

The Problem of Resistance in Greece and the national Plan “Prokroustis”

How to Face the Problem

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ESCMID Postgraduate Education Course

**Endemic and Emerging
Infectious Diseases in the
Mediterranean Countries**

Limassol, Cyprus 23 - 24 MARCH 2013

Factors Associated with CPE Colonization/infection

- Stay in ICU
- Poor functional status of the host
- Prior use of antibiotics
- Prolonged length of stay
- Sharing a room with a known carrier
- Increased prevalence of carriers on the ward

CPE Colonization

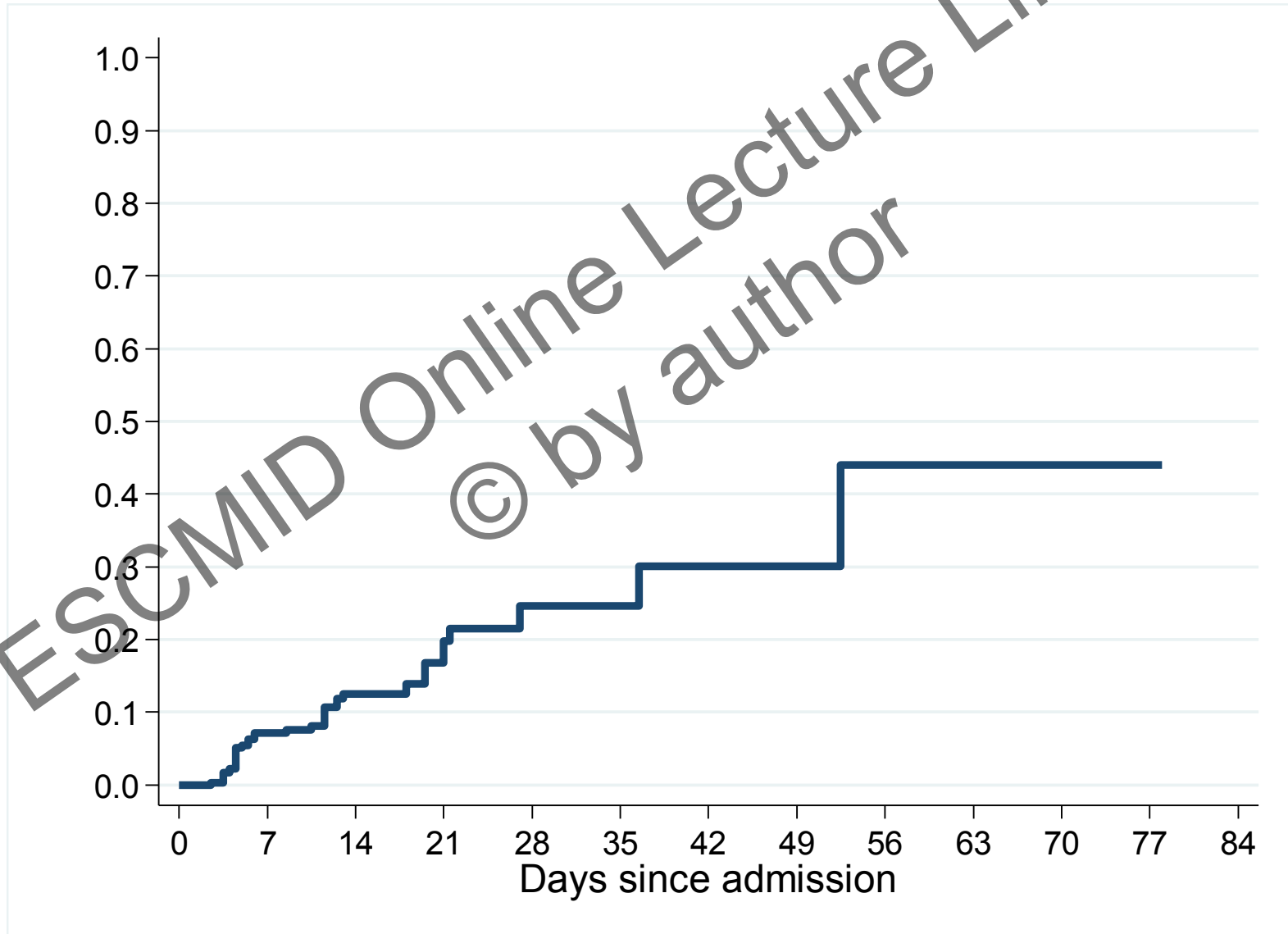
- Median carriage time at least 3 months
- 10% of CPE colonized patients progress to infection. In the presence of severe immunosuppression this subset may be higher 20%
- During carriage, shedding and transmission to other patients may take place
- Transmission of mobile genetic elements containing the carbapenamase gene to other strains colonizing the GIT may occur, resulting in new CPE clones and species

Saidel-Odes et al *Infect Control Hosp Epidemiol* 2012; 33: 14–19

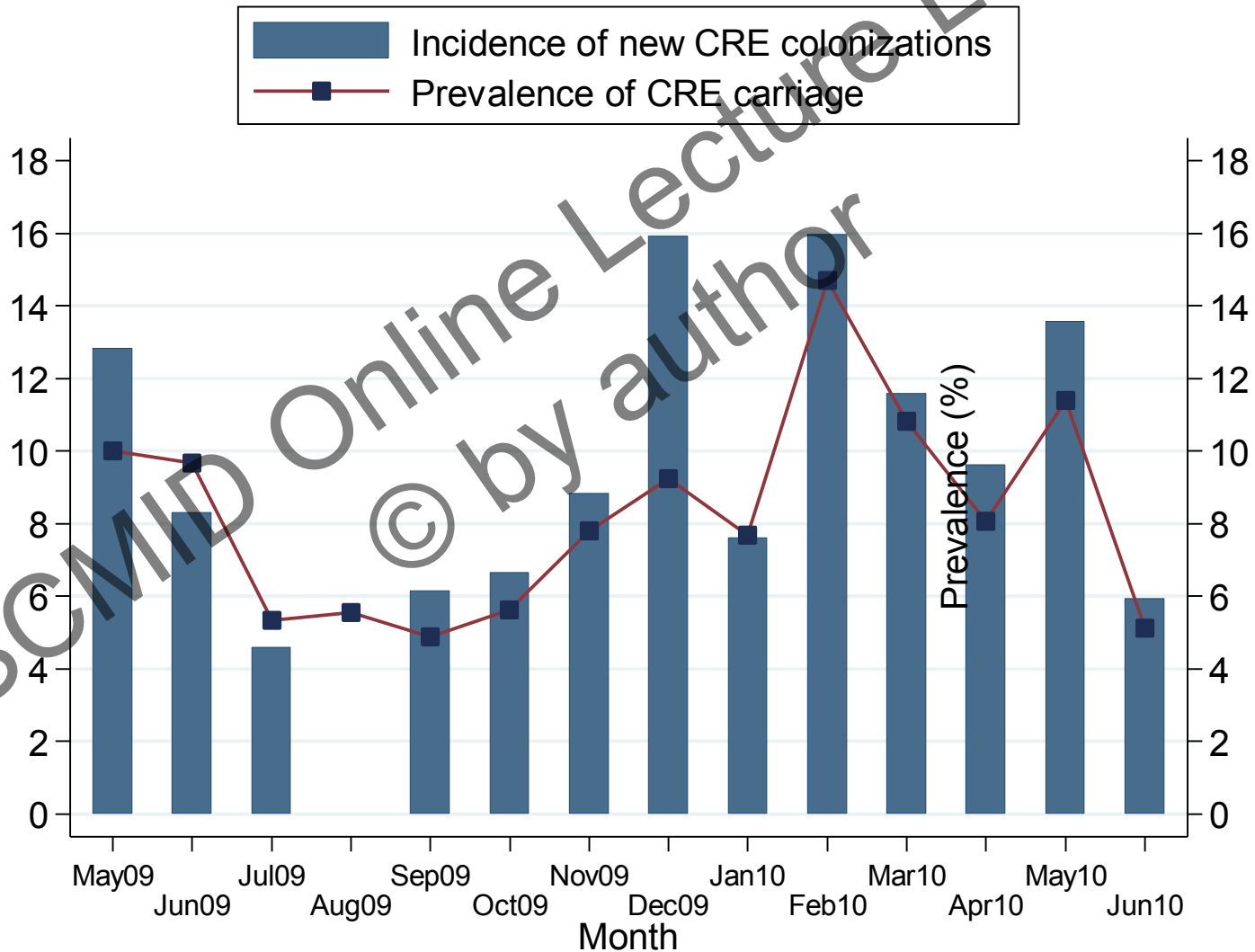
Borer A et al *Am J Infect Control* 2011

Schechner V et al *Clinical Microbiology Infection* 2012

Kaplan-Meier estimate of the probability of becoming colonized within a surgical unit



Monthly Incidence and Prevalence of CPE Colonization in a Surgical Unit



Hand Hygiene Observation Form

Observer (initials): _____ Surgeon service: _____
 Date (DD/MM/YYYY): ____/____/____ Start time (A.M./P.M.): ____:____ End time (A.M./P.M.): ____:____
 Surgical ward: _____ Station number: _____

Professional 1	Professional 2	Professional 3	Professional 4
<input type="checkbox"/> Medical doctor <input type="checkbox"/> Nurse <input type="checkbox"/> Auxiliary nurse <input type="checkbox"/> Other HCW	<input type="checkbox"/> Medical doctor <input type="checkbox"/> Nurse <input type="checkbox"/> Auxiliary nurse <input type="checkbox"/> Other HCW	<input type="checkbox"/> Medical doctor <input type="checkbox"/> Nurse <input type="checkbox"/> Auxiliary nurse <input type="checkbox"/> Other HCW	<input type="checkbox"/> Medical doctor <input type="checkbox"/> Nurse <input type="checkbox"/> Auxiliary nurse <input type="checkbox"/> Other HCW

	Opp	Indication	Action	Opp	Ind
1					
2					
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Opp	Indication	Action	Opp	Ind
1	<input checked="" type="checkbox"/> bef-pat <input type="checkbox"/> bef-asept <input type="checkbox"/> aft-bfluid <input type="checkbox"/> aft-pat <input type="checkbox"/> aft-surr	<input checked="" type="checkbox"/> rub <input type="checkbox"/> wash <input type="checkbox"/> missed <input type="checkbox"/> gloves	1	<input type="checkbox"/> b <input type="checkbox"/> b <input type="checkbox"/> a <input type="checkbox"/> a <input type="checkbox"/> a
2	<input type="checkbox"/> bef-pat <input checked="" type="checkbox"/> bef-asept <input checked="" type="checkbox"/> aft-bfluid <input type="checkbox"/> aft-pat <input type="checkbox"/> aft-surr	<input checked="" type="checkbox"/> rub <input type="checkbox"/> wash <input type="checkbox"/> missed <input type="checkbox"/> gloves	2	<input type="checkbox"/> b <input type="checkbox"/> b <input type="checkbox"/> a <input type="checkbox"/> a <input type="checkbox"/> a

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Compliance with Hand Hygiene

[Am J Infect Control.](#) 2011 Aug;39(6):517-20

Hospital	% overall HH compliance (95% CI)	% HH compliance of doctors (95% CI)	% missed HH actions with gloves	% total HH actions performed with ABHR	Hospital ABHR consumption 2007/2008 (L/1000 pt-days)
1	19 (15-23)	25 (16-38)	20	42	23.1
2	75 (70-80)	59 (45-71)	29	87	27.3
3	27 (24-29)	18 (13-24)	92	90	8.3
4	39 (35-44)	40 (27-55)	39	34	7.5
5	14 (11-18)	8 (4-16)	40	0	1.5
6	25 (21-30)	34 (24-41)	41	93	23.9
7	76 (71-81)	60 (48-71)	28	38	11.4
8	50 (45-56)	52 (43-62)	31	65	36.6
9	67 (62-72)	72 (62-80)	18	97	No data
10	56 (51-60)	19 (11-31)	6	99	35.3
Overall	40 (38-41)	37 (33-40)	38	71	

MOSAR WP4 study centres

Success stories

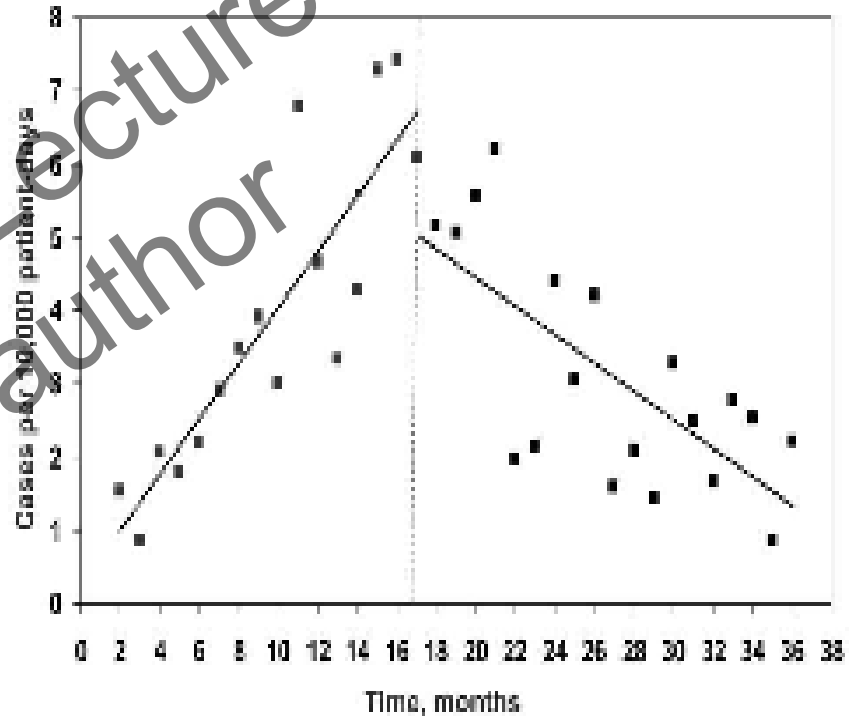
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Studies Reporting Successful Infection Control

Non-endemic regions	Endemic regions
Herbert,(Infect Control Hosp Epidemiol 2007; 28:98)	Kochar,(Infect Control Hosp Epidemiol 2009; 30:447)
Kassis,(Eurosurveillance Noveb 2010]	Munoz-Price, (Infect Control Hosp Epidemiol 2010; 31:)
Carbonne,(Eurosurveillance Dec 2010)	Munoz-Price, (Infect Control Hosp Epidemiol 2010; 31:341)
	Endimiani, (J Antimicrob Chemother 2009; 64: 1102
	Gregory (Infect Control Hosp Epidemiol 2010; 31:476)
	Ben David (Infect Control Hosp Epidemiol 2010; 31 :620)
	Schwaber (CID 2011; 52: 848)

Potential Role of Active Surveillance in the Control of a Hospital-wide Outbreak of CRKP

- ✓ Setting: 1,600-bed tertiary hospital, Israel
- ✓ Baseline IC measures: contact precautions for KPC cases based on clinical cultures
- ✓ Interventions: 1) daily report of colonization prevalence (national action plan) 2) active surveillance from pts in high-risk units and from pts with epidemiologic links to KPC carriers



Ben-David ICHE 2010; 31: 620-626

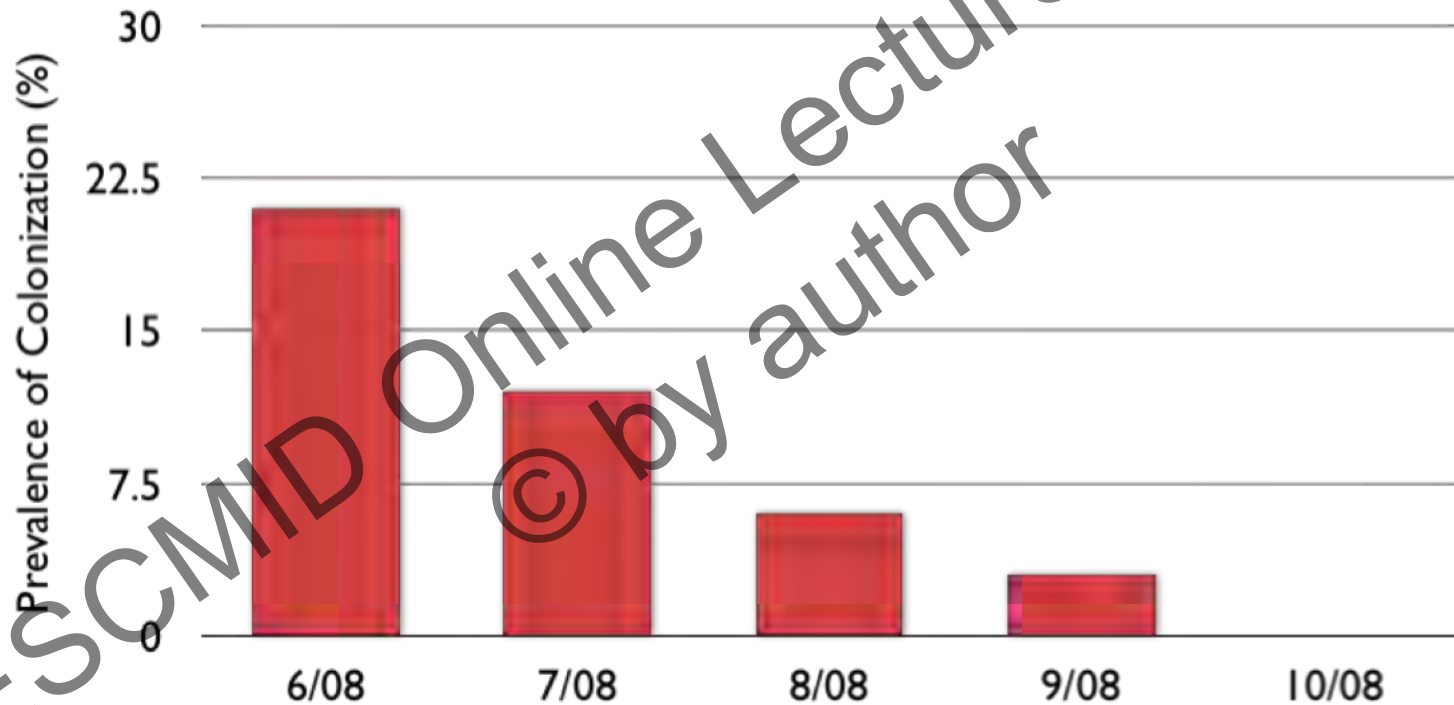
Successful Control of an Outbreak at a LTACH

Bundled intervention

- Decolonization (daily chloroexidine baths)
- Improved environmental cleaning
- Identification of carriers (PPS and active surveillance cultures)
- Isolation (preemptive contact precautions and cohorting)

Munoz-Price ICHE 2010; 31:341

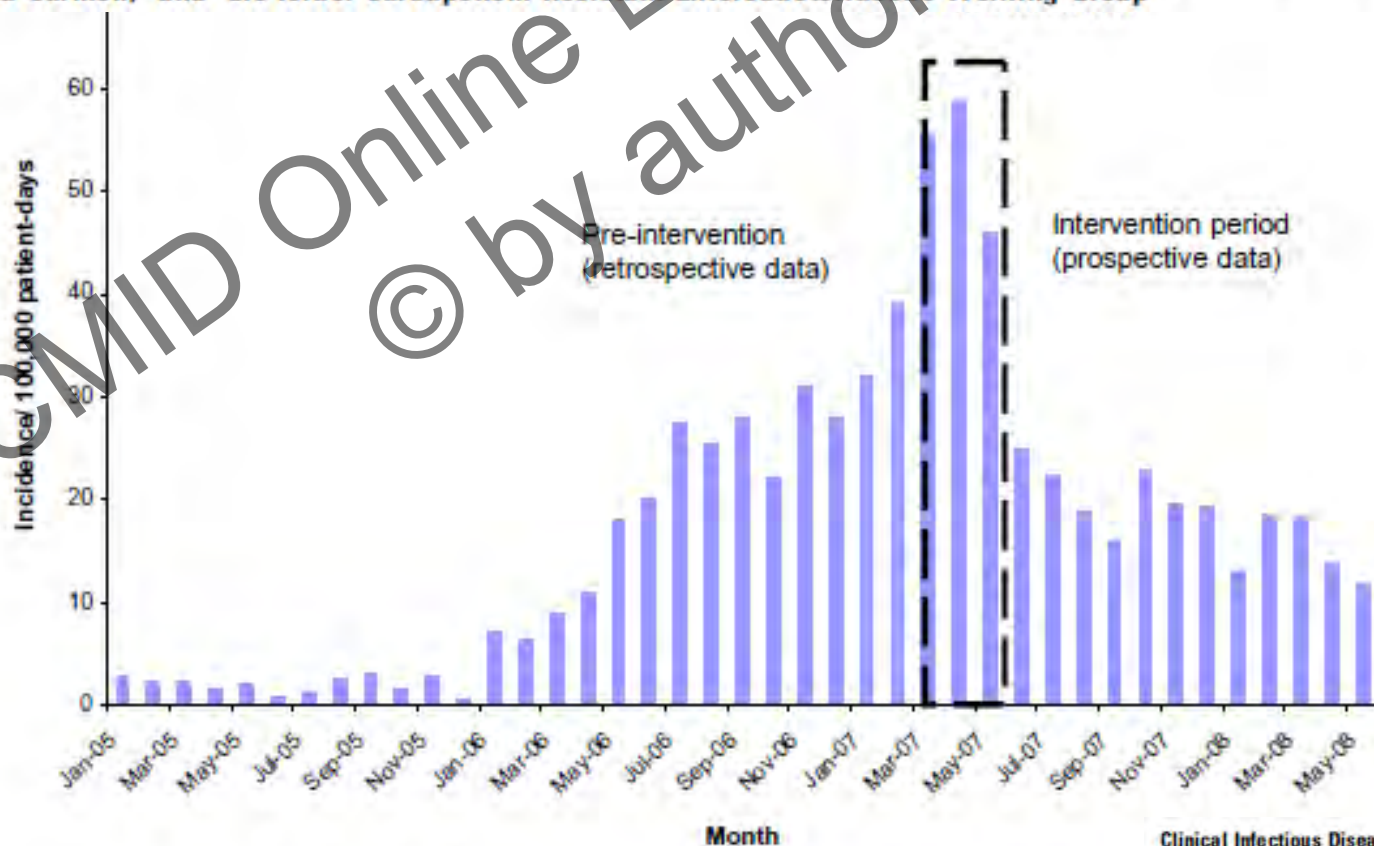
Prevalence of Colonization with CPE before and after Intervention



Munoz-Price ICHE 2010; 31:341

Containment of a Country-wide Outbreak of Carbapenem-Resistant *Klebsiella pneumoniae* in Israeli Hospitals via a Nationally Implemented Intervention

Mitchell J. Schwaber,¹ Boaz Lev,² Avi Israeli,² Ester Solter,¹ Gill Smollan,¹ Bina Rubinovitch,¹ Itamar Shalit,¹ Yehuda Carmeli,¹ and the Israel Carbapenem-Resistant Enterobacteriaceae Working Group^a



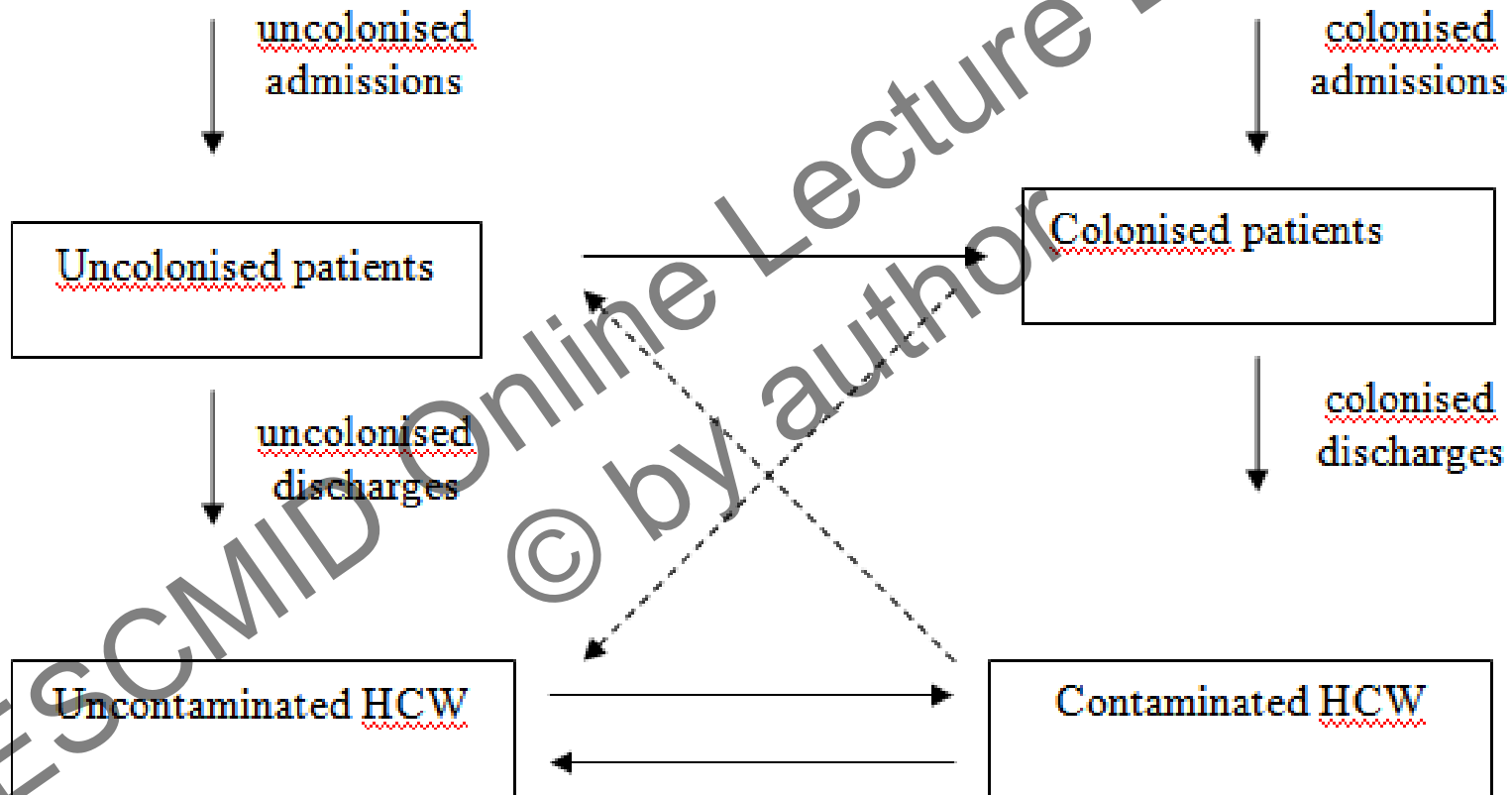
Mathematical modeling for CPE transmission within the hospital setting

- ✓ Ross-Macdonald model for vector-borne diseases
 - HCWs are the vectors transmitting CPE from patient to patient
 - It assumes that the environment does not contribute to transmission
- ✓ It makes use of the available data and provides estimates of R

Austin et al PNAS 1999; 96: 1152

Grundmann et al, JID 2002; 185: 481

Theoretical framework for transmission within the hospital setting



Austin et al PNAS 1999; 96: 1152
Grundmann et al, JID 2002; 185: 481

Data for the model of CPE transmission

Parameter	Symbol	Value used in the model	Note
Number of beds	B	30	
Discharge rate for <u>uncolonised</u> patients (/day)	μ_u	1/10.3	1/duration of stay of <u>uncolonised</u> patients
Discharge rate for <u>colonised</u> patients (/day)	μ_c	1/22.9	1/duration of stay of <u>colonised</u> patients
Admission rate (/day)	λ	5.0-8.7	$\mu_u \frac{occupancy}{1 - occupancy}$ using monthly estimates of bed occupancy
<u>Colonisation</u> prevalence on admission (%)	φ	0% - 4.9%	Monthly estimates are used
Per capita contact rate (patient/HCW/day)	α	1.4	
Probability of a patient becoming <u>colonised</u> during contact with contaminated HCW	b_p	-	Estimated by the model
Probability of a <u>HCW</u> becoming contaminated during contact with <u>colonised</u> patient	b_h	21.4%	
Decontamination rate of <u>HCWs</u> (/day)	μ_h	24	1/duration of contamination where duration is assumed 1 hour (1/24 days)
Hand washing compliance	p	21%	

Basic reproduction number (R_0)

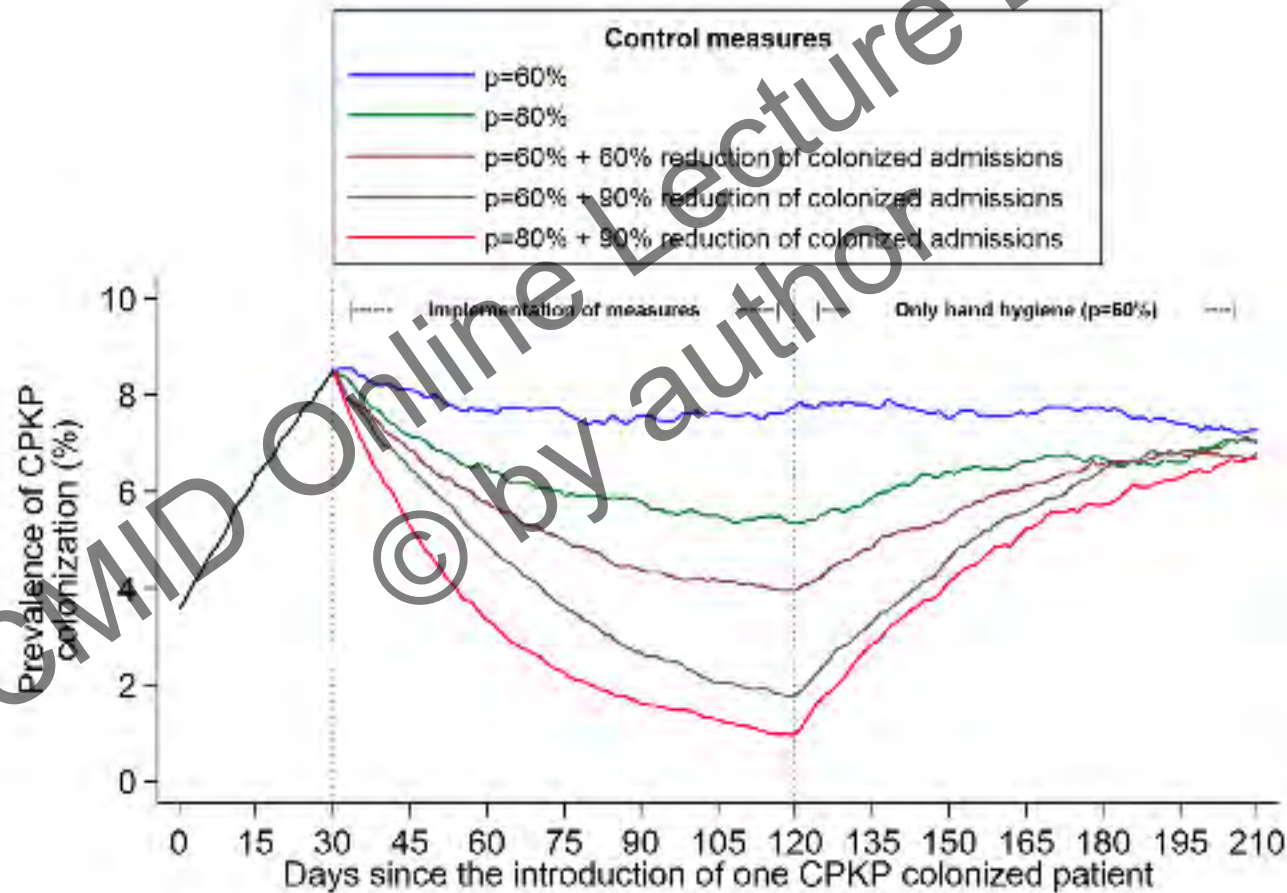
- ✓ **Basic reproduction number R_0 :**

The average number of secondary cases generated by a primary case (in the absence of infection control measures)

- ✓ For an epidemic to occur, more than one secondary cases have to be generated by the primary case, i.e. **$R_0 > 1$**

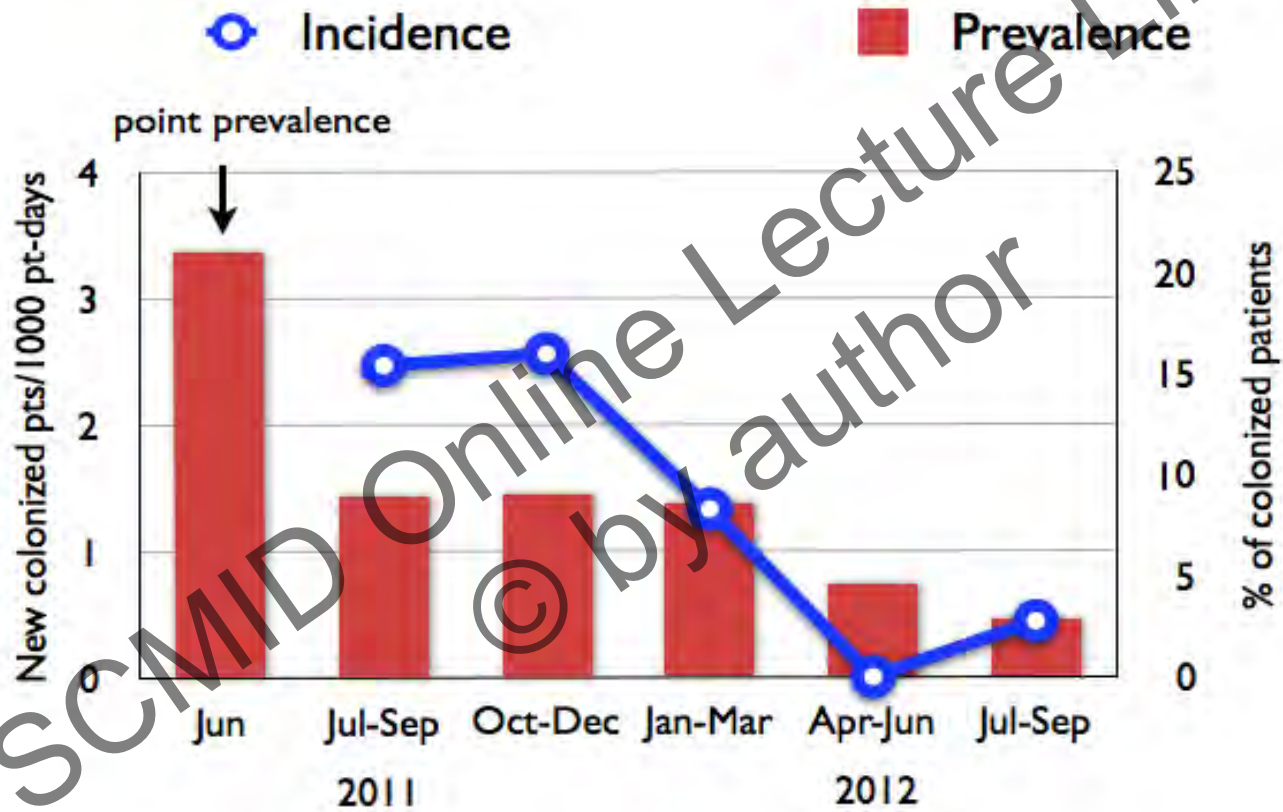
- ✓ In the presence of infection control measures, R_0 is reduced to R and control strategies are successful if they result to an **$R < 1$**

Impact of Infection Control measures on Transmission of CPKP in an Endemic Setting



Intervention Measures in Hematology Unit (Laiko Hospital Athens, Greece)

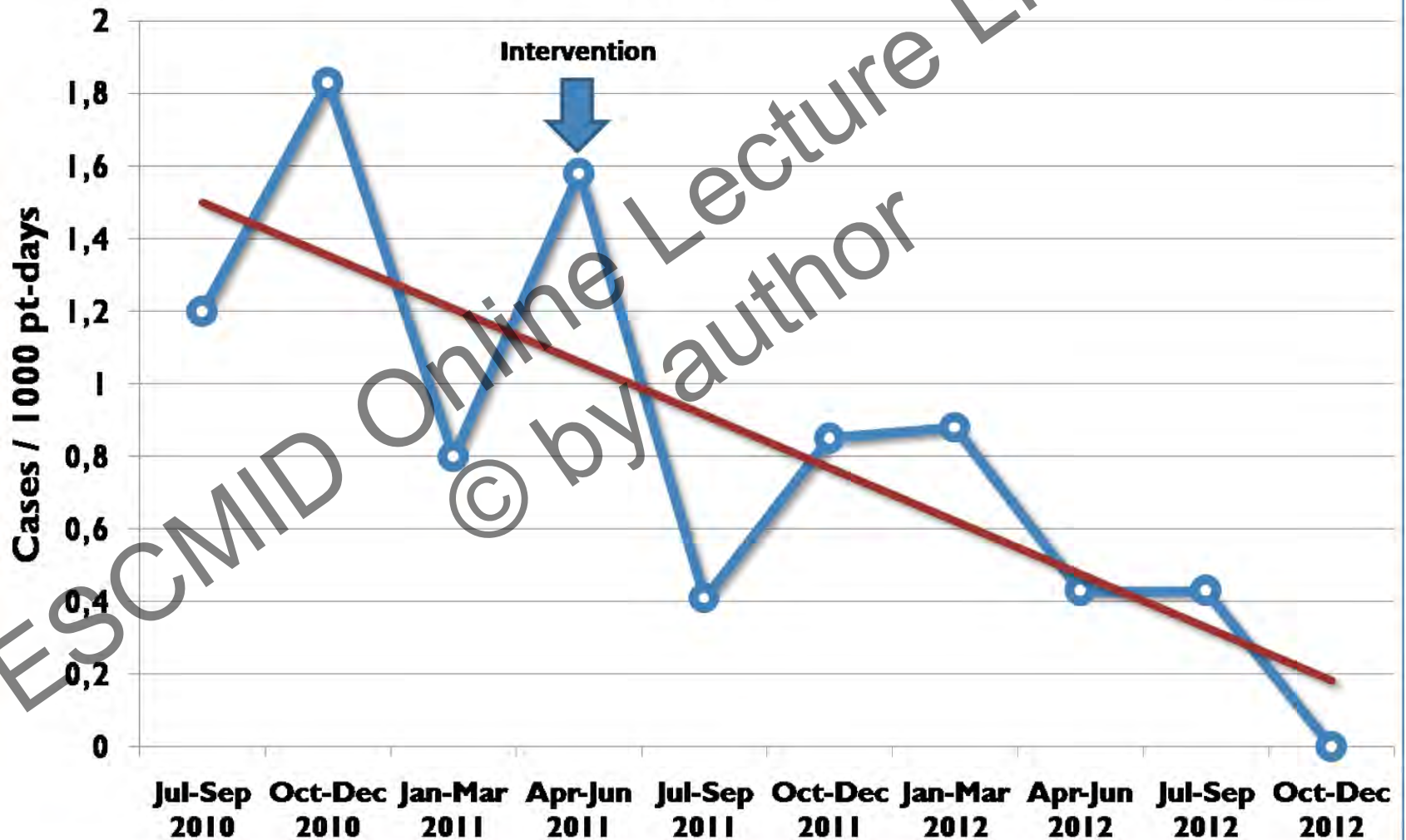
- Point prevalence
- Active surveillance upon admission and weekly thereafter
- Physical separation of CPE carriers
- Dedicated HCP when possible
- Promotion of hand hygiene
- Contact precautions
- Daily observations for compliance



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Incidence of CPKP Bloodstream Infections in Hematology Unit



Suggested Action plan for IC measures in settings with sporadic occurrence or complete absence of CPE

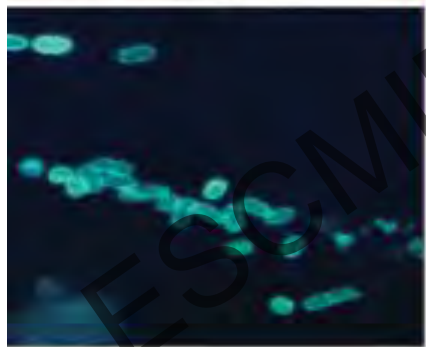
- Reliable detection of the first index case
- Screening of all patients in contact with an index case
- Preemptive isolation of high risk pts while awaiting the screening results
- Enhanced infection control aimed at containment and ultimate eradication of nosocomial clusters

Suggested Control Measures for Countries where CPE are Endemic

At the hospital level

- Active surveillance of high-risk patients
- Physical separation of carriers from non-carriers
- Dedicated staff
- Training and measures to keep staff and hospital administration informed
- Daily census of CPE carriers
- Daily observations for compliance in the intervention measures (check list)

Coordinated effort involving all stakeholders including healthcare facilities and providers, public health authorities, and industry



Guidance for Control of Carbapenem-resistant Enterobacteriaceae (CRE)

2012 CRE Toolkit

Guidance for Control of Carbapenem-resistant Enterobacteriaceae (CRE)



Basic Principles

- Recognize these organisms as epidemiologically important
- Understand the prevalence in your region
- Identify colonized and infected patients when present in the facility
- Implement regional and facility- based interventions designed to stop the transmission of these organisms

Core Measures for All Acute and Long-term Care Facilities



- ✓ Hand hygiene
- ✓ Contact Precautions
- ✓ Patient and staff cohorting
- ✓ Minimize use of invasive devices
- ✓ Promote antimicrobial stewardship
- ✓ Screen patient with epidemiologic links to CRE colonized or infected patients and/or conduct point prevalence surveys of units containing CRE patients

Supplemental Measures for Healthcare Facilities with CRE Transmission

✓ Conduct active surveillance testing

- Screen high-risk patients at admission or at admission and periodically during their facility stay for CRE.
- Preemptive CP can be used while results of admission surveillance testing are pending
- Consider screening patients transferred from facilities known to have CRE at admission

✓ Chlorhexidine bathing

- Bathe patients with 2% chlorhexidine



National Action Plan (intervention phase)

- Active surveillance cultures in high risk patients
- Separation of carriers from non-carriers (isolation/cohorting)
- Promotion of hand hygiene
- Contact precautions.

National Action Plan (intervention phase)

- Communication between hospitals and public health authorities, notification and feedback.
-
- Systemic evaluation for adherence to the intervention measures will.

Problems in intervention

- Crowded hospitals (patients even in corridors)
 - Isolation/cohorting many times impossible
- Nurse/patient ratio 1:20
- Many healthcare workers do not have appropriate training on IC practices and underestimate the problem
- IC committees do not function effectively (lack of staff, no special training, no supervisor)