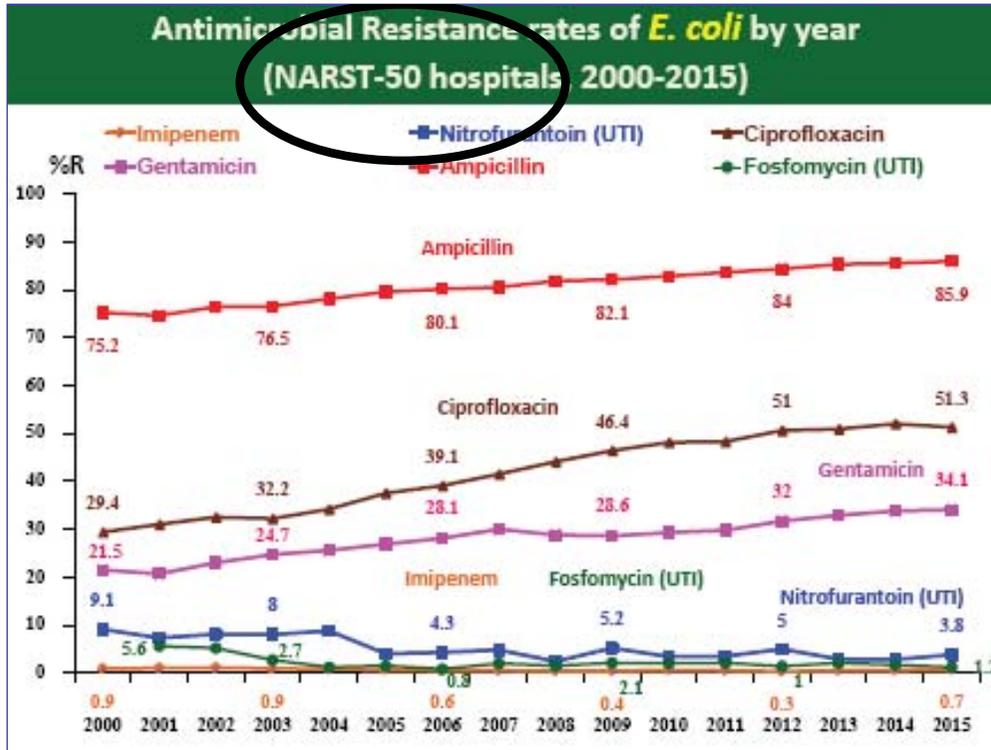


# Carbapenems resistant Enterobacteriaceae (CRE)

Khachornsakdi Silpapojakul MD  
Prince of Songkla University  
Hat yai, Thailand



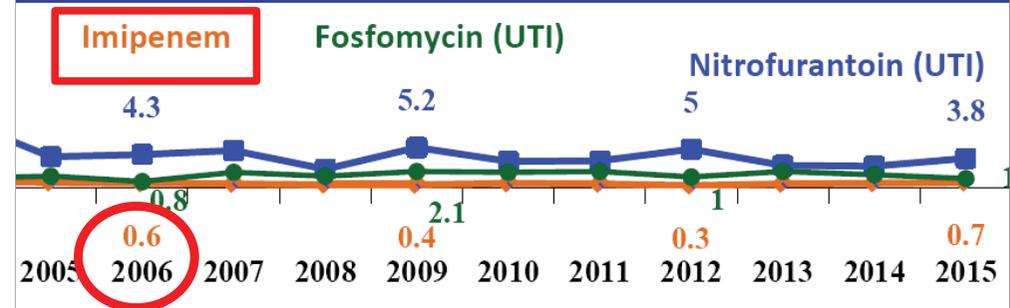
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# Prevalence of CREs in Thailand How much ?

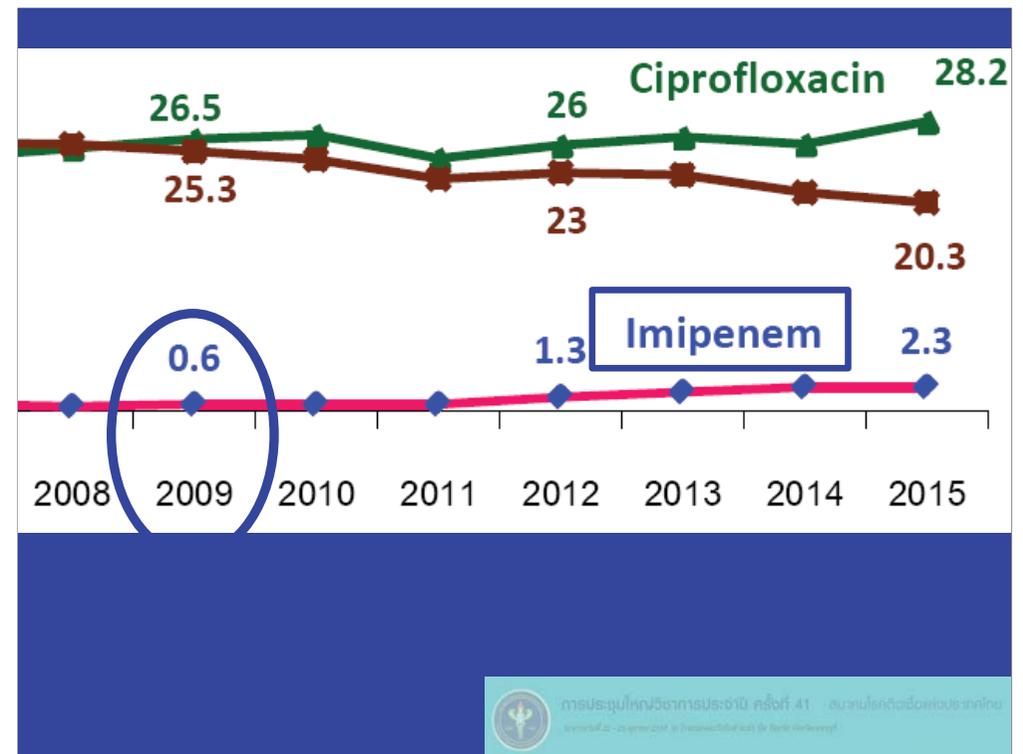
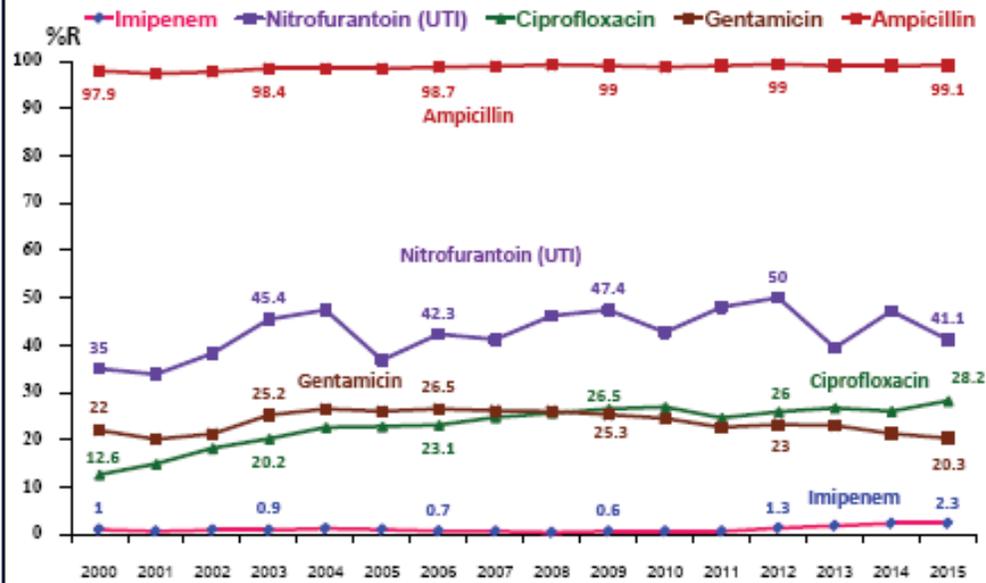


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## Antimicrobial Resistance rates of *K. pneumoniae* by year (NARST-50 hospitals, 2000-2015)



## Survey for Carbapenemase-Producing *Klebsiella pneumoniae* isolated from Clinical Specimens in Thai Hospitals

Rajan Manchanda<sup>1</sup>,  
Anuwat Ruangsri<sup>1</sup>,  
Arisara Viriyavaree<sup>1</sup>,  
Sataporn Inpirut<sup>1</sup>,  
Sunisa Thongma<sup>1</sup>,  
Sawanya Pongparit<sup>1</sup>,  
Suwanna Trakulsomboon<sup>2</sup>

Year: = 2010  
Site: = 4 Bangkok Hospitals  
No. of Ertapenem resistant = 18/351(5.1%)

## PSU Ertapenem- resistant *K pneumonia*



Year: = 2010 -2011  
 Site: = Khonkaen  
 No. of Ertapenem resistant: = 104/4818(2.2%)  
 Clonal transmission: 2/8

## Emergence of NDM-1- and IMP-14a-producing Enterobacteriaceae in Thailand

Benchamas Rimrang<sup>1</sup>, Aroonwadee Chanawong<sup>2\*</sup>, Aroonlug Lulitanond<sup>2</sup>, Chotechana Wilailuckana<sup>2</sup>, Nicha Charoensri<sup>2</sup>, Pipat Sribenjalux<sup>2</sup>, Waewta Phumsrikaew<sup>3</sup>, Lumyai Wonglakorn<sup>3</sup>, Anusak Kerdsin<sup>4</sup> and Ploenchan Chetchotisakd<sup>5</sup>

## CREs, PSU

| Year | surveillance | clinical cases | Total |
|------|--------------|----------------|-------|
| 2012 | 5            | 1              | 6     |
| 2013 | 11           | 13             | 24    |
| 2014 | 57           | 31             | 88    |
| 2015 | 84           | 33             | 117   |
|      | 157          | 78 (33.2%)     | 235   |

First CRE Isolates: -> CA UTI in SRCU ward in June of 2012

**“CREs colonization/infection in PSU was first detected in surgical wards in mid 2012 and in medical wards by the end of the same year . Major outbreaks began in 2013.”**



## **PSU- CREs: Where??**

|                    |                     |
|--------------------|---------------------|
| <b>Surgery</b>     | <b>= 36 ( 46%)</b>  |
| <b>Medicine</b>    | <b>= 26 ( 33%)</b>  |
| <b>Orthopedics</b> | <b>= 5 (6.4%)</b>   |
| <b>Gynaecology</b> | <b>= 4 ( 5.1 %)</b> |
| <b>Pediatrics</b>  | <b>= 3 ( 3.8%)</b>  |



## **Remark:**

**“ Half of CRE cases occurred in surgical patients and CREs were relatively uncommon in children and there has been no outbreak in NICU. Regarding the infection control, surgical personnels are our No. 1 clients. ”**



## **CREs in PSU: which site?** (excluding RSC surveillance cultures)

|                               |                   |
|-------------------------------|-------------------|
| <b>1. Urine</b>               | <b>= 32 (41%)</b> |
| <b>2. Sputum</b>              | <b>= 14</b>       |
| <b>1.1 Emphyema</b>           | <b>= 2</b>        |
| <b>2. Intraabd. infection</b> | <b>= 13</b>       |
| <b>3. Blood</b>               | <b>= 10</b>       |
| <b>4. Surgical wound</b>      | <b>= 5</b>        |
| <b>5. Others</b>              | <b>= 2</b>        |
| <b>Total</b>                  | <b>= 78</b>       |



## CREs in surgical wards: which site? (excluding RSC surveillance cultures)

|                        |      |
|------------------------|------|
| 1. Urine               | = 15 |
| 2. Intraabd. infection | = 11 |
| 3. Sputum              | = 5  |
| 1.1 Empyema            | = 1  |
| 2. Blood               | = 3  |
| 3. Surgical wound      | = 3  |
| 4. Others              | = 2  |
| Total                  | = 40 |



## Orthopedic CREs: Sites

UTI (4) ,  
Blood (1) ,  
RSC surveillance (7)



## Gynecologic CREs: Sites

UTI (4) ,  
Blood (2) ,  
RSC surveillance (1)



## Pediatric CREs: Sites

UTI (2) ,  
Blood, pus (1) ,  
RSC surveillance (1)



## Remark:

“ The most common site of CRE infections is the urine. Guidelines to Mx and prevent CA-UTI should be on the priority list in fighting against CRE infections.”



## PSU Hospital

2012

2013

|                                 |                    |            |
|---------------------------------|--------------------|------------|
| No. of patients catherized      | 3424               | 3477       |
| Total duration of days on Foley | 11776              | 11320 days |
| Mean duration of days on Foley  | 3.4                | 3.2 days   |
| No. of CA-UTI                   | 55 (1.6%)          | 29 (0.8%)  |
|                                 | <i>P = 0.00338</i> |            |



|                            | 2012 | 2013 |
|----------------------------|------|------|
| No. of patients catherized | 3424 | 3477 |
| Surgical patients          | 2499 | 2504 |
| Medical patients           | 721  | 781  |
| Pediatric patients         | 204  | 192  |



## Pediatric CREs: Sites & Clinical

- 1 Urosepsis in a 6 mo old baby c posterior urethral valve c vesicourinary relulx & multiple epsodes of UTIs. Survived with fosfomycin & ciprofloxacin.
2. Fatal UTI from Satoon Hospital in a child with neuroblastoma & hydronephrosis.
3. Buttock ulcer in a baby c 1 immune def & recurrent pneumonia. -> died.



## Remark:

The rarity of CREs in children might be due to the uncommon occurrence of UTI and urinary instrumentation in children.”



## The other reasons:



## PSU MRSA 2010 -2014

| ปี 2010 | ปี 2011 | ปี 2012 | ปี 2013 | ปี 2014 |
|---------|---------|---------|---------|---------|
| 165     | 138     | 148     | 100     | 78      |



| หอผู้ป่วย    | 2551 | 2552 | 2553 | 2554 | 2555 |
|--------------|------|------|------|------|------|
| NICU1 (NMCU) | N/A  | N/A  | 1    | 1    | 1    |
| NICU2 (NICU) | 12   | 2    | -    | 1    | 0    |
| PICU         | 6    | 3    | -    | 2    | 1    |
| เด็ก 1       | 1    | 3    | -    | -    | 1    |
| เด็ก 2       | 4    | -    | 2    | 3    | 0    |
| ศัลยกรรมเด็ก | 2    | 3    | 2    | -    | 0    |



## Remark:

“The rarity of CREs in children in PSU Hospital might be also due to the excellent handwashing practices in the Department of Pediatric (as indirectly evidenced by the rarity of MRSA isolates in their wards.)”



## PSU- CREs Epidemiology by department : Medical wards



## CREs in medical wards, PSU

| Year | surveillance | clinical cases | Total |
|------|--------------|----------------|-------|
| 2012 | 3            | 0              | 3     |
| 2013 | 7            | 5 (41.7%)      | 12    |
| 2014 | 22           | 8 (26.7%)      | 30    |
| 2015 | 64           | 13 (16.9 %)    | 77    |
|      | 96           | 26 (23.2%)     | 112   |

First CRE Isolates: RSCs in Oct (Fl.11) & Nov (MICU) & Dec (Fl. 11) in 2012.



“CRE colonization in PSU Medical ward was first detected in late 2012 before infections appeared , first in RCU. (in early 2013), and ? spread to MICU in June 2013. Major outbreak of CRE in medical wards occurred first in male med ward in 2014, followed by female ward in 2015.”



## PSU Ertapenem- resistant *K pneumonia*

|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
| 2%   | 1.9% | 1.4% | 1.4% | 2.8% | 4.9% | 6.8% |

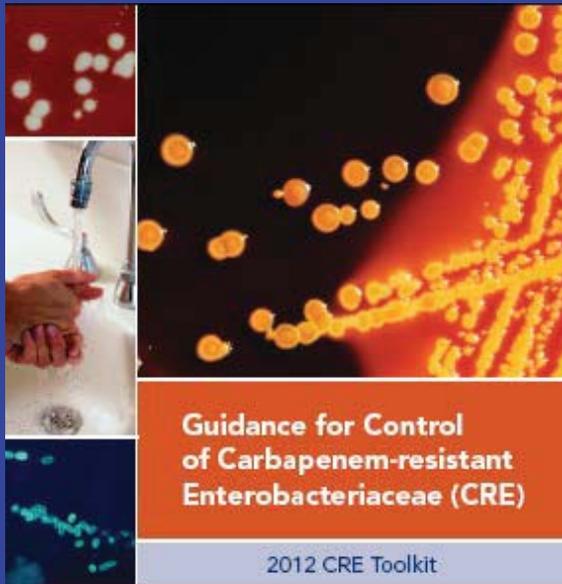


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## CRE vs. IC



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National Center for Emerging and Zoonotic Infectious Diseases  
Division of Fieldwork and Surveillance



สาขาโรคติดต่ออุบัติใหม่

## 8 Core Measures:

1. Hand hygiene
2. Contact Precautions
3. Patient and staff cohorting
4. Minimize use of invasive devices.
5. Promote antimicrobial stewardship.
6. Screening.



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## 2 Supplemental Measures for Healthcare Facilities with CCL Transmission

- Conduct active surveillance testing.
- Chlorhexidine bathing

## 8 Core Measures:

### 1. Hand hygiene

Promote hand hygiene.  
Monitor hand hygiene adherence and provide feedback.

### ผลสำรวจการล้างมือก่อน-หลัง ดูแลผู้ป่วยที่มีผลการเพาะเชื้อพบเชื้อCRE หรือ VRE (July- Sept 2015)

| PROCEDURE<br>CRE/VRE | nurse  |         |       |         | PN     |         |       |         |
|----------------------|--------|---------|-------|---------|--------|---------|-------|---------|
|                      | before |         | after |         | before |         | after |         |
|                      | ล้าง   | ไม่ล้าง | ล้าง  | ไม่ล้าง | ล้าง   | ไม่ล้าง | ล้าง  | ไม่ล้าง |
| ICU ตัลยกรรม         | 19     | 0       | 19    | 0       | 10     | 0       | 10    | 0       |
| ICU อายุรกรรม        | 24     | 0       | 24    | 0       | 4      | 0       | 4     | 0       |
| อายุรกรรมชาย 1       | 21     | 0       | 21    | 0       | 11     | 0       | 11    | 0       |
| อายุรกรรมทั่วไป      | 0      | 0       | 0     | 0       | 0      | 0       | 0     | 0       |
| RCU                  | 18     | 5       | 23    | 0       | 5      | 1       | 6     | 0       |
| อายุรกรรมหญิง        | 20     | 0       | 20    | 0       | 0      | 0       | 0     | 0       |

### ผลสำรวจการล้างมือก่อน-หลัง ดูแลผู้ป่วยที่มีผลการเพาะเชื้อพบเชื้อCRE หรือ VRE (July- Sept 2015)

| PROCEDURE<br>CRE/VRE | doctor |         |       |         | นศพ    |         |       |         |
|----------------------|--------|---------|-------|---------|--------|---------|-------|---------|
|                      | before |         | after |         | before |         | after |         |
|                      | ล้าง   | ไม่ล้าง | ล้าง  | ไม่ล้าง | ล้าง   | ไม่ล้าง | ล้าง  | ไม่ล้าง |
| ICU ตัลยกรรม         | 7      | 0       | 7     | 0       | 0      | 0       | 0     | 0       |
| ICU อายุรกรรม        | 2      | 8       | 4     | 6       | 0      | 0       | 0     | 0       |
| อายุรกรรมชาย 1       | 10     | 1       | 10    | 1       | 2      | 0       | 2     | 0       |
| อายุรกรรมทั่วไป      | 0      | 0       | 0     | 0       | 0      | 0       | 0     | 0       |
| RCU                  | 0      | 0       | 0     | 0       | 0      | 0       | 0     | 0       |
| อายุรกรรมหญิง        | 4      | 0       | 4     | 0       | 0      | 0       | 0     | 0       |

# Frequency of *Klebsiella pneumoniae* Carbapenemase (KPC)–Producing and Non-KPC-Producing *Klebsiella* Species Contamination of Healthcare Workers and the Environment

Clare Rock, MD;<sup>1</sup> Kerri A. Thom, MD, MS;<sup>1</sup>  
Max Masnick, BA;<sup>1</sup> J. Kristie Johnson, PhD;<sup>2</sup>  
Anthony D. Harris, MD, MPH;<sup>1</sup>  
Daniel J. Morgan, MD, MS<sup>1,3</sup>

*Infect Control Hosp Epidemiol* 2014;35(4):426-429



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กรุงเทพฯ 22-25 กุมภาพันธ์ 2558 ณ โรงแรมดิเวลโลว์ กรุงเทพฯ

**Overall, 10(10.4%) of 96 HCW-patient interactions resulted in contamination of HCW gloves or gowns.**

The rate of contamination with *Klebsiella* species is similar to that with MRSA (13.8%-18.5%), and VRE (8.5%-13.9%).



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## Frequency (%) of contamination by activity

|                                     |                |
|-------------------------------------|----------------|
| Wound care                          | 36.4% (4/11)   |
| Manipulation of catheter or drain   | 37%(10/27)     |
| Touching bed rail                   | 22.8% (18/79)  |
| Touching intravenous pump or tubing | 20% (11/55)    |
| Physical examination                | 13.3% (21/158) |



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## 2. Contact Precautions.

Place CRE colonized or infected patients on Contact Precautions (CP)



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## 2. Contact Precautions.

Gloves & Gown ,especially for patients who are totally dependent upon HCP for their activities of daily living, are ventilator-dependent, are incontinent of stool, or have wounds with drainage that is difficult to control.

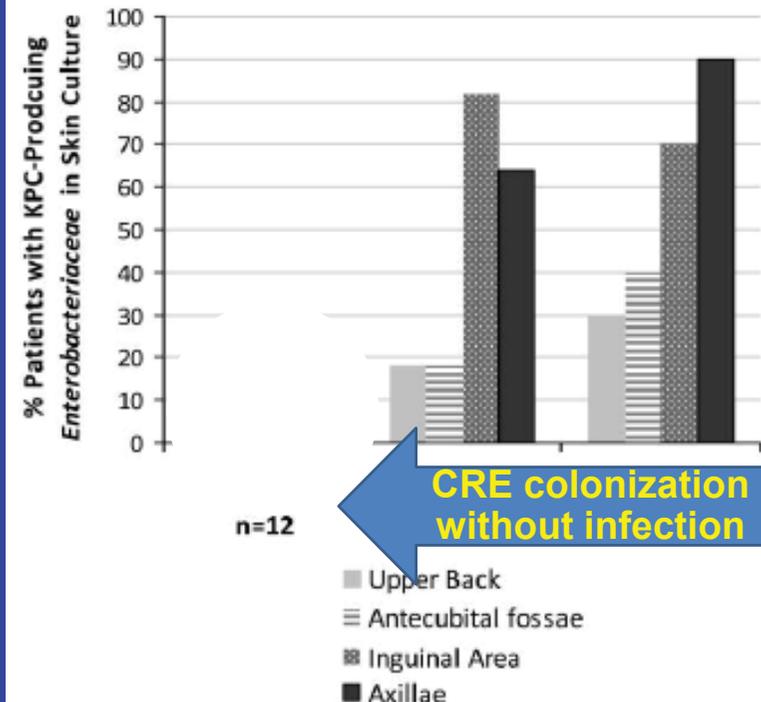
For other residents who are able to perform hand hygiene, are continent of stool, are less dependent on staff for their activities of daily living, and are without draining wounds, the requirement for Contact Precautions might be relaxed.

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY JANUARY 2013, VOL. 34, NO. 1

ORIGINAL ARTICLE

### Anatomic Sites of Patient Colonization and Environmental Contamination with *Klebsiella pneumoniae* Carbapenemase-Producing Enterobacteriaceae at Long-Term Acute Care Hospitals

Caroline J. Thurlow, MD;<sup>1,2</sup> Kavitha Prabaker, MD;<sup>1,2</sup> Michael Y. Lin, MD, MPH;<sup>1,2</sup> Karen Lolans, BS;<sup>1</sup> Robert A. Weinstein, MD;<sup>1,2</sup> Mary K. Hayden, MD;<sup>1,2</sup>  
for the Centers for Disease Control and Prevention Epicenters Program



### 3. Patient and staff cohorting.

When available, cohort CRE colonized or infected patients and the staff that care for them.

“if not available, these patients should be cohorted together.”

### CREs in the Dept. of Medicine :

No. of clinical cases  
2012-2015                      2015

RCU

FI.9

FI 11

MICU

### CRE in PSU-Surgical ICUs

First isolate from: Urine on 30<sup>th</sup> June 2012

| Year | surveillance | clinical isolates | Total |
|------|--------------|-------------------|-------|
| 2012 | 0            | 1                 | 1     |
| 2013 | 0            | 0                 | 0     |
| 2014 | 1            | 3                 | 4     |
|      | 1            | 4                 | 5     |

Last isolate: 22<sup>nd</sup> Oct 2014

### CRE in PSU-male Med Ward

| Year | surveillance | clinical isolates | Total |
|------|--------------|-------------------|-------|
| 2012 | 0            | 0                 | 0     |
| 2013 | 0            | 0                 | 0     |
| 2014 | 8            | 2                 | 10    |
| 2015 | 31           | 6                 | 37    |

Last isolate: 1<sup>st</sup> Sept 2015

## CRE in PSU-female Med Ward

| Year | surveillance | clinical isolates | Total |
|------|--------------|-------------------|-------|
| 2012 | 2            | 0                 | 2     |
| 2013 | 0            | 0                 | 0     |
| 2014 | 0            | 0                 | 0     |
| 2015 | 16           | 6                 | 22    |

Last isolate: 22<sup>nd</sup> Sept 2015



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## Remark:

“Although symptomatic CREs have declined in MICU & RCU ( 0 and 1 case in 2015, respectively) the disease are still active in FI.9 & FI.11.”



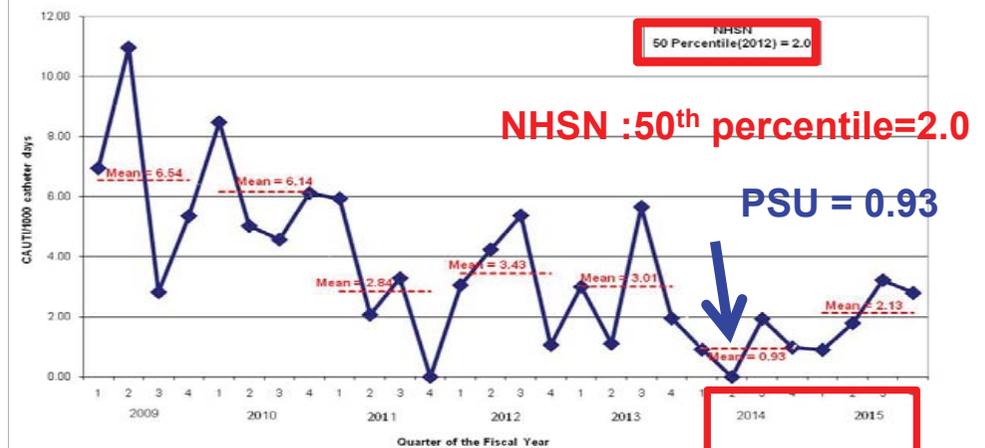
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Why are we successful in controlling CREs in ICUs but not in ordinary wards ???



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Catheter-Associated Urinary Tract Infection in ICU



การประเมินคุณภาพการประจําปี ครั้งที่ 41 สถาบันส่งเสริมเพื่อประเทศไทย  
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| หอผู้ป่วย | CAUTI ประจำปีงบประมาณ |      |      |       |      |      |      |
|-----------|-----------------------|------|------|-------|------|------|------|
|           | 2551                  | 2552 | 2553 | 2554  | 2555 | 2556 | 2557 |
| RCU       | 18.40                 | 4.72 | 9.62 | 14.76 | 5.56 | 0.00 | 0.00 |

| หอผู้ป่วย    | CAUTI rate (ครั้ง/1000วัน) |      |      |   |
|--------------|----------------------------|------|------|---|
|              | 1                          | 2    | 3    | 4 |
| ไตรมาส       |                            |      |      |   |
| ICUอายุรกรรม | 0.00                       | 0.00 | 0.00 |   |

|           | No. infected |         | CA UTI-rate |      |
|-----------|--------------|---------|-------------|------|
|           | 2012         | 2013    | 2012        | 2013 |
| SRCU      | 9            | 9       | 8.1         | 10.6 |
| SICU      | 5            | 6       | 1.7         | 2.1  |
| Surg 1    | 2            | 2       | 1.6         | 1.6  |
| Surg 2    | 8            | 2       | 7.8         | 2.1  |
| Neurosurg | 2            | 3       | 4.6         | 6.9  |
| Surg 4    | 3            | 1       | 2.5         | 0.8  |
| Trauma    | 3            | 0       | 3.4         | 0    |
| Total     | 32/2499      | 23/2504 | P= 0.2187   |      |

**Remark:**

“ “ Zero CA-UTI is possible and real. The declined incidence of CREs in MICU , SICU & RCU wards might be, in some part, due to improved prevention of CA-UTI in those units.”

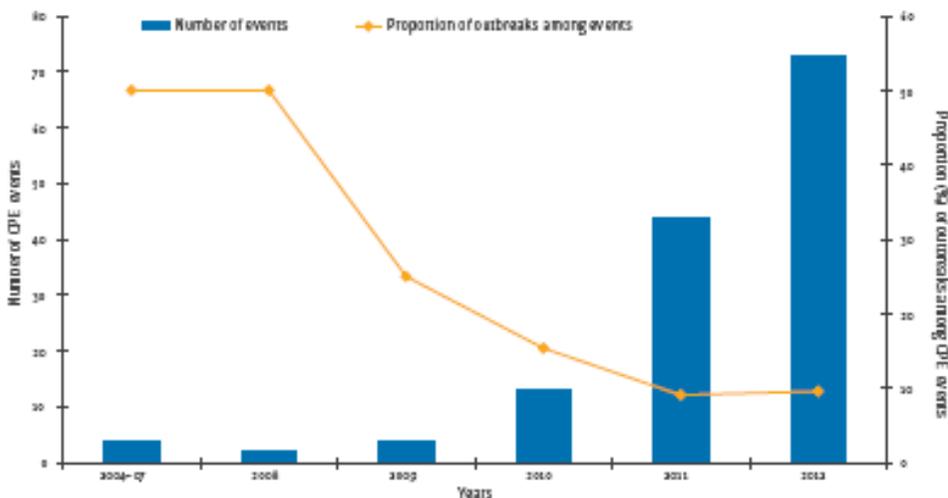


# Long-term control of carbapenemase-producing Enterobacteriaceae at the scale of a large French multihospital institution: a nine-year experience, France, 2004 to 2012

S Fournier (sandra.fournier@sap.aphp.fr)<sup>1</sup>, C Montell<sup>1</sup>, M Lepointeur<sup>2</sup>, C Richard<sup>2</sup>, C Brun-Buisson<sup>3</sup>, V Jarlier<sup>4</sup>, AP-HP Outbreaks Control Group<sup>5</sup>

□□□□ □□□□□□□□. 201□□1□□1□□□□□□=20802.

**FIGURE**  
 Number of carbapenemase-producing Enterobacteriaceae (CPE) events (n=140) and proportion of outbreaks among these events at Assistance Publique-Hôpitaux de Paris, France, 2004–2012



if a secondary case was identified, patients had to be cohorted in three distinct areas with dedicated nursing staff:

1. C/E patients section,
2. contact patients section and
3. C/E-free patients section for newly admitted patients with no previous contact with C/E cases

| Event* and related cases  | Measures Implemented within two days following admission of the Index case |                     | Delayed measures of control <sup>b</sup> | P value |
|---|--|---------------------|--|---------|
|   | Dedicated nursing staff  | Barrier precautions |  |         |
| Number of cases   | 18   | 74                  | 108                                      | –       |
| Number of secondary cases (proportion of secondary cases among cases) | 0 (0%)   | 19 (26%)            | 41 (38%)                                 | 0.001   |

## Dedicated nursing staff

18

0 (0%)

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

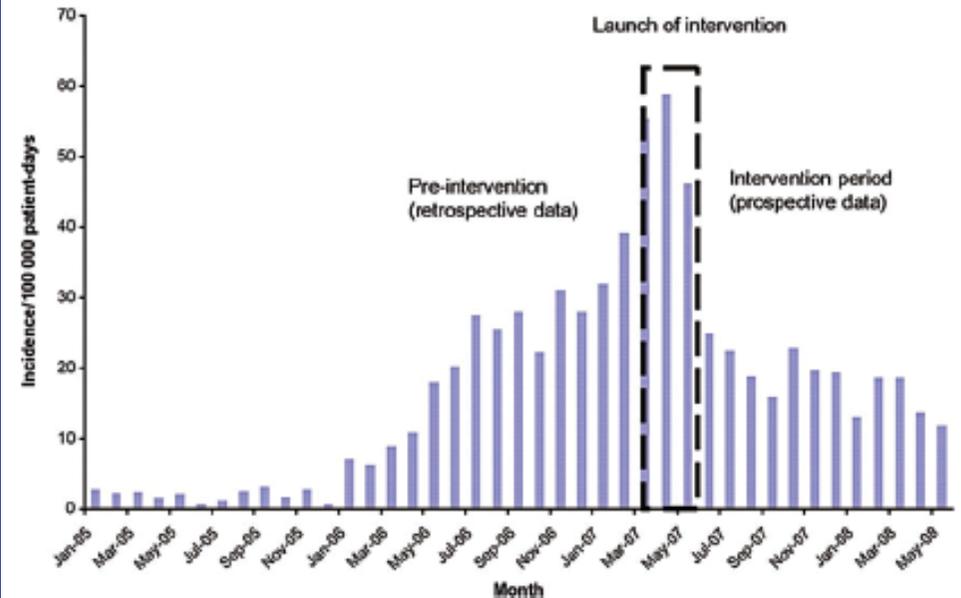
Mitchell J. Schwaber and Yehuda Carmeli  
National Center for Infection Control, Tel Aviv, Israel

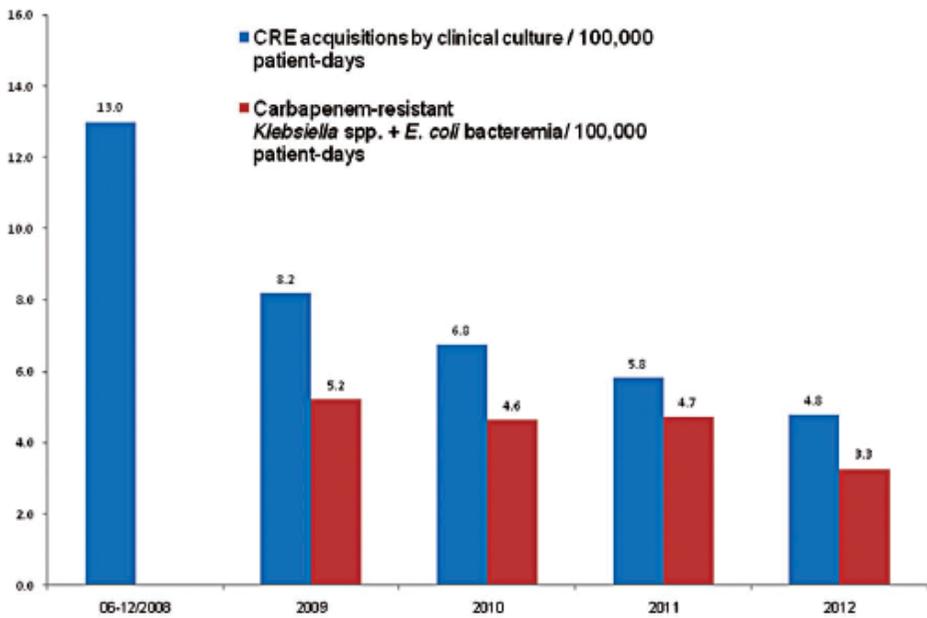
Carbapenem-resistant Enterobacteriaceae (CRE) incidence in Israel, 2011-2018

In March 2007, the Israel Ministry of Health established a task force which the following year became the National Center for Infection Control (NCIC).

## Interventions

“Carriers be cared for by a dedicated nursing staff, meaning that nurses caring for carriers would not be assigned to care for noncarriers on the same shift.”

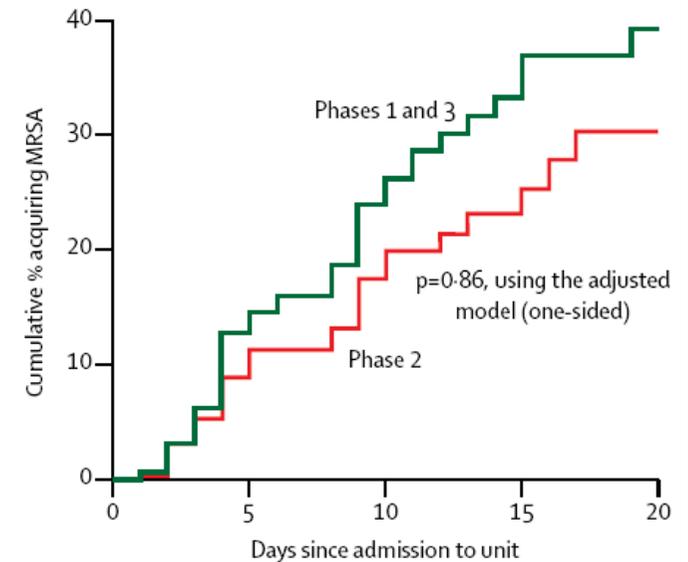
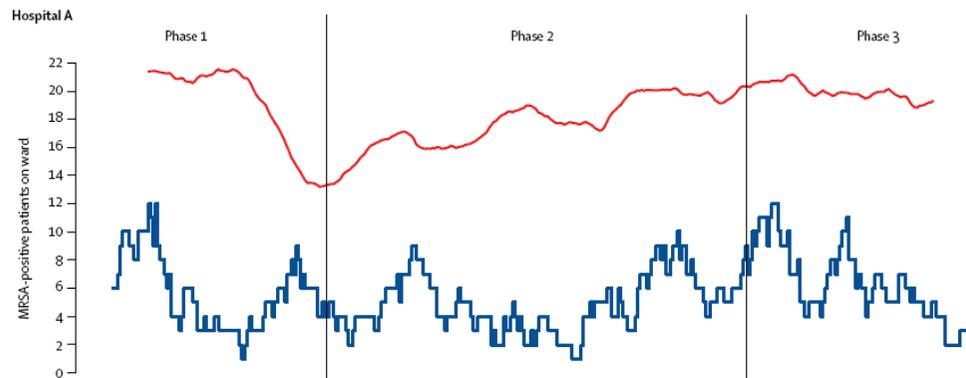




## Isolation of patients in single rooms or cohorts to reduce spread of MRSA in intensive-care units: prospective two-centre study

Jorge A Cepeda, Tony Whitehouse, Ben Cooper, Janeane Hails, Karen Jones, Felicia Kwaku, Lee Taylor, Samantha Hayman, Barry Cookson, Steve Shaw, Chris Kibbler, Mervyn Singer, Geoffrey Bellingan, A Peter R Wilson *Lancet* 2005;365:295-304

Study sites: 3 ICUs of 2 London teaching hospitals.



| Number at risk | 0   | 5   | 10 | 15 | 20 |
|----------------|-----|-----|----|----|----|
| Phases 1 and 3 | 351 | 140 | 66 | 36 | 24 |
| Phase 2        | 347 | 154 | 70 | 34 | 24 |

Figure 3: MRSA acquisition in intensive-care unit by study phase

Observed compliance with handwashing = 21%

handwashing opportunities observed = one every 3 min.



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Journal of Hospital Infection (1998) 39: 213-219



## The effect of increased bed numbers on MRSA transmission in acute medical wards

C. C. Kibbler, A. Quick and A.-M. O'Neill

Department of Medical Microbiology, Royal Free Hospital, Pond St, London NW3 2QG, UK

**Summary:** An 18-month prospective survey was performed to examine the effect of adding a fifth bed to four-bedded bays in three acute medical wards on colonization by methicillin-resistant *Staphylococcus aureus* (MRSA). Screening procedures were in accordance with the UK national guidelines. All patients newly colonized with MRSA were visited, and their bed location determined. Data from the five-bedded bays were compared with those from four-bedded bays in similar wards. Potential routes of transmission were investigated by observational surveys. The relative risk of colonization in five-bedded medium dependency bays was 3.15 compared with that of similar four-bedded bays ( $P < 0.005$ ); and in the five-bedded low dependency bays was 3.16 ( $P < 0.005$ ). Increasing the number of beds in a fixed area heightens the risk of cross-infection with MRSA.

**Keywords:** MRSA; infection control; hospital design and construction; nosocomial.



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INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY

March 1996

## THE ROLE OF UNDERSTAFFING IN CENTRAL VENOUS CATHETER-ASSOCIATED BLOODSTREAM INFECTIONS

Scott K. Fridkin, MD; Suzanne M. Pear, RN, MS, CIC; Theresa H. Williamson, RN, BSN, CIC; John N. Galgiani, MD; William R. Jarvis, MD

### ABSTRACT

**OBJECTIVE:** To determine risk factors for central venous catheter-associated bloodstream infections (CVC-BSI) during a protracted outbreak.

**DESIGN:** Case-control and cohort studies of surgical intensive care unit (SICU) patients.

**SETTING:** A university-affiliated Veterans Affairs medical center.

**PATIENTS:** Case-control study: all patients who developed a CVC-BSI during the outbreak period (January 1992 through September 1993) and randomly selected controls. Cohort study: all SICU patients during the study period (January 1991 through September 1993).

**MEASUREMENTS:** CVC-BSI or site infection rates, SICU patient clinical data, and average monthly SICU patient-to-nurse ratio.

**RESULTS:** When analyzed by hospital location and site, only CVC-BSI in the SICU had increased significantly in the outbreak period compared to the previous year (January 1991 through December 1991; pre-outbreak period). In SICU patients, CVC-BSI were associated with receipt

of total parenteral nutrition (TPN); odds ratio, 16; 95% confidence interval, 4 to 73). When we controlled for TPN use, CVC-BSI were associated with increasing severity of illness and days on assisted ventilation. SICU patients in the outbreak period had shorter SICU and hospital stays, were younger, and had similar mortality rates, but received more TPN compared with patients in the pre-outbreak period. Furthermore, the patient-to-nurse ratio significantly increased in the outbreak compared with the pre-outbreak period. When we controlled for TPN use, assisted ventilation, and the period of hospitalization, the patient-to-nurse ratio was an independent risk factor for CVC-BSI in SICU patients.

**CONCLUSIONS:** Nursing staff reductions below a critical level, during a period of increased TPN use, may have contributed to the increase in CVC-BSI in the SICU by making adequate catheter care difficult. During healthcare reforms and hospital downsizing, the effect of staffing reductions on patient outcome (ie, nosocomial infection) needs to be critically assessed (*Infect Control Hosp Epidemiol* 1996;17:150-158).



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# Nursing staff workload as a determinant of methicillin-resistant *Staphylococcus aureus* spread in an adult intensive therapy unit

A. F. Vicca

Public Health Laboratory, Leicester Royal Infirmary, Infirmary Square, Leicester LE1 5WW

**Summary:** Acquisition of methicillin resistant *Staphylococcus aureus* (MRSA) in the intensive care unit of a tertiary referral centre was monitored over a 19-month period. The incidence of new cases of MRSA correlated with peaks of nursing staff workload and times of reduced nurse/patient ratios within the unit. This implies that nurse understaffing contributes significantly to the spread of MRSA in an ITU setting.

### Introduction

Methicillin resistant *Staphylococcus aureus* (MRSA) is a major cross-infection problem in hospitals today. The Leicestershire hospitals have had a particular problem recently. It seemed obvious that MRSA outbreaks occurred during periods when the affected unit was very busy. The possibility that MRSA

period of their stay in the ITU identified. Each day on the unit they were identified as either 'known MRSA positive' or 'would subsequently become MRSA positive'. This allowed the elimination of diagnostic time lags caused by laboratory delays and enabled the identification of times of potential transmission.

The following information was collected (per 8-h shift): number of trained nursing staff

Vol. 17, No. 3 INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY 147

Editorial

## Understaffing: A Risk Factor for Infection in the Era of Downsizing?

Barry M. Farr, MD, MSc

Francis Bacon observed that "knowledge is power." There must be few uses of power more gratifying than to stop an epidemic of bloodstream infections, as demonstrated in the accompanying article by Fridkin et al.<sup>1</sup> Catheter-related bloodstream infections are particularly troublesome because of dramatic morbidity, a case fatality rate of 14%,<sup>2</sup> and their iatrogenic nature.

decision to treat would result in a diagnosis of bloodstream infection according to NNIS definitions, even if several other sets of simultaneous blood cultures were negative.<sup>3</sup> It is not stated whether the method employed for catheter segment cultures was the same as that recommended by Maki,<sup>7</sup> and, if so, why a CFU count >15 was not used (as recommended by Maki) rather than qualitative grading of microbial

## Remark:

The main reason that we could control CREs transmission in MICU, SICU & RCU is because of the better nurse- to- patient ratio in these unit .

## Remark:

“This may also explain the absence of CREs in our NICU.”

## CREs in MICU & RCU: ??Gone ??

## CREs in PSU-MICU

| Year | surveillance | clinical isolates | Total |
|------|--------------|-------------------|-------|
| 2012 | 1            | 0                 | 1     |
| 2013 | 4            | 1                 | 5     |
| 2014 | 1            | 2                 | 3     |
| 2015 | 8            | 0                 | 8     |
|      | 14           | 3 (18%)           | 17    |

Last clinical case: July 2014

Last isolate: surveillance RSC, 6<sup>th</sup> July 2015

## CREs in PSU-RCU

| Year | surveillance | clinical isolates | Total |
|------|--------------|-------------------|-------|
| 2012 | 0            | 0                 | 0     |
| 2013 | 3            | 4                 | 7     |
| 2014 | 13           | 4                 | 17    |
| 2015 | 9            | 1                 | 10    |
|      | 25           | 9                 | 34    |

Last clinical case: UTI ,Apr 2015

Last isolate: surveillance RSC,30<sup>th</sup> June 2015

## Remark:

“ Eventhough the number of clinical CRE cases in ICUs has declined to only one case in 2015, active surveillance in June 2015 had identified 17 asymptomatic rectal carriers of CREs in these units .”

## Take home message:

“ Clinical CRE cases were just a tip of a giant iceberg.”



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กรุงเทพฯ 22-25 ส.ค. 2558 ณ โรงแรมดิเวลโลว์ กรุงเทพฯ

## Active surveillance for CREs:

To do or not to do????



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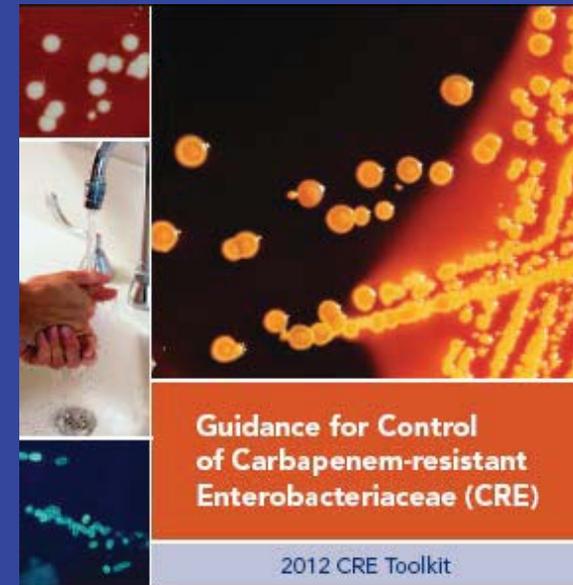
## Yield of PSU active surveillance

Number of colonized case detected among contacts of CRE-cases = 22/263 (8.4%)

[For VRE= 3/65 (4.6%)]



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Global Center for Emerging and Zoonotic Infectious Diseases  
Division of Fieldwork Data & Surveillance



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## 8 Core Measures:



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## 7. Conduct active surveillance testing.

“Screen high-risk patients at admission or at admission and periodically during their facility stay for CRE.



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## PSU-CREs: A prospective one month surveillance study.

Time: 9 June- 8 July 2015

Site: Fl. 11 female med ward.

Fl. 9 male med ward.

RCU & MICU.



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Weekly rectal swab culture using selective media for CREs on every patient until discharge or death.



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## Results:

No. of new patients admitted during this one month of the study = 260

Became positive on follow-up cultures = 32/260 = 12.3%

Incidence of CREs = 12.3%

None of the patients had clinical symptoms related to their CREs.

## PSU- CREs in urine

Total = 32

Colonized without pyuria = 5 (15.6%)

Asymptomatic pyuria = 3 (9.4%)

Symptomatic UTI = 23 (71.9%)

Bacteremia = 1 (3.1%)

“ One fourth of CREs in urine did not need Rx. and bacteremia associated c CREs in urine was rare.”

## CREs: Infection vs colonization

Clinical Infectious Diseases 2010;50:625–663

IDSA GUIDELINES

Diagnosis, Prevention, and Treatment of Catheter-Associated Urinary Tract Infection in Adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America

Thomas M. Hooton,<sup>1</sup> Suzanne F. Bradley,<sup>3</sup> Diana D. Cardenas,<sup>2</sup> Richard Colgan,<sup>4</sup> Suzanne E. Geerlings,<sup>7</sup> James C. Rice,<sup>5\*</sup> Sanjay Saint,<sup>3</sup> Anthony J. Schaeffer,<sup>6</sup> Paul A. Tambayh,<sup>8</sup> Peter Tenke,<sup>9</sup> and Lindsay E. Nicolle<sup>10,11</sup>

## Suggestion

**In Foley catheter- related UTIs, bacteremia is uncommon. ดังนั้น, ใจเย็นเย็น**



## Suggestion

**ต่อให้มี pyuria, ถ้าผู้ป่วยไม่มีอาการ จงอย่า treat**



## Take home message:

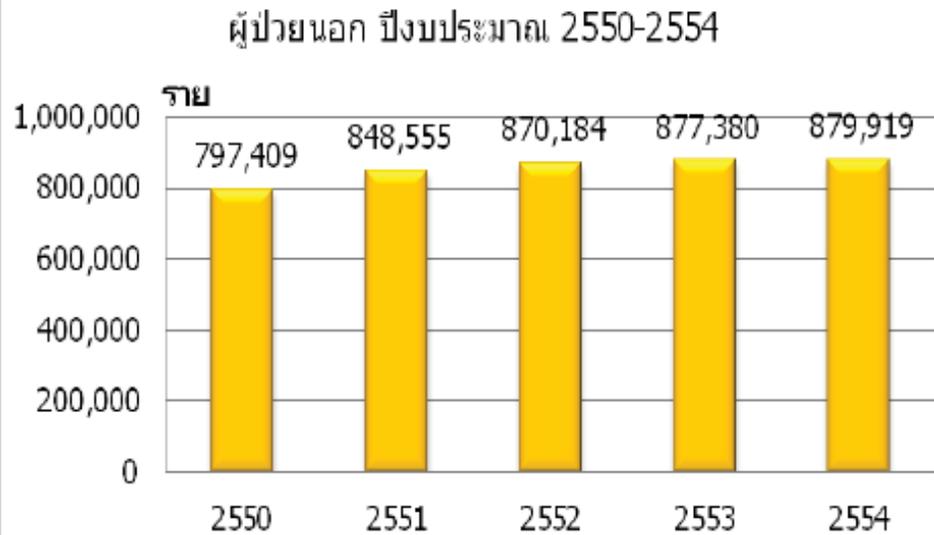
**“ Clinical CRE cases were just a tip of a giant iceberg. Unrecognized colonization may later develop into an overt infection under antibiotic pressure. An antibiotic stewardship program is urgently needed. ”**



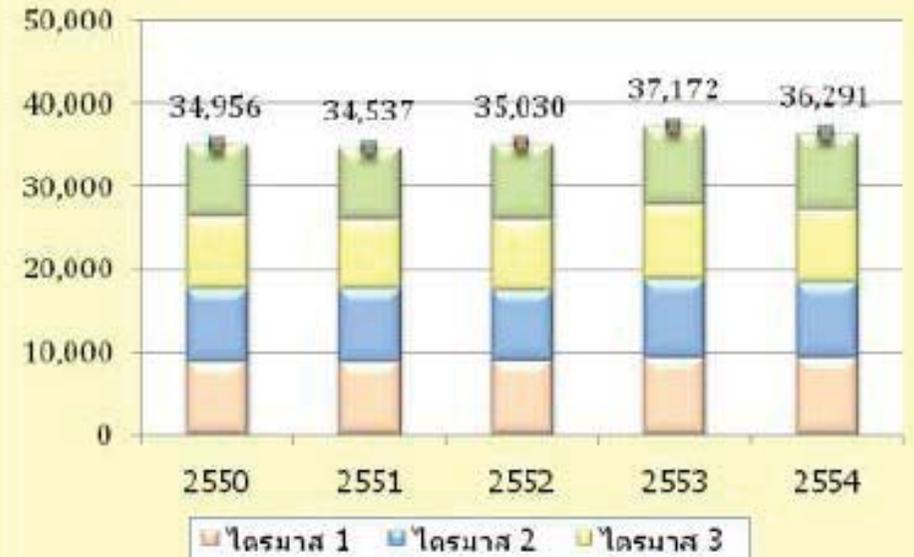
## Antibiotic Stewardship ??



## PSU- Out Patients



## PSU In- Patients



### Prevalence and Impacts of Nosocomial Infection in Thailand 2001

Somwang Danchaivijitr MD\*, Chertsak Dhiraputra MD\*\*,  
Somporn Santiprasitkul MSc\*\*\*, Tepnimitr Judaeng MNS\*\*\*

42 hospitals  
Point prevalence survey  
March 2001  
18,456 patients.  
Patients on antibiotics = 48.5%

### PSU Hospital HCWs in 2013:

|   |             |
|---|-------------|
| <b>No. of bed:</b>                                      | <b>816</b>  |
| <b>Nurses &amp; Nurse-aids</b>                          | <b>1799</b> |
| <b>4<sup>th</sup> -6<sup>th</sup> yr. Med Students:</b> | <b>407</b>  |
| <b>Residents:</b>                                       | <b>382</b>  |
| <b>MD. Staffs</b>                                       | <b>312</b>  |
| <b>Total:</b>   | <b>2900</b> |

**“ Could the Infectious Diseases Association of Thailand provide us with an electronic software that contains algorithm, step by step, when to start and stop the antibiotics and which one to choose. ???”**



## **My proposed CRE- strategies:**

1. **Prioritize: High risks wards eg. Transplant, hematology, NICU Units**
2. **? Screening**
3. **Implement a hospital-wide program for “ Zero CA-UTI”**
4. **Consider splitting “ high CREs ward”**
5. **Optional no gown if CRE carriers are ambulatory**
6. **Wait for software from IDAT**



**So, what should you do for wards with high prevalence of colonized CREs ????**



# The French & Israeli Experiences

if a secondary case was identified, patients had to be cohorted in three distinct areas with dedicated nursing staff:

1. 'CPE patients' section,
2. 'contact patients' section and
3. 'CPE-free patients' section for newly admitted patients with no previous contact with CPE cases

## RESEARCH ARTICLES

Long-term control of carbapenemase-producing Enterobacteriaceae at the scale of a large French multihospital institution: a nine-year experience, France, 2004 to 2012

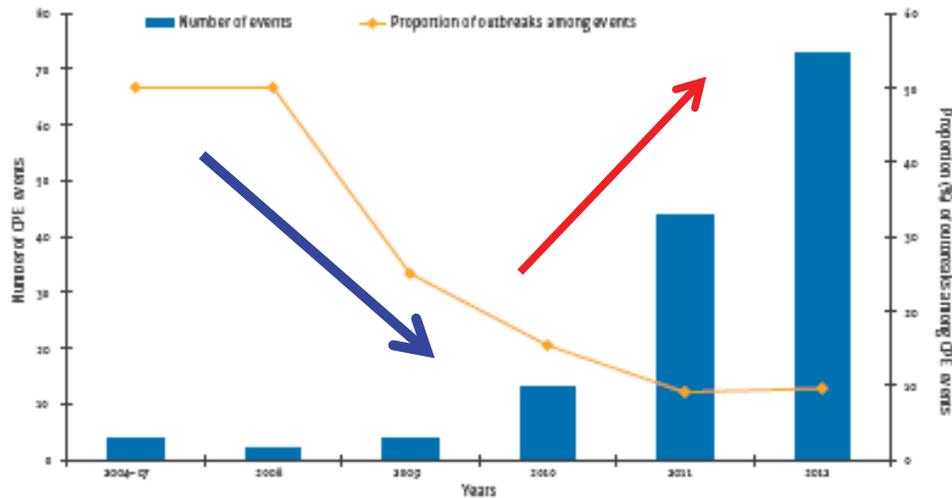
S Fournier (sandra.fournier@sap.aphp.fr)<sup>1</sup>, C Montell<sup>1</sup>, M Lepointeur<sup>2</sup>, C Richard<sup>2</sup>, C Brun-Buisson<sup>3</sup>, V Jarlier<sup>4</sup>, AP-HP Outbreaks Control Group<sup>5</sup>

*Euro Surveill.* 2014;19(19):pii=20802.

| Event* and related cases  | Measures Implemented within two days following admission of the Index case |                     | Delayed measures of control <sup>a</sup> | P value |
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**FIGURE**  
Number of carbapenemase-producing Enterobacteriaceae (CPE) events (n=140) and proportion of outbreaks among these events at Assistance Publique-Hôpitaux de Paris, France, 2004–2012



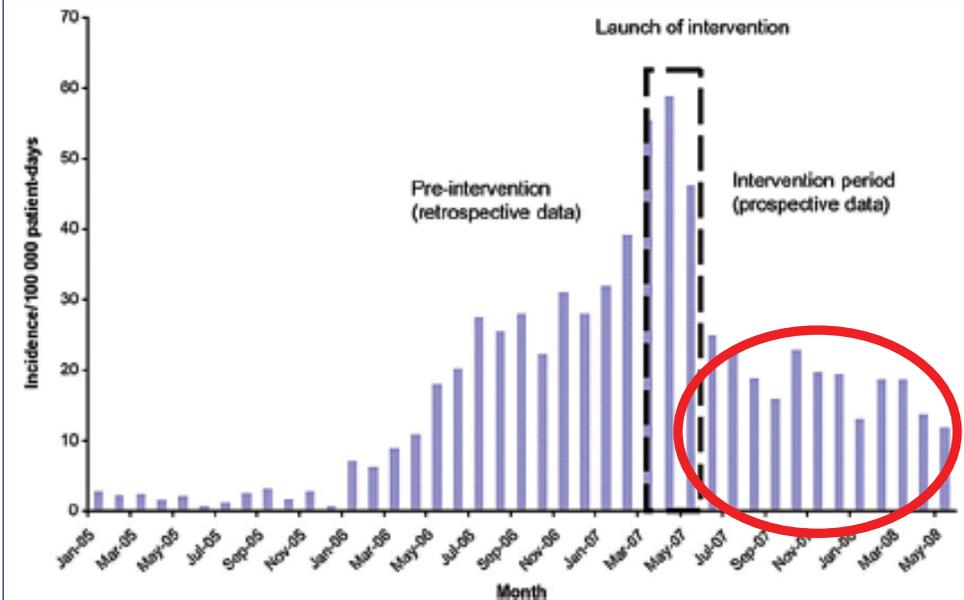
## An Ongoing National Intervention to Contain the Spread of Carbapenem-Resistant Enterobacteriaceae

Mitchell J. Schwaber and Yehuda Carmeli  
National Center for Infection Control, Tel Aviv, Israel

*Clinical Infectious Diseases* 2014;58(5):697–703

## Interventions

“Carriers be cared for by a dedicated nursing staff, meaning that nurses caring for carriers would not be assigned to care for noncarriers on the same shift.”



Are there any other alternatives ???



## The Global Challenge of Carbapenem-Resistant Enterobacteriaceae in Transplant Recipients and Patients With Hematologic Malignancies

Michael J. Sattin,<sup>1,2</sup> Stephen G. Jenkins,<sup>2,3</sup> and Thomas J. Walsh<sup>1,2</sup>

*Clinical Infectious Diseases* 2014;58(9):1274–83



Is it worth to limit the spread of CREs ??



CREs: ??? Increased mortality????





Major article

Outcomes of carbapenem-resistant *Enterobacteriaceae* isolation: Matched analysis



Christopher Bogan BS<sup>a</sup>, Keith S. Kaye MD, MPH<sup>a</sup>, Teena Chopra MD, MPH<sup>a</sup>, Kayoko Hayakawa MD, PhD<sup>a</sup>, Jason M. Pogue PharmD<sup>b</sup>, Paul R. Lephart PhD<sup>c</sup>, Suchitha Bheemreddy MD<sup>a</sup>, Tsilia Lazarovitch PhD<sup>d</sup>, Ronit Zaidenstein MD<sup>e</sup>, Federico Perez MD<sup>f,g</sup>, Robert A. Bonomo MD<sup>f,g,h,i,j</sup>, Dror Marchaim MD<sup>e,k,\*</sup>

## Bivariate analyses of outcomes

|                                      |                     |
|--------------------------------------|---------------------|
| CRE vs controls <sup>‡</sup>         | 3.2 (1.4-7.2), .006 |
| CRE vs susceptible <sup>‡</sup>      | 3.3 (1.5-7.5), .004 |
| CRE vs ESBL                          | 1.8 (0.9-3.6), .15  |
| CRE vs all 3 non-CRE groups combined | 2.6 (1.4-4.7), .003 |

**Table 2**  
Bivariate analyses of outcomes associated with isolation of

| Parameter                 | Died in hospital |
|---------------------------|------------------|
| CRE                       | 23 (38.3)        |
| ESBL                      | 17 (28.3)        |
| Susceptibles <sup>‡</sup> | 10 (16.7)        |
| Controls <sup>‡</sup>     | 10 (16.7)        |

## Multivariate Analysis

Multivariable models of in-hospital mortality after excluding the uninfected colonized-only CRE cases and their matches

| Variable | CRE vs all 3 non-CRE groups combined |         |
|----------|--------------------------------------|---------|
|          | OR (95% CI)                          | P value |
| CRE      | 2.6 (0.9-25)                         | .1      |

“ CRE isolation was not an independent predictor for in-hospital mortality in any of the models despite associated with deterioration in functional status [odds ratio, 9; P < .002].”

## Predictors of Carbapenem-Resistant *Klebsiella pneumoniae* Acquisition among Hospitalized Adults and Effect of Acquisition on Mortality<sup>▽</sup>

Mitchell J. Schwaber,<sup>1\*</sup> Shiri Klarfeld-Lidji,<sup>1</sup> Shiri Navon-Venezia,<sup>1</sup> David Schwartz,<sup>2</sup> Azita Leavitt,<sup>1</sup> and Yehuda Carmeli<sup>1</sup>

Division of Epidemiology and Preventive Medicine<sup>1</sup> and Clinical Microbiology Laboratory,<sup>2</sup> Tel Aviv Sourasky Medical Center, Tel Aviv, Israel

TABLE 6. Multivariable risk factors for mortality

| Covariate   | Patients with CRKP vs patients with CSKS |       | Patients with CRKP vs hospitalized controls |        |
|---|--|-------|---|--------|
|   | OR (95% CI)                              | P     | OR (95% CI)                                 | P      |
| Carbapenem-resistant <i>Klebsiella</i> <sup>a</sup> | 5.4 (1.7–17.1)                           | 0.005 | 6.7 (2.4–18.8)                              | <0.001 |



Journal of Hospital Infection 83 (2013) 307–313

Available online at www.sciencedirect.com



Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin



## Impact of carbapenem resistance on the outcome of patients' hospital-acquired bacteraemia caused by *Klebsiella pneumoniae*

K. Hussein<sup>a,b,\*</sup>, A. Raz-Pasteur<sup>a,b</sup>, R. Finkelstein<sup>a,b</sup>, A. Neuberger<sup>a</sup>, Y. Shachor-Meyouhas<sup>a,b</sup>, I. Oren<sup>a,b</sup>, I. Kassis<sup>a,b</sup>

<sup>a</sup>Infectious Diseases Unit, Rambam Health Care Campus, Haifa, Israel

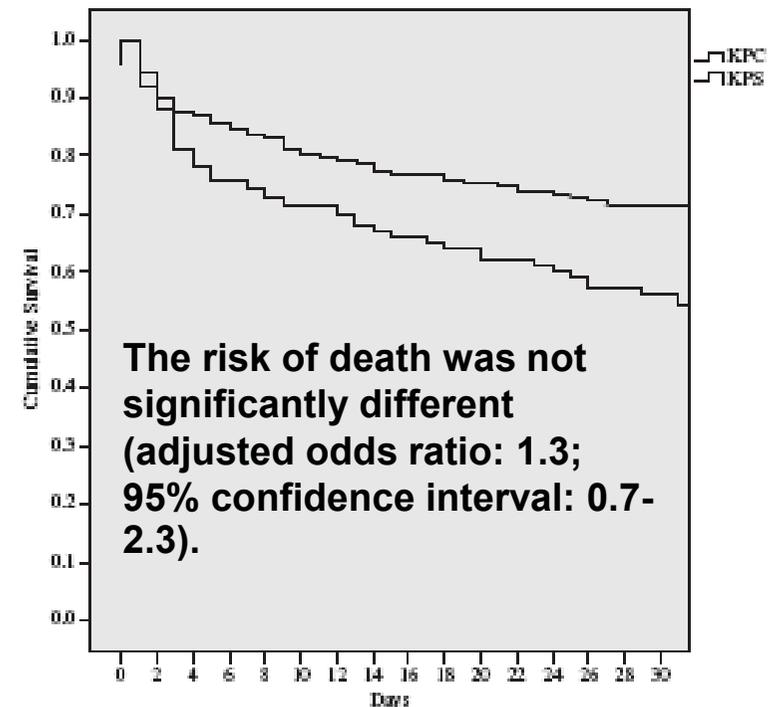


## Risk Factors, Molecular Epidemiology and Outcomes of Ertapenem-Resistant, Carbapenem-Susceptible *Enterobacteriaceae*: A Case-Case-Control Study

Jocelyn Teo<sup>1</sup>, Yiyang Cai<sup>1</sup>, Sarah Tang<sup>1</sup>, Winnie Lee<sup>1</sup>, Thean Yen Tan<sup>2</sup>, Thuan Tong Tan<sup>3</sup>, Andrea Lay-Hoon Kwa<sup>1\*</sup>

PLoS ONE 7(3): e34254.  
 doi:10.1371/journal.pone.0034254

“In-hospital mortality rates and clinical response rates were significantly different between ERE and ESE groups, however ERE infection was not a predictor of mortality.”



## CREs in PSU : Other wards?

## PSU- CREs in the Dept. of Surgery

## CREs in surgical wards: which site? (excluding RSC surveillance cultures)

|                        |      |
|------------------------|------|
| 1. Urine               | = 15 |
| 2. Intraabd. infection | = 11 |
| 3. Sputum              | = 5  |
| 1.1 Empyema            | = 1  |
| 2. Blood               | = 3  |
| 3. Surgical wound      | = 3  |
| 4. Others              | = 2  |
| Total                  | = 40 |

## Examples of CREs abdominal infections

1. Peritonitis from ruptured duodenum stump post surgery for CA stomach.
2. Presacral abscess from anastomosis leakage post CA sigmoid surgery.
3. Enterocutaneous fistula post multiple gunshot wound c bowel injuries.
4. Enterocutaneous fistula post small bowel injuries from MCA.
5. Intestinal perforation from adhesion post surgery for CA pancreas

## Examples of CREs abdominal infections

6. A referred case from Trang Hospital with Intraabd infection from esophageal perforation after fish bone injury.
7. Peritonitis from post colectomy & subtotal hepatectomy from CA colon with liver metastasis.



## Remark:

“ Intraabdominal infection is the second most common site of CRE infections in the surgical patients and frequently associated with intraabdominal soiling from GI tract injuries.”



## Orthopedic CREs: Sites

UTI (4) ,  
Blood (1) ,  
RSC surveillance (7)



## Orthopedic CREs: Clinical

1. Catheter related urine colonization without pyuria acquired from Yala Hospital in :GSW with C6 cord injury & quadriplegia.
2. Asymptomatic CA-UTI c pyuria in spinal cord compression from Ca breast
3. CA- UTI in spinal cord compression from metastatic CA prostate.



## Remark:

“CREs in orthopedic ward were associated with patients with retained Foleys from spinal cord injury or compression from metastatic cancer”



## CREs in Gynecologic Ward

First isolate: RSC, 7<sup>th</sup> Jan 2013

| Year | surveillance | clinical isolates | Total |
|------|--------------|-------------------|-------|
| 2012 | 0            | 0                 | 0     |
| 2013 | 1            | 0                 | 1     |
| 2014 | 1            | 4                 | 5     |
| 2015 | 0            | 0                 | 0     |
|      | 2            | 4                 | 6     |

Last isolate: 8<sup>th</sup> Dec 2014



## Gynecologic CREs: Sites

UTI (4) ,  
Blood (2) ,  
RSC surveillance (1)



## Gynecologic CREs: Clinical

1. Bacteremia from infected PCN in advanced CA cervix invading bladder.-→ survived with fosfomycin & PCN revision.
2. Infected PCN in advanced CA Cx with colon & bladder involvement &DVT-→died.
3. Infected PCN in advanced CA Cx with colon & bladder involvement & DVT-→survived with PCN revision.



## Remark:

**“CREs in gynecologic ward were associated with terminal patients with percutaneous nephrostomy for obstructive uropathy from cervical or uterine cancers. Some of them also had colonic involvement.”**

