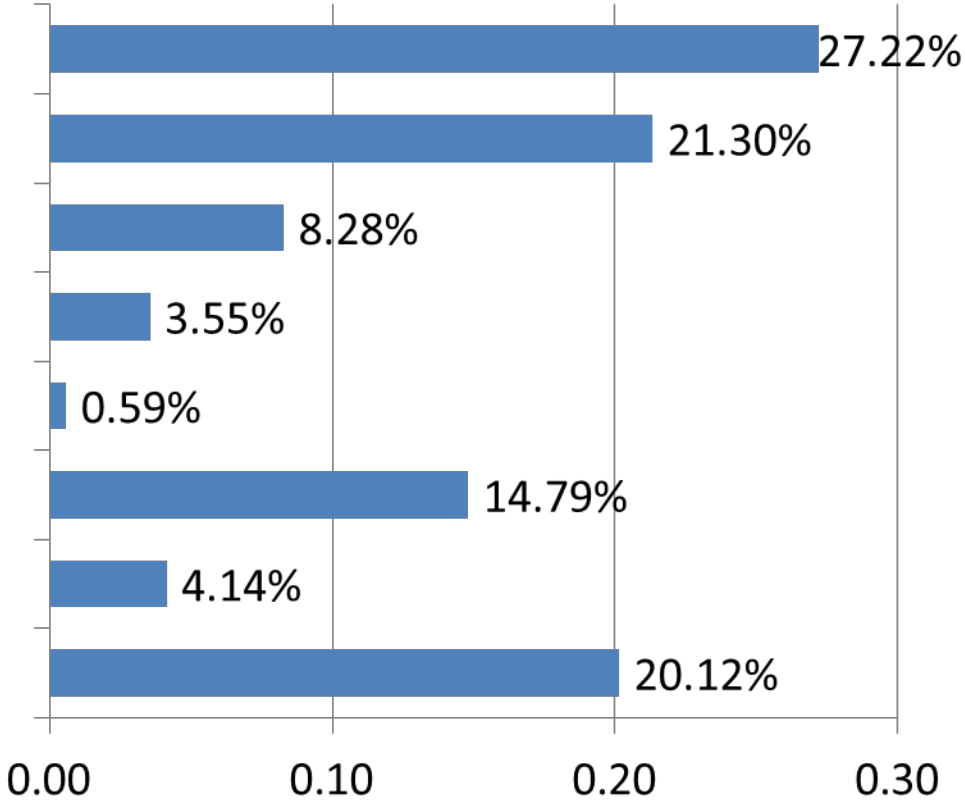
Antibiotic Resistance and Mandatory Screening

Allison McGeer and

Elizabeth Bryce

Your profession is….

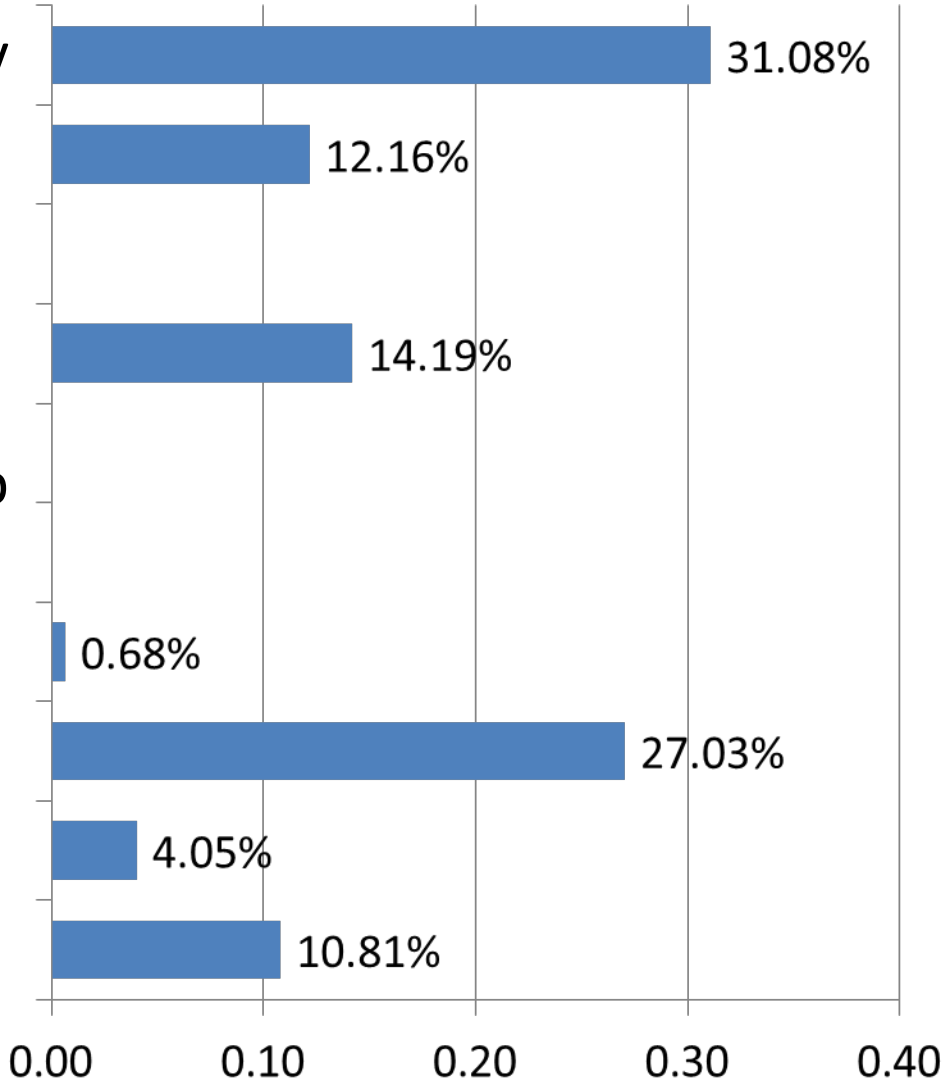
1. Infectious Disease MD
2. Medical Microbiologist
3. Microbiologist
4. Internal Medicine
5. ICP
6. Laboratory Technologist
7. PhD Microbiology
8. Other



N=169

You work primarily in

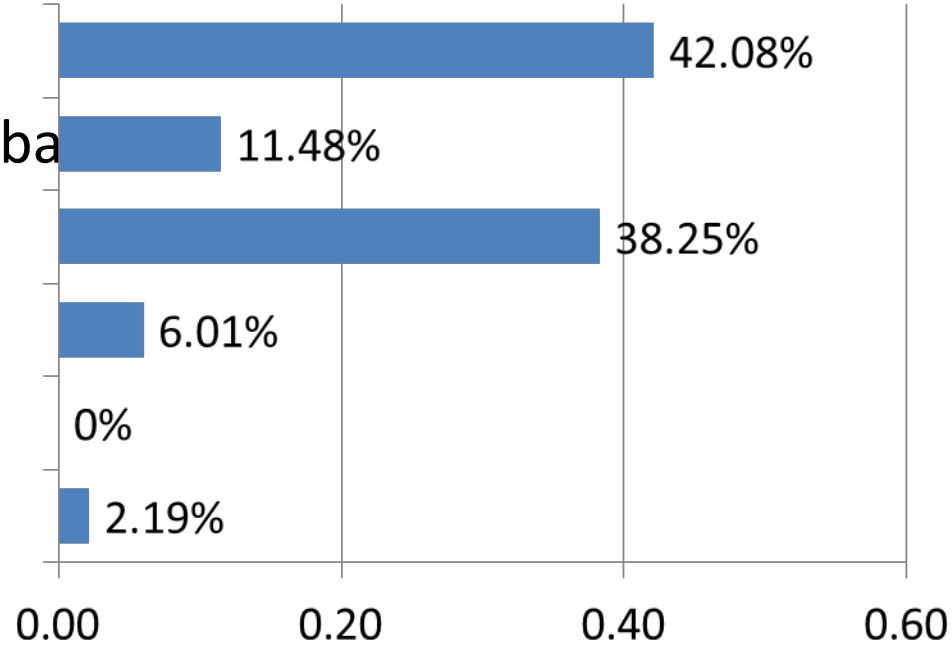
1. An acute care adult facility
2. An acute care pediatric facility
3. Mixed adult and pediatric acute care facility
4. A continuing care or rehab facility
5. An outpatient setting
6. A laboratory setting
7. A private office
8. An academic setting



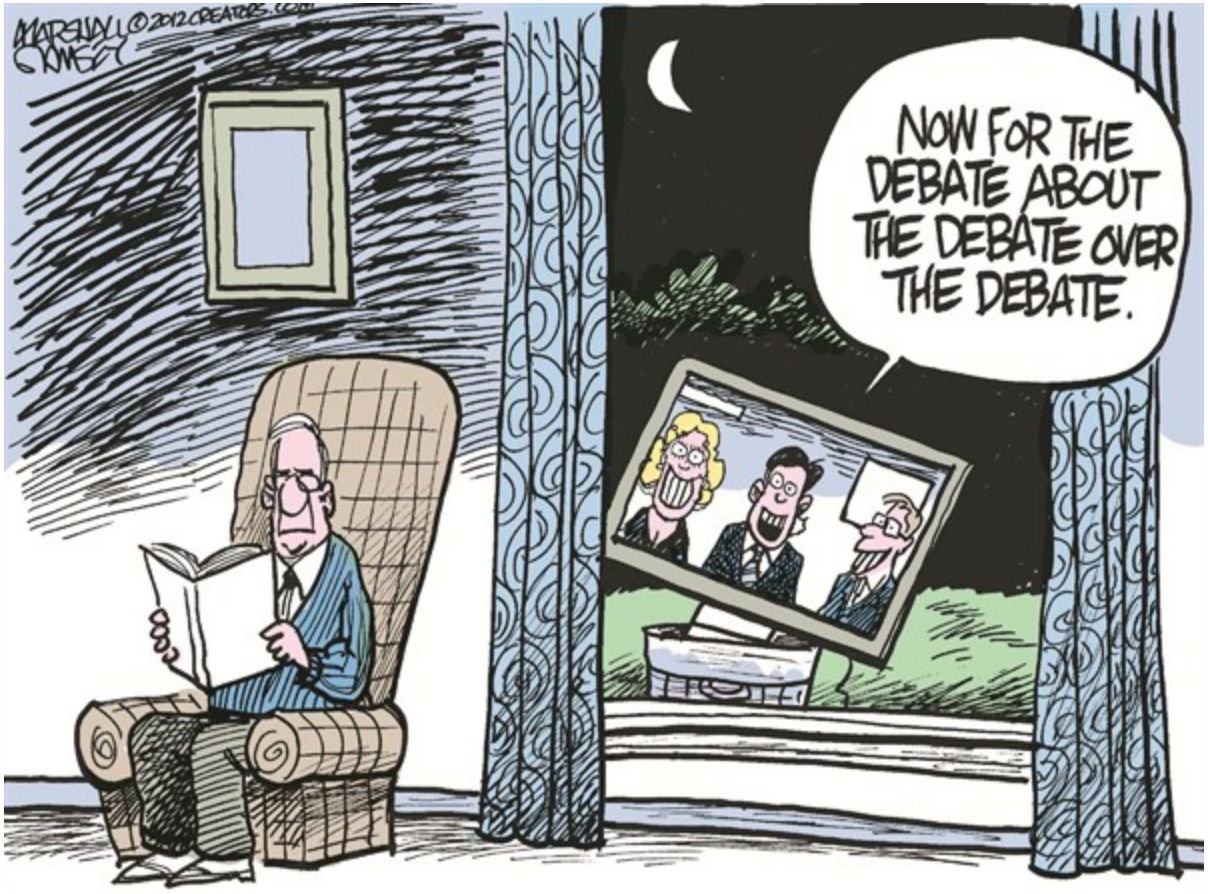
N=148

You are from

1. Alberta or BC
2. Saskatchewan or Manitoba
3. Quebec or Ontario
4. The Maritimes
5. Yukon, NWT or Nunavut
6. A country other than Canada



N=183


MARSHALL ©2012 CREATORS.COM
NOW FOR THE DEBATE ABOUT THE DEBATE OVER THE DEBATE.

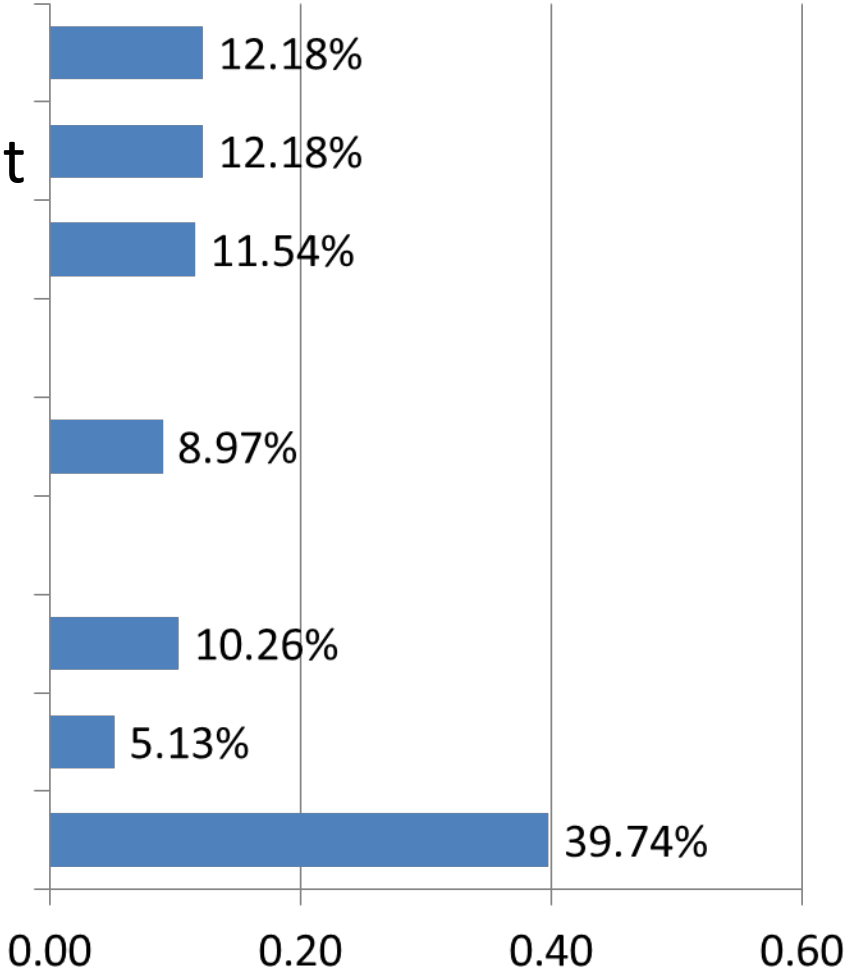
Here's Liz to explain the rules….

- You will be asked a series of groups of questions related to aspects of mandatory screening
- We'll highlight some recent relevant studies (you can too)
- The slides with the results will be posted post-conference

Be it resolved that *screening and transmission control* for antibiotic-resistant organisms should be *mandatory* components of hospital-based infection control programs.

"Mandatory" to you means…..

1. The government requires it
2. Accreditation Canada requires it
3. Your provincial government guidelines recommend it
4. Your infection control department has decided
5. 1 or 2
6. 1 or 2 or 3
7. 1 or 2 or 3 or 4



N=156

What should governments mandate about hospitals and AROs?

1. Reduction or acceptable rate targets for ARO infections (UK)
2. Publicly reporting
3. The existence of control programs, but not content
4. Nothing!
5. 1 and 2
6. 1 and 3
7. 2 and 3

System failed: no responses

Consequences of mandatory reporting

Muller M, Detsky AS JAMA 2010;304;1116 ***Hand Hygiene***

- Provides incentive to maximize performance BUT hospitals "overestimate" compliance

Weber S et al 2007 SHEA Position Statement ***Legislative Mandates***

- "would exclude local experts…. From the process of risk assessment and resource allocation.."

Millar M. J Hosp Infect. 2009;73:408-13. ***National Targets***

- Commentary on thinking about fairness and cost-effectiveness in infection prevention targets

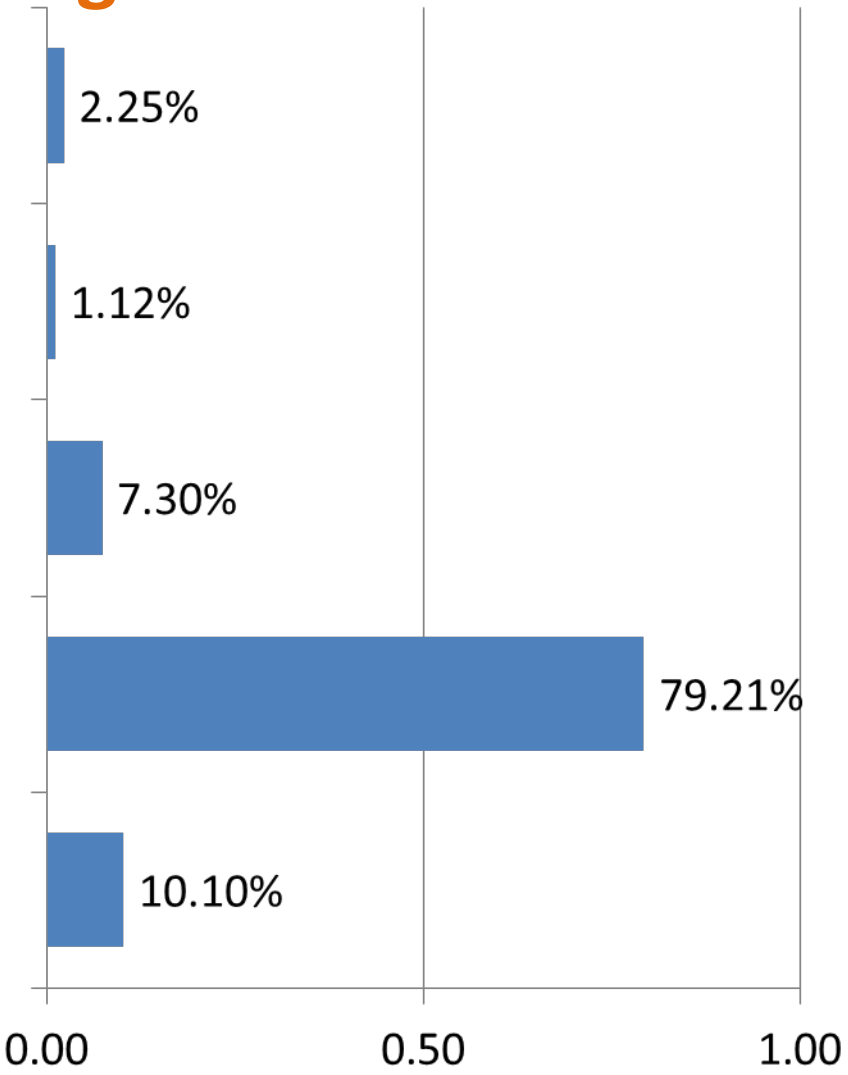
Johnson AP, et al. JAC. 2012;67:802. ***UK MRSA bacteremia reporting***

- Review of the history and impact of reporting and targets

Control Programs

In your opinion, does your hospital need an ARO control program?

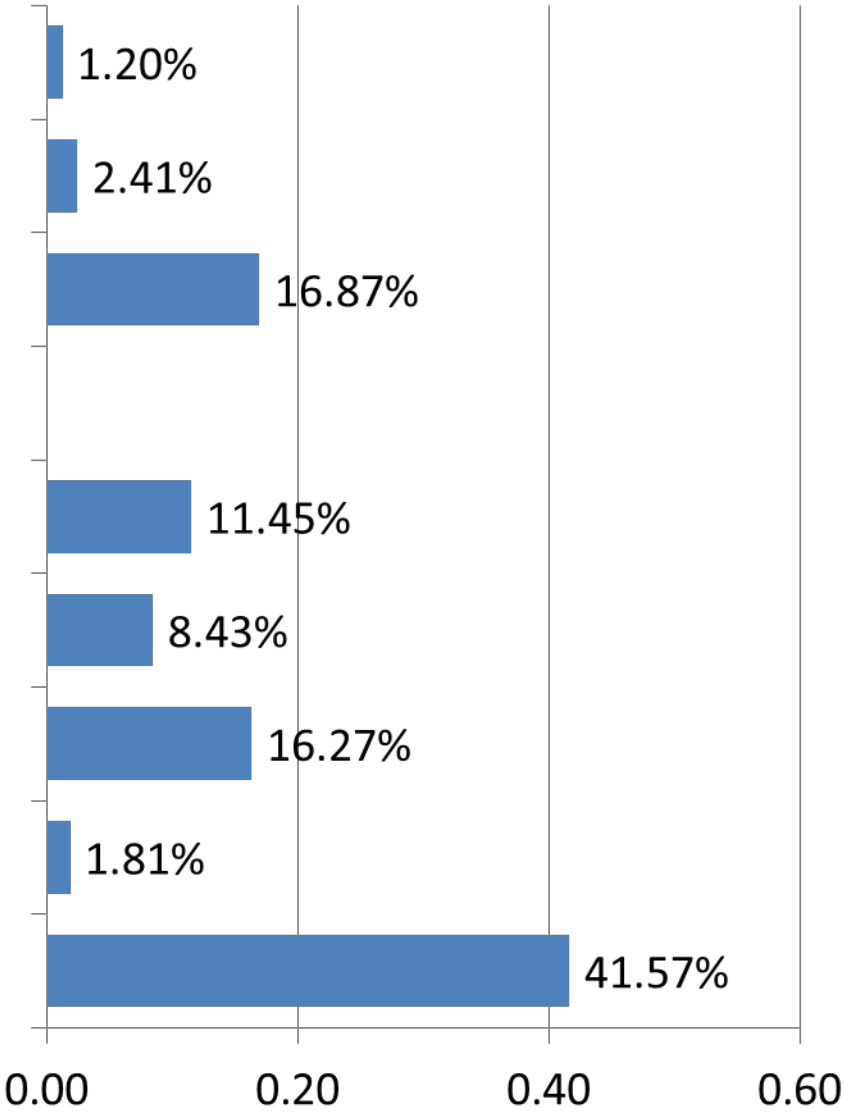
1. No, transmission of ARO's is not a problem
2. No, an ARO control program will not reduce the transmission of AROs
3. No, our efforts are better invested in other prevention programs (eg. hand hygiene, CHG bathing)
4. Yes, a control program for at least one ARO will reduce patient risk
5. Not sure



N=178

A control program for an ARO *to you* means…

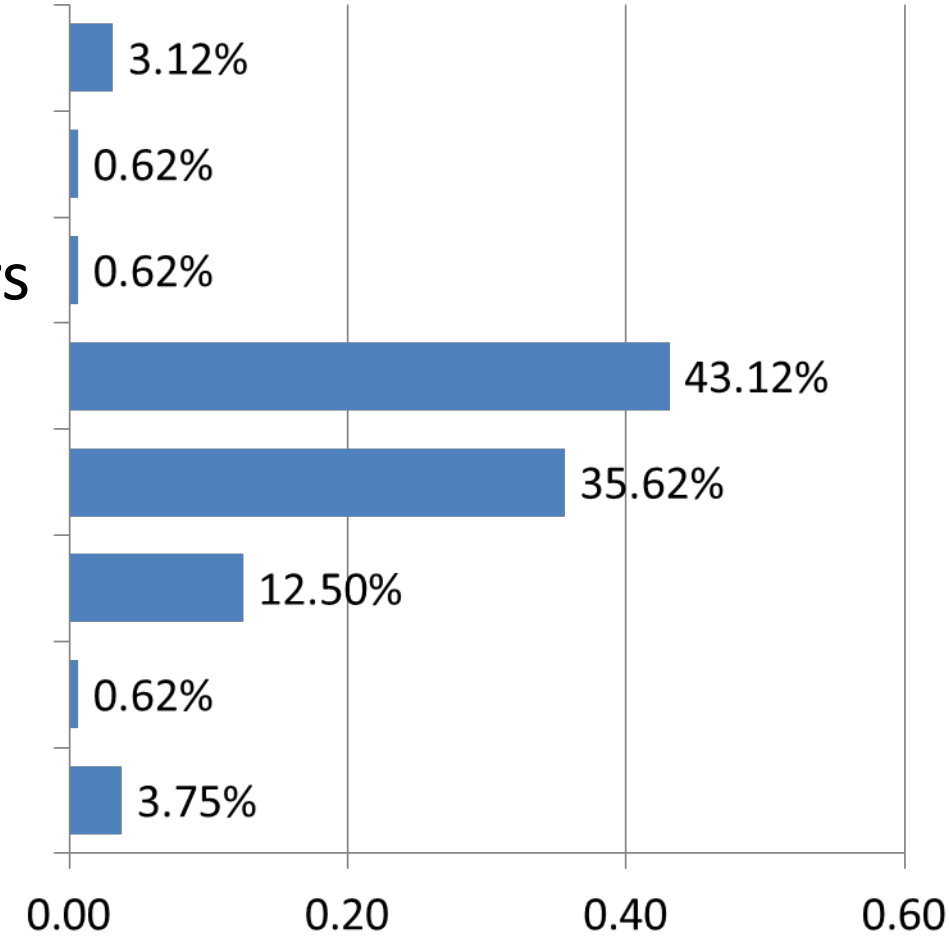
1. Admission ARO Screening
2. Additional precautions for infected/colonized patients
3. A combination of prevalence screening, contact screening, response to transmission events
4. 1 and 2
5. 1 and 3
6. 2 and 3
7. None of the above
8. All of the above



N=166

Which organisms does your hospital have specific control programs for currently?

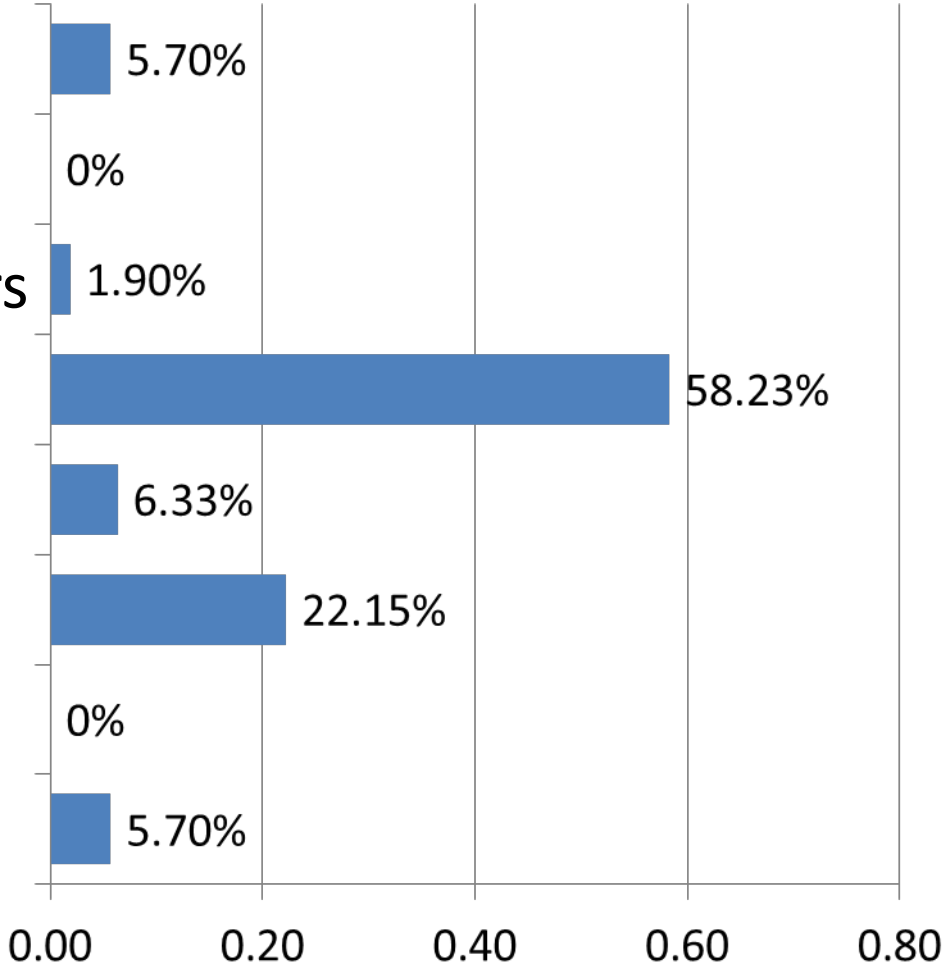
1. MRSA
2. VRE
3. Carbapenemase-producers
4. All of the above
5. 1 and 2
6. 1 and 3
7. 2 and 3
8. None of the above



N=160

What organisms SHOULD your hospital have control programs for?

1. MRSA
2. VRE
3. Carbapenemase producers
4. All of the above
5. 1 and 2
6. 1 and 3
7. 2 and 3
8. None of the above



N=158

Are we making progress with HAIs?

CNISP 2006-2011

- No change in CDI, CLABSI, CSF shunts
- Increasing VRE (0.1-0.7 per 10,000 pt days)
- ?decrease in MRSA (1.7-1.5 per 10,000 pt days)

US:* Magill *et al. NEJM 2014; 370:1198

- Results of point prevalence survey
- Top organisms: CDI (12%), SA (11%), Klebsiella (9.9%)
  E. coli (9.3%), Enterococci (8.7%)

What are the right infection prevention programs?

Programs that target an (or >1) organism(s)

Programs that target transmission of all (or some) organisms

Programs that target an infection type (CLABSI, SSI)

CPOs and Outcomes

	Years of collection and origin	Number of cases	Source of infection	Overall mortality	Mortality			Mortality with most frequent combinations	Mortality with most frequent monotherapy	Risk factors associated with mortality in multivariable analysis
					Combination treatment	Monotherapy	p value			
Tumbarello et al (2012)[113]	2010–2011, Italy	125	Unknown (75; 60%), lower respiratory tract (28; 22%), urinary tract (17; 14%), line related (13; 10%), and other (5; 4%)	Crude 30 day mortality: 52 (42%)	27/79 (34%)	25/46 (54%)	0·002	Colistin with tigecycline (7/23; 30%), tigecycline with gentamicin (6/12; 50%), and tigecycline with colistin and meropenem (2/16; 13%)	Colistin (11/22; 50%), tigecycline (10/19; 53%), and gentamicin (4/5; 80%)	Septic shock at presentation, inadequate empirical therapy, APACHE score, and triple combination therapy
Zarkotou et al (2011)[80]	2008–2010, Piraeus, Greece	53	Primary bacteraemia (23; 43%), line related (12; 23%), respiratory tract (7; 13%), urinary tract (6; 11%), soft tissues (4; 8%), and CNS (1; 2%)	30 day attributable mortality: 18/53 (34%),* and crude mortality: 28/53 (53%)*	0/20 (0%)†	7/15 (47%)†	0·001	Colistin with tigecycline (0/9; 0%) and tigecycline with gentamicin (0/2; 0%)	Colistin (4/7; 57%), tigecycline (2/5; 40%), gentamicin (0/2; 0%), and carbapenem (1/1; 100%)	Absence of appropriate antimicrobial treatment combination, APACHE score, and age
Qureshi et al (2012)[114]	2005–2009, New York City and Pittsburgh, USA	41	Line related (13; 32%), pneumonia (10; 24%), urinary tract (7; 17%), and primary bacteraemia (6; 15%)	Crude 28 day mortality: 16 (39%)‡	2/15 (13%)‡	11/19 (58%)‡	0·01	Carbapenem with colistin (1/5; 20%) and carbapenem with tigecycline (0/3; 0%)	Colistin (4/7; 57%); tigecycline (4/5; 80%) and carbapenem (2/4; 50%)	Absence of appropriate combination as definitive therapy

APACHE=acute physiology and chronic health evaluation. *Only included 35 patients who completed at least 48 h of appropriate antibiotic treatment. †Attributable mortality was assessed during the index hospitalisation. ‡28 day mortality among 34 patients who received definitive therapy.

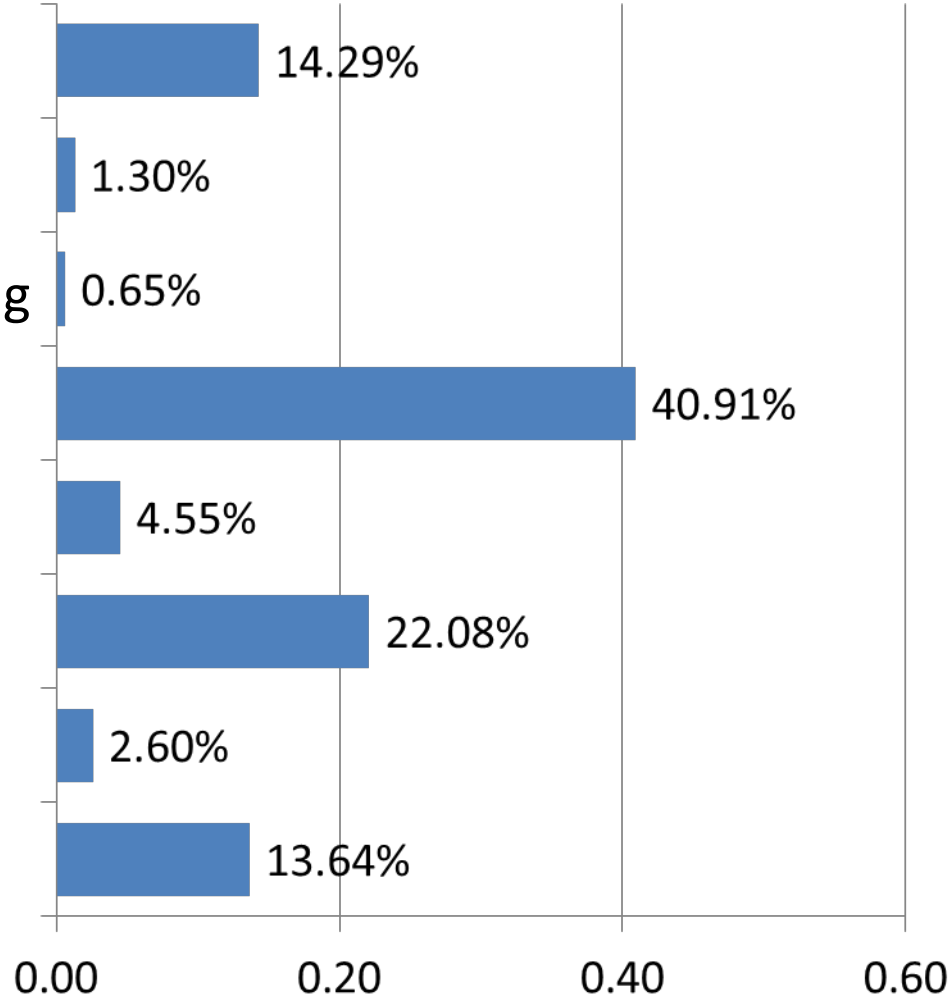
Table 1: **Treatment combinations and mortality among patients with bloodstream infections caused by Enterobacteriaceae producing *Klebsiella pneumoniae* carbapenemases**

Munoz-Price SL Lancet Infectious Diseases 2013; 13:785

Surveillance or Screening

What are the components of your hospital's screening program?

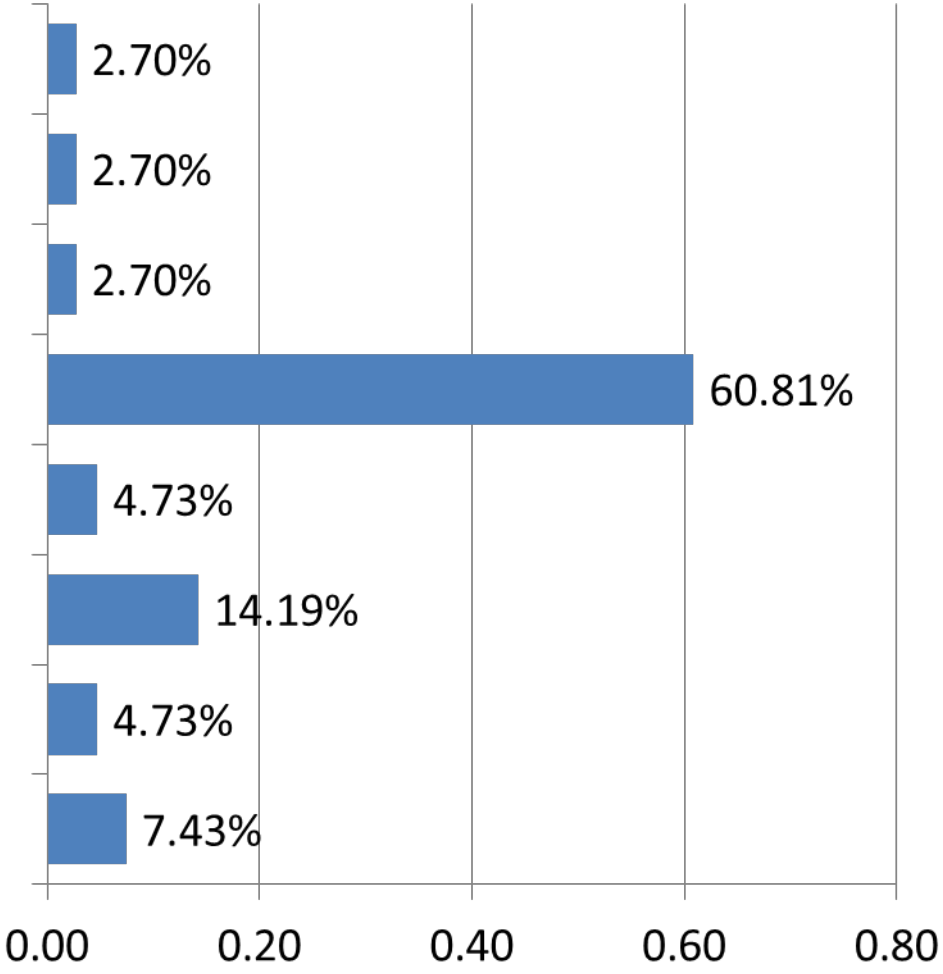
1. Admission screening (some or all)
2. Prevalence screening
3. Roommate/other contact screening
4. All of the above
5. 1 and 2
6. 1 and 3
7. 2 and 3
8. Not relevant to my setting



N=154

What SHOULD be the components of your hospital's screening program?

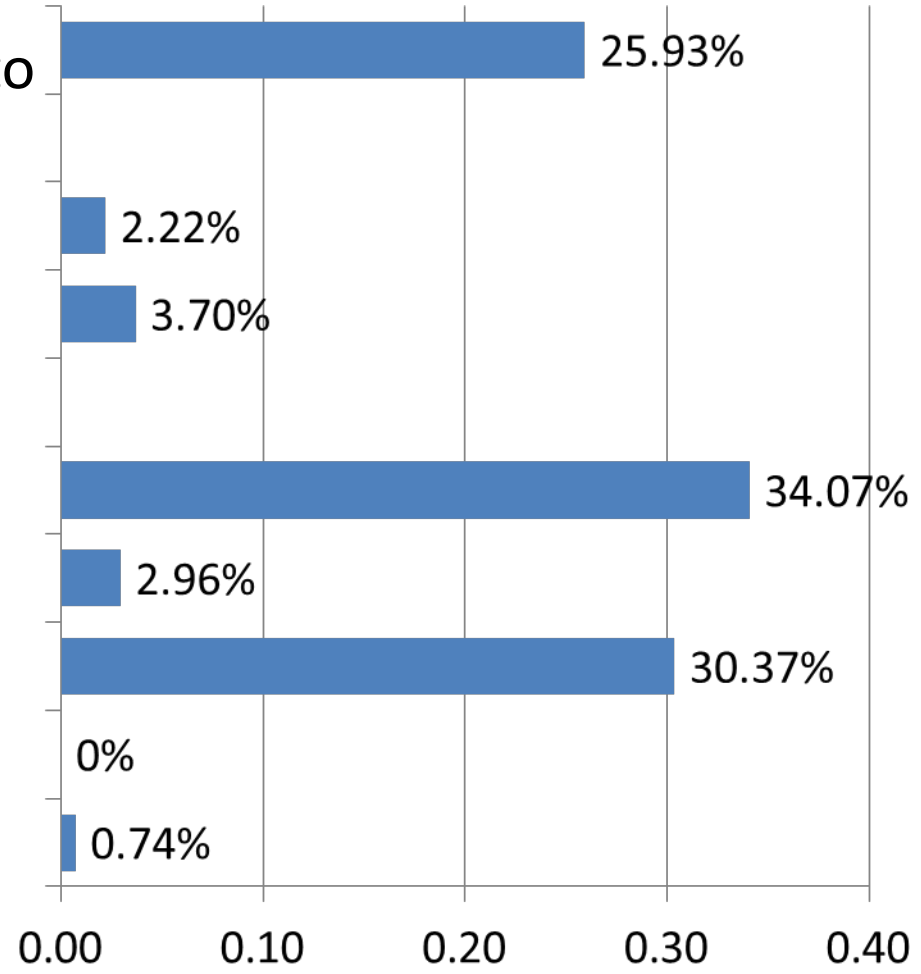
1. Admission screening (some or all patients)
2. Prevalence screening
3. Roommate or other contact screening
4. All of the above
5. 1 and 2
6. 1 and 3
7. 2 and 3
8. Not relevant to my setting



N=148

What to you are the right reasons for admission screening?

1. Identifying colonization and preventing cross-transmission to other patients
2. “ Benchmark” my facility
3. Improve empiric antibiotics if patient develops an infection
4. All of the above
5. 1 and 2
6. 1 and 3
7. 2 and 3
8. None of the above



N=135

A note on laboratory screening

- Intensity of screening varies

  e.g. Leber et al: Lab based screening of CD stools for VRE – 41% (58) of CDI pos specimens were VRE +

- Screening protocols vary (e.g. CPOs)
- Sensitivity of detection varies (PCR vs traditional)

Mandatory laboratory screening ≠ consistent screening

Table 1. Sensitivity of different screening sites and combinations for detection of methicillin-resistant *Staphylococcus aureus* (MRSA) by culture and by PCR rapid test (Xpert MRSA)

	Culture[a]		PCR rapid test[b]	
Screening sites	**No. of positive samples**	**Sensitivity, % (95% CI)**	**No. of positive samples**	**Sensitivity, % (95% CI)**
Single sites				
Nose	1509	48 (46–50)	193	62 (56–67)
Groin	1984	63 (62–65)	213	68 (63–73)
Throat	1923	61 (60–63)	134	43 (37–49)
Combinations of sites				
Nose and groin	2475	79 (77–80)	288	92 (89–95)
Nose and throat	2377	76 (74–77)	230	74 (68–78)
Groin and throat	2799	89 (88–90)	258	83 (78–87)
Nose, groin, and throat	3002	96 (95–96)	309	99 (97–100)
Nose, groin, throat, and wounds	3113	99 (99–99)	310	99 (97–100)
Nose, groin, throat, wounds, and others	3137	100	312	100

[a]Period, 2006–2009; positive screenings (≥1 positive site), 3137.
[b]Period, 2009; positive screenings (≥1 positive site), 312.

Senn L Clin Microbiol Infect 2012;18:E31-E33

Screening swabs and predicting MR in clinical SA isolates

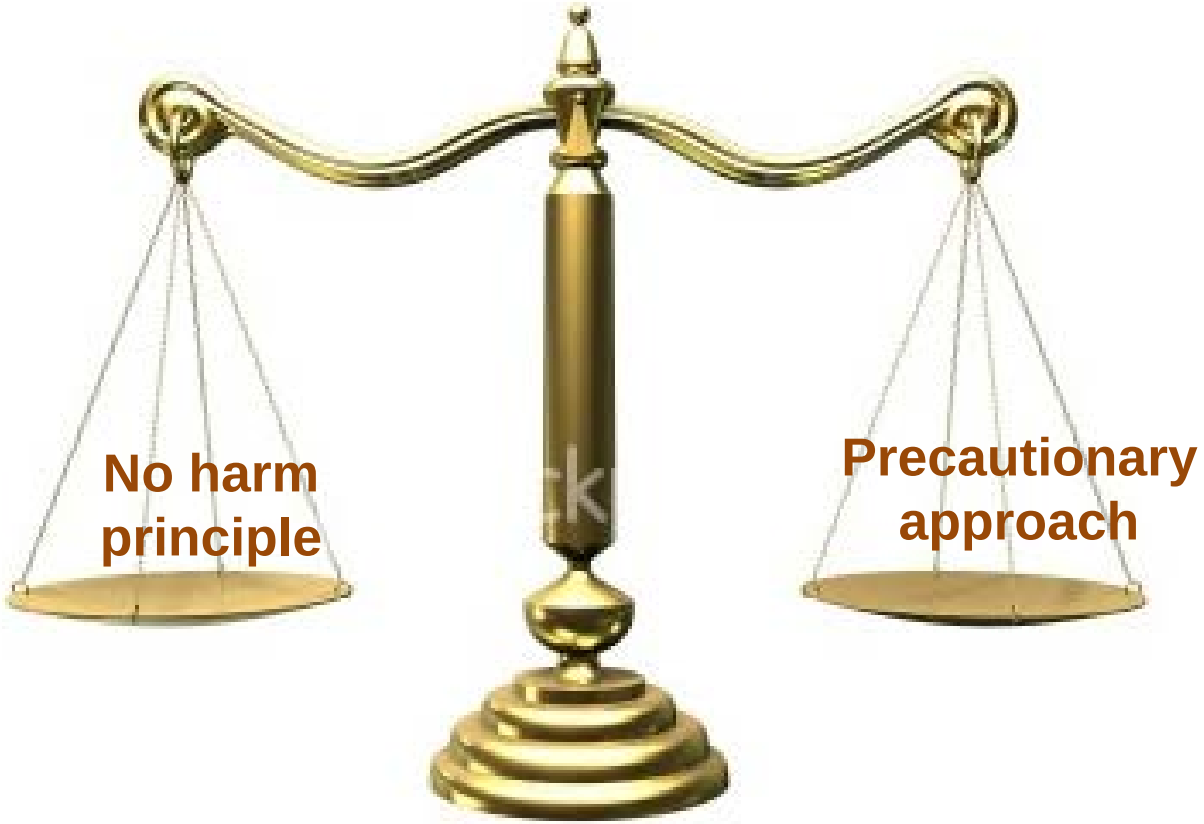
Table 2: Test characteristics of screening to predict methicillin resistance in clinical isolates of *Staphylococcus aureus*, stratified by time from screening swab to isolate collection

Characteristic	Overall	Immediate*	Recent†	Remote‡
True positive, no.	50	20	17	13
True negative, no.	428	127	203	98
False positive, no.	3	0	1	2
False negative, no.	29	2	12	15
Sensitivity, % (95% CI)	63 (52–74)	91 (71–99)	59 (39–77)	46 (28–66)
Specificity, % (95% CI)	99 (98–100)	100 (97–100)	100 (97–100)	98 (93–100)
Positive likelihood ratio (95% CI)	91 (29–284)	–§	120 (17–865)	29 (7–120)
Negative likelihood ratio (95% CI)	0.37 (0.28–0.49)	0.09 (0.01–0.30)	0.42 (0.27–0.64)	0.42 (0.27–0.65)
Positive predictive value, % (95% CI)	94 (84–99)	100 (83–100)	94 (73–100)	87 (60–98)
Negative predictive value, % (95% CI)	94 (91–96)	98 (95–100)	94 (90–97)	87 (79–92)

CI = confidence interval.
*Swab obtained within 48 hours before isolate collection.
†Swab obtained between 48 hours and 14 days before isolate collection.
‡Swab obtained more than 14 days before isolate collection.
§Test characteristics could not be calculated owing to high specificity values.

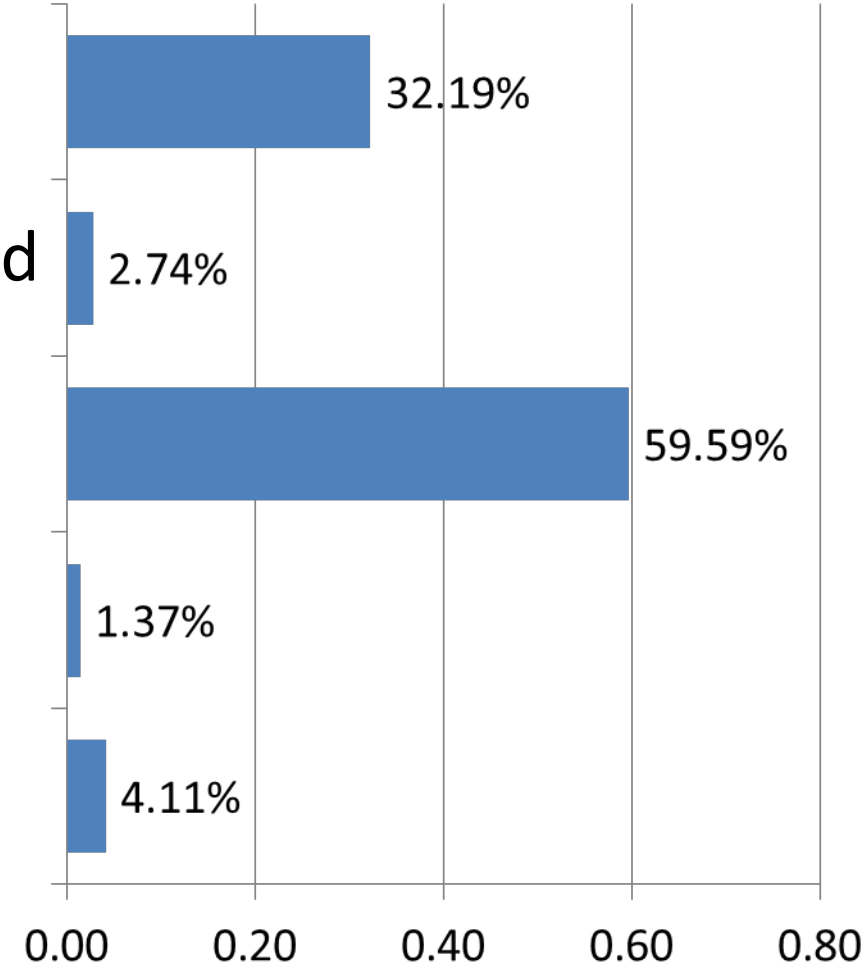
MacFadden CMAJ 2013;185:E725

Getting the balance right



What are the important positive consequences of ARO control programs?

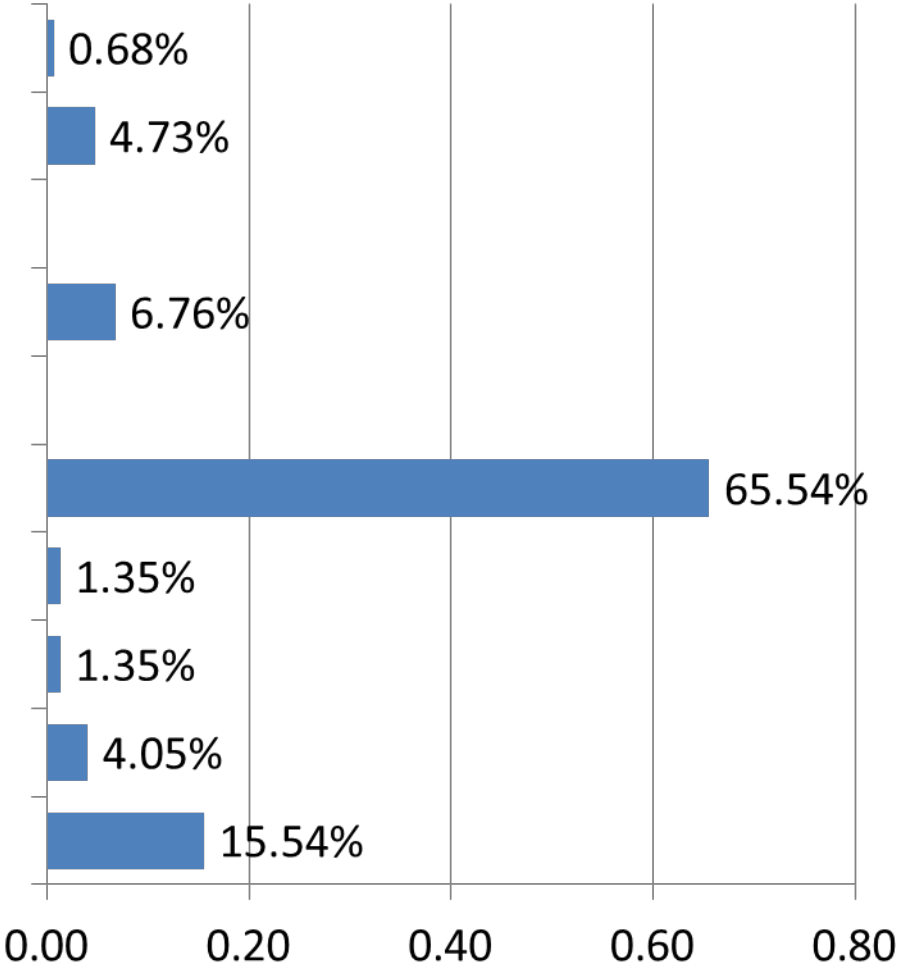
1. Ability to reduce cross-transmission (benefit others)
2. Ability to benefit the screened individual
3. Both
4. None
5. Don’t know



N=146

What are the important negative consequences of ARO control programs?

1. Decreased quality of care for isolated patients
2. Uses dollars and resources that could be used for other purposes
3. Isolation “fatigue” of HCWs decreases benefit of precautions
4. All
5. None
6. 1 and 2
7. 1 and 3
8. 2 and 3



Effects of isolation

Abad C JHI 2010;76;97-102

- Lit review 15 studies; majority showed higher depression, anxiety and anger scores, HCWs spent less time with isolated pts, pt satisfaction adversely affected, eight-fold increase in adverse events in isolated pts

Matlow A Peds 2008;122:e411

- 24 isolated/41 nonisolated pts. No difference in interactions *with medical team* in time spent and organ systems examined

Dhar S ICHE 2014;35:213

- 1013 observations on compliance with HH/barriers for contact isolation. As proportion of pts in isolation in compliance“

Effects of isolation

Confounding

- what makes you sad, anxious, angry is also what gets you an ARO (complex medical condition, long LOS, many interventions)

Goodliffe ICHE 2013 epub ahead of print

- Patient interaction rates:
  - 5.2/hr (4 bed); 4.5/hr (2 bed); 3.8/hr (private); 2.9/hr (private+isolation)
  - Greatest difference with shorter visits without HHO
  - No difference in visits associated with a moment 2/3 HHO

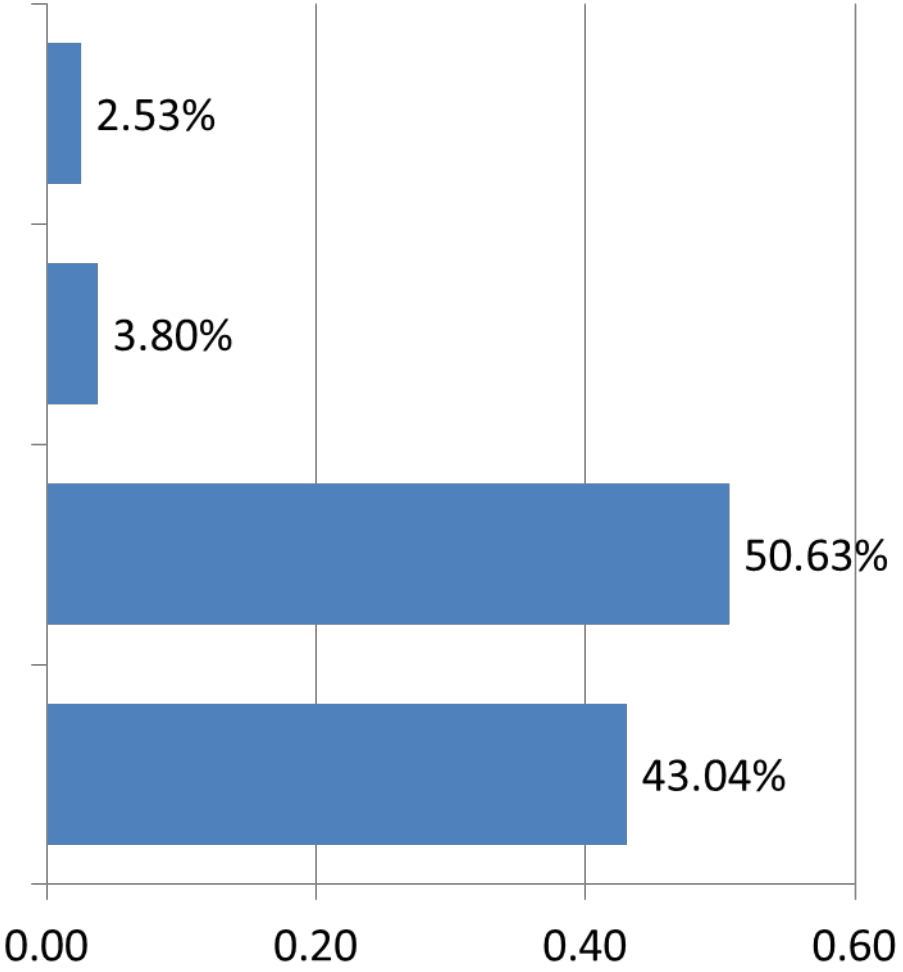
Impact of Screening and Control Programs

Your opinion!

Imagine a non-screening world……..

Which statement would apply to your hospital?

1. AROs would **not** be a problem for patients in my hospital
2. AROs would cause **less** harm to patients in my hospital
3. AROs would cause **more** harm to patients in my hospital
4. Could go either way

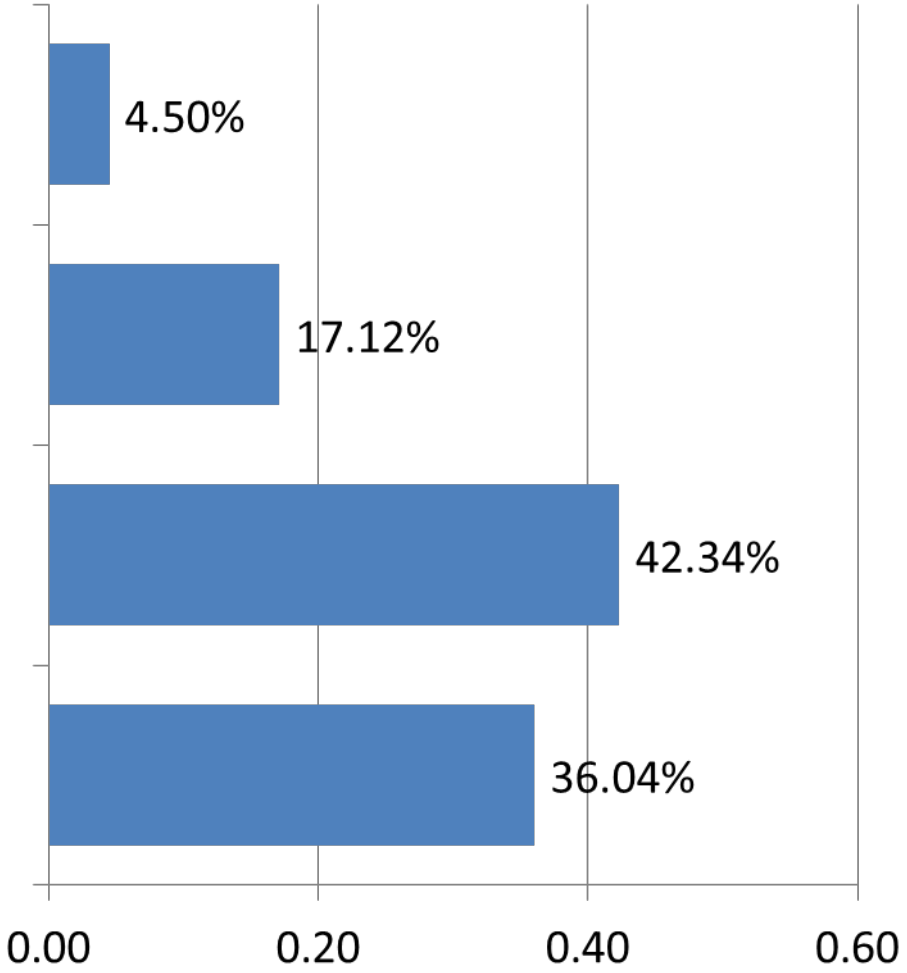


N=158

Imagine a non transmission based precautions world

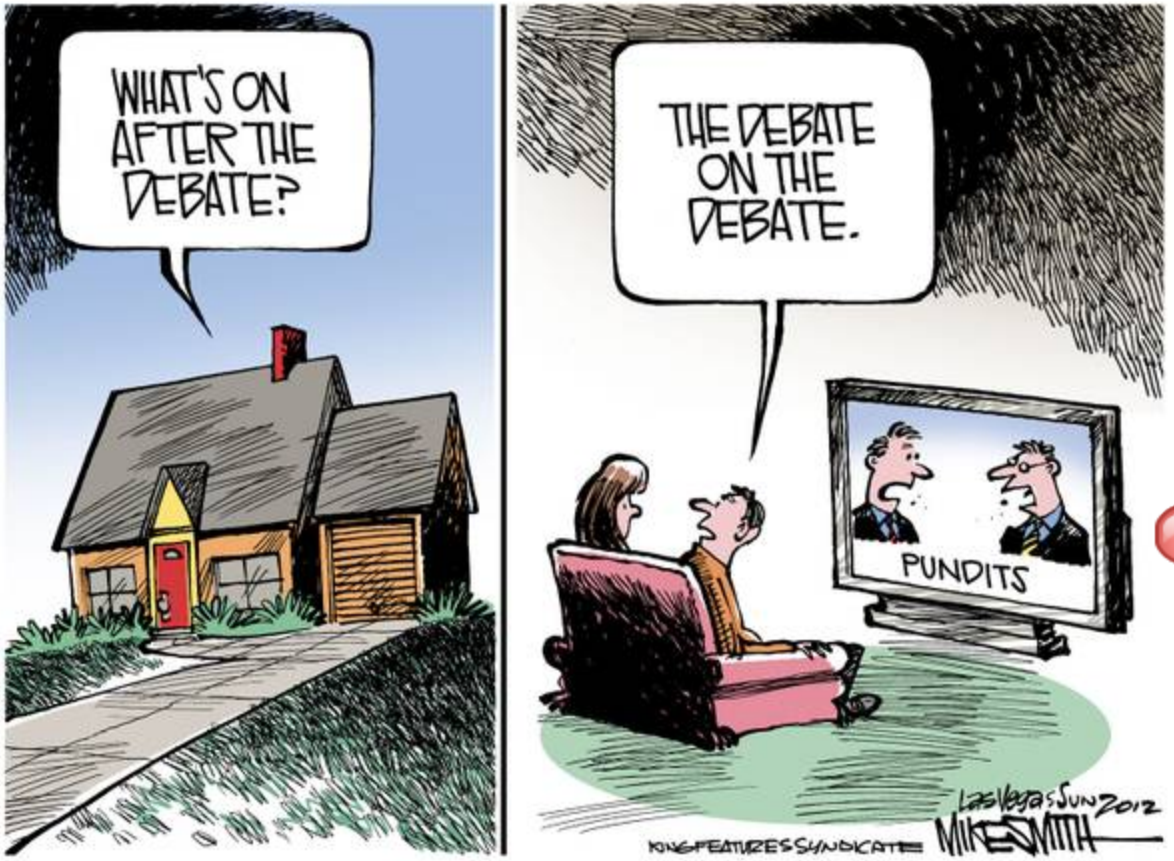
Which statement would apply to your hospital?

1. AROs would **not** be a problem for patients in my hospital
2. AROs would cause **less** harm to patients in my hospital
3. AROs would cause **more** harm to patients in my hospital
4. Could go either way

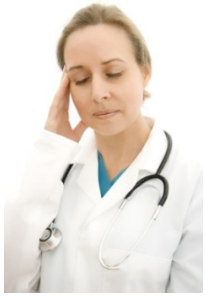


N=111

THE DEBATE IS OVER.

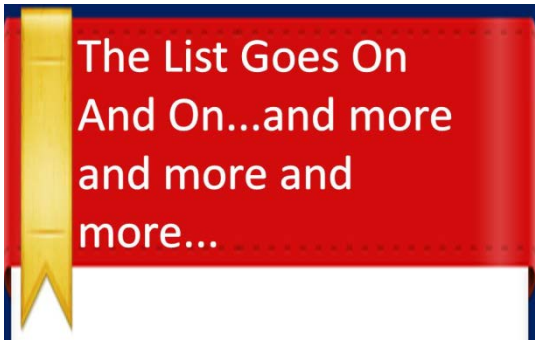


Some last thoughts



Problems with the literature on the effect of ARO screening/precautions

- Regional nature of programs makes effective RCTs impossible
- Heterogeneity in the nature of the screening makes interpretation difficult
- Interventions often deployed as part of a “bundle” limiting conclusion re relative value of each intervention



Current debate is whether we should be employing traditional **VERTICAL** control strategies versus **HORIZONTAL** PROGRAMS….

AHRQ Comparative Effectiveness Review #102 MRSA

- "evidence insufficient to reach a conclusion regarding the effectiveness of screening

Mutters NT Dtsch Arztebl Int 2013. VRE

- Insufficient data to make a recommendation for VRE screening…

Huskins WC N Engl J Med 2011 RCT 10 ICUs MRSA and VRE

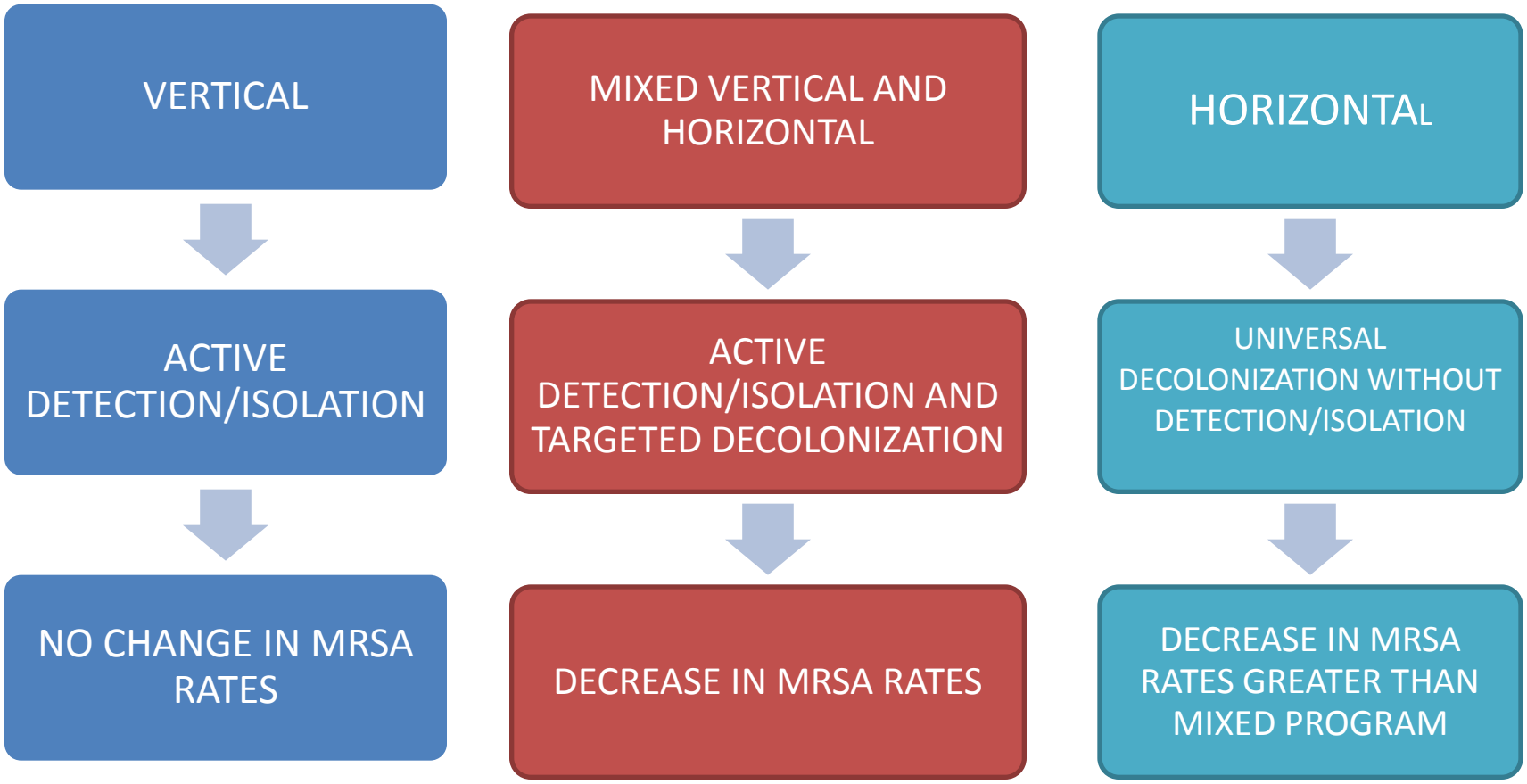
- Gp 1 = surveillance + reporting of results/precautions
- Gp 2 = surveillance + no results given
- No difference in incidence of MRSA or VRE

Aboelela S AJIC 2006;34:484-94 Barrier precautions

"…not possible to determine whether there is a specific set of interventions that is essential….to reduce risk of transmission.

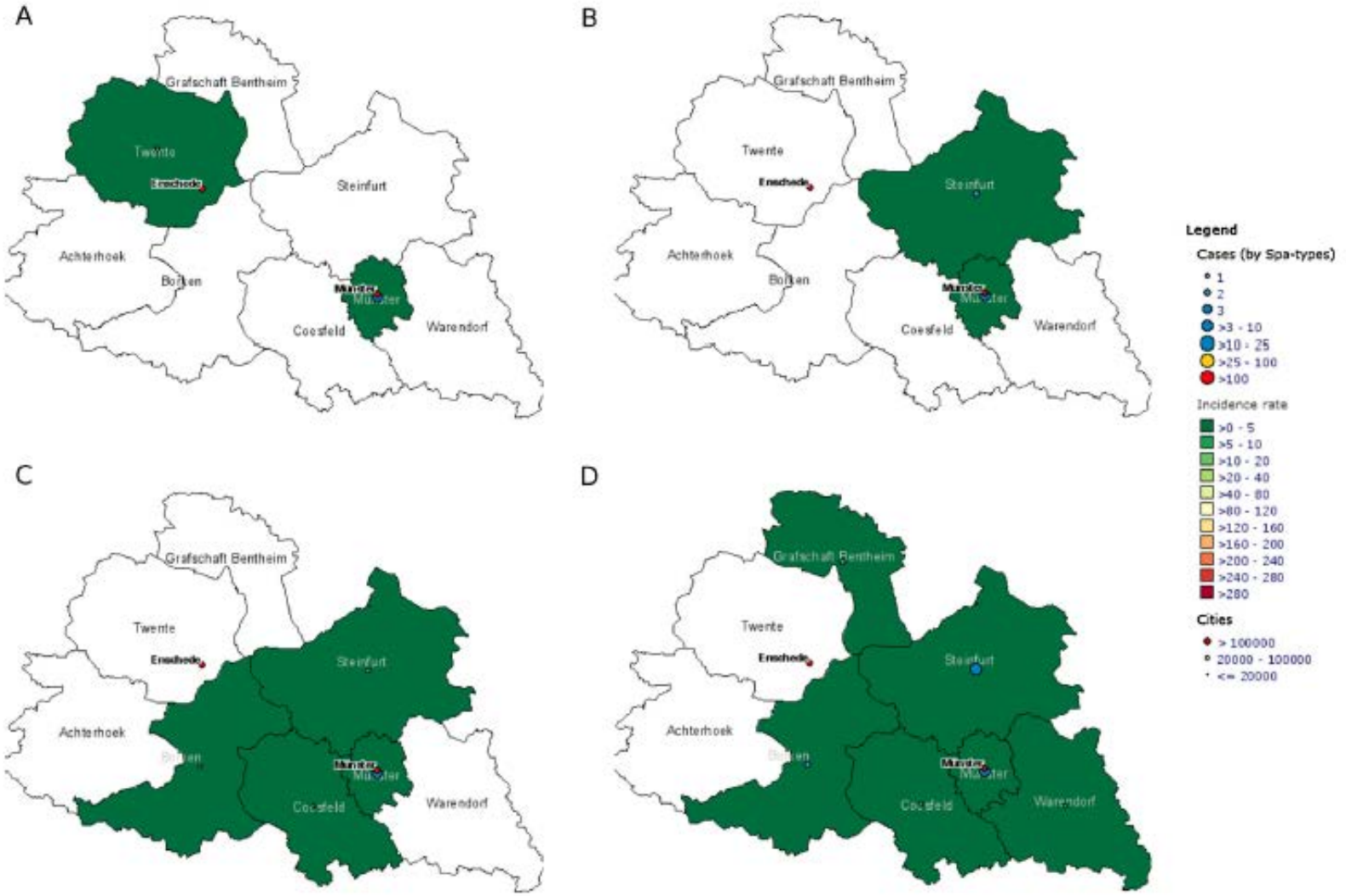
Targeted versus universal decolonization to prevent ICU Infection Huang SS NEJM 2013;268;24

Cluster randomized trial in 43 ICUs focusing on MRSA prevention



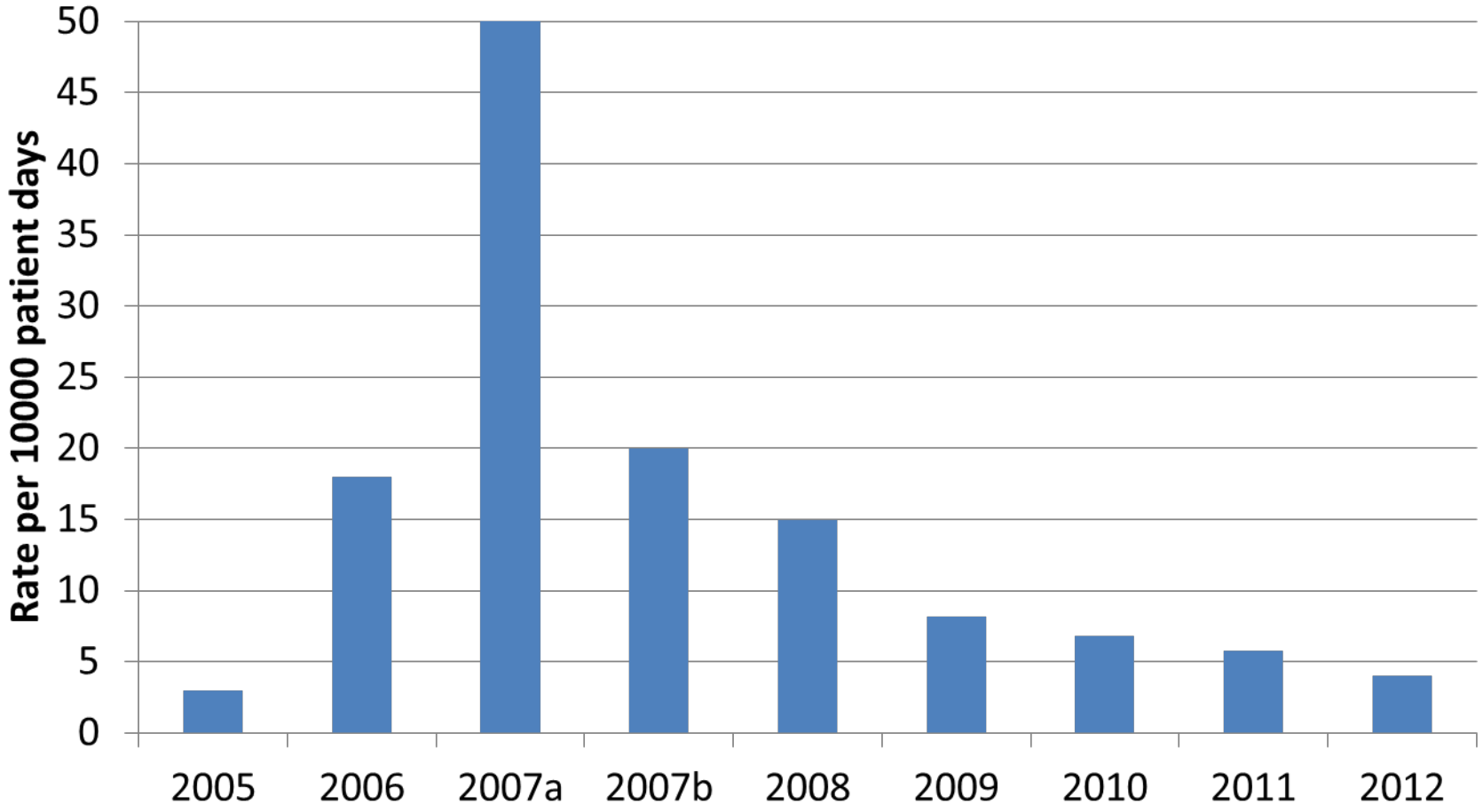
Lack of effectiveness of traditional screening and isolation
Reconsider the pursuit of mandating these measures
Focus efforts on horizontal control programs designed to reduce ALL infections

Dissemination of spa type t104 MRSA in Euregio hospitals, 2005-2008



Ciccolini Int J Med Micro 2013; 303:380

An Ongoing National Intervention to Contain the Spread of Carbapenem-Resistant Enterobacteriaceae



Schwaber CID Mar2014


Right Decision
Wrong Decision

Context is Everything

Need to consider:

- Epidemiology
  - ?Endemic ?Emerging
- Virulence
- Ability to Treat (now and future)
- Ability to Decolonize
- Cost-effectiveness

References

1 Muller M, Detsky AS JAMA 2010;304;1116

2 Weber S et al 2007 SHEA Position Statement

3 Munoz-Price SL Lancet Infectious Diseases 2013; 13:785

4 Leber AL ICHE 2001;22:160

5 MacFadden CMAJ 2013;185:E725

6 Senn L Clin Microbiol Infect 2012;18:E31-E33

7 Abad C JHI 2010;76;97-102

8 Matlow A Peds 2008;122:e411

9 AHRQ Comparative Effectiveness Review #102

10 Mutters NT Dtsch Arztebl Int 201

11 Huskins WC N Engl J Med 2011 RCT 10 ICUs 3

12 Aboelela S AJIC 2006;34:484-94

13 Huang SS NEJM 2013;268;24

14 Ciccolini Int J Med Micro 2013; 303:380

15 Schwaber CID Mar2014