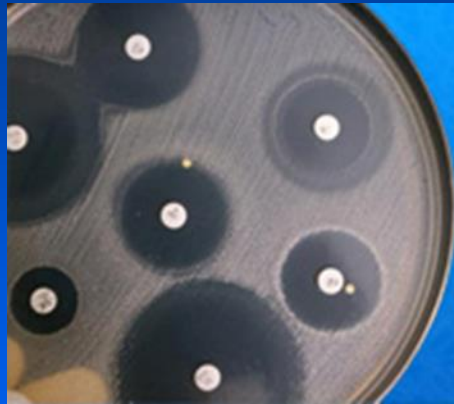


# Prevention of Multidrug-Resistant Organism Transmission in Hospitals



Professor Dr. Akeau Unahalekhaka  
Faculty of Nursing, Chiang Mai University

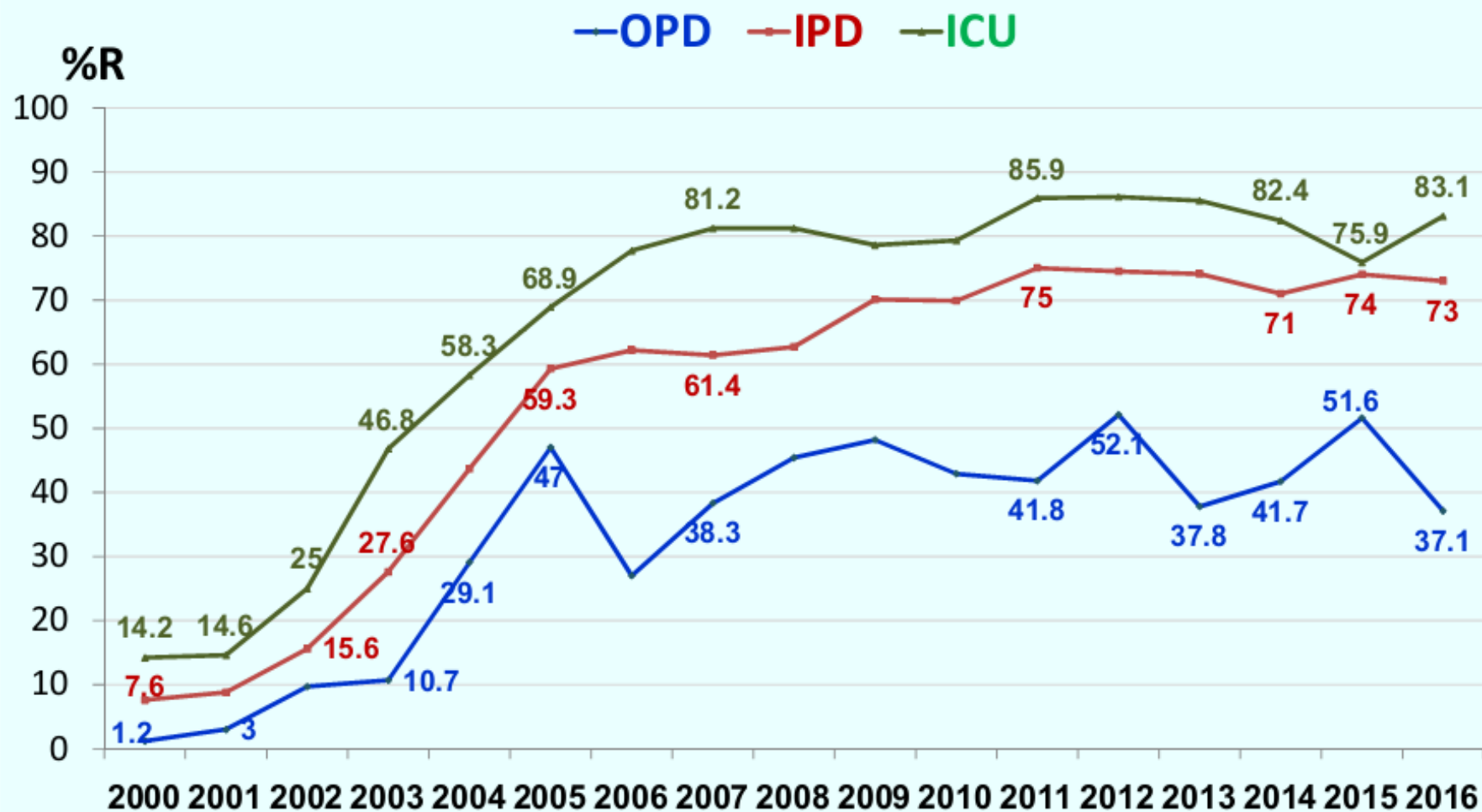
# Problems of MDR Organisms in Thailand



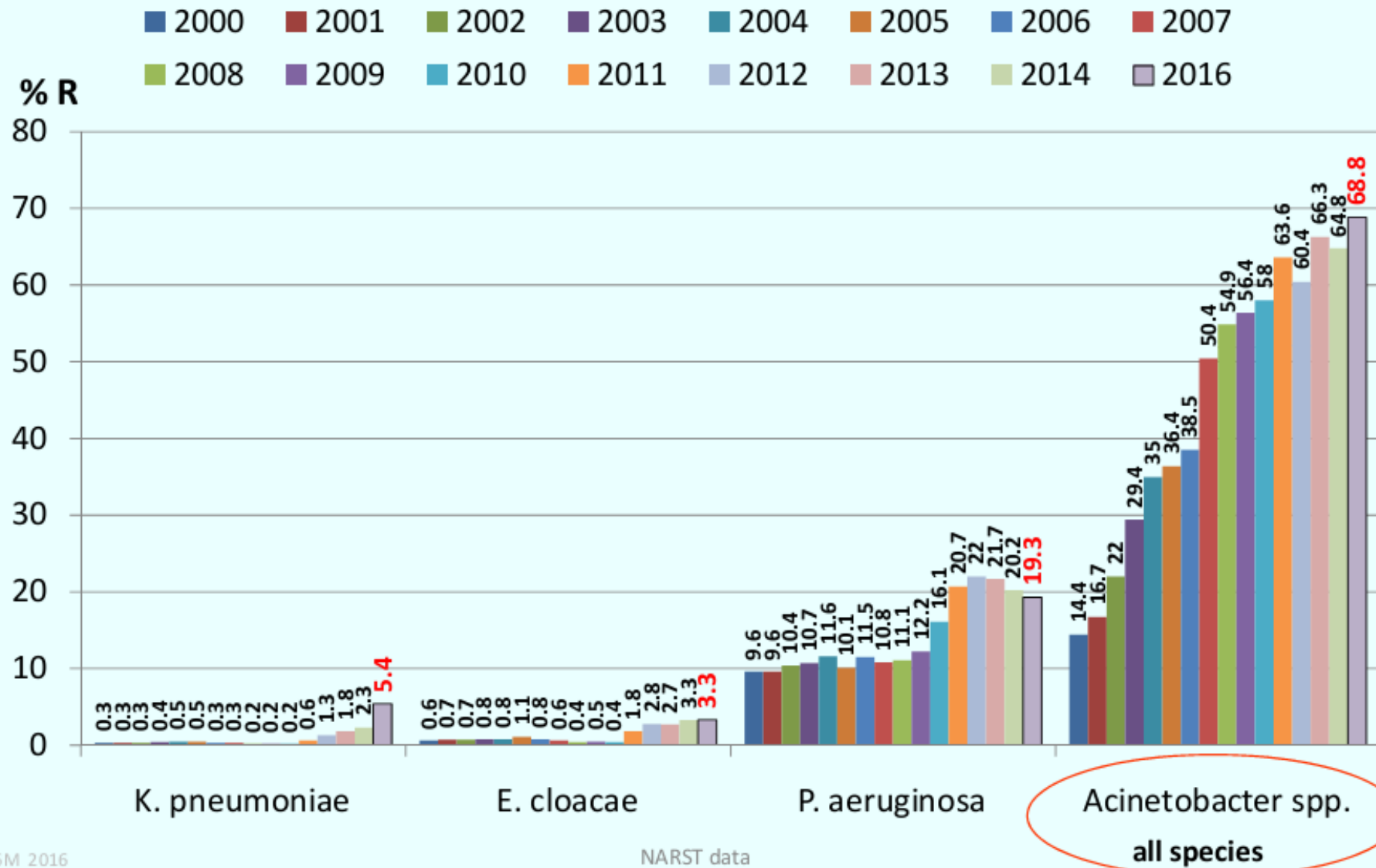
**NARST**

National Antimicrobial Resistance Surveillance Center Thailand

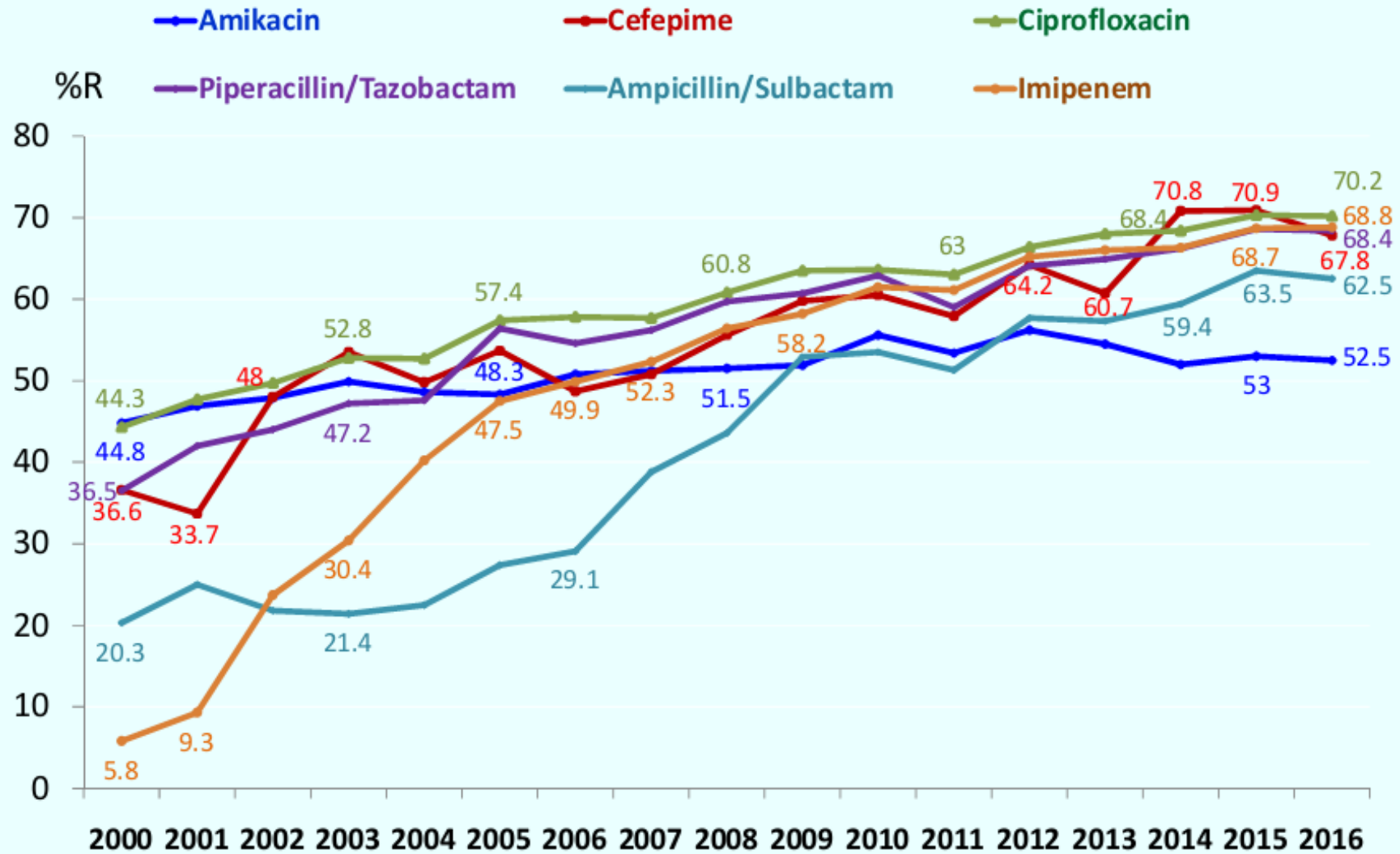
# Percent resistance of *A. calcoaceticus-baumannii* complex to Imipenem



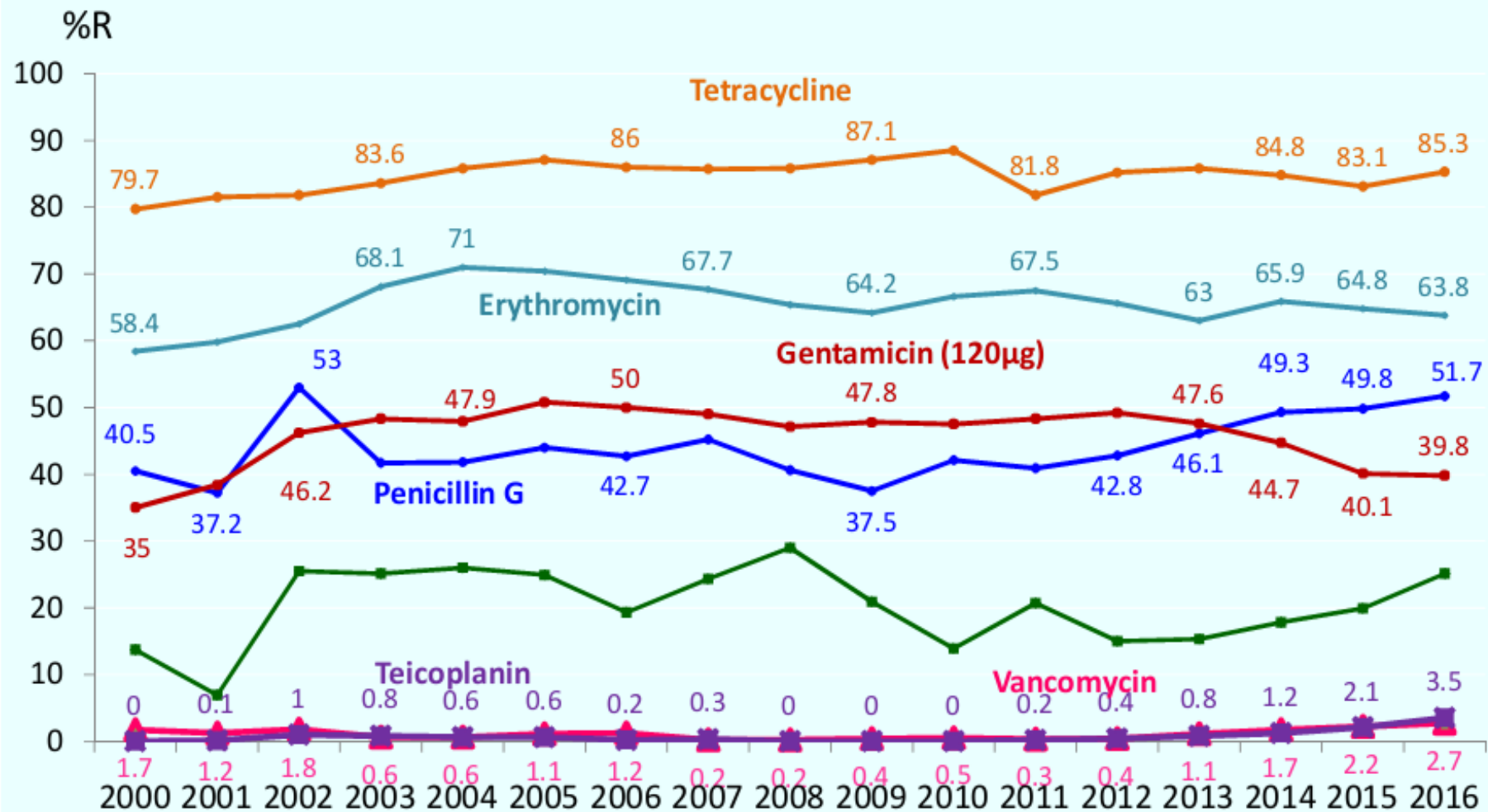
# Rate of Imipenem Resistant *Acinetobacter* spp.



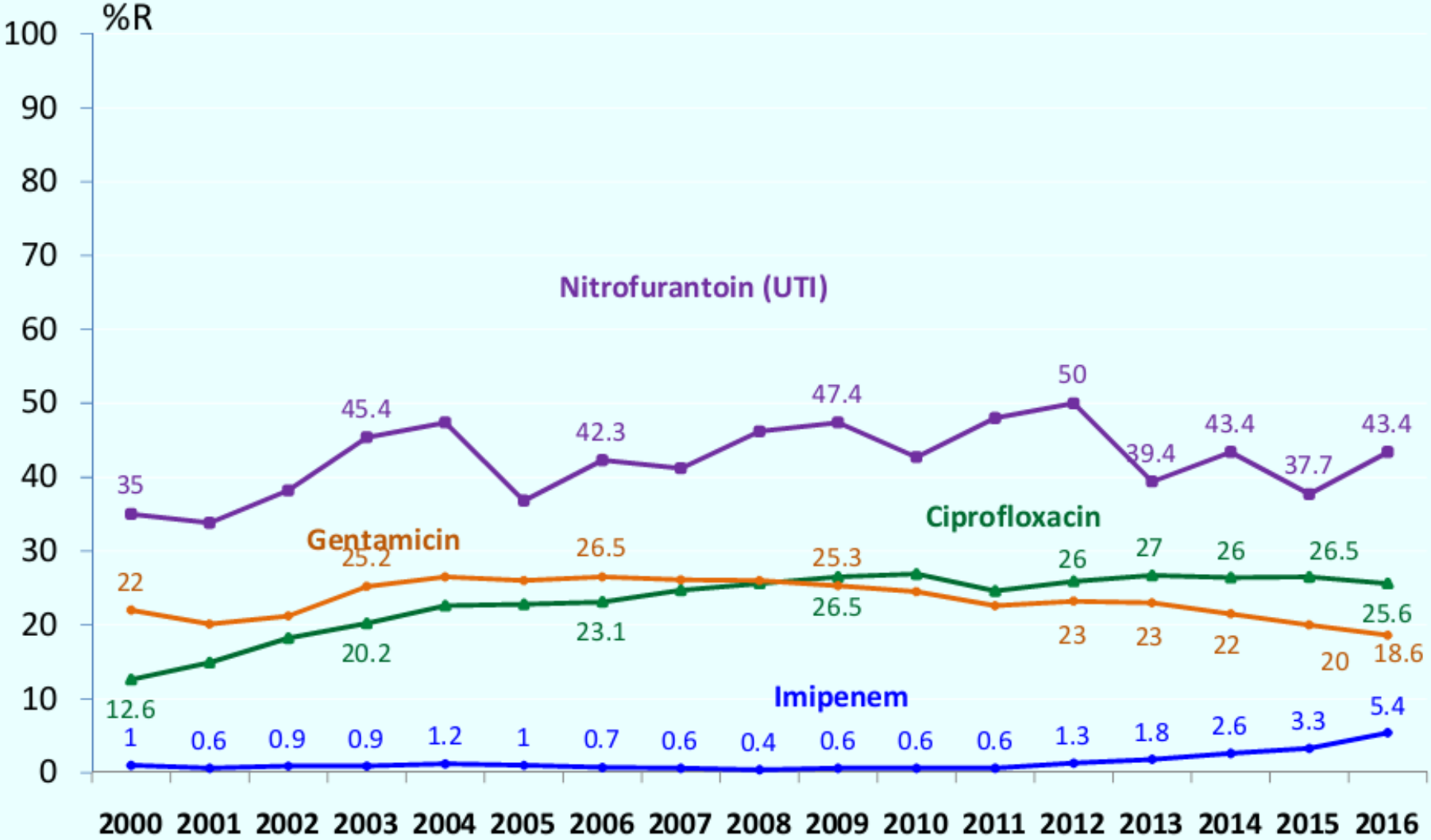
# Antimicrobial Resistance rates of *Acinetobacter* spp. by year (NARST-46 hospitals, 2016)



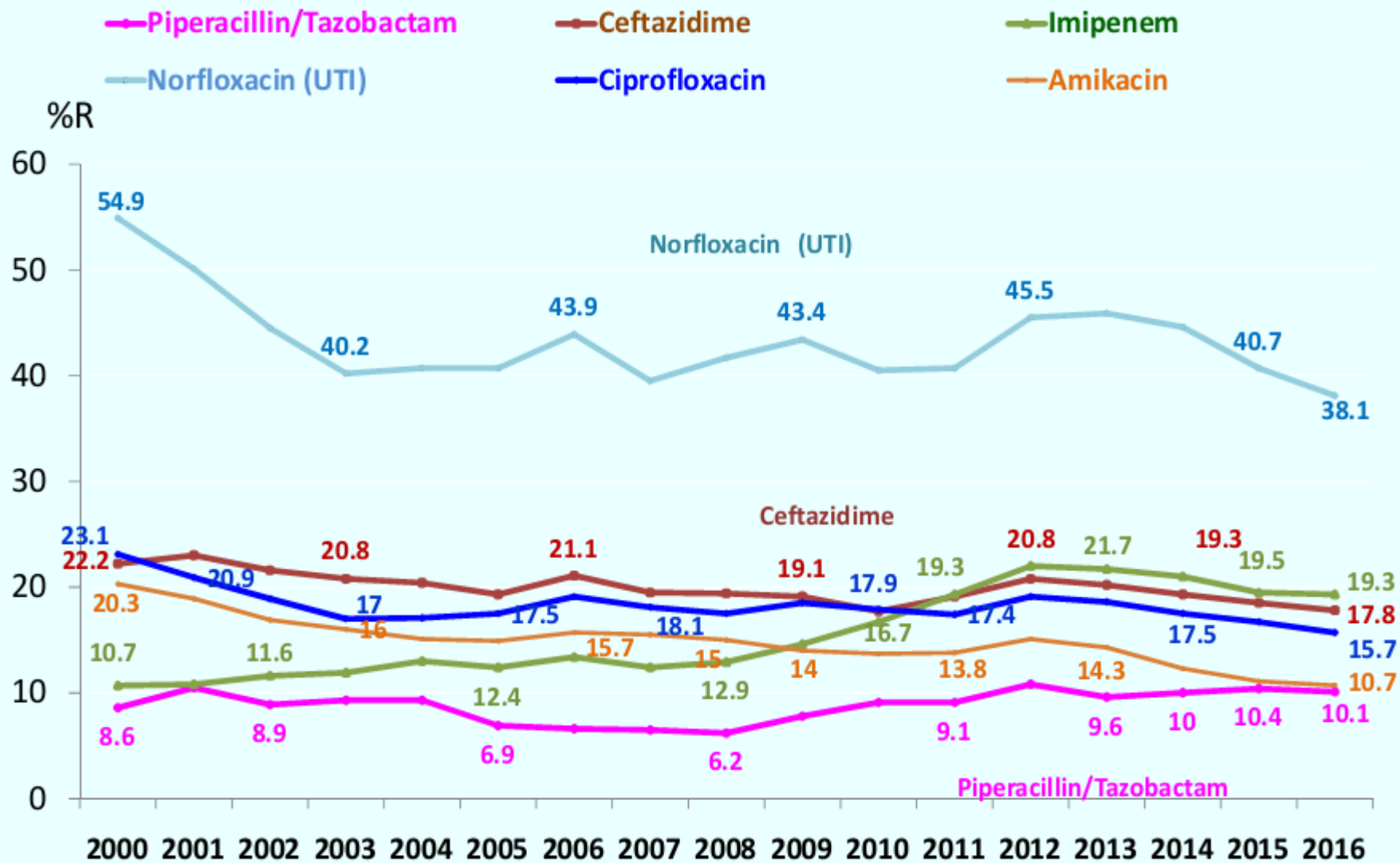
# Antimicrobial Resistance rates of *Enterococcus* spp. by year (NARST-46 hospitals, 2016)



# Antimicrobial Resistance rates of *K. pneumoniae* by year (NARST-46 hospitals, 2016)

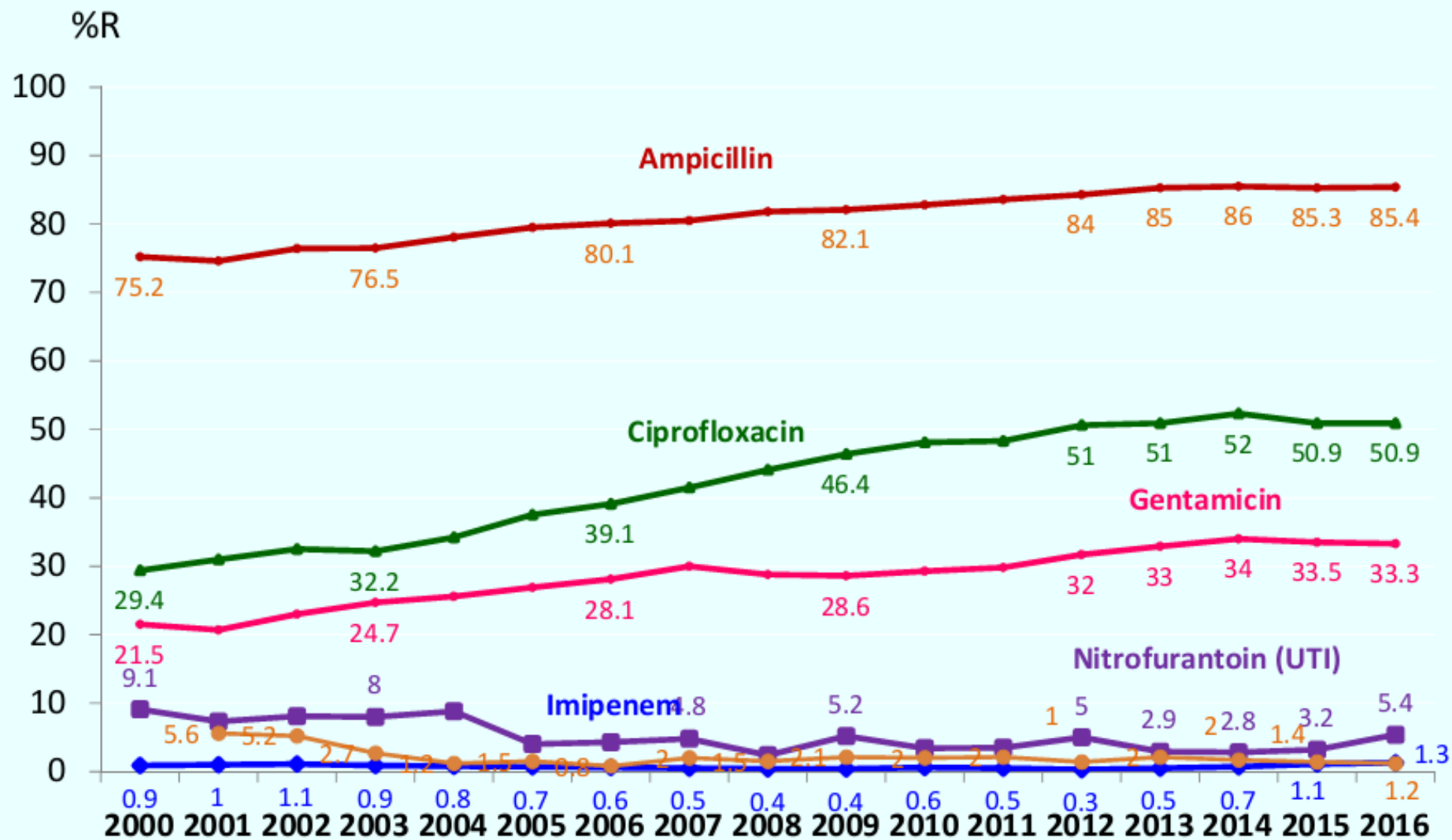


# Antimicrobial Resistance rates of *P. aeruginosa* by year (NARST-46 hospitals, 2016)



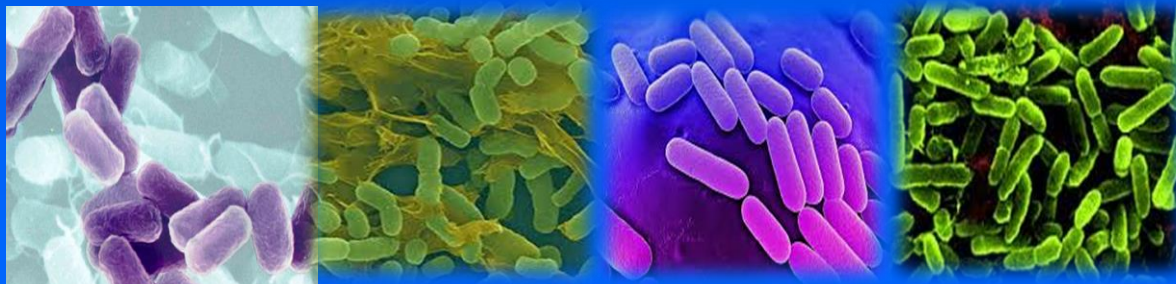


# Antimicrobial Resistance rates of *E. coli* by year (NARST-46 hospitals, 2016)



# Multidrug Resistant Organisms (MDRO)

- Microorganisms, predominantly bacteria, that are resistant to one or more classes of antimicrobial agents.
- Although the names of certain MDROs describe resistance to only one agent (e.g., MRSA, VRE), these pathogens are frequently resistant to most available antimicrobial agents.



# Examples of MDROs

- Methicillin-resistant *Staphylococcus aureus* (MRSA)
- Vancomycin-intermediate *Staphylococcus aureus* (VISA)
- Vancomycin-resistant *Staphylococcus aureus* (VRSA)
- Vancomycin-resistant *Enterococcus* (VRE)
- *Streptococcus pneumoniae* resistant to penicillin and other broad-spectrum agents

# Clinical Importance of MDROs

- MDRO infections have clinical manifestations that are similar to infections caused by susceptible pathogens.
- Options for treating patients with MDRO infections are often extremely limited.
- Resistance to new agent has already emerged in clinical isolates.
- ICUs may have a higher prevalence of MDRO infections than do non-ICU settings.

# Clinical Importance of MDROs

- MDR pathogens are a growing threat in hospitals.
- Each year nearly 2 million patients in the US get HAI, about 90,000 die from HAI.
- More than 70% of pathogen that cause HAI are resistant to at least one of the drugs most commonly used.
- MDRO infected patients are more likely to have longer hospital stays and require treatment with second- or third-choice drugs that may be less effective, more toxic, and/or more expensive.

# Outcomes of Carbapenem Resistance

- Mortality rate 38% among carbapenem resistant *A. baumannii* (CRAB) vs. 24% carbapenem sensitive *A. baumannii* (CSAB) (95% CI, 1.2-2.2).
- BSI is a predictor for mortality.
- Carbapenem resistant associated with higher antibiotic cost and admission cost.

# Why Concern over MDRO Infections?

- Cause serious, difficult-to-treat infections that can result in substantial morbidity, mortality, increased lengths of stay and excess cost
- Frequently preventable
  - ❖ Usually acquired via transmission by:
    - \* caregiver-to-patient
    - \* environment-to-patient
    - \* patient-to-patient
  - ❖ Judicious use of antimicrobials may decrease incidence of microorganisms developing antibiotic resistance



# 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



# Key Prevention Strategies



- Prevent infection
- Diagnose and treat infection effectively
- Use antimicrobials wisely
- Prevent transmission



# 12 Steps to Prevent Antimicrobial Resistance: Hospitalized Adults

## Prevent Infection

1. Vaccinate
2. Get the catheters out

## Diagnose and Treat Infection Effectively

3. Target the pathogen
4. Access the experts

## Use Antimicrobials Wisely

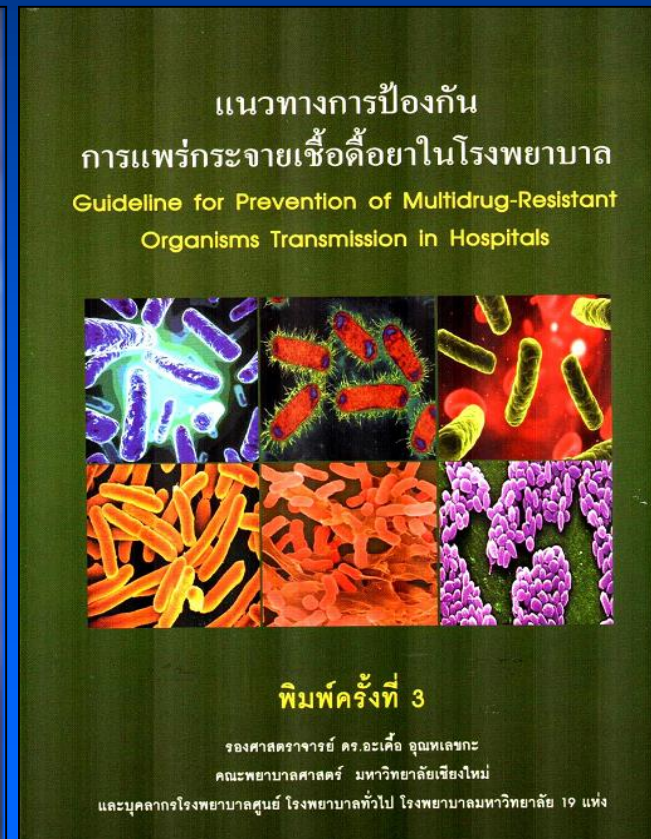
5. Practice antimicrobial control
6. Use local data
7. Treat infection, not contamination
8. Treat infection, not colonization
9. Know when to say “no” to vanco
10. Stop treatment when infection is cured or unlikely

## Prevent Transmission

11. Isolate the pathogen
12. Break the chain of contagion

# แนวทางการป้องกันการแพร่กระจายเชื้อดื้อยาในโรงพยาบาล

Guideline for Prevention of Multidrug Resistant Organisms Transmission in Hospitals



# การดำเนินการป้องกันการแพร่กระจายเชื้อคอตีบ ระดับโรงพยาบาล

# กิจกรรมที่โรงพยาบาลควรดำเนินการ เพื่อป้องกันการแพร่กระจายเชื้อโควิด

- กำหนดให้การป้องกันการติดเชื้อโควิดในโรงพยาบาลเป็นเรื่องสำคัญในลำดับต้น
- บรรลุเรื่องการป้องกันการติดเชื้อโควิดในแผนการดำเนินงานของโรงพยาบาล
- ส่งเสริมให้บุคลากรเข้าร่วมประชุมเพื่อแลกเปลี่ยนเรียนรู้การแก้ไขปัญหาเชื้อโควิด
- สนับสนุนงบประมาณและทรัพยากรบุคคลในการป้องกันการติดเชื้อโควิด
- สนับสนุนอุปกรณ์ป้องกันร่างกายส่วนบุคคลอย่างเพียงพอแก่ทุกหน่วยงาน
- เชิญผู้เชี่ยวชาญด้านการป้องกันการติดเชื้อเพื่อประเมินการดำเนินงานของโรงพยาบาล
- ปรึกษาผู้เชี่ยวชาญในกรณีที่พบว่ามี การแพร่กระจายเชื้อโควิดอย่างต่อเนื่อง

# กิจกรรมที่โรงพยาบาลควรดำเนินการ เพื่อป้องกันการแพร่กระจายเชื้อดื้อยา

- รายงานผลการเฝ้าระวังการติดเชื้อดื้อยา ความไวของเชื้อต่อยาต้านจุลชีพแก่ผู้บริหารระดับสูง หัวหน้าหน่วยงาน แพทย์ผู้รักษาและบุคลากรที่เกี่ยวข้องอย่างน้อยปีละครั้ง
- ประเมินนิเทศบุคลากรใหม่เกี่ยวกับการป้องกันการติดเชื้อในโรงพยาบาล
- ให้ความรู้และฝึกอบรบบุคลากรเกี่ยวกับการปฏิบัติการป้องกันการแพร่กระจายเชื้อดื้อยาอย่างน้อยปีละครั้ง
- ทบทวนความรู้บุคลากรในหน่วยงานที่พบปัญหาการติดเชื้อดื้อยาเป็นระยะ
- ประเมินการปฏิบัติตามหลัก standard precautions และ contact precautions ของบุคลากรเป็นระยะอย่างต่อเนื่อง



# MDROs Bundle

- Administrative measures
- Active surveillance culture
- Education & feed back
- Environmental cleaning & disinfection
- Device-associated bundles
- Antimicrobial stewardship
- Hand Hygiene
- Contact precautions
- Minimize shared equipment
- Chlorhexidine baths

# Role of Nurses in Prevention of HAI & MDRO Transmission

## 1. Prevention of HAI & MDRO transmission

- Surveillance
- Isolation precautions
- Hand hygiene
- Environmental control
- Education of patients and their family

## 2. Effective diagnosis - Specimen collection, transportation and storage

## 3. Antimicrobial administration



# Surveillance

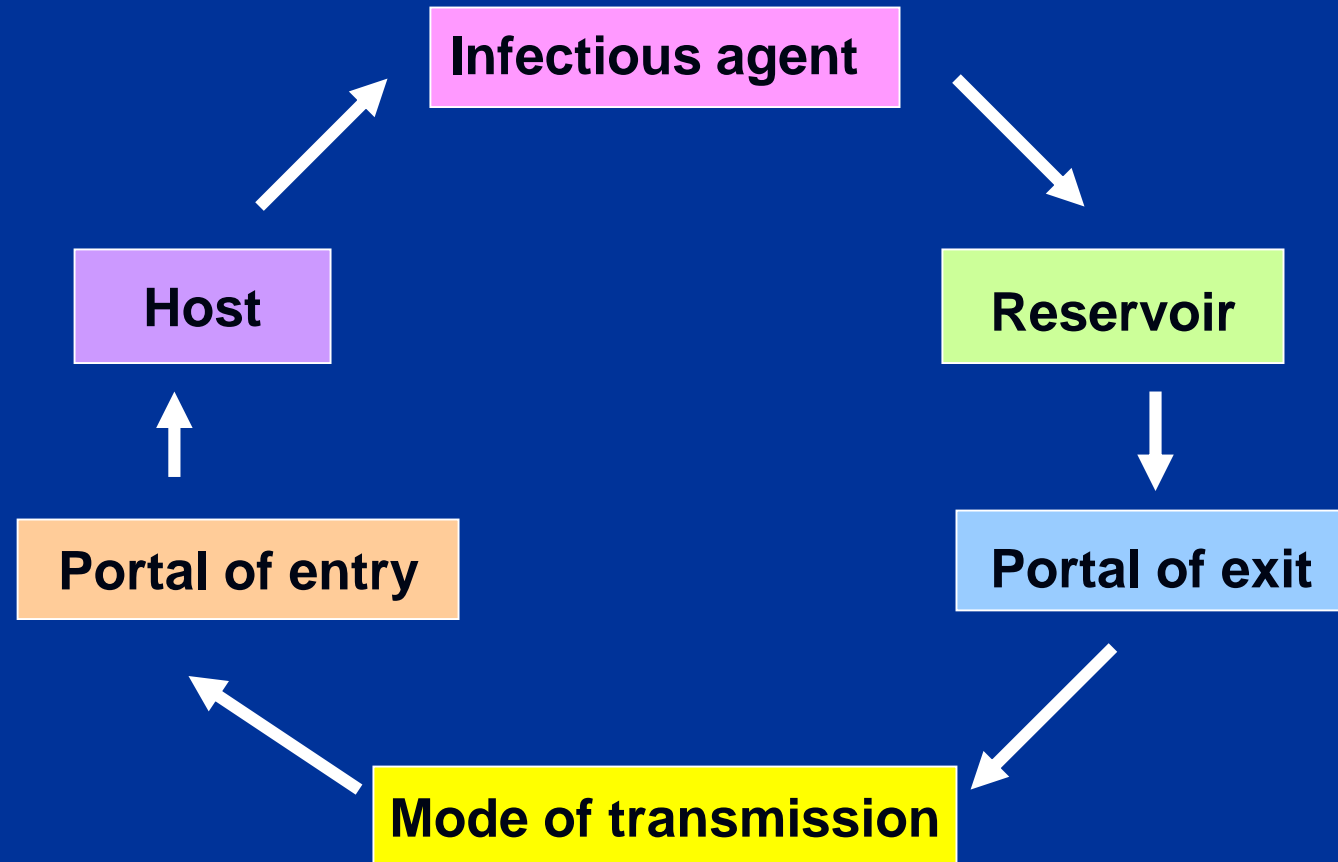
- Surveillance should be conducted to identify hospital-associated infection from MDROs.
- **Active surveillance cultures** should be obtained to identify asymptotically colonized individuals, particularly in **high-risk patients** or institutions with significant nosocomial transmission of MDROs.
- Cultures should be performed at **appropriate periodic intervals**.

# Isolation Precautions

Isolation Precautions are designed to prevent the spread of microorganisms among patients, personnel and visitors.

Since agent and host factors are more difficult to control, interruption of the chain of infection in the hospital is directed primarily at transmission.

# Chain of Infection



# Modes of Transmission in the Hospital

<b>Contact</b>	
Direct	Physical contact between personnel and patient (e.g., MRSA on personnel's hands)
Indirect	Contacts contaminated inanimate objects (e.g., ultrasound probe contaminated with MRSA or VRE)
<b>Droplet</b>	Infectious droplets deposited on mucous membranes of the nose or mouth
<b>Airborne</b>	Airborne phase in disease dissemination
<b>Vectorborne</b>	Not a significant source in hospital

# Source of Pathogens

- Endogenous - Normal flora on patient's body
- Exogenous
  - ◆ Animate - Personnel, relatives
  - ◆ Inanimate - Medical equipment,  
Environmental surface

# ICU Setting: Multiple Sources of Pathogens



# Isolation Precautions

```
graph TD; A[Isolation Precautions] --> B[Standard precautions]; A --> C[Transmission-based precautions]; B --> B1[Universal Precautions (UPs)]; B --> B2[Body Substance Isolations (BSI)]; C --> C1[Contact precautions]; C --> C2[Droplet precautions]; C --> C3[Airborne precautions];
```

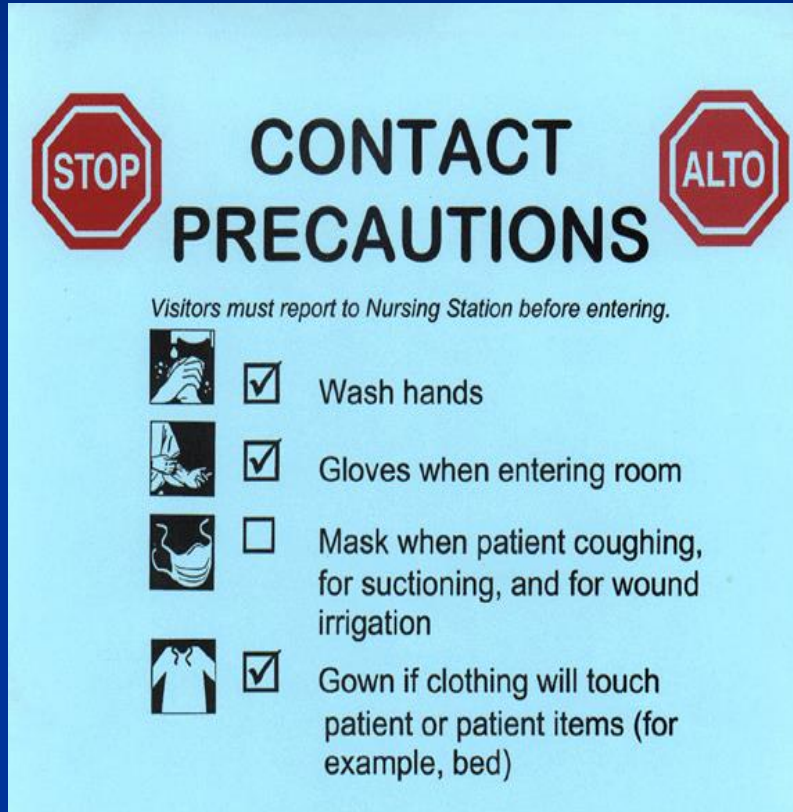
## Standard precautions

- Universal Precautions (UPs)
- Body Substance Isolations (BSI)

## Transmission-based precautions

- ***Contact precautions***
- Droplet precautions
- Airborne precautions

# Contact Precautions



The sign features a red octagonal 'STOP' sign on the left and a red octagonal 'ALTO' sign on the right. The text 'CONTACT PRECAUTIONS' is centered between them. Below the text, it states 'Visitors must report to Nursing Station before entering.' and lists four items with checkboxes: 'Wash hands' (checked), 'Gloves when entering room' (checked), 'Mask when patient coughing, for suctioning, and for wound irrigation' (unchecked), and 'Gown if clothing will touch patient or patient items (for example, bed)' (checked). Each item is accompanied by a small icon: hands being washed, a person wearing gloves, a surgical mask, and a white gown.

**CONTACT PRECAUTIONS**

Visitors must report to Nursing Station before entering.

- Wash hands
- Gloves when entering room
- Mask when patient coughing, for suctioning, and for wound irrigation
- Gown if clothing will touch patient or patient items (for example, bed)

Used for pathogens that can easily be transmitted by contact with patient and/or items in the patient's environment

- ❖ Patient placement- isolation room
- ❖ Personal protective equipment - gloves and gown when entering room
- ❖ Hand hygiene
- ❖ Patient transport
- ❖ Patient-care equipment
- ❖ Environmental control measures



# **Isolation Precautions for Suspected or Confirmed MDRO Patients**

# Contact Precautions

- Contact precautions should be employed in caring for patients colonized or infected with MDROs.
- House patients in order to provide maximal spatial separation, preferably in isolation room.
- Patient transportation out of the room should be limited and should be conducted with appropriate contact precautions.
- Communicate precautions to relevant departments.

# Contact Precautions

- Appropriate hand hygiene
- Gloves and gowns should be worn when caring for a patient colonized or infected with MDROs.
  - Wear gloves and gown before entering room
  - Change gloves after contact with infective material
  - Remove gloves before leaving room & wash hands
  - Avoid contact with contaminated surfaces while leaving room
- Masks should be worn when caring for patients colonized or infected with MRSA, VISA, or VRSA whenever droplet aerosols may be encountered.

# Cohorting

- If isolation room is not available, patients infected with the same organisms can be **cohorted** (share rooms). The **distance between beds** should be at least 1 meter, Whenever possible.
- HCWs assigned to cohorted patient-care units should be **experienced staff** and should not “float” or be assigned also to other patient care areas.
- **Limit number** of persons entering the cohorted area
- Consider having **portable X-ray** equipment available in cohort areas.

# Patient Transport within Hospital

- Transport of patients out of the isolation room should be for essential purposes only.
- The receiving area should be informed as soon as possible.
- Surgical masks are appropriate for patients during transport.
- Patients should perform hand hygiene after contact with respiratory secretions.

# Patient Transport within Hospital

- If a mask cannot be tolerated (e.g. due to the patient's age or deteriorating respiratory status) instruct patient to cover nose/mouth with tissue during coughing/sneezing.
- If there is patient contact with surfaces, these surfaces should be cleaned and disinfected afterwards.

# Waste Disposal

- Use standard precautions when working with solid waste that may be contaminated
- All waste generated in the isolation room should be removed from the room in suitable containers or bags that do not allow for spillage or leakage of contents.
- One layer of packing is adequate providing the used equipment and soiled linen and waste can be placed in the bag without contaminating the outside of the bag.

# Waste Disposal

- Double bagging is unnecessary
- When transporting waste outside the isolation room use utility gloves followed by hand hygiene.
- Urine or faeces can be flushed into the sewerage system if there is an adequate system in place.
- Close toilet cover when flushing.



# Cleaning and Disinfecting

- Room should be cleaned daily.
- Use hospital approved disinfectant according to the manufacturer directions.
- MDRO room should be cleaned last
- Disposable equipment

# Education

- **Education and training** regarding MDROs should be conducted with all healthcare workers.
- HCWs should receive **feedback** on institutional and unit rate of MDRO and rates of adherence to preventive measures (e.g. hand hygiene compliance, etc.)

# Education of Patients and Their Family

- While admitting
- Before discharge

# Patient Equipment

- Disposable, single-use patient care equipment is preferred, whenever possible.
- Dedicate non-critical items to the patient's room e.g. stethoscope.
- Minimal stocks of disposable items (e.g. dressings, kidney dishes) are to be stored in the room. On patient discharge, these items are to be discarded.
- Equipment that is designated reusable and required for use on other patients shall be cleaned and disinfected prior to leaving the room.

# Patient Equipment

- Disinfectant wipes may be used for specialized medical equipment e.g. x-ray and ECG machines.
- Items requiring further reprocessing (e.g. sterilization) should be processed as per normal.
- Used bedpans / urinals / measuring jugs shall be sanitized in a pan sanitizer immediately following use, or disposed.

# Environmental Cleaning

- Cleaning regimens shall ensure the room is cleaned on a daily basis and on patient discharge.
- Cleaning regimens must include all horizontal surfaces, walls that are visibly contaminated, and frequently touched items (e.g. door handles, bed rails, bedside lockers, over-bed table, call bell, IV poles, telephone, TV remote, monitors and bathroom and toilet amenities)
- Increased cleaning is recommended if the patient has risk factors for dissemination, such as diarrhea or incontinence.
- Disposable single-use cleaning equipment is preferred.

# Environmental Cleaning

- Any re-useable cleaning equipment is to be dedicated to the patient's room and cleaned and disinfected after each use.
- If re-useable mop heads are used they shall be bagged and sent for laundering at the completion of each use.
- Physical (manual or mechanical) cleaning is the most important step in the cleaning process and sole reliance on a disinfectant without physical cleaning is not recommended.
- A 2-step clean is required, which involves using a neutral detergent followed by the use of a bactericidal disinfectant e.g. a chlorine-containing solution. Alternatively, a 2-in-1 clean using a combined detergent / bactericidal disinfectant can be used.

# On Patient Discharge

- Any unused / unopened disposable items shall be discarded.
- Patient bed screens (and window curtains, if fitted) shall be sent for laundering / dry cleaning.
- The room can be used immediately after cleaning, once surfaces are dry.



# Use of Disinfectants

- As disinfectants are inactivated by organic material, any visible soiling should be removed with paper towels prior to cleaning.
- Information on how to prepare and use the disinfectant and relevant material safety data sheets shall be available to cleaning staff.

# Specimen Collection

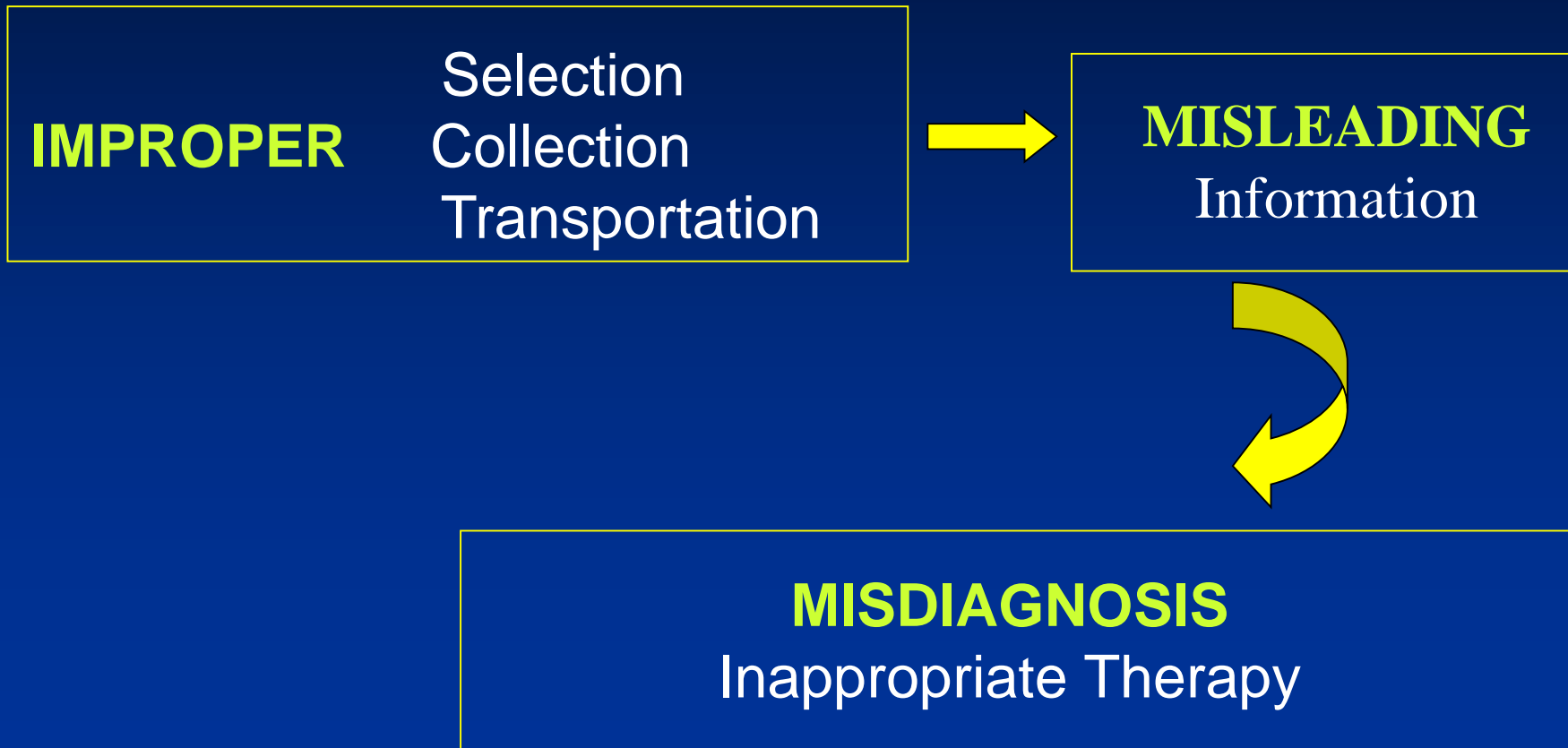


**Effective diagnosis**



Specimen Collection, transportation  
and Storage

# Specimen Collection, Transportation and Storage



# Specimen Collection/ Transport / Handling

- Specimens must be placed in leak-proof specimen bags.
- Personnel who transport specimens should be trained in safe handling practices & decontamination procedures in case of a spill.
- Specimens should be delivered by hand where possible.
- HCWs who collect specimens from infected patients should wear PPE.
- The accompanying request form should be clearly labelled as “(suspected) EID” and notify laboratory by telephone
- Health-care facility laboratories should follow best biosafety practices.

# ปัจจัยที่มีผลต่อความน่าเชื่อถือ ของผลการตรวจทางห้องปฏิบัติการ

1. การเลือกตำแหน่งในการเก็บสิ่งส่งตรวจอย่างเหมาะสม โดยเลือกตำแหน่งที่มีการติดเชื้อหรือตำแหน่งที่มีการอักเสบ
2. หลีกเลี่ยงการปนเปื้อนเชื้อประจำถิ่น
3. เลือกวิธีการเก็บที่ถูกต้องและใช้วัสดุอุปกรณ์ ในการเก็บสิ่งส่งตรวจ ที่ถูกต้องเหมาะสม
4. ภาชนะสำหรับบรรจุสิ่งส่งตรวจต้องทำให้ปราศจากเชื้อ
5. ปริมาณของสิ่งส่งตรวจไม่มากหรือน้อยเกินไป

# ปัจจัยที่มีผลต่อความน่าเชื่อถือ ของผลการตรวจทางห้องปฏิบัติการ

6. เก็บสิ่งส่งตรวจก่อนที่ผู้ป่วยจะได้รับยาต้านจุลชีพ
7. ระยะเวลาในการส่งสิ่งส่งตรวจไปห้องปฏิบัติการ
  - เชื้อตาย
  - normal flora หรือ เชื้อที่ปนเปื้อนสิ่งส่งตรวจอาจปล่อยสารบางชนิดออกมา
  - normal flora หรือ เชื้อที่ปนเปื้อนสิ่งส่งตรวจอาจเพิ่มจำนวนเร็วกว่าเชื้อก่อโรค

**Antimicrobial use**



**Antimicrobial drug administration**



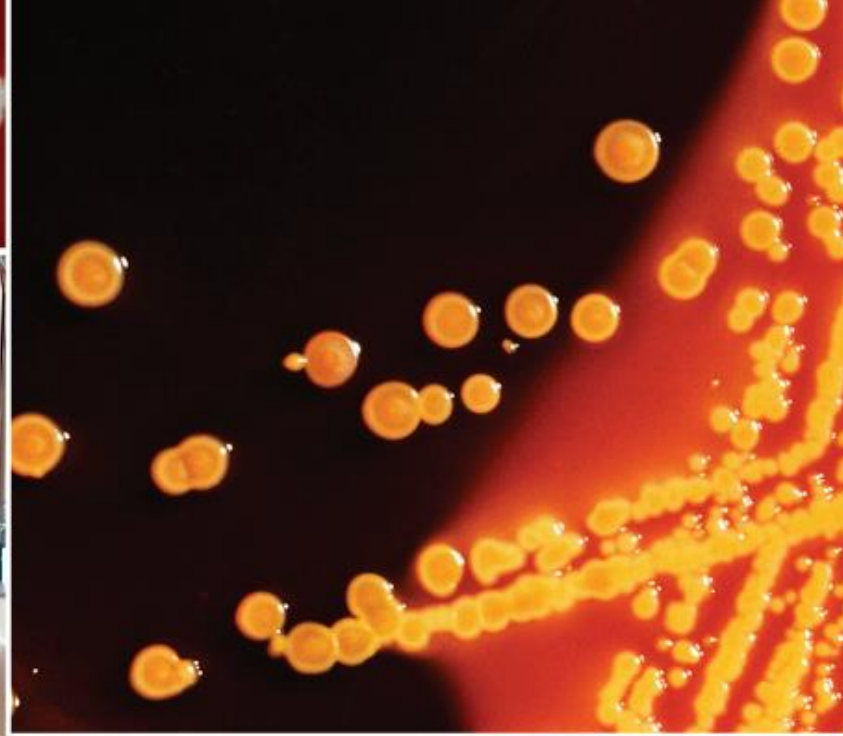
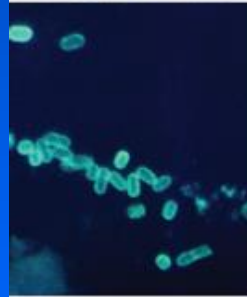
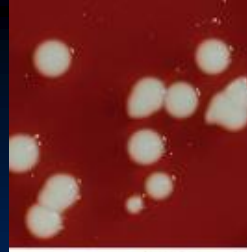
# Prevention of HAI Significant Pathogens

“Super Bugs”



# Strategies to Control the Spread of Multidrug Resistant Gram Negative Bacteria

- Hand hygiene
- Patient should be isolated
- Contact precautions (use of gowns and gloves)
- Environment and source control
- Cohorting of patients with similar organisms
- Enhanced infection prevention and control measures



## Guidance for Control of Carbapenem-resistant Enterobacteriaceae (CRE)

2012 CRE Toolkit

National Center for Emerging and Zoonotic Infectious Diseases  
Division of Healthcare Quality Promotion



# Core Measures to Prevent CRE for All Acute Care Facilities

## 1. Hand hygiene (HH)

- Promote, monitor and provide HH feedback
- Ensure access to hand hygiene stations

# Core Measures to Prevent CRE for All Acute Care Facilities

## 2. Contact Precautions (CP)

- Place CRE colonized or infected patients on CP
  - Preemptive CP might be used for patients transferred from high-risk settings
- Educate hospital personnel about CP
- Monitor CP adherence and provide feedback
- No recommendation for discontinuation of CP
- Develop lab protocols for notifying about potential CRE

# Core Measures to Prevent CRE for All Acute Care Facilities

## 3. Patient and staff cohorting

- When available cohort CRE colonized or infected patients and the staff that care for them even if patients are housed in **single rooms**
- If the number of single patient rooms is limited, reserve these rooms for patients with **highest risk** for transmission (e.g., incontinence)

# Core Measures to Prevent CRE for All Acute Care Facilities

4. Minimize use of invasive devices
5. Promote antimicrobial stewardship
6. Screening
  - Screen patient with epidemiologic links to unrecognized CRE colonized or infected patients and/or conduct point prevalence surveys of units containing unrecognized CRE patients

# Supplemental Measures for Healthcare Facilities with CRE Transmission

## 1. 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

## 2. Chlorhexidine bathing

- Bathe patients with 2% chlorhexidine



# Useful Website

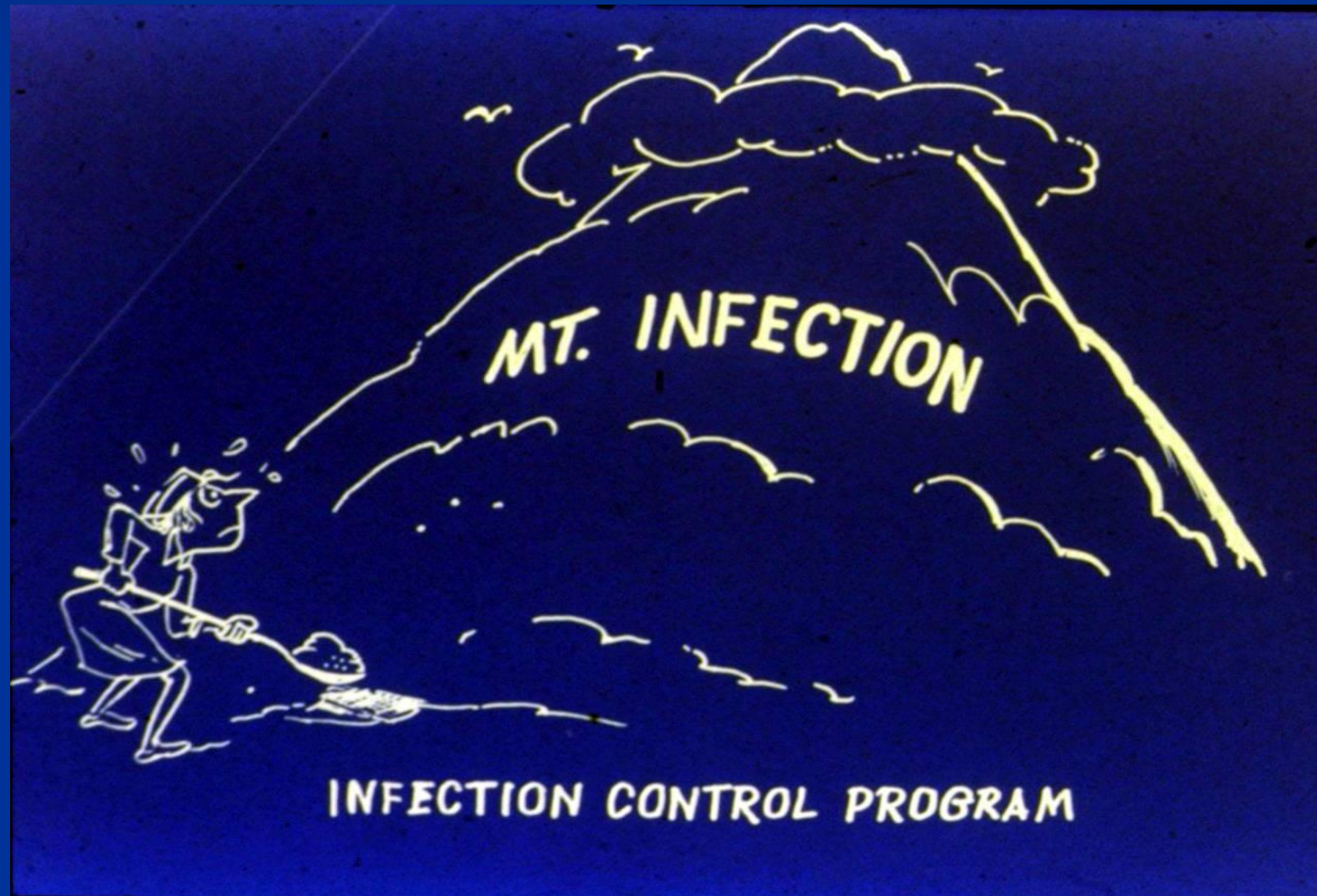
- [www.cdc.gov](http://www.cdc.gov)
- [www.who.int](http://www.who.int)
- [www.theific.org](http://www.theific.org)
- [www.apic.org](http://www.apic.org)

The screenshot shows the CDC website homepage. At the top left is the CDC logo with the text "Centers for Disease Control and Prevention" and the tagline "CDC. Saving Lives. Protecting People™". A search bar is located at the top right. Below the header is a navigation menu with categories like "Diseases & Conditions", "Healthy Living", "Travelers' Health", "Emergency Preparedness", and "More CDC Topics". The main content area features a large banner for "Zika & Pregnancy" with the subtext "Learn more about Zika virus and pregnancy" and an image of a pregnant woman. Below the banner are social media icons and a "What's New" section with several small article thumbnails, including one for "CARBON MONOXIDE (CO) POISONING".

The screenshot shows the World Health Organization website homepage. At the top is the WHO logo and the text "World Health Organization". A search bar is located at the top right. Below the header is a navigation menu with categories like "Health topics", "Data", "Media centre", "Publications", "Countries", "Programmes", "Governance", and "About WHO". The main content area features a "News and top stories" section with a headline "WHO announces a Public Health Emergency of International Concern" and a sub-headline "1 February 2016 - WHO announced today that the recent cluster of neurological disorders and neuronal malformations reported in the Americas region constitutes a Public Health Emergency of International Concern". Below this is an image of a doctor examining a child. To the right is an "Outbreaks and emergencies" section with buttons for "Ebola outbreak", "MERS-CoV outbreak", "Microcephaly/Gnath virus", and "Emergencies". Below that is a "WHO fact sheets" section with links for "Household air pollution and health", "Chronickallaria (gastro-worm disease)", "African swine fever", "Infant and young child feeding", and "Children: reducing mortality".

The screenshot shows the International Federation of Infection Control website homepage. At the top is the IFIC logo and the text "International Federation of Infection Control". A search bar is located at the top right. Below the header is a navigation menu with categories like "Home", "About", "Membership", "Education", "Conferences", "Publications", "Grants and Scholarships", and "Contact Us". The main content area features a large banner for the "16th CONGRESS OF THE INTERNATIONAL FEDERATION OF INFECTION CONTROL" held in "VIENNA, AUSTRIA" from "16 - 19 MARCH 2016". Below the banner are three sections: "IFIC Newsletter" with a link to the January 2016 edition, "International Journal of Infection Control" with a link to Vol. 11, No. 4 (2015), and "Other News" with a link to the January 2016 e-newsletter. There are also links for "Successful Candidates of the Mentor Exchange Scholarship Grant" and "Basic Concepts of Infection Control: Hungarian Chapter update".

**Give good care**  
**and do your patient no harm**





**LEADING** the effort to improve  
**HEALTHCARE SAFETY**