Control of VRE Outbreak

Local experience

W.K.To

Nov 2012

VRE (耐萬古霉素腸球菌) – Some facts …

- Enterococci live in our intestines and on our skin, usually without causing disease
- Some patients contract VRE more easily:
  - Those who have been previously treated with the antibiotic vancomycin or other antibiotics for long periods of time.
  - Hospitalized patients, particularly when they receive antibiotic treatment for long periods of time.
  - People with weakened immune systems such as patients in intensive care units, or in cancer, haematology or transplant wards.
  - Patients who have undergone surgical procedures such as abdominal or chest surgery.
  - Patients with medical devices that stay in for some time such as urinary catheters or central intravenous (IV) catheters.
- Most cases are asymptomatic carriers, but colonized individuals are at an increased risk of developing VRE infection (relative risk of 3).
- Most common infections being the urinary tract, surgical wounds, and/or bloodstream infecton.

VRE (耐萬古霉素腸球菌) – Some facts …

- Mortality of VRE bacteremia is approximately twice that of vancomycin sensitive Enterococcal (VSE) species (36.6% with VRE versus 16.4% with VSE).
- Non-human reservoir: animals, poultry, relate to use of growth promoter avoparcin (Europe)
- There are limited treatment options:
  - Linezolid, Synercid (not for E. faecalis)
  - Daptomycin
  - Doxycycline, fosfomycin (UTI)
- Absence of decolonization protocol:
  - ?Use of oral Ramoplanin (a non absorbable a glycolipodepsipeptide)
- Prolonged survival in environment:
  - Survive in wide range of pH and temperature (between 10C to 45C)
  - It can survive on dry surface (7 days to 4 months).
- Well-known for its ability in causing nosocomial outbreak. The most common species causing outbreaks in hospitals are *Enterococcus faecalis* and *Enterococcus faecium*.

Some facts …VRE global situation

First reported in 1986 (30 years after vancomycin was clinically introduced)

Hong Kong (2010)	0.4%
U.S. (2003)[1]	28.5%
U.K. (2007)[2]	8.5-12.5%*
Australia (2005)[3]	0.73%
Singapore (2006)[4]	0.8%

US:

- 1989-1993: 0.3→7.9% of nosocomial enterococcal infections (26 fold) (NNIS)
- 0.4 →13.6% in ICU, (34 fold) (>200 beds, university hospitals) (MMWR 1993;42:597-9)

Taiwan#

- **1996: 1.2%, 2000: <2%□ 2003: 6.1%**

*Blood culture case only

1. National Nosocomial Infections Surveillance (NNIS) System Report, data summary from January 1992 through June 2004, issued October 2004. Am J Infect Control 2004
2. Emergence and Spread of Vancomycin Resistance Among Enterococci in Europe. Eurosurveillance 2008
3. Prevalence of Antimicrobial Resistance in Enterococcus Isolates in Australia, 2005: Report from the Australia Group on Antimicrobial Resistance. CDI 2007
4. Amtimicrobial drug resistance in Singapore hospitals. Emerg Infect Dis. 2007

JHI 2010;74:377-84

80人染VRE 抗藥惡菌 港臨「非常時期」

■曾艾壯籲各醫院小心處理病人糞便防VRE擴散。香港文匯報記者林裕華 攝

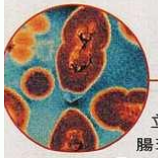
香港文匯報訊 (記者 林裕華) 港人感染抗萬古霉素腸球菌(VRE)近年趨升，從前年9宗源頭個案，增至今年至今已有25宗，明愛醫院和伊利沙伯醫院更出現交叉感染擴散，共有80人受感染。醫管局總感染控制主任曾艾壯表示，雖然VRE未成為風土病，但已進入「非常時期」，醫院須做好檢測和清潔工作，防止疫情擴散。

VRE是隱性抗藥惡菌，藏於腸道內並沒有明顯病徵，對抗生素萬古霉素具抗藥性。近年本港VRE源頭個案漸趨上升，2009年有9宗、2010年為15宗，今年至今已有25宗。因VRE多循糞便傳播，醫護人員處理病人糞便時容易交叉感染，明愛醫院和伊利沙伯醫院便因而出現較大規模VRE爆發，分別有43人和37人受感染。

護士工友處理糞便交叉感染

曾艾壯表示，明愛醫院感染人士來自內科和老人科，護士和工友常要處理長者糞便，故出現交叉感染，而伊利沙伯醫院感染人士則來自腸外科，治

惡菌VRE肆虐九龍 病人激增



【本報訊】公立醫院抗萬古霉素腸球菌（VRE，圖）個案較去年倍增，經化驗證實帶菌的病人由去年15宗增至今年25宗，其中逾九成個案來自九龍區三個醫院聯網。醫管局上月進行的普查，也發現兩個來自瑪嘉烈醫院和明愛醫院的樣本帶VRE，反映惡菌在九龍區肆虐。

可因併發症致死

根據醫管局數字，經糞便或血液樣本化驗後，今年有25名病人證實感染VRE，較去年的15宗增約一倍，也較09年的9宗大增。今年的25宗個案中，有23人來自九龍中、西和東醫院聯網，當中九龍西佔11個。

VRE可經感染者的糞便傳播，速度甚快，伊利沙伯醫院今年感染及帶菌病人總數達37人；同屬九龍西的明愛醫院則共有43人感染及帶菌。帶菌者未必致病，但亦有可能出現腹痛及發燒等症狀，最嚴重可因併發症致死。

醫管局曾進行普查，化驗上月17至21日收到的141名肚瀉病人糞便樣本，發現明愛醫院和瑪嘉烈醫院各有一名病人感染VRE，比率為1.42%。但醫管局總感染控制主任曾艾壯認為這數字顯示VRE未有在公立醫院擴散，「只係個別醫院問題。」

Superbug leads to five deaths

Cross-infection occurred in two recent clusters of hospital-acquired superbug infections that resulted in five deaths, the Hospital Authority has admitted.

As of Monday, eight Caritas Medical Centre patients have been confirmed to have vancomycin-resistant Enterococcus bacteria, while 32 have the same superbug at Queen Elizabeth Hospital. The five deaths occurred at the latter.

Both hospitals will be provided with an ultraviolet device from next month to help prevent spread of the superbug.

The move follows a worrying trend that has seen the number of new patients testing positive for VRE in hospitals grow from nine in 2009 to 15 last year and to 25 so far this year.

Tests carried out on stool samples of patients, who sought treatment in accident and emergency wards in 15 hospitals for diarrhea between October 17 and

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明愛內科及老人科病房 3名病人為VRE帶菌者

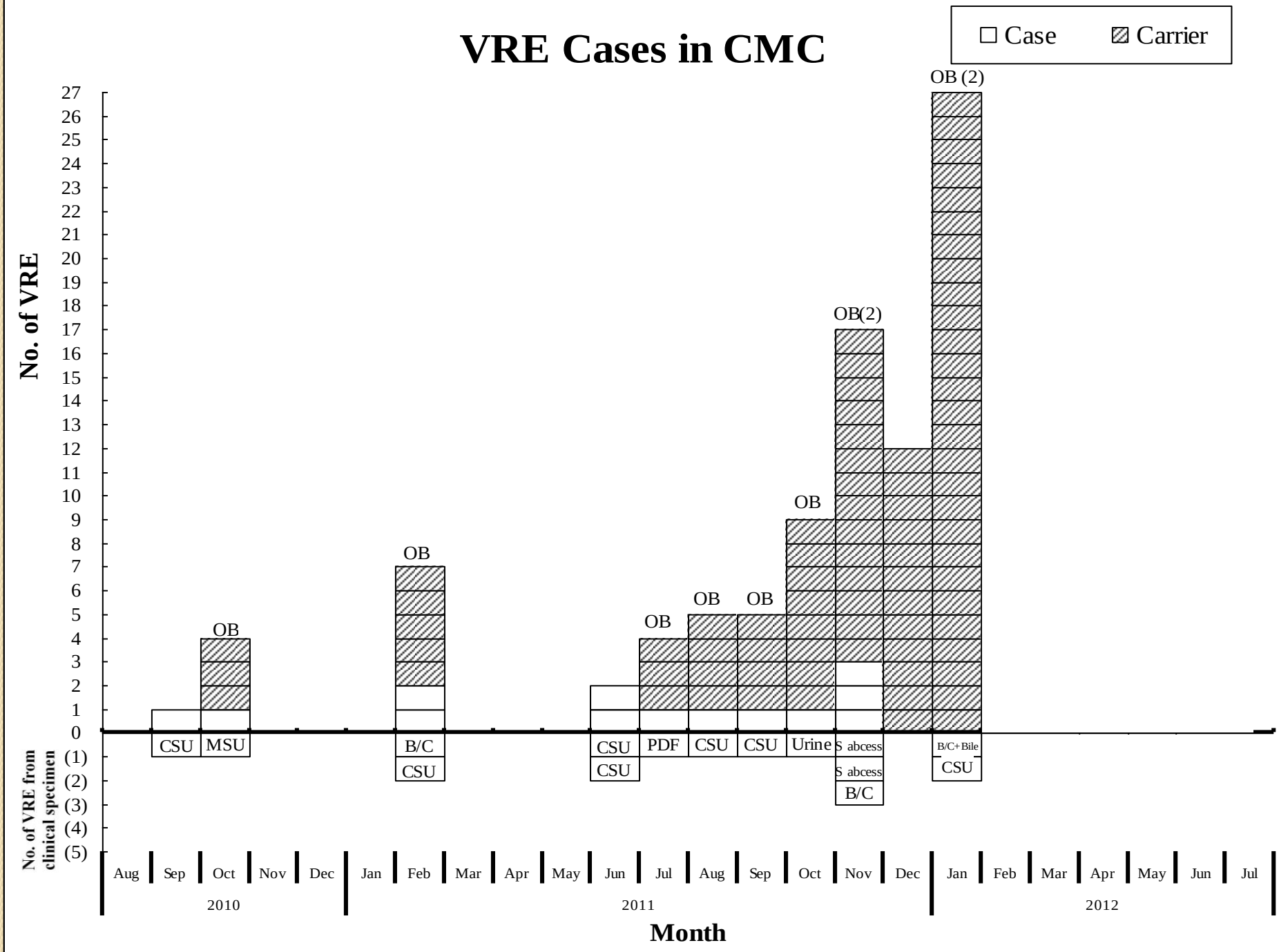
明愛醫院內科及老人科病房自上月25日起，先後已有3名、年齡介乎75歲至88歲的男病人，確診為抗萬古霉素腸道鏈球菌(VRE)帶菌者。

3名病人現時情況穩定，正接受進一步觀察及隔離治療。該院已按既定程序，加強感染控制措施，亦已根據指引，為21名曾與患者有接觸，及正接受醫學監察的病人進行測試，現正等待結果。有關個案亦已呈報醫院管理局及衛生防護中心跟進。

VRE Clustering in CMC

Year	Month	Clinical cases	Carriers	Total cases
2010	Sep/ Oct	1	3	**4**
2011	Feb	2	5	**7**
	Jul	1	3	**4**
	Aug*	1	4	**5**
	Sep*	1	4	**5**
	Oct	1	6	**7**
	Nov (As of 21 Nov)	1	10	**11**
			Total	**43**

* epi-link


VRE Cases in CMC
Case
Carrier
No. of VRE
No. of VRE from clinical specimen
Month
2010
2011
2012
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
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CSU
OB (2)

VRE Containment Program

"Find and confine strategy" HA

A. **Early case identification**
   - Active Surveillance

B. **Isolation/ Mandate infection control measures**

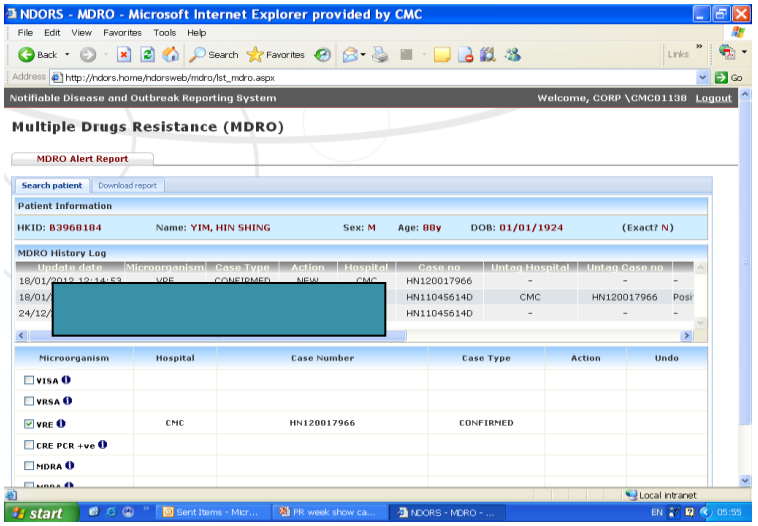
C. **Environmental Hygiene**

D. **Antibiotic stewardship program**

Active surveillance

- Contact screening
- Screening of high risk patients

- Define contact as patients stayed in same cubicle/ward (by risk assessment/different phase)
- Special computer program: assisted contact tracing of > 6000 contacts
- Alert tagging for VRE cases & those contacts who cannot be screened immediately
- Acute Surveillance culture: screened > 2,600 patients



To standardize the Alert messages of VRE flagged in Clinical Management System

Contact:	Case
A VRE contact, implement Contact Precautions on admission, perform VRE screening and inform ICT	A VRE case confirmed on _____, implement single room isolation on admission, Perform VRE screening and inform ICT

To standardize the Alert messages of VRE flagged in Clinical Management System

Case with history of negative screening

A VRE case confirmed on _____,
1st negative screening on _____,
2nd negative screening on _____,
.
.
implement Contact Precautions on admission,
Perform VRE screening and inform ICT

Isolation and infection control measures

Isolation:

- Known positive cases
  - Single room
  - Cohort in a cubicle (with toilet facilities)
  - Transfer to IDC, PMH
  - A designated isolation ward (with the help of staff from other cluster hospitals)
  - Off isolation after 3 or more negative samples and at least 6 months from last positive
- Contacts
  - Contact precaution/ cohort while pending screening result, precaution can be off after 1 negative result
  - For some vulnerable cases, a second screening would apply

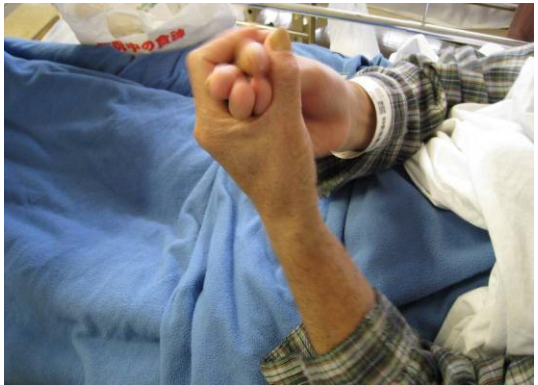
Infection control measures

- Standard precaution &
- Contact Precautions: with signage at the entrance of isolation rooms

HH Promotion

Building on the WHO HH Promotion Program in 2007

- To reinforce HH compliance
- Focus on promoting HH, ***A****fter and* ***B****efore Patient* ***C****ontacts* ------ "HH ABC"
- Practice Patient Hand Hygiene Round



HH Moment Everywhere!







國際手衛生日
Hand Hygiene Day
護理前後 潔手護手
Touching Moments, We Care
潔手七式
Hand Hygiene Technique
潔手5時刻
護手小貼士
Hand Hygiene Compliance
Outstanding Ward
1. YEE 3, DDU
2. Y2W, M4G
3. ICU/HDU/CCU
Congraulations!


Infection control practices
Target on 5 basic care procedures

1. Hand hygiene
2. Ryle's tube feeding
3. Perineum care
4. Incontinence care
5. Urinary catheter care

Caritas Medical Centre
鼻胃管餵飼之工作評核表

Department / Unit : _____
Date : _____

Please put a "✓" in the appropriate column
 # Please circle the appropriate source of information

No	Item	# Source of Information	Yes	No	N/A	Remarks
1.	清潔雙手，預備程序之所需物品	AS / O / CR				
2.	清潔雙手，核對及預備病人	AS / O / CR				
3.*	清潔雙手	AS / O / CR				
4.*	測試鼻胃管的正確位置： - 檢查鼻胃管上的刻度是否正確 - 檢查鼻胃管上的膠布有否鬆脫 - 檢查鼻胃管有否捲曲在口腔內 - 用 60 毫升管飼針筒抽取胃液並放於即棄杯內，用酸鹼度測試紙進行測試，胃液正常酸鹼度爲≤ 5.5 - 如不能確定鼻胃管之正確位置或未能抽取胃液，向護士報告及查詢	AS / O / CR				
5.	抽測胃排空情況，以檢查對食物之吸收，如抽取之胃液超過 50 毫升或不正常顏色（如啡色、紅色），向護士報告及查詢	AS / O / CR				

- Develop work instruction sheets
- Train the trainer approach
- Demo & Return Demo
- VCD production to facilitate training
- IC talks / ICLN training in meeting
- Audit & Evaluation
- ICN ward rounds

Enhancement of Environmental Hygiene

Improvement works

- Set up the Hospital Environmental Hygiene Working Group in June 2011
  - Representatives from wards, central domestic team, hosp admin, ICT and Q&S Team.
- Recommendations to hospital management:
  - Regular cleaning to frequently touched areas
  - Evaluate, transform the existing cleaning services in hospital
  - Set up standard cleaning regime, protocol of cleaning methods (who, where, when & how: e.g.; to make sure thorough disinfection for "high touch" areas at least twice daily with freshly prepared disinfectant (e.g. sodium hypochlorite 1,000 ppm)
  - Additional resources: manpower, time, equipment etc

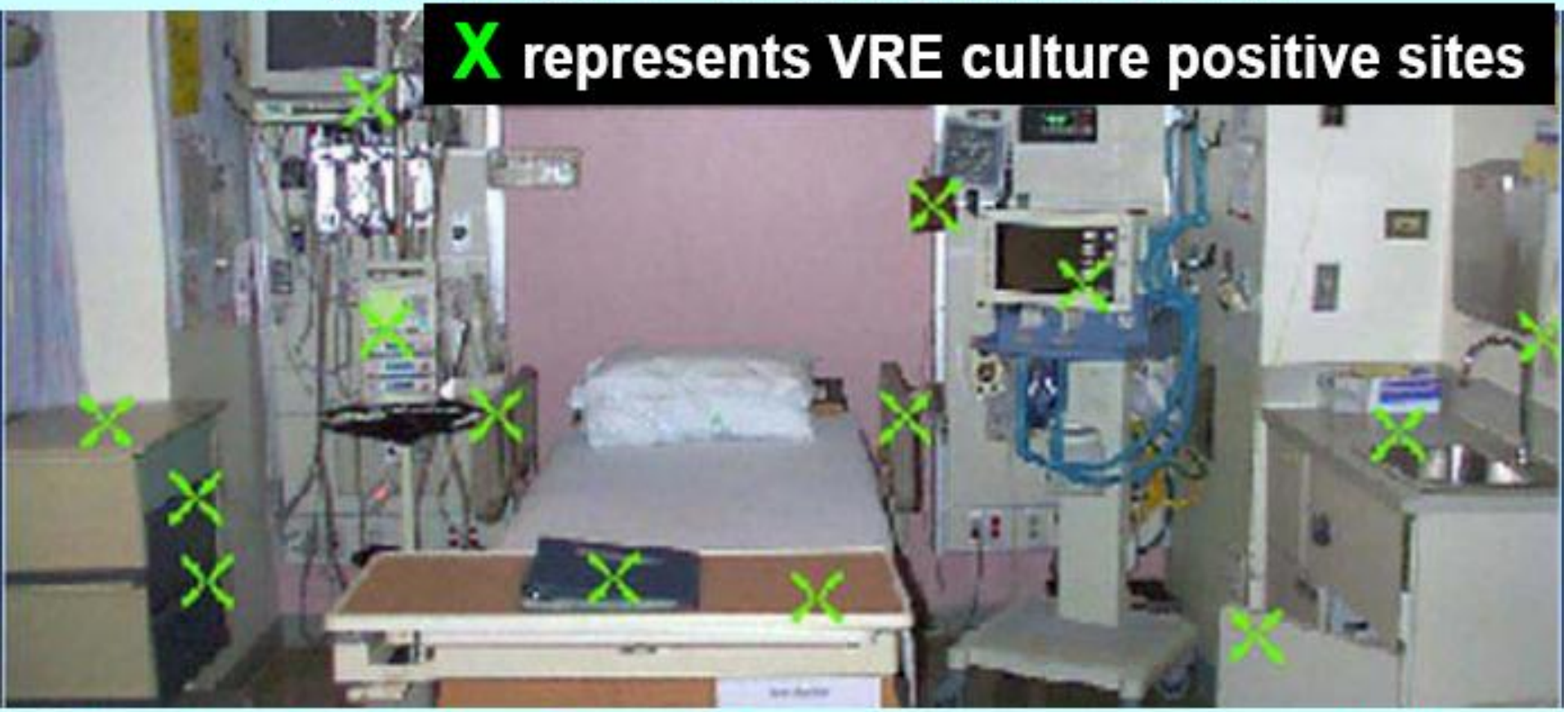
Audit on environmental hygiene

- Evaluate the cleaning effectiveness
  - UV assessment
  - Environmental screening

    - 94 samples: 3 positive
      - From container for swabbing accessories
      - Bed side rail
      - Trolley for Napkin round
    - Important role in cross transmission

  - Enforce the training

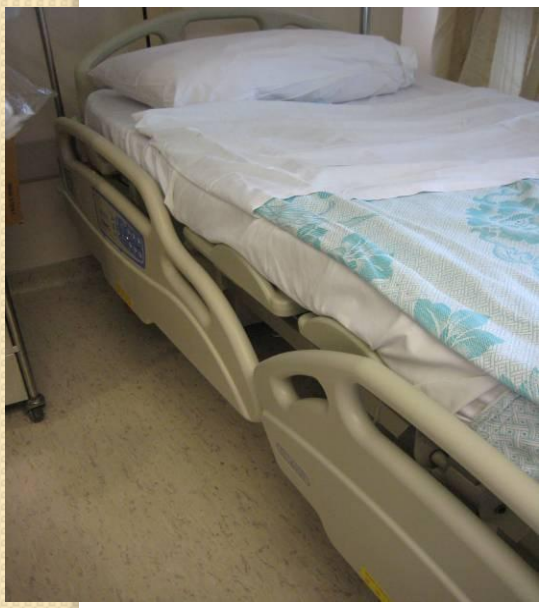
The Inanimate Environment Can Facilitate Transmission

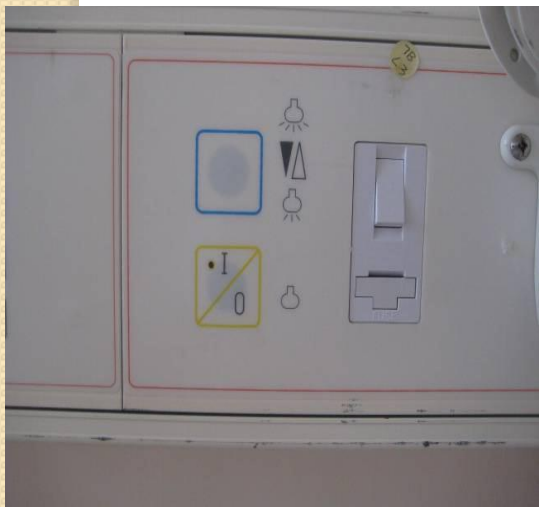


~ Contaminated surfaces increase cross-transmission ~

Abstract: The Risk of Hand and Glove Contamination after Contact with a VRE (+) Patient Environment. Hayden M, ICAAC, 2001, Chicago, IL.

Frequent touch areas – enhance cleaning and disinfection





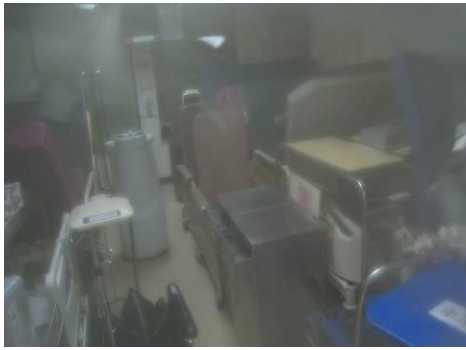
Thorough Cleaning of environment & equipment

(New technology for Terminal Decontamination

Hydrogen Peroxide Vapor (HPV)

Manual cleaning before HPV decontamination

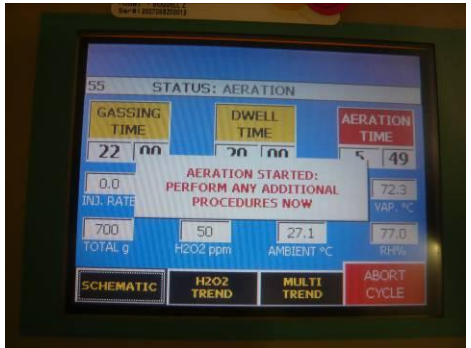
All exhausts are sealed by EMSD staff



HPV in progress

Monitoring tool for leakage checking

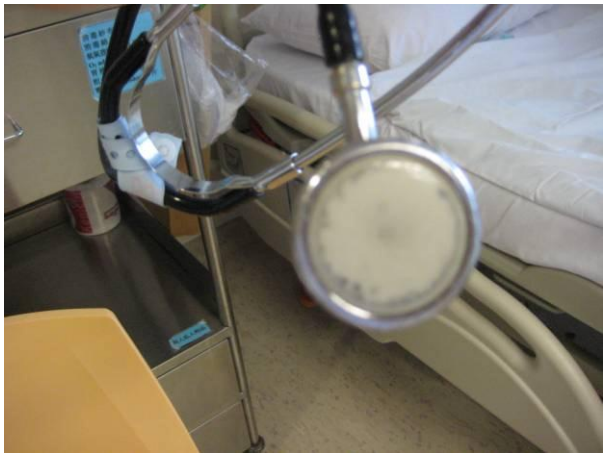
HPV Bio-decontamination

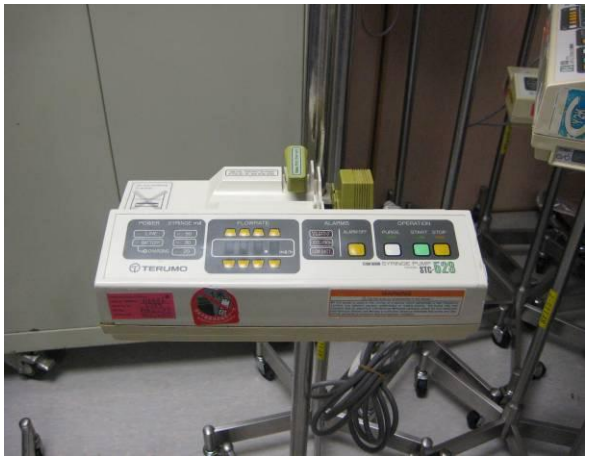


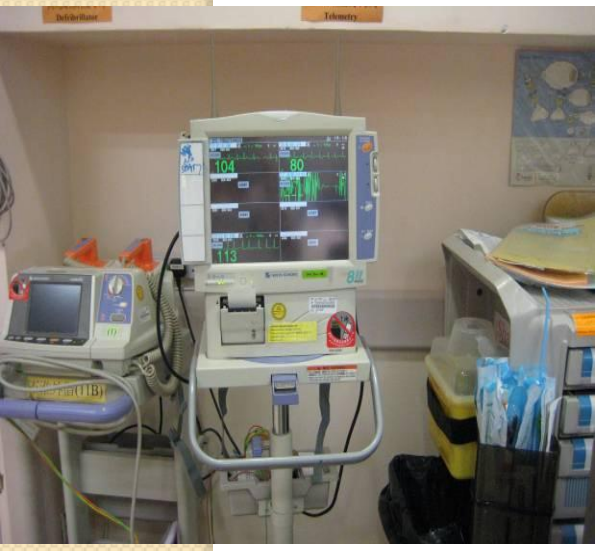
New technology for Terminal Decontamination - Portable mobile UV device (Tru-D)

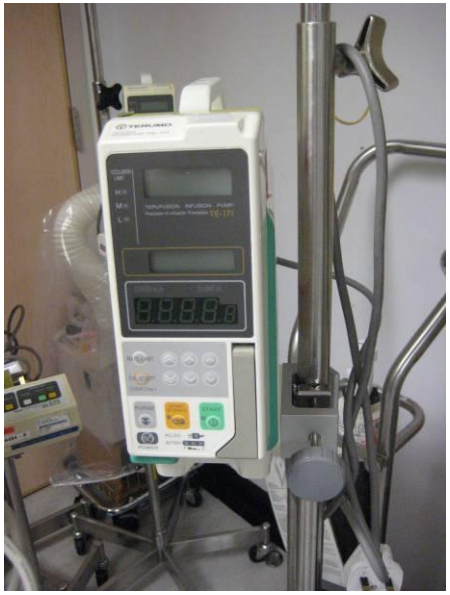
- Service procurement
- Easy to operate and ready to use
- Require 30-60 minutes
- Indication:
  - toilet facility,
  - difficult to manually clean non critical items (bed pans, commode & wheelchair),
  - isolation room,
  - treatment room,
  - operation theater etc .

Designated equipment or be disinfected between use







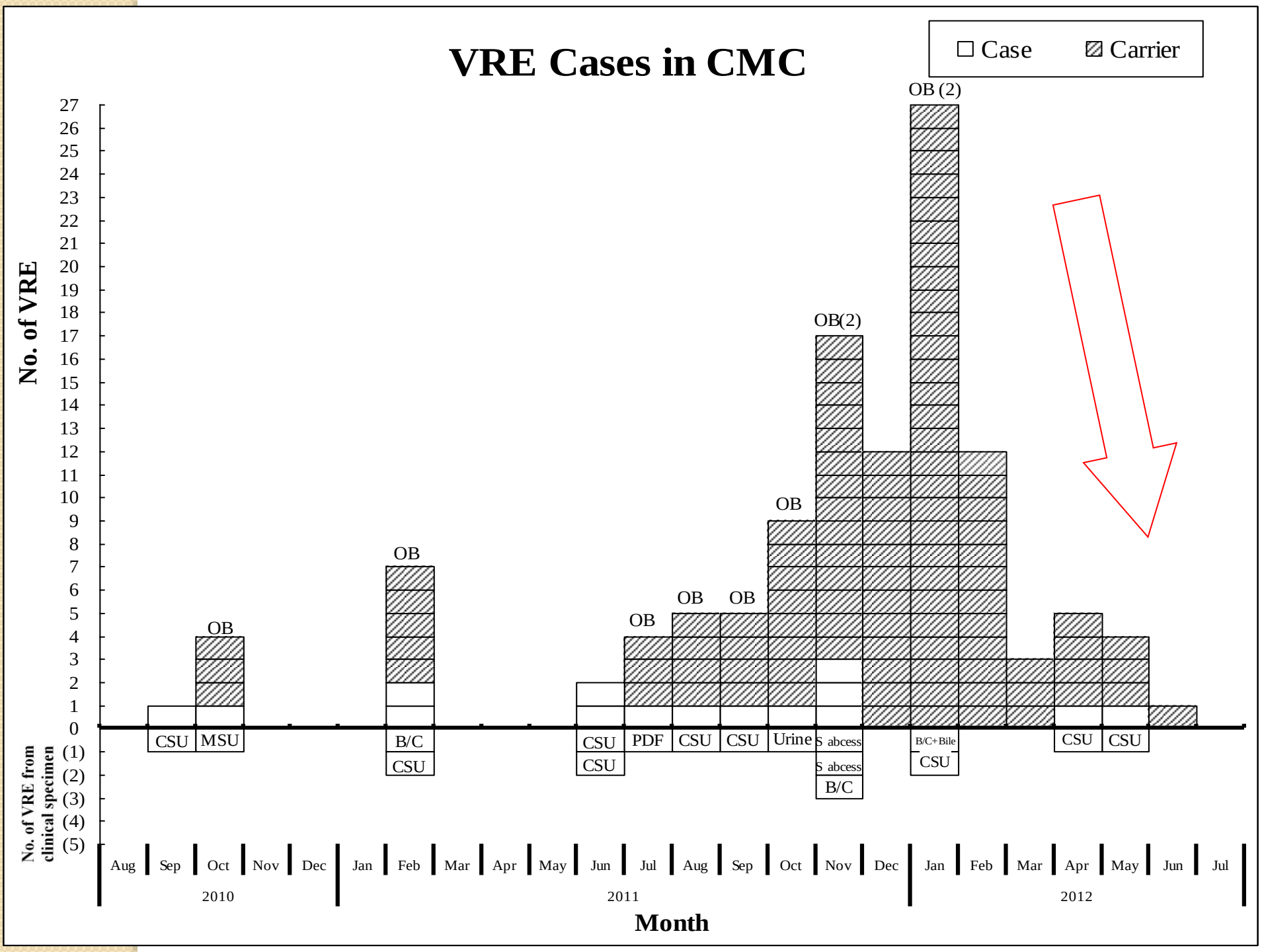


Enhance staff communication and training

- IC talks: 839 attendances
- Train-the-trainer workshops: 94 staff trained
- Train the ward staff on basic care procedures
- Enforce the environmental cleaning techniques
- Staff forum / IC link staff meetings
- Hospital administration monitored daily bed situation of VRE cases

Training & Education

Result


VRE Cases in CMC
Case
Carrier
No. of VRE
No. of VRE from clinical specimen
Month
2010
2011
2012
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
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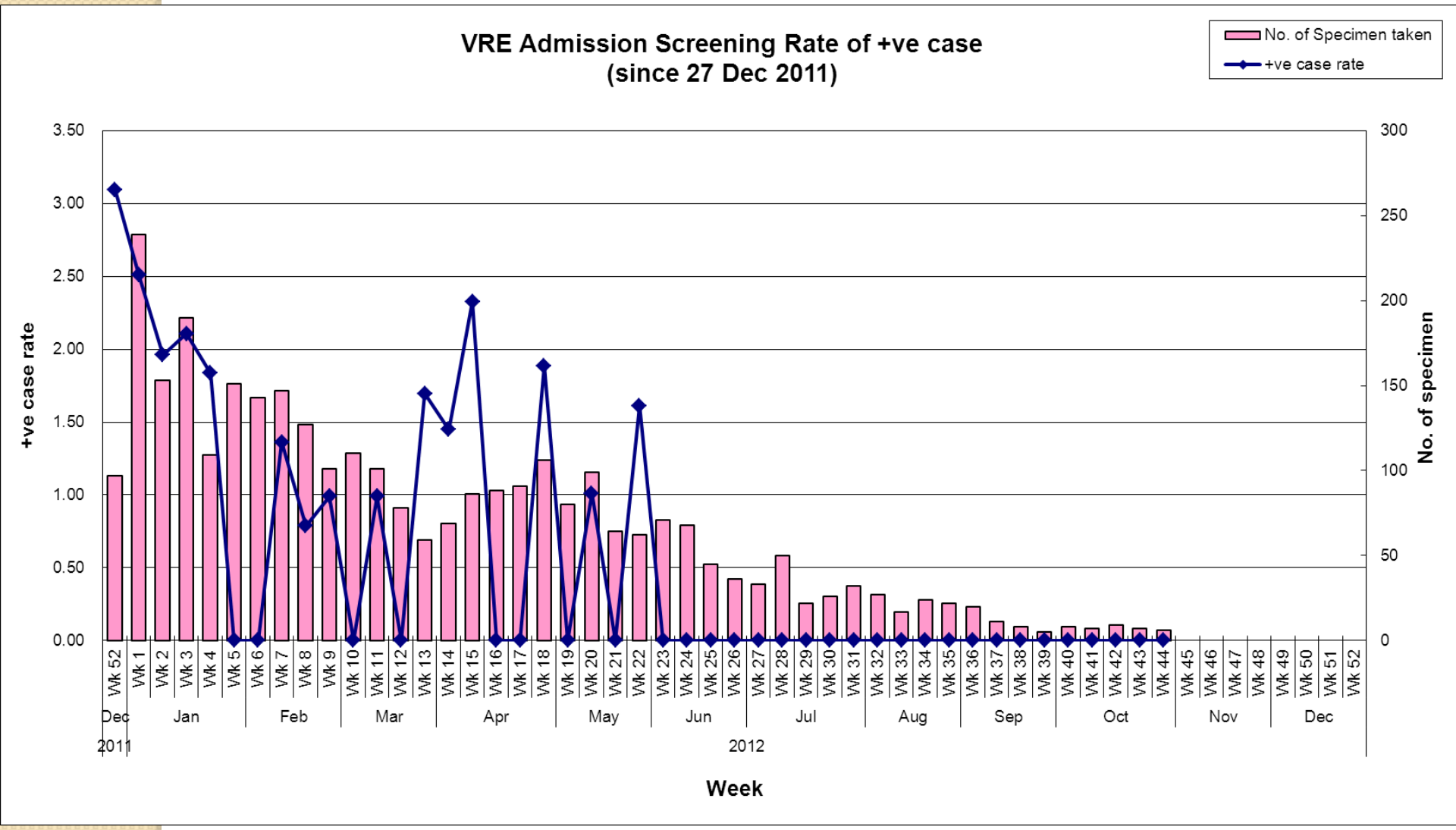
CSU
CSU
CSU


VRE Admission Screening Rate of +ve case
(since 27 Dec 2011)
No. of Specimen taken
+ve case rate
+ve case rate
No. of specimen
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
300
250
200
150
100
50
0
Wk 52 Wk 1 Wk 2 Wk 3 Wk 4 Wk 5 Wk 6 Wk 7 Wk 8 Wk 9 Wk 10 Wk 11 Wk 12 Wk 13 Wk 14 Wk 15 Wk 16 Wk 17 Wk 18 Wk 19 Wk 20 Wk 21 Wk 22 Wk 23 Wk 24 Wk 25 Wk 26 Wk 27 Wk 28 Wk 29 Wk 30 Wk 31 Wk 32 Wk 33 Wk 34 Wk 35 Wk 36 Wk 37 Wk 38 Wk 39 Wk 40 Wk 41 Wk 42 Wk 43 Wk 44 Wk 45 Wk 46 Wk 47 Wk 48 Wk 49 Wk 50 Wk 51 Wk 52
Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
2011
2012
Week

Quality Improvement Program for Control of Vancomycin Resistant Enterococcus (VRE) in Caritas Medical Centre (CMC)

AFFILIATION

Dr Wing-kin TO (1), Annie Fat-ying LEUNG (1), Yuk-ling FUNG (1), Edna Kwai-fung LAU (1), Teresa Tak-wai CHAN (1)
(1) Infection Control Team, Caritas Medical Centre, Hospital Authority, Hong Kong SAR

INTRODUCTION

Isolated cases of VRE had been detected in medical wards of CMC since Jun 2011. Cumulating ward-based clusters established a major outbreak event. A quality improvement program by multidisciplinary approach had been implemented and controlled the VRE spread successfully.

OBJECTIVE

To control VRE outbreak within the hospital and to prevent the spread of VRE to long term care facilities (LTCF) through a comprehensive program involving multidisciplinary teams.

THE QUALITY IMPROVEMENT PROGRAM

1. Surveillance with computer systems and laboratory technology

More than 6000 patients were identified by patient contact tracing system (PAS) with alerts and reminder tagged on the Clinical Management System (CMS) and Multi-drug Resistance Organism data bank (MDRO system). Health care professionals within Hospital Authority were therefore able to initiate corresponding infection control measures at the point of care.

2. Isolation and infection control precautions for VRE patients

- ✓ Single room isolation, designated isolation ward
- ✓ Designated equipment
- ✓ Enhance hand hygiene (HH) compliance among staff
- ✓ Initiate HH round for patients before meals

3. Enhance environmental cleaning and disinfection

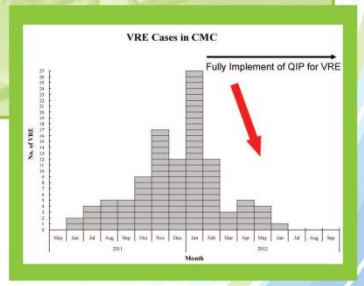
- ✓ Set up a working group composed of Central Domestic Service Team, Hospital Administration, Quality & Safety Team, Infection Control Team and Nursing representatives from clinical wards.
- ✓ Revise hygiene standard and protocol
- ✓ Set up central cleaning team
- ✓ Enforce training to cleaning staff
- ✓ Audit of cleaning effectiveness by ultra-violet marker assessment
- ✓ New technology for environmental disinfection: hydrogen peroxide vapor and mist

4. Quality Improvement of 5 targeted basic care procedures

- ✓ Hand hygiene
- ✓ Nasopharyngeal tube feeding
- ✓ Perineum care
- ✓ Incontinence care
- ✓ Urinary catheter care

5. Enhance staff communication

- ✓ Talks, workshops, visual aids, staff forum/meetings
- ✓ Daily bed situation of VRE cases to hospital management



RESULT & OUTCOME

The program has successfully controlled the spread and outbreaks.
VRE detected in CMC gradually decreased. From the peak with 27 cases in Jan 2012 to 1 case in Jun 2012 and then no case was detected for months thereafter. No VRE outbreak/cluster was reported since Jan 2012. No spread of VRE to LTCF was noticed.

CONCLUSION

To combat the challenge on tight manpower and inadequate resources, we realized "SIMPLE is BEAUTIFUL". The fundamental of infection control is Hand Hygiene. Environmental and equipment hygiene are also important. Bundle of care can even achieve better results.

2012 Asian Hospital Management Awards

- Recognize the effort of our staff
- Impress our top management
- Acknowledge the support from all parties, especially the support from HO and other hospitals

What we have learned in this outbreak:

Total cases	118 cases
OAHR	54 cases
1st isolates from rectal screen	104 cases (2 of them (1.9%) having positive culture from clinical sites subsequently)
1st isolates from clinical site: Urine: 10 Blood: 2 Bile: 1 PD fluid: 1	14 cases (2 of them have no positive rectal isolates) ? Acquired directly from other patients

Clinical : Rectal carrier = 1: 7.4 or,
13.5% of the cases are isolated from clinical specimens

Transmission: Findings from the first 23 cases

- Primary contact (Contacts of patient with positive clinical isolates):

  Positive rate: 16/108 = 15%

- Secondary contact (Contacts of asymptomatic rectal carriers)

  Positive rate: 1/20 = 5.0%

  (Patients having VRE isolated in clinical are more infectious than rectal carrier)

- 25% of the +ve contacts have contact time of < 48h

  (Prolonged contact is an important contributing factor, but it is NOT a must!)

Clearance

DURATION OF COLONIZATION WITH VANCOMYCIN RESISTANT ENTEROCOCCUS
Infect Control Hosp Epidemiol 2002;23:207-211

- A total of 116 patients colonized with VRE had 423 follow-up cultures, a mean of 204 days (range, 4 to 709 days) after their initial isolate.
- The first follow-up culture, collected a mean of 125 days after the initial positive isolate, was negative in 64%.
- After 1 neg follow-up culture, the next one was negative in 92% of the patients.
- After 2 neg cultures, 95% remained culture-negative.
- After 3 sequential neg cultures, 35 (95%) of 37 patients remained culture-negative.

Vancomycin-resistant Enterococcus faecium on a pediatric oncology ward: duration of stool shedding and incidence of clinical infection.
Pediatr Infect Dis J. 1996 Oct;15(10):848-54.

- 35% of the colonized patients cleared VRE from stool; 43% were persistent carriers, excreting organisms for 19 to 331 days (median, 112 days)
- Carriage of the same VRE clone for up to 1 year was demonstrated

Evaluation of the duration of vanA vancomycin-resistant Enterococcus faecium carriage and clearance during a large-scale outbreak in a region of eastern France
Am J Infect Control 2011; 39:169-171

- The median duration of carriage was 42 days (maximum 708 days).

The epidemiology of fecal carriage of vancomycin-resistant enterococci
Infect Control Hosp Epidemiol. 1997 Nov;18(11):762-5

- The length of carriage varied from 19 to 303 days (median, 41 days)

Consensus of clearance/off tagging of VRE carrier?

Guidelines	Frequency	Duration of tagging
SHEA 2003 /HICPAC 1995	3 consecutive negative screening cultures at least 1 week apart	
Provincial VRE Guideline Canada	With the direction of ICT	2 years
MRO guidelines for Renal Replacement Therapy Australia	3 consecutive negative screening cultures at least 1 week apart, 2 weeks after antibiotics	6 months No unhealed wounds Whenever on antibiotics*
Prevention and Control of HAI Protocol for Management of VRE Australia	3 consecutive negative screening cultures at least 1 week apart	6 months Free of hospitalization/ Antibiotics / invasive devices **or** solitary one positive with multiple negatives#
MDRO guideline Ireland	3 consecutive negative screening cultures at least 1 week apart + risk assessment	Permanent
HAHO guideline	2 consecutive negative screening cultures at least 48 hrs apart, 48 hrs after antibiotics	1 year for the MDRO tagging system (ICT)

Clearance

107 cases: 11 cases with no testing after positive

+ve to -ve	no. of patient	55 cases
	range	8-230 days
	mean	67.18 days
	median	45 days
	90 percentile	155.4 days
+ve to Death	no. of pt	48 cases
	range	1 - 331 days
	mean	53.25 days
	median	15 days
Still positive: 4 cases		D310, D312 D351, D626

Combine: (+ve to -ve & +ve to death & still positive):	107 cases
Range	1 - 626 days
Mean	73.4 days
Median	39 days
90 percentile	192 days

Recurrence (Recur after ≥2 negative): 11 cases (10.2%)

- 4 negative: 3 cases
- 3 negative: 3 cases
- 2 negative: 5 cases
- All except one recur within 6 months since last positive, the exceptional case recurred after 9 months and there were 4 negative culture in between.. Reinfection??

Contact	Untagged after 6 months
Known positive	Generally, 3 or more negative samples and at least 6 months from last positive

Discharge arrangement

- Inform ICT on VRE patient transfer or discharge
- Discharge to home is allowed and education pamphlets on infection control precautions for VRE should be given to patients upon discharge
- Discharge to OAH is not allowed until clearance of VRE carriage (initial phase) or after discussion of CICO, HICT, CGAT and CHP
  - Assessment have been made for 12 cases: It took 7-50 days, average was 16 days, to be discharge to aged home after clinical fit for discharge
  - Spreading in OAH is limited (unpublished data, personal communication)

醫院管理局
HOSPITAL AUTHORITY

衞生防護中心
Centre for Health Protection
感染控制處
Infection Control Branch

給感染或帶有多重抗藥性細菌病人的資料單張和出院指導

多重抗藥性細菌的種類

細菌的抗藥性是指抗生素未能有效抑制或殺死細菌，導致細菌所引起的感染難以治癒。多重抗藥性細菌是指一些以多種常用抗生素治療，也不能治癒的細菌。雖然現時仍可使用其他抗生素予以治療，但是這些抗生素的效能可能較弱或會引起較多的副作用。以下是常見多重抗藥性細菌的例子：

1. 抗甲氧西林金黃葡萄球菌 (一般稱爲耐藥性金黃葡萄球菌) / 萬古霉素中介耐藥性金黃葡萄球菌/抗萬古霉素金黃葡萄球菌 (MRSA/VISA/VRSA)
2. 超廣譜β-內酰胺酶耐藥性細菌 (ESBL)
3. 抗萬古霉素腸道鏈球菌 (VRE)
4. 抗碳青霉烯腸道桿菌 (CRE)
5. 抗碳青霉烯鮑氏不動桿菌 / 耐多藥鮑氏不動桿菌 (CRA/MDRA)
6. 耐多藥綠膿假單胞菌 (MRPA)

病徵

多重抗藥性細菌可導致各類型與醫護環境相關的感染，如肺炎、尿道感染、傷口感染以至菌血症。雖然多重抗藥性細菌可寄存於沒有感染症狀的人士身上多月甚或多年，但它們較易入侵免疫力較弱或病情危殆的病患者，並引發感染。這些高危人士在感染後的情況一般較爲嚴重，或會致命，往往治療方法的選擇亦是有限。

傳播途徑

多重抗藥性細菌是接觸性傳播的傳染病，通常透過直接接觸受污染的物件、環境或人與人之間接觸時而傳播。個人和環境衞生欠佳可導致多重抗藥性細菌在醫院環境和社區之間廣泛及交叉傳播。其他因素包括皮膚損傷/傷口、或擠迫的環境等，亦有助於散播這些細菌。

一般感染控制措施

要預防及控制多重抗藥性細菌散播，醫護人員、病人及其家屬需特別留意並履行下列事項：

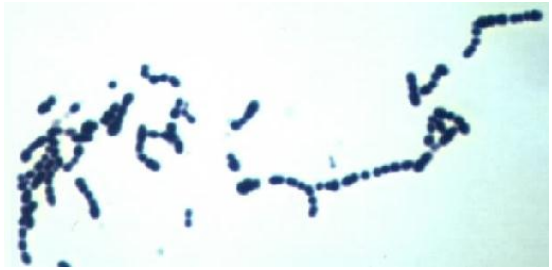
1. 保持良好的個人衞生，例如每天更換衣服及洗澡。
2. 保持雙手清潔，經常用清水及梘液徹底清潔雙手或用酒精搓手液揉搓雙手。
3. 避免與別人共用個人物品，如毛巾、牙刷及剃鬚刀等。
4. 避免徒手直接接觸傷口、造口、引流或任何被身體分泌物污染之物件。
5. 使用適當的個人防護裝備，如處理血液、體液、分泌物或排泄物時，必須戴上手套及穿上保護衣；如進行可能有血液或體液濺出的護理程序時，必須戴上手套、口罩、眼罩及穿上保護衣。處理完畢後，要徹底洗手。
6. 應即時處理任何破損的皮膚或傷口，並使用敷料將傷口完全覆蓋，而處理傷口後須洗淨雙手。
7. 如有外露的傷口，應避免使用公共浴室、按摩及水療設施。
8. 保持環境衞生及消毒可供循環使用的儀器。
9. 如出現感染徵狀，應立即找醫生診治。
10. 不要濫用抗生素，抗生素應由醫生處方才可使用。

若院友帶有抗碳青霉烯腸道桿菌 (CRE) 、抗萬古霉素腸道鏈球菌 (VRE) 、抗萬古霉素金黃葡萄球菌 (VISA/VRSA) 或耐多藥綠膿假單胞菌 (MRPA) 等多重抗藥性細菌，請於入住時通知安老院舍的主管，以便院舍職員切實執行適當的感染控制措施及提供足夠的支援。

若院友帶有多重抗藥性細菌，安老院舍應注意以下附加的感染控制措施

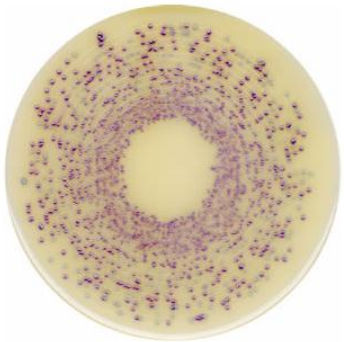
院舍應對帶有多重抗藥性細菌的院友和其他院友進行風險評估，決定是否需要施行隔離預防措施。對沒有感染徵狀而有自我照顧能力的帶菌院友，遵行常規的感染控制措施和標準防護措施*已經足夠。這類帶菌院友仍可與非帶菌院友一同參與日常社交活動。對帶有多重抗藥性細菌及有內置性導管（如導尿管、腹膜透析導管、鼻胃管等）、皮膚破損（如壓瘡）、外露的傷口（如氣管造口）或未能維持個人和環境衞生的院友，則應遵行標準防護措施及修訂版接觸傳播防護措施*。

Role of Laboratory



- Clinical specimen: Early detection
  - Perform Van MIC for all enterococci
- Surveillance
  - Rectal swabs are less sensitive than faecal samples for detecting low levels of VRE colonisation. False negative results may explain some apparent 'relapses.'
  - For surveillance: collect specimen

    after the course of antibiotics
- Molecular Typing



Method: Work Protocol

Culture, PCR

(A) Direct bioMerieux Chrom VRE agar

- 37°C for two days, read at 16, 24 & 48 hr - look for purple colony

(B) BD Enterococcosel Broth

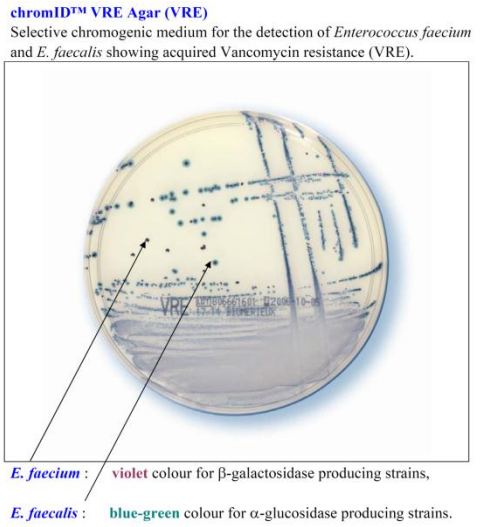
- 37°C for one day, read at 16 & 24 hr, subculture any blackening broth

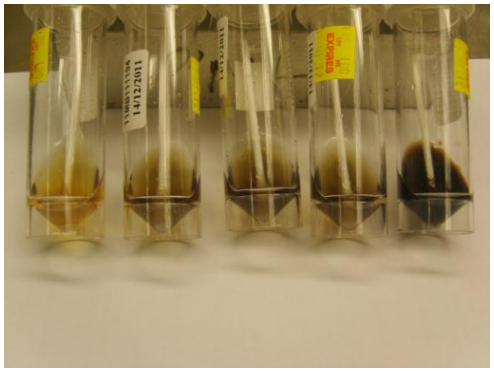
(C) Broth enrichment followed by PCR:

- Protocol: Select those blackening broth in morning of day 1 (after 16 hr), PCR by PHLC, aiming to have result in the same day

(D) PCR (Abbott m2000) for Van A and B (HK$150)

- For stool or rectal swab
- Not specific for enterococci
- Not distinguish viable or non viable organisms





IMDx™ VanR for Abbott *m*2000™

Batch 1
232 specimens

1. Direct Chromagar: Pick up 7 out of 9 cases. Among the 7 cases, 3 were detected after 16-18hr, 3 after full 24 hr, 1 detected only on day 2.
2. Broth enrichment: 9 cases: Pick up additional 2 cases.
3. Broth enrichment followed by PCR by PHLC:
   - The broth of 3 of the known positive cases (33%) darken within 16 hours (morning of day 1), therefore, the remaining are missed according to the protocol.
   - Non-specific: 30% (70/232) broth blacken after 16 hours, if incubate for 44 hours, 43% (101/232) will become blackening
4. Abbott direct PCR: (**80 samples**)
   5 known positive by culture: detect 3 (60%)
   2 false positive: VanB detected but culture negative

Batch 2
32 specimens

1. Direct Chromagar: Pick up 3 (3/5 = 60%). Among the 3 cases, 2 were detected after 16-18hr, and 1 detected only on day 2.
2. **Broth enrichment**: **5** cases.
3. Abbott direct PCR:
   5 positive (100%)
   2 false positive: 1 Van B but culture negative
   1 Van A: Enterococcus avium / rhaffinosus

Summary

A. **Direct bioMerieux Chrom VRE agar**
   - For routine contact screening, early alert and shorter TAT, but problem of false negative

B. **BD Enterococcosel Broth**
   - (37°C for one day, read at 16 & 24 hr, subculture any blackening broth)
   - Good for low bacterial load, but more workload. Suggested choice for environmental screening

C. **Broth** enriched **Van A & B PCR**
   - Broth screening is both non-specific and insensitive

D. **Abbott Direct PCR**
   - Van B false +ve problem, Van A +ve not necessary E. fecalis or feceum. Less sensitive than broth, need batch run, not flexible, labour intensive, expensive.

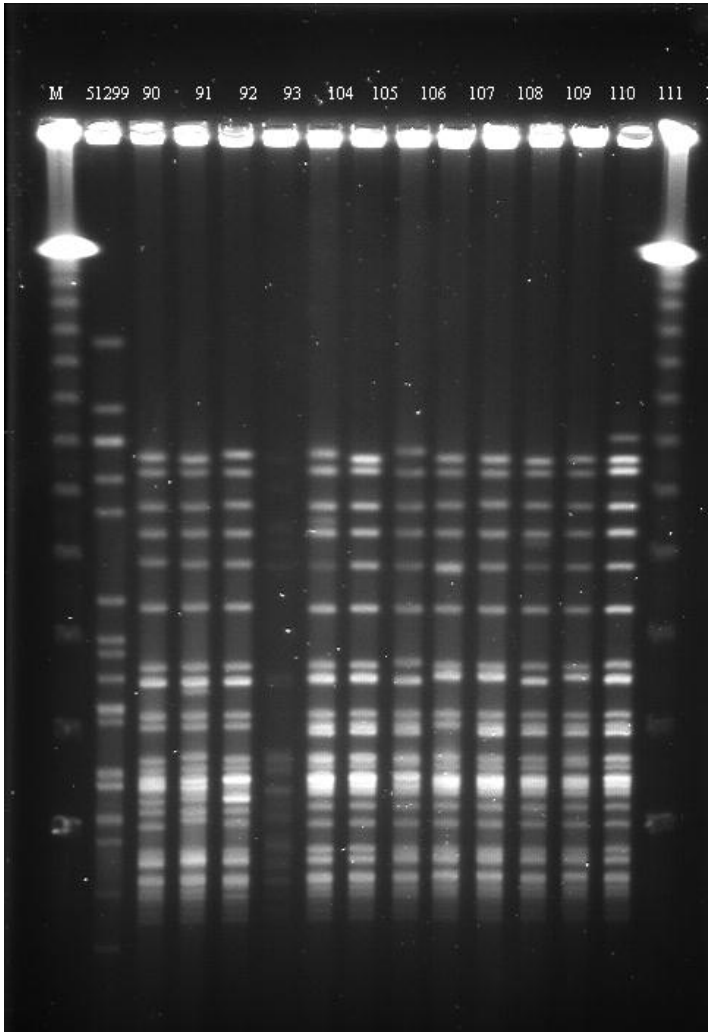
Surveillance:

We choose Method A as

1. Early identification is important so as to implement proper isolation precaution,
2. Less workload especially in outbreak situation
3. The false negative case should have lower bacterial load and less important in term of infection control
4. Appropriate timing, repeat culture may be more important

Molecular typing

- Pulsed-field gel electrophoresis (PFGE)
  - Gold standard: high degree of differentiation
  - Time-consuming
  - Comparability between lab. is unsatisfying
- Multi-locus sequence typing (MLST)
  - long-term epidemiological investigations
  - Standard nomenclature
  - Costly

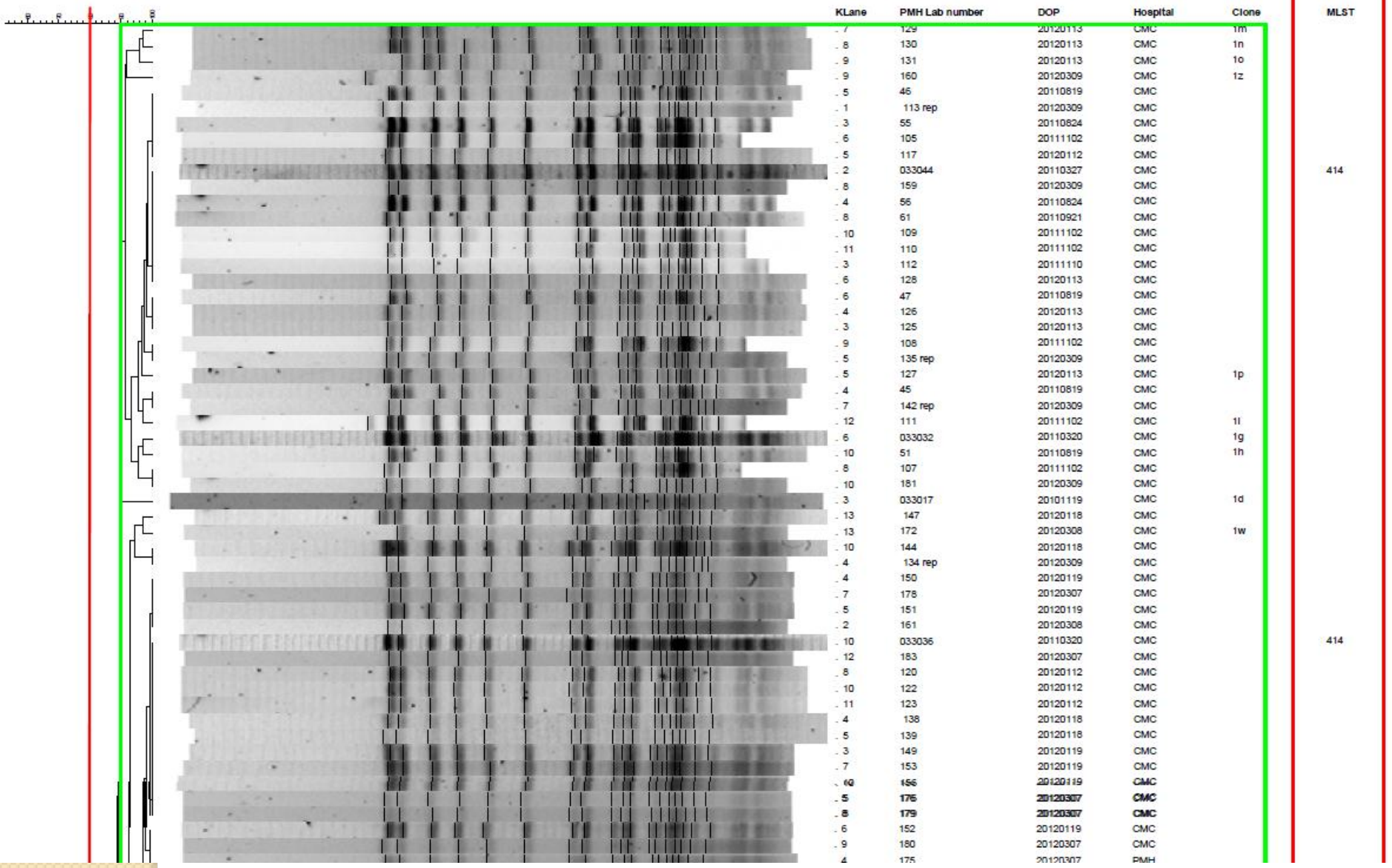


CMC VRE PFGE Resulis

CMC VRE PFGE

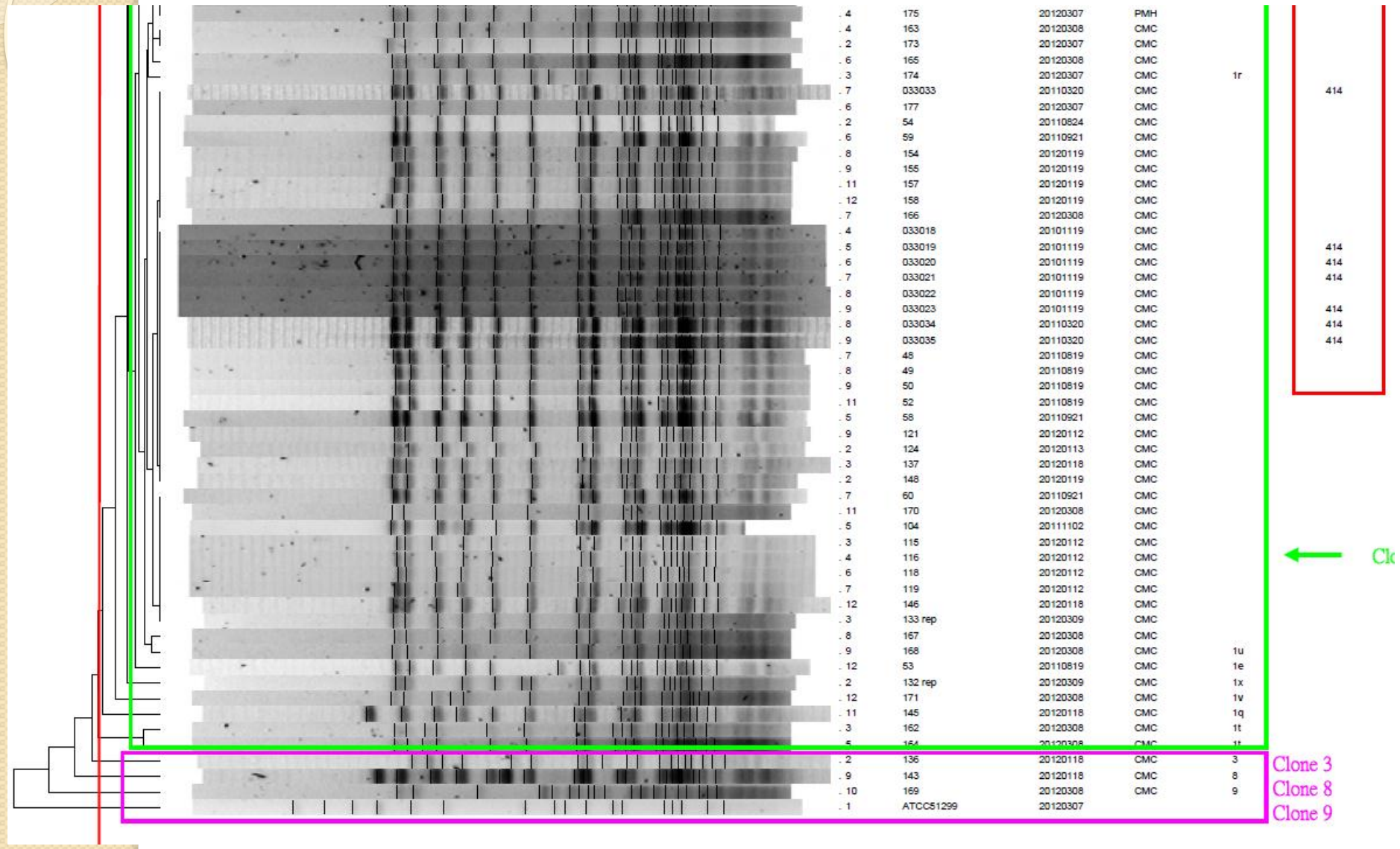
VRE PFGE

80%Similarity



KLane	PMH Lab number	DOP	Hospital	Clone	MLST
7	129	20120113	CMC	1m	
8	130	20120113	CMC	1n	
9	131	20120113	CMC	1o	
9	160	20120309	CMC	1z	
5	46	20110819	CMC		
1	113 rep	20120309	CMC		
3	55	20110824	CMC		
6	105	20111102	CMC		
5	117	20120112	CMC		
2	033044	20110327	CMC		414
8	159	20120309	CMC		
4	56	20110824	CMC		
8	61	20110921	CMC		
10	109	20111102	CMC		
11	110	20111102	CMC		
3	112	20111110	CMC		
6	128	20120113	CMC		
6	47	20110819	CMC		
4	126	20120113	CMC		
3	125	20120113	CMC		
9	108	20111102	CMC		
5	135 rep	20120309	CMC		
5	127	20120113	CMC	1p	
4	45	20110819	CMC		
7	142 rep	20120309	CMC		
12	111	20111102	CMC	1l	
6	033032	20110320	CMC	1g	
10	51	20110819	CMC	1h	
8	107	20111102	CMC		
10	181	20120309	CMC		
3	033017	20101119	CMC	1d	
13	147	20120118	CMC		
13	172	20120308	CMC	1w	
10	144	20120118	CMC		
4	134 rep	20120309	CMC		
4	150	20120119	CMC		
7	178	20120307	CMC		
5	151	20120119	CMC		
2	161	20120308	CMC		
10	033036	20110320	CMC		414
12	183	20120307	CMC		
8	120	20120112	CMC		
10	122	20120112	CMC		
11	123	20120112	CMC		
4	138	20120118	CMC		
5	139	20120118	CMC		
3	149	20120119	CMC		
7	153	20120119	CMC		
10	156	20120119	CMC		
5	175	20120307	CMC		
8	179	20120307	CMC		
6	152	20120119	CMC		
9	180	20120307	CMC		
4	175	20120307	PMH		

MLST ST 414

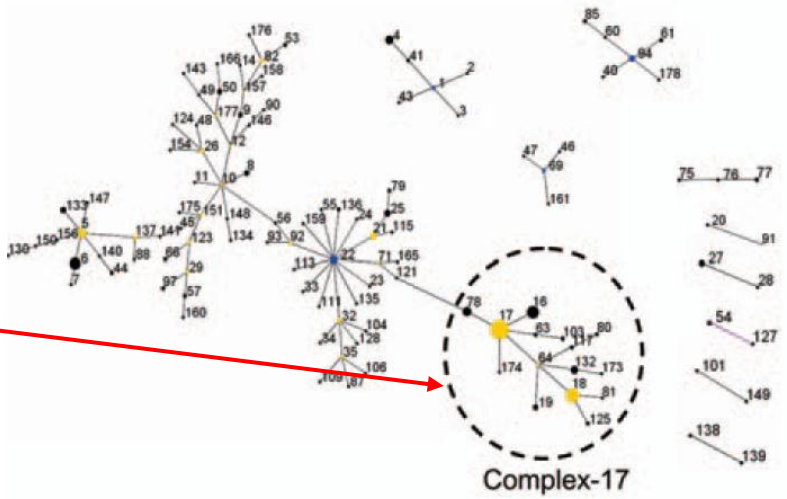

. 4 175 20120307 PMH
. 4 163 20120308 CMC
. 2 173 20120307 CMC
. 6 165 20120308 CMC
. 3 174 20120307 CMC 1r
. 7 033033 20110320 CMC
. 6 177 20120307 CMC
. 2 54 20110824 CMC
. 6 59 20110921 CMC
. 8 154 20120119 CMC
. 9 155 20120119 CMC
. 11 157 20120119 CMC
. 12 158 20120119 CMC
. 7 166 20120308 CMC
. 4 033018 20101119 CMC
. 5 033019 20101119 CMC
. 6 033020 20101119 CMC
. 7 033021 20101119 CMC
. 8 033022 20101119 CMC
. 9 033023 20101119 CMC
. 8 033034 20110320 CMC
. 9 033035 20110320 CMC
. 7 48 20110819 CMC
. 8 49 20110819 CMC
. 9 50 20110819 CMC
. 11 52 20110819 CMC
. 5 58 20110921 CMC
. 9 121 20120112 CMC
. 2 124 20120113 CMC
. 3 137 20120118 CMC
. 2 148 20120119 CMC
. 7 60 20110921 CMC
. 11 170 20120308 CMC
. 5 104 20111102 CMC
. 3 115 20120112 CMC
. 4 116 20120112 CMC
. 6 118 20120112 CMC
. 7 119 20120112 CMC
. 12 146 20120118 CMC
. 3 133 rep 20120309 CMC
. 8 167 20120308 CMC
. 9 168 20120308 CMC 1u
. 12 53 20110819 CMC 1e
. 2 132 rep 20120309 CMC 1x
. 12 171 20120308 CMC 1v
. 11 145 20120118 CMC 1q
. 3 162 20120308 CMC 1t
. 2 136 20120118 CMC 3
. 9 143 20120118 CMC 8
. 10 169 20120308 CMC 9
. 1 ATCC51299 20120307
414
414
414
414
414
414
Clone 3
Clone 8
Clone 9

Comments from Dr. Tenover about the one band different

"one-band difference is that one PFGE pattern has an additional band not present in the other pattern. This can be caused by several events, but it means the strains are highly related. One possibility is that one strain gains (or losses) a large plasmid, which shows up as a novel band. Sometimes these are obvious because the band is disproportionately dark or light due to copy number issues. Another common cause is that a new restriction site cleaves off a piece of DNA from a very large fragment, so the large fragment doesn't appear to change size because it is so big but a new band appears. In either case, these are highly related strains and likely part of the outbreak."

Global Spread of Vancomycin-resistant *Enterococcus faecium* from Distinct Nosocomial Genetic Complex

Rob J.L. Willems,* Janetta Top,* Marga van Santen,† D. Ashley Robinson,‡ Teresa M. Coque,§ Fernando Baquero,§ Hajo Grundmann,† and Marc J.M. Bonten*



ST414 belongs to CC17

Vancomycin-resistant enterococci (VRE) have caused hospital outbreaks worldwide, and the vancomycin-resistance gene (*vanA*) has crossed genus boundaries to methicillin-resistant *Staphylococcus aureus*. Spread of VRE, therefore, represents an immediate threat for patient care and creates a reservoir of mobile resistance genes for other, more virulent pathogens. Evolutionary genetics, population structure, and geographic distribution of 411 VRE and vancomycin-susceptible *Enterococcus faecium* isolates, recovered from human and nonhuman sources and community and hospital reservoirs in 5 continents, identified a genetic lineage of *E. faecium* (complex-17) that has spread globally. This lineage is characterized by 1) ampicillin resistance, 2) a pathogenicity island, and 3) an association with hospital outbreaks. Complex-17 is an example of cumulative evolutionary processes that improved the relative fitness of bacteria in hospital environments. Preventing further spread of this epidemic *E. faecium* subpopulation is critical, and efforts should focus on the early disclosure of ampicillin-resistant complex-17 strains.

The emergence of vancomycin-resistant enterococci (VRE) followed a worst-case scenario for nosocomial pathogens: the first VRE isolates that harbored the *vanA* transposon were identified in 1987 in Europe (1,2), and within 10 years VRE represented >25% of enterococci associated with bloodstream infections in hospitalized patients in the United States (3).

Enterococci are normal inhabitants of the gastrointestinal tract of humans and animals. Two species cause most enterococcal infections, *Enterococcus faecalis* and *E. faecium*. The relative importance of *E. faecium* as a pathogen has increased with the occurrence of high-level resistance to multiple antimicrobial drugs, such as ampicillin and vancomycin (4). The rapid increase of vancomycin resistance compromises physicians' ability to treat infections caused by many of these strains because often no other antimicrobial drugs are available. The epidemiology of VRE infection differs between Europe and the United States. In Europe, VRE are frequently isolated from farm animals, which have been associated with the abundant use of avoparcin as a growth promoter in the agricultural industry, until it was banned in 1997 (5). The reported prevalence of VRE in hospitals has been low, but increasing rates (>10%) in stool and clinical samples were reported recently (6–9). In the United States, avoparcin was never approved for use in agriculture, and neither were any other glycopeptides; consequently, VRE have not been found in animals or healthy persons. However, nosocomial VRE infection and transmission have occurred much more frequently in the United States. Recent reports have documented, in hospitalized patients, horizontal transfer of the *vanA* gene from vancomycin-resistant *E. faecalis* to methicillin-resistant *Staphylococcus aureus* (MRSA), creating MRSA with high-level resistance to vancomycin (10–13). Nosocomial spread of VRE may therefore create a reservoir of mobile resistance genes for other, more virulent, nosocomial pathogens. Without extensive control measures, large-scale emergence of vancomycin-resistant *S. aureus* (VRSA) may be the next stage in the global crisis of antimicrobial resistance.

The existence of VRE in different ecologic niches complicates the understanding of its epidemiology. Although previous molecular epidemiologic studies on limited numbers of strains suggested host specificity and overrepresentation of certain clones in hospital outbreaks (14,15), these studies did not elucidate the patterns of evolutionary

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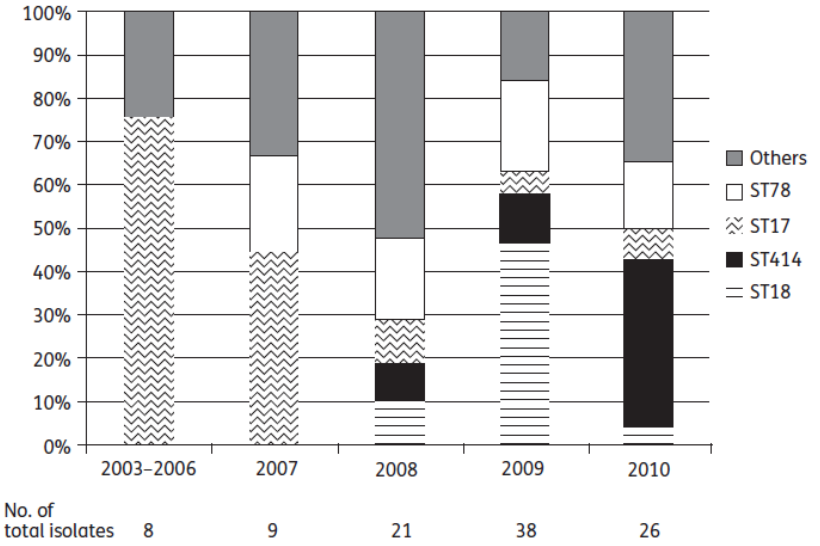
Microbiological and clinical characteristics of VRE faecium bacteraemia in Taiwan



In summary …..

- VRE is in raising trend world-wide and HK will NOT be an exception
- To control the outbreak / speed of raising:
  - Fundamentals for IC: Hand hygiene and environmental / equipment hygiene
  - Bundles of care for specific organisms (VRE as example)
    - Active surveillance
    - Isolation
    - High risk procedures, e.g, napkin round, nasogastric tube feeding
    - Designated equipment
    - Environmental hygiene – with support of new technology, e.g. HPV
  - IT support: Contact tracing, tagging..
  - Communication: Misunderstanding, morale..
  - Commitment is important!
    - Top manager support:
    - ICT's business → Everyone's business

Acknowledgement

Multi-disciplinary

- Infection control team: Overall plan and coordination of the program
- Clinical departments: Give inputs to the proposed control practices, implement the infection control measures, and take part in the surveillance process.
- Doctors: Patients management, early discharge of patients and prudent use of antibiotics. (ASP)
- Hospital management: Support the control strategy and actual support in term of resources
- Hospital supporting services: Enhance the environment cleansing/ disinfection
- Quality and Safety Unit: Participate basic care procedures quality improvement
- School of Nursing: Participate basic care procedure quality improvement and video tapes production
- Community Geriatric Assessment Team: Liaise with long term care facilities to prevent spread of VRE to the LTCF
- Department of Pathology: Laboratory support for the surveillance program and diagnosis of VRE infection, molecular typing of the isolates
- CHP, Department of Health: Improve the infection control standard of the involved LTCF.
- Clinical staff from other cluster hospitals: Participate in opening a designated ward for VRE patients and as manpower support for that ward.

Future Directions

Canadian Agency for Drugs and Technologies in Health Screening, Isolation, and Decolonization Strategies for Vancomycin-Resistant Enterococci or Extended Spectrum Beta-Lactamase Producing Organisms: A Systematic Review of the Clinical Evidence and Health Services Impact (Sept 2012)

- **Active surveillance and infection prevention and control measures help to prevent horizontal transmission of the infection.**
- Implementation of precautionary measures needs to take into consideration the **negative psychological effects** that isolation may have on hospitalized patients and the impact on patient flow and the unavailability of single rooms for other types of isolation.
- Patients infected or colonized with VRE use **more hospital resources** due to increased LOS, increased usage of hospital beds, increased health care worker staffing, and the need for precautions to prevent the spread of infection.
- The relative contributions of infection control measures versus the effect of infection or illness itself to resource use were not clear. A **balance** between a **potential reduction in infection risk** and **increased resource use** is an **important consideration when implementing control strategies**.

What next… ??

Prevalence is increasing…

- Further actions for containment?
  - Broaden the ASC scope?
    - High risk, admission, prevalence, extend contact tracing (ward, <48hrs, 2 –ve…)
    - Isolation beds
    - Workload – frontline, ICT, laboratory
  - Enhancement of environmental hygiene?
- When to refine our strategy?
  - Protect the high risk group
  - Prevent infection outbreak
  - Basic contact precaution

Thank you!