Drug resistant Gram negative pathogens: local epidemiology & control measures

1 Jun 2010

Hospital Visits on 31 May 2010

- PWH & QEH
- At each hospital, materials to be covered:
  - Visit to clinical areas with high prevalence/ hx of clustering of drug resistant G- bugs (ICU, selected medical wards,…)
  - Discussion on the
    - prevailing practice of respective ICT on surveillance, IC and outbreak mx (if any) for drug resistant G- bugs
    - practical difficulties encountered and exploration on potential solution
    - comments and suggestions from Dr. Perl

Prince of Wales Hospital
1303 Patient beds;
Affiliated to the Chinese University of HK

Courtesy of Infection Control Team, PWH

Infection Control Team In PWH

- 1 Infection Control Officer (also the Chief of Service of the Department of Microbiology and the Cluster ICO)
- 6 Infection Control Nurses

Courtesy of Infection Control Team, PWH

Cumulative Report on Antibiotic Susceptibility, PWH, 2009

Commonly isolated gram negative bacteria		Ampicillin	Piperacillin	Ampicillin / Sulbactam	Amoxicillin / Clavulanate	Piperacillin/Tazobactam	Cefoperazone/Sulbactam	Ticarcillin / Clavulanic acid	Cefuroxime (Oral)	Cefuroxime (Parenteral)	Cefotaxime	Ceftazidime	Cefepime	Cotrimoxazole	Nitrofurantoin	Gentamicin	Amikacin	Ciprofloxacin	Imipenem	Meropenem	ESBL
Isolates from all specimen from all units, PWH, 2009																					
E. Coli	no. sensitive	1080			2917	3508	3369		1187	2896	3015		985	2219	2529	2720	3903	2591	3948		910
	no. tested	3947			3948	3946	3948		2639	3948	3948		1309	3841	2639	3948	3947	3948	3948		3948
	% sensitive	27			74	89	85		45	73	76		75	58	96	69	99	66	100		23
Klebsiella spp	no. sensitive				937	1049	1097		290	943	1050		611	876	319	1114	1219	1008	1231		157
	no. tested				1231	1231	1231		529	1231	1231		702	1167	529	1231	1231	1231	1231		1231
	% sensitive				76	85	89		55	77	85		87	75	60	90	99	82	100		13
Pseudomonas aeruginosa	no. sensitive		1101			1107	1039	956				1109	1090			1127	1140	1055	1107	1132	
	no. tested		1155			1155	1155	1154				1155	1155			1155	1155	1155	1154	1154	
	% sensitive		95			96	90	83				96	94			98	99	91	96	98	
Acinetobacter spp	no. sensitive			263		239	276	232				260	254			254	311	230	293	284	
	no. tested			343		343	343	343				343	342			343	343	343	343	343	
	% sensitive			77		70	80	68				76	74			74	91	67	85	83	

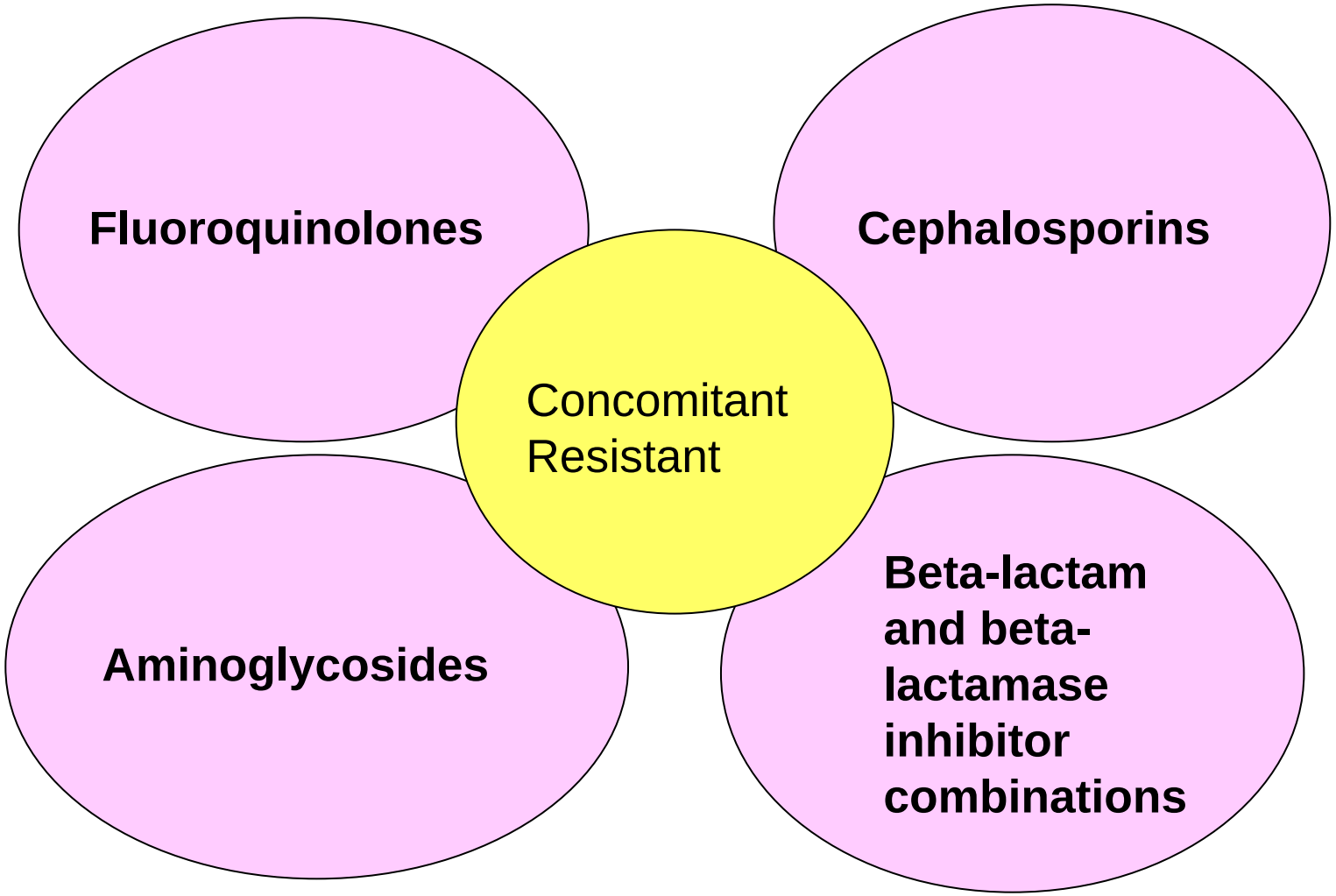
Courtesy of Infection Control Team, PWH

Cumulative Report on Antibiotic Susceptibility, PWH, 2009

Commonly isolated gram negative bacteria		Ampicillin	Piperacillin	Ampicillin / Sulbactam	Amoxicillin / Clavulanate	Piperacillin/Tazobactam	Cefoperazone/Sulbactam	Ticarcillin / Clavulanic acid	Cefuroxime (Oral)	Cefuroxime (Parenteral)	Cefotaxime	Ceftazidime	Cefepime	Cotrimoxazole	Nitrofurantoin	Gentamicin	Amikacin	Ciprofloxacin	Imipenem	Meropenem	ESBL
Isolates from all specimens from ICU, PWH, 2009																					
Pseudomonas aeruginosa	no. sensitive		59			59	54	52				59	58			59	60	58	57	58	
	no. tested		61			61	61	61				61	61			61	61	61	61	61	
	% sensitive		97			97	89	85				97	95			97	98	95	93	90	
Acinetobacter spp	no. sensitive			20		19	23	18				21	21			21	31	20	29	30	
	no. tested			37		37	37	37				37	37			37	37	37	37	37	
	% sensitive			54		51	62	49				57	57			57	84	54	78	81	
Klebsiella spp	no. sensitive				60	62	64		3	62	64		61	63	4	69	74	66	74		8
	no. tested				74	74	74		5	74	74		69	73	5	74	74	74	74		74
	% sensitive				81	84	86		60	84	86		88	86	80	93	100	89	100		11
E. Coli	no. sensitive	8			28	34	33		8	30	33		22	31	15	35	60	34	61		28
	no. tested	61			61	61	61		15	61	61		46	59	15	61	61	61	61		61
	% sensitive	13			46	56	54		53	49	54		48	53	100	57	98	56	100		46

Courtesy of Infection Control Team, PWH

HA Definition for MDRA



Courtesy of Infection Control Team, PWH

Definition for Multidrug Resistant Acinetobacter species in PWH

Resistant to Ceftazidime

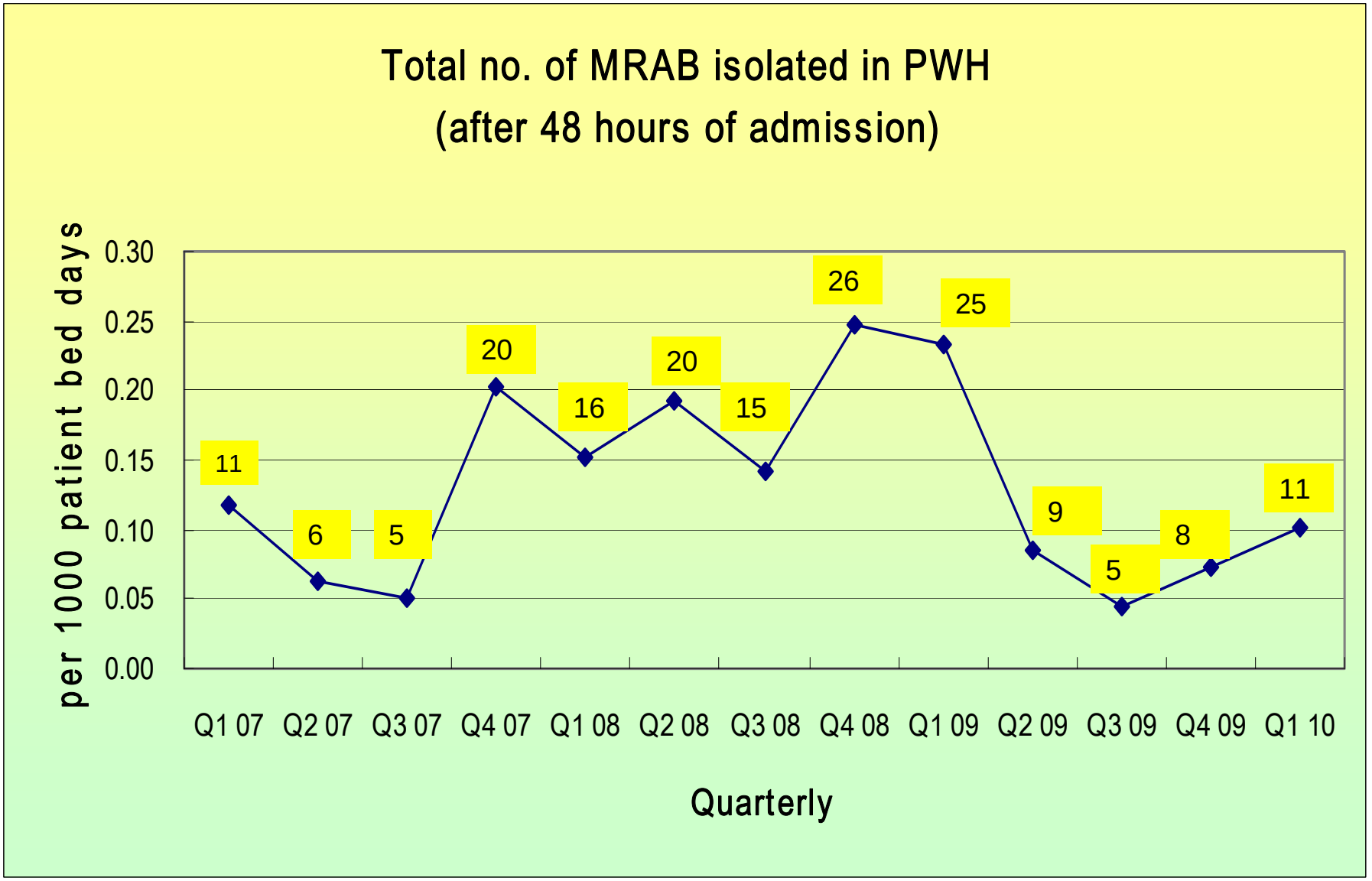
+

At least 3 of the followings:

- Imipenem,
- Piperacillin / tazobactam,
- Cefoperazone / sulbactam
- Ticacillin,
- Ciprofloxacin
- Gentamicin
- Amikacin

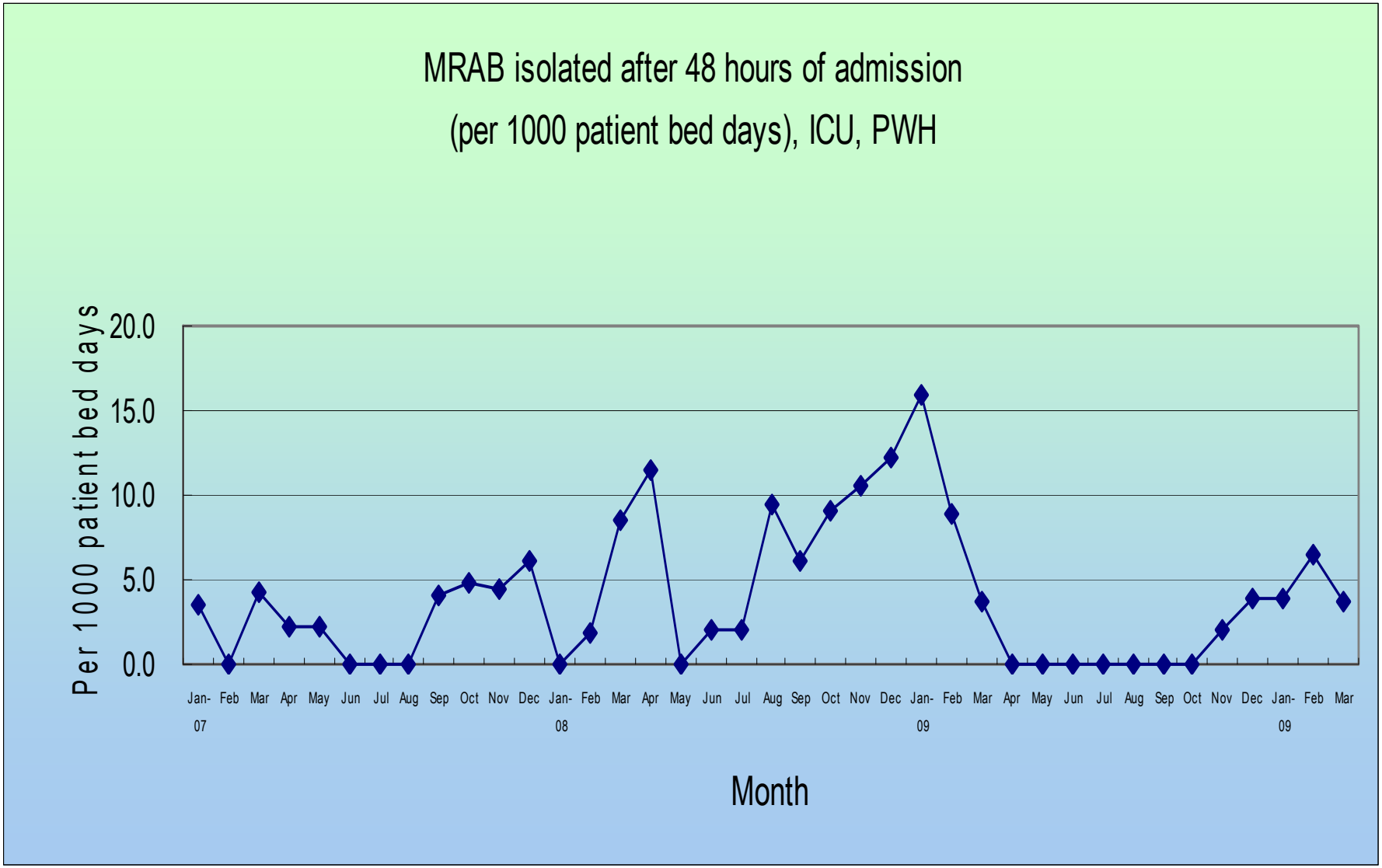
Courtesy of Infection Control Team, PWH

PWH definition: Multidrug Resistant Acinetobacter species



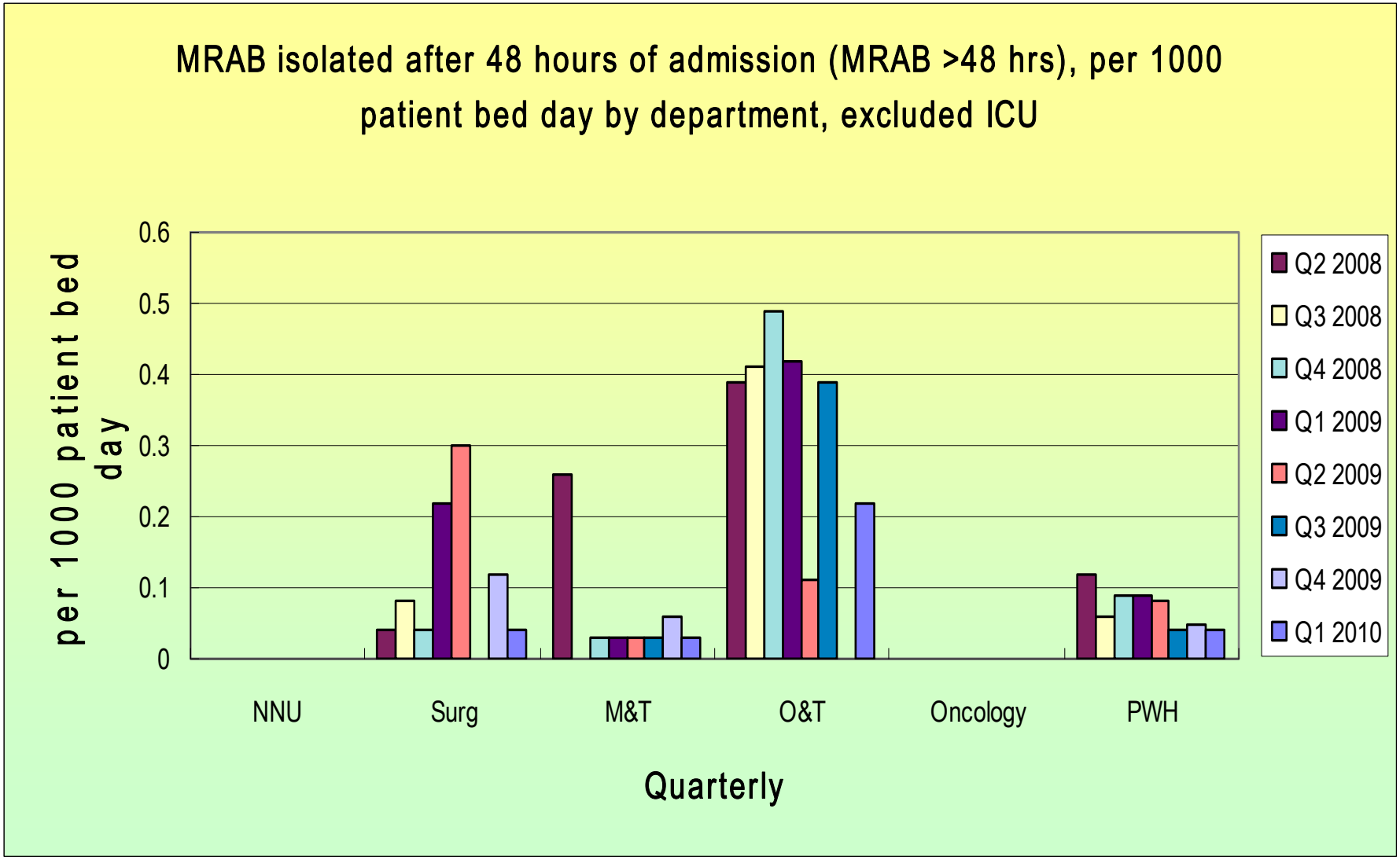
Courtesy of Infection Control Team, PWH

PWH definition: Multidrug Resistant Acinetobacter species



Courtesy of Infection Control Team, PWH

PWH definition: Multidrug Resistant Acinetobacter species



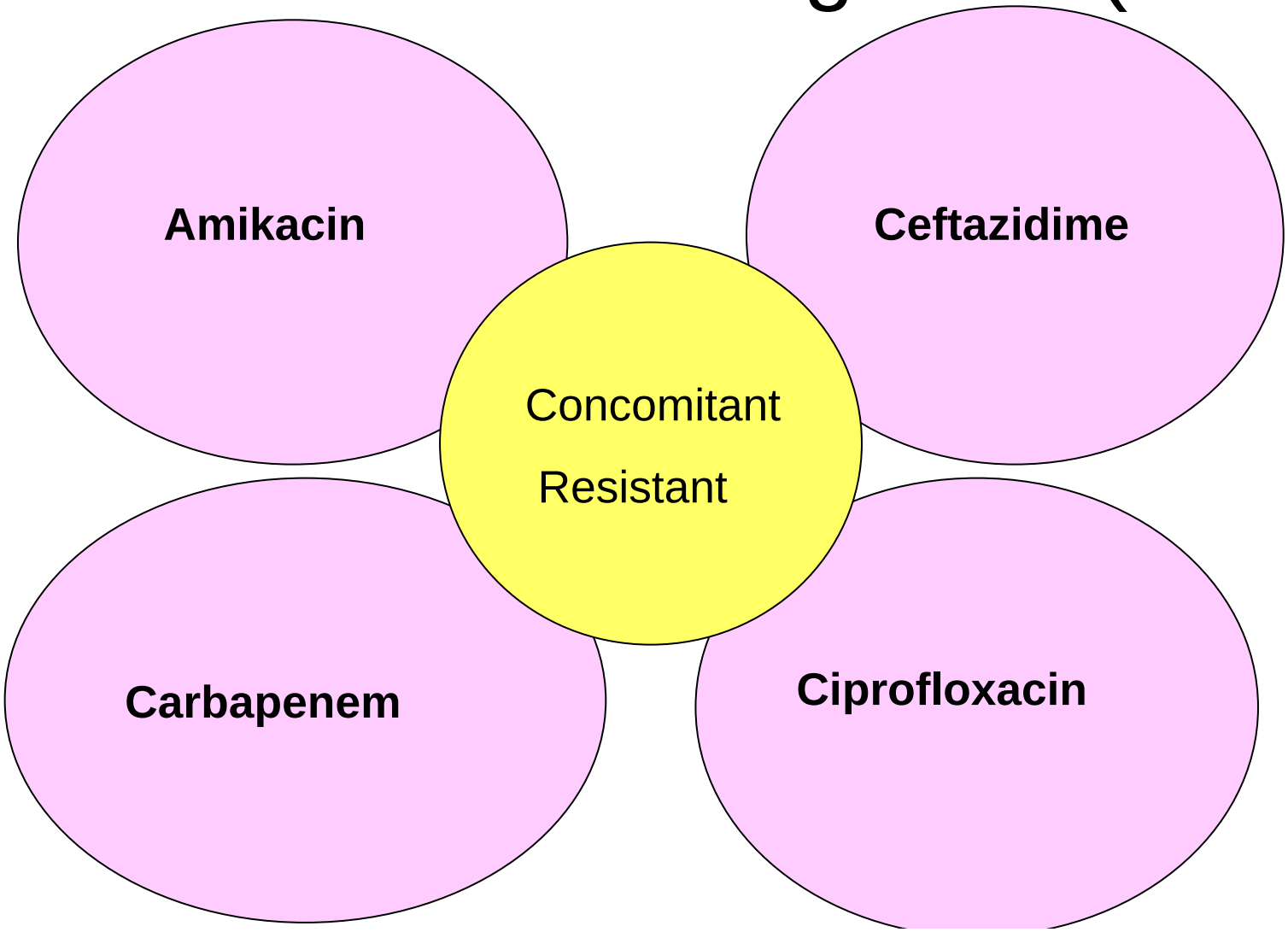
Courtesy of Infection Control Team, PWH

HA definition: Multidrug Resistant Acinetobacter species

Quarterly	Number of cases	Department
Q1 2009	0	0
Q2 2009	0	0
Q3 2009	3	M&T: 3
Q4 2009	2	M&T: 1 ICU: 1
Q1 2010	0	0

Courtesy of Infection Control Team, PWH

Definition for Multiple-drugs Resistant Pseudomonas aeruginosa (MRPA)



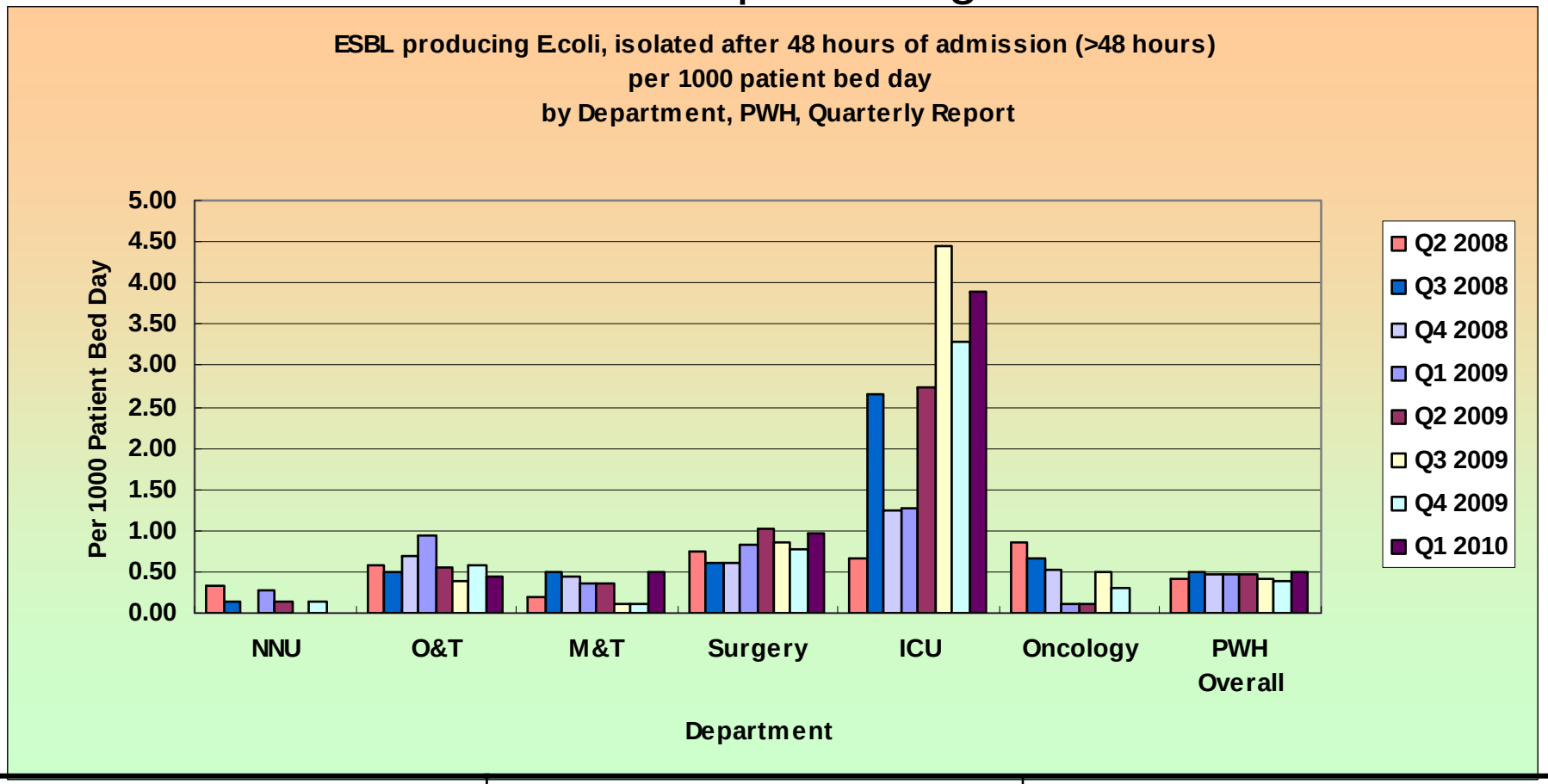
Courtesy of Infection Control Team, PWH

Multiple-drugs Resistant Pseudomonas aeruginosa (MRPA)

Quarterly	Number of cases	Department
Q1 2009	0	
Q2 2009	1	Surg: 1
Q3 2009	1	M&T: 1
Q4 2009	1	ICU: 1
Q1 2010	0	

Courtesy of Infection Control Team, PWH

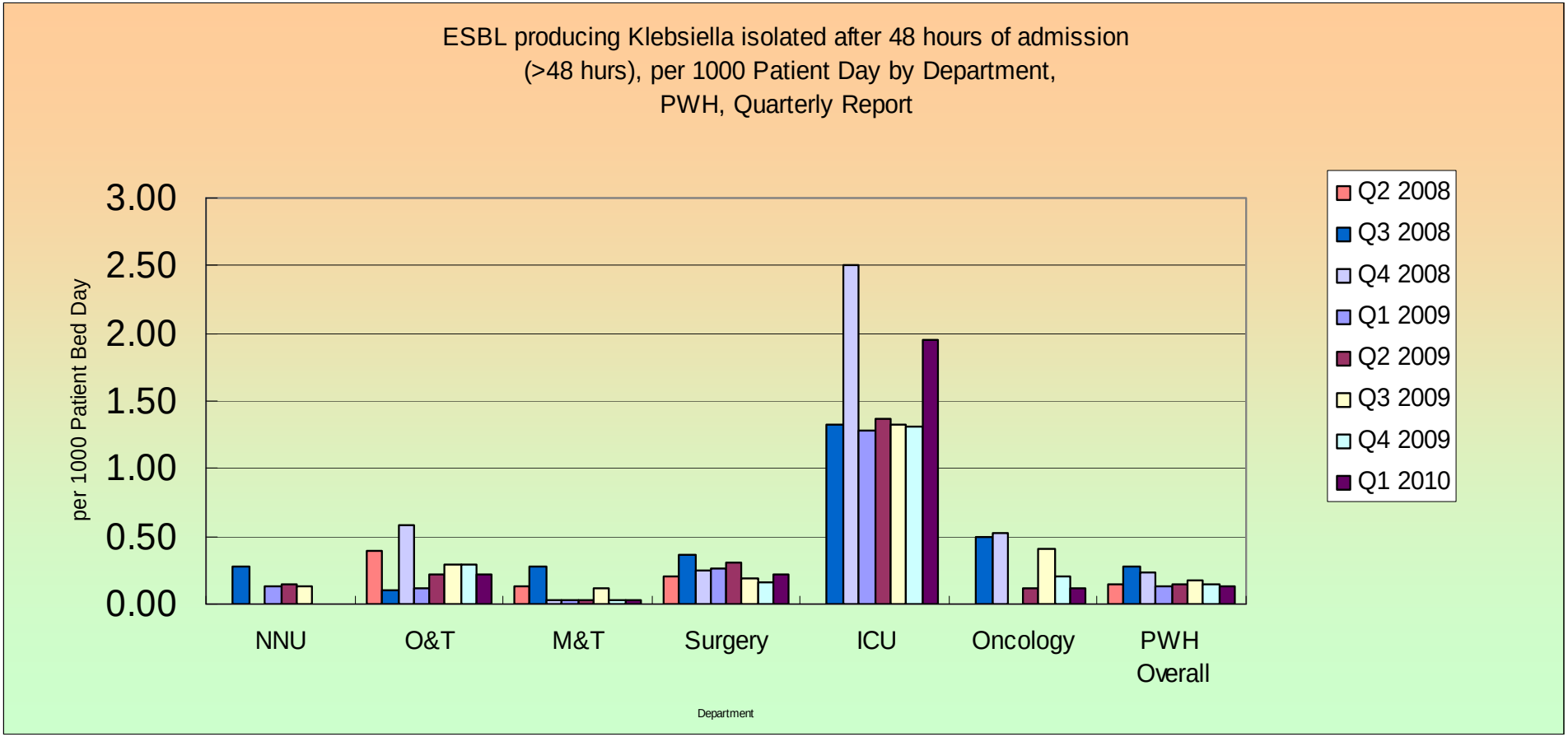
Prevalence of ESBL producing E coli in PWH



	>48	<48 + >48
Q2 2009	51	202
Q3 2009	48	244
Q4 2009	43	230
Q1 2010	55	269
***Around 900-1000 new isolations per year		

Courtesy of Infection Control Team, PWH

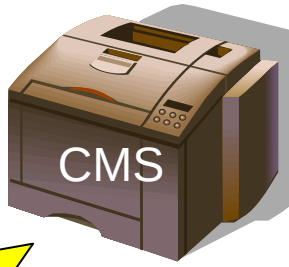
Prevalence of ESBL producing Klebsiella in PWH



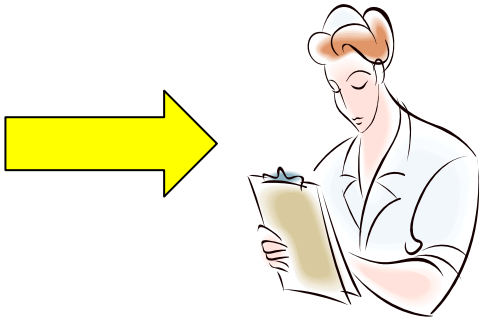
	>48	<48 + >48
Q2 2009	15	33
Q3 2009	21	54
Q4 2009	15	47
Q1 2010	14	46
***Around 250 new isolations per year		

Courtesy of Infection Control Team, PWH

Workflow of Infection Control Monitoring for Alert Organism



ICN Office



Ward Visit by ICN

Ward

IC measures implemented by ward nurse

Courtesy of Infection Control Team, PWH

Sample of laboratory result

Date Collected: 20/05/10 12:09
Date Arrived: 20/05/10 16:29
Specimen:- MID-STREAM URINE

Microscopy : Moderate numbers of WBC seen (10,000 - 100,000 cells/ml)
RBC not seen
Epithelial cells seen
Bacteria present

Routine culture :-

Organism 1 : > 100,000 CFU/ml of Escherichia coli isolated

Sensitive to:

Cotrimoxazole	Gentamicin
Nitrofurantoin	Piperacillin/tazobactam

Intermediate to:

Amoxycillin/clavulanate	Cefoperazone/sulbactam

Resistant to:

Ampicillin	Cefotaxime
Ceftazidime	Cefuroxime (oral)
Cefuroxime (parenteral)	Ciprofloxacin

ESBL positive

*** Extended-spectrum B-lactamase (ESBL) producing strain isolated. ***

Carbapenems should be regarded as the drugs of choice for serious infections with ESBL-producing organisms.

CONTACT PRECAUTION IS REQUIRED. FOR ENQUIRIES, PLEASE CONTACT INFECTION CONTROL TEAM.

Signed By: MR. CHEUNG SIU WAI
*** This Laboratory is accredited by NATA (Accreditation No. 14140) ***

Courtesy of Infection Control Team, PWH

Infection Control Measures for MDRO

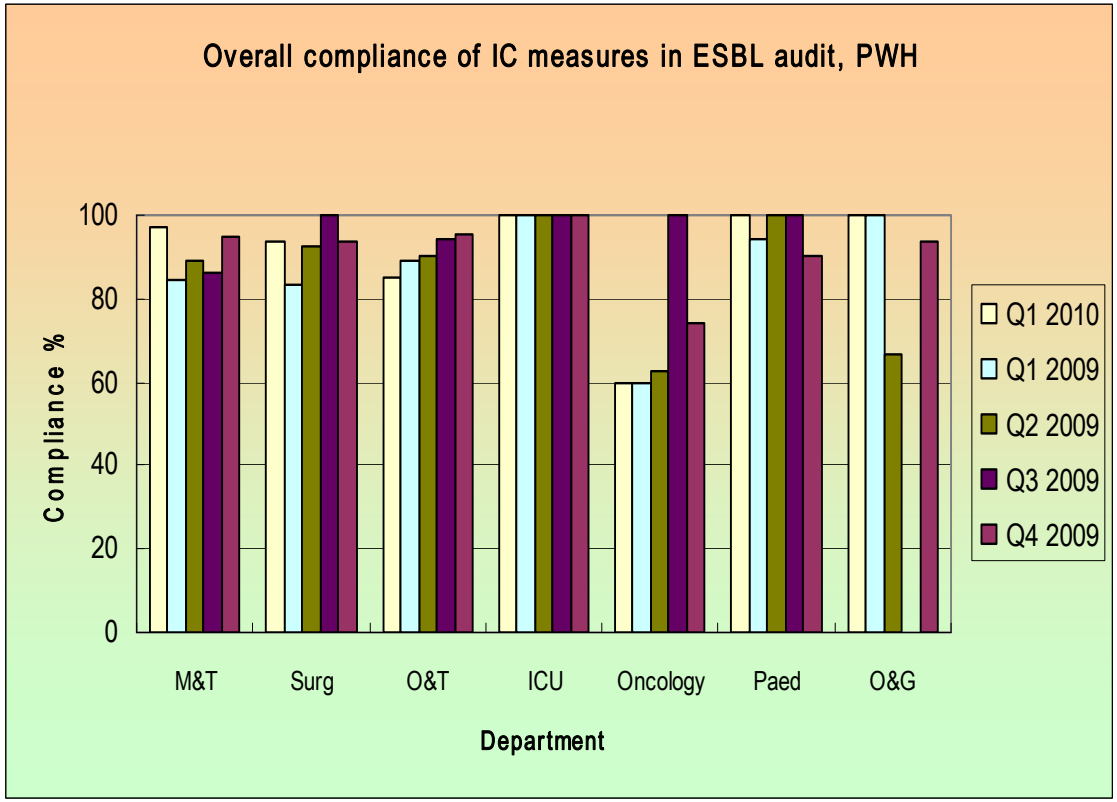
- Isolate the patients in single room if possible, if not available place in corner bed or cohort together
- Contact precautions – wear gloves and disposable gowns during close patient contact
- Perform hand hygiene after removal of gloves
- Dedicated use of equipments such as stethoscopes, BP Cuff
- Environmental disinfection with 1000ppm hypochlorite solution
- MDRA / MRPA – Dedicated mop, bucket or other cleansing equipments
- MDRA / MRPA - Tagging in the CMS (Computer Management System) so that contact precautions are to be taken on re-admission

Courtesy of Infection Control Team, PWH

Other measures - Audit for ESBL producing organism

Audit items included

- ✓CP signage
- ✓Alcohol handrub at bedside
- ✓Designated equipment
- ✓PPE for close contact



Courtesy of Infection Control Team, PWH

Sharing of epidemiology of the Alert organisms (including the MDROs) to frontline colleagues

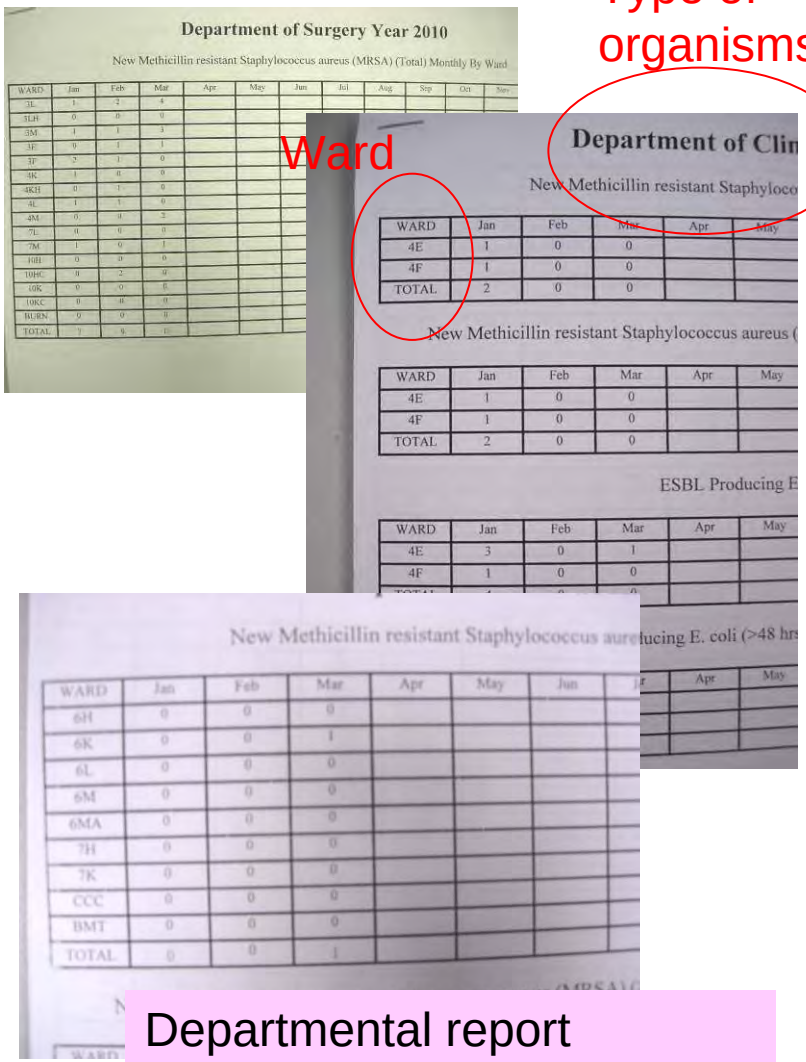
Type of report	**Content**	**Target group**
Departmental report (Monthly)	The number of new isolations of alert organisms by month	COSs, DOMs
Quarterly report (Quarterly)	The rate of hospital acquired infection of selected alert organisms and related audit result Presented in the quarterly Infection Control Committee Meeting	COSs, DOMs, DICCs

Courtesy of Infection Control Team, PWH

Report sample

Type of organisms

Ward


Department of Surgery Year 2010

New Methicillin resistant Staphylococcus aureus (MRSA) (Total) Monthly By Ward

Department of Clin

New Methicillin resistant Staphyloco

WARD	Jan	Feb	Mar	Apr	May
4E	1	0	0		
4F	1	0	0		
TOTAL	2	0	0		

New Methicillin resistant Staphylococcus aureus (

WARD	Jan	Feb	Mar	Apr	May
4E	1	0	0		
4F	1	0	0		
TOTAL	2	0	0		

ESBL Producing E

WARD	Jan	Feb	Mar	Apr	May
4E	3	0	1		
4F	1	0	0		

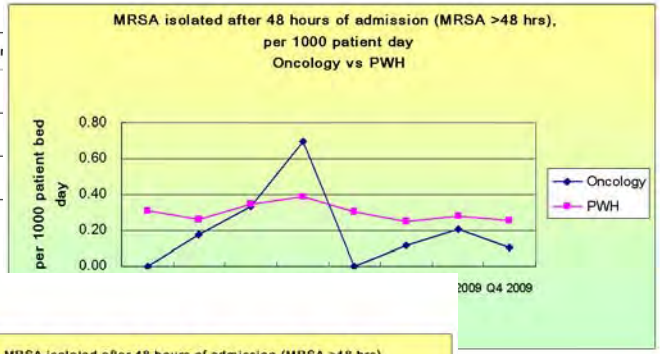
New Methicillin resistant Staphylococcus aure ucing E. coli (>48 hr

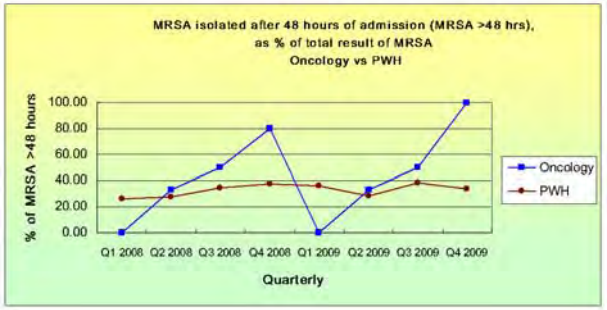
WARD	Jan	Feb	Mar	Apr	May	Jun
6H	0	0	0			
6K	0	0	1			
6L	0	0	0			
6M	0	0	0			
6MA	0	0	0			
7H	0	0	0			
7K	0	0	0			
CCC	0	0	0			
BMT	0	0	0			
TOTAL	0	0	1			

Departmental report

IC Measures Audit of MRSA Cases in Oncology

Audit Items	Q1 2008	Q2 2008	Q3 2008	Q4 2008	Q1 2009	Q2 2009	Q3 2009	Q4 2009
1. CP Signage at bedside	3/3	2/2	NA	3/3	1/1	2/2	3/3	1/1
	100%	100%	NA	100%	100%	100%	100%	100%
2. Alcohol handrub a/v at bed end	3/3	2/2	NA	3/3	1/1	2/2	3/3	1/1
	100%	100%	NA	100%	100%	100%	100%	100%
3. Designated equipment or disinfect after use	2/3	2/2	NA	3/3	1/1	2/2	3/3	1/1
	67%	100%	NA	100%	100%	100%	100%	100%
4. PPE for close contact	1/2	2/2	NA	2/2	0/0	2/2	1/1	1/1
% Overall compliance ra								
Type of patient placemer								
1. single room								
2. Cohort nursing								
3. General ward cubicle								





Quarterly report

Courtesy of Infection Control Team, PWH

Environmental cleaning schedule

Locations	Cleaning frequency for the patient surrounding environment
General patient	Daily
Patient with contact precautions	Twice daily

Courtesy of Infection Control Team, PWH

Additional IC measures for clustering / outbreak

- Isolate/ cohorted affected patient
- Comprehensive cleaning after isolation of the patients
- Patient screening (same cubicle or the whole wards depending on the extent of involvement)
- Environmental screening – commonly touched areas
- Review of hand hygiene practices
- Outbreak meeting with the clinical management

Courtesy of Infection Control Team, PWH

Training for frontline staff

Infectious Disease Control Training Centre
Hospital Authority / Infection Control Branch
(CHP) August 2006

Items and Descriptions	Isolation Precautions Signage *(example*)*	Usage
1. PVC Signage Card ▪ Size: 132mm x 132mm ▪ Materials: PVC Card i) Droplet Precautions ii) Contact Precautions		For placing near patients' bed
2. PVC Signage Card ▪ Size: 170mm x 180mm ▪ With 4 small holes on top ▪ Materials: PVC card i) Droplet Precautions ii) Contact Precautions iii) Airborne Precautions		For displaying on the door of isolation room
3. Art Card Signage ▪ Size: A5 ▪ Materials: 210 gsm matt art paper i) Droplet Precautions ii) Contact Precautions iii) Airborne Precautions		

Type of Isolation Precautions	Examples	Patients Placement	Hand Washing	Mask	Eye Protection	Gown	Gloves	Patient Care Equipments	Patient Transport
Contact Precautions 	MRSA, Scabies, GE	Single room or Cohort in a room/ main ward	SP	SP	SP	When anticipating close contact with patient	Whenever contact with patient	Designated or disfect after every patient use	Limit for essential purpose; Notify receiving area
Droplet Precautions 	Influenza, Pertussis, Rubella	Single room or at least 3 feet apart from adjacent patients	SP	Surgical Mask (Within 3 feet of patient)	SP	SP	SP	Designated or disfect after every patient use	Patient should wear surgical mask
			SP	N95 Respirator	SP	SP	SP	Designated or disfect after every patient use	Patient should wear surgical mask

Required every 18 months

Courtesy of Infection Control Team, PWH

Specific training sessions

Acinetobacter

What is Acinetobacter

- Commonly fou
- Able to survive
- Most common persistently car personnel

What's ESBL producing organism?

Extended Spectrum Beta- Lactamases

Resistance to

Extended-spectrum Beta-lactams

Multi-drug Resistant *Acinetobacter* Infections

Resistant to

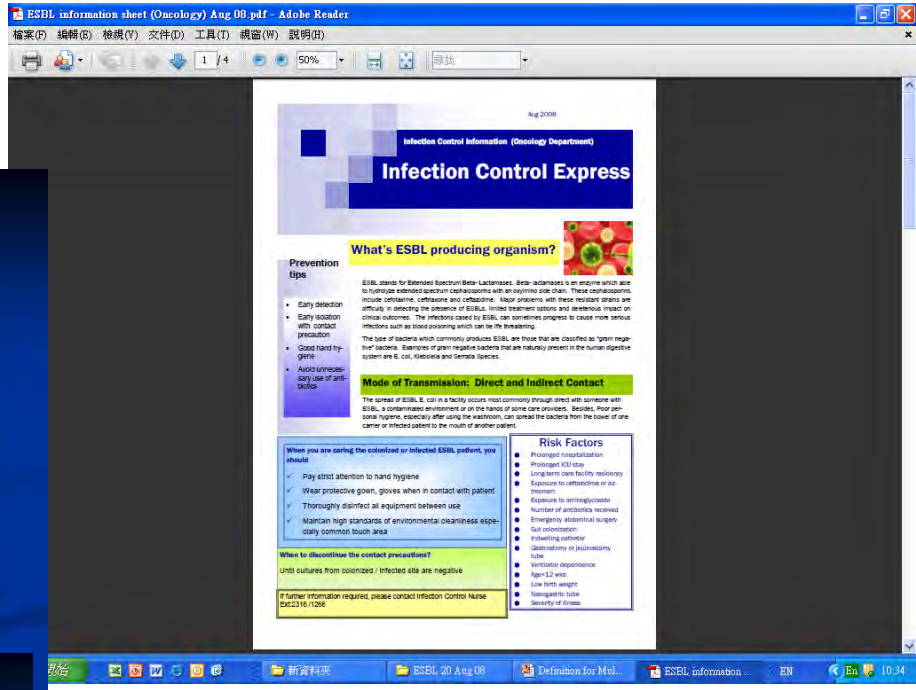
- Fortum(Ceftazidime)

At least three of follow

- Amikin(Amikacin)
- Ciprofloxacin
- Sulperazon (Cepfoperon
- Tazocin(Piperacillin/tazo

Risk Factors of ESBLs infection

- Prologned hospitalization
- Prolonged ICU stays
- Long-term care facility residency
- Exposure to ceftazidime or aztreonam
- Number of antibiotics received
- Emergency abdominal surgery
- Gut colonization
- Indwelling catheter
- Ventilator dependence
- Age<12 wks
- Severity of illness



When there is clustering or increase in the incidence

Courtesy of Infection Control Team, PWH

Antibiotics Stewardship Program

- Target to “big gun antibiotics” – carbapenems, ceftazidime, piperacillin / tazobactam, cefoperazone / sulbactam, IV quinolones, vancomycin, linezolide
- List of items used by wards are generated by pharmacy
- Concurrent feedback by daily review
- Manpower problems

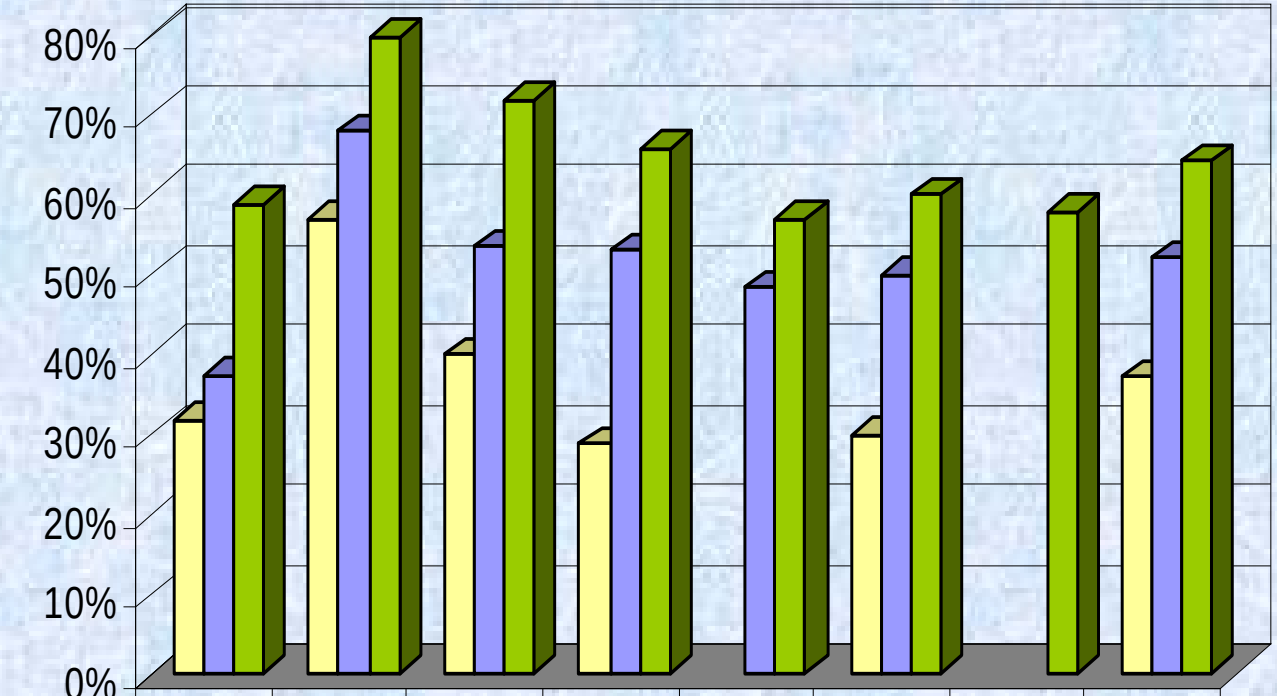
Courtesy of Infection Control Team, PWH

Summary of Hand Hygiene Audit result 2009

- Adopted WHO HH Audit tool since 2007
- Targeted department: 7 (M&T, Surg, O&T, ICU, O&G, Paed & Oncology)
- Total opportunities: 1737
- Overall compliance in 2009: 64%

Courtesy of Infection Control Team, PWH

Overall Hand Hygiene Compliance of PWH (By Department)

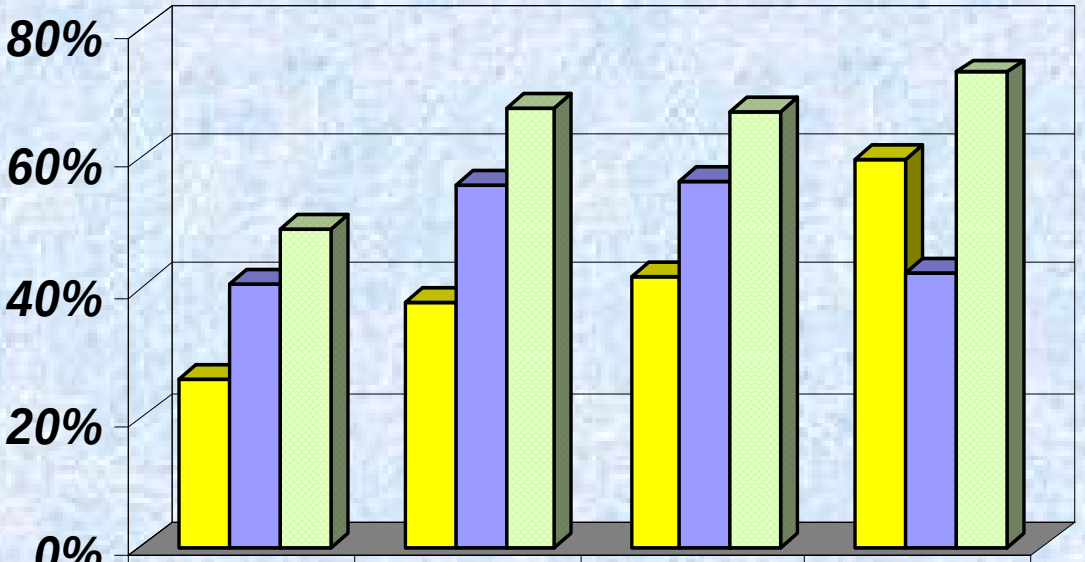


	Surg	ICU	O&T	Paed	O&G	M&T	Onco	PWH
2007	32%	57%	40%	29%		30%		37%
2008	38%	68%	54%	53%	48%	50%		52%
2009	59%	80%	72%	66%	57%	60%	58%	64%

Departments

Courtesy of Infection Control Team, PWH

Overall Hand Hygiene Compliance of PWH (By Rank)



	Doctor	Nurse	HCA	Others
2007	26%	38%	42%	60%
2008	41%	56%	56%	42%
2009	49%	68%	67%	73%

Departments

Courtesy of Infection Control Team, PWH

Questions/ Issues	ICT	Dr. Perl:
1.Hand hygiene compliance is relatively low among physicians, ~ 40%	It is identified that the most non-compliant moment is before patient contact, such as before wound inspection. Feedbacks to departments were made.	➢It is better to review if there are any deficits on 1.Knowledge 2.Attitude 3.Behavior 4.Culture 5.HH facilities ➢Identified the problems and try to change the culture by behavioral change; physicians should took the lead. ➢HH audit and checklist serve as objective tools to reduce confrontation, but they do not influence much on culture/behavior change. Feedback mechanism is very important. ➢Some examples to drive change: - “Competition” among departments - Bonus system
2. Definition on GN resistance organism	Is any standard definition in US?	No standard definition among US hospitals

3. Chlorhexidine bathing	1. What is the view on using Chlorhexidine bathing as a routine practice? 2. Have taken a trial period in PWH ICU, from the preliminary observation, there was an increase in MDRA	In JH, it's been implemented in the adult ICU and benefit in reducing nosocomial infection have been demonstrated. Study are being carried out in paed. ICU currently.
4. Curtain	As a role of reservoir/ transmission of DNR pathogens	In US hospitals, wards are mostly composed of double bed rooms, so not really known if curtain is a big issue. Change curtain daily for norovirus, CD cases
5. Disinfection: Hydrogen peroxide vaporization	What is the view of using it as chemical disinfection?	It is used for environmental disinfection. Patients have to be removed temporarily but equipment can be left in ward.

Queen Elizabeth Hospital

- The only acute hospital in KCC
- ~1775 beds
- Departments include:

medical, surgical, orthopedics, CTS, NS, pediatrics, obstetrics & gynecological, oncology, & Intensive care unit …….

Courtesy of Infection Control Team, QEH

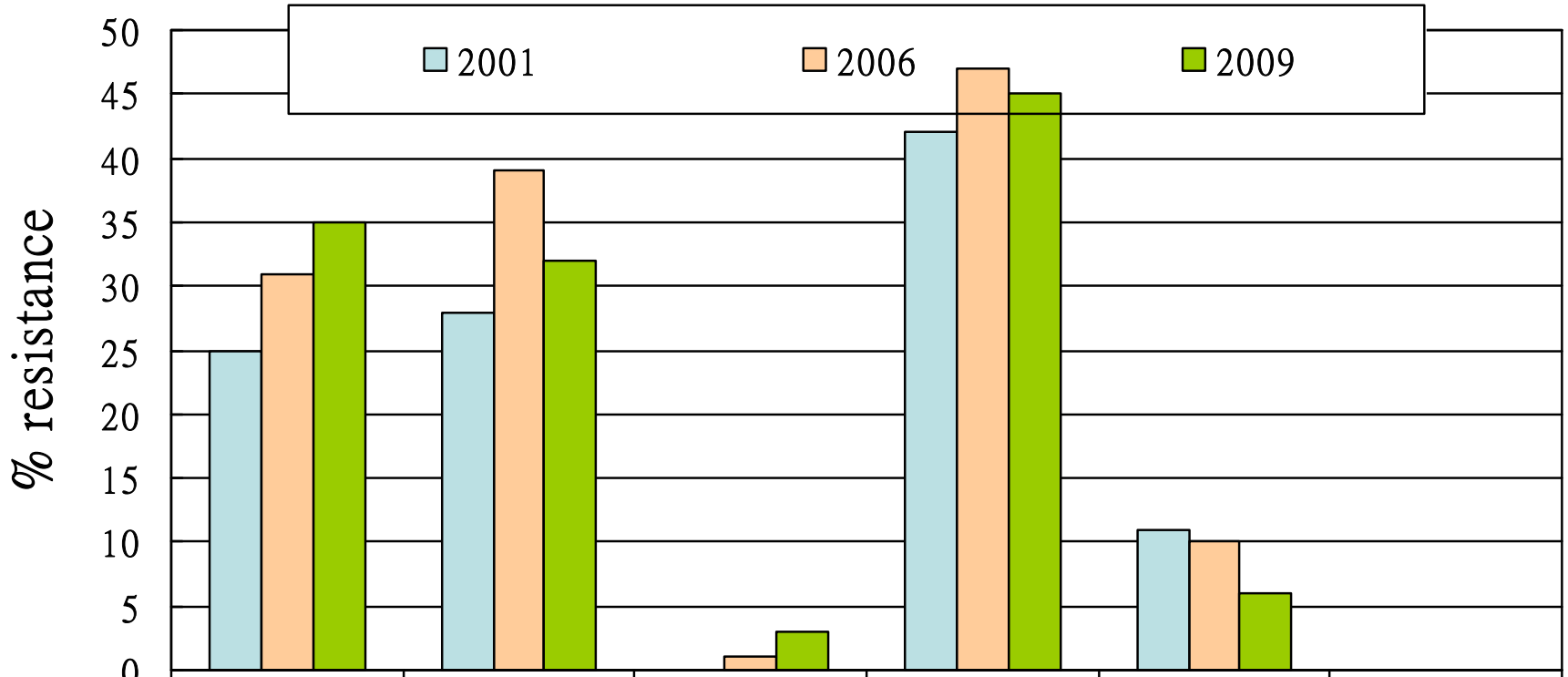
Adult Intensive care unit (ward B6 & D6)

- 16 ICU beds + 2 HDU beds
- No. of patient admission per month in average : 96
- No. of patient days per month in average: 493

Data source: EIS, CDARS Jan to Dec 2009

Courtesy of Infection Control Team, QEH

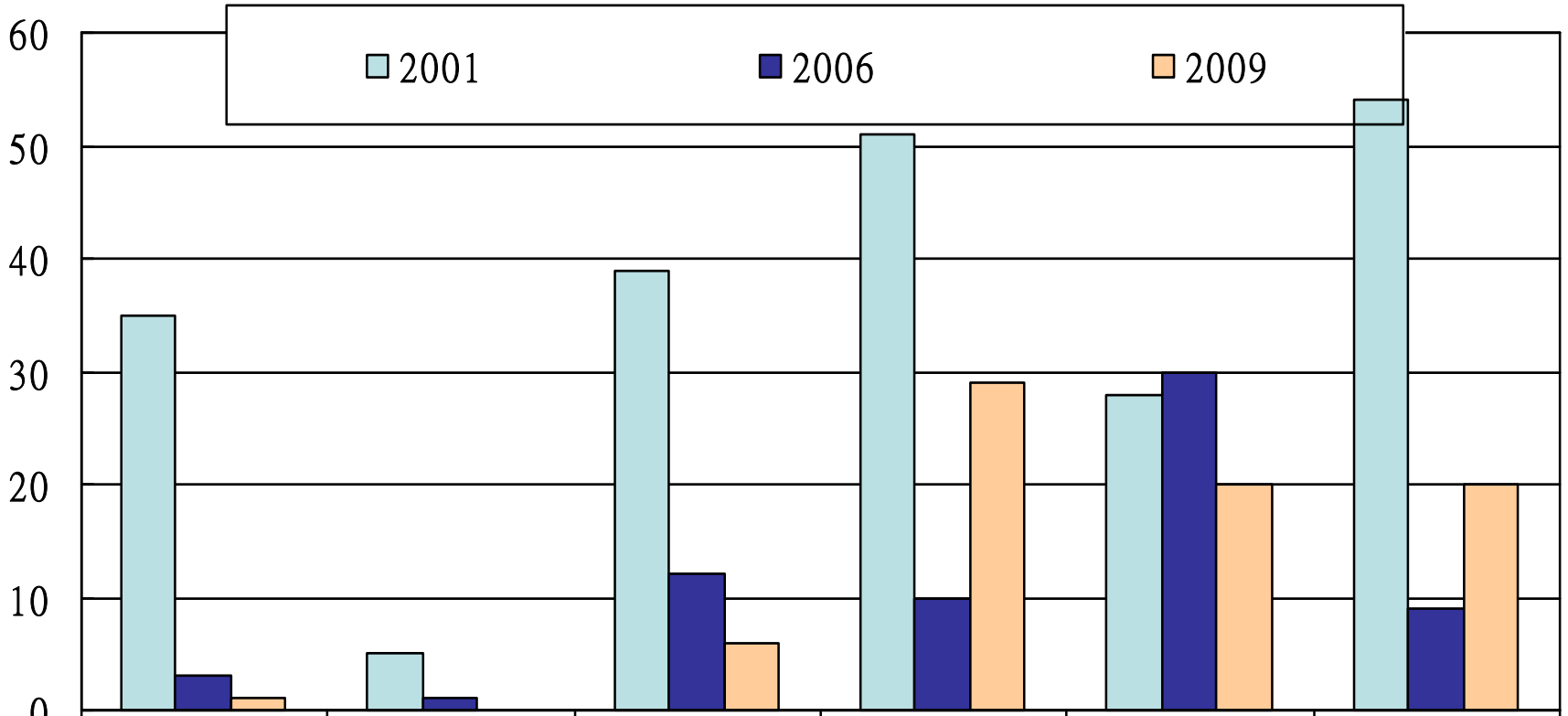
ICU Susceptibility Data: Escherichia coli



	ESBL+	GEN	AMK	CIP	TZP	IMI
2001	25	28	0	42	11	0
2006	31	39	1	47	10	0
2009	35	32	3	45	6	0

Courtesy of Infection Control Team, QEH

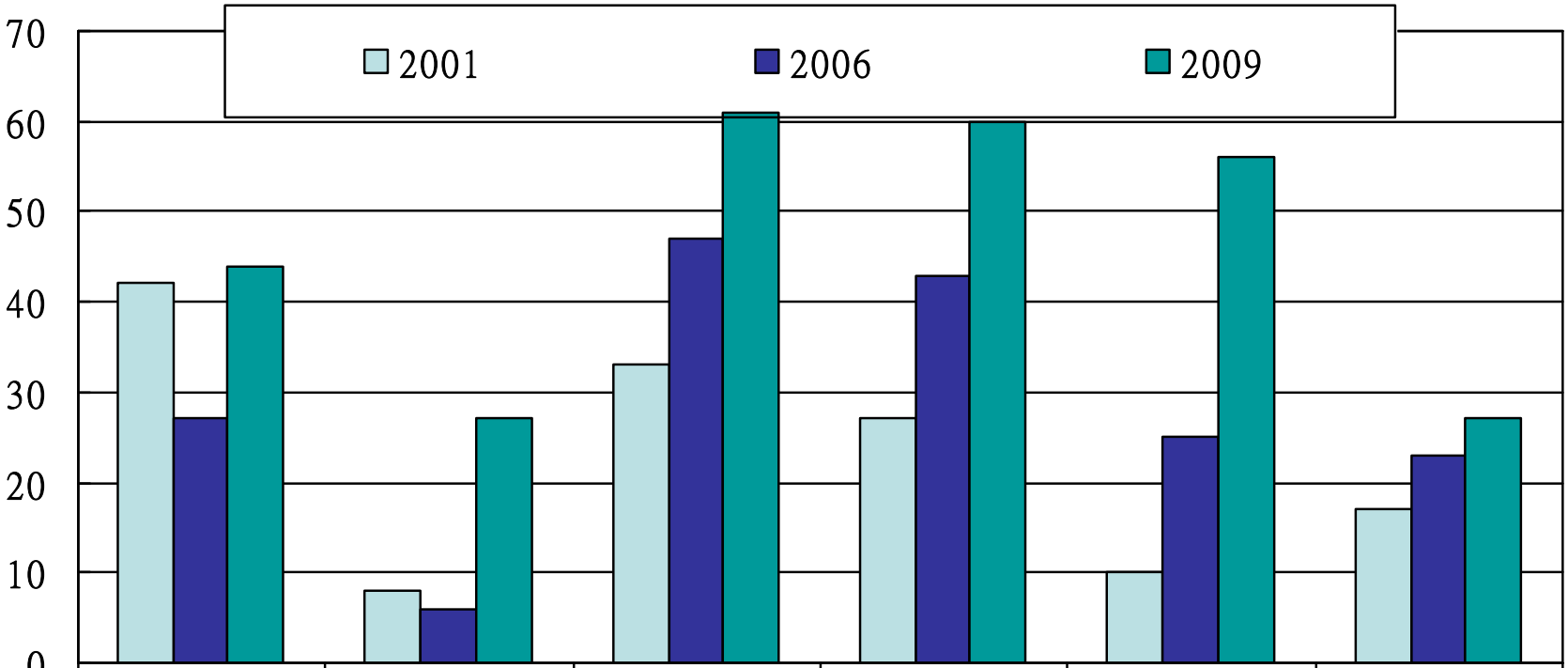
ICU Susceptibility Data: P. aeruginosa



	GEN	AMK	CIP	TZP	IMI	CAZ
2001	35	5	39	51	28	54
2006	3	1	12	10	30	9
2009	1	0	6	29	20	20

Courtesy of Infection Control Team, QEH

ICU Susceptibility Data: Acinetobacter spp



	GEN	AMK	CIP	TZP	IMI	UNA
2001	42	8	33	27	10	17
2006	27	6	47	43	25	23
2009	44	27	61	60	56	27

Courtesy of Infection Control Team, QEH

Surveillance Data & Trends of Drug Resistant Gram Negative pathogens

Multiple-Drug Resistant *Pseudomonas aeruginosa* (MRPA)

- Defined as co-resistant to Imipenem, Ceftazidime, Amikacin, Ciprofloxacin

Year	2002	2003	2004	2005	2006	2007	2008	2009
No. of new MRPA cases in QEH	79	82	50	8	5	1	1	**0**

- "**Find And Confine"**
- Active surveillance culture were done of all high risk groups, on sputum, urine, wound from ICU and ventilator ward patients;
- Communication and cooperation with cluster hospitals (BH &KH) for inter-hospital transfer of MRPA patients
- Isolate in single room until 3 consecutive negative cultures in weekly intervals

Courtesy of Infection Control Team, QEH

Definitions of Multiple-drugs Resistant *Acinetobacter* species (MDRA) in QEH

MDRA

- Co-resistant to all seven antibiotics (in four classes)

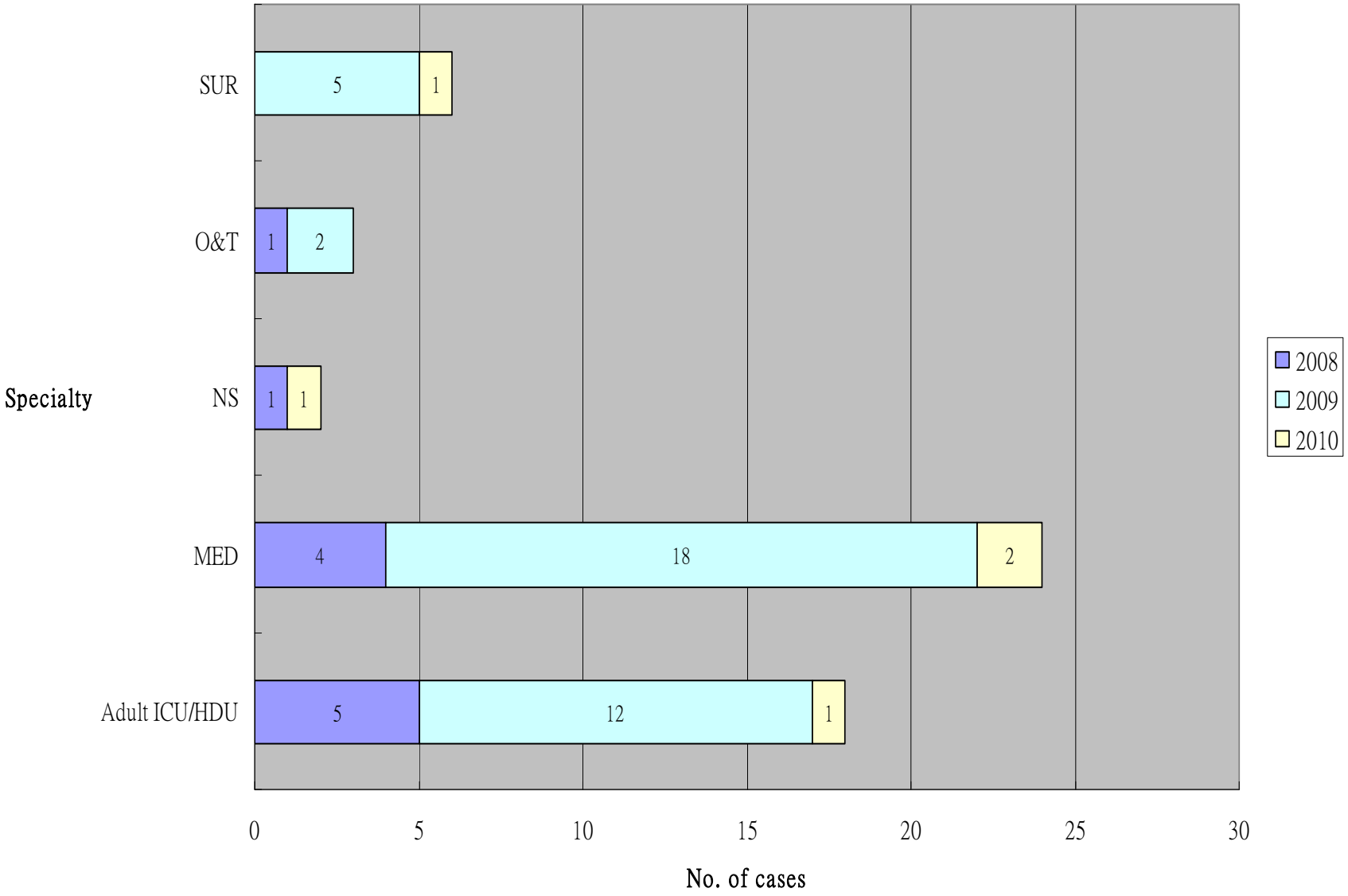
p-MDRA

- resistant to 3 out of 4 classes of antibiotics

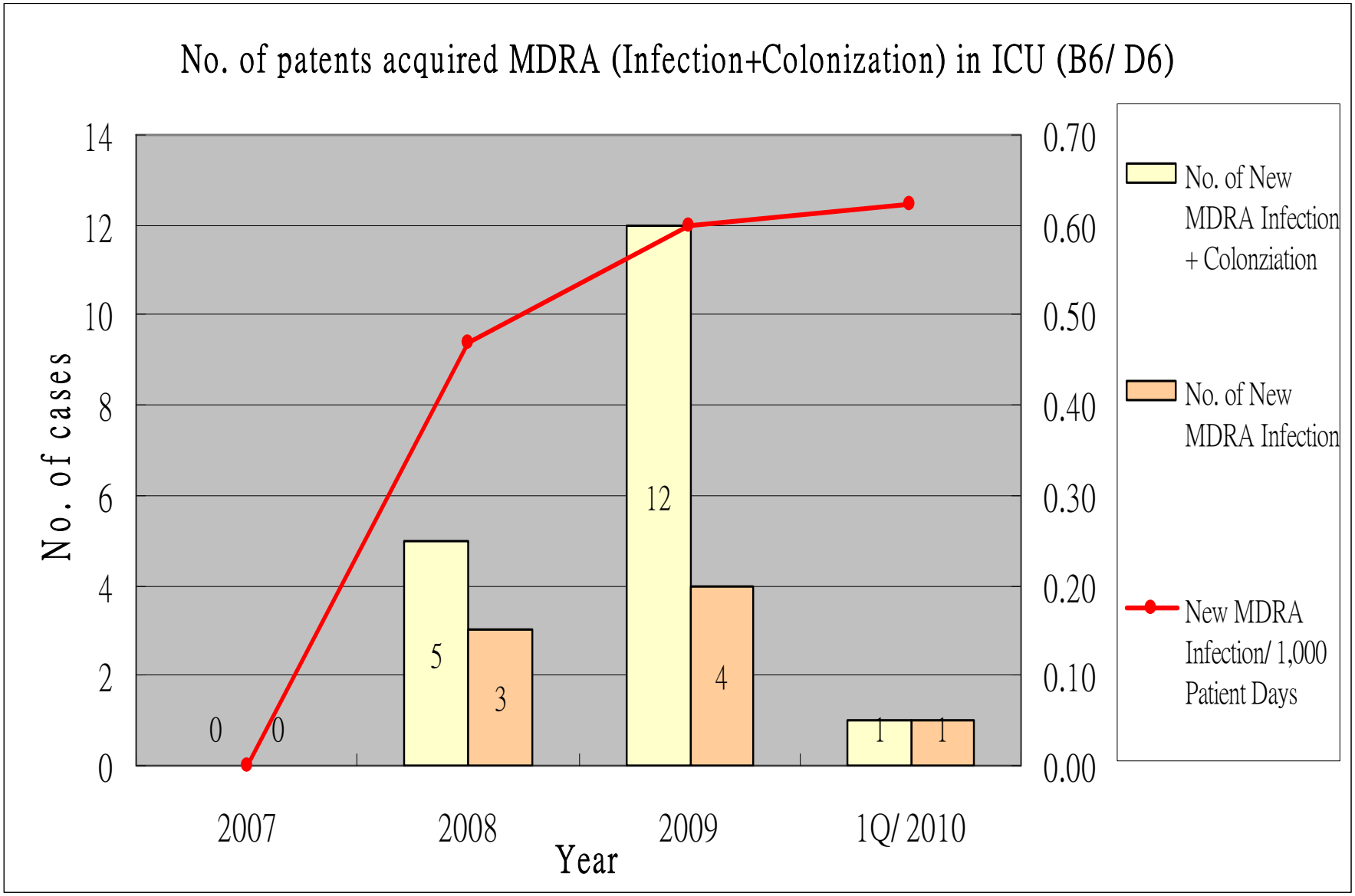
Classes of Antibiotics	Antibiotic Agents
Fluoroquinolones	Ciprofloxacin Ofloxacin
Aminoglycosides	Amikacin
Cephalosporins	Ceftazidime Cefepime
Beta-lactam & beta-lactamase inhibitor combinations	Ampicillin-sulbactam Sulperazone

- Carbapenems are not included in the MDRA criteria

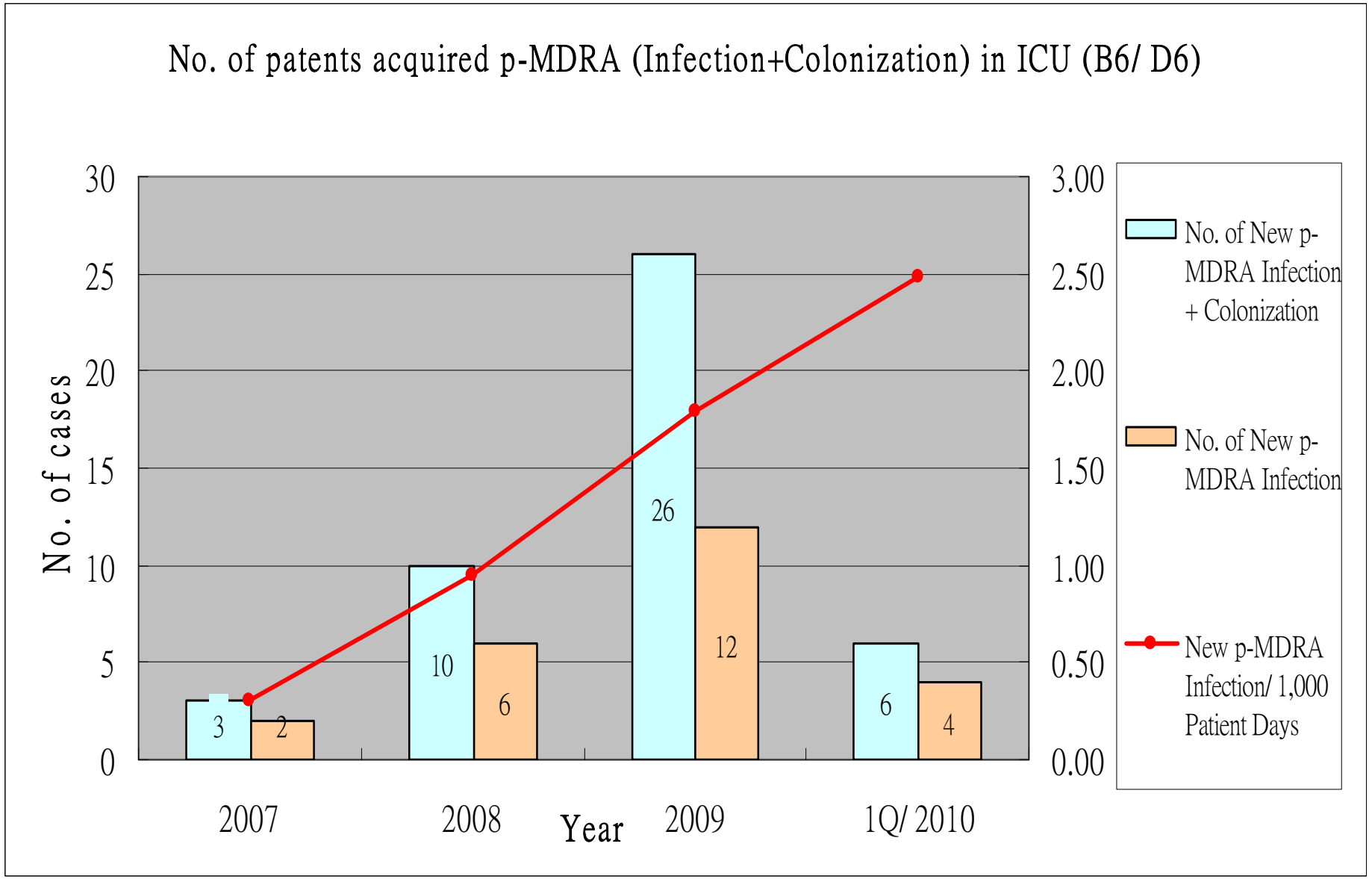
Courtesy of Infection Control Team, QEH



Courtesy of Infection Control Team, QEH

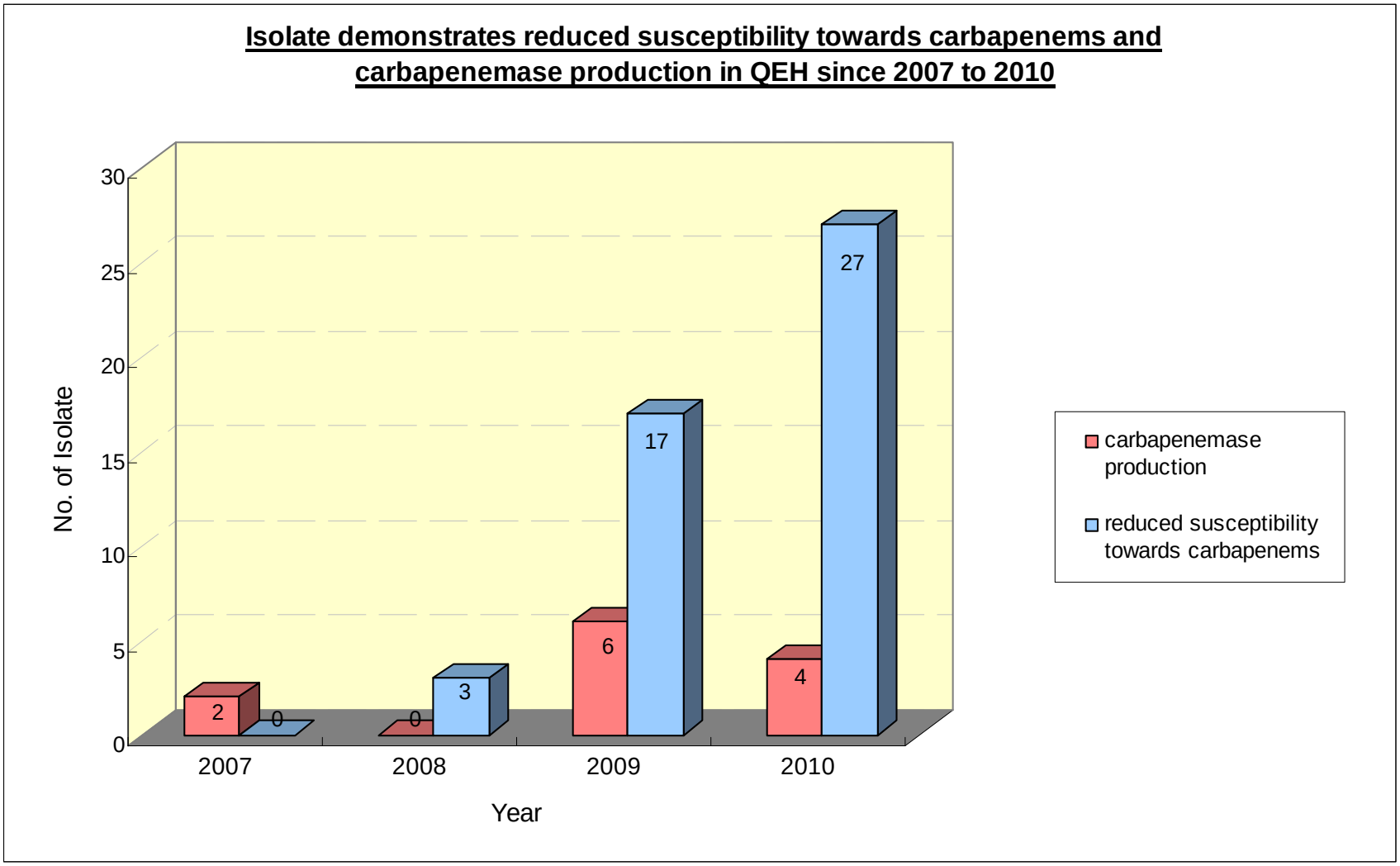


Courtesy of Infection Control Team, QEH



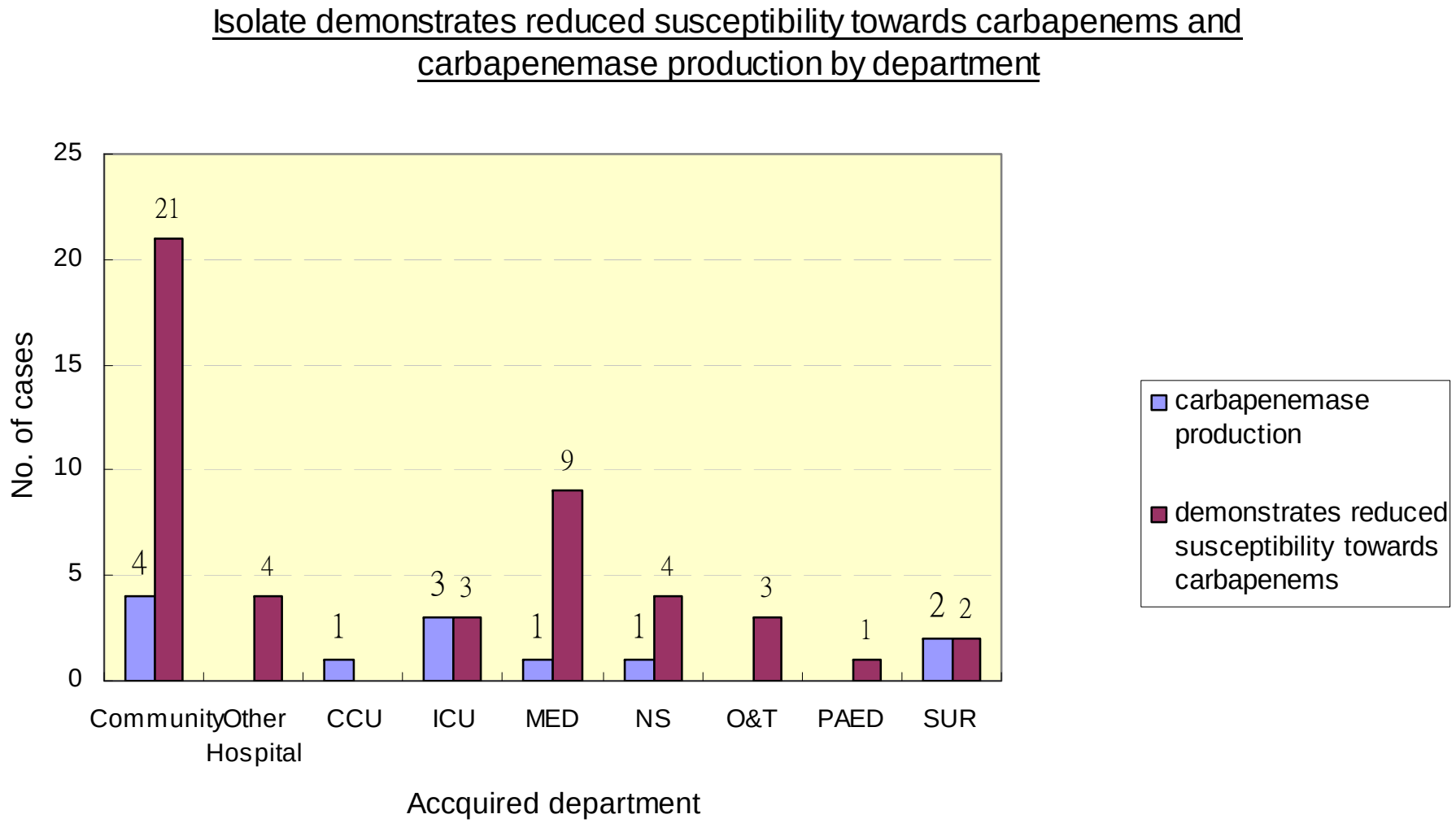
Courtesy of Infection Control Team, QEH

Reduced susceptibility towards carbapenems & carbapenemase production



Courtesy of Infection Control Team, QEH

Reduced susceptibility towards carbapenems & carbapenemase production



Courtesy of Infection Control Team, QEH

Infection Control Measures
SP + CP

- Patient placement
- Hand Hygiene
- PPE
- Dedicate use of equipment
- Environmental decontamination
- Patient tracking in CMS

Courtesy of Infection Control Team, QEH

Strategic Plan

- Collaborate with ICT and ICU
- To minimize the risk of MDRO cross transmission

Courtesy of Infection Control Team, QEH

Hand Hygiene enhancement

- On-going monitoring compliance rate

- Specified Hand hygiene program in ICU
  - IC patrol team

Courtesy of Infection Control Team, QEH

Environmental cleansing

- Color coding
- Train the supporting staff
- For MDRO patients
  - After napkin change or bathing
  - Perform more frequently on high touch surface
  - Disposable wipe

- Regular culture screening
    - monthly
  - ATP (Adenosine Triphosphate) bioluminescent

Courtesy of Infection Control Team, QEH

Care Bundles

- Catheter associated blood stream infection (CABSI)
  - Already in place
  - *Bactiguard* for Central line insertion

Courtesy of Infection Control Team, QEH

Questions/ Issues	ICT	Dr. Perl:
1. GN resistance organisms in QEH	Previously MRPA was a challenge in QEH, its rate has been much reduced after implementation of targeted infection control program. Acinetobacter spp. now becomes the most difficult one to handle among all GN resistant organisms in QEH	Acinetobacter spp. is more difficult to control once it establishes its niche in the hospital environment, since it can survive in the environment for an extended period of time.
2. CVC Catheter	What is the view on Bactiguard CVC catheter? It has promoted as a very common used catheter in US, is it real?	Not familiar with the mentioned catheter

3. Routine typing in HK	➢Molecular typing would be used for outbreaks / clustering of cases ➢In-house PFGE in the past but largely stopped due to suboptimal performance	It is recommend to perform typing to identify the transmission of GNR organisms
4. Problems on environmental cleaning	Dr. Lai (ICU consultant) said that it is hard to persuade staff to use plastic keyboard cover, lately he has purchased silicon covers for trial.	Computer keyboard is definitely an at-risk item and any attempt to keep it clean is worthwhile.
5. Antibiotic usage	Dr. Lai (ICU consultant) said that they would try to see if there is any difference in using Unasyn and Augmentin for initial antibiotic prescription on selection pressure of MDRA.	

Acknowledgement

- Dr. Raymond Lai, COS (Microbiology)/ ICO, PWH/ Cluster ICO, NTEC
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- Infection Control Team, QEH/KCC