

Before an outbreak - what to do after first MDR Gram-negatives enter your hospital?

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Rising threat from MDR-GNR



% of all HAI caused by GNRs.



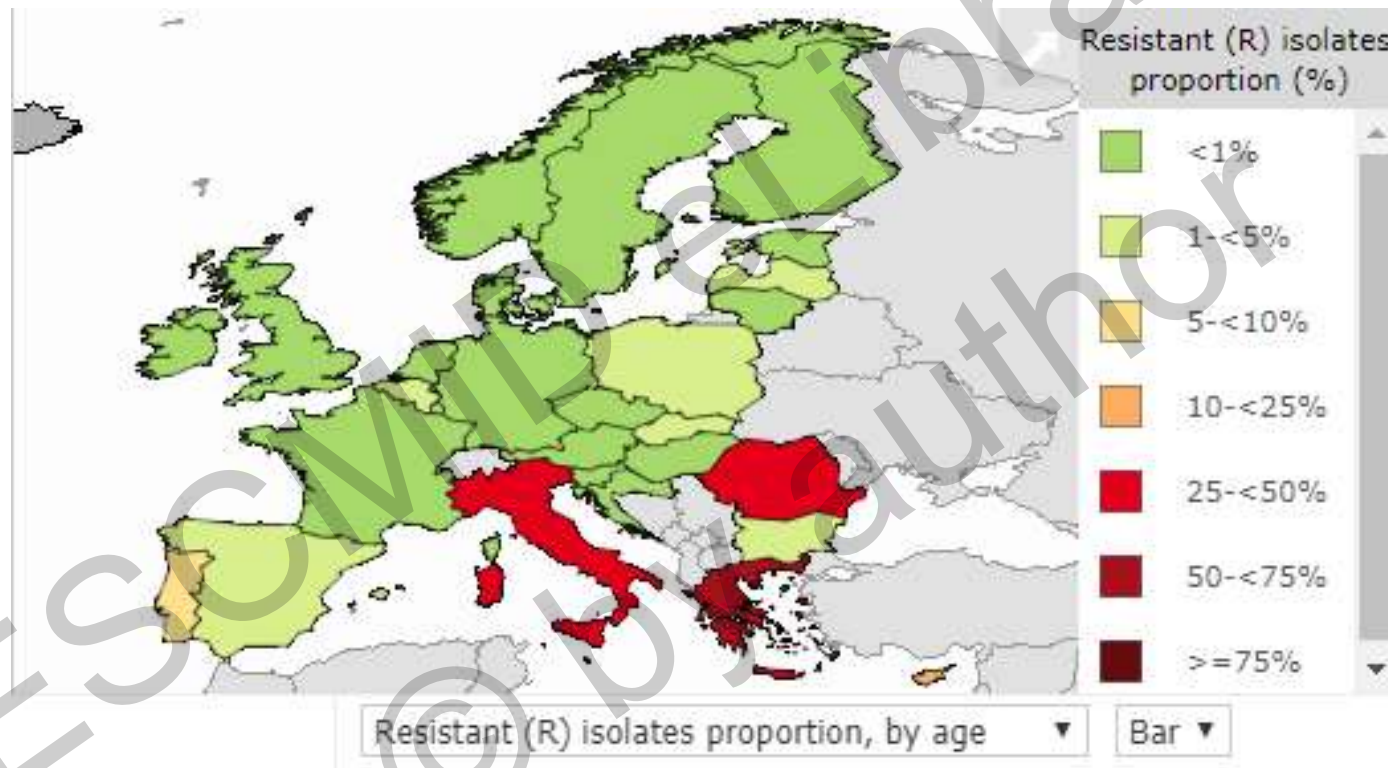
% of ICU HAI caused by GNRs.

Non-fermenters	<i>Acinetobacter baumannii</i> <i>Pseudomonas aeruginosa</i> <i>Stenotrophomonas maltophilia</i>	CPE
Enterobacteriaceae	<i>Klebsiella pneumoniae</i> <i>Escherichia coli</i> <i>Enterobacter cloacae</i>	

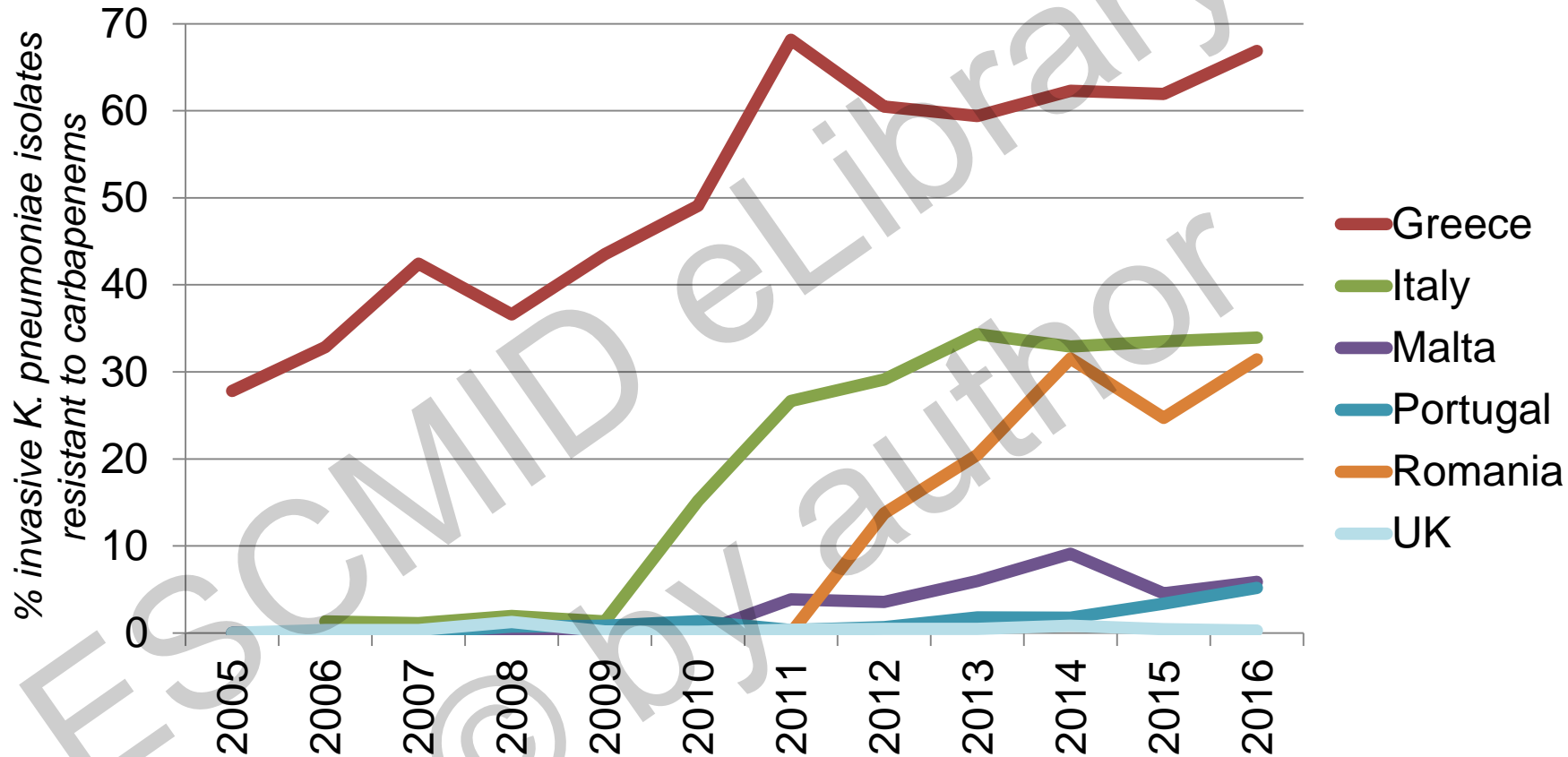
CPO

CRE in Europe, 2016

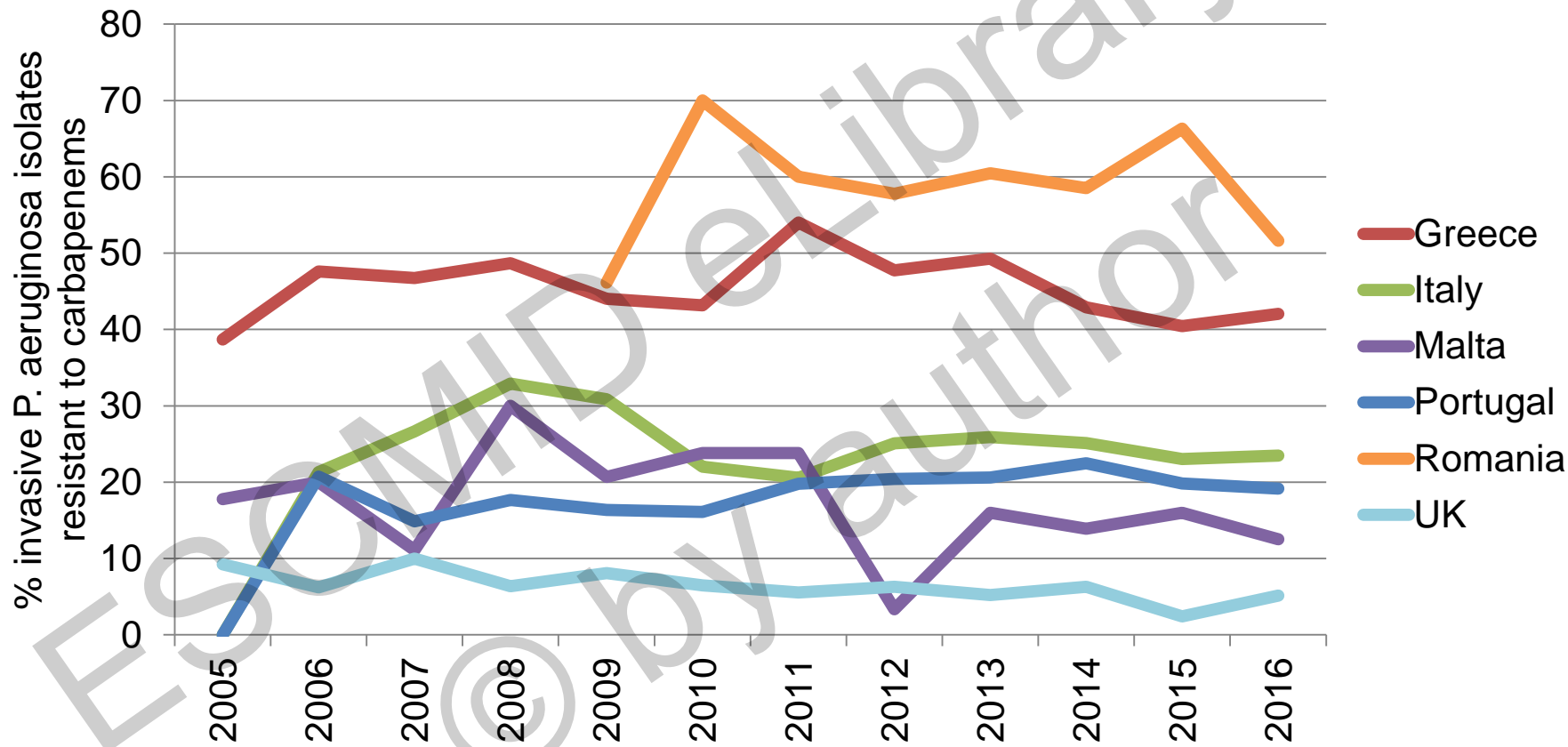
% invasive K. pneumoniae isolates resistant to carbapenems



Emergence of CRE in Europe, 2005-2016

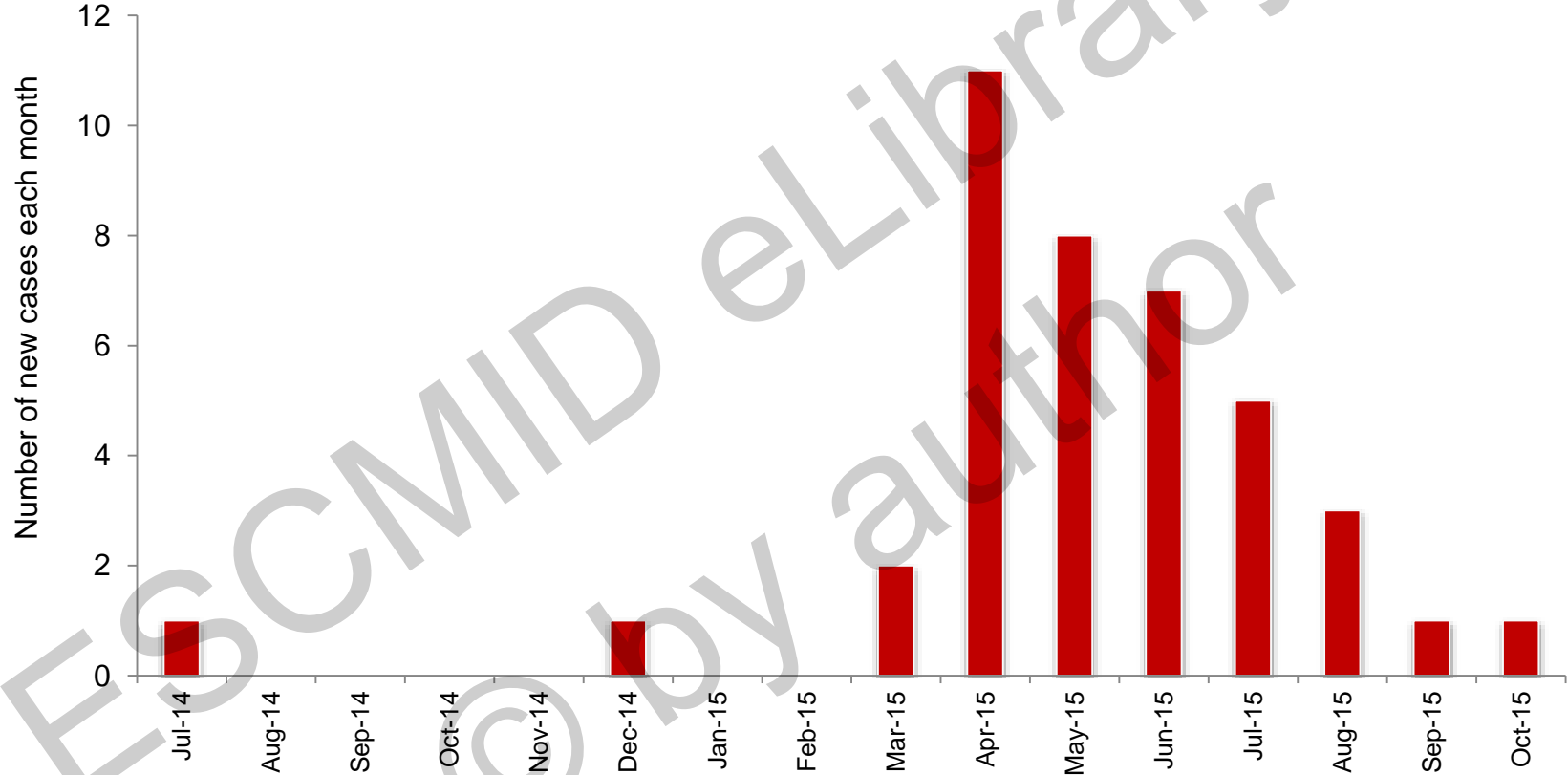


Carbapenem-resistant *P. aeruginosa* in Europe, 2005-2016



K. pneumoniae NDM outbreak; total number of cases

8 cases first identified by clinical culture, 32 by screening culture; of these 32, 14 had a subsequent positive clinical culture



Outbreak response

Screening

Lab
methods

Comms

Peer
learning

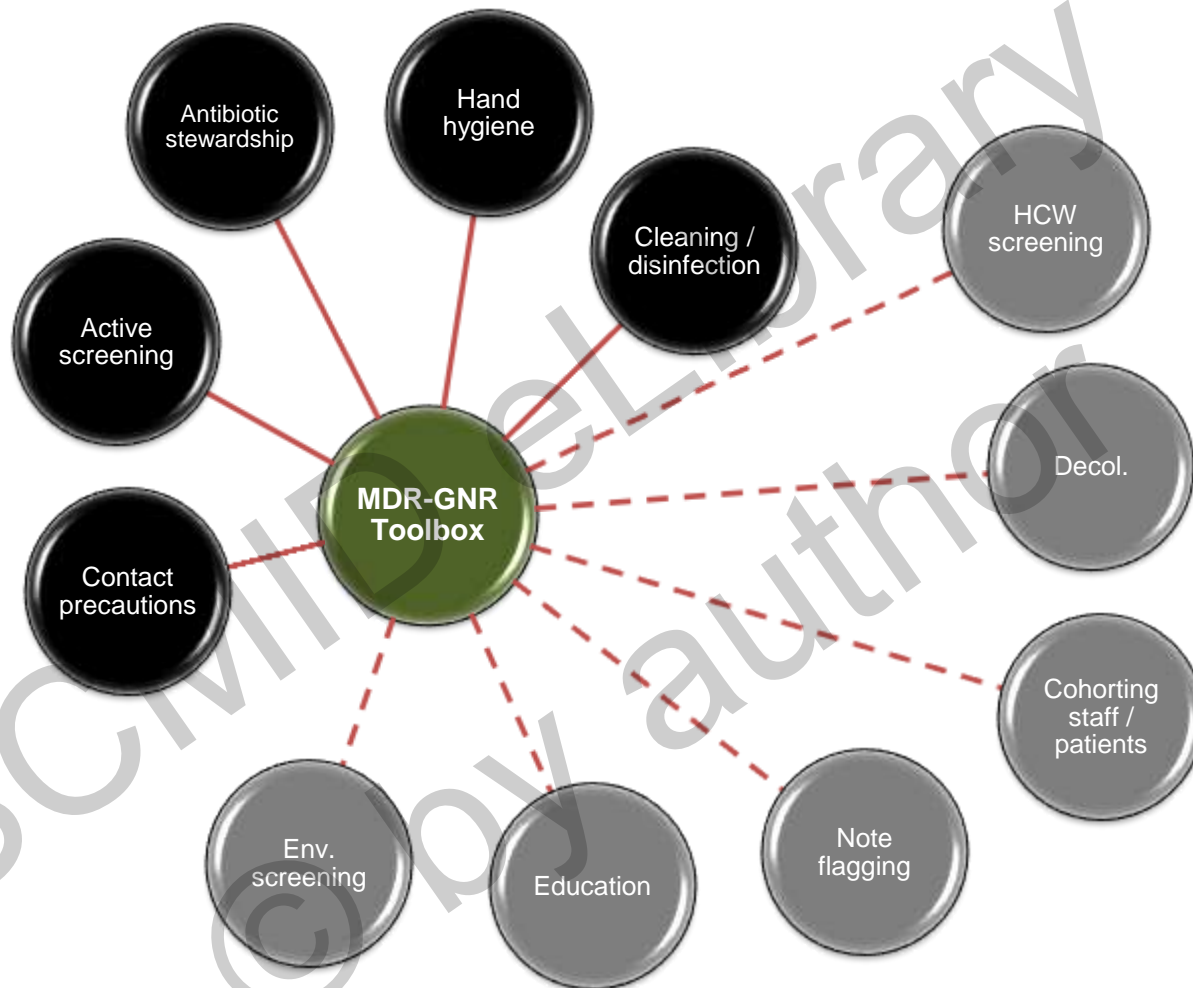
Hand
hygiene

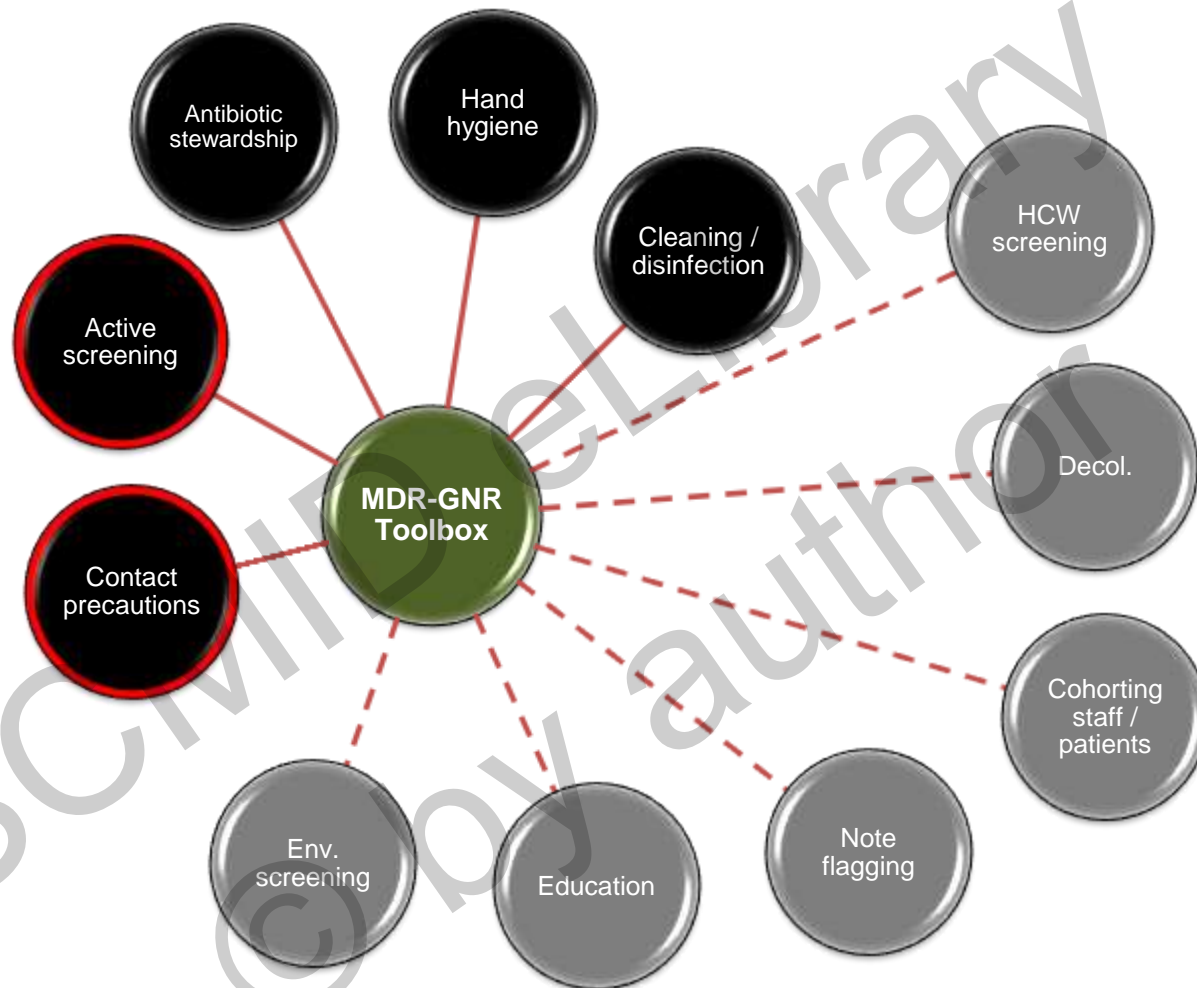
Cleaning /
disinfection /
decon

External
reviews

Antibiotics
stewardship

Applied
research





Question 1

Who should be screened for CPE at the time of hospital admission?

1. Everybody
2. All admissions to high risk specialties
3. Risk factor based screening of all admission
4. All admissions to high risk specialties PLUS risk factor based screening of all admissions
5. Nobody

Question 2

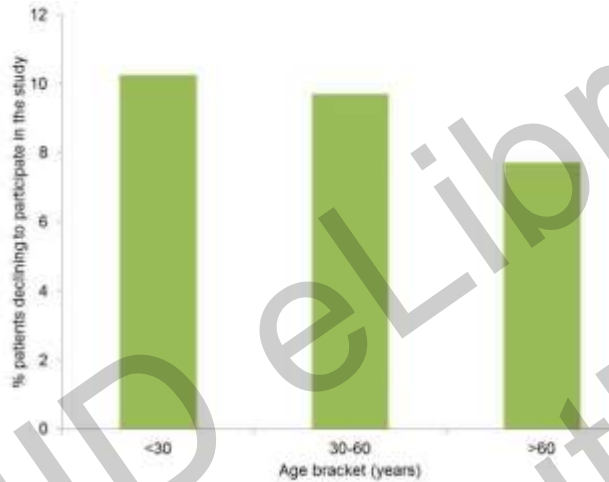
Who should be screened for MDR *Acinetobacter baumannii* at the time of hospital admission?

1. Everybody
2. All admissions to high risk specialties
3. Risk factor based screening of all admission
4. All admissions to high risk specialties PLUS risk factor based screening of all admissions
5. Nobody

How do I screen for CPE?

- Rectal swab is the best sample
 - Insert no more than 2cm into rectum
 - Twist gently and withdraw
 - Ideally want to see faeces on swab.
- Patient and staff education as to why this is needed in order to overcome taboos
- Alternate specimen is stool sample, but have to wait for the patient to 'go'

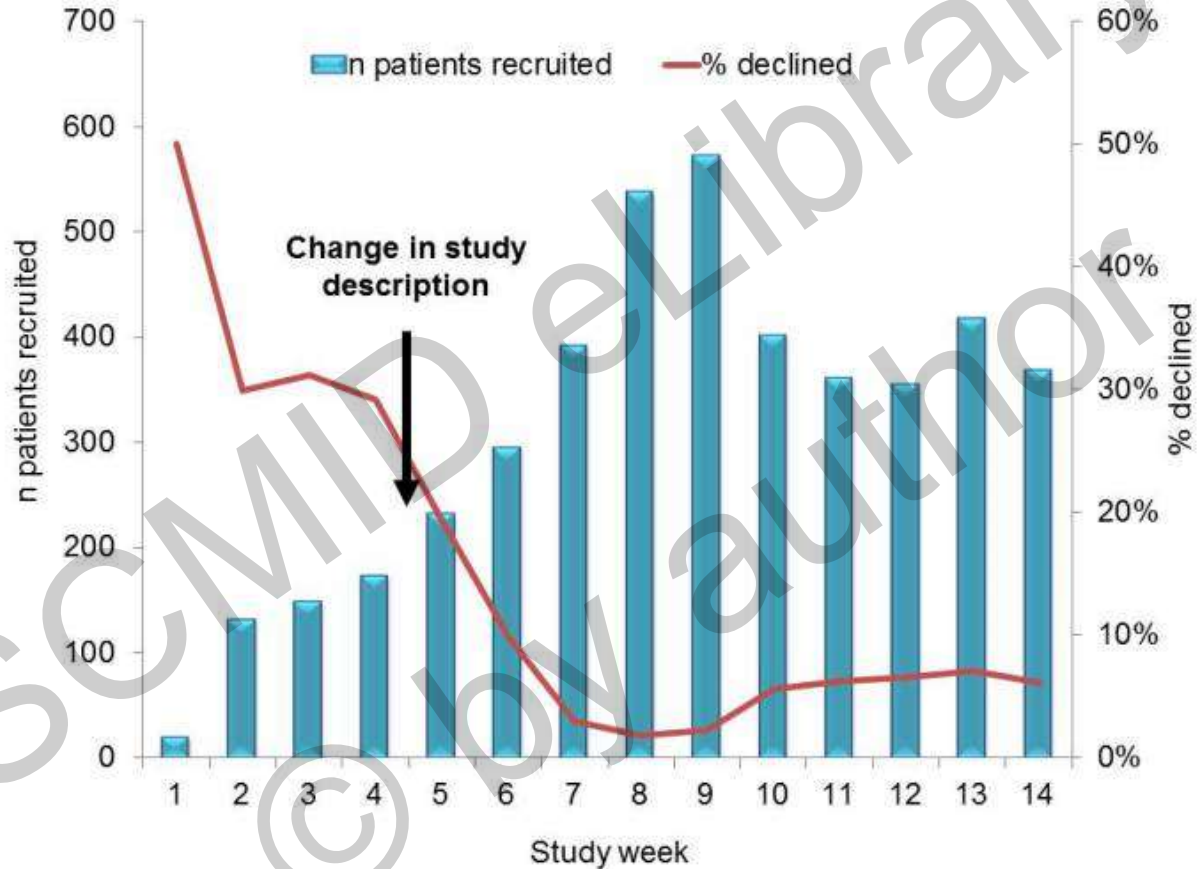
Can I swab your rectum please?



Factors associated with patients declining to provide a rectal swab were:

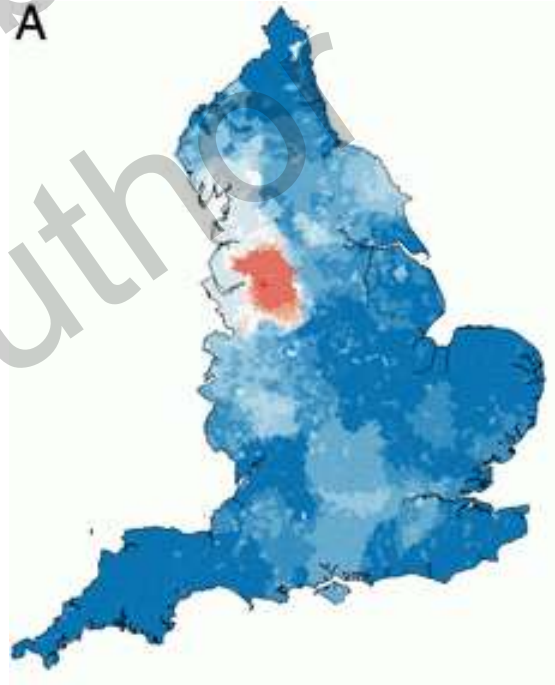
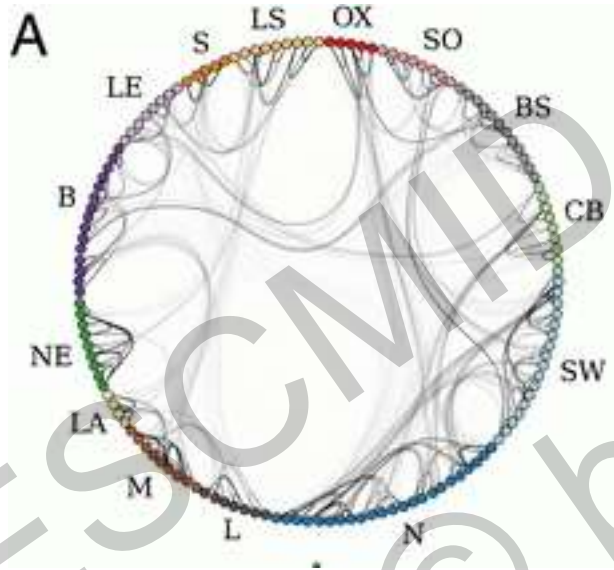
- younger age (odds ratio (OR) 0.99, 95% confidence interval (CI) 0.99-1.00) female gender (OR 1.26, CI 1.04-1.52),
- transfers from other hospitals (OR 1.77, CI 1.07-2.93) or an unknown admission route (OR 1.61, CI 1.09-2.37),
- admission before the change in study description (OR 0.39, CI 0.31-0.48)
- the staff member who consented the patient ($p < 0.001$);
- ethnicity was not a significant factor.

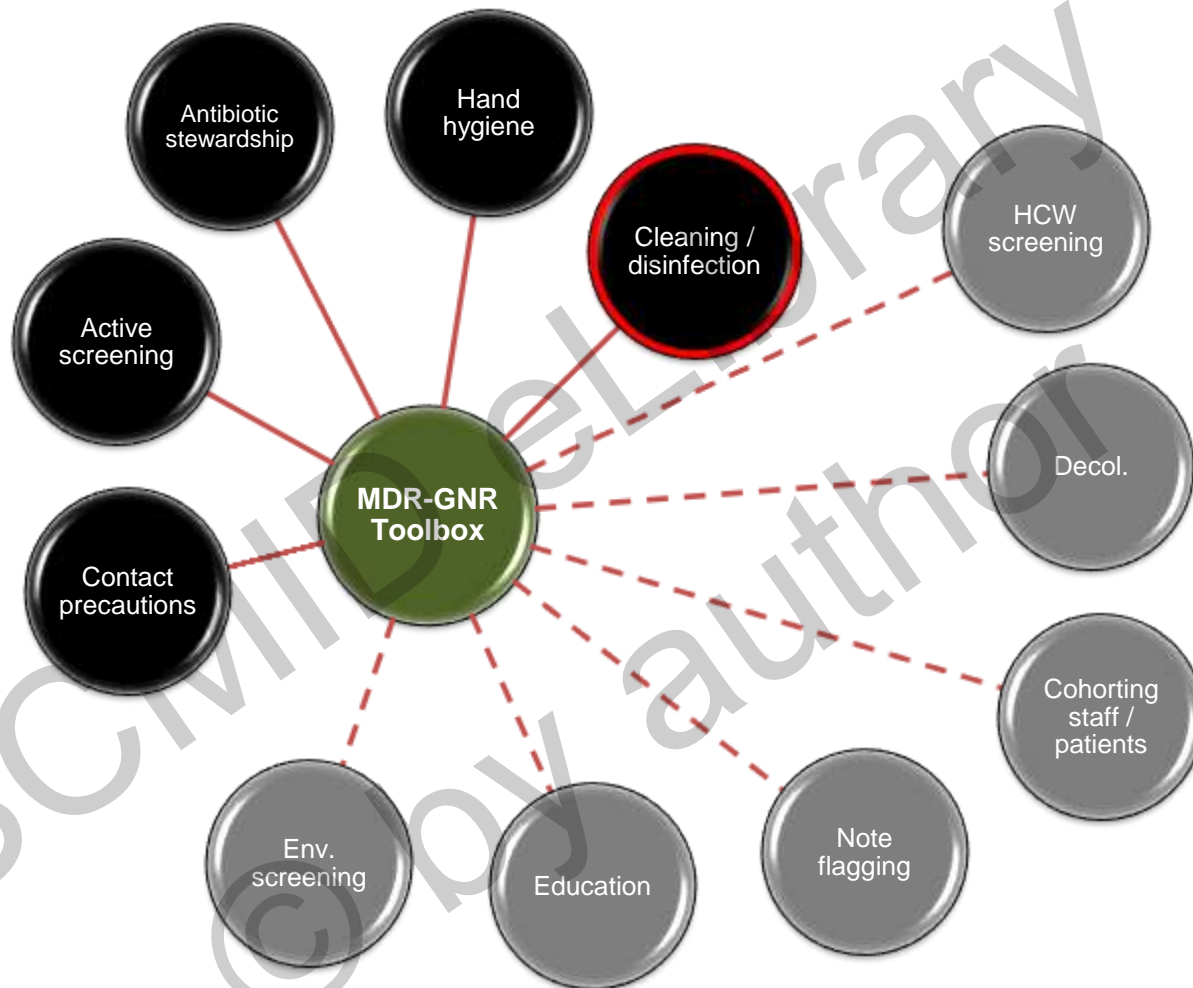
Improving screening compliance



Distant large problems vs. small local ones?

CPE introductions come from hospitals within a regional referral network, even if the prevalence in another referral network is much higher (more than 100x higher, in fact)!





Question 3

What should be used for terminal disinfection following a case of CPE?

1. No enhanced disinfection required
2. Depends on context (e.g. outbreak vs. non-outbreak, ICU vs. non-ICU)
3. UV room decontamination
4. Hydrogen peroxide vapour room decontamination
5. Sodium hypochlorite (“bleach”)

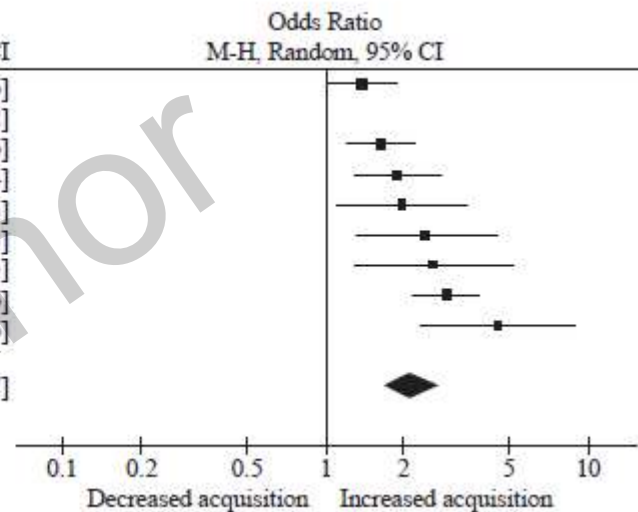
Question 4

What should be used for terminal disinfection following a case of MDR *Acinetobacter baumannii*?

1. No enhanced disinfection required
2. Depends on context (e.g. outbreak vs. non-outbreak, ICU vs. non-ICU)
3. UV room decontamination
4. Hydrogen peroxide vapour room decontamination
5. Sodium hypochlorite (“bleach”)

Contaminated surfaces

Study or Subgroup	Decreased acquisition		Control		Weight	Odds Ratio	
	Events	Total	Events	Total		M-H, Random, 95% CI	95% CI
Huang (MRSA)	57	1454	248	8697	16.2%	1.39	[1.04, 1.86]
Nseir (ESBL producing Gram neg)	8	50	50	461	0.0%	1.57	[0.70, 3.52]
Huang (VRE)	58	1291	256	9058	16.2%	1.62	[1.21, 2.16]
Ajao (Klebsiella sp. or Escherichia coli)	32	648	235	8723	14.2%	1.88	[1.29, 2.74]
Nseir (Pseudomonas)	21	85	61	426	10.4%	1.96	[1.12, 3.45]
Drees (VRE)	19	138	31	500	9.7%	2.42	[1.32, 4.43]
Shaughnessy (Clostridium difficile)	10	91	77	1679	8.3%	2.57	[1.28, 5.15]
Mitchell (MRSA)	74	884	163	5344	16.4%	2.90	[2.18, 3.86]
Nseir (Acinetobacter)	16	52	41	459	8.6%	4.53	[2.32, 8.86]
Total (95% CI)		4643		34886	100.0%	2.14	[1.65, 2.77]
Total events	287		1112				
Heterogeneity: $\tau^2 = 0.09$; $\chi^2 = 21.32$, $df = 7$ ($P = 0.003$); $I^2 = 67\%$							
Test for overall effect: $Z = 5.74$ ($P < 0.00001$)							



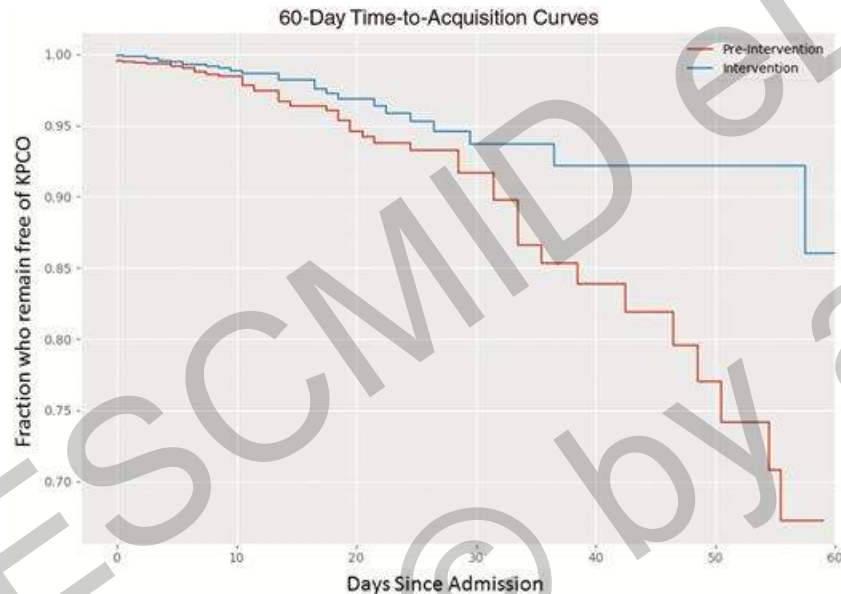
MDR-GNR cleaning & disinfection checklist

- Clean / declutter
- Monitor cleaning process (e.g. fluorescent markers)
- All equipment disinfected before leaving room
- Enhanced daily disinfection using bleach
- Terminal disinfection using bleach or, ideally, H₂O₂ vapor¹⁻³

1. Gopinath *et al. Infect Control Hosp Epidemiol* 2013;34:99-100.
2. Snitkin *et al. Sci Transl Med* 2012;4:148ra116.
3. Verma *et al. J Infect Prevent* 2013;7:S37.

Contaminated sinks / drains

- CPE (*K. pneumoniae*) acquisition and clinical infection halved through improved management of sinks (OR = 0.51 for acquisitions, and 0.29 for clinical cultures) (n=~7,500 pts).



Enterobacteriaceae vs. non-fermenters

Share	Differ
Gram stain reaction	Risk factors & at-risk population
Concerning AMR	Potential for epidemic spread
	Infection profile & mortality
	Prevalence
	Colonisation site & duration
	Transmission routes
	Resistance profile & mechanisms

Question 5

What is the single most important intervention to reduce the spread of MDR-GNR in hospitals?

1. Hand hygiene
2. Screening and isolation
3. Antibiotic stewardship
4. Cleaning / disinfection

When the first MDR-GNR (especially CPE) enter
your hospital...

Get
communicating

Get screening

Get out the
disinfection
'big guns'

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