VRE Control in Singapore

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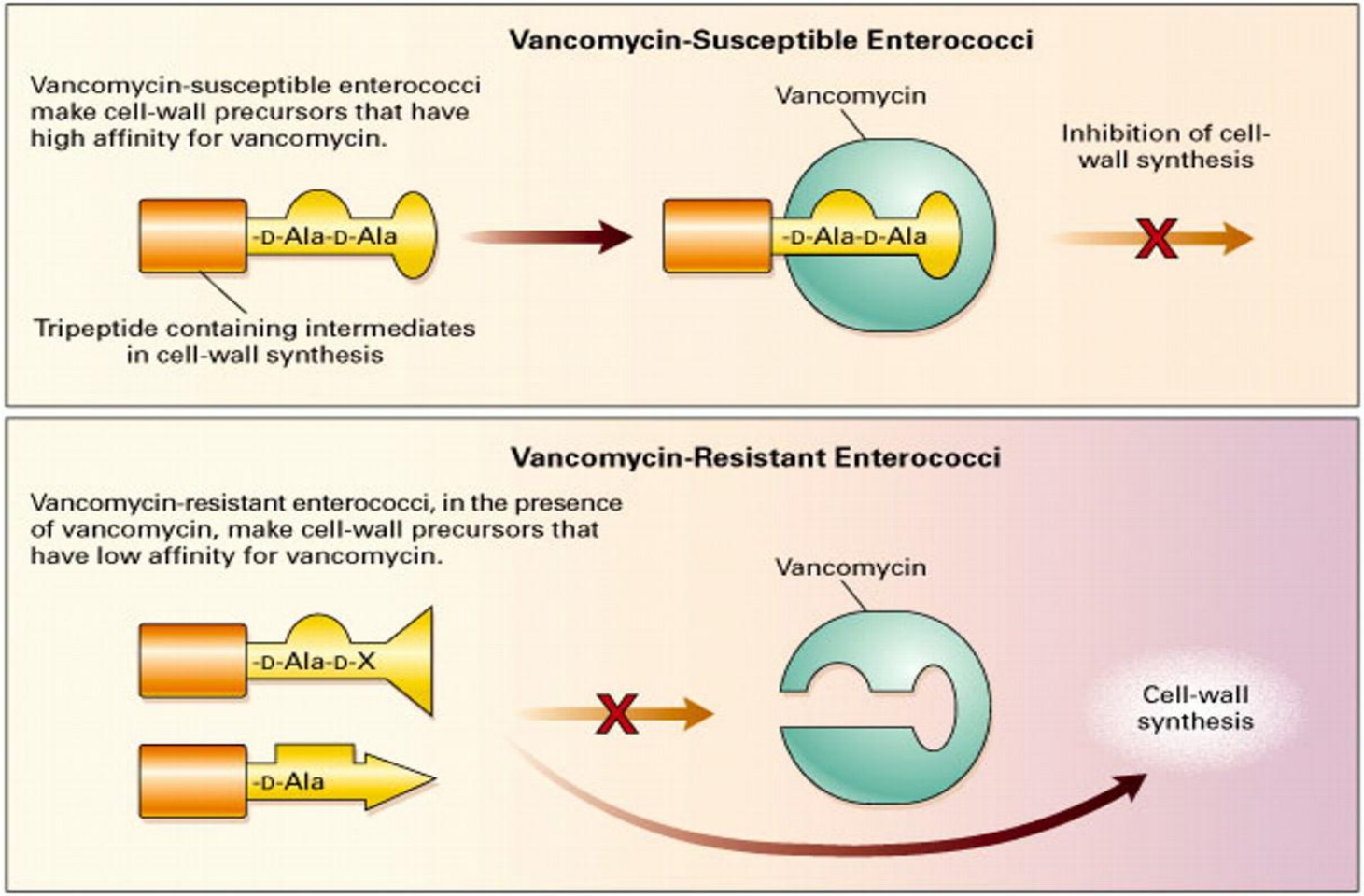
VRE – a global problem



Murray, B. E. N Engl J Med 2000;342:710-721

VRE outbreak in a community hospital

some lessons learnt

Slides courtesy of Dr Surinder Pada

Index

- 44 yr old female admitted to ward 10 on 6 May with
  - Lower abdominal pain 3/7
  - Fever
  - Poor urinary flow
  - diarrhoea
  - IUCD 2003
- Ct abdo pelvis: fat stranding, free fluid in pelvis. Oedematous uterus, dilated R fallopian tube. = Pelvic inflammatory disease
- TF to NUH on 8 May
- OT: 10 May IUCD tip
  - Enterococcus faecium, VRE

Description	Results	Unit	Ref.Ranges
Sample Origin	Tip		
Specimen comment	IUCD		
Request status	Completed		
Direct Exam	.		
Gram Smear	White Blood Cells 2+ (few) Epithelial cells 3+ (moderate) Organism not seen		
Visual Aspect	.		
Neg AnO2 comment	No growth of anaerobes		
Comment	Enterococcus is intrinsically resistant to cephalosporins, clindamycin and co-trimoxazole. Enterococcus faecium (vancomycin-resistant) isolated. van B genotype detected by molecular typing.		
Identification	.		
Organism 1	Enterococcus faecium (Vancomycin resistant) (Moderate)		
Sensitivity 1	.		
Organism 1	Enterococcus faecium (Vancomycin resistant)		
Vancomycin MIC	Resistant		
Vancomycin MIC	12.000	mg/L	
Ampicillin	Resistant		
Ampicillin	>=32 mg/L		
Gentamicin 500 HC	Resistant		
Teicoplanin	Sensitive		
Teicoplanin	<=0.5 mg/L		
Linezolid	Sensitive		
Linezolid	2.000	mg/L	

Next steps

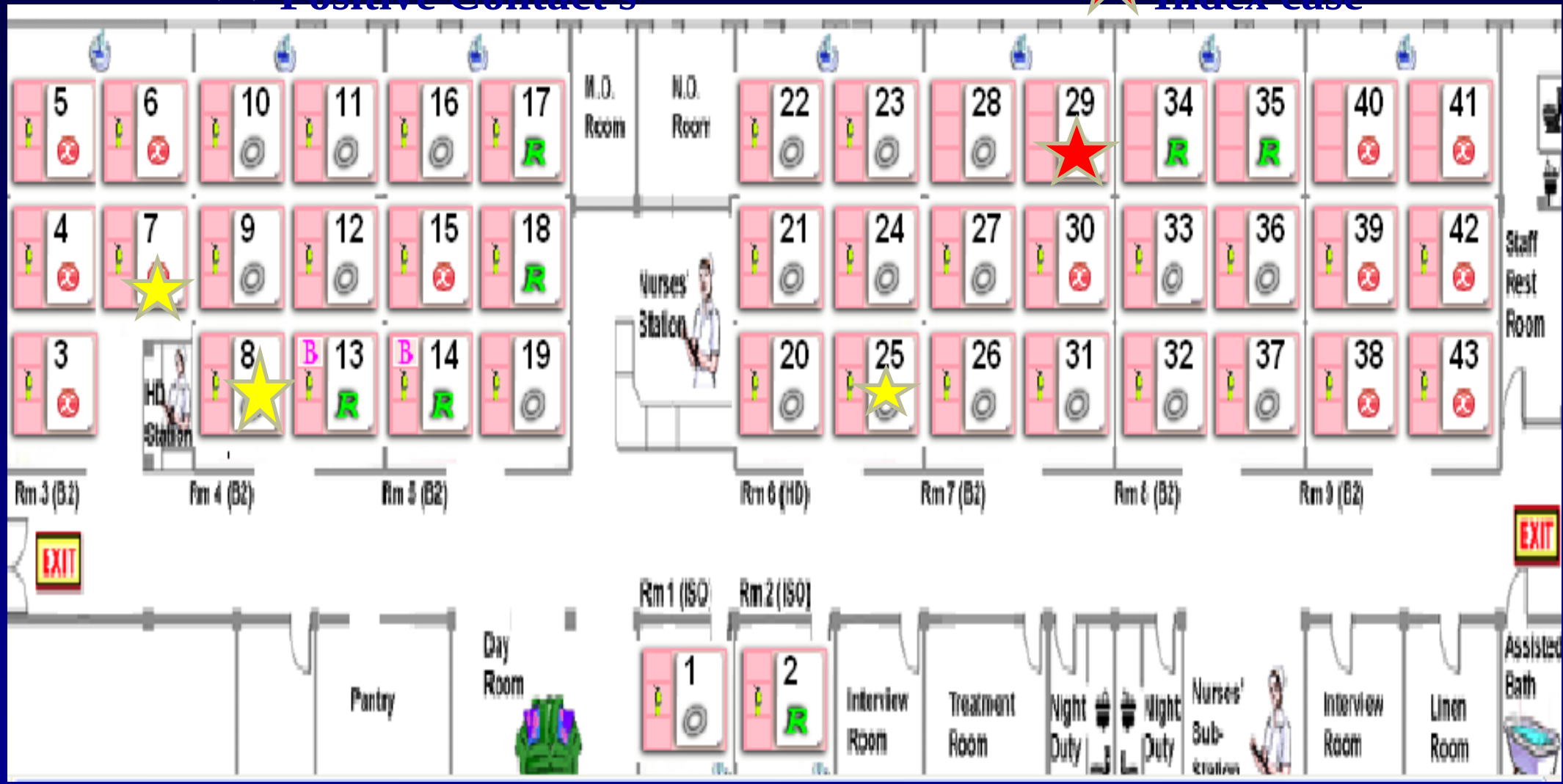
- Patients in the same cubicle as index screened.
- All patients still on the ward when patient was admitted screened
- 2 out of 5 Positive for VRE

Action Taken

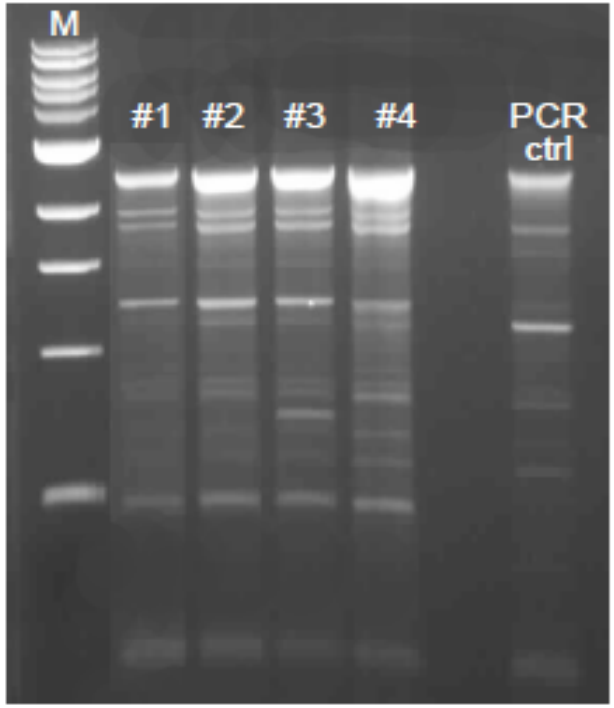
- Informed CMB on 19/5/2012: plan to
  - Shut down ward 10
  - Screen all existing patients on the ward
  - Environment services- terminal cleaning of patient room and toilets
  - All staff to observe contact precautions
- Step up infection control measures
- Further case detected on screening
- Terminal cleaning of the whole ward
- Reopened ward on 22 May 2012
- Continued step up of environmental cleaning for 2 weeks thereafter

Positive Contact s

Index case



Genomic fingerprinting by ERIC-PCR



Isolates
#1: S0347600F
#2: S0236116G
#3: S2558346I
#4: S6830917D (NUH)

#1, #2 and #4 are indistinguishable
#3 is similar to the other 3 isolates

"**Indistinguishable**" isolates or those with the same genotype have no obvious band differences.
"**Similar**" isolates have one band difference.

Screening of Contacts

From 5th to 19th Jun 2012, 117 patients stayed in Ward 10. Rectal swabs /stools were tested for VRE.

- ❖26 inpatients were screened
  - ✓3 pts screened VRE positive
- ❖91 discharged patients
  - ✓19 swabs were done in SOC – negative
  - ✓1 patient, VRE positive from 2nd specimen, done at TTSH
  - ✓71 Contacts awaiting to be screened

Index pt with VRE in Ward 11

- 91 yr old female admitted to ward 11 on 1.7.12 for:
  - Bleeding GIT
  - Bedbound, non-mobile
- Admission history
  - Had been seen in TTSH ED and TF to AH
  - 1st admission to AH
  - 9 admissions to TTSH, admitted every month


CPRS Loading Completed

01-07-2012	[AH]
16-06-2012	[TTSH]
13-05-2012	[TTSH]
12-04-2012	[TTSH]
02-03-2012	[TTSH]
02-02-2012	[TTSH]
02-12-2011	[TTSH]
14-11-2011	[TTSH]
04-09-2010	[TTSH]
11-08-2006	[TTSH]

Action taken

- Stop admission and transfer in ward 11 on 5/7/2012
- Existing patients in same cubicle had VRE screening done
- Initiate Infection Control measures
- Terminal Cleaning
- Results out on 7/7/2012 and all negative.
- Reopened for new admission in ward 11 on 8/7/2012

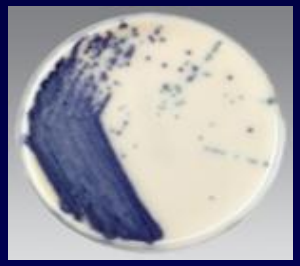

The Index Case
Patients' Toilet
Cleaner
Sluice
EXIT
35 R
34 R
29 O NI
28 R NI
23 O
22 R
B 17 R
16 O
12 R
11 C
6 O
5 O
36 P
33 P
30 O NI
27 O NI
24 O
21 O
18 O
15 O
13 P
10 P
7 O
4 X
37 X
32 O
31 O NI
26 O NI
25 O
20 R
19 O
Nurses' Sub-Station
14 O
9 O
8 O
3 X
Nurses' Station
Rm 8 (C)
Rm 7 (C)
Rm 6 (C)
Rm 5 (HD)
Rm 4 (C)
Rm 3 (C)
Rm 2 (ISO)
Rm 1 (ISO)
Assisted Bath
Nurses' Sub-Station
Linen Room
Staff Rest Room
N.O. Room
Night Duty
Supplies Room
Treatment Room
2 R
1 I R
M.O. Room
Day Room

WARD 11

Improvements

- Update of policy
- Clear instructions for chain of command
- Clear case definitions
- Project on enhanced environmental cleaning
- Continued initiatives on Hand hygiene

Lab detects case



ICN

E
S

Infection Control Chairperson

Senior nursing Management on call

Director Nursing

Nurse manager of affected ward/s

CM
B

Informed of outbreak
Case definition
Plan moving forward

Inform senior hospital management: CEO, COO

Bed Mgt

Closure of ward notified

Lab Med

Nature of screening test required
Update on expected number of samples
Turn around time discussions

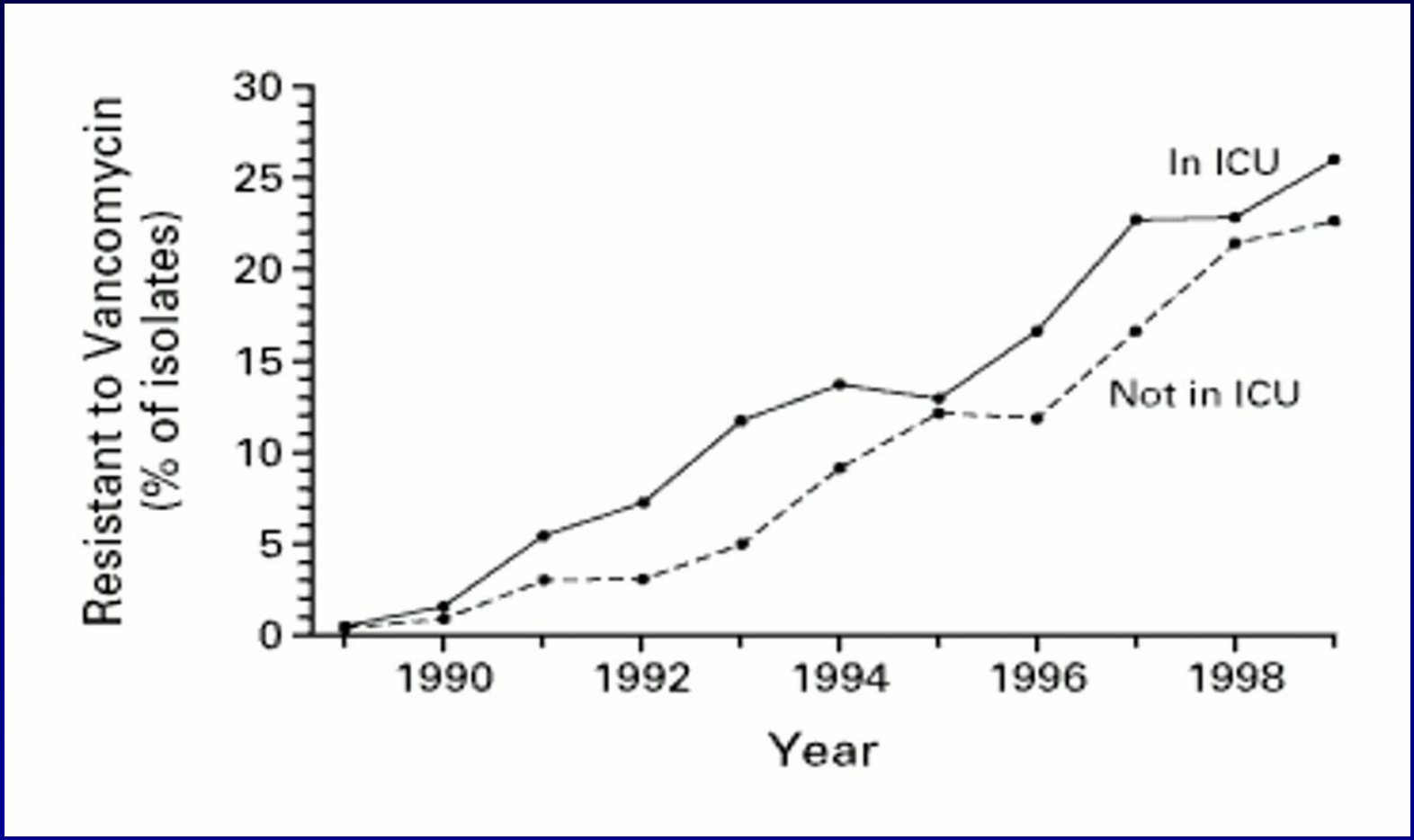
p
Co

Patient-centred issues and communication as needed

E mail communications

- Infection control chairperson will
  - Send out updates 2x per day to CMB
  - At the beginning and the end of work day
- Email cc list will include: COO, BMU, DN, Corp coms, Lab, Environmental services, Head Medical Affairs, Nurse manager of the affected ward
- Infection control chair will
  - Send general email to all clinicians on outbreak and relevant information at the beginning and as needed

Resistance of Nosocomial Isolates of Enterococci to Vancomycin in the National Nosocomial Infections Surveillance System USA



Murray, B. E. N Engl J Med 2000;342:710-721

The NEW ENGLAND JOURNAL of MEDICINE

VRE from SENTRY data

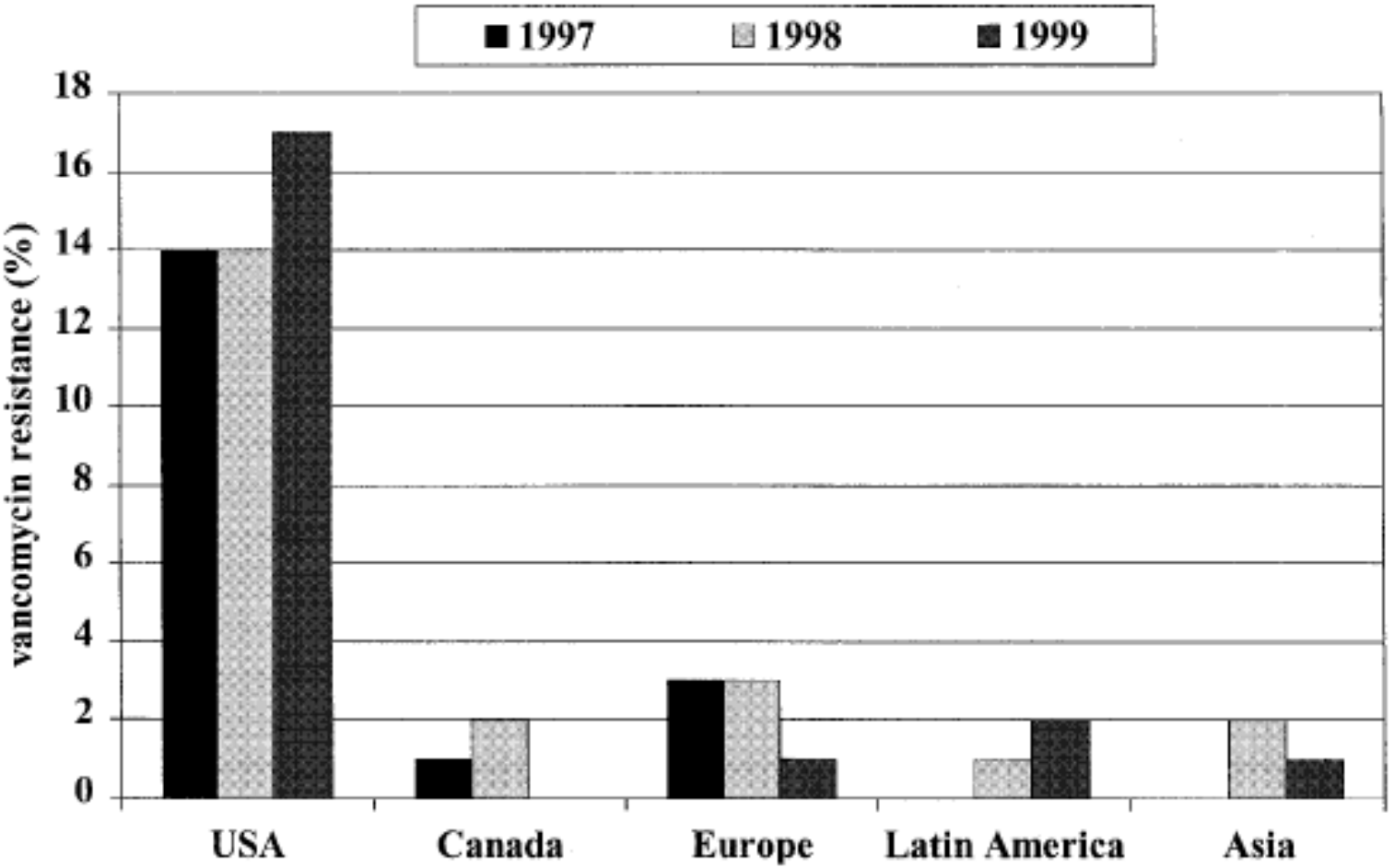


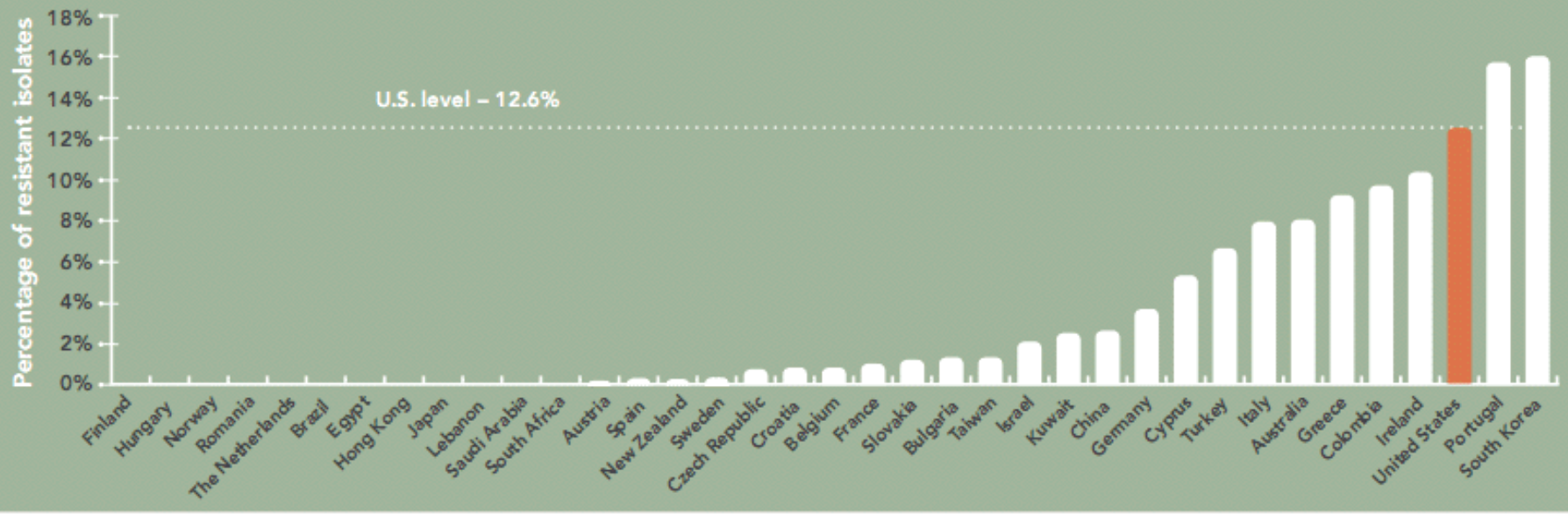
FIG. 1. Trends in vancomycin resistance of all tested enterococci ($n \sim 5{,}000$ nosocomial isolates) in each monitored region of the world, as reported by the SENTRY antimicrobial surveillance program (57).

Harbarth, Cosgrove, Carmeli, AAC 2002 from Low et al CID 2001

Asian Epidemiology

FIGURE 1.5

Vancomycin-resistant enterococci rates in the United States and other countries



Sources: Brazil, 2002 (Titze-de-Almeida, Filho et al. 2004); Egypt, Lebanon, Saudi Arabia, South Africa, and Turkey, 2001–2002 (Bouchillon, Johnson et al. 2004); Hong Kong, 2000 (Ho 2003); Japan, 2000 (Arakawa, Ike et al. 2000); New Zealand, 2000 (Briggs, Upton et al. 2002); Taiwan and United States, 2000 (McDonald, Lauderdale et al. 2004); Kuwait, 1999–2001 (Udo, Al-Sweih et al. 2003); Australia, 1999 (Nimmo, Bell et al. 2003); Colombia, 2001–2002 (Arias, Reyes et al. 2003); China (Liu, Xu et al. 2003); South Korea, 2002 (Lee, Kim et al. 2004); European countries, 2004 (RIVM 2005).

CDDEP THE CENTER FOR Disease Dynamics, Economics & Policy
RESOURCES FOR THE FUTURE

VRE in Singapore

VANCOMYCIN-RESISTANT ENTEROCOCCI IN A SINGAPORE TEACHING HOSPITAL PRIOR TO 2005

Dear Sir,

Sporadic cases of vancomycin-resistant enterococci (VRE) infection and colonisation have been reported from Singapore's hospitals for many years. We would like to report our experience with testing for VRE at the National University Hospital (NUH), a 900-bed teaching hospital in Singapore.

Since 1999, all clinically-significant isolates of *Enterococcus faecium* and *E. faecalis* from blood, urine and wounds were tested for vancomycin susceptibility. Apart from disc testing, the use of enterococcosel agar containing 6ug/L of vancomycin[1] and the use of Vitek automated systems were introduced during this period. Our findings are as follows:

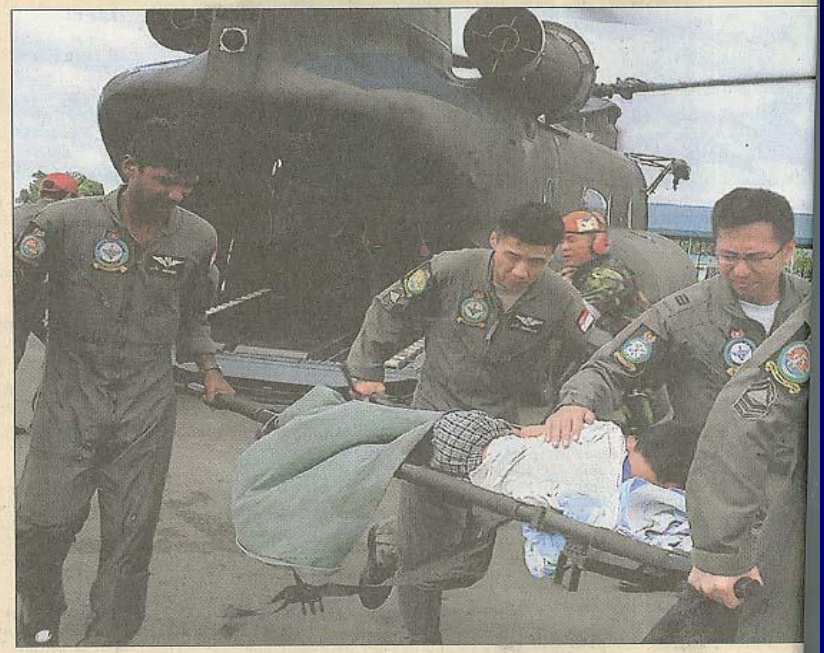
VRE (MIC ≥32ug/mL)

Year	No. of isolates
1999	0
2000	0
2001	0
2002	0
2003	1
2004	4

THE STRAITS

220 PAGES IN EIGHT PARTS » MICA (P) 093/03/2005 SATURDAY, APRIL 2 2005 A SINGAPORE PR

S'PORE QUAKE RESCUE OPS IN FULL SWING



Singapore Armed Forces personnel rush a victim from Nias island for medical treatment. Three SAF Chinook he-

licopters are helping to evacuate casualties from the earthquake-hit area to Medan, besides airlifting relief supplies.

The SAF medical team on the island has treated 165 patients since it arrived on Thursday, a Defence Ministry statement said.

About 150 personnel, including members from the Singapore Civil Defence Force, are at Nias and in Medan, Defence Minister Teo Chee Hean told The Straits Times at a book launch yesterday.

"The airstrip and the port/pier facilities on Nias are not able to take the large volumes of aid that are required, so Chinooks and other lift capabilities are very critical now," he said.

MORE REPORTS, ASIA PAGES 26 & 28

Non-urgent ops off after SGH is hit by superbug

15 patients have tested positive for drug-resistant bacteria strain

Treatment is possible, but it is expensive.

Dr Kumar said that out of the 15 carriers found at SGH, only one has been infected, a diabetic who has had a leg amputated.

hospital will need to be tested for the bacteria, which is usually spread through direct contact with another carrier.

Prof Tay said patients who have the bacteria may

aggressive steps to ensure that the VRE does not become entrenched in this hospital."

The cancellation of all non-urgent surgery will allow the hospital "greater manoeuvrability" should it need to isolate more patients.

When The Straits Times visited the hospital yesterday evening, there were signs put up along the hospital's corridors reminding patients, visitors and staff to wash their hands to minimise the risk of infection.

Bottles of hand-washing liquid were also placed outside the lifts and at patients' beds. In addition, notices restricting visitors to two per

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Control of a hospital-wide vancomycin-resistant *Enterococci* outbreak

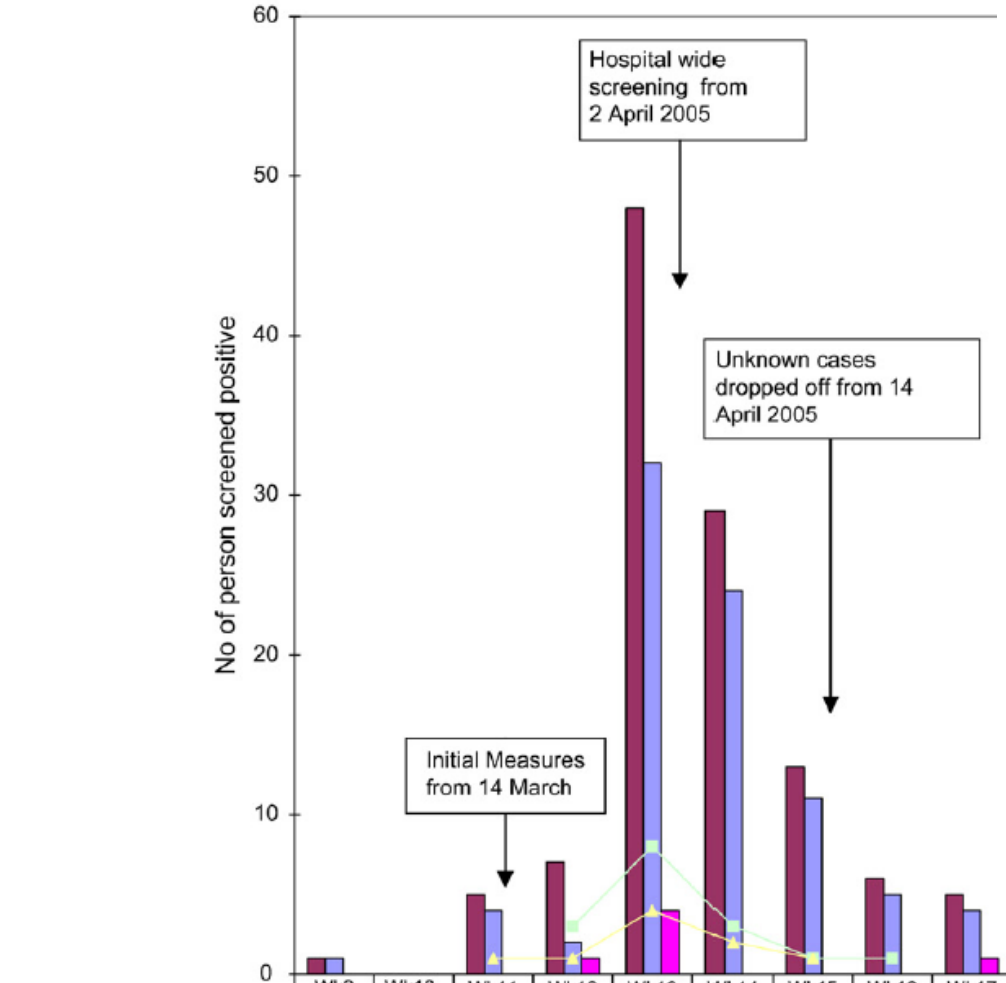
Asok Kurup, MRCP,[a] M. P. Chlebicki, ABIM,[b] M. L. Ling, FRCPA,[a] T. H. Koh, FRCPA,[c] K. Y. Tan, RN,[a] L. C. Lee, RN,[a] and K. B. M. Howe, RN[a]
Singapore

Background: To analyze control measures used to eradicate a large vancomycin-resistant *Enterococci* (VRE) outbreak in a nonendemic 1600-bed tertiary care institution.

Methods: In mid-March 2005, VRE Van B was isolated from 2 clinical samples from different wards. Despite such measures as screening patients sharing rooms with index cases and isolating VRE patients, 43 isolates from different wards were detected by the end of March 2005. To eradicate a hospital-wide outbreak, a coordinated strategy between March and June 2005 comprised (1) formation of a VRE task force, (2) hospital-wide screening, (3) isolation of carriers, (4) physical segregation of contacts, (5) surveillance of high-risk groups, (6) increased cleaning, (7) electronic tagging of VRE status, and (8) education and audits. This is a retrospective study of this multipronged approach to containing VRE. The adequacy of rectal swab sampling for VRE was assessed in a substudy of 111 patients. The prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA)/VRE co-colonization or co-infection also was determined.

Results: A total of 19,574 contacts were identified. Between April and June 2005, 5095 patients were screened, yielding 104 VRE carriers, 54 of whom (52%) were detected in the first 2 weeks of hospital-wide screening. The initial positive yield of 11.4% of persons actively screened declined to 4.2% by the end of June 2005. Pulsed-field typing revealed 1 major clone and several minor clones among the 151 total VRE cases, including 4 clinical cases. Hospital-wide physical segregation of contacts from other patients was difficult to achieve in communal wards. Co-colonization or co-infection with MRSA, which was present in 52 of 151 cases (34%) and the indefinite electronic tagging of positive VRE status strained limited isolation beds. Analysis of 2 fecal or rectal specimens collected 1 day apart may detect at least 83% of VRE carriers.

Conclusion: A multipronged strategy orchestrated by a central task force curbed but could not eradicate VRE. Control measures were confounded by hospital infrastructure and high MRSA endemicity. (Am J Infect Control 2008;36:206-11.)



	Wk9	Wk10	Wk11	Wk12	Wk13	Wk14	Wk15	Wk16	Wk17	Wk18	Wk19	Wk20	Wk21	Wk22	Wk23	Wk24	Wk25
No of person screened positive	1	0	5	7	48	29	13	6	5	5	0	2	6	7	4	7	6
PFGE results A	1		4	2	32	24	11	5	4	3		2	6	7	4	7	4
PFGE results B				1	4				1	1							
PFGE results C				3	8	3	1	1									
PFGE results others			1	1	4	2	1			1							2
Total person screened*	-	-	-	-	-	254	683	1154	961	323	131	210	291	228	312	245	142

A multipronged strategy orchestrated by a central task force helped curb the outbreak at the expense of bed management systems, loss of revenue, and inconvenience to patients. The total cost of this strategy is still being computed. Eradicating VRE was hampered by our large hospital size, heterogenous patient mix with numerous inpatient movements, and communal wards. The 2006 VRE incidence in SGH was 0.04 per 1000 patient-days. Along with surveillance of risk groups including communal ward patients, the following measures are aimed at averting another outbreak:

- Screening for VRE for all interhospital and overseas hospital transfers
- Screening for VRE in all patients sharing the same cubicle as a newly diagnosed carrier
- Isolation with contact precautions for all carriers
- Vancomycin audit, as well as audits of other antibiotics
- Hand hygiene vigilance

ERADICATION OF A LARGE OUTBREAK OF A SINGLE STRAIN OF vanB VANCOMYCIN-RESISTANT *ENTEROCOCCUS FAECIUM* AT A MAJOR AUSTRALIAN TEACHING HOSPITAL

Keryn J. Christiansen, MBBS, FRCPA; Patricia A. Tibbett, RN, BAppSc; William Beresford, MBChB, FAFPHM; John W. Pearman, MD, FRCPA; Rosie C. Lee, RN, BNsg; Geoffrey W. Coombs, BAppSc; Ian D. Kay, BAppSc; Frances G. O'Brien, BAppSc; Silvano Palladino, BAppSc, MHthMgt; Charles R. Douglas, MBBS, FAFPHM; Philip D. Montgomery, MBBS, FRACMA; Terri Orrell, RN, BNsg; Allison M. Peterson, RN, BNsg; Frank P. Kosaras, BAppSc; James P. Flexman, PhD, FRCPA; Christopher H. Heath, FRCPA, FRACP; Cheryll A. McCullough, BAppSc

ABSTRACT

OBJECTIVE: To demonstrate that nosocomial transmission of vancomycin-resistant enterococci (VRE) can be terminated and endemicity prevented despite widespread dissemination of an epidemic strain in a large tertiary-care referral hospital.

INTERVENTIONS: Two months after the index case was detected in the intensive care unit, 68 patients became either infected or colonized with an epidemic strain of vanB vancomycin-resistant *Enterococcus faecium* despite standard infection control procedures. The following additional interventions were then introduced to control the outbreak: (1) formation of a VRE executive group; (2) rapid laboratory identification (30 to 48 hours) using culture and polymerase chain reaction detection of *van*A and *van*B resistance genes; (3) mass screening of all hospitalized patients with isolation of carriers and cohorting of contacts; (4) environmental screening and increased cleaning; (5) electronic flagging of medical records of contacts; and (6) antibiotic restrictions (third-generation cephalosporins and vancomycin).

RESULTS: A total of 19,658 patient and 24,396 environmental swabs were processed between July and December 2001. One hundred sixty-nine patients in 23 wards were colonized with a single strain of vanB vancomycin-resistant *E. faecium*. Introducing additional control measures rapidly brought the outbreak under control. Hospital-wide screening found 39 previously unidentified colonized patients, with only 7 more nonsegregated patients being detected in the next 2 months. The outbreak was terminated within 3 months at a cost of $2.7 million (Australian dollars).

CONCLUSION: Despite widespread dissemination of VRE in a large acute care facility, eradication was achievable by a well-resourced, coordinated, multifaceted approach and was in accordance with good clinical governance (*Infect Control Hosp Epidemiol* 2004;25:384-390).

A costly outbreak?

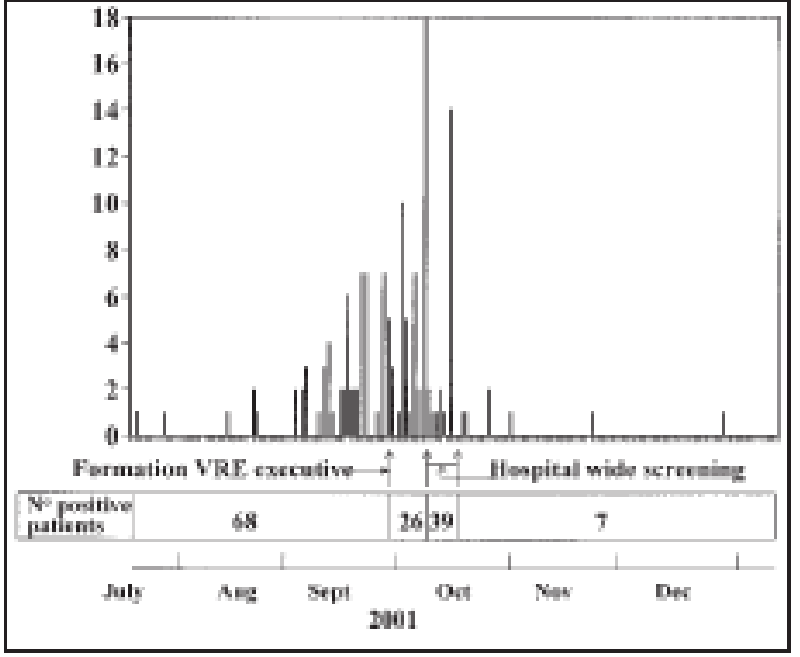


FIGURE 3. The epidemic curve showing the number of patients with vanB vancomycin-resistant *Enterococcus faecium* colonization or infection. This e the 29 contact patients detected, as outpatients or on the active outpatient screening program. VRE = van- nt enterococci.

TABLE
COSTS INCURRED DURING THE PERIOD FROM JULY TO DECEMBER 2001 IN THE ERADICATION OF VANCOMYCIN-RESISTANT ENTEROCOCCI

	Cost*
Staffing (ie, nursing, patient care assistants, laboratory staff, and administrative support)	$590,602
Medical, surgical, and diagnostic supplies (ie, drugs, diagnostic supplies, patient appliances, and materials)	$275,153
Contracting (ie, cleaners and other staffing resources)	$584,320
Domestic charges (ie, cleaning and clothing consumables)	$320,594
Building works (ie, electronic taps in the ICU and dispensers for disinfectant and detergents)	$56,749
Other (ie, printing, stationary, and all other consumables)	$381,887
Equipment (ie, LightCycler† [VRE PCR])	$65,000
Total	$2,277,305

ICU = intensive care unit; VRE = vancomycin-resistant enterococci; PCR = polymerase chain reaction.
*Australian dollars.
†Roche LightCycler (Roche Molecular Biochemicals, Mannheim, Germany).

Vancomycin-resistant Enterococci in Singaporean Hospitals: 5-year results of a Multi-centre Surveillance Programme

Yiying Cai,[1] *BSc (Pharm)*, Joey PJ Chan,[2] *FRCPath*, Dale Andrew Fisher,[3] *FRACP*, Li Yang Hsu,[3] *MPH*, Tse Hsien Koh,[4] *FRCPath*, Prabha Krishnan,[5] *FRCPath*, Andrea LH Kwa,[1] *PharmD*, Thean Yen Tan,[6] *MRCPath*, Nancy WS Tee,[7] *FRCPA*

Table 1. Number of vancomycin-resistant enterococci (VRE) and percentage of vancomycin resistance among all *Enterococcus* spp. isolates in Singaporean hospitals.

Year	All VRE isolates, number (range*)	Percentage vancomycin resistance^ (range*)	Clinical VRE isolates, number (range*)	Percentage clinical vancomycin resistance^ (range*)
2006	57 (0-20)	1.5% (0%-6.9%)	15 (0-7)	0.4% (0%-1.5%)
2007	78 (0-26)	1.6% (0%-7.1%)	19 (0-7)	0.6% (0%-2.5%)
2008	71 (0-23)	1.5% (0%-6.2%)	12 (0-5)	0.4% (0%-1.8%)
2009	114 (0-74)	3.3% (0%-4.5%)	22 (0-10)	0.7% (0%-2.3%)
2010	98 (0-41)	2.3% (0%-6.6%)	20 (0-13)	0.7% (0%-2.4%)

* Distribution range among participating hospitals.

^ Calculated using the number of all *Enterococcus* spp. cultured as the denominator. Results from Hospital 5 were not included as the denominator figures were not available.

outbreaks in separate hospitals over the past 5 years indicates the need for continued vigilance in order to prevent any further increase in VRE prevalence locally.

Ann Acad Med Singapore 2012;41:77-81

Key words: Vancomycin-resistant enterococci, Passive surveillance, Antimicrobial resistance, endemics

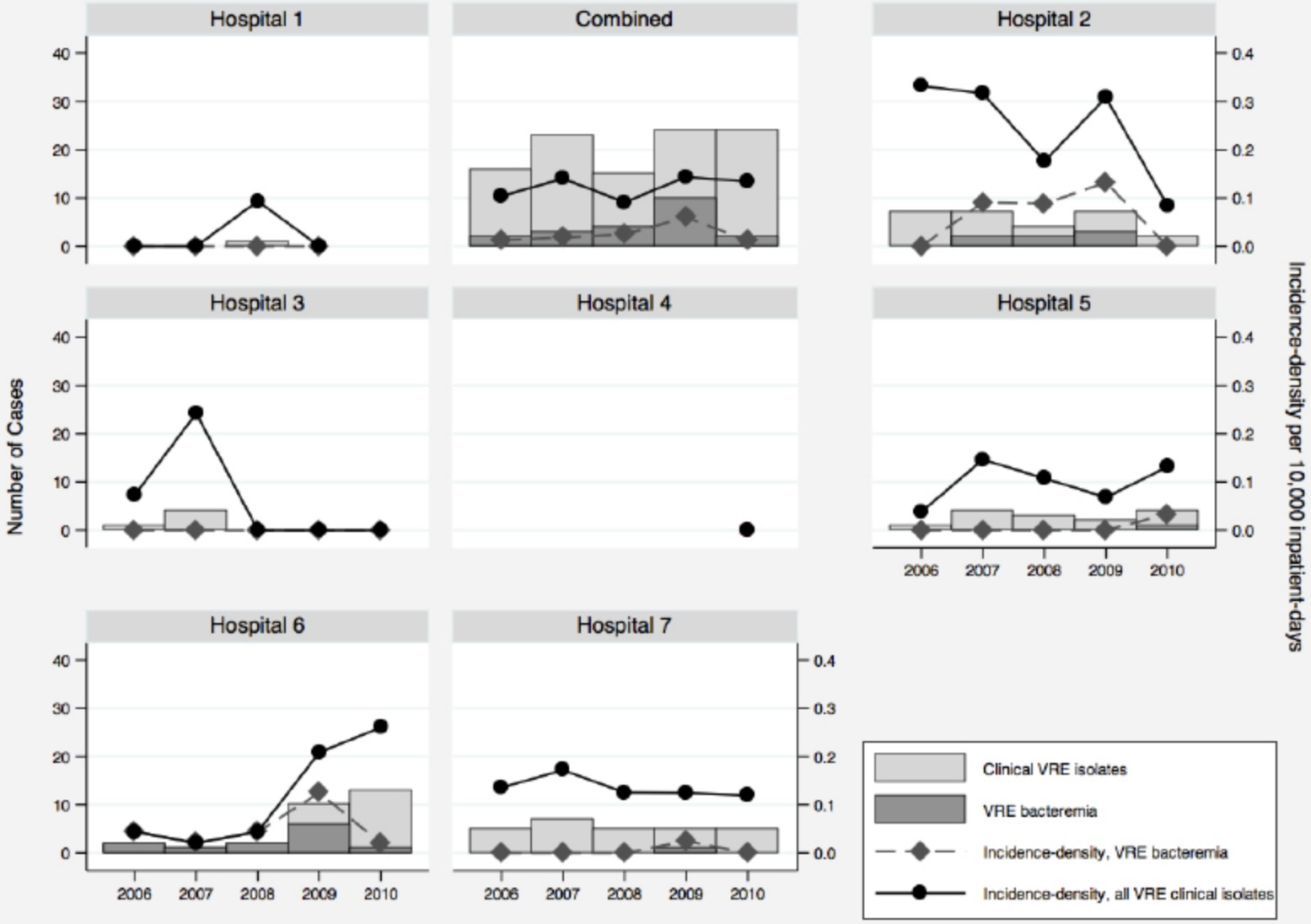


Fig. 1. Incidence-density and number of vancomycin-resistant enterococci isolates from clinical and blood cultures, by hospital, 2006-2010.

US HICPAC Guidelines:

- 1 Place VRE-infected or colonised patients in single rooms or in the same room as other VRE-colonised patients
- 2. Wear gloves when entering the room of a VRE-colonised patient
- 3. Wear a gown when entering the room of a VRE-colonised patient and when substantial contact is anticipated
- 4. Remove gloves and gowns before leaving the room and degerm hands
- 5. Dedicate the use of noncritical items (eg, stethoscope, thermometer) to a single patient or cohort
- 6. Determine the colonisation status of roommates of newly identified VRE carriers
- 7. Adopt a policy for deciding when a patient can be removed from isolation precautions
  8 Highlight the records of colonised patients, so that they can be isolated again when readmitted

ORIGINAL INVESTIGATION

Role of Environmental Contamination as a Risk Factor for Acquisition of Vancomycin-Resistant Enterococci in Patients Treated in a Medical Intensive Care Unit

José A. Martínez, MD; Robin Ruthazer, MPH; Karen Hansjosten, RN; Laurie Barefoot, RN; David R. Snydman, MD

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Results: Thirty cases were matched with 60 appropriate controls. Cases were more likely to have been in the hospital for longer than 7 days before MICU admission

Table 1. 1999 Environmental Surveys Performed at Several Intervals After Terminal Room Cleaning

Cleaning Procedure	Date	Room No.	No. of Positive Samples/ No. of Samples Taken	Soiled Items	PFGE Type
Conventional	March 23	10	4/9	Light switch, toilet rinser, bathroom faucets, telephone handle	1, 1, 2, 2
Conventional	March 24	6	0/9	NA	NA
Conventional	March 26	7	2/6	2 IV pumps	2
Intensive	May 25	7	0/12	NA	NA
Intensive	June 21	9	0/10	NA	NA

Abbreviations: IV, intravenous; NA, not applicable; PFGE, pulsed-field gel electrophoresis.

contamination, even after extensive cleaning. This study underscores the need for better cleaning and the role of the environment in transmission of VRE.

Arch Intern Med. 2003;163:1905-1912

JOURNAL OF CLINICAL MICROBIOLOGY, Dec. 1998, p. 3734–3736 Vol. 36, No. 12
0095-1137/98/$04.00+0

Survival of Vancomycin-Resistant and Vancomycin-Susceptible Enterococci on Dry Surfaces

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Institute of Hygiene, Free University Berlin, 12203 Berlin,[1] and Institute of Social Medicine, Working Group Epidemiology, Free University Berlin, 14195 Berlin,[2] Germany

Received 15 June 1998/Returned for modification 6 August 1998/Accepted 7 September 1998

We compared the abilities of *Enterococcus faecium* strains (three vancomycin-resistant enterococci [VRE] and five vancomycin-susceptible enterococci [VSE]) and *Enterococcus faecalis* strains (one VRE and 10 VSE) to survive under dry conditions. Bacterial suspensions of the strains were inoculated onto polyvinyl chloride and stored under defined conditions for up to 16 weeks. All strains survived for at least 1 week, and two strains survived for 4 months. A statistical model was used to distribute the 19 resulting survival curves between two types of survival curves. The type of survival curve was not associated with the species (*E. faecalis* versus *E. faecium*), the source of isolation (patient versus environment), or the susceptibility to vancomycin (VRE versus VSE). Resistance to dry conditions may promote the transmissibility of a strain, but VRE have no advantages over VSE with respect to their ability to survive under dry conditions.

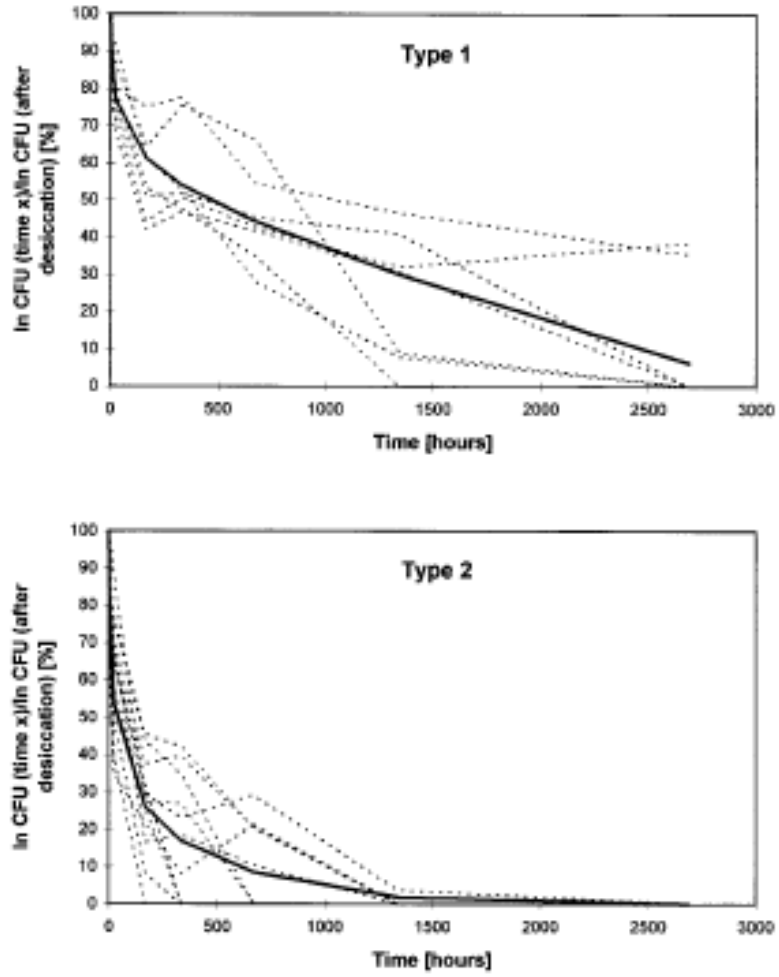


FIG. 1. Distribution of 19 survival curves (dotted lines) between two types of survival curves by using a finite-mixture model. Solid bold lines, statistically derived types of survival curves; *x* axis, survival time in hours; *y* axis, percentage of natural logarithm of colony count compared to natural logarithm of colony count after desiccation.

Discharge Cleaning Standards for Hospital Rooms of Patients Placed on Contact Precautions*

Table 1. Discharge Cleaning Standards for Hospital Rooms of Patients Placed on Contact Precautions*

Cleaning Surface	Protocol†
Dusting of room	Includes use of high dusting tool
Spot cleaning of walls	Limited to high-touch and visibly soiled areas‡
Bedside tables and carts	All surfaces wiped, including inside drawers
Bed	Linen removed; wiping of frame, all mattress sides, rails, skirts, wheels, pillow
Bed curtains	Replaced
Closet, chairs, and floor lamps	All surfaces wiped
Hand controls	Wiping of bed controls, telephone, television control, all cords
Patient care equipment	Wiping of poles, monitors, blood pressure cuffs, dedicated stethoscopes, etc
Bathroom	Surfaces and fixtures wiped; toilet sanitized; toilet mop replaced in ICUs only§
Waste receptacles	Wiped and relined
Bed linen	Clean linen placed
Floor	Mopped; mops changed daily or when visibly soiled

*Representative descriptions of the detailed protocol are provided.
†All cleaning performed using a quaternary ammonium agent.
‡High-touch surfaces with frequent hand contact, such as doorknobs and light switches.
§In non–intensive care units (ICUs), mop container is cleaned and refilled with germicidal solution.

Huang, S. S. et al. Arch Intern Med 2006;166:1945-1951.

ARCHIVES OF INTERNAL MEDICINE

Predictors of Methicillin-Resistant Staphylococcus aureus (MRSA) and Vancomycin-Resistant Enterococci (VRE) Acquisition*

Table 3. Predictors of Methicillin-Resistant *Staphylococcus aureus* (MRSA) and Vancomycin-Resistant Enterococci (VRE) Acquisition*

Model	Odds Ratio (95% Confidence Interval)	*P* Value
MRSA		
Prior occupant MRSA positive	1.4 (1.0-1.8)	.04
Age, in decades	1.1 (1.0-1.2)	.02
Pre-ICU LOS†	1.2 (1.1-1.4)	<.001
Leukemia	0.4 (0.2-0.9)	.02
VRE		
Prior occupant VRE positive	1.4 (1.0-1.9)	.02
Age, in decades	1.2 (1.1-1.3)	<.001
Pre-ICU LOS†	1.4 (1.3-1.6)	<.001
Diabetes mellitus	1.3 (1.0-1.7)	.03

Abbreviations: ICU, intensive care unit; LOS, length of stay.
*No interactions found.
†By 10-day intervals.

Huang, S. S. et al. Arch Intern Med 2006;166:1945-1951.

ARCHIVES OF INTERNAL MEDICINE

Formulary control for VRE

TABLE 1. Antibiotic formulary interventions

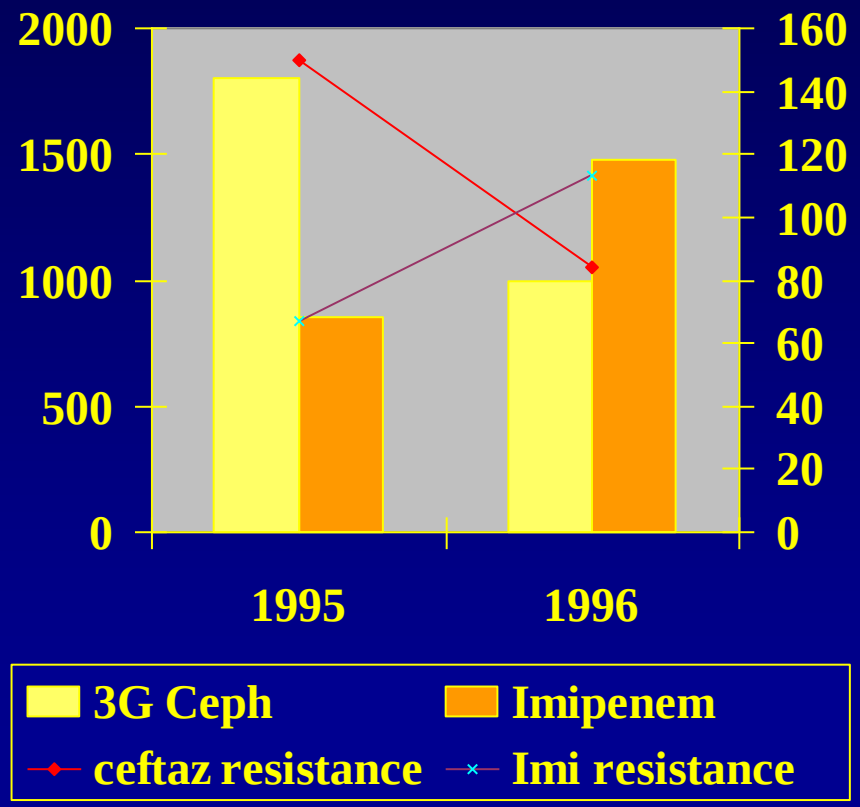
First author (reference)	Publication yr	Setting	Intervention[a]	Outcome
Rubin (89)	1992	Pediatric oncology ward	Restriction of i.v. vancomycin	Decrease of colonization with VRE
Lam (52)	1995	Hospital	Restriction of oral vancomycin	Decrease of clinical isolates with VRE
Morris (68)	1995	Hospital	Restriction of vancomycin; no restriction of cephalosporins	No significant changes in VRE colonization or infection rates
Belliveau (5)	1996	Hospital	Restriction of vancomycin	No new VRE outbreaks but no decline in endemic VRE
Quale (85)	1996	Hospital	Restriction of vancomycin, clindamycin, and broad-spectrum cephalosporins	Decrease in fecal colonization and infections with VRE
Anglim (1)	1997	Hospital	Restriction of vancomycin; enhanced infection control measures; surveillance cultures from high-risk patients	Significant decrease in the incidence of VRE acquisition
Lai (51)	1998	Hospital	Restriction of vancomycin	No significant changes, failure of eradication
Bradley (13)	1999	Oncology unit	Restriction of ceftazidime and replacement with PIP-TZB	Significant decrease in VRE acquisition with increase after restart of ceftazidime use
Montecalvo (65)	1999	Oncology unit	Reduction in several classes of antibiotics	Decreased VRE infection and colonization rate
Smith (93)	1999	Hospital	Restriction of cephalosporins and replacement with PIP-TZB	Decline in VRE prevalence
Manzella (59)	2000	Hospital	Ceftriaxone-erythromycin versus levofloxacin treatment	Decreased VRE colonization rate
May (60)	2000	ICU	Restriction of cephalosporins and replacement with PIP-TZB	Eradication of all VRE infections
Nourse (74)	2000	Oncology unit	Restriction of cephalosporins and glycopeptides	Complete eradication of VRE infection and transmission

[a] Abbreviations: i.v., intravenous; PIP-TZB, piperacillin-tazobactam.

Harbarth, Cosgrove, Carmeli, AAC 2002

Absolute antibiotic restriction:

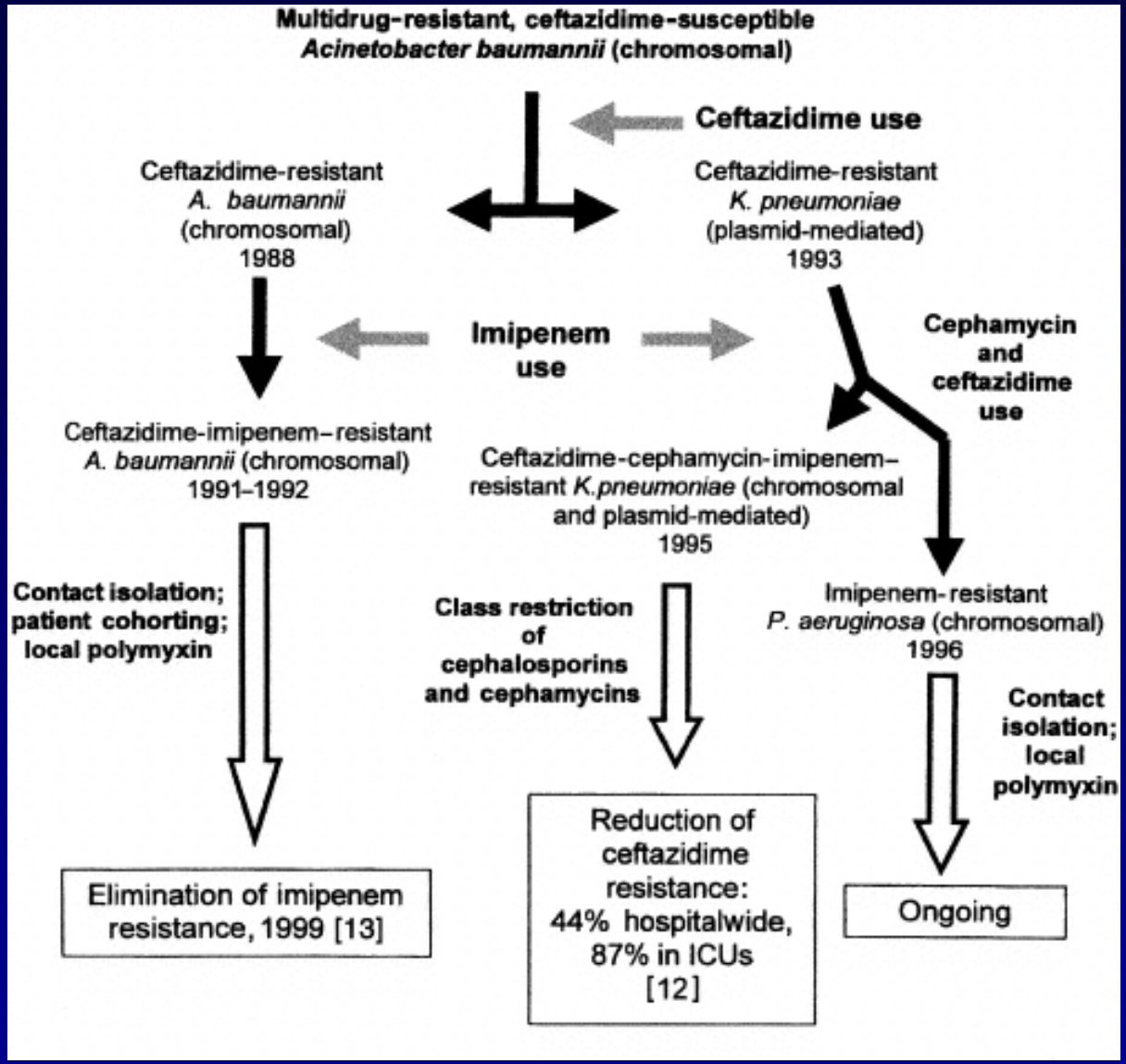
- 3rd generation cephalosporin use –80%
- Ceftaz resistance –44%
- Imipenem use +140%
- Imipenem resistance +89%
  - *Rahal JJ et al JAMA 1998;280:1233-7*



Effect of antibiotic restriction:

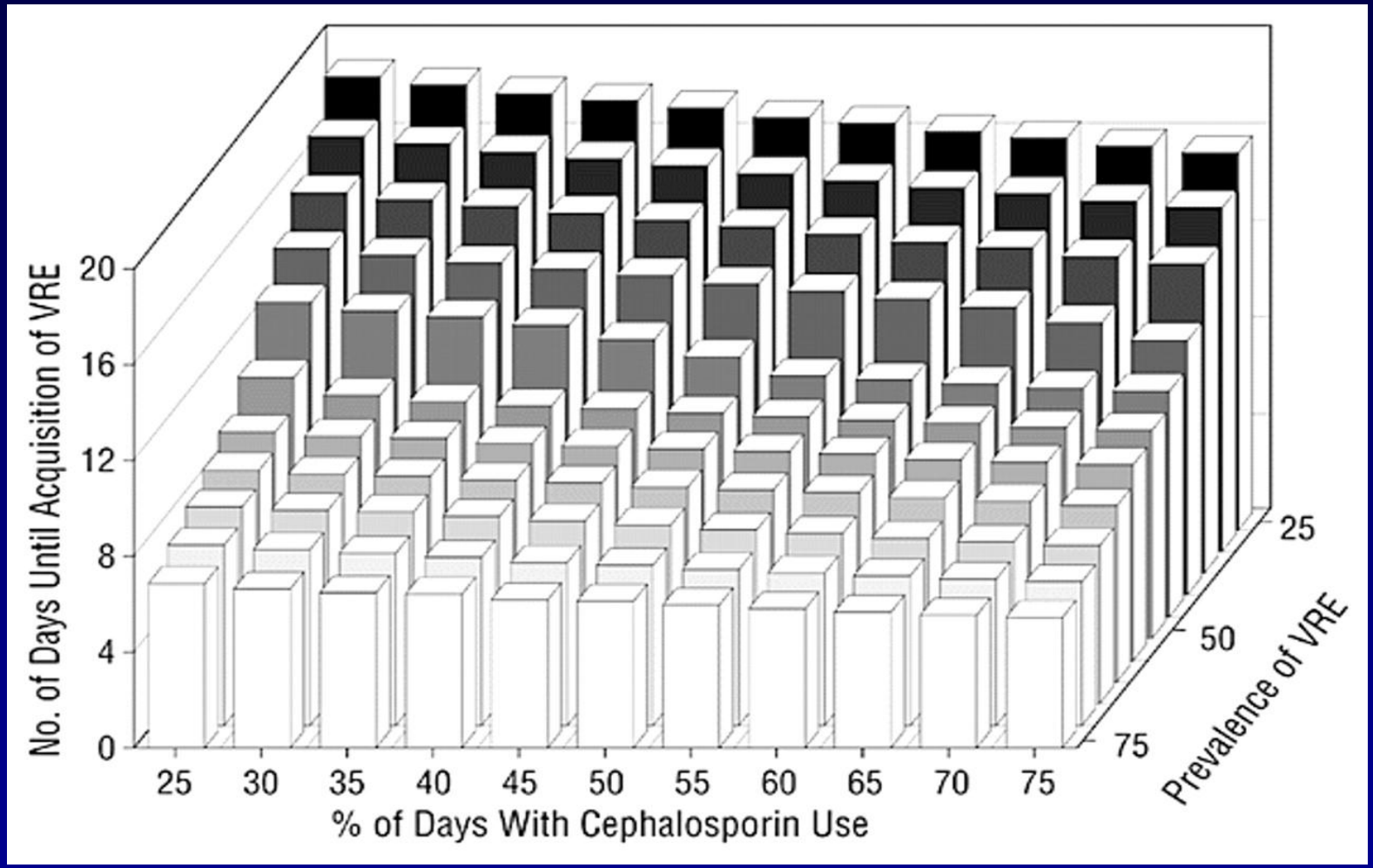
Squeezing the balloon:

- "Constraining one end causes the other end to bulge: Addressing the problem of antibiotic resistance by limiting the use of one class of compounds may be counteracted by corresponding changes in prescribing and drug resistance that are even more ominous"
    - *John P Burke JAMA 1998;280:1270-1*



Urban C, Segal-Maurer S, Rahal JJ. Clin Infect Dis. 2003;36:1268-74

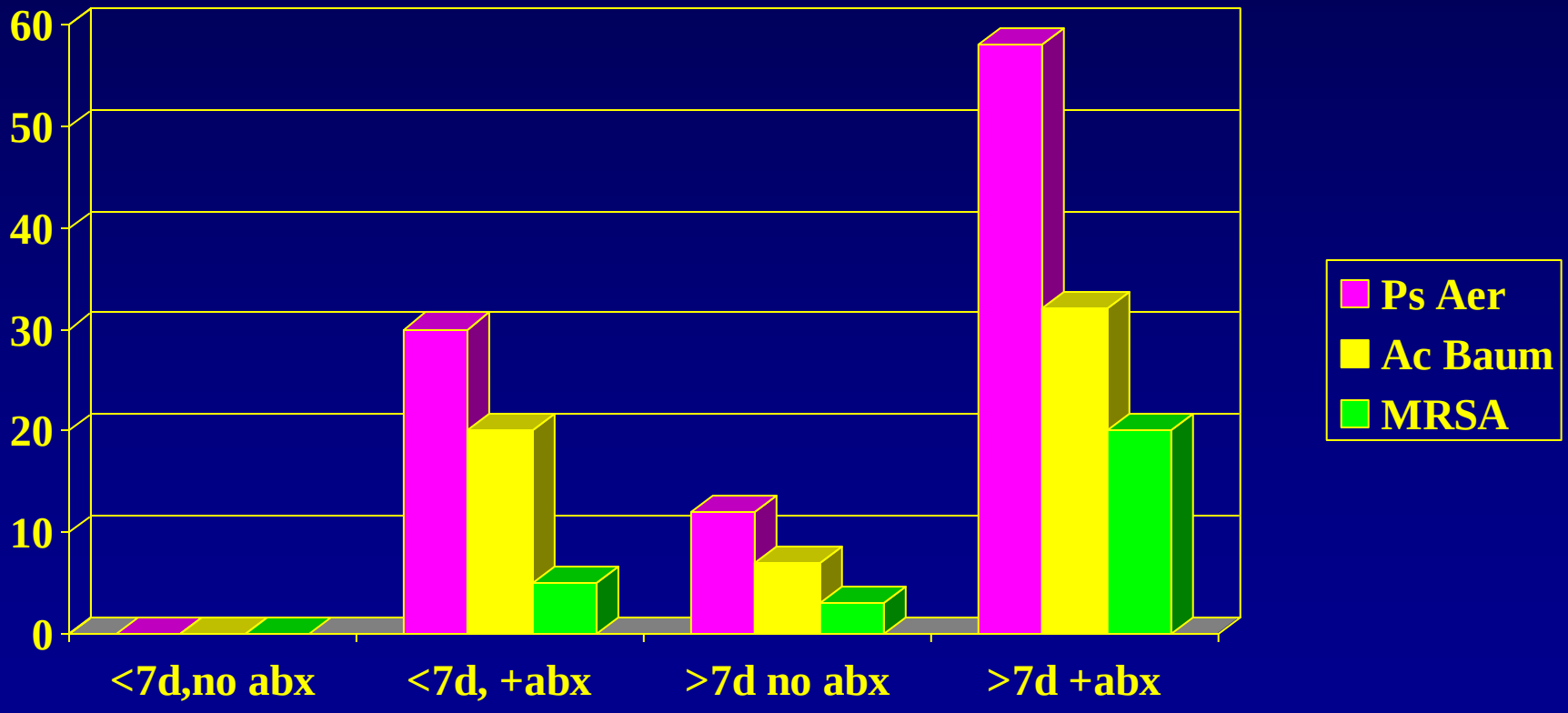
The median number of days until acquisition of vancomycin-resistant enterococci (VRE) in relation to the "colonization pressure" (prevalence) and the use of third-generation cephalosporins



Bonten, M. J. M. et al. Arch Intern Med 1998;158:1127-1132.

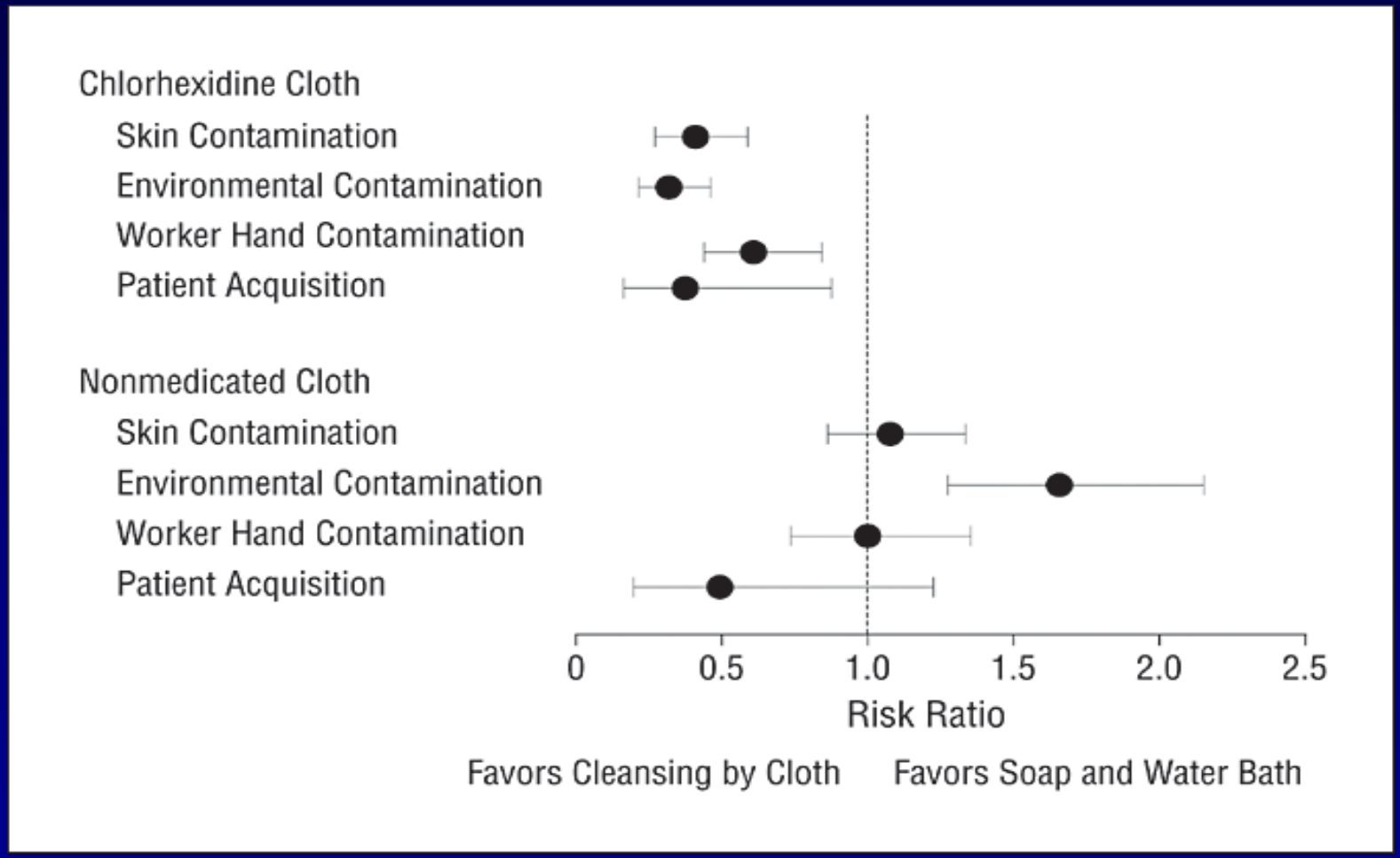
ARCHIVES OF INTERNAL MEDICINE

Ecological impact of antibiotics



Trouillet JL et al. Am J Resp Crit Care Med 1998;157:531-9

Risk ratios for skin contamination and environmental or health care worker contamination by or patient acquisition of vancomycin-resistant enterococci (VRE)



Vernon, M. O. et al. Arch Intern Med 2006;166:306-312.

ARCHIVES OF INTERNAL MEDICINE

Transfer of Vancomycin-Resistant Enterococci via Health Care Worker Hands

Amy N. Duckro, DO; Donald W. Blom, RN; Elizabeth A. Lyle, AB; Robert A. Weinstein, MD; Mary K. Hayden, MD

Background: The roles of the contaminated hospital environment and of patient skin carriage in the spread of vancomycin-resistant enterococci (VRE) are uncertain. Transfer of VRE via health care worker (HCW) hands is assumed but unproved. We sought to determine the frequency of VRE transmission from sites in the environment or on patients' intact skin to clean environmental or skin sites via contaminated hands of HCWs during routine care.

Methods: We cultured sites on the intact skin of 22 patients colonized by VRE, as well as sites in the patients' rooms, before and after routine care by 98 HCWs. Observers recorded sites touched by HCWs. Cultures were obtained from HCW hands and/or gloves before and after care. All isolates underwent pulsed-field gel electrophoresis. We defined a transfer to have occurred when a culture-negative site became positive with a VRE pulsotype after being touched by an HCW who had the same pulsotype on his or her hands or gloves and who had previously touched a colonized or contaminated site.

Results: Health care workers touched 151 negative sites after touching a site that was positive for VRE. Sixteen negative sites (10.6%) became positive after contact. The percentage of times that contact with a site led to a transfer was highest for antecubital fossae and blood pressure cuffs.

Conclusions: Vancomycin-resistant enterococci were transferred from contaminated sites in the environment or on patients' intact skin to clean sites via HCW hands or gloves in 10.6% of opportunities. Controlling VRE by decontaminating the environment and patients' intact skin may be an important adjunctive infection control measure.

Arch Intern Med. 2005;165:302-307

Description of 16 Vancomycin-Resistant Enterococci (VRE) Transfers

Duckro, A. N. et al. Arch Intern Med 2005;165:302-307.

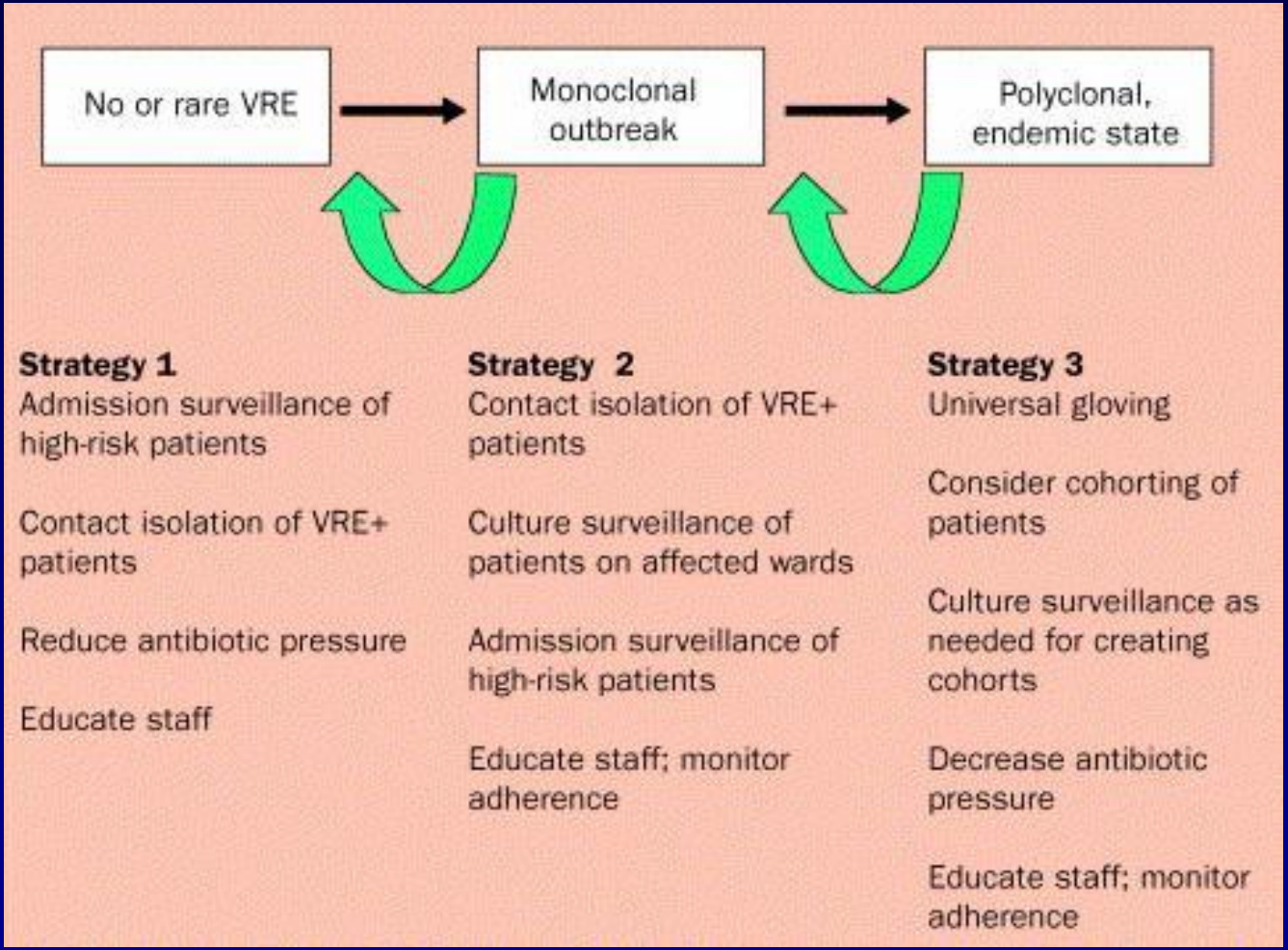
ARCHIVES OF INTERNAL MEDICINE

Table. Description of 16 Vancomycin-Resistant Enterococci (VRE) Transfers

No. of Culture Events	Health Care Worker No.	Origin Site*	Destination Site	VRE Pulsotype†	Vancomycin Resistance Type‡
2	1	Inguinal region	Bed rail	16	A
3	2	Antecubital region	Blood pressure cuff	5	B
6	3	Chest Bed rail	Infusion pump	10	A
6	3	Chest Bed rail	Transducer	10	A
6	4	Hygiene products Chest Wrist Wrist Inguinal region Wrist Wrist Chest Hygiene products Bed rail Wrist	Ankle	10	A
7	5	Inguinal region Inguinal region Ankle	Suction equipment	10	A
7	5	Inguinal region Ankle Ankle Inguinal region Wrist Wrist Bed rail	Bed table	10	A
10	6	Chest	Antecubital region	4	A
10	6	Chest Chest	Bed rail	4	A
12	7	Wrist	Inguinal region	19	A
12	8	Inguinal region	Drawer handle	19	A
16	9	Antecubital region	Back	4	A
16	9	Antecubital region Bed table Ankle	Wrist	4	A
19	10	Antecubital region Bed rail Bedding Blood pressure cuff Bedding	Back	21	B
19	10	Antecubital region Bed rail Bedding Blood pressure cuff Bedding Bed rail Suction equipment Bed rail	Ankle	21	B
25	11	Soap dispenser	Wrist	4	A

*Sites are listed in order of contact and according to the number of times that they were contacted.
†No *Enterococcus faecalis* strain was involved in a transfer.
‡Letter designates *vanA* or *vanB* resistance genotype.

Tailored strategies???



Bonten, Willems, Weinstein Lancet ID 2001;1:314-25

MAJOR ARTICLE

Genotyping and Preemptive Isolation to Control an Outbreak of Vancomycin-Resistant *Enterococcus faecium*

E. M. Mascini,[1] A. Troelstra,[2] M. Beltsma,[2] H. E. M. Blok,[2] K. P. Jalink,[2] T. E. M. Hopmans,[2] A. C. Fluit,[2] R. J. Hené,[3] R. J. L. Willems,[2,4] J. Verhoef,[2] and M. J. M. Bonten[2,4]

[1]Department of Clinical Microbiology and Clinical Immunology, Rijnstate Hospital, Arnhem, and [2]Eijkman-Winkler Centre for Microbiology,

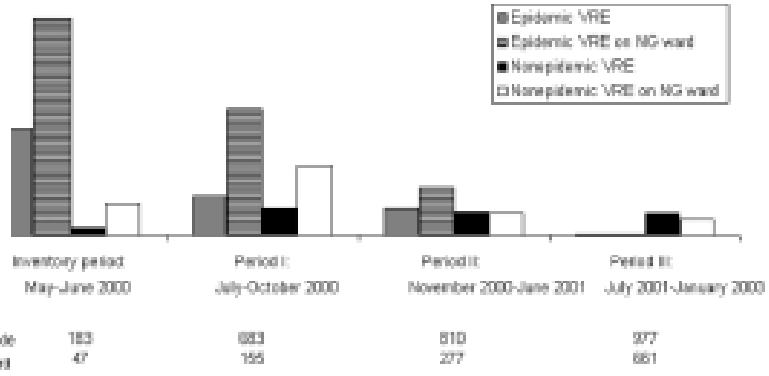


Figure 1. Percentages of newly identified patients colonized with epidemic (clusters I and II) and nonepidemic vancomycin-resistant *Enterococcus faecium* (VRE) during the different outbreak periods, 2000–2003. NG, nephrology/gastroenterology; Pts, patients.

Table 1. Summary of infection-control measures during the 3 periods of the outbreak.

Measure	Period I (June 2000–October 2000)	Period II (November 2000–June 2001)	Period III (July 2001–January 2003)
Cohorting of patients	A cohort of epidemic VRE patients, roommates of epidemic VRE patients, readmitted epidemic VRE patients, and newly admitted patients	A cohort of epidemic VRE patients, possible epidemic VRE patients, and newly admitted patients	No cohorts
Cohorting of nursing staff	Cohorts as much as possible into a cohort for all nursing staff, contact isolation for all patients	Cohorts as much as possible into a cohort	No special measures
Isolation of epidemic VRE patients	Contact isolation in a single room; patients stored in hospital information system	Contact isolation in a single room; patients stored in hospital information system	Contact isolation in a single room; patients stored in hospital information system
Isolation of possible epidemic VRE patients	For roommates of epidemic VRE patients, contact isolation in a cohort or single room until a negative culture results; for ward contacts of epidemic VRE patients, treatment in cohort until a negative swab test results; no contact isolation	Preemptive isolation of all patients hospitalized in the ward between January and November 2000, regardless of culture results; patients stored in hospital information system	None
Environmental disinfection	Disinfection of rooms of epidemic VRE patients after discharge	Disinfection of rooms of epidemic VRE patients after discharge	Disinfection of rooms of epidemic VRE patients after discharge
VRE screening	Containment of swabs from nonscreened and possible epidemic VRE patients 3 times weekly	Containment of swabs from nonscreened and possible epidemic VRE patients once weekly	Containment of swabs from nonscreened and possible epidemic VRE patients once weekly until September 2001 and once monthly thereafter

NOTE. Patients admitted with an epidemic strain of vancomycin-resistant enterococcus infection (VRE) were labeled "epidemic VRE patients." Patients with prior hospitalization in the nephrology/gastroenterology (NG) ward or medical intensive care unit were considered to be "possible epidemic VRE patients" until a consecutive rectal swab test results were negative for VRE.

Mascini et al Clinical Infectious Diseases 2006;42:739-746

Table 1. **Risk Factors for Nosocomial Colonization or Infection with Methicillin-Resistant *Staphylococcus aureus*, Vancomycin-Resistant Enterococcus, *Clostridium difficile*, Extended-Spectrum β-Lactamase–Producing Gram-Negative Bacilli, and *Candida**

Risk Factors	Odds Ratio or Relative Risk (References)				
	Methicillin-Resistant *Staphylococcus aureus* (11, 12, 16–26)	Vancomycin-Resistant Enterococcus (27–48)	Extended-Spectrum β-Lactamase–Producing Gram-Negative Bacilli (49–57)	*Clostridium difficile* (58–77)	*Candida* (78–87)
Advanced age	1.2 to 1.3 (17, 23)	2.6 (45)	NS (49, 51, 54, 56)	1.0 to 14.1 (60, 69, 74, 77)	1.5 (78)
Underlying disease			† (51), NS (49, 56, 57)		
Renal failure	† (12, 17, 18, 22, 23, 26)	4.4 to 6.98 (35, 42)		1.71 to 6.7 (66, 76)	1.4 to 22.1 (79, 84)
Hematologic cancer	† (12, 17, 23, 26), NS (22)	8.4 (33)			1.7 to 45.0 (82, 83)
Hepatic failure	† (12, 17, 23, 26)				7.3 to 42 (85, 86)
Severity of illness‡	1.9 (24)	2.3 to 6.1 (29, 30, 32, 47)	11.6 (53)	2.0 (63)	† (80–83, 85–87)
Interhospital transfer of a patient; patient from a nursing home	6.9 (24)	4.1 to 2.9 (32, 45)	3.6 (52)	3.1 (66)	21.3 (79)
Extended length of stay	1.7 to 17.5 (16–19, 21–23, 25, 26)	1.1 to 2.9 (28, 31–34, 38, 44)	1.1 to 9.0 (49, 50, 57)	1.3 to 3.6 (62, 67, 75)	(83)§
Invasive procedures or devices	(17)§				
Gastrointestinal surgery	(18, 45)§	3.3 to 6.93 (31, 48)	2.5 to 13 (49, 56)	1.6 to 6.0 (58, 60, 61, 74)	2.5 (84)
Transplantation	† (12, 18, 23, 25)	3.2 to 6.75 (44, 46)	† (51, 55, 56), NS (54, 57)	4.2 (66)	3.2 (84)
Central venous or arterial catheter	2.7 to 4.7 (12, 17, 22, 26)	2.7 (38)	1.8 (51, 52)	† (58–77)	5.8 to 26.4 (78–80, 87)
Urinary catheter	NS (11, 17, 18, 22, 26)	† (34, 36, 41, 44, 47, 48), NS (38, 40, 45)	2.5 to 12.8 (51, 54, 55)	† (58–62, 64–77), NS (63)	13.0 (79)
Intubation and mechanical ventilation	(18)§	† (34, 41, 44), NS (36, 38, 40, 45, 47)	1.2 to 2.8 (51, 54, 55)	† (58–77)	† (81, 85–87)
Tube feeding	5.5 (19)	1.3 to 6.1 (33, 36)	1.4 (56)	1.4 to 19.7 (63, 68, 73)	† (81, 85, 86), NS (87)
Anti-infective therapy					
Cephalosporins	3.1 (24)	1.6 to 13.8 (39, 41, 44)	NS (49, 52, 54–56), † (52, 56)	1.4 to 28.6 (64, 65, 69)	NS (81, 86, 87)
Penicillins	NS (22, 23), † (11, 12, 17, 18)	† (34, 36, 48), NS (37, 38, 40, 44)	NS (49, 55), † (51, 52, 54, 56)	3.4 to 4.9 (59, 68)	NS (81, 86, 87)
Clindamycin	† (12, 17, 18, 22, 26)	(37)§	NS (49, 55), † (51, 52, 54, 56)	15.6 to 42 (61, 62)	NS (81, 86, 87)
Vancomycin	† (11, 17, 18, 23), NS (22)	2.3 to 11.0 (27, 29, 32, 33, 40, 42, 44–46, 48)	† (49, 51, 52, 54, 55)	3.1 (59)	275 (81)
Fluoroquinolones		38 (29)	1.4 to 8.77 (49, 56, 57)		
Multiple antibiotics	1.7 to 11.3 (16, 19, 21, 24, 26)	1.6 to 14.5 (42, 43, 45, 47)	(49, 50, 53, 56)§	1.6 to 22.6 (63, 65, 70, 72, 74)	1.7 to 25.1 (79, 80)

* NS = not significant.
† Not evaluated.
‡ According to Acute Physiology and Chronic Health Evaluation II (APACHE II) score or Simplified Acute Physiology Score (SAPS).
§ Found significant in a multivariable model but magnitude of increased risk not quantified.

Safdar & Maki
Ann Intern Med
2002;136:834-44

Journal of Hospital Infection (2000) 44: 294–300
Article no. jhin.1999.0696, available online at http://www.idealibrary.com on IDEAL®

Control of an outbreak of vancomycin-resistant *Enterococcus faecium* in an oncology ward in South Africa: effective use of limited resources

K. M. McCarthy*, W. Van Nierop*, A. Duse*, A. Von Gottberg*, M. Kassel*, O. Perovic* and R, Smego*

**Division of Hospital Epidemiology and Infection Control, Department of Clinical Microbiology and Infectious Diseases, School of Pathology, South African Institute of Medical Research and the University of the Witwatersrand*

Summary: An outbreak of vancomycin-resistant enterococci (VRE) occ
large teaching hospital in Johannesburg, South Africa. The outbreak str
faecium carrying the *vanA* resistance genotype. Macro-restriction analysis
were clonally related. Modified infection control interventions were impl
was achieved. Although the epidemiology of VRE is well documente
Australia, this problem has only recently emerged in South Africa.
appears similar to that described for outbreaks elsewhere. © 2000 The H

Keywords: Vancomycin-resistant enterococci (VRE); South Africa; infection cont

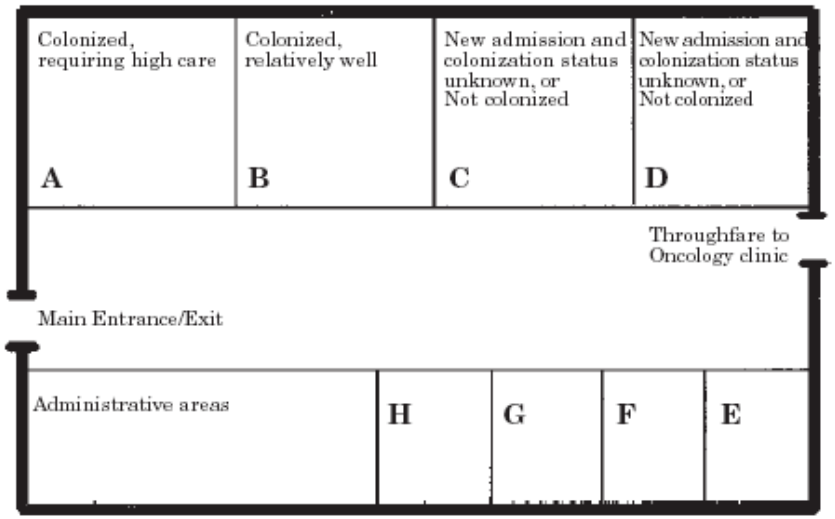


Figure 1. A floorplan of the adult oncology ward. A-D: Large cubicles containing six to eight beds. |E-H: Isolation cubicles. New patients are allocated to cubicle D or an isolation cubicle until results of rectal surveillance swab available.

Screening for Vancomycin-resistant Enterococci Using Stools Sent for *Clostridium difficile* Cytotoxin Assay is Effective: Results of a Survey of 300 Patients in a Large Singapore Teaching Hospital

Joshua KX Tay,[1] *MBBS*, Ethan E Bodle,[2] *MD, MPH*, Dale A Fisher,[1,3] *MBBS, FRACP*, Raymond VTP Lin,[4] *MBBS, FRCPA*, Gamini Kumarasinghe,[4] *MBBS, FRCPath, FRCPA*, Paul A Tambyah,[1,3] *MBBS, FAMS*

Abstract

Introduction: To assess the efficacy of screening stools se assay (CDTA) for surveillance of vancomycin-resistant Methods: From April to May 2005, all stools submitted for using vancomycin containing culture media. Isolates we vancomycin resistance confirmed, followed by polymerase c vancomycin resistance genes and DNA fingerprinting. Ov period, stool specimens or rectal swabs were also obtained (haematology, oncology, renal and intensive care). Fifty compared in terms of VRE risk factors previously ident prevalence of VRE in both groups was similar [3/204 (1.5% in the high-risk arm; $P = 1.0$, Fisher's exact test]. Prevalence including age, duration of hospitalisation, exposure to antibio presence of malignancy and diabetes mellitus was similar i failure ($P < 0.05$) was more common in the high-risk group. genetically distinct by variable number tandem repeat (V *faecium* (2 with the vanB gene, 1 with vanA) and one *E. fa* our high-risk patients are VRE carriers. In-hospital VRE s is a simple, reasonable surrogate for screening individual high-risk patients as the patient risk profile is similar and the yield comparable in a low-prevalence setting.

Table 1. Comparison of Patients in the CDTA Group and High-risk Group*

Variable	CDTA patients (n = 51)	High-risk patients (n = 51)	*P* value
Baseline characteristics			
Male, %	43.1	52.9	0.33
Age, y	57.8 ± 20.3	58.4 ± 17.1	0.89
Chinese, %	66.7	52.9	0.23
Clinical characteristics			
Duration of hospitalisation, d	11.3 ± 16.9	10.1 ± 10.0	0.65
Time in intensive care, d	4.6 ± 10.6	3.8 ± 9.1	0.71
Institutional transfer, n (%)	3 (5.9)	3 (5.9)	1.0
Underlying conditions, n (%)			
Diabetes	12 (23.5)	21 (41.2)	0.06
Renal failure	5 (9.8)	15 (29.4)	0.01
Haematologic cancer	7 (13.7)	5 (9.8)	0.54
Other cancer	15 (29.4)	12 (23.5)	0.50
Invasive procedures or devices, n (%)			
Gastrointestinal surgery	3 (5.9)	6 (11.8)	0.49
Central arterial or venous catheter	20 (39.2)	20 (39.2)	1.0
Urinary catheter	18 (35.3)	19 (37.3)	0.84
Nasogastric tube	16 (31.4)	12 (23.5)	0.38
Mechanical ventilation	15 (29.4)	10 (19.6)	0.25
Anti-infective therapy, n (%)			
Aminoglycosides	17 (33.3)	14 (27.5)	0.52
Cephalosporins	28 (54.9)	26 (51.0)	0.69
Fluoroquinolones	18 (35.3)	11 (21.6)	0.12
Metronidazole	11 (21.6)	8 (15.7)	0.45
Vancomycin	14 (27.5)	13 (25.5)	0.82
Multiple antibiotics†	32 (62.3)	25 (49.0)	0.16

* Values are expressed as the mean ± SD unless otherwise noted
† Defined as having 2 or more antibiotics administered during period of hospitalisation

Ann Acad Med Singapore 2007;36:926-9

HOSPITAL ADMINISTRATIVE POLICY

ISOLATION POLICY: PATIENTS WITH VANCOMYCIN RESISTANT ENTEROCOCCUS (VRE)

Document No.:	Revision:	Original Date:	Effective Date:
NUH-HAP-INF-018	07	01-12-04	20-08-11
Process Owner:		**Approval:**	
A/Prof Dale Fisher Chairman, Infection Control Committee		A/Prof Aymeric Lim Chairman, Medical Board	
Description of Content/Change:			
☐ New Document ☐ Major Content Change ☒ Minor Content Change ☐ Non-content Change ☐ Deletions Only			

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1.0 Objective

6.3 Contact Tracing

6.3.1 Patients in the same room or cubicle as a VRE positive patient on/ or after the date of sampling are to be identified. One sample from peri-rectal or rectal or colostomy site is to be taken for contact patients who are still in hospital, and Contact Precautions must be practised when attending to patient until the VRE screening result is known to be negative. Those patients need NOT be placed in a single room unless result is positive for VRE. No swab will be taken for contact patient who has already been discharged.

6.3.2 Look-back tracing may only be necessary for cases where index patient is a potential high shedder or exposed patients are high risk group and exposure within one month.

6.3.3 The cost of the "contact" patients' VRE test is borne by the Epidemiology Unit.

7.0 Annexes

Journal of Clinical Microbiology, Mar. 2006, p. 1153–1155 Vol. 44, No. 3
0095-1137/06/$08.00+0 doi:10.1128/JCM.44.3.1153–1155.2006

Emergence of Linezolid Resistance in the Vancomycin-Resistant *Enterococcus faecium* Multilocus Sequence Typing C1 Epidemic Lineage

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Received 27 October 2005/Returned for modification 1 December 2005/Accepted 10 January 2006

A relatively high rate of vancomycin-resistant *Enterococcus faecium* not susceptible to linezolid was observed in intensive care unit patients. Linezolid-resistant isolates carried the G2576T mutation in the 23S rRNA gene, belonged to different clones, and shared the same allelic profile, which clusters in the C1 multilocus sequence typing epidemic lineage.

Should we try to control VRE?

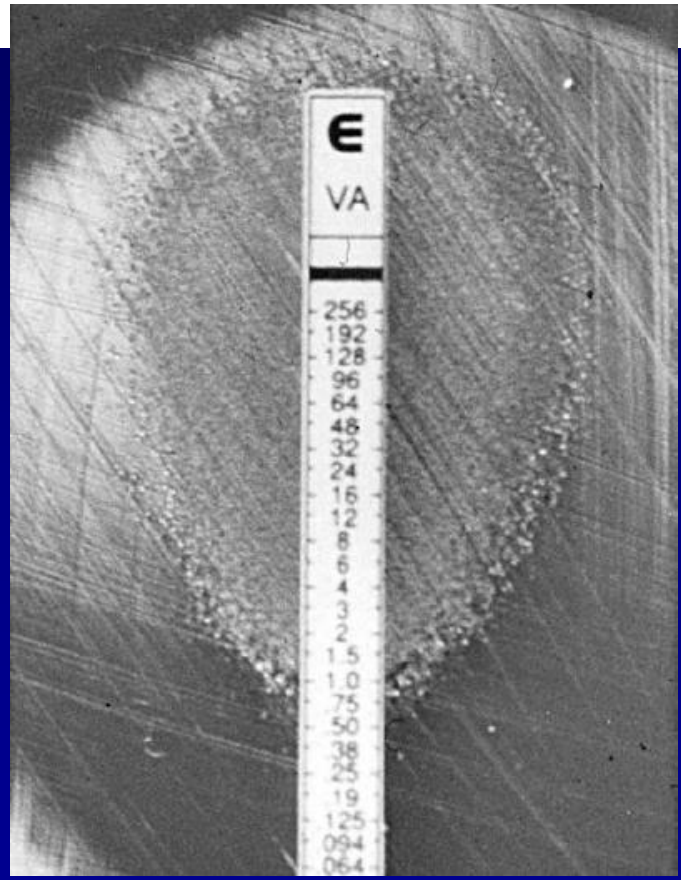
TABLE 1. Clinical data of patients infected or colonized by linezolid-resistant *E. faecium* and molecular typing of linezolid-resistant isolates

Patient (sex/age [yr])	Ward[a]	Underlying disease(s)	Risk factors[b]	Strain code	Type or site of infection (isolation date [mo/day/yr])	Linezolid MIC (µg/ml)	PFGE type[c]	MLST type	Detection of G2576T mutation	Detection of T2504 mutation
P1 [illegible]	[illegible]	Kidney transplant	Prolonged hospitalization [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Yes	[illegible]
				[illegible]	[illegible]	[illegible]	[illegible]		Yes	Yes
P2 [illegible]	[illegible]	[illegible]	Prolonged hospitalization [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Yes	Yes
				[illegible]	[illegible]	[illegible]	[illegible]		Yes	Yes
				[illegible]	[illegible]	[illegible]	[illegible]			
P3 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Yes	Yes
P4 [illegible]	[illegible]	[illegible]	Prolonged hospitalization [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Yes	Yes
P5 [illegible]	[illegible]	[illegible]	Prolonged hospitalization [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Yes	Yes
P6 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Yes	Yes
				[illegible]	[illegible]	[illegible]	[illegible]		Yes	Yes

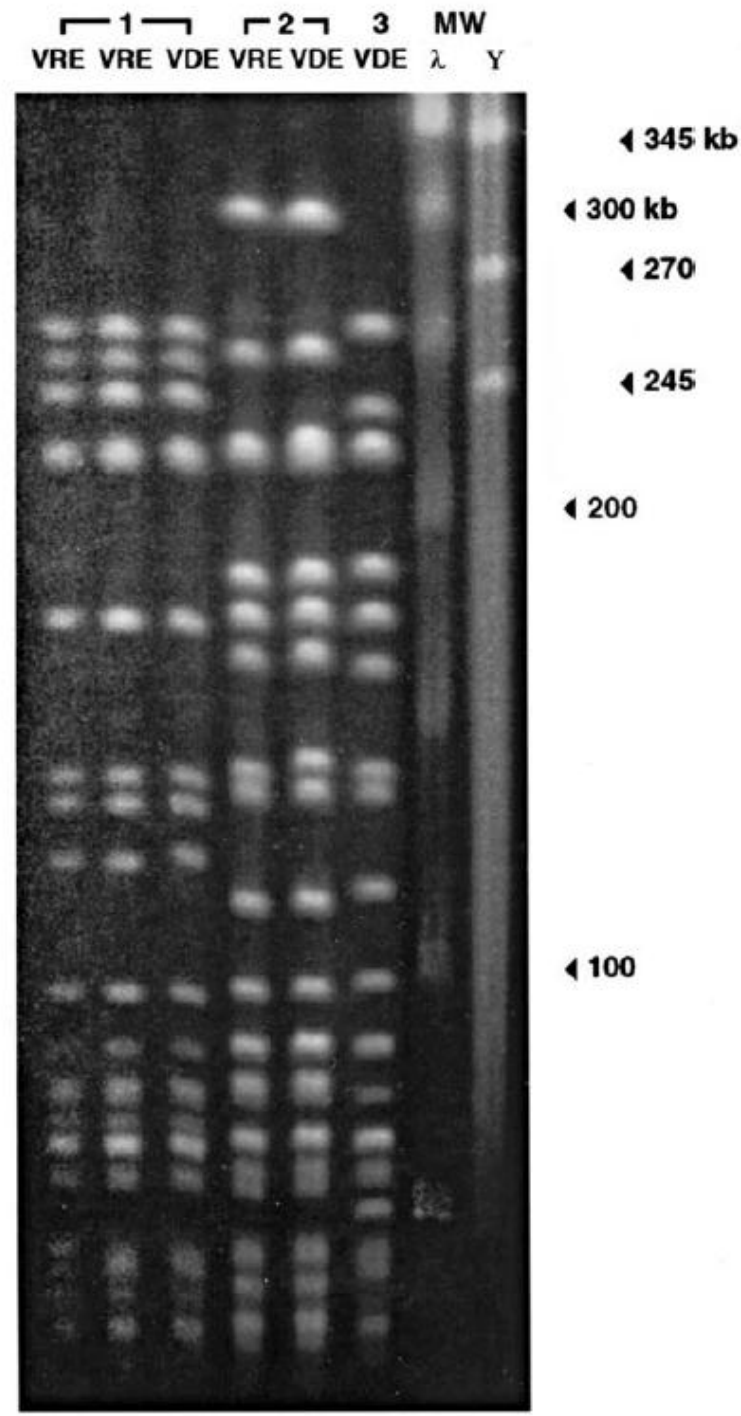
[a] [illegible]
[b] [illegible]
[c] [illegible]

Nosocomial Infection with Vancomycin-dependent Enterococci[1]

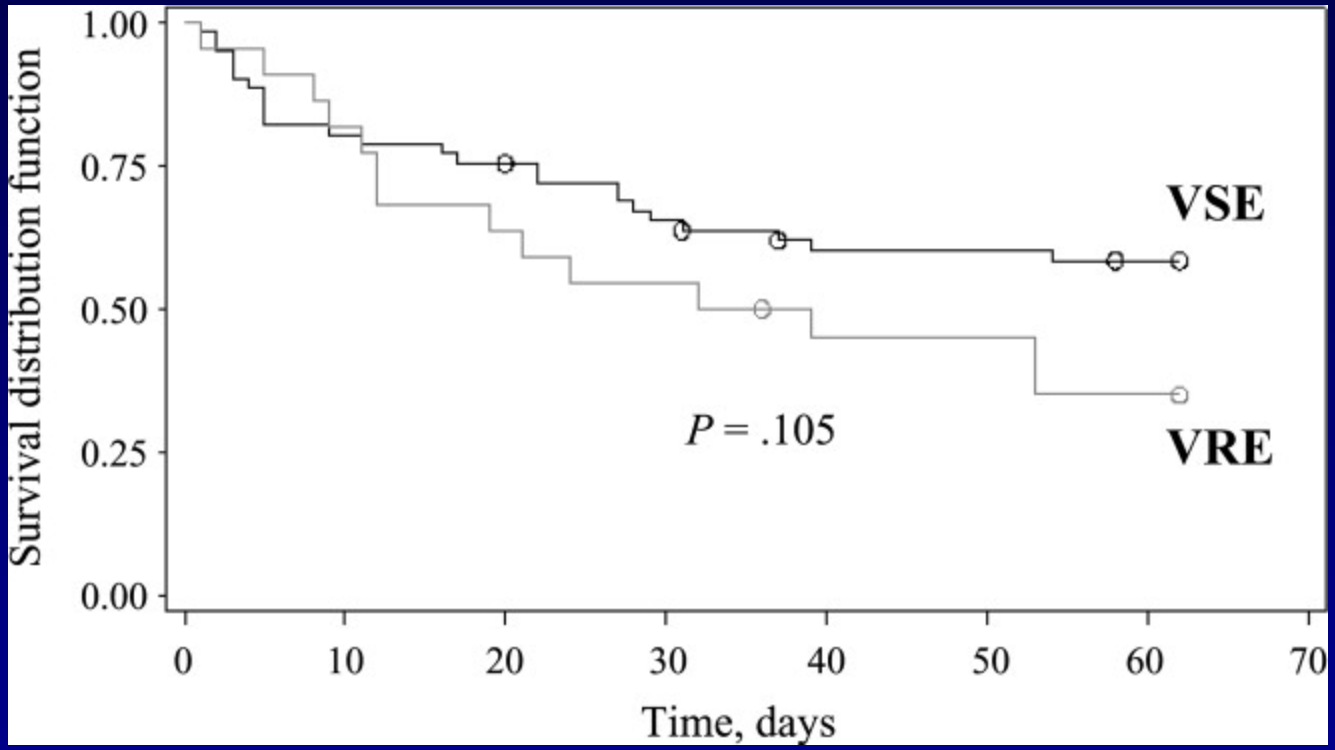
Paul A. Tambyah,* John A. Marx,* and Dennis G. Maki*



EID 2004



May not be necessary: VRE & Mortality (neutropenic pts)



DiazGranados & Jernigan JID 2005;191:588-595

May not be possible: VRE from poultry

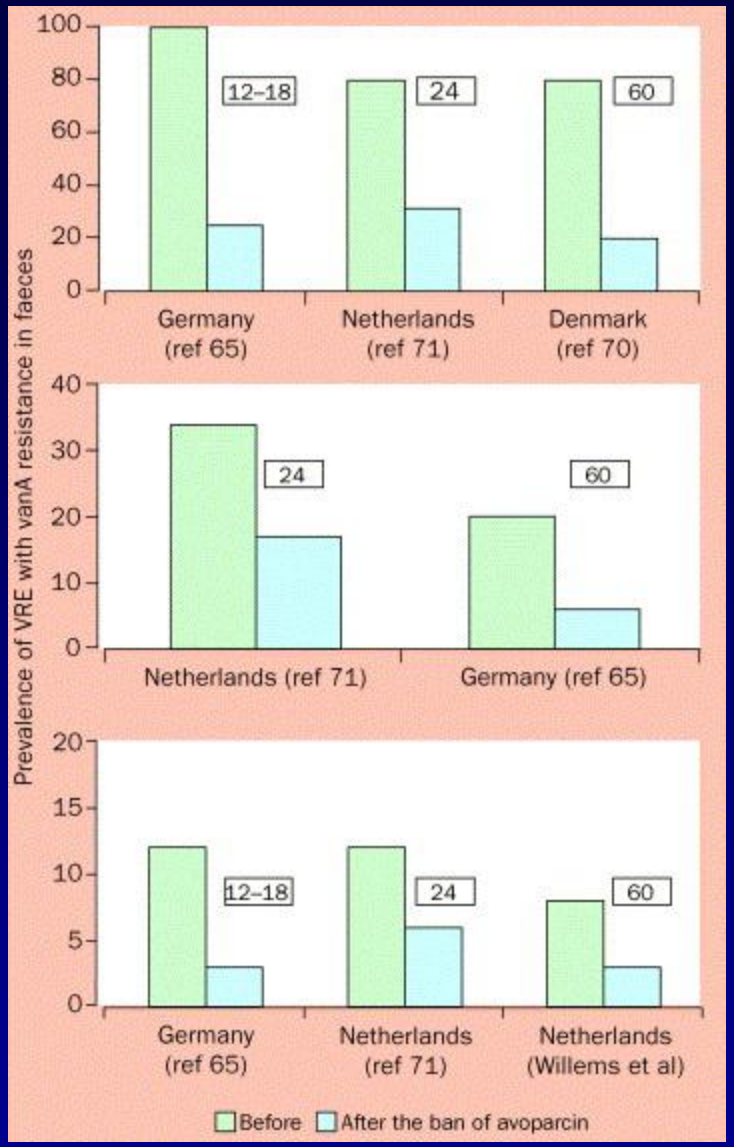
TABLE 1. Numbers of VREF and VSEF isolates recovered from various poultry sources in Norway at different times and analyzed by the AFLP method

Source of isolates	No. of isolates				Reference(s)
	1995	1998	1999	Total	
Broiler or turkey feces	15	20	14	49	4, 5, 14
Broiler or turkey carcass					
VREF	15	20	0	35	6, 14
VSEF	0	21	0	21	Unpublished data
Total	15	41	0	56	
Broiler farm environment					5
Farm 1	0	0	46	46	
Farm 2	0	0	45	45	
Farm 3	0	0	11	11	
Farm 4	0	0	3	3	
Farm 5	0	0	8	8	
Total	0	0	113	113	
Total	30	61	127	218	

Borgen et al Appl Envir Micro 2002

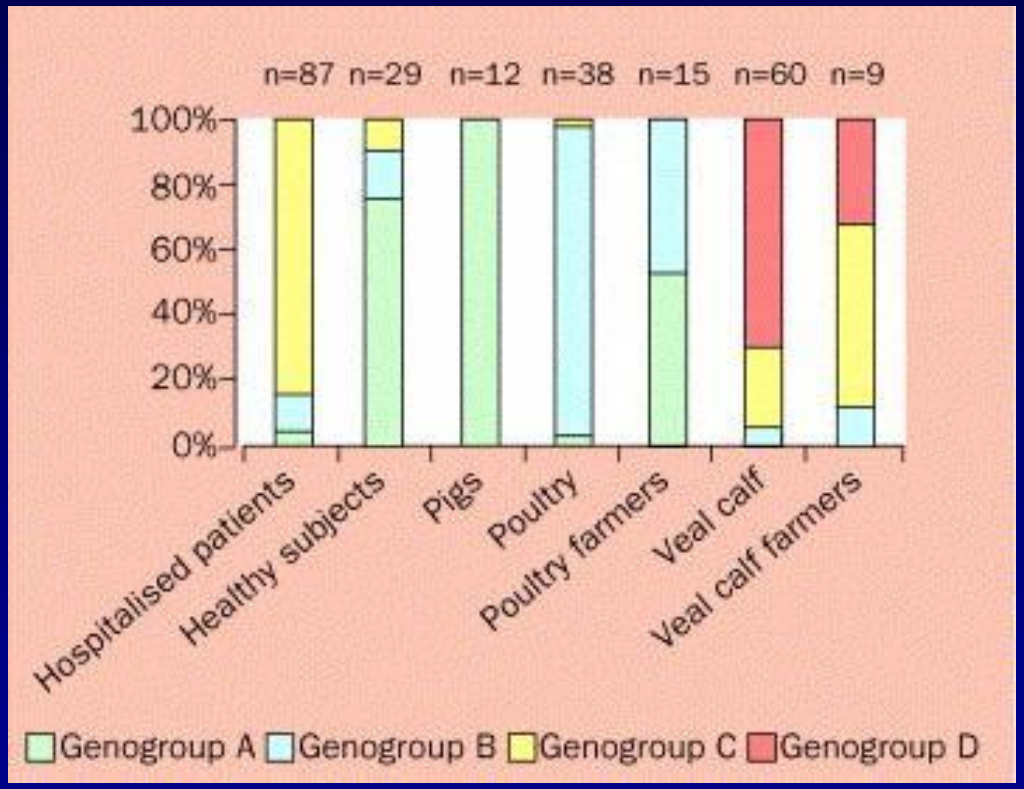
VRE in the Community in Europe

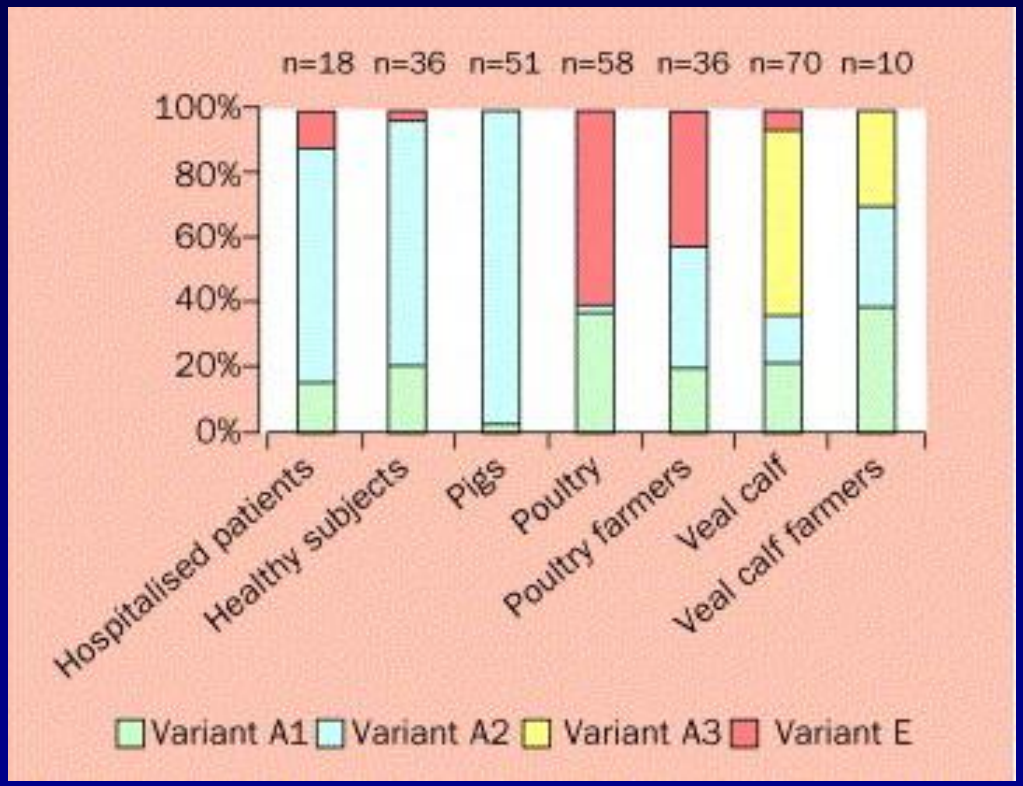
Before and after Avoparcin Ban



Bonten, Willems, Weinstein Lancet ID 2001;1:314-25

VRE in the Netherlands





Distribution of the major Tn1546 transposon types

Bonten, Willems, Weinstein Lancet ID 2001;1:314-25

Singapore hospitals ARE different

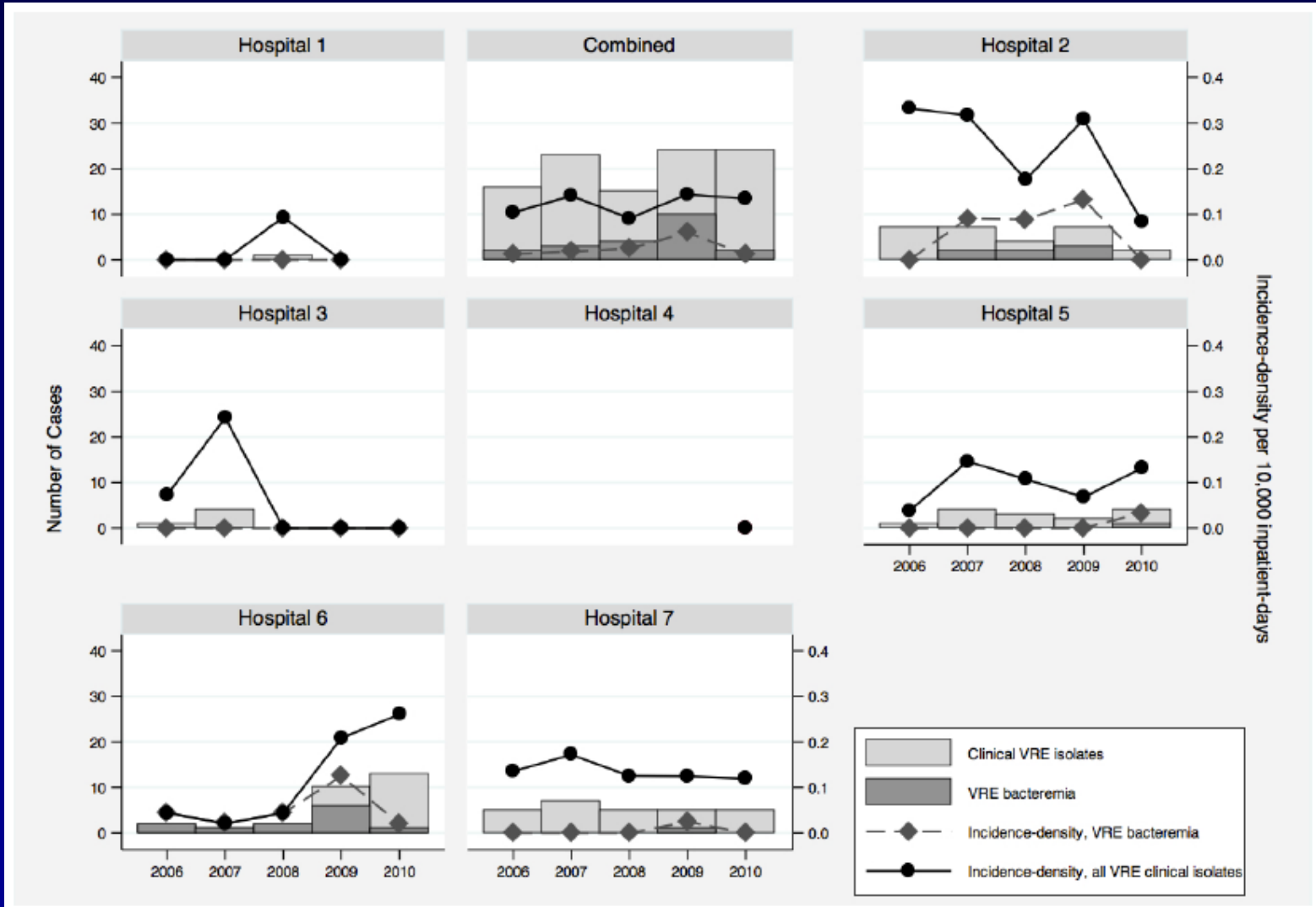


Fig. 1. Incidence-density and number of vancomycin-resistant enterococci isolates from clinical and blood cultures, by hospital, 2006-2010.

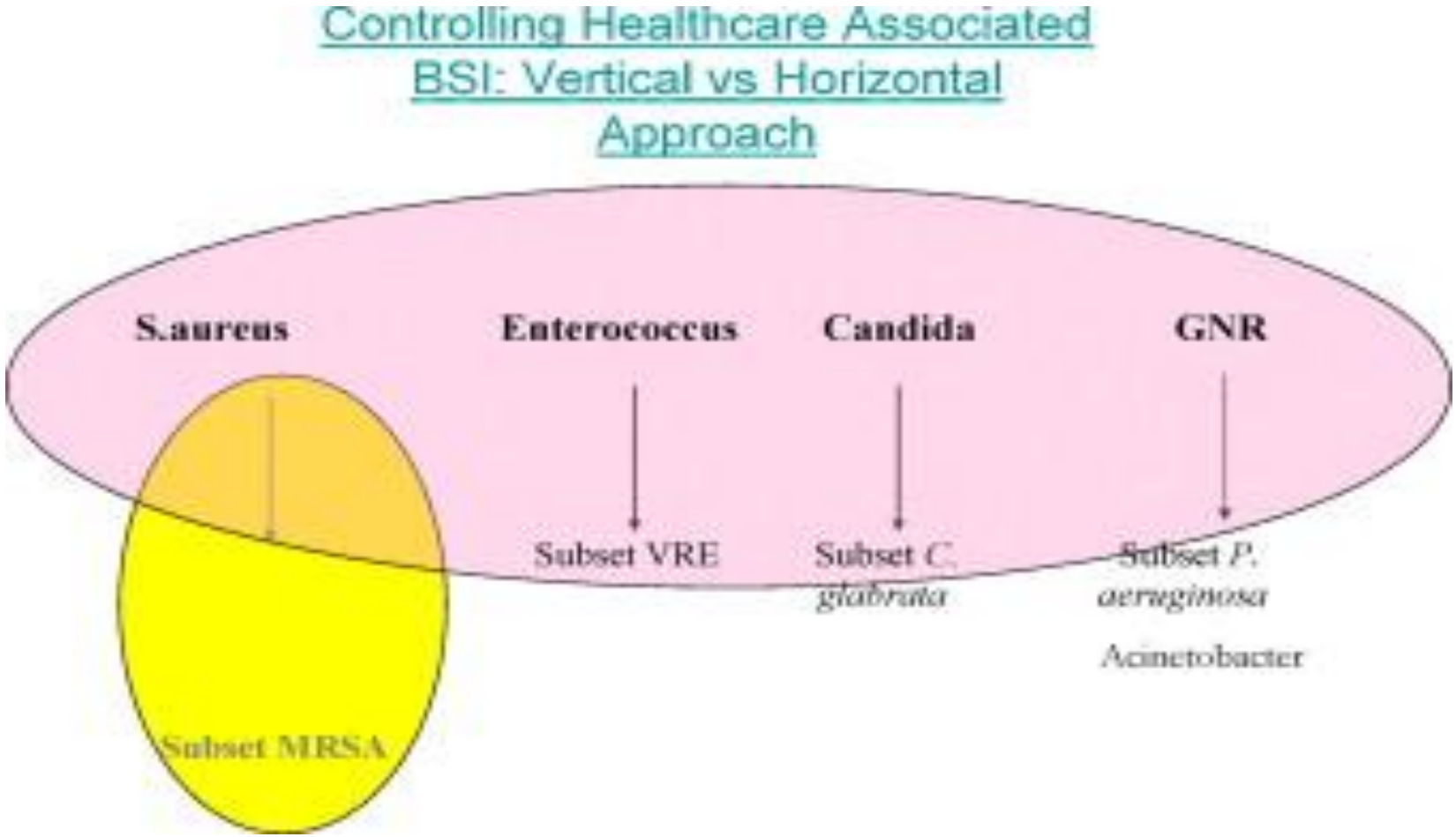


Figure 2 A conceptual image of a vertical program such as one focusing on <ce:italic> Staphylococcus aureus</ce:italic> or MRSA vs. one focusing on all organisms causing healthcare-associated infections including all <ce:italic> S. aureus</ce:it...

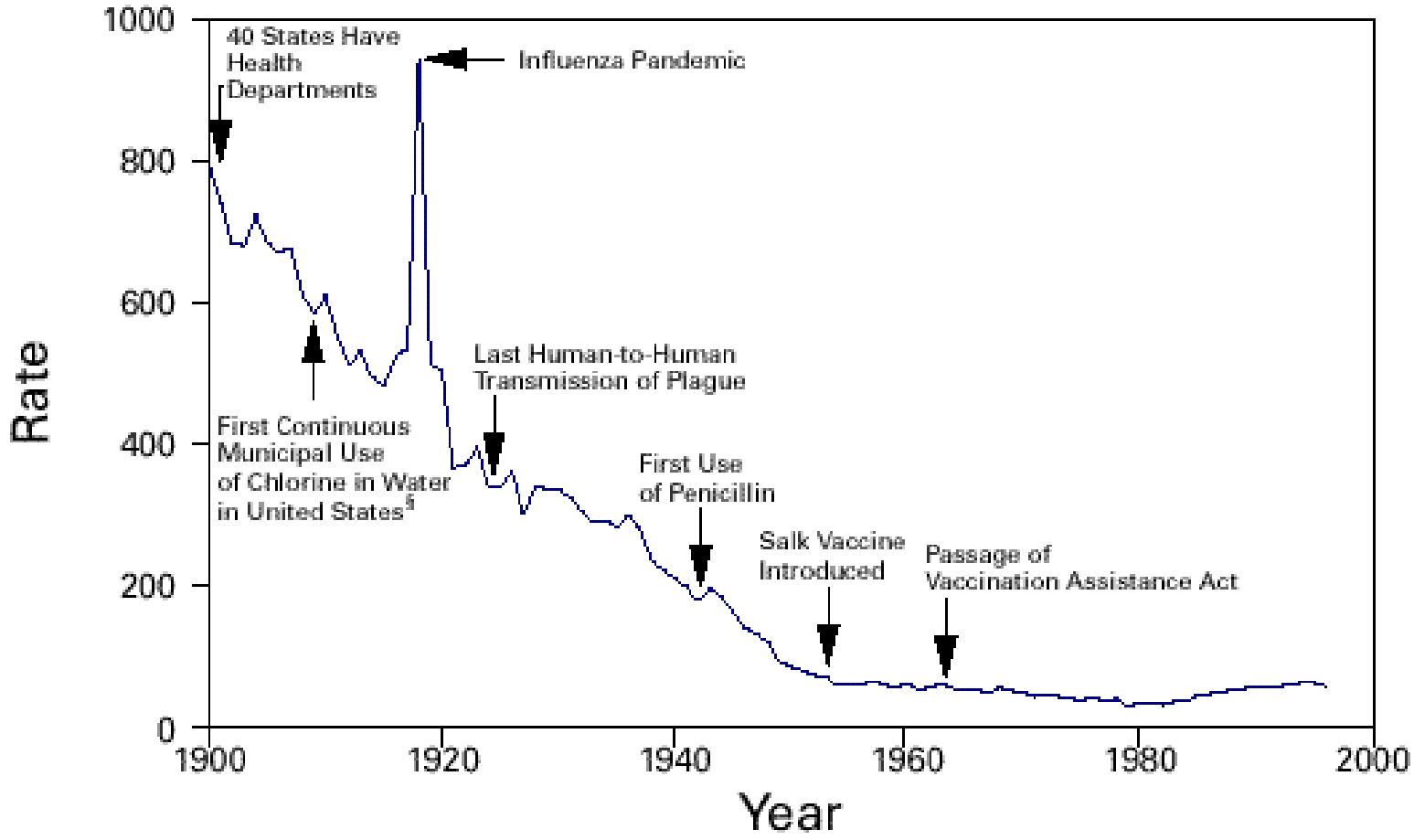
Richard P. Wenzel , Michael B. Edmond

Infection control: the case for horizontal rather than vertical interventional programs

International Journal of Infectious Diseases Volume 14, Supplement 4 2010 S3 - S5

http://dx.doi.org/10.1016/j.ijid.2010.05.002

FIGURE 1. Crude death rate* for infectious diseases — United States, 1900–1996†



*Per 100,000 population per year.

†Adapted from Armstrong GL, Conn LA, Pinner RW. Trends in infectious disease mortality in the United States during the 20th century. JAMA 1999:281;61–6.

§American Water Works Association. Water chlorination principles and practices: AWWA manual M20. Denver, Colorado: American Water Works Association, 1973.

MMWR 1999 / 48(29);621-629

Why do infection control??

- It saves money
- It saves lives
- It is the right thing to do……

Paul Ananth Tambyah

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