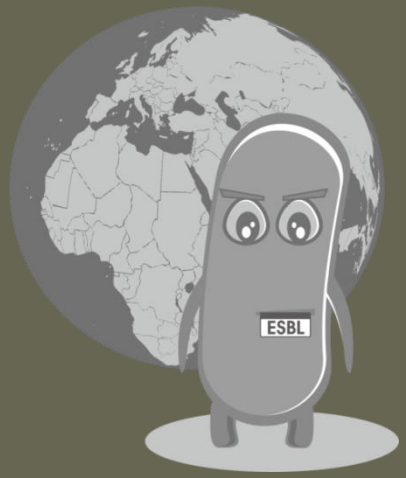
MRSA



Journal of Gerontology 1999; 54A, 260-267

The ESBL Pandemic





1940: First β-Lactamase
1965: TEM
1972: SHV
1990: CTX-M family
1999: CTX-M 15

Since 1983, ESBLs have broadened their spectrum of hydrolytic activity to oxyimino-cephalosporins (ceftriaxone, ceftazidime or cefotaxime) and monobactams (aztreonam). However, they remain susceptible to cephamycins (cefoxitin or cefotetan), carbapenems and temocillin. They are often associated with other resistance mechanisms.

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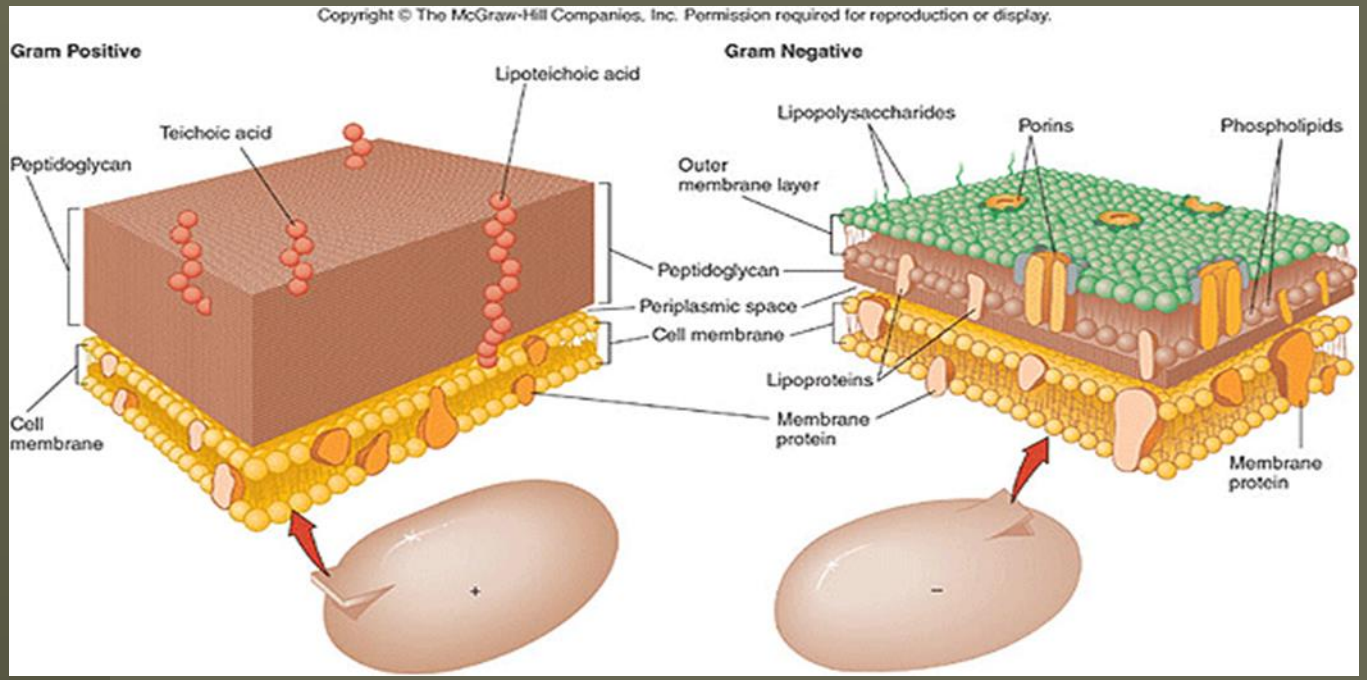


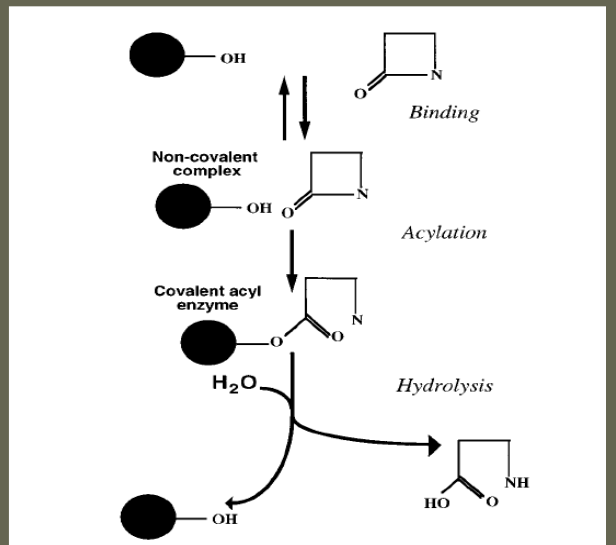
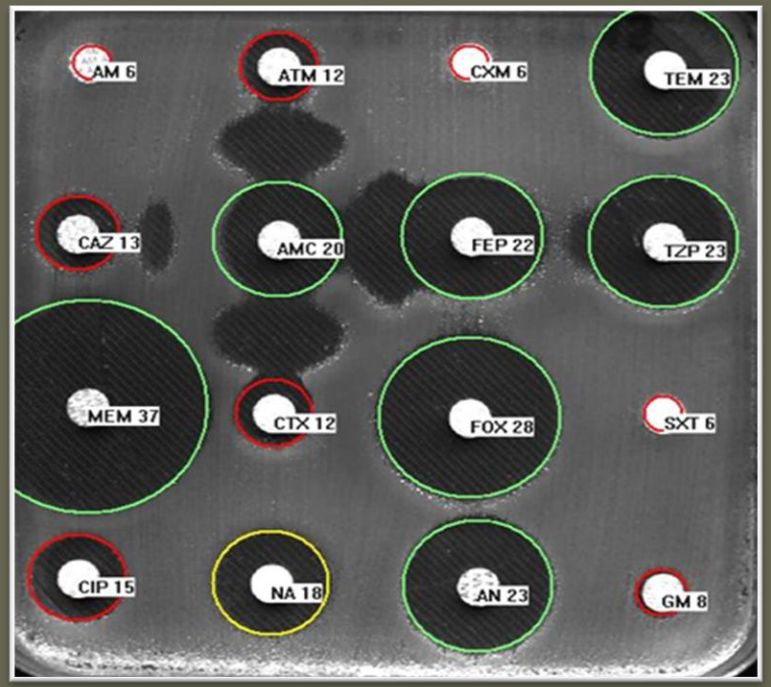


FIG. 1. Action of a serine β-lactamase. The enzyme first associates noncovalently with the antibiotic to yield the noncovalent Michaelis complex. The β-lactam ring is then attacked by the free hydroxyl on the side chain of a serine residue at the active site of the enzyme, yielding a covalent acyl ester. Hydrolysis of the ester finally liberates active enzyme and the hydrolyzed, inactive drug. This mechanism is followed by β-lactamases of molecular classes A, C, and D, but class B enzymes utilize a zinc ion to attack the β-lactam ring (256).



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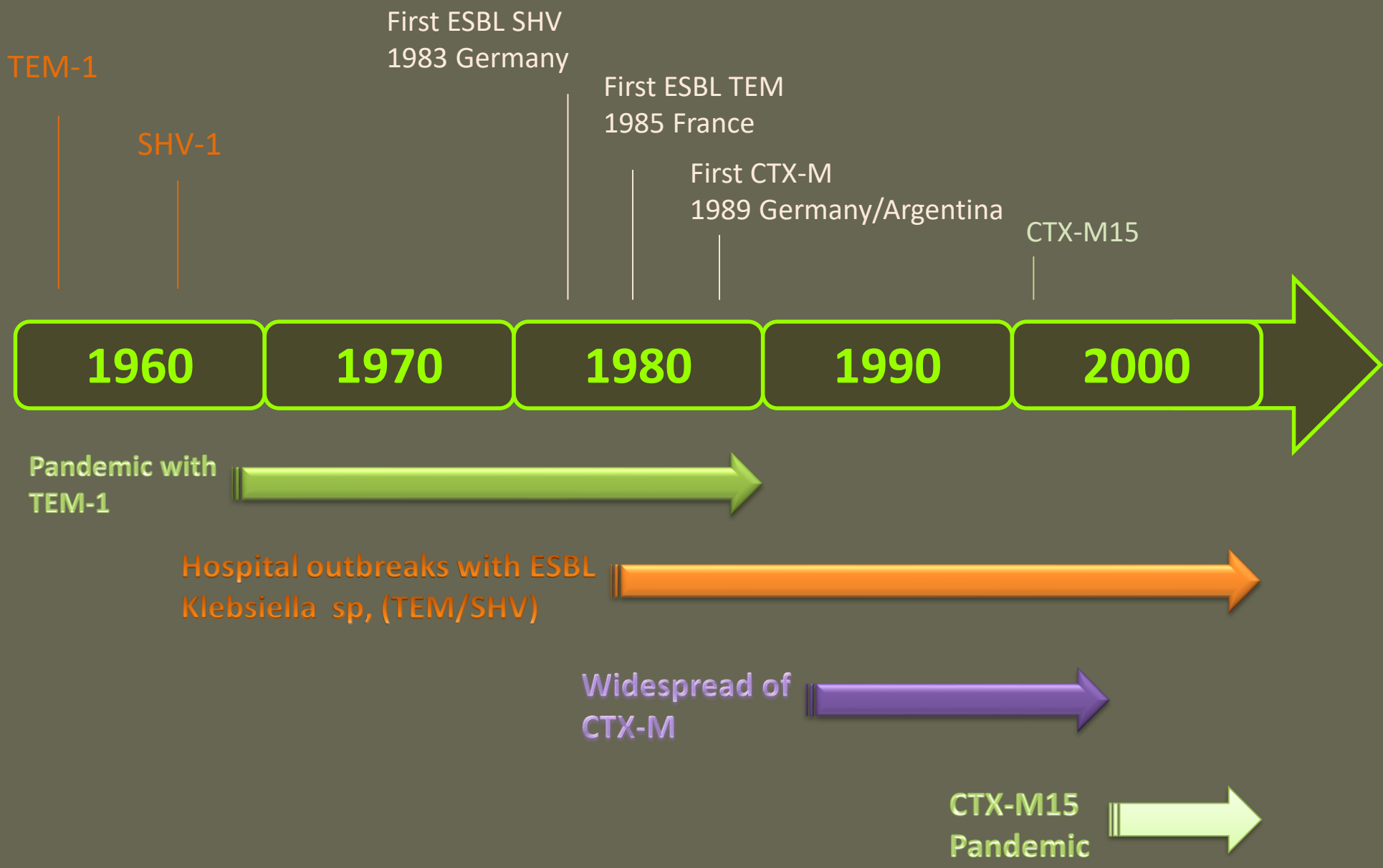

Pitout JD; 2013

Outbreak of Ceftazidime Resistance Caused by Extended-Spectrum β-Lactamases at a Massachusetts Chronic-Care Facility

LOUIS B. RICE,[1]† SANDRA H. WILLEY,[2] GENOVEFA A. PAPANICOLAOU,[3] ANTONE A. MEDEIROS,[3] GEORGE M. ELIOPOULOS,[1] ROBERT C. MOELLERING, JR.,[1] AND GEORGE A. JACOBY[4]*

New England Deaconess Hospital, Boston, Massachusetts 02115[1]; Youville Hospital, Cambridge, Massachusetts 02138[2]; Miriam Hospital, Providence, Rhode Island 02906[3]; and Massachusetts General Hospital, Boston, Massachusetts 02114[4]

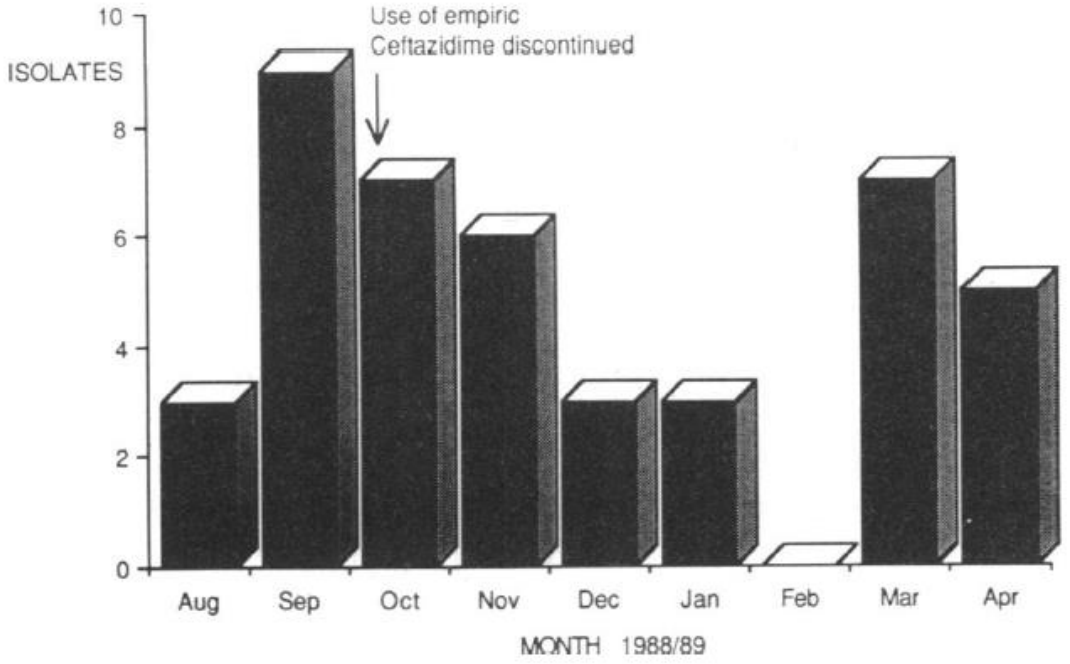

FIG. 1. Number of ceftazidime-resistant enterobacteria isolated at Youville Hospital from the start of the outbreak through April 1989. The date on which empiric ceftazidime use was discontinued (1 October 1989) is indicated.

Plasmid transmission

Antimicrobial Agents and Chemotherapy 1990; 2193-2199

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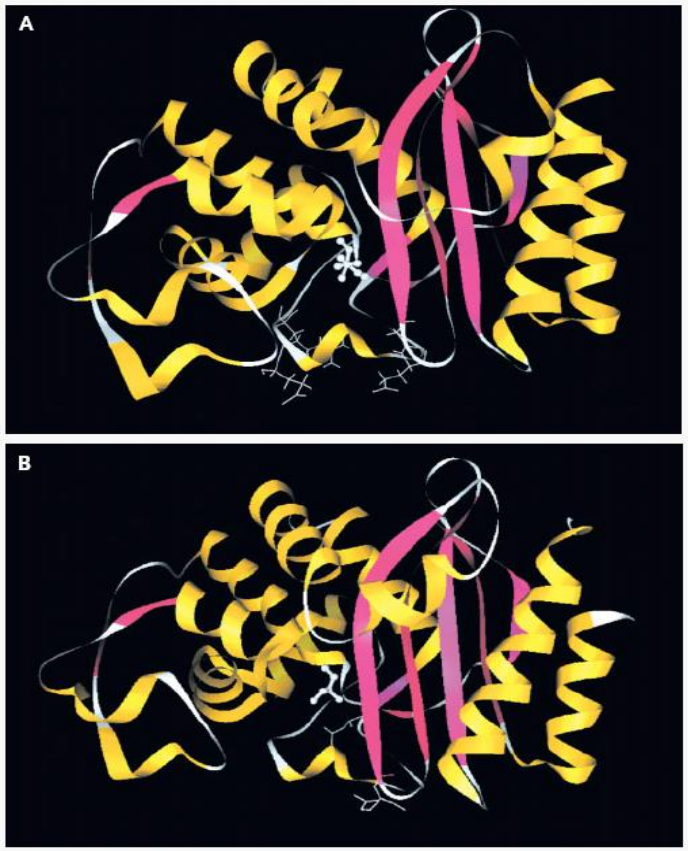

Figure 1. Schematic Diagrams of TEM and SHV β-Lactamases.

In these ribbon diagrams of TEM β-lactamases[13] (Panel A) and SHV β-lactamases (Panel B),[14] the critical serine residue at position 70 is shown in ball-and-stick mode (at the center of each molecule) and the atoms of residues in which amino acid substitutions yield an extended-spectrum β-lactamase (ESBL) phenotype are shown in stick mode. Colors are used to highlight the molecule's secondary structure: yellow indicates α-helixes, pink β-strands, and gray turns. Amino acid substitutions at positions 104, 164, 238, and 240 in TEM β-lactamases lead to the ESBL phenotype, but ESBLs with the broadest spectrum of activity usually have more than a single substitution. Many TEM ESBLs confer greater resistance to ceftazidime and aztreonam than to cefotaxime, but those with a serine substitution at position 238 may enhance resistance to cefotaxime as well. In the SHV family, substitutions at position 238 or at positions 238 and 240 are the most common and are associated with resistance to ceftazidime, cefotaxime, and aztreonam.[15] Less commonly, an alteration at position 146 or 179 provides selective ceftazidime resistance; the change at position 146 causes a moderate decrease in susceptibility to imipenem as well.[16,17]

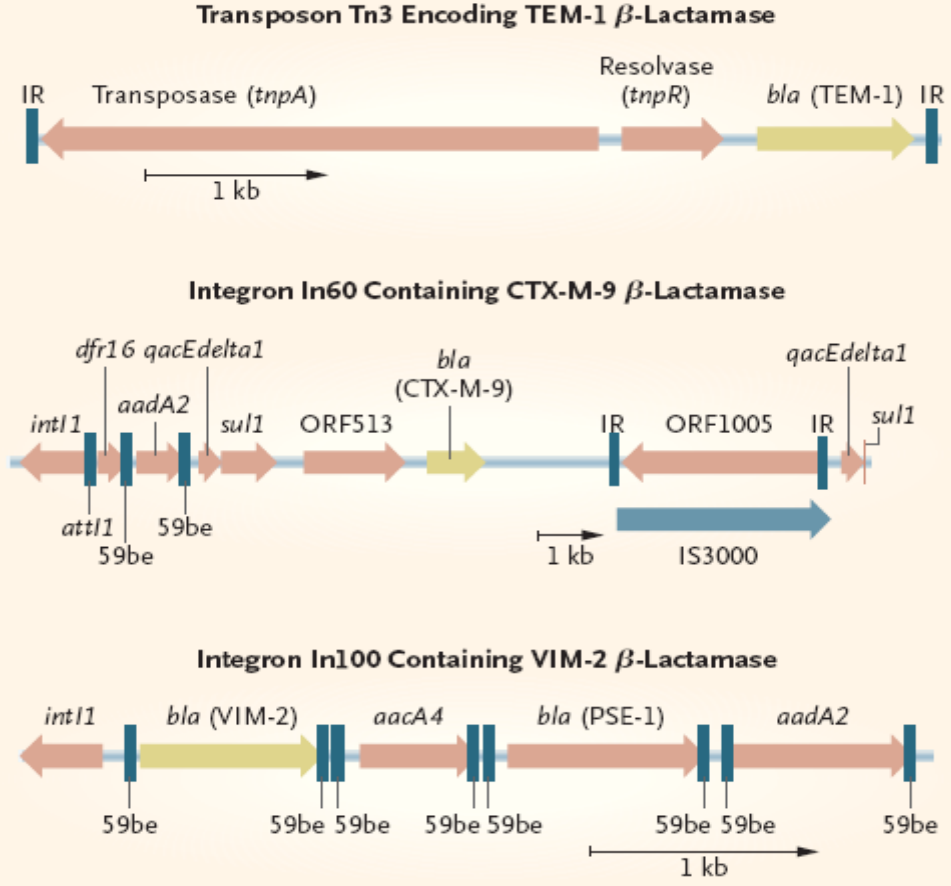

Figure 2. Schematic Diagrams of Genetic Units Encoding Various β-Lactamases.

Diagrams of transposons and integrons encoding TEM-1,[41] CTX-M-9,[42] and VIM-2[43] β-lactamases are shown. IR denotes inverted repeat, *bla* β-lactamase gene, *dfr* dihydrofolate reductase gene, *qac* gene conferring resistance to quaternary ammonium compounds, *delta* deletion derivative, *intI* site-specific integrase gene, *aad* aminoglycoside adenylyltransferase gene, *sul* dihydropteroate synthetase gene, ORF open-reading frame, *attI* recombination site, 59be 59-base element, *aac* aminoglycoside acetyltransferase gene, and IS insertion sequence.

Jacoby GA, NEJM 2005; 352:380-391

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Incidence of ESBL in STCF and LTCF
Cross-sectionnal study between 1996 andt 2005
Assistance Publique des Hôpitaux de Paris

47 hospitals = 21000 beds

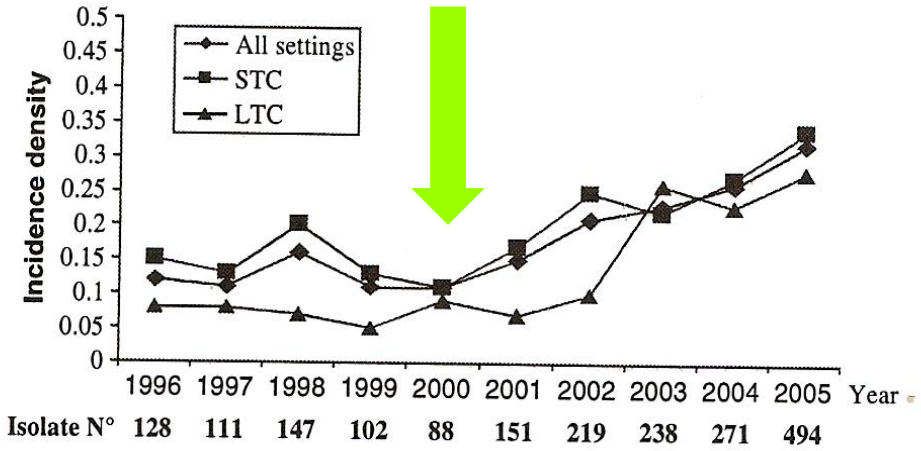

Fig. 1. Incidence density/1000 hospitalisation days of extended-spectrum β-lactamase-producing isolates in all Assistance Publique Hôpitaux de Paris (AP-HP) settings, in AP-HP short-term-care facilities and AP-HP long-term-care facilities (1996–2005). The number of isolates collected each year is indicated at the bottom.

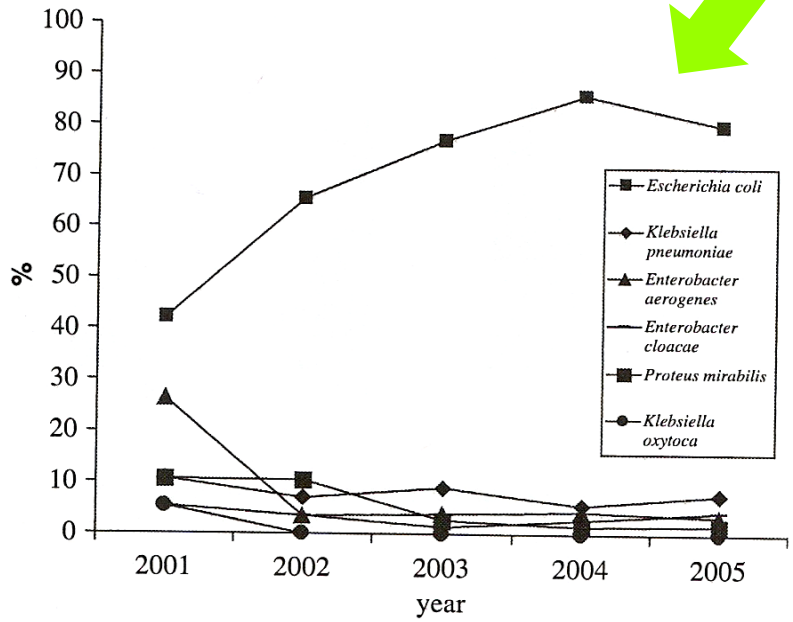

Fig. 2. Prevalence (%) of extended-spectrum β-lactamase-producing isolates by species in Assistance Publique Hôpitaux de Paris long-term-care facilities (2001–2005).

Nicolas-Chanoine MH, CMI 2008;14 (suppl1):111-116

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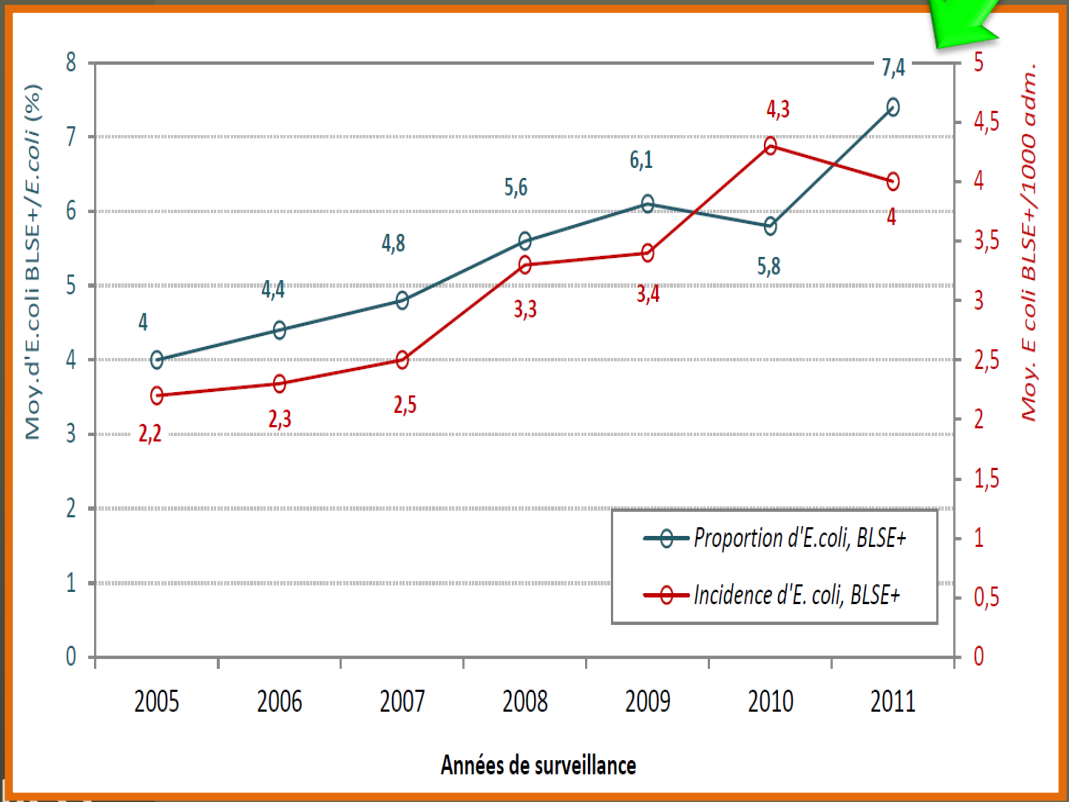
National surveillance programme (ISP-WIV)

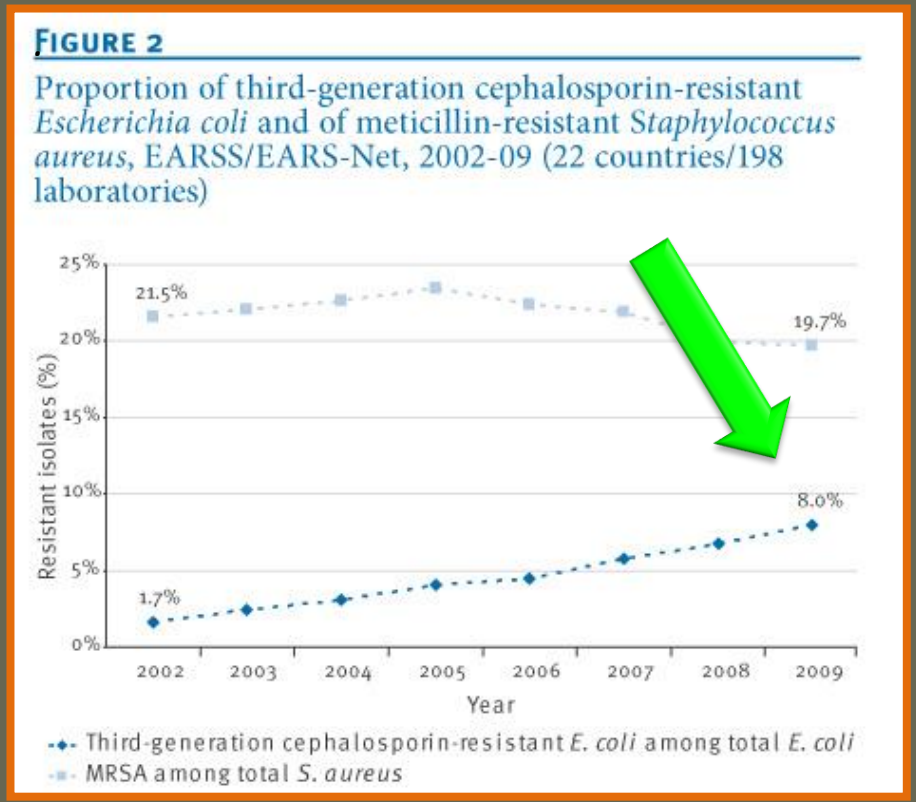
NSIH: 2005-2011



B. Jans et al., NSIH programme Annual Report, 2011
IPH / EPI Reports Nr. 2012 -024

European Antimicrobial Resistance Surveillance Network

EARS-Net: 2002 to 2009



Gagliotti C et al, EARS-Net Participants (Disease Specific Contact Points for AMR). Euro Surveill. 2011

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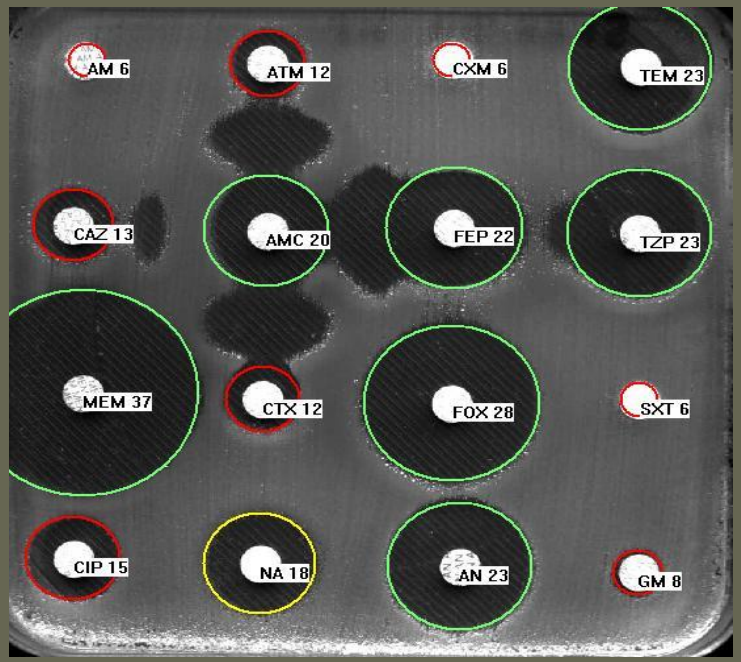
isp wiv .be

Scientific Institute of Public Health
Juliette Wytsmanstreet 14 - B 1050 Brussels - Belgium
Phone : +32 2 642 51 11 - Fax : +32 2 642 50 01

ecdc EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

Carbapenemase-producing Enterobacetria, the new threat



http://www.nsih.be/surv_carba/carbapenemase_fr.asp

Nasal carriage of SA as a risk factor in categories other than surgical patients

- Increase risk of bactaeremia in patients in ICU: RR:4,0-20,4
- Increase risk of bacteraemia in patients with intravascular device: RR: 6,3-12,4
- Increase risk of peritonitis in patients under peritoneal dialysis: RR: 1,8-14,0
- Increase risk of access site infection in patients under hemodialysis: RR: 1,8-4,7
- Increase risk of all type infection in LTCF residents: RR: 5,5
- Increase risk of bacteremia in HIV patients

Kluytmans J, Clinical Microbiology Reviews 1997

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Higher risk for MRSA carriers:

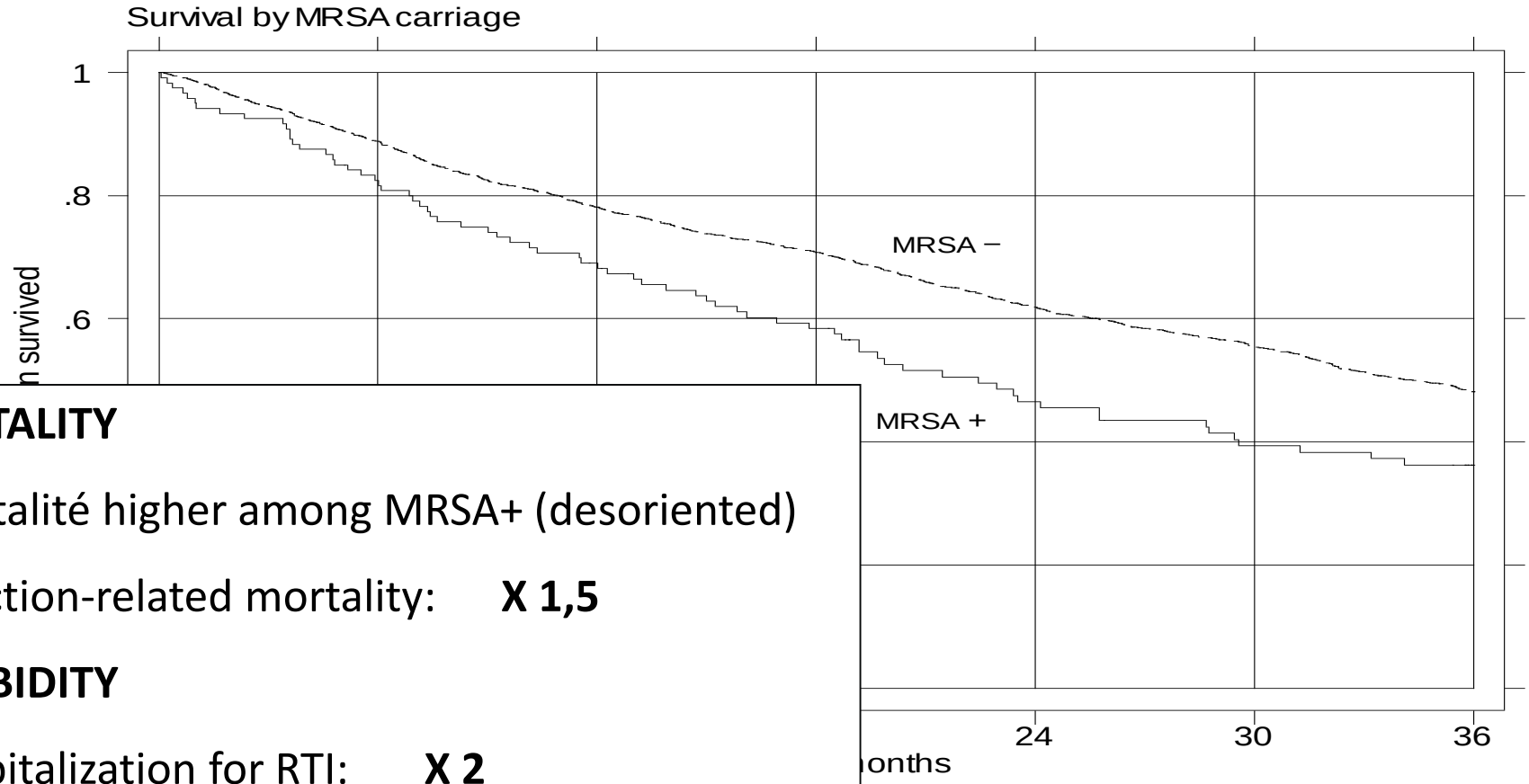
- 488 ICU Patients
- Carriage rate: 13%
- Rate of Bactaeremia (n=38; 8%)

– Non carriers: control group (Ref.)	n=6 (1,7%)
– MSSA Carriers: RR: 5,4 (95%CI: 1,9-15,2)	n= 8 (9,5%)
– MRSA Carriers: RR: 21,7 (95%CI: 9,2-50,8)	n=24 (38%)

Pujol et al. Am J Med 1996

2000: Outcomes of MRSA Carriage

Kaplan-Meier survival estimates by MRSA status at baseline in 23 nursing homes, April-June 2000 - June 2003



MORTALITY

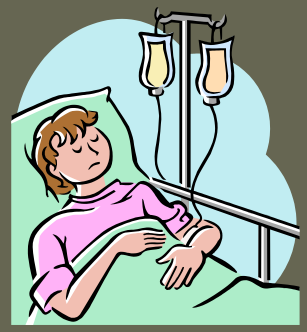
. Mortalité higher among MRSA+ (desoriented)

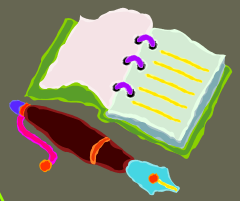
. Infection-related mortality: **X 1,5**

MORBIDITY

. Hospitalization for RTI: **X 2**

ESBL colonisation, a first step...





Schwaber MJ et al. **Mortality and delay in effective therapy associated with extended-spectrum beta-lactamase production in Enterobacteriaceae bacteraemia: a systematic review and meta-analysis**. *J Antimicrob Chemother* 2007, **60**(5):913-920.

Lautenbach E et al. **Extended-spectrum beta-lactamase-producing Escherichia coli and Klebsiella pneumoniae: risk factors for infection and impact of resistance on outcomes**. *Clin Infect Dis* 2001, **32**(8):1162-1171.

Medical ward, Tel Aviv - 2003: 10 months

Stool samples

N=241

Fecal carriage: 11%

Bacteraemia within 3 months:

- ESBL +: 4 (15%)
- ESBL-: 1 (0.5%)

OR: 38.9; P<.001

Ben-Ami R., CID 2006:42 925-934

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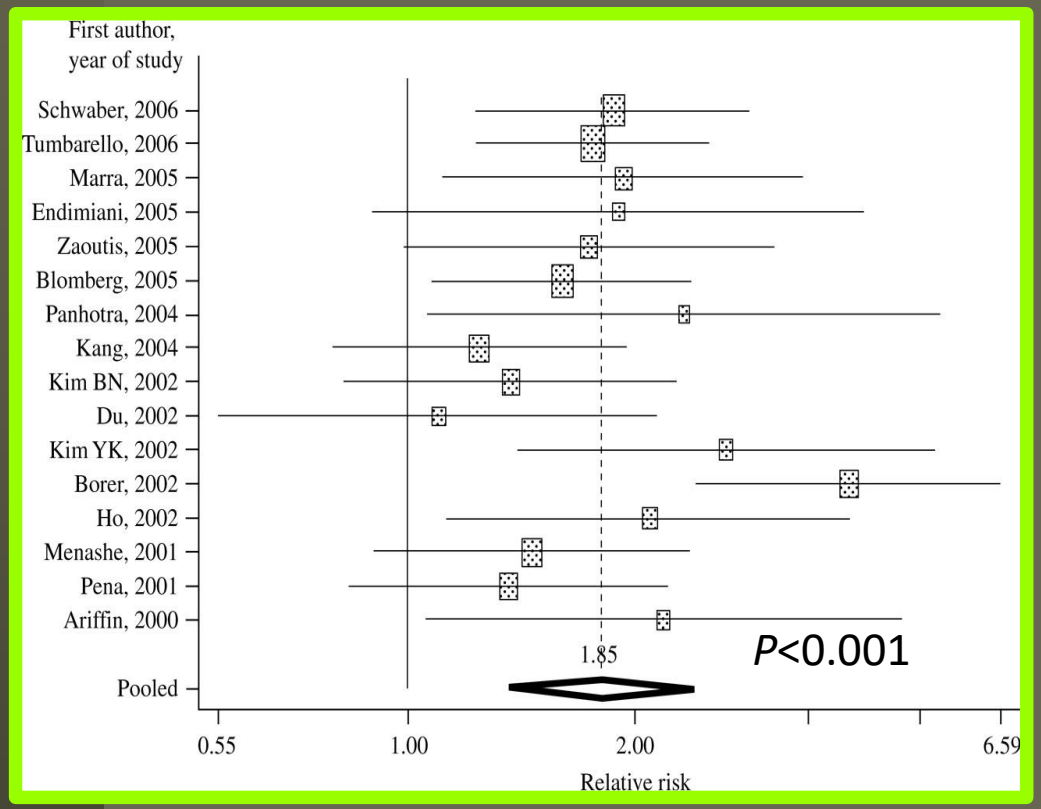
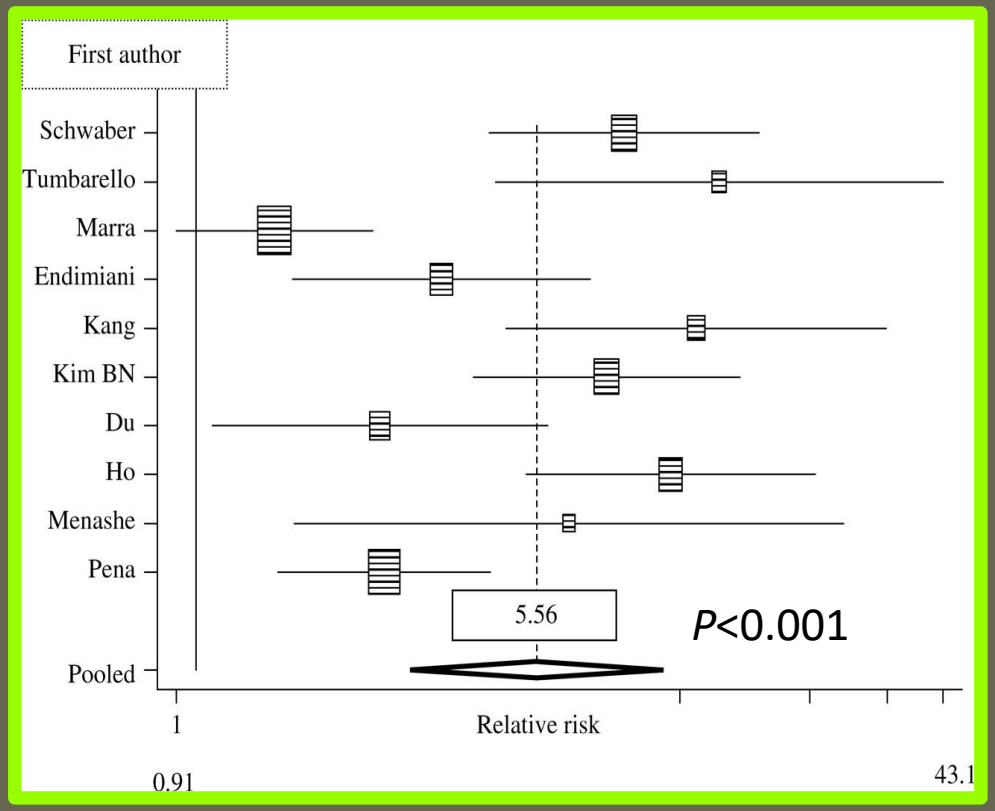
Meta-analysis of mortality in ESBL-producing versus non-ESBL-producing Enterobacteriaceae bacteraemia



Mortality in ESBL-producing versus non-ESBL-producing Enterobacteriaceae bacteraemia. There was significant heterogeneity among the study results ($P = 0.001$).



Delay in effective therapy in ESBL-associated versus non-ESBL-associated Enterobacteriaceae bacteraemia.). There was significant heterogeneity among the study results ($P < 0.001$).

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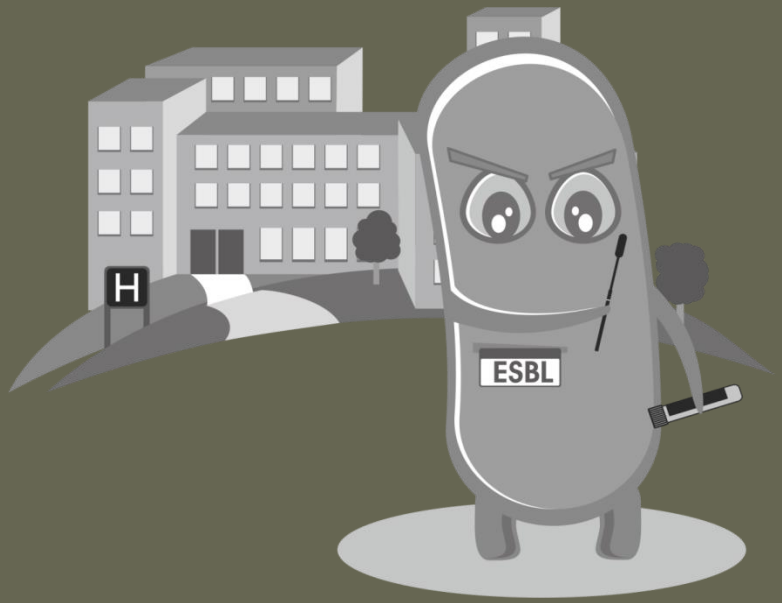
Schwaber M J , Carmeli Y J. Antimicrob. Chemother. 2007;60:913-920

Data from the Hospital Setting

Multidrug-resistant bacteria colonization amongst patients newly admitted to a geriatric unit: a prospective cohort study



Schoevaerdts D et al. Journal of Infection 2012; 65(2): 109-18

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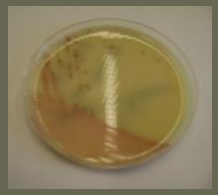
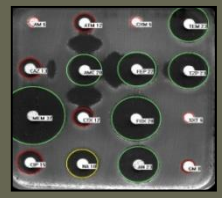
N= 473 →  → N=337 →  →  → 

N=136

N=337	Prevalence at admission % (95%CI)	Prevalence at discharge % (95%CI)	Attack rate / 100 admissions (95%CI)	Incidence density / 1000 patient-days (95%CI)
ESBLE	[39/337] # 11.6 (8.2-15.0)	[34/275] 12.4 (8.5-16.3)	[11/243] 4.5 (1.9-7.1)	[11/6222] 1.8 (0.7-2.8)
MRSA	[24/320] 7.5 (4.6-10.4)	[31/275] 11.3 (7.8-15.6)	[12/238] 5.0 (2.6-8.6)	[12/5000] 2.4 (1.2-4.2)
VRE	[2/335] 0.6 (0.1-2.1)	[1/274] 0.4 (0.0-2.0)	[0/272] 0	[0/6989] 0

= Number under brackets [n/n] express the number of positive cases / total number of screened patients (or number of hospital days for the incidence density).

Study period: 01.01.2010- 01.01.2011

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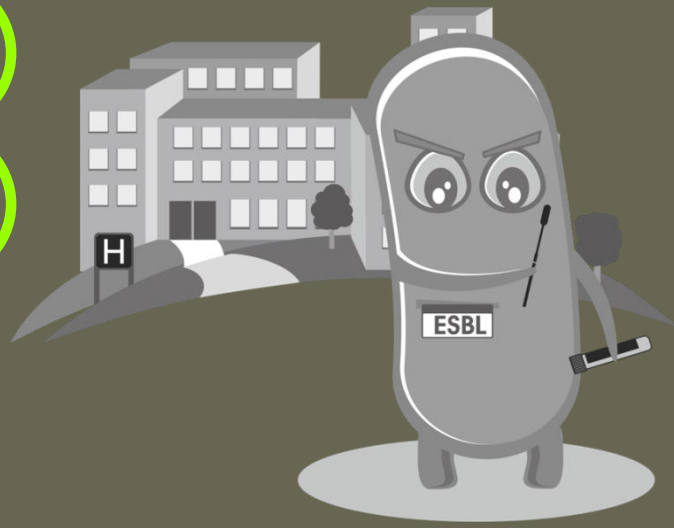
Risk factors of ESBL carriage at admission to hospital

- Functionnal status — X1,2
- Chronic catheters — X3,2
- Multiple contacts with the hospital — X2,5



- AB exposure
- Comorbidity
- Albumine level
- Pet at home

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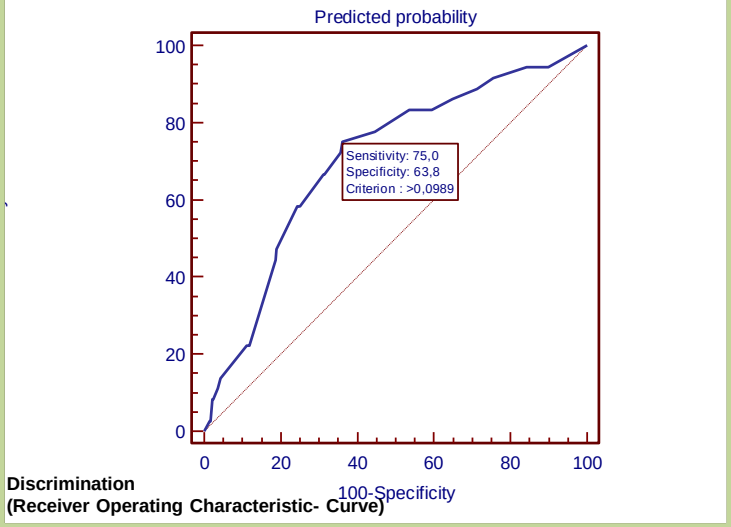
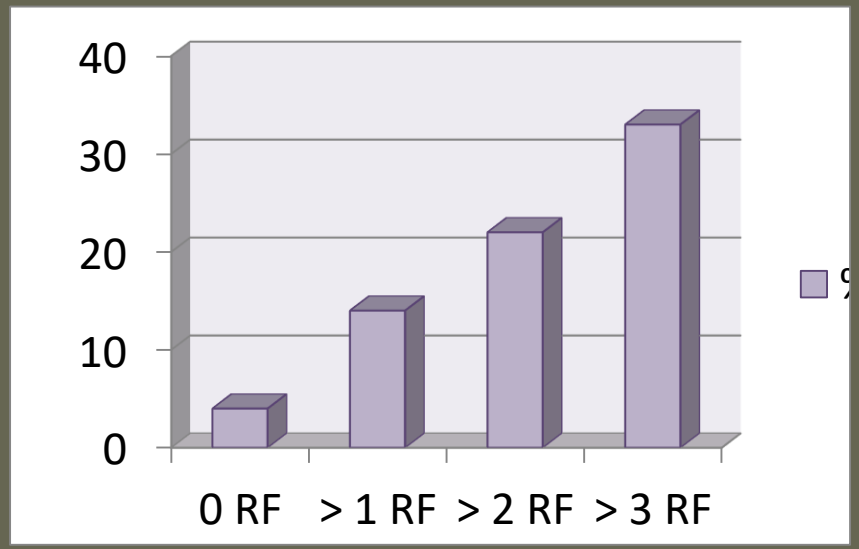
Individual risk factors for ESBL carriage
Multivariate analysis

ESBL (n=315)	adj. OR	95%CI	P-value
Chronic catheter	3.20	2.00-8.55	0.020
Multiple contacts with hospital in the past year	2.53	1.18-5.41	0.017
Low level of autonomy	1.18	0.99-1.41	0.060





AUC: 0.70 (95%CI: 0.65-0.76); *P*<0.001

Hosmer-Lemeshow Goodness-of-fit: *P*=0,679

VIF: 1,01

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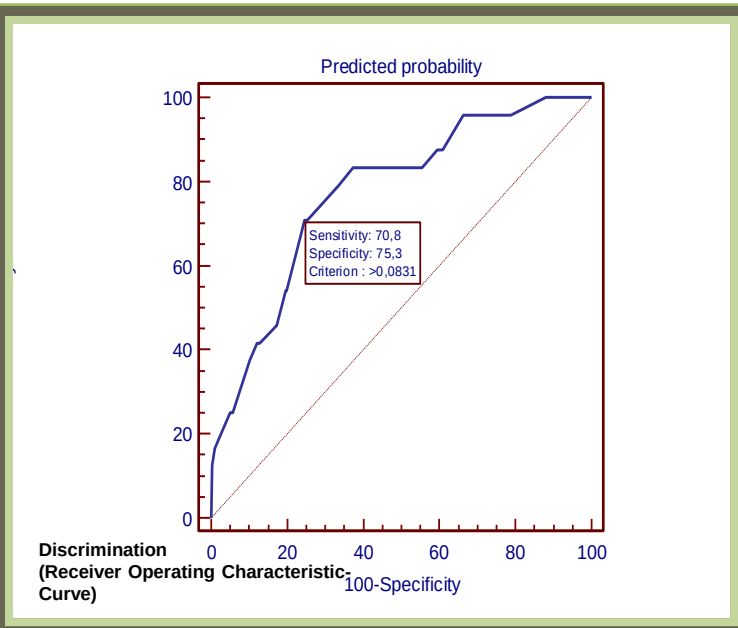
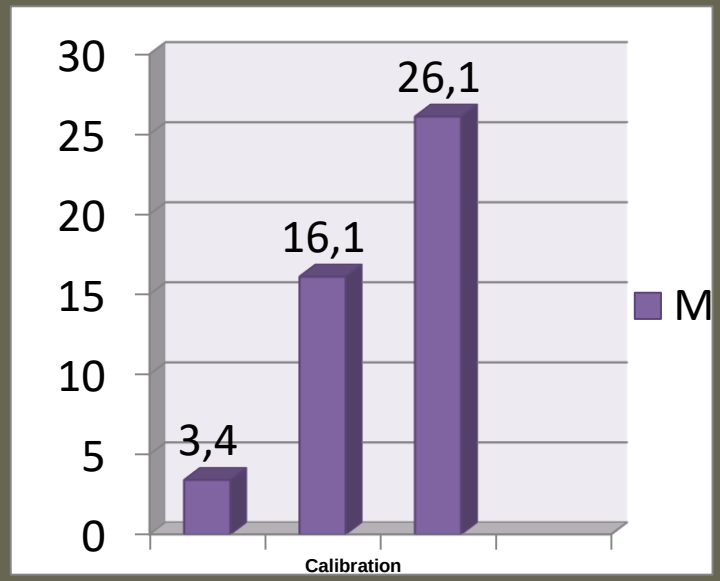
Individual risk factors for MRSA carriage
Multivariate analysis

MRSA (n=319)	adj. OR	95%CI	P-value
Chronic wounds	3.51	1.36-9.03	0.009
Anti-acid use	3.03	1.22-7.52	0.017
Low level of autonomy	1.45	1.14-1.85	0.003



AUC: 0.77 (95%CI: 0.72-0.82); *P*<0.001

Hosmer-Lemeshow Goodness-of-fit: *P*=0,267



1= prob level between 0-0.10
2= prob level between 0.10-0.20
3= prob level between > 0.20

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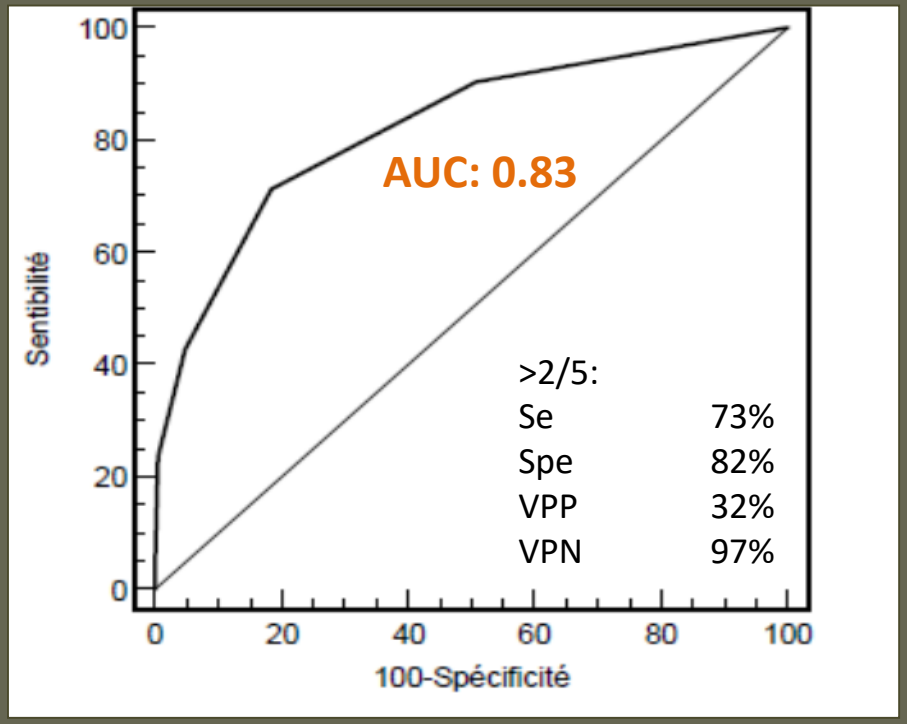
Assessment of a simple clinical score for screening methicillin-resistant Staphylococcus aureus colonization in elderly patients upon hospital admission

- Age >87 years
- Previous MRSA carriage
- Multiple hospital stay
- Chronic wounds
- AB exposure



(2006-2007) N= 221; Prevalence of 10% [95%CI: 0.06-0.15]

Schoevaerdts D. et al. J Am Geriatr Soc. 2010 Jul; 58(7): 1415-7

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Data from Nursing Homes

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Nursing homes as a reservoir of extended-spectrum β-lactamase (ESBL)-producing ciprofloxacin-resistant *Escherichia coli*

Paul J. Rooney[1]*, Maureen C. O'Leary[2], Anne C. Loughrey[1], Mark McCalmont[1], Brian Smyth[3], Philip Donaghy[2], Motasim Badri[4,5], Neil Woodford[6], Edi Karisik[6] and David M. Livermore[6]

16 NH
294 residents
fecal samples
(2005-2006)
Prevalence:
40%

Characteristic	Univariate analysis		Multivariate analysis	
	OR (95% CI)	*P* value[a]	OR (95% CI)	*P* value
MRSA				
yes	1.85 (1.05–3.27)	0.03	1.11 (0.57–2.16)	0.76
no	1		1	
Antibiotic use				
yes	2.19 (1.25–3.83)	0.006	0.90 (0.44–1.84)	0.77
no	1		1	
Antibiotic use, days	1.03 (1.01–1.04)	0.001	1.01 (0.99–1.03)	0.43
Fluoroquinolone use				
yes	2.79 (1.59–4.92)	<0.0001	0.23 (0.04–1.23)	0.09
no	1		1	
Fluoroquinolone use, days	1.19 (1.09–1.28)	<0.0001	1.33 (1.04–1.69)	0.02
Trimethoprim use				
yes	2.53 (1.48–4.35)	0.001	2.17 (0.66–7.15)	0.21
no	1		1	
Trimethoprim use, days	1.09 (1.02–1.16)	0.01	0.92 (0.80–1.07)	0.28
History of UTI				
yes	3.73 (2.28–6.09)	<0.0001	2.56 (1.37–4.78)	0.003
no	1		1	
Catheter use				
yes	4.35 (1.35–14.02)	0.01	2.32 (0.65–8.25)	0.20
no	1		1	
Total no. of visits to outpatients or Accident & Emergency unit	1.20 (1.02–1.41)	0.02	1.10 (0.95–1.28)	0.20
Admitted to hospital				
yes	1.69 (1.05–2.72)	0.03	1.28 (0.75–2.18)	0.36
no	1		1	

MRSA refers to a finding of MRSA colonization or infection at any time. The other parameters refer to the period 1 January 2004 to 31 May 2006.
[a] *P* value: Wald test.

Rooney PJ et al. Journal of Antimicrobial Chemotherapy 2009; 64:635-641

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Nursing homes as a reservoir of extended-spectrum β-lactamase (ESBL)-producing ciprofloxacin-resistant *Escherichia coli*

Paul J. Rooney[1]*, Maureen C. O'Leary[2], Anne C. Loughrey[1], Mark McCalmont[1], Brian Smyth[3], Philip Donaghy[2], Motasim Badri[4,5], Neil Woodford[6], Edi Karisik[6] and David M. Livermore[6]

Home	Bed capacity of home	Specimens examined	MDR *E. coli*-positive specimens	Strain A specimens, *n* (%)
A	24	22	11	9 (82)
B	39	37	20	6 (30)
C	30	13	8	3 (38)
D	41	30	9	9 (100)
E	61	38	6	4 (67)
F	26	24	18	5 (28)
G	78	15	2	1 (50)
H	26	22	12	7 (58)
I	32	9	3	1 (33)
J	28	3	1	1 (100)
K	9	6	0	0 (0)
L	34	21	6	4 (67)
M	24	21	11	0 (0)
N	30	16	10	6 (60)
O	21	12	0	0 (0)
P	55	5	2	2 (100)
Total		294	119	58 (49)

Epidemic strain
E coli O25b
ST131

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Rooney PJ et al. Journal of Antimicrobial Chemotherapy 2009; 64:635-641

Epidemiology of multi-drug microorganisms amongst nursing home residents in Belgium

Project funded by BAPCOC & BICS

Jans B, Schoevaerdts D et al. PLoS One. 2013 May 30;8(5)

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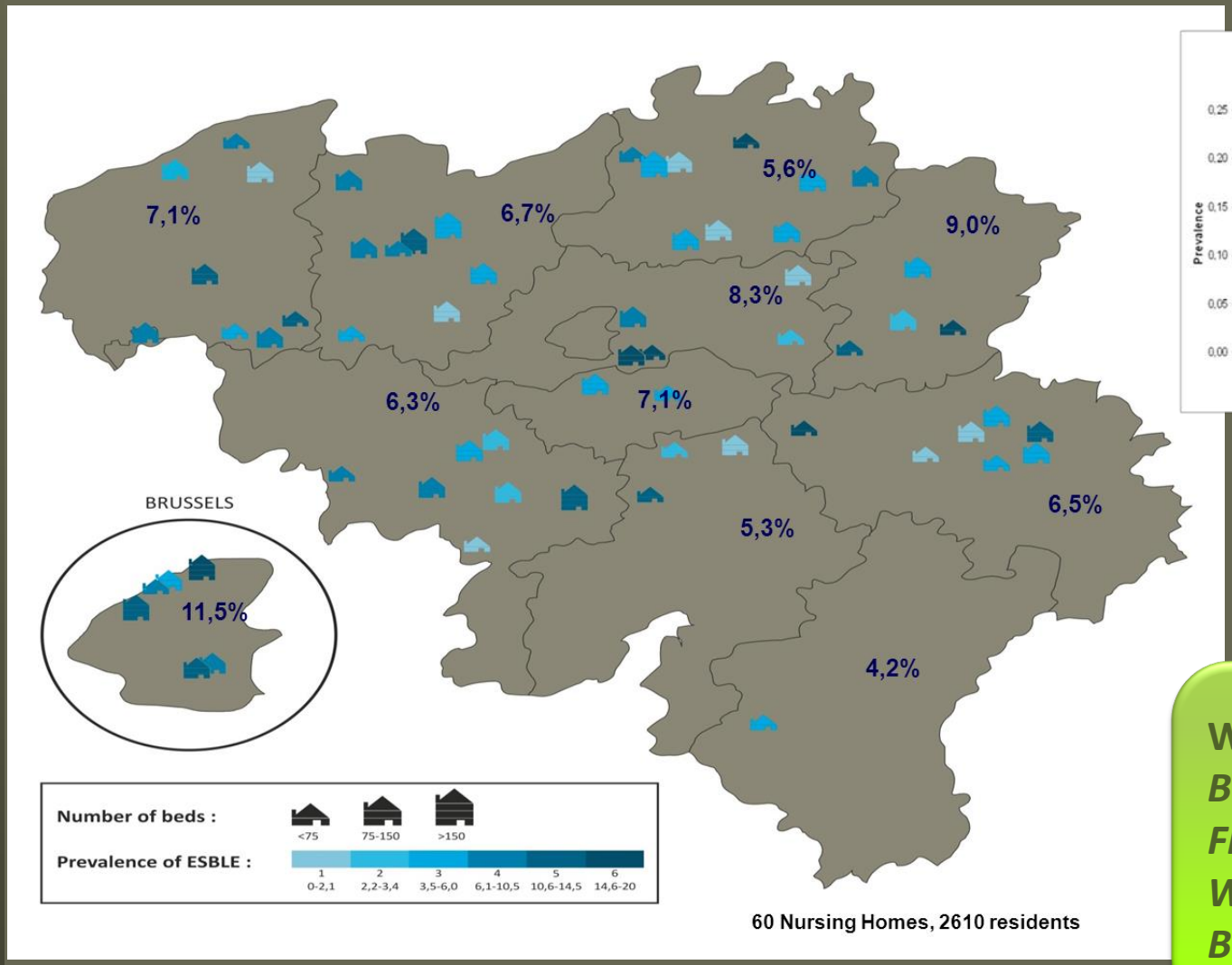
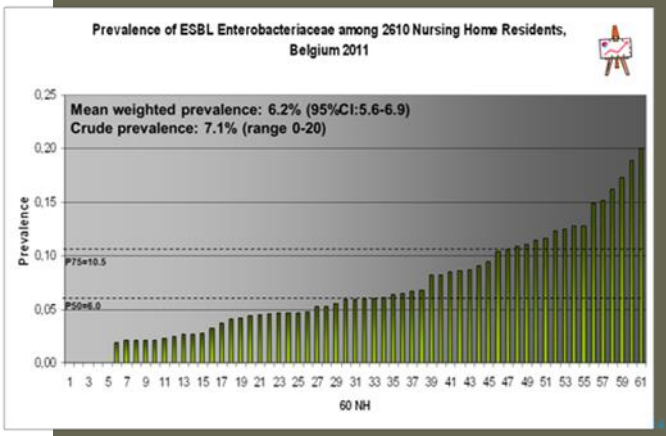
ESBL carriage among Belgian NH residents





Weighted Prevalence:

Belgium: 6.2 [5.6-6.9]

Flanders: 6.0 [5.2-6.9]

Wallonia: 5.1 [4.2-6.2]

Brussels: 11.0 [8.5-14]*

Study period: June-October 2011

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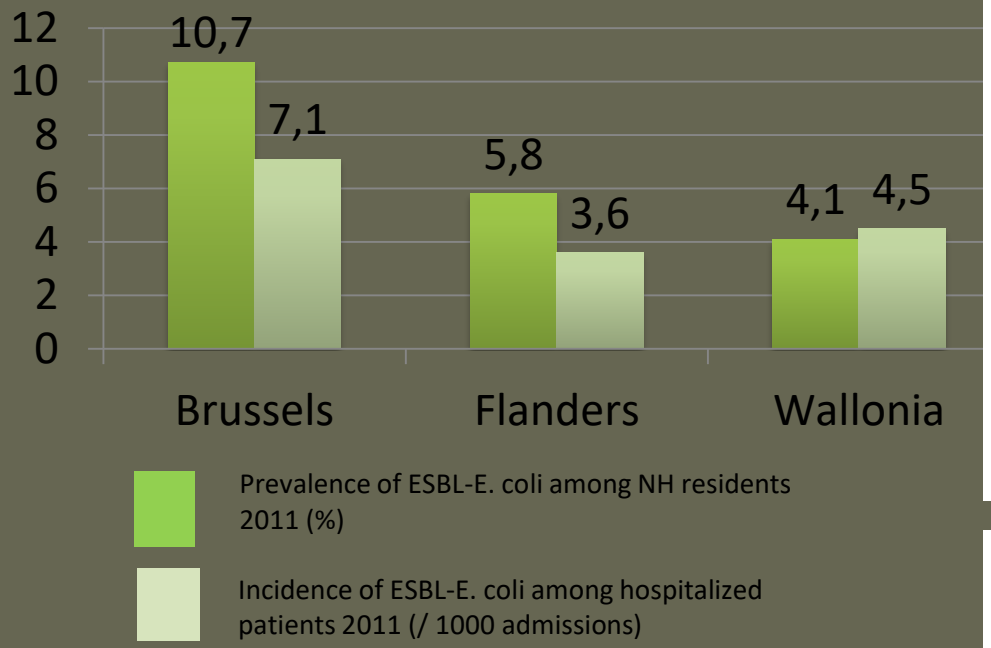
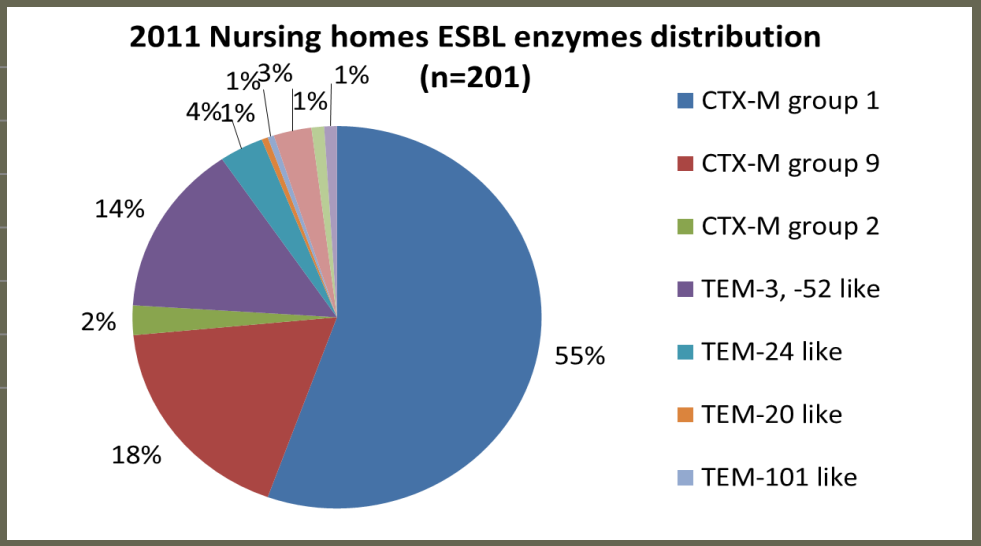
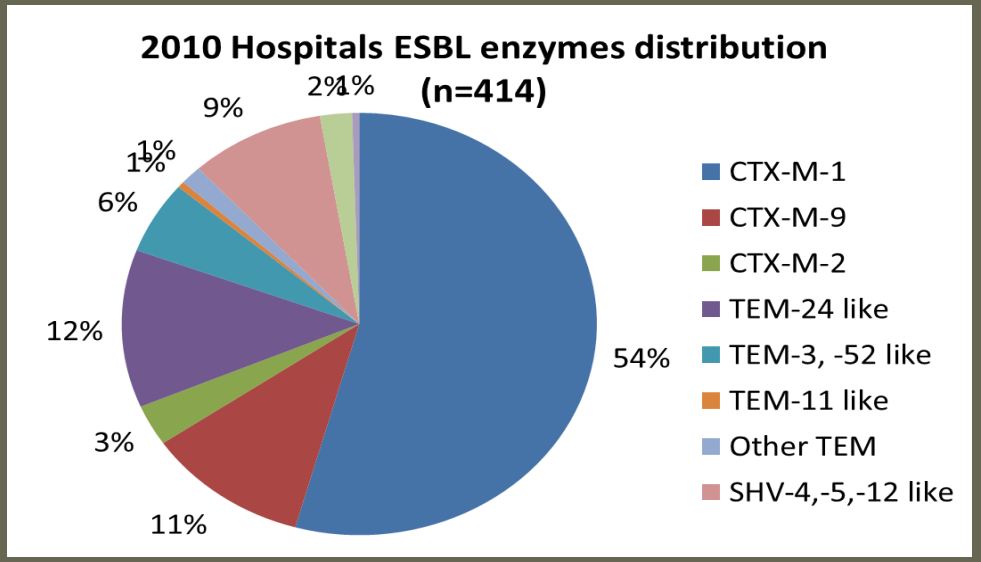
Comparison between Hospital and NHs



Graph provided by Béa Jans, Public Health Institute





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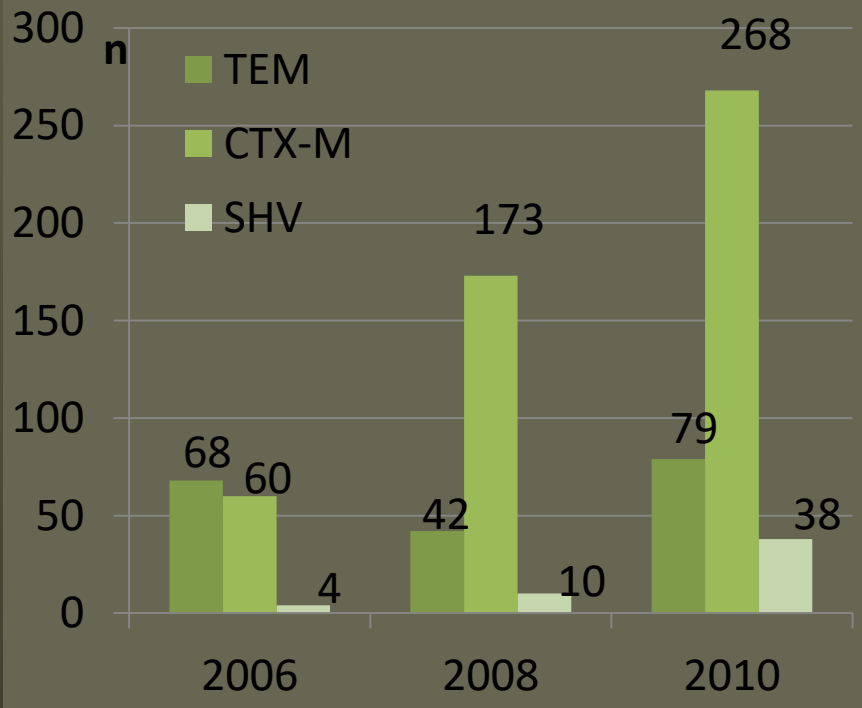
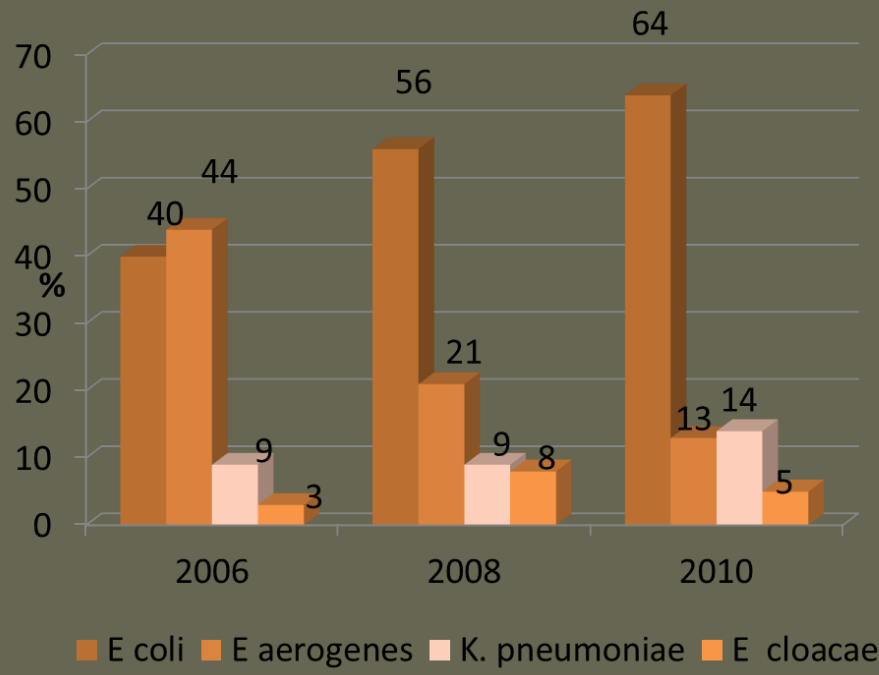
Trends in production of extended-spectrum beta-lactamases among *Enterobacteriaceae* of clinical interest: results of a nationwide survey in 100 Belgian hospitals.

CTX-M-1 group: 79%
(CTX-M15: 85%)
CTX-M-9 group: 16%
CTX-M-2 group: 4%





Rodriguez-Villalobos H, J Antimicrob Chemother. 2011 Jan;66(1):37-47

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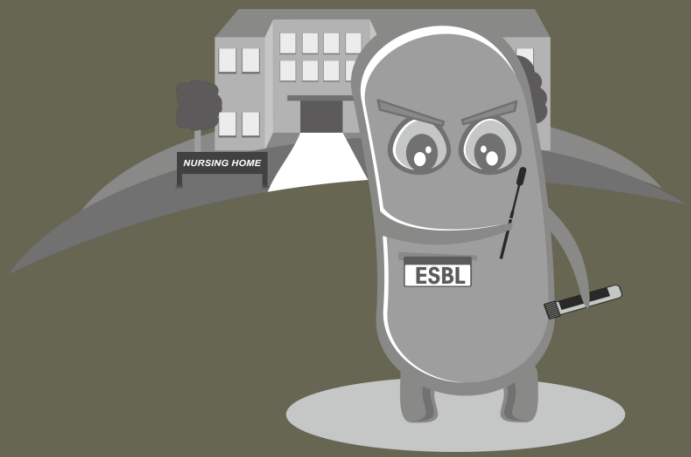
Risk factors of ESBL carriage among NH residents

Level of mobility	X1,8
Male gender	X1,5
Previous AB exposure	X1,6
Previous ESBL carriage	X6,6
Comorbidity (COPD, UTI)	X1,7
Bladder catheter	X2,3
Chronic wounds	X1,8
Functional status	X1,7



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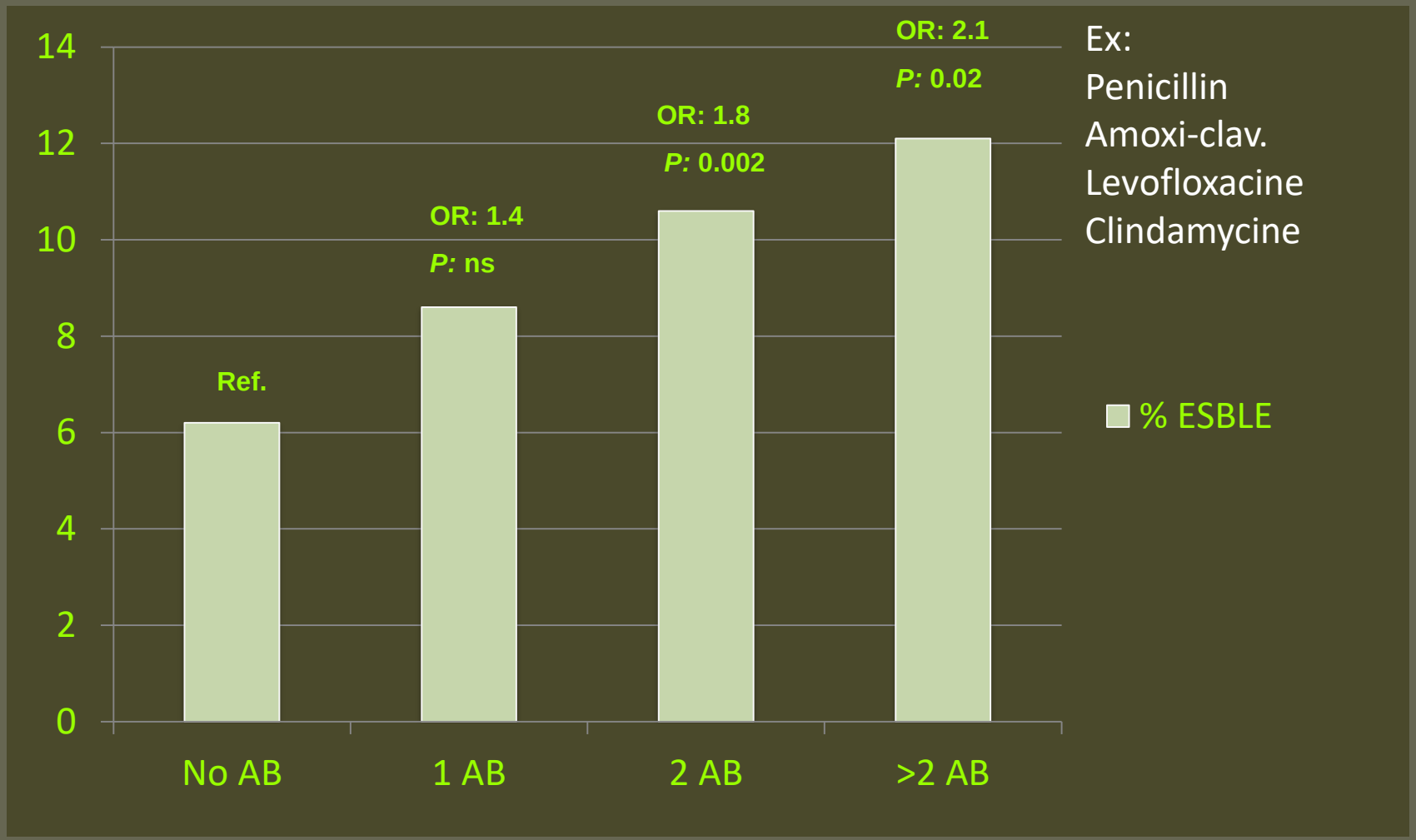
AB exposure



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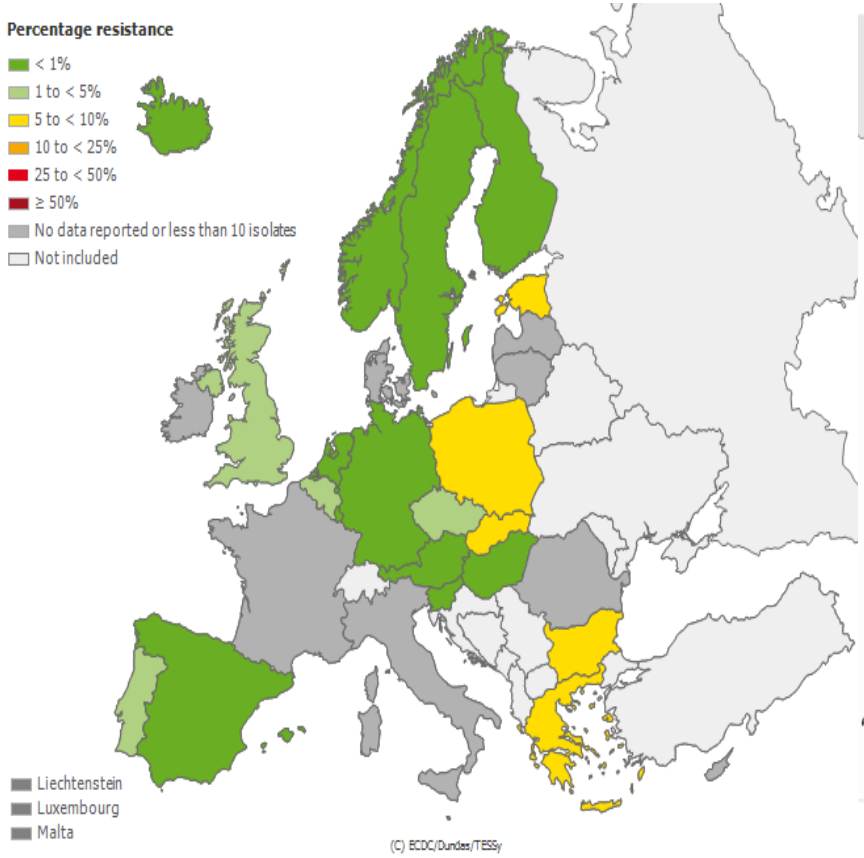
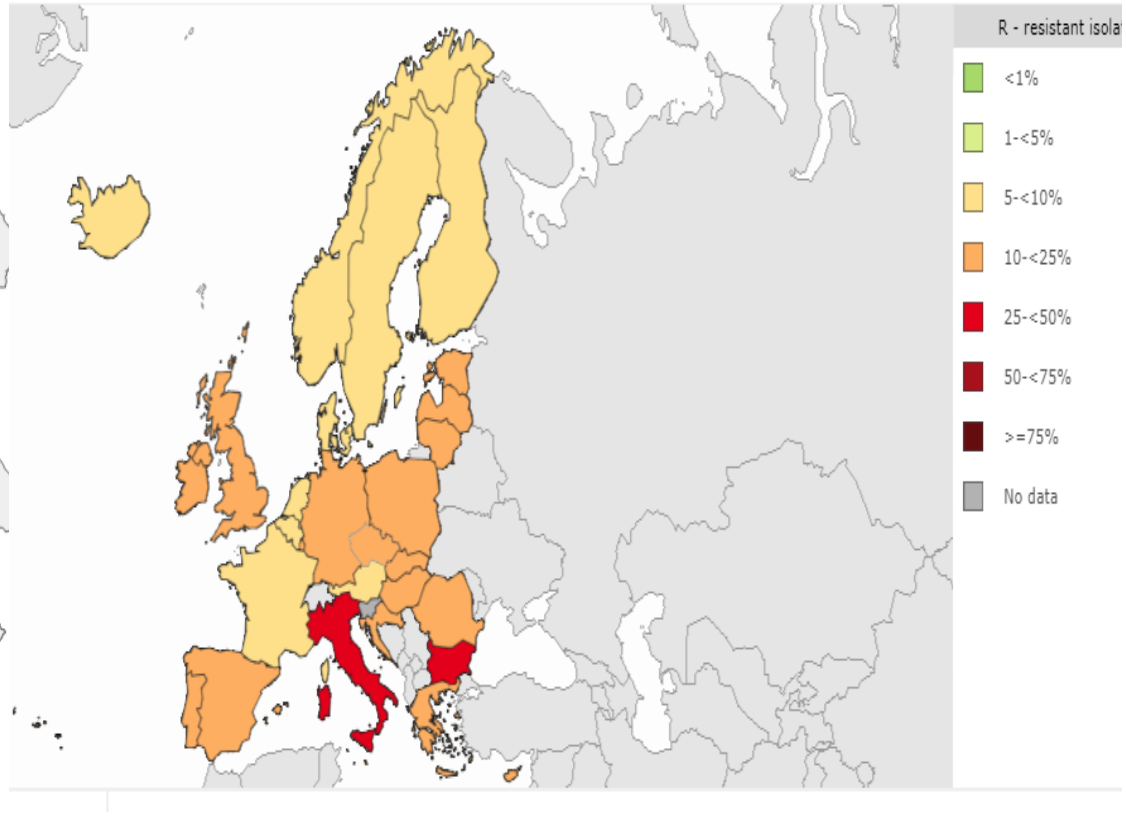
Proportion of invasive Strains : *E. coli* C3-R 2001 et 2019

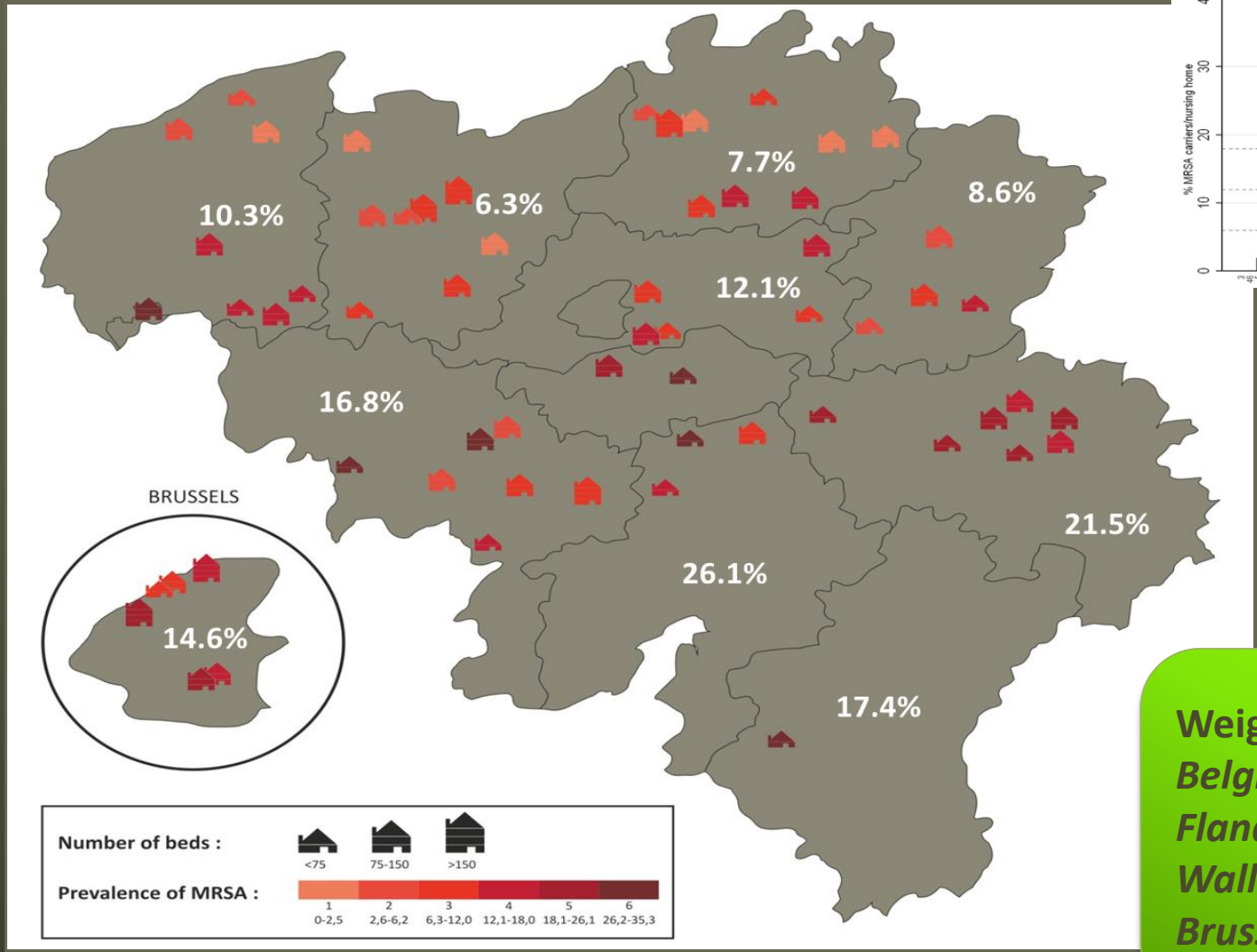


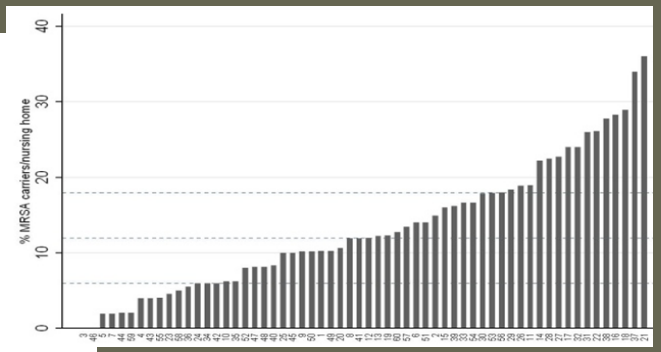


2001 **2019**

EARS-Net Database

MRSA carriage among NH residents





Weigthed prevalence:
Belgium: 12,2 [11,3-13,1]
Flanders: 7,9 [7,0-8,9]
Wallonia: 18,3 [16,5-20,2]
Brussels: 14,7 [11,8-18,1]

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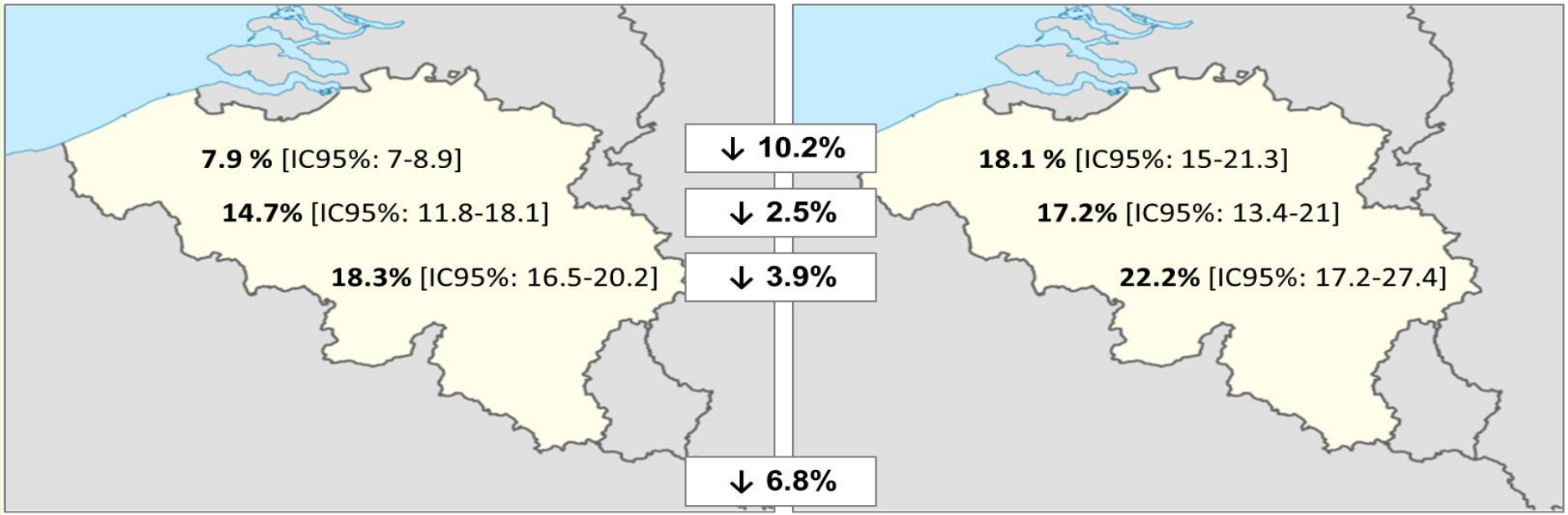
Etude 2011

Prévalence pondérée: 12.2 % [IC95%: 11.3-13.1]
Min. : 0 %
Max.: 36 %

Etude 2005

Prévalence pondérée: 19 % [IC95%: 16.5-21.5]
Min. : 2 %
Max.: 42.9 %



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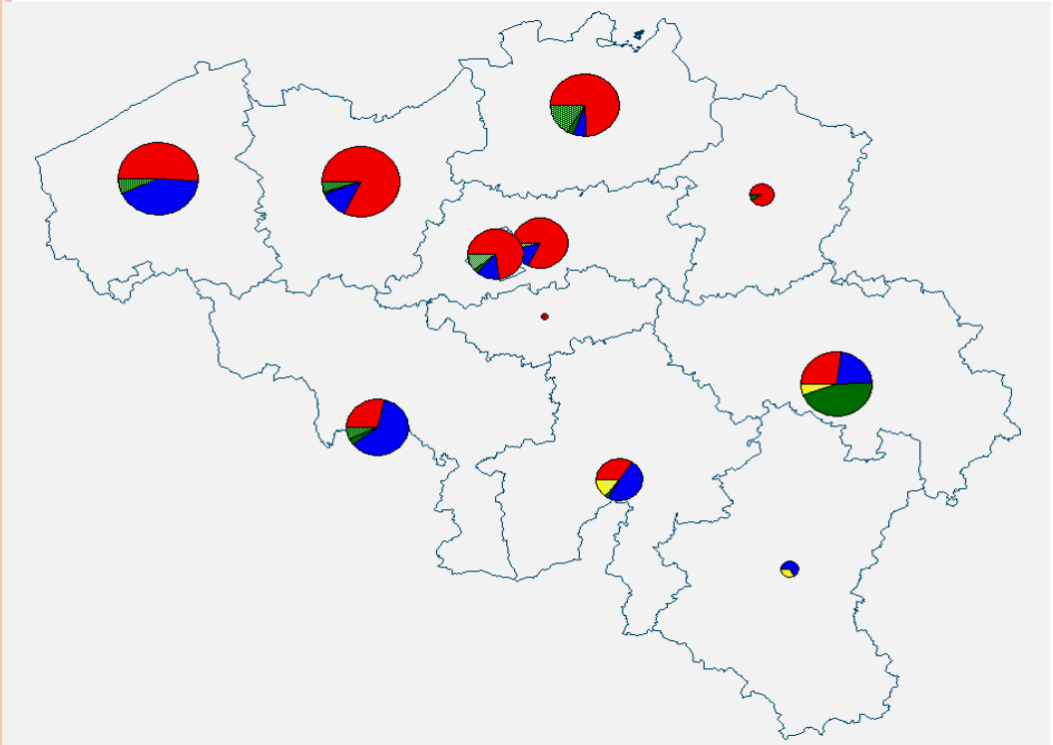
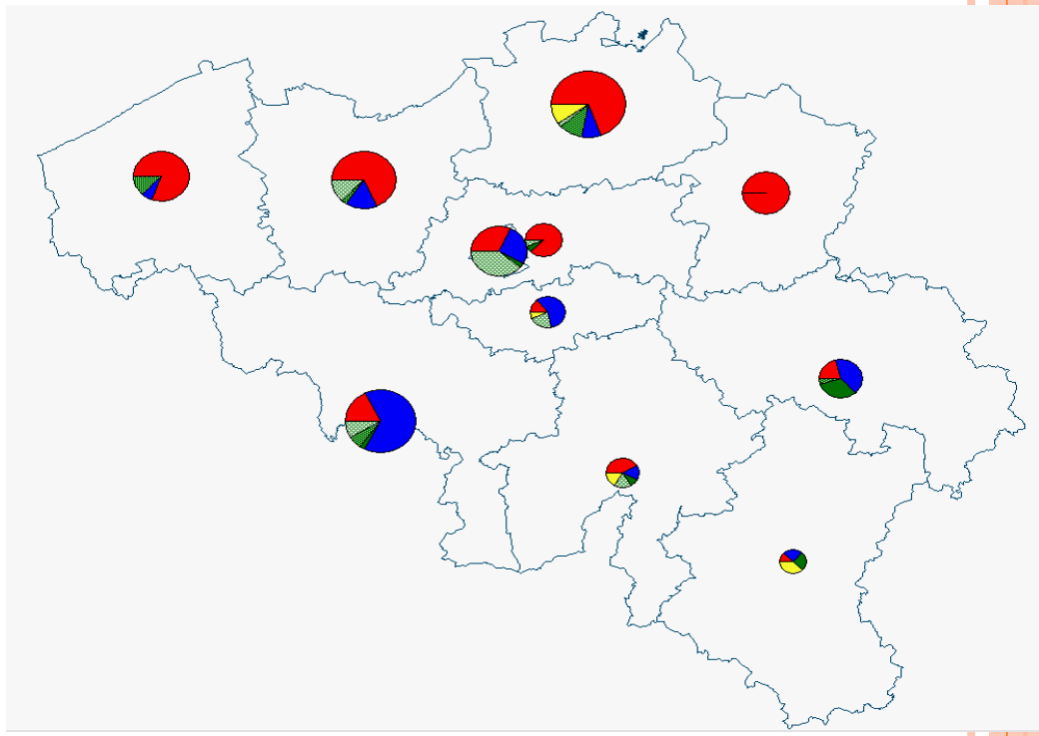
Distribution of epidemic MRSA by genotype Nursing Homes versus Hospitals, 2005





Nursing Homes
(n = 587 strains)

- ST45-IV
- ST8- IV
- ST225- II
- ST5-IV
- ST5- II
- ST22-IV

Hospitals
(n = 326 strains)

Denis *et al.* JAC 2009

Risk factors of MRSA carriage

Hospital

- Functional status X1,5
- Chronic wounds X3,5
- Anti-acid use X3,0

Nursing homes

- Functional status X1,9
- Chronic wounds X1,9
- Anti-acid use X1,5
- Previous MRSA X3,8

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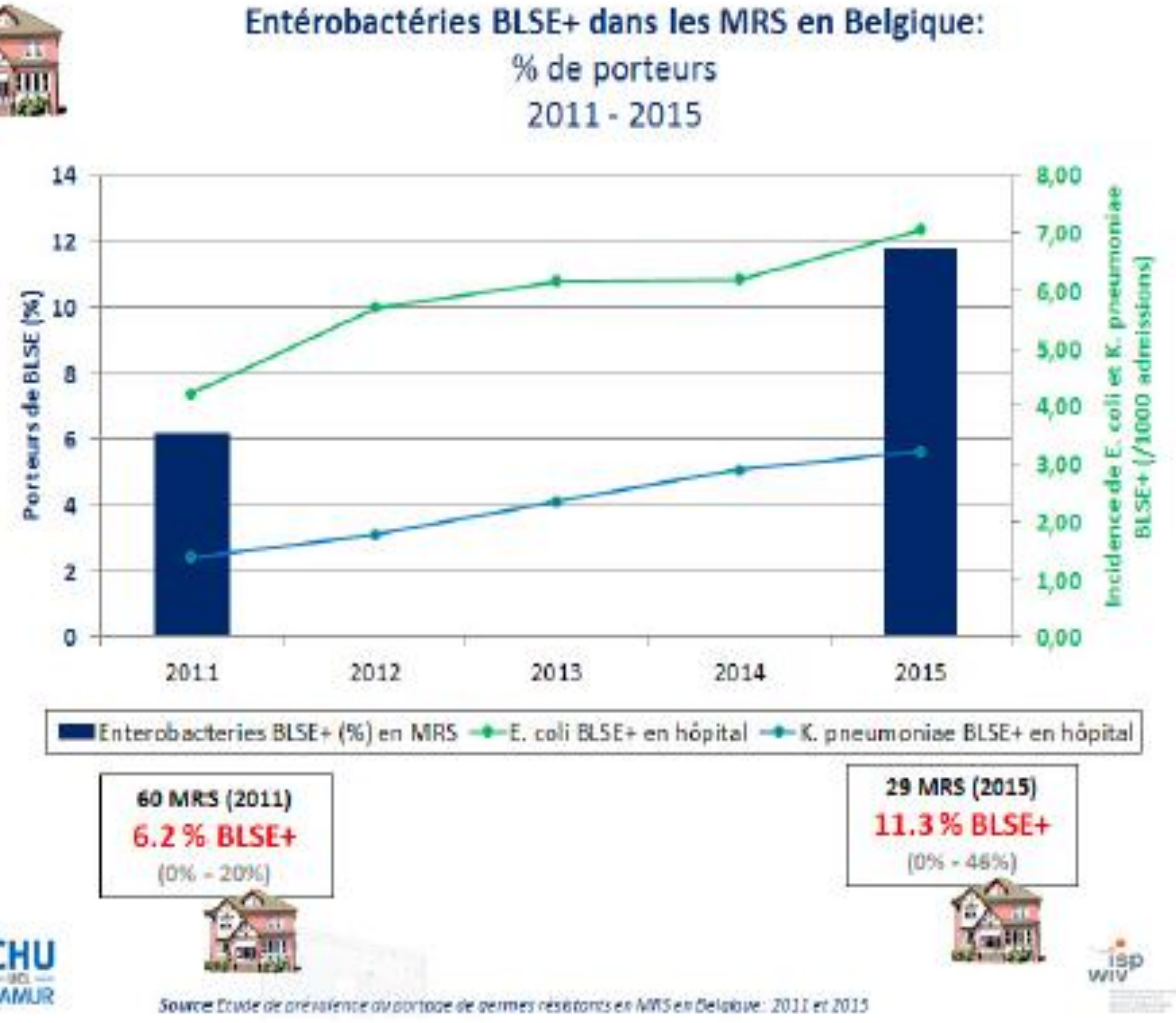
Figure 13 | Évolution du portage d'E-BLSE en MRS et de l'incidence d'E-BLSE dans les hôpitaux aigus: 2011-2015

	BLSE	MRSA
2005	?	19%
2011	6,2%	12,2%
2015	11,9%	9%



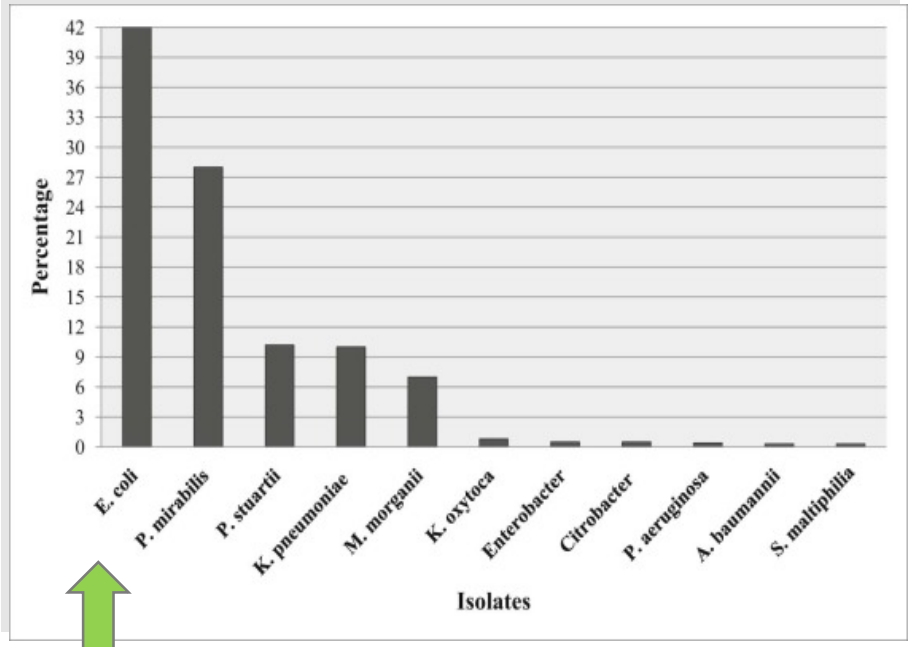
Jans B, Latour K, Catry B, Huang Te-Din , Schoevaerdts D, Berhin C, Bogaerts P, Glupczynski Y, Argudin MA, Deplano A, Dodémont M, Nonhoff C, Roisin S, Denis O, Loens K, Ieven G, Goossens H: **Étude nationale de prévalence du portage de germes résistants aux antibiotiques en maison de repos et de soins (MRS) en Belgique en 2015,** Rapport Final 2016

Prevalence of multidrug-resistant gram-negative bacteria among nursing home residents: A systematic review and meta-analysis

Sainfer Aliyu MPhil, MSEd, MHPM, BSN, RN [a,*], Arlene Smaldone PhD, CPNP, CDE [a], Elaine Larson PhD, RN, CIC, FAAN [a,b]

Variable	Number of studies	% Colonization (95% CI)
Study location		
Non USA	3	0.14 (0.06-0.30)
USA	5	0.38 (0.23-0.55)
Study design		
Cross sectional	3	0.23 (0.08-0.51)
Prospective	4	0.24 (0.10-0.48)
Retrospective	1	0.59 (0.15-0.92)
Year of study		
During or before 2012	4	0.23 (0.09-0.47)
After 2012	4	0.32 (0.13-0.60)
Culture site		
1 - 2 sites	4	0.32 (0.12-0.62)
3 or more sites	4	0.23 (0.08-0.50)

$P < 0.05$, % colonization significantly higher in studies conducted in U.S.
CI = Confidence Interval
Non USA = Korea and Germany



Am J Infect Control. 2017;45(5):512-518

Increase incidence of infection with ageing ?

- Ageing
- Immuno-senescence
- Co-morbidities (dementia)
- Poornutrition
- Polymedication
- Functional impairment and frailty
- Geriatric syndroms like delirium, falls, incontinence,…
- Promiscuity (nursing home residents)
- Low compliance to hygiene control procedure
- Low rate of vaccination

Infections and Functional Impairment in Nursing Home Residents: A Reciprocal Relationship

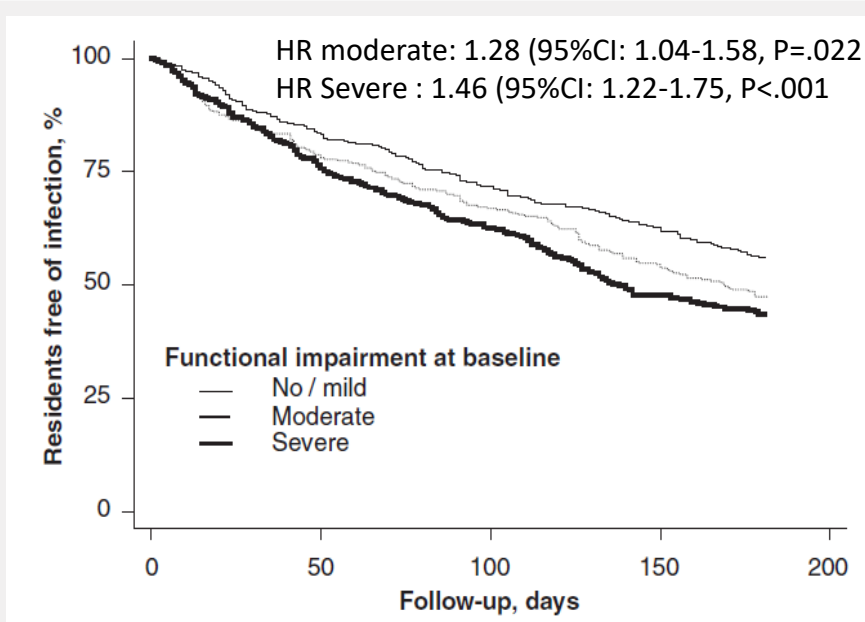
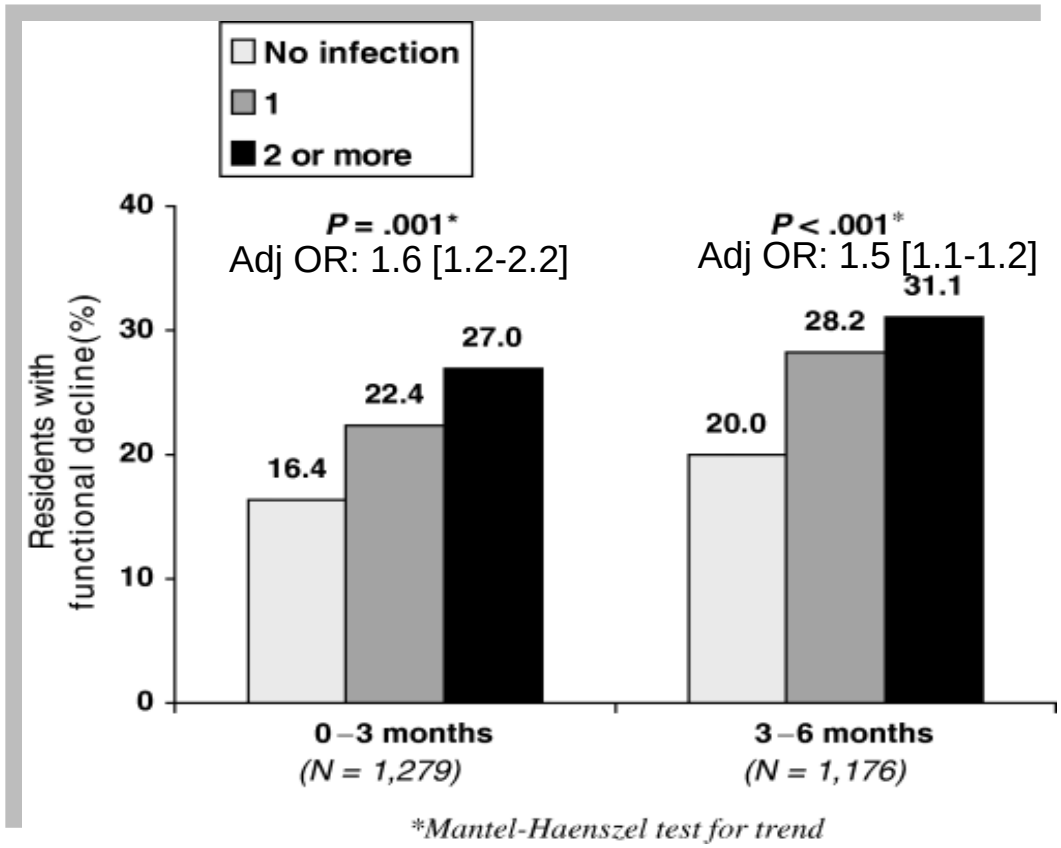


Figure 4. Kaplan-Meier survival curves of infection-free survival in residents with no/mild (activity of daily living (ADL) score = 5 or 6), moderate (ADL score = 2–4), and severe (ADL score = 0 or 1) functional impairment at study baseline ($P < .001$, log-rank test).



Büla CJ et al. Journal American Geriatric Society 2004; 700-6

Age
Malnutrition
Immunosenescence
Diseases
Contextual factors

Chronic Undernutrition

Dysregulations:
Hormonal status
Inflammation
Coagulation

THE CYCLE OF FRAILTY

↓ Total energy expenditure

↓ Physical activity

↓ Walking speed

↓ Resting metabolic rate

↓ Strength / Power

Hb ↓and anemia
Sarcopenia
Atherosclerosis
↓IG-F1

Insulin resistance
Osteopenia
↓ VO2max

Complications state
Infection,Impaired balance, Disability, Immobilisation, Falls,…

Lang PO, European Geriatric Medicine 2010; 112-121

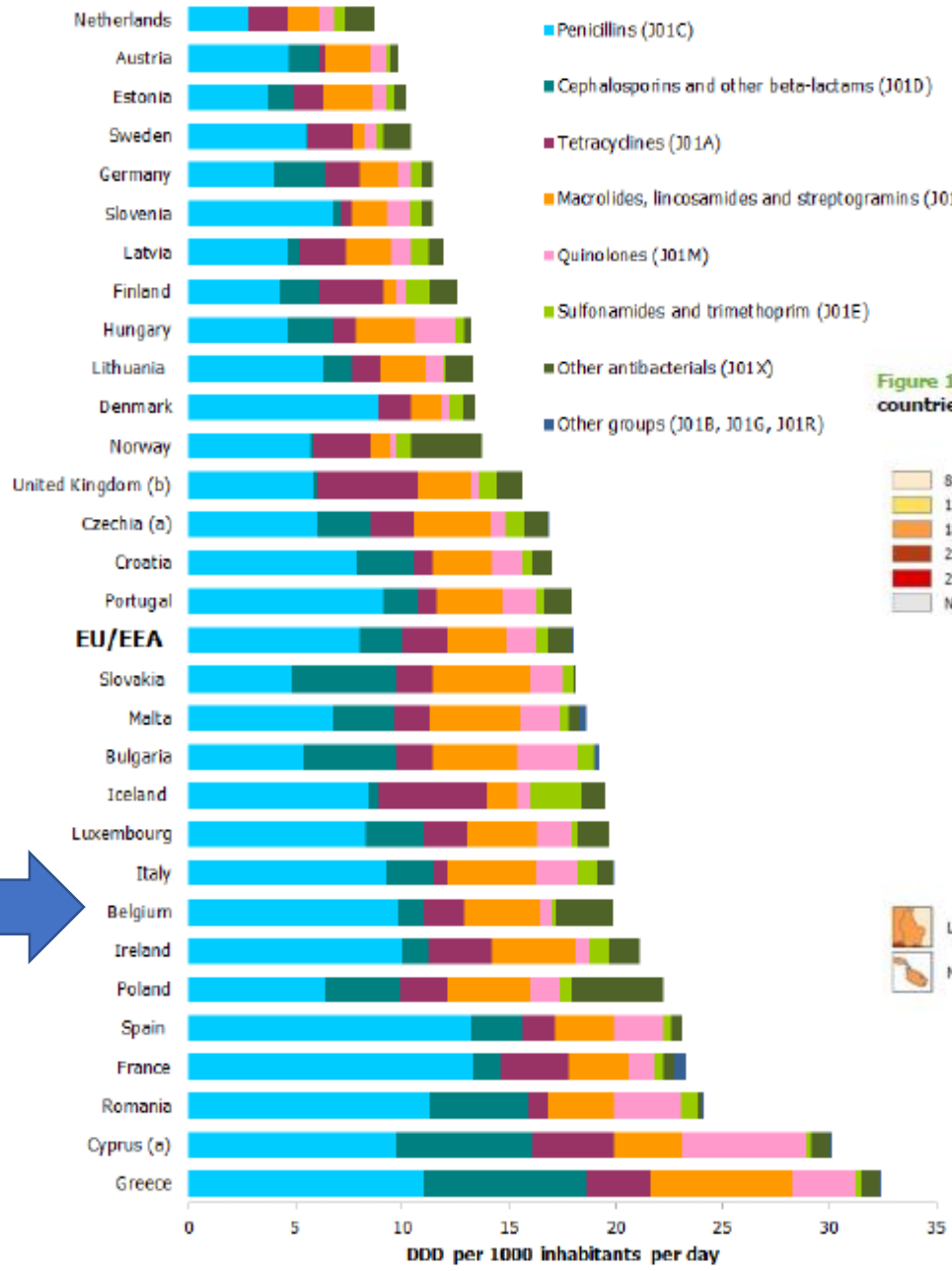
Differences between ESBL and MRSA

	ESBL	MRSA
Incidence	Increase	Decrease
Reservoir	Gut and urinary tract	Skin, mucosa, nose and throat
Community reservoir	Important	Less important
Hospital alert system	Less frequent	Frequent
Screening strategies	Less well-defined	Well defined
Balance between cross-transmission and AB pressure	AB pressure >Cross transmission	Cross transmission>AB pressure
Dissemination	Polyclonal and clonal (ST 131)	Clonal (ST 45-8-5)
decolonization treatment	Not suggested	Suggested

How to control HAIs
The 4 major issues

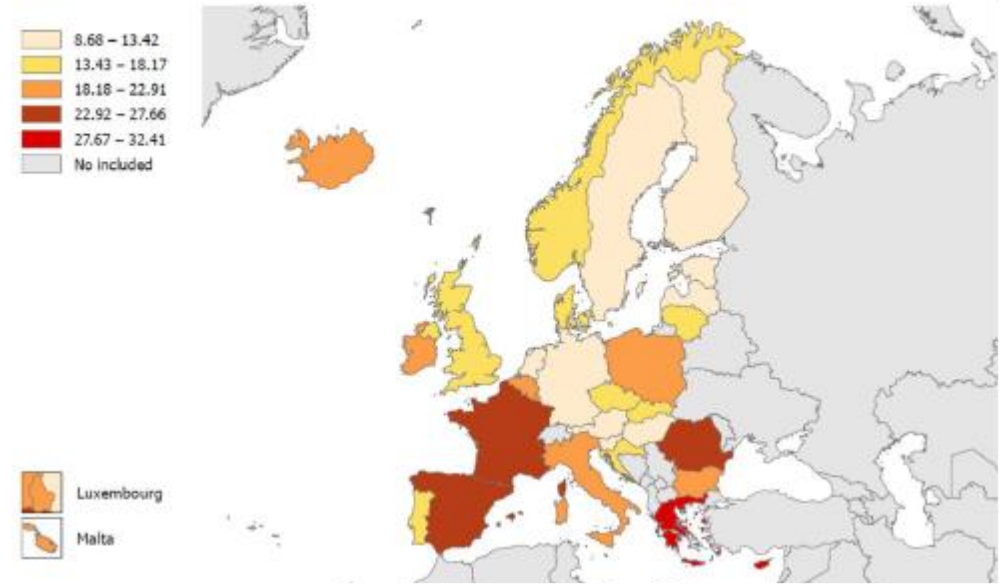
- Antibiotic practices
- To reduce cross-transmission
- Action against the environment
- To Measure and promote surveillance

Figure 2. Consumption of antibacterials for systemic use (ATC group J01) in the community, by country and ATC group level 3, EU/EEA, 2019 (expressed as DDD per 1 000 inhabitants per day)



-1,7% between 2010 and 2019

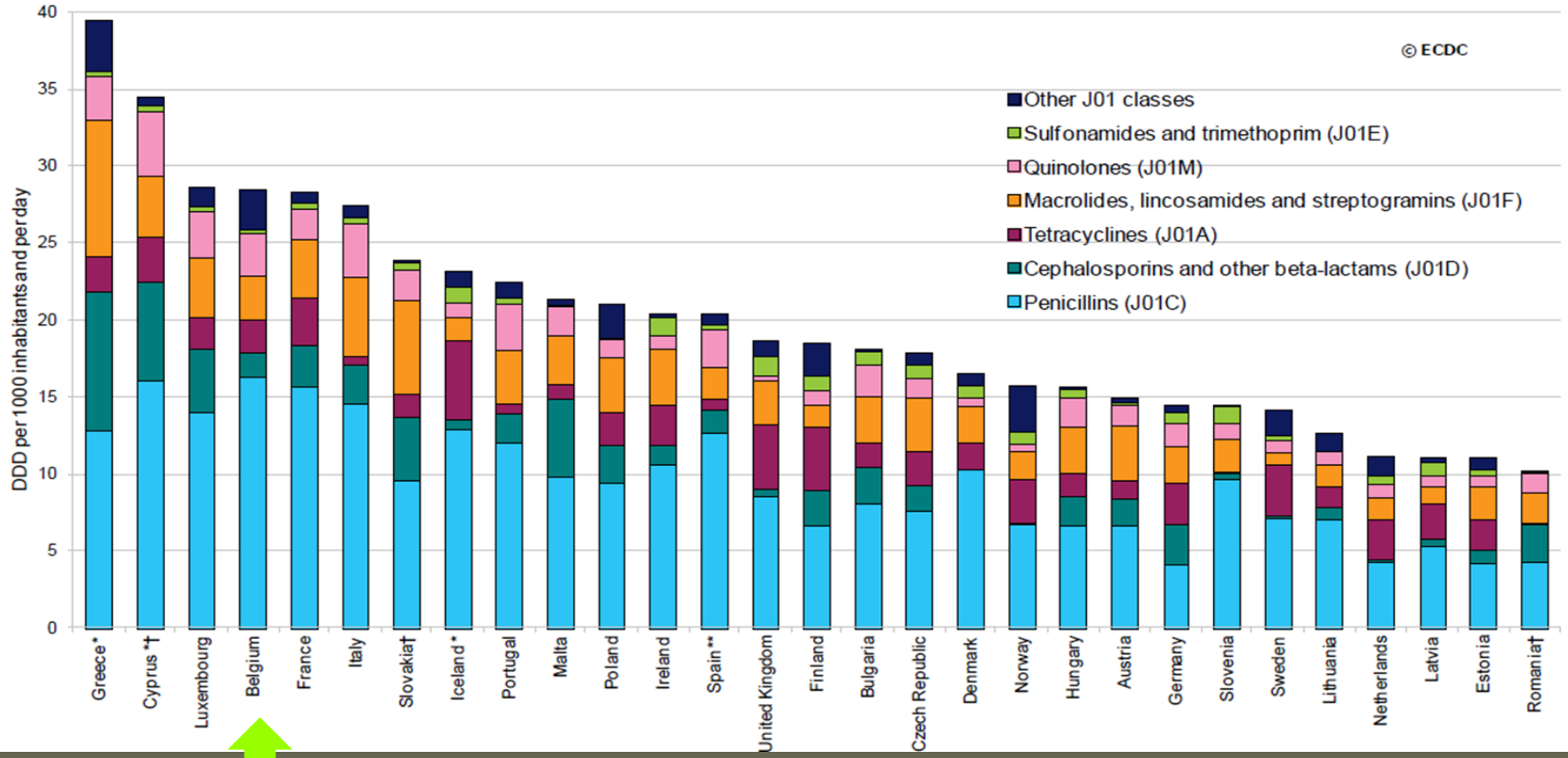
Figure 1. Consumption of antibacterials for systemic use (ATC group J01) in the community, EU/EEA countries, 2019 (expressed as DDD per 1 000 inhabitants per day)



Antimicrobial consumption in the EU/EEA

Annual Epidemiological Report for 2019

Figure 2. Consumption of antibiotics for systemic use in the community by antibiotic class in 29 EU/EEA countries, 2010 or latest year available*



N° 4

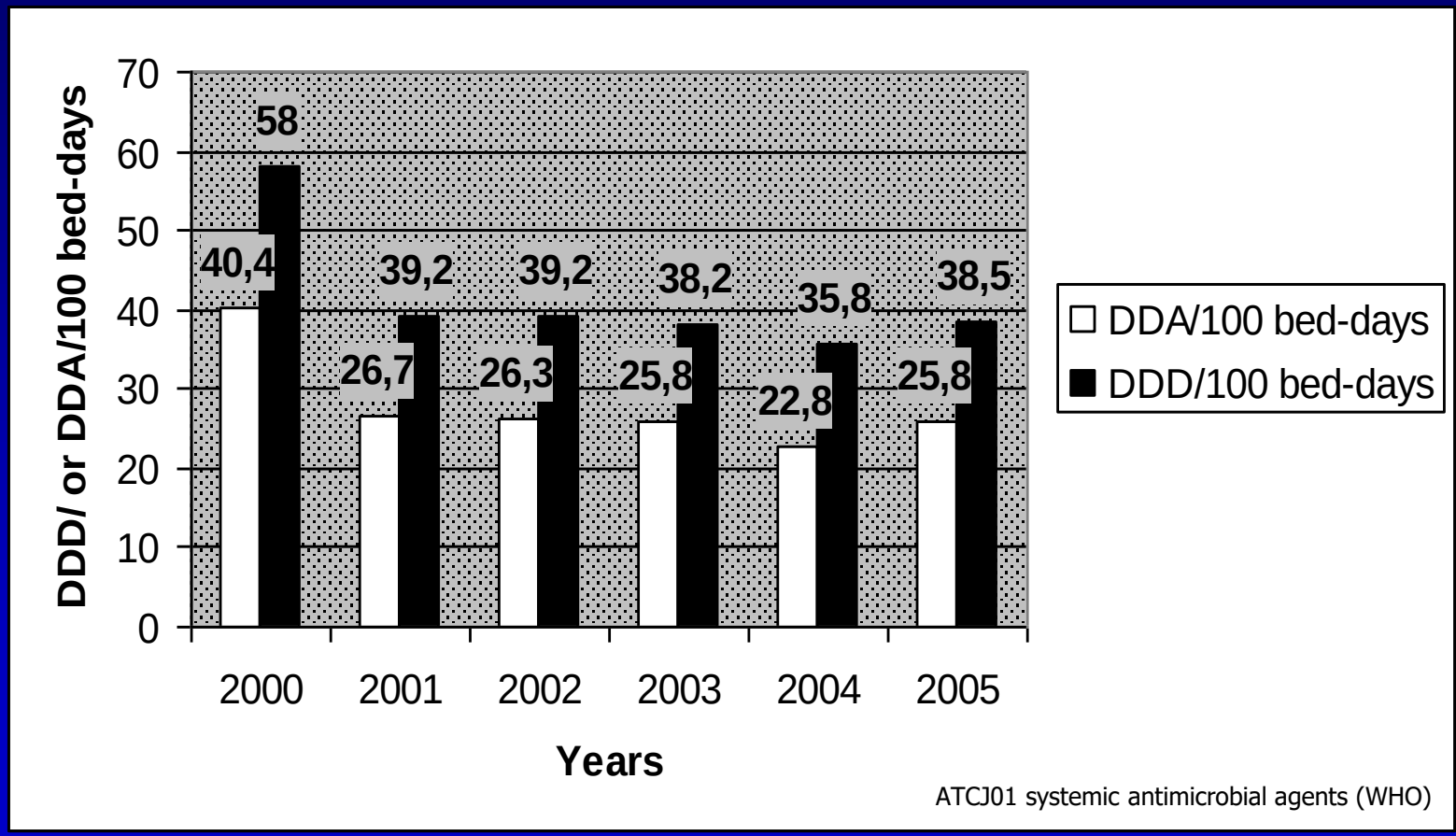
http://app.esac.ua.ac.be

2010

EFFECT OF A 5-YEAR MULTIDISCIPLINARY COLLABORATIVE PROGRAM ON ANTIBIOTIC CONSUMPTION IN AN ACUTE GERIATRIC WARD

Global antimicrobial usage in the geriatric unit

(Cliniques UCL Mont-Godinne 2000-2005)



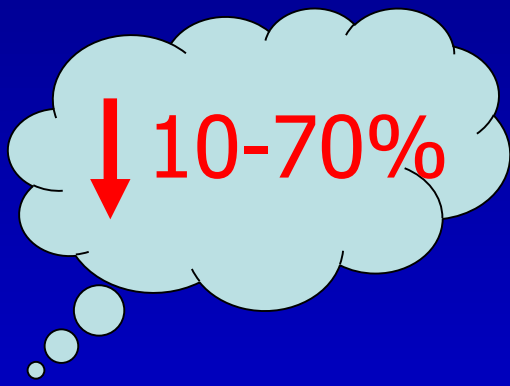
ATCJ01 systemic antimicrobial agents (WHO)

Diff. DDA 2005 vs 2000: - 36%, Spearman Coeff: r=-0.89, p=0.015
Diff. DDD 2005 vs 2000: -34%, Spearman Coeff: r=-0.81, p=0.05

D Schoevaerdts et al. J Am Geriatr Soc. 2008

Effectiveness of bundle behavioral interventions and nonpharmacological interventions to control HAI

- “Hand hygiene” statement
- Urinary and central venous catheters protocols
- Better nutrition
- Search and destroy strategy
- Sufficient number of nurses
- Surface cleaning
- Multidisciplinary quality improvement team
- Educational programs
- Compliance monitoring and feedback



Aboelela SW, Stone PW, Larson EL. Effectiveness of bundled behavioural interventions to control healthcare-associated infections: a systematic review of the literature. J Hosp Infect. 2007;66(2):101-8.
Curtis LT. Prevention of hospital-acquired infections: review of non-pharmacological interventions. J Hosp Infect. 2008 Jul;69(3):204-19.
Harbarth S, Sax H, Gastmeier P.The preventable proportion of nosocomial infections: an overview of published reports. J Hosp Infect. 2003;54(4):258-66

Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship

- Use of guidelines and clinical pathway (AI)
- Prosp. audit with intervention and feedback (AI)
- Parenteral to oral conversion (AI)
- De-escalation therapy (AII)
- Dose optimization (AII)
- Formulary restriction (AII)

Dellit T H et al. Clin Infect Dis. 2007;44:159-177

Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship

- Multidisciplinary AB stewardship team (AIII)
- Collaboration with whole hospital (AIII)
- Information technology (AIII)
- Microbiology laboratory (AIII)
- Education (BII)
- Computer-based surveillance (BII)
- AB order forms (BII)
- Combination therapy (CII)
- AB Cycling (CII)

Dellit T H et al. Clin Infect Dis. 2007;44:159-177

Effectiveness of comprehensive implementation of individualized bundling infection control measures for prevention of health care–associated infections in general medical wards

Montri Korbkitjaroen, MS, Sribenja Vaithayapichet, BNS, Kanchana Kachintorn, BNS, Duangporn Jintanothaitavorn, MA, Natcha Wiruchkul, MNS, and Visanu Thamlikitkul, MD
Bangkok, Thailand

HAI	Intervention wards (954 patients-6950 hosp days	Control wards (920 patients, 9777 hosp days)	Diff. *P*-value
VAP	6,5 episodes / 1000 resp-days	16,3 episodes / 1000 resp-days	-9,8%, 0,009
CA UTI	2,9 episodes / 1000 cath- days	7,3 episodes / 1000 cath-days	-4,4%, 0,013
CA BSI	2,9 episodes / 1000 cath-days	3,9 episodes / 1000 cath-days	1,0% 0,840
Overall HAI	5,5 episodes / 1000 hosp-days	8,7 episodes / 1000 hosp-days	-3,2%, 0,008

Regular visit of the infection control team

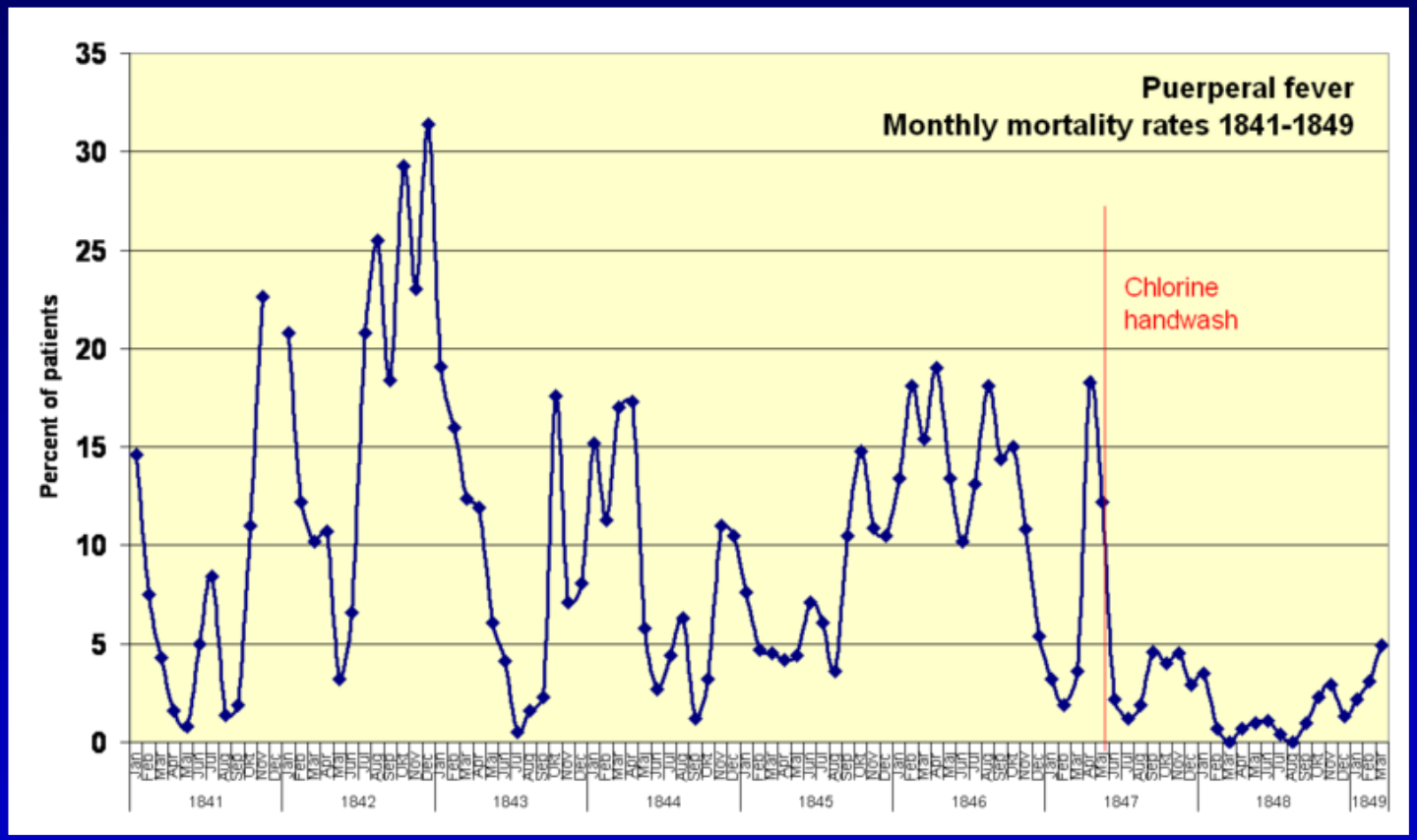
Checklist sheet

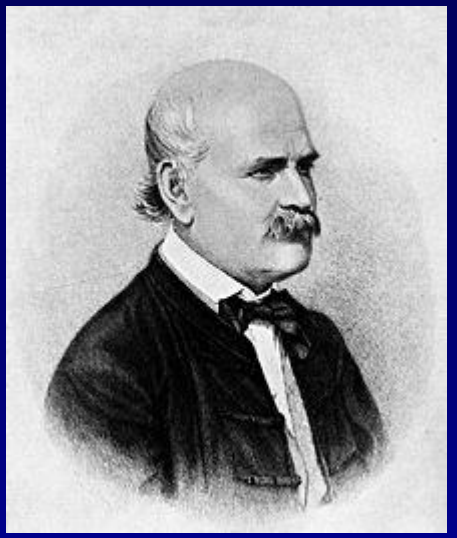
Risk factor screening for HAI

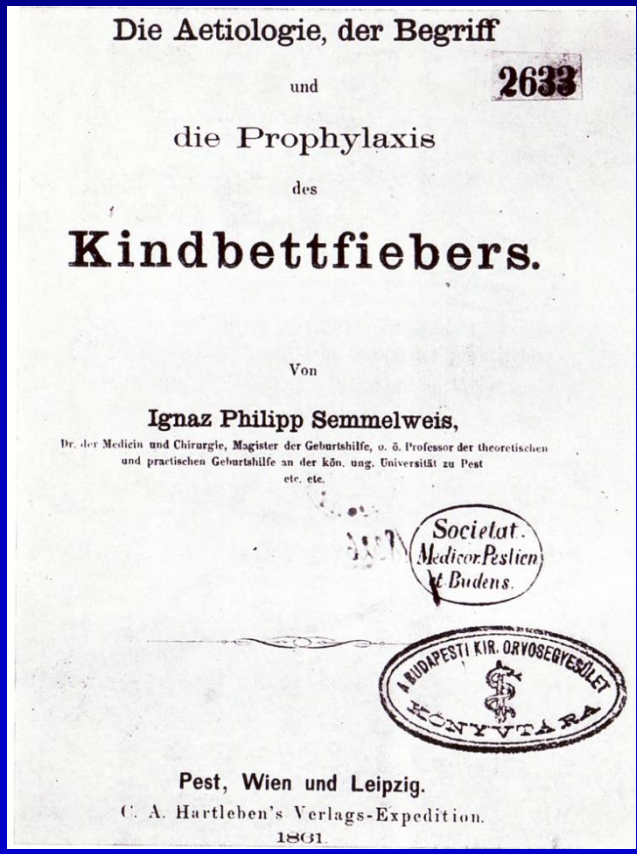
Infection bundle for the prevention of VAP, CABSI, CAUTI

Korbkitjaroen M, Am J Infect Control 2011; 39:471-6

Sir Ignaz Semmelweis






Die Aetiologie, der Begriff

und

2633

die Prophylaxis

des

Kindbettfiebers.

Von

Ignaz Philipp Semmelweis,

Dr. der Medicin und Chirurgie, Magister der Geburtshilfe, o. ö. Professor der theoretischen und practischen Geburtshilfe an der kön. ung. Universität zu Pest etc. etc.

Societat. Medicor. Peslien. et Budens.

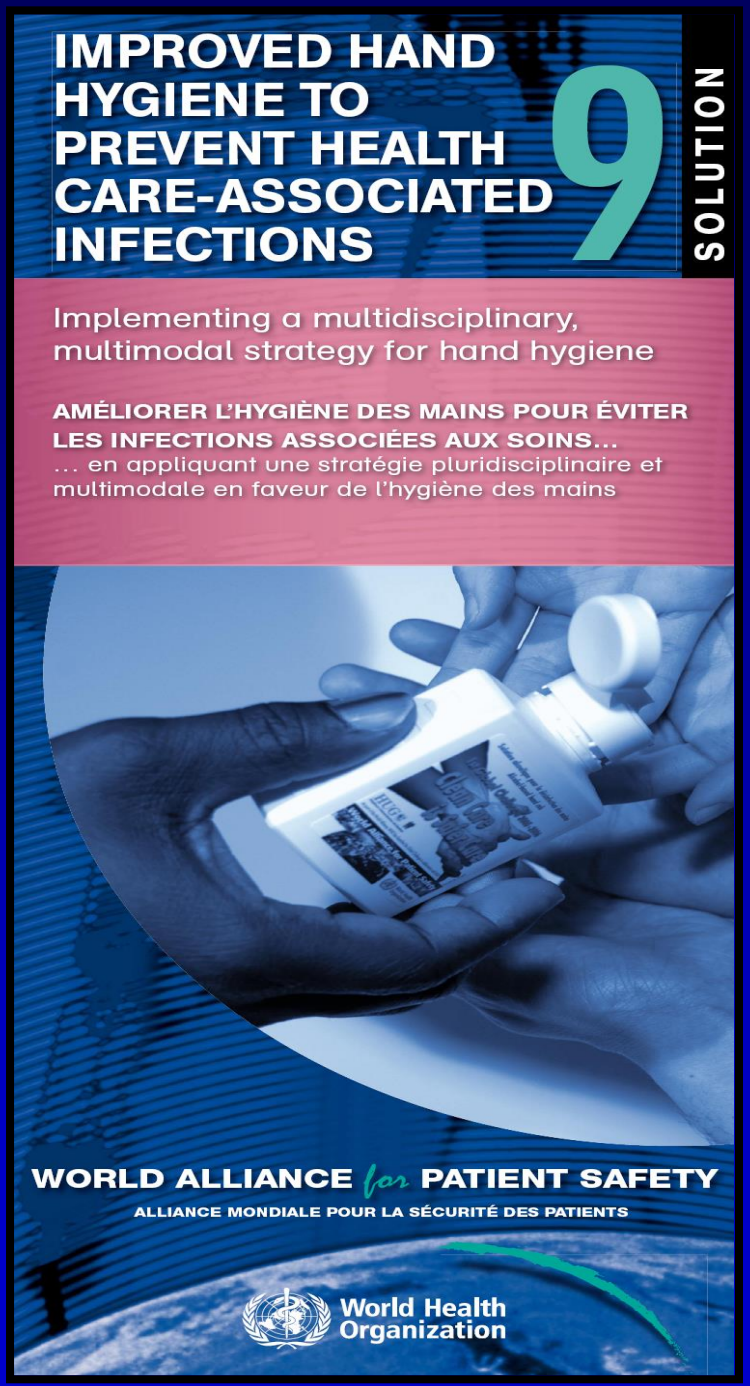
A BUDAPESTI KIR. ORVOSEGYESÜLET KÖNYVTÁRA

Pest, Wien und Leipzig.

C. A. Hartleben's Verlags-Expedition.

1861.


LES ANTIBIOTIQUES
C'EST PAS AUTOMATIQUE
Prévenir
les infections
Limiter
les dispositifs
invasifs
Prévenir
la transmission
croisée
Vacciner
les personnels
et les patients
pour prescrire moins
Mieux utiliser les antibiotiques
pour préserver leur efficacité
ASSISTANCE PUBLIQUE HÔPITAUX DE PARIS


IMPROVED HAND HYGIENE TO PREVENT HEALTH CARE-ASSOCIATED INFECTIONS
9
SOLUTION
Implementing a multidisciplinary, multimodal strategy for hand hygiene
AMÉLIORER L'HYGIÈNE DES MAINS POUR ÉVITER LES INFECTIONS ASSOCIÉES AUX SOINS...
... en appliquant une stratégie pluridisciplinaire et multimodale en faveur de l'hygiène des mains
WORLD ALLIANCE for PATIENT SAFETY
ALLIANCE MONDIALE POUR LA SÉCURITÉ DES PATIENTS
World Health Organization


"U bent in goede handen"

National Initiatives Since 1994 in Belgium

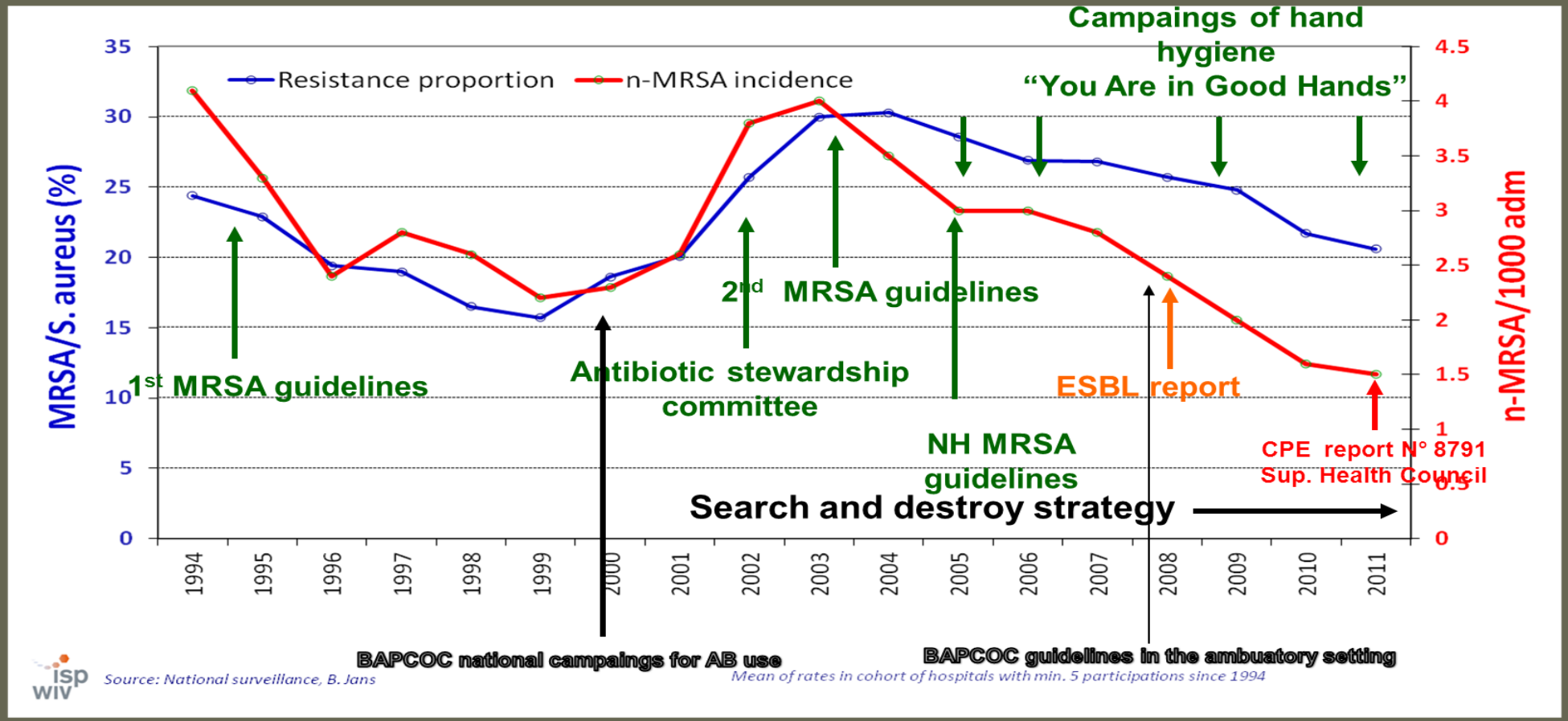


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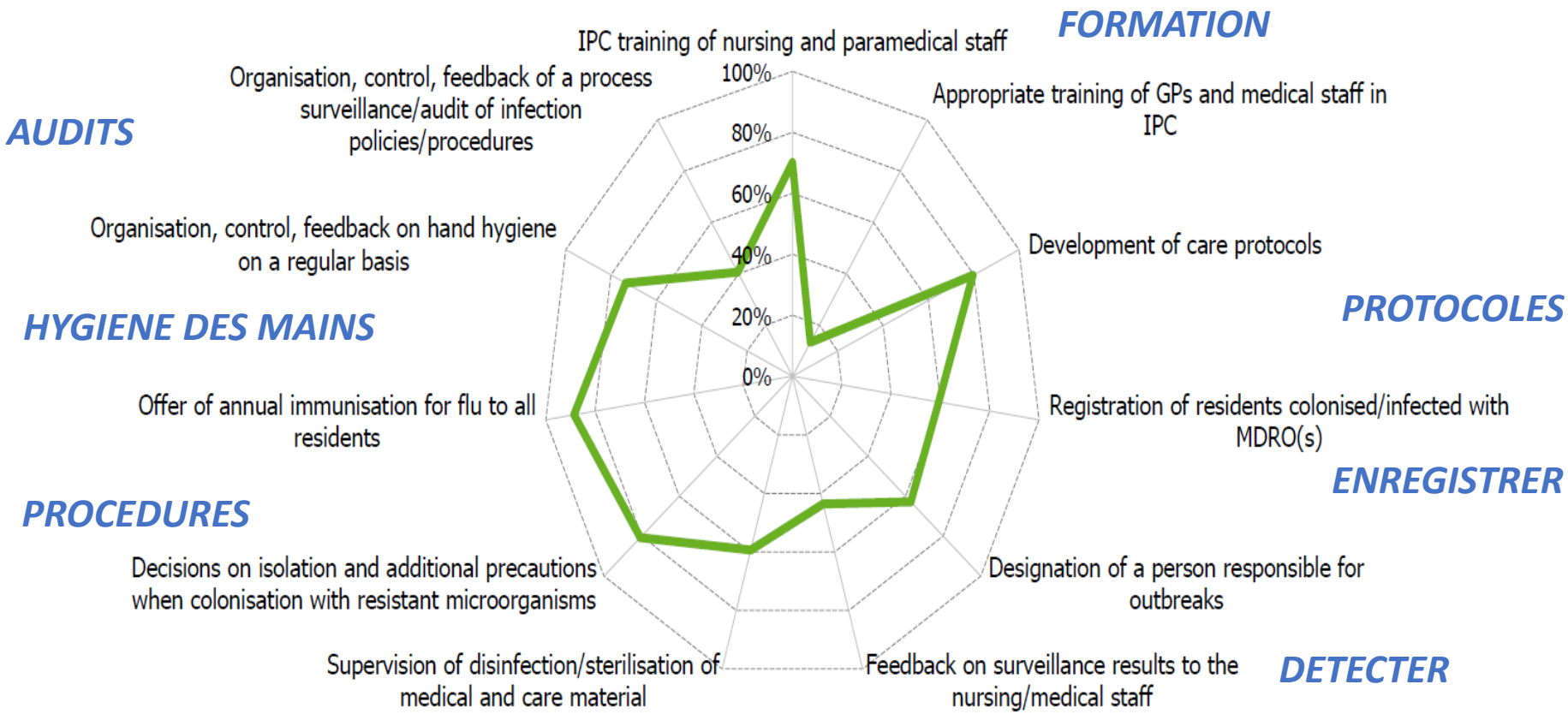
Figure 16. Infection prevention and control (IPC) practices present in the included LTCFs, HALT-2, 2013 (n=1 046 LTCFs)



IPC: Infection prevention and control; MDRO: multidrug-resistant microorganisms

www.ecdc.europa.eu

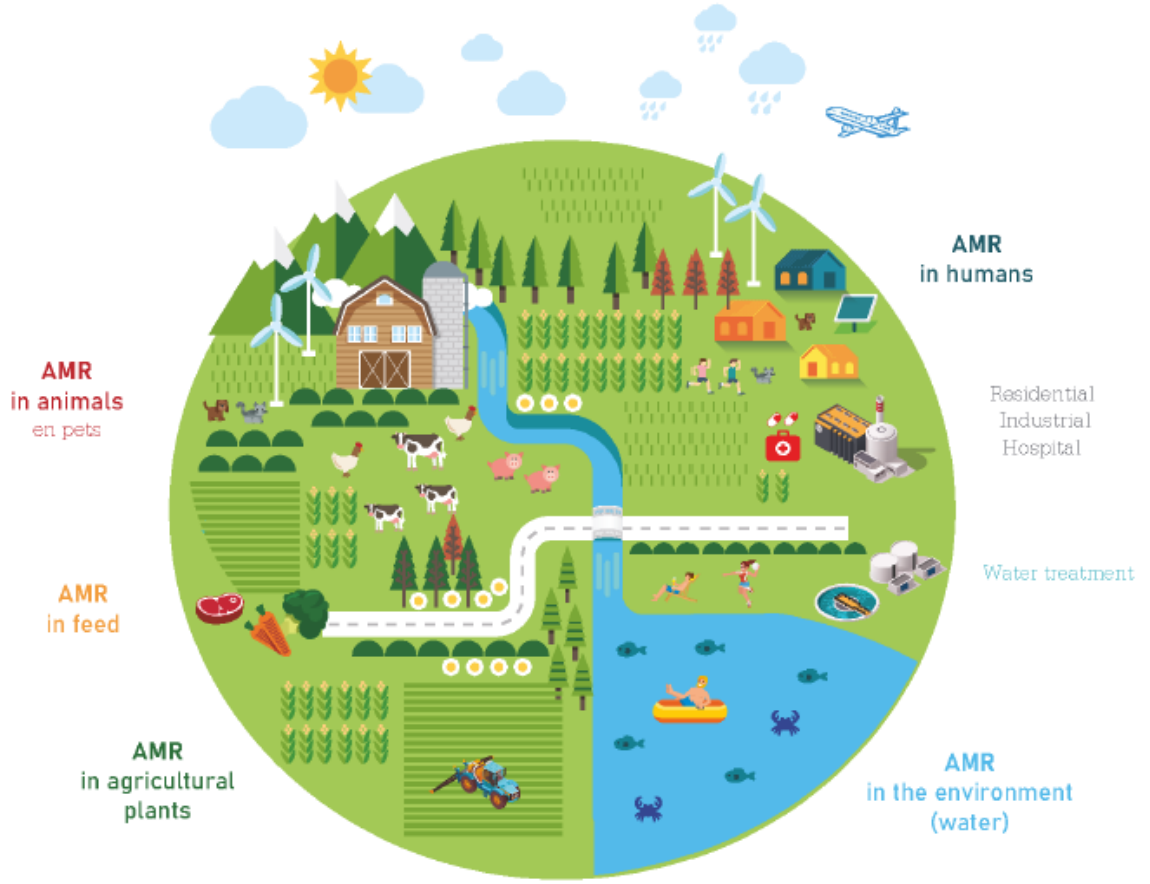
Doi.10.2900/24172

ONE WORLD ONE HEALTH

BELGIAN "ONE HEALTH" NATIONAL ACTION PLAN ON THE FIGHT AGAINST ANTIMICROBIAL RESISTANCE (AMR) 2020-2024

BELGIAN ACTION PLAN
AMR
One Health

AMR in a "One World, One Health" perspective



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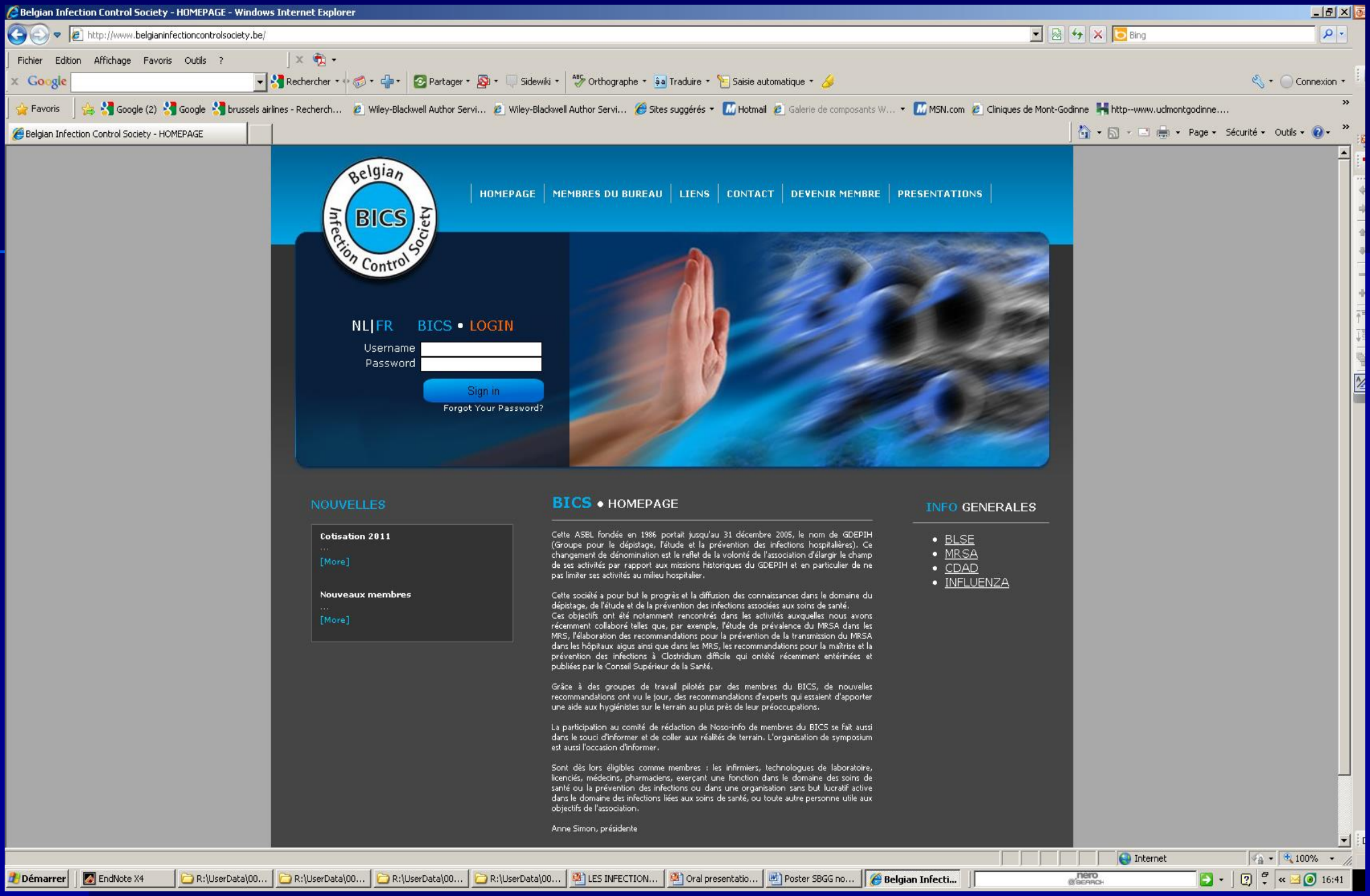
file:///C:/Users/00017975/Desktop/en-amr_one_health_national_plan_final_1.pdf



http://www.belgianinfectioncontrolsociety.be

What should be known by students ?

1. HAI
    1. Impact of HAI on LOS, survival and costs ?
    2. Prevalence of HAI in Belgium ?
    3. What are the 4 most frequent HAI ?
2. MDRO
    1. Outcomes of MDRO carriage/infection ?
    2. How to access to epidemiological data ?
    3. Risk factors of MDRO carriage ?
    4. Prevalence of MDRO carriage in Belgian healthcare facilities ?
    5. Value of a clinical scoring system to detect MDRO carriers ?
3. How to control HAI ?