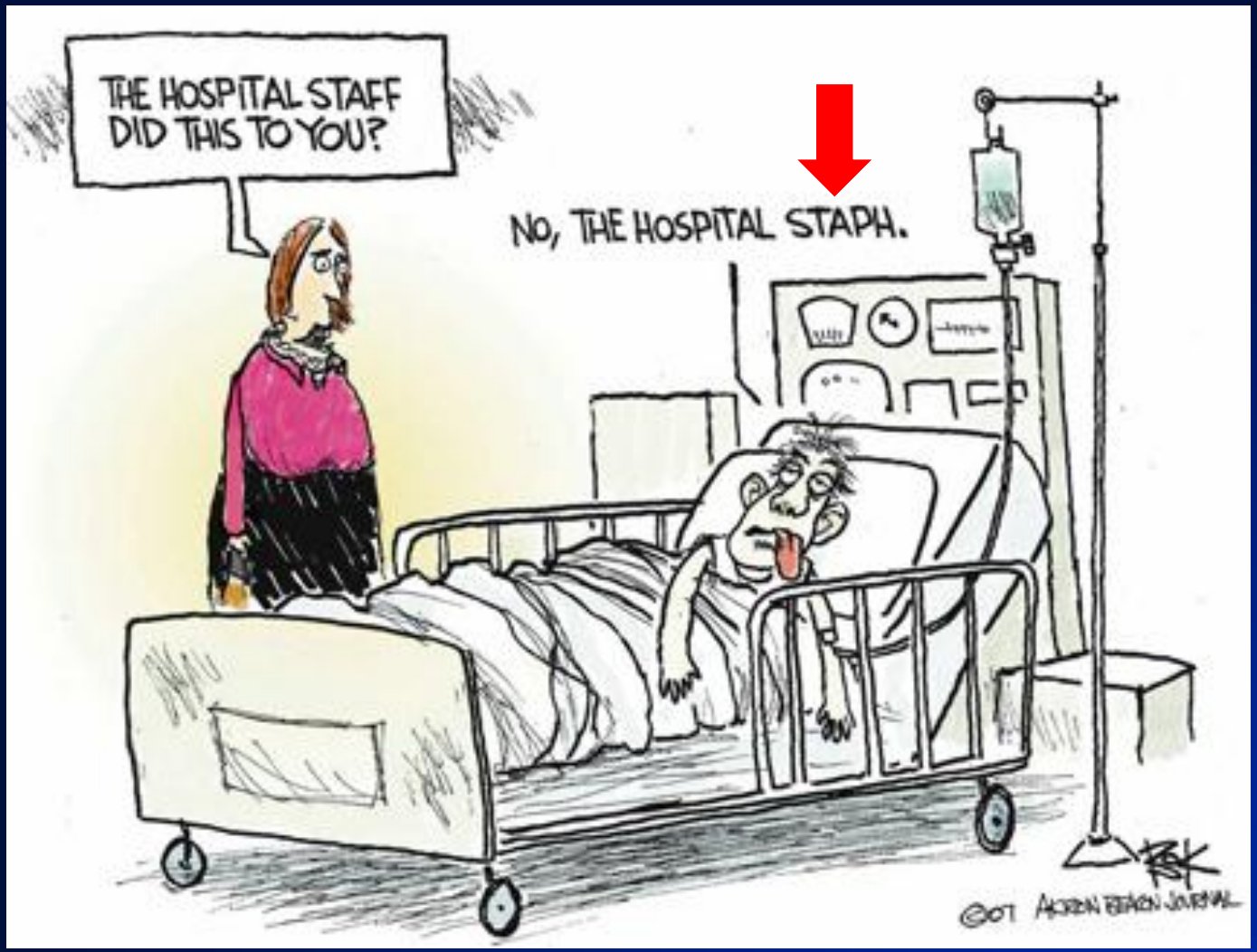
Infection Control Priorities for Antibiotics Resistance

- The Search and Destroy Strategy

WH Seto
Hong Kong
China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COMBAT DRUG RESISTANCE

No action today, no cure tomorrow

7 APRIL 2011 **WORLD HEALTH DAY**

World Health Organization

Emerging carbapenemases: a global perspective

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Given the dearth of novel or even new antibiotics, we are now facing an end-game scenario that, while currently more prevalent in some countries than others, will eventually become global [11,66,89]. Perhaps it would be simpler and more cost-effective, particularly in the short-term, to help other countries impose effective infection control measures and, where appropriate,

Fig. 3. Representation of the global distribution of mobile metallo-β-lactamases.

Management of Multidrug-Resistant Organisms In Healthcare Settings, 2006

Jane D. Siegel, MD; Emily Rhinehart, RN MPH CIC; Marguerite Jackson, PhD; Linda Chiarello, RN MS; the Healthcare Infection Control Practices Advisory Committee

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Tier 1

Tier 1. General Recommendations for Routine Prevention and Control of MDROs in Healthcare Settings

Administrative Measures/Adherence Monitoring	MDRO Education	Judicious Antimicrobial Use	Surveillance	Infection Control Precautions to Prevent Transmission	Environmental Measures	Decolonization
Make MDRO prevention/control an organizational priority. Provide administrative support and both fiscal and human resources to prevent and control MDRO transmission. *(IB)* Identify experts who can provide consultation and expertise for analyzing epidemiologic data, recognizing MDRO problems, or devising effective control strategies, as needed. *(II)* **Implement systems to communicate information about reportable MDROs to administrative personnel and state/local health departments. *(II)*** Implement a multi-disciplinary process to monitor and improve HCP adherence to recommended practices for Standard and Contact Precautions.*(IB)* Implement systems to designate patients known to be colonized or infected with a targeted MDRO and to notify receiving healthcare facilities or personnel prior to transfer of such patients within or between facilities. *(IB)* Support participation in local, regional and/or national coalitions to combat emerging or growing MDRO problems.*(IB)* Provide updated feedback at least annually to healthcare providers and administrators on facility and patient-care unit MDRO infections. Include information on changes in prevalence and incidence, problem assessment and performance improvement plans. *(IB)*	Provide education and training on risks and prevention of MDRO transmission during orientation and periodic educational updates for HCP; include information on organizational experience with MDROs and prevention strategies. *(IB)* **Education**	In hospitals and LTCFs, ensure that a multi-disciplinary process is in place to review local susceptibility patterns (antibiograms), and antimicrobial agents included in the formulary, to foster appropriate antimicrobial use. *(IB)* Implement systems (e.g., CPOE, susceptibility report comment, pharmacy or unit director notification) to prompt clinicians to use the appropriate agent and regimen for the given clinical situation. *(IB)* Provide clinicians with antimicrobial susceptibility reports and analysis of current trends, updated at least annually, to guide antimicrobial prescribing practices. *(IB)* In settings with limited electronic communication system infrastructures to implement physician prompts, etc., at a minimum implement a process to review antibiotic use. Prepare and distribute reports to providers. *(II)*	Use standardized laboratory methods and follow published guidelines for determining antimicrobial susceptibilities of targeted and emerging MDROs. Establish systems to ensure that clinical micro labs (in-house and outsourced) promptly notify infection control or a medical director/designee when a novel resistance pattern for that facility is detected. *(IB)* In hospitals and LTCFs: …develop and implement laboratory protocols for storing isolates of selected MDROs for molecular typing when needed to confirm transmission or delineate epidemiology of MDRO in facility. *(IB)* …establish laboratory-based systems to detect and communicate evidence of MDROs in clinical isolates *(IB)* …prepare facility-specific antimicrobial susceptibility reports as recommended by CLSI; monitor reports for evidence of changing resistance that may indicate emergence or transmission of MDROs *(IA/IC)* …develop and monitor special-care unit-specific antimicrobial susceptibility reports (e.g., ventilator-dependent units, ICUs, oncology units). *(IB)* …monitor trends in incidence of target MDROs in the facility over time to determine if MDRO rates are decreasing or if additional interventions are needed. *(IA)* **Surveillance**	Follow Standard Precautions in all healthcare settings. *(IB)* Use of Contact Precautions (CP): --- In *acute care settings* : Implement CP for all patients known to be colonized/infected with target MDROs.*(IB)* --- In *LTCFs: Consider the individual patient's clinical situation and facility resources in deciding whether to implement CP (II)* --- In *ambulatory and home care settings, follow Standard Precautions (II)* ---In *hemodialysis units*: Follow dialysis specific guidelines *(IC)* No recommendation can be made regarding when to discontinue CP. (*Unresolved issue)* Masks are not recommended for routine use to prevent transmission of MDROs from patients to HCWs. Use masks according to Standard Precautions when performing splash-generating procedures, caring for patients with open tracheostomies with potential for projectile secretions, and when there is evidence for transmission from heavily colonized sources (e.g., burn wounds). Patient placement in hospitals and LTCFs: When single-patient rooms are available, assign priority for these rooms to patients with known or suspected MDRO colonization or infection. Give highest priority to those patients who have conditions that may facilitate transmission, e.g., uncontained secretions or excretions. When single-patient rooms are not available, cohort patients with the same MDRO in the same room or patient-care area. *(IB)* When cohorting patients with the same MDRO is not possible, place MDRO patients in rooms with patients who are at low risk for acquisition of MDROs and associated adverse outcomes from infection and are likely to have short lengths of stay. *(II)*	Follow recommended cleaning, disinfection and sterilization guidelines for maintaining patient care areas and equipment. Dedicate non-critical medical items to use on individual patients known to be infected or colonized with an MDRO. Prioritize room cleaning of patients on Contact Precautions. Focus on cleaning and disinfecting frequently touched surfaces (e.g., bed rails, bedside commodes, bathroom fixtures in patient room, doorknobs) and equipment in immediate vicinity of patient. **Environment**	Not recommended routinely

Administration **Usage** **IC isolation** **De-colonize**

Tier 2

Tier 2. Recommendations for Intensified MDRO control efforts

Institute one or more of the interventions described below when 1) incidence or prevalence of MDROs are not decreasing despite the use of routine control measures; or 2) the *first* case or outbreak of an epidemiologically important MDRO (e.g., VRE, MRSA, VISA, VRSA, MDR-GNB) is identified within a healthcare facility or unit (*IB*) Continue to monitor the incidence of target MDRO infection and colonization; if rates do not decrease, implement additional interventions as needed to reduce MDRO transmission.

Administrative Measures/Adherence Monitoring	MDRO Education	Judicious Antimicrobial Use	Surveillance	Infection Control Precautions to Prevent Transmission	Environmental Measures	Decolonization
Obtain expert consultation from persons with experience in infection control and the epidemiology of MDROS, either in-house or through outside consultation, for assessment of the local MDRO problem and guidance in the design, implementation and evaluation of appropriat4e control measures. *(IB)* Provide necessary leadership, funding and day-to-day oversight to implement interventions selected. *(IB)* Evaluate healthcare system factors for role in creating or perpetuating MDRO transmission, including staffing levels, education and training, availability of consumable and durable resources; communication processes, and adherence to infection control measures.*(IB)* Update healthcare providers and administrators on the progress and effectiveness of the intensified interventions. *(IB)*	Intensify the frequency of educational programs for healthcare personnel, especially for those who work in areas where MDRO rates are not decreasing. Provide individual or unit-specific feedback when available. *(IB)*	Review the role of antimicrobial use in perpetuating the MDRO problem targeted for intensified intervention. Control and improve antimicrobial use as indicated. Antimicrobial agents that may be targeted include vancomycin, third-[d] generation cephalosporins, anti-anaerobic agents for VRE; third generation cephalosporins for ESBLs; and quinolones and carbapenems. *(IB)*	Calculate and analyze incidence rates of target MDROs (single isolates/patient; location-, service-specific) *(IB)* Increase frequency of compiling, monitoring antimicrobial susceptibility summary reports *(II)* Implement laboratory protocols for storing isolates of selected MDROs for molecular typing; perform typing if needed *(IB)* Develop and implement protocols to obtain active surveillance cultures from patients in populations at risk. *(IB)* (See recommendations for appropriate body sites and culturing methods.) Conduct culture surveys to assess efficacy of intensified MDRO control interventions. Conduct serial (e.g., weekly) unit-specific point prevalence culture surveys of the target MDRO to determine if transmission has decreased or ceased.*(IB)* Repeat point-prevalence culture-surveys at routine intervals and at time of patient discharge or transfer until transmission has ceased. *(IB)* If indicated by assessment of the MDRO problem, collect cultures to assess the colonization status of roommates and other patients with substantial exposure to patients with known MDRO infection or colonization. *(IB)* Obtain cultures from HCP for target	**Use of Contact Precautions:** **Implement Contact Precautions (CP) routinely for all patients colonized or infected with a target MDRO. *(IA)*** **Don gowns and gloves *before or upon entry* to the patient's room or cubicle. *(IB)*** **In LTCFs, modify CP to allow MDRO-colonized/infected patients whose site of colonization or infection can be appropriately contained and who can observe good hand hygiene practices to enter common areas and participate in group activities** **When active surveillance cultures are obtained as part of an intensified MDRO control program, implement CP until the surveillance culture is reported negative for the target MDRO *(IB)*** No recommendation is made for universal use of gloves and/or gowns. (*Unresolved issue*) **Implement policies for patient admission and placement as needed to prevent transmission of the problem MDRO. *(IB)*** When single-patient rooms are available, assign priority for these rooms to patients with known or suspected MDRO colonization or infection. Give highest priority to those patients who have conditions that may facilitate transmission, e.g., uncontained secretions or excretions. When single-patient rooms are not available, cohort patients with the same MDRO in the same room or patient-care area. *(IB)* When cohorting patients with the same MDRO is not possible, place MDRO patients in rooms with patients who are at low risk for acquisition of MDROs and associated adverse outcomes from infection and are likely to have short lengths of stay. *(II)* **Stop new admissions to the unit or facility if transmission continues despite the implementation of the intensified control measures. *(IB)*** **Education** **Surveillance** **Environment**	Implement patient.-dedicated use of non-critical equipment *(IB)* Intensify and reinforce training of environmental staff who work in areas targeted for intensified MDRO control. Some facilities may choose to assign dedicated staff to targeted patient care areas to enhance consistency of proper environmental cleaning and disinfection services *(IB)* **Monitor cleaning performance to ensure consistent cleaning and disinfection of surfaces in close proximity to the patient and those likely to be touched by the patient and HCWs (e.g., bedrails, carts, bedside commodes, doorknobs, faucet handles) *(IB)*.** Obtain environmental cultures (e.g., surfaces, shared equipment) only when epidemiologically implicated in transmission *(IB)* **Vacate units for environmental assessment and intensive cleaning when previous efforts to control environmental transmission have failed *(II)*** **Administration** **Usage** **IC isolation** **De-colonize**	Consult with experts on a case-by-case basis regarding the appropriate use of decolonization therapy for patients or staff during limited period of time as a component of an intensified MRSA control program *(II)* When decolonization for MRSA is used, perform susceptibility testing for the decolonizing agent against the target organism or the MDRO strain epidemiologically implicated in transmission. Monitor susceptibility to detect emergence of resistance to the decolonizing agent. Consult with microbiologists for appropriate testing for mupirocin resistance, since standards have not been established. Do not use topical mupirocin routinely for MRSA decolonization of patients as a component of MRSA control programs in any healthcare setting. *(IB)* Limit decolonization to HCP found to be colonized with MRSA who have been epidemiologically implicated in ongoing transmission of MRSA to patients. *(IB)* No recommendation can [illegible]de for [illegible]onization of patients [illegible]arry VRE or MDR-

Consults **do more** **target antibiotics** **Start doing**

Control of MDRO - Tier one

Surveillance:

1.Laboratory testing of sensitivity
2.Notify Infection Control of cases for action
3.Report general sensitivity pattern to hospital
4.Monitor trends of organisms tested and in special units

Isolation:

1. Standard precautions
2. Contact precautions for MDRO cases
3. Prioritized single rooms

Environment:

1. Standard cleaning of environment with focus on touched surfaces
2. Dedicated non-critical medical items

Control of MDRO- Tier two

Rates are increasing or 1st case of important organism

Enhance Surveillance:

1. Prevalence survey of hospital
2. Survey of special units and/or patients at risk
3. Surveillance of contacts and/or special units
4. Surveillance of healthcare workers when there is epidemiologic evidence.

Isolation:

1. Isolate cases and colonizers. Considering tagging and isolating readmissions of colonizers.
2. Stop new admissions if needed.
3. Close unit if needed

Environment:

1. Enhance consistency of cleaning. Consider dedicated staff.
2. Environmental cultures only when epidemiologically indicated
3. Vacate units for intense cleaning

Search and Destroy Strategy
refers to a military strategy that became a large component of the Vietnam War.

The idea was to insert ground forces into hostile territory, search out the enemy, destroy them, and withdraw immediately afterward.

Enforce strict rules & body count is the measure of success

Conventional Strategy (clear and hold) - attacking and conquering an enemy position, then fortifying and holding it indefinitely. **It is a step by step process**

Control of MRSA

"the AHA report and recent reviews of MRSA lament the lack of studies documenting the efficacy of most control measures commonly used for this organism. Until such studies are performed, no consensus will be reached about MRSA control measures and the ambivalence regarding this organism will persist"

Mylotte JM, Infect Control Hosp Epidemiol 1994; 15: 73-77

Incidence of MRSA in different parts of the world

Country of origin	% MRSA*
Scandinavia, the Netherlands	<1
USA	28
UK	32
Belgium	40
Japan, Korea	70

From: The Path of Least Resistance, SMAC Report, 1998, UK

MRSA control - the Dutch model (since 1988)

ICHE, 1996; 17: 512-513; EJ Clin Micro 99:18:461; Infection 05: 5/6:309

- Screen all contacts (staff + patient) and in same ward of MRSA isolates.
- Screen: nose, throat, perineum, sputum, urine & wound x3
- Ward close with 2 MRSA case or 1 staff with MRSA
- All persons with MRSA are isolated in single rooms (infection or colonization)
- All staff caring for patients are screen daily (first 2 in 24 hrs)
- Mask, cap, gown and gloves for all entering room
- All patients from other countries isolated in single rooms and screened until 3 sets of –ve cultures.
- All carriers (patients and staff) treated with nasal mupirocin

Cost: US $250,000 for outbreak of 3-5 patients

Search and Destroy:

And the results ...

Surveillance of MRSA in the Netherlands, 1989 to 1994

Number of	1989	1990	1991	1992	1993	1994
Isolates	152	168	211	190	267	231
Patients	102	134	179	160	233	188
Staff	50	34	32	30	34	43
Hospitals	30	42	53	46	59	60

Vandenbroucke-Grauls CMJE, Infect Control Hosp Epidemiol 1996; 17: 512-513,

Search and Destroy:

Use all possible measures

– both tier 1 and tier 2

Treat, Treat, Treat

Now it is 2005

"It is recommended not to take surveillance cultures among staff members, unless the outbreak remains uncontrolled with the measures indicated above, and only if it is clear beforehand what will be done with a positive result."

Kluytmans, Kluytmans, Voss Infection 05: 5/6:309

Commenting on the "search and destroy" strategy

"These countries remain in position to response vigorously to a single case of MRSA; an entirely different situation from hospitals with widespread MRSA"

21 signatories JHI 44(2)2000:151

UK Combined working party report 1998

“a more flexible targeted approach”

- Recommendations graded by the strength of evidence
- Flexibility for the endemic situation
- Classification of clinical areas into high / moderate / low risk

"Usually accepted that eradication would be unlikely in the highly endemic setting"

< 20 cases	100% elimination
20-39 cases	79% elimination
>39 cases	10% elimination

Marshall et al, JHI 2004:56:253

Boyce JM: ICHE 1991:12:36

Still we should try to lower the incidence…

Global Consensus Conference

Toronto 1999

Global Concensus: AJIC 1999; 27: 503-513

1999

Endorsed by CDC, LCDC, APIC, CHICA, ICNA,, IFIC.

Aim:
Achieve consensus on Infection Control practices for MRSA & VRE

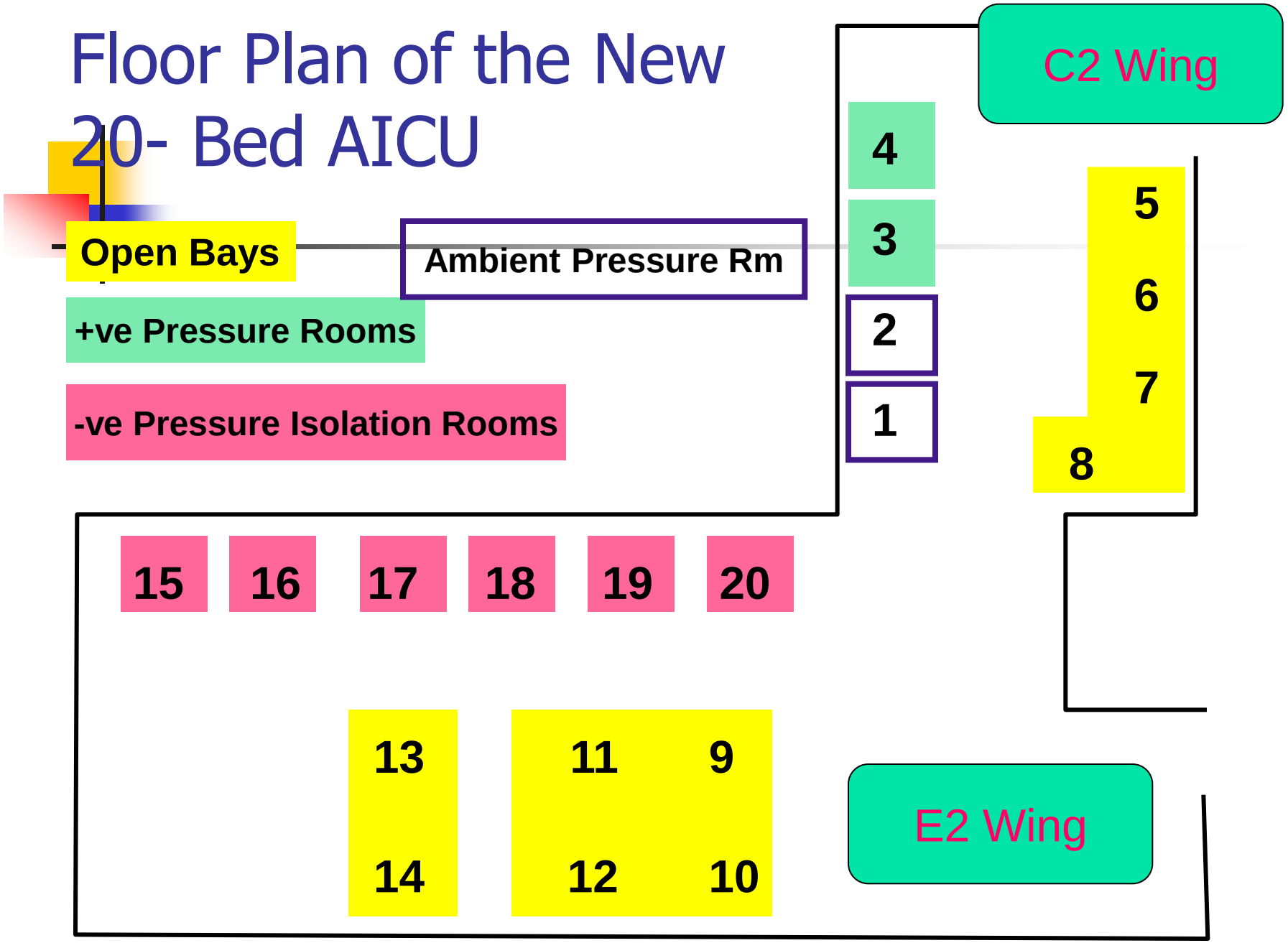
82 "experts in the field" by invitation only

http://www.hc-sc.gc.ca/main/lcdc/web/dpg_e.htlm

Global consensus conference - Toronto 1999
APIC, CHICA and ICNA

- **Barriers workshop**
  - isolation in single room , if possible
  - use of clean non-sterile gloves for patient contact
  - no recommendation for gowns / aprons
  - limited indications for patient / staff screening
- **Skin workshop**
  - antiseptic handwash in high risk areas/patients and for MRSA patients
  - alcohol handrub if no visible soil
- **Environment workshop**
  - hospitals need to ensure adequate cleaning practices
  - daily cleaning for hand contact surfaces (detergent disinfectant)
  - dedicated equipment, clean & disinfect others
  - decolonization therapy not recommended unless colonized person spreading organism

Floor Plan of the New 20- Bed AICU



MRSA in QMH –Hospital Acquired Infections (per 1000 admissions)

No sig diff

	2002	2003	2004	p (3 yrs)	2005	2006	2007	p (6 yrs)
Hospital - wide	**1.28 (133)**	**1.25 (117)**	**0.87 (87)**	<0.0001	**0.68 (70)**	**0.94 (97)**	**0.91 (99)**	**<0.00001**
ICU	**25.4 (43)**	**15.5 (23)**	**12.5 (20)**	<0.005	**10.6 (17)**	**11.4 (19)**	**4.68 (8)**	**<0.0007**

Comparing regression curves of Hospital vs ICU $\chi 2 = 90.7$; $p < 0.00001$

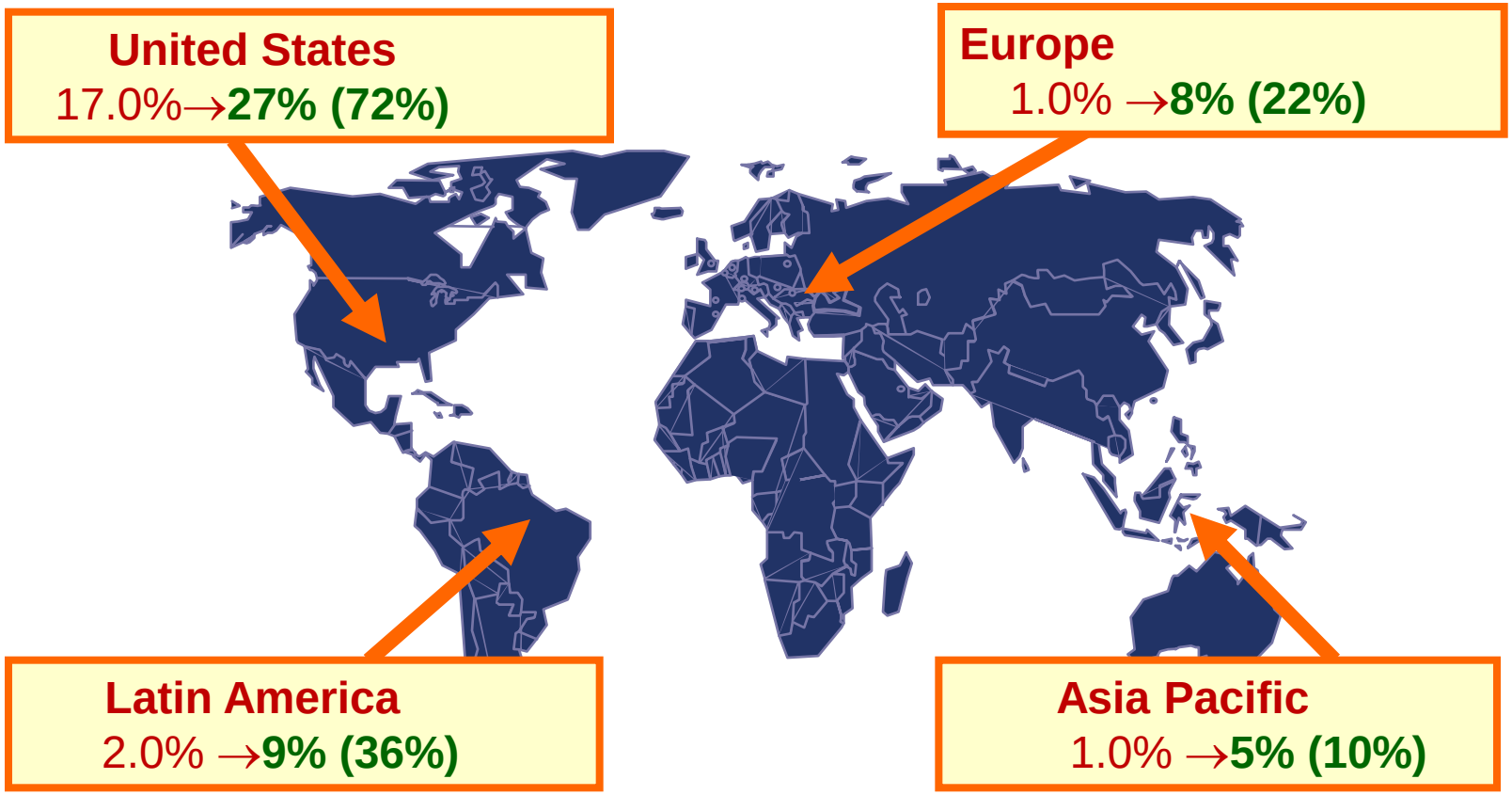
Isolation Policies in Hospital Authority – Hong Kong

IC tactics	MRSA BSI	VISA/ VRSA	VRE	ESBL	CRE	CRAB/ MDRA	CRPA/ MRPA
Single room	No	Yes	Yes	No	If available	If available (MDRA)	Yes (MRPA-XDR)
PPE, HH, EnH, Deq	HH	Yes	Yes	HH	Yes	Yes	Yes
CMS alert	No	Yes	Yes	No	Yes	MDRA	Yes
Discharge to RCHE	Allowed	**2 –ve culture**	**2 –ve culture**	Allowed	2 –ve culture	Allowed	MRPA: 2 –ve culture
Send isolate to reference lab	No	Yes	Yes	No	Yes	No	No
Notify Dept Health.	No	Yes	Yes	No	No	No	MRPA: Yes

Vancomycin resistant enterococci (VRE)

Worldwide Prevalence of VRE

1997-1999 → VRE (*E. faecium*) 2005-2007



Low DE et al. *Clin Infect Dis* 2001;32:S133-S45.
SENTRY 2007

Recommendations for preventing the spread of vancomycin resistance

The Hospital Infection Control Practices Advisory Committee (HICPAC)

MMWR, Sept 22, 1995

CDC

September 22, 1995 / Vol. 44 / No. RR-12

MMWR

Recommendations and Reports

MORBIDITY AND MORTALITY WEEKLY REPORT

Recommendations for Preventing the Spread of Vancomycin Resistance

Recommendations of the
Hospital Infection Control Practices
Advisory Committee (HICPAC)

Four Key Elements for Controlling VRE

- Prudent vancomycin usage**
- Continuing education programs for staff
- Role of microbiology lab. in detecting, reporting and control (screen by rectal swabs)
- appropriate infection control measures

Vancomycin

YES

1. Infections by β-lactam resistant gram+ve
2. Empirical Rx only for special patients at risk
3. β-lactam allergy with serious infections
4. AAC not responding to metronedazole
5. Surgical prophylaxis with prosthesis
6. Presumed pneumococcal meningitis

No

1. Most initial empirical Rx of neutropenic
2. 1 bld culture of CNS, Bacillus & Diptheroids
3. Rx of β-lactam sensitive organisms
4. Routine prophylaxis
5. Irrigation or topical application
6. Primary Rx of AAC

Four Key Elements for Controlling VRE

- Prudent vancomycin usage**
- Continuing education programs for staff
- Role of microbiology lab. in detecting, reporting and control (screen by rectal swabs)
- appropriate infection control measures

4 levels of screening

1. Evaluate all enterococcus isolated
2. Screen contacts
3. Screen high risk groups (ICU, oncology, transplant, renal)
4. Widespread surveys

HICPAC Recommendations

- single room or cohorting
- gloves on entering rooms
- gloves + gown if contact with patient, faeces, contaminated surfaces is anticipated
- handwashing with antiseptic soap e.g chlorhexidine
- dedicated noncritical items
- screen roommates
- identify on readmission

Staphylococcus aureus

			2009	2010	2011
Isolated with ST results			**16,596**	**16,639**	**17,326**
Antibiotics tested	Clindamycin	Tested	9,478	9,992	11,127
		% S	59.7%	59.6%	60.1%
	Erythromycin	Tested	15,157	15,293	15,867
		% S	59.5%	58.9%	58.6%
	Fusidic Acid	Tested	15,822	15,879	16,605
		% S	94.7%	94.8%	95.3%
	Gentamicin	Tested	16,448	16,535	17,209
		% S	73.4%	74.8%	76.1%
	Methicillin	Tested	3,977	3,893	3,810
		% S	66.8%	65.5%	64.0%
	Vancomycin	Tested	16,585	16,581	17,251
		% S	100.0%	100.0%	100.0%

Escherichia coli

			2009	2010	2011
Isolated with ST results			**46,906**	**47,156**	**46,348**
Antibiotics tested	Amikacin	Tested	40,697	40,591	40,856
		% S	98.3%	98.1%	98.2%
	Amoxicillin+clavulanate	Tested	43,856	44,139	45,483
		% S	70.9%	69.7%	70.5%
	Ampicillin	Tested	40,544	40,573	39,850
		% S	24.5%	24.6%	23.7%
	Cefotaxime	Tested	17,170	16,785	18,043
		% S	70.9%	68.5%	62.7%
	Cefuroxime (oral/axetil)	Tested	38,037	39,374	38,556
		% S	44.3%	46.2%	48.1%
	Gentamicin	Tested	46,897	47,152	46,342
		% S	68.5%	67.7%	67.3%
	Imipenem	Tested	31,571	29,472	29,774
		% S	100.0%	100.0%	100.0%
	Levofloxacin	Tested	24,580	24,699	35,704
		% S	64.7%	63.6%	61.5%

Acinetobacter species

			2009	2010	2011
Isolated with ST results			**5,757**	**5,550**	**4,646**
Antibiotics tested	Amikacin	Tested	5,739	5,535	4,643
		% S	78.4%	82.4%	82.8%
	Cefoperazone+Sulbactam	Tested	5,236	4,963	4,278
		% S	63.5%	64.8%	63.7%
	Ciprofloxacin	Tested	3,970	3,715	2,913
		% S	42.5%	44.4%	44.1%
	Gentamicin	Tested	5,753	5,547	4,642
		% S	61.5%	65.4%	67.3%
	Imipenem	Tested	4,803	4,707	3,975
		% S	57.7%	61.1%	59.4%
	Piperacillin+Tazobactam	Tested	4,857	4,644	3,910
		% S	46.2%	48.6%	49.1%

Our situation are not optimal

Be alert

and do our best in infection control practices

Thank you