ESCMID EUROPEAN SOCIETY OF CLINICAL MICROBIOLOGY AND INFECTIOUS DISEASES

EUCIC EUROPEAN COMMITTEE ON INFECTION CONTROL
European Society of Clinical Microbiology and Infectious Diseases

EUCIC Local Module
Improving Antibiotic Prescription and Infection Control in the Emergency Room

Screening and isolation

Carlos Palos

HOSPITAL DA LUZ LEARNING HEALTH

Hospital Universitario La Paz

Introduction

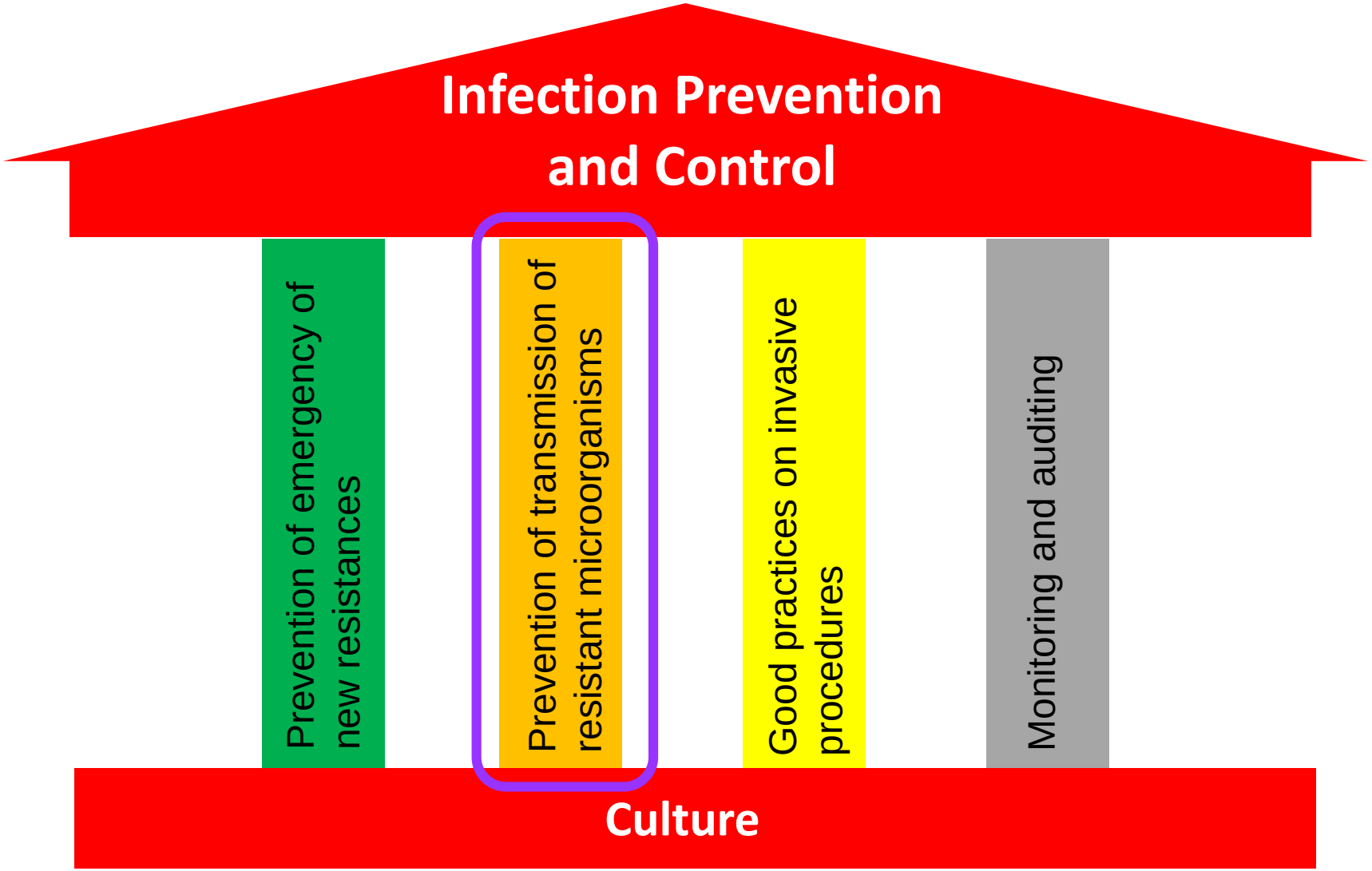
Summary

Screening and isolation

- The central role of Emergency Room
  - Most hospital admissions are made through ER in many acute hospitals
  - Patients admitted may represent a threat to other patients, healthcare workers, students and visitors, as they may be infected or colonized by Epidemiologically Important Microorganisms
  - Overcrowding, understaffing and emergency per se can contribute to inappropriate practices
  - Decisions made at ER do impact in other areas and for prolonged time
    - Microbiologic exams
    - Prescribed antibiotics
    - Bed allocation

Summary

Screening and isolation



Summary

Screening and isolation

Infection Prevention and Control

Summary

Screening and isolation

Summary

Screening and isolation

- **Strategies to reduce the cross transmission of microorganisms**
  - "Search and destroy" or "search and contain" strategies
    - Universal screening vs targeted screening (high risk patients for epidemiologic significant microorganisms (MRSA, VRE, Carbapenem Resistant (CR) *Enterobacteriacea*, CR *Acinetobacter baumannii*, CR *Pseudomonas aeruginosa*, others)
      - On hospital admission
      - On special units admission
      - Before surgical procedures
      - During hospitalisation (periodic assessment, contact with colonized or infected patients, prolonged antibiotic course...)
  - Isolation
  - Decolonization whenever indicated

- **Screening**
  - Presumptive identification of unrecognized disease in an apparently healthy, asymptomatic population by means of tests, examinations or other procedures that can be applied rapidly and easily to the target population
    - WHO cancer screening definition, available on http://www.who.int/cancer/prevention/diagnosis-screening/screening/en/
  - Probability driven process (risk assessment)
  - Purpose is reducing morbidity and mortality of the screened population or other populations in case of transmissible diseases
  - Screening must be followed by other interventions

- Screening tools (risk assessment+laboratory)
  - Good sensitivity and specificity (100% for "Gold standard tests")

Result	Disease	No Disease	Total
Positive test	True positive (TP)	False positive (FP)	Total patients with positive test (TP + FP)
Negative test	False negative (FN)Total patients with disease	True negative (TN)Total patients without disease	Total patients with negative test (TN + FN)Total patients
Sensitivity = TP/(TP + FP)	Positive predictive value = TP/(TP + FP)		
Specificity = TN/(TN + FP)	Negative predictive value = TN/(TN + FN)		

  - Available
  - Easy to use
  - Non invasive or minimally invasive
  - Cost-effective

Why?

•Why?

To Screen or Not to Screen? The Problem of Resistant Gram-Positive and Gram-Negative Bacterial Pathogens

Wolfgang R Heizmann[1]*, and Christian Magiera[2]

Heizmann WR, Magiera C (2016) JSM Microbiology 4(2): 1032.

Consequently;as a result of screening there are at least three benefits:i) knowing a patient is colonized by a multiresistant pathogen can guide the choice of antibiotic leading to a higher chance for appropriate initial therapy; ii) precautions can be taken early to avoid the spread of multi resistant bacteria within an institution and iii) better knowledge of the epidemiology of multi resistant bacteria in the population.

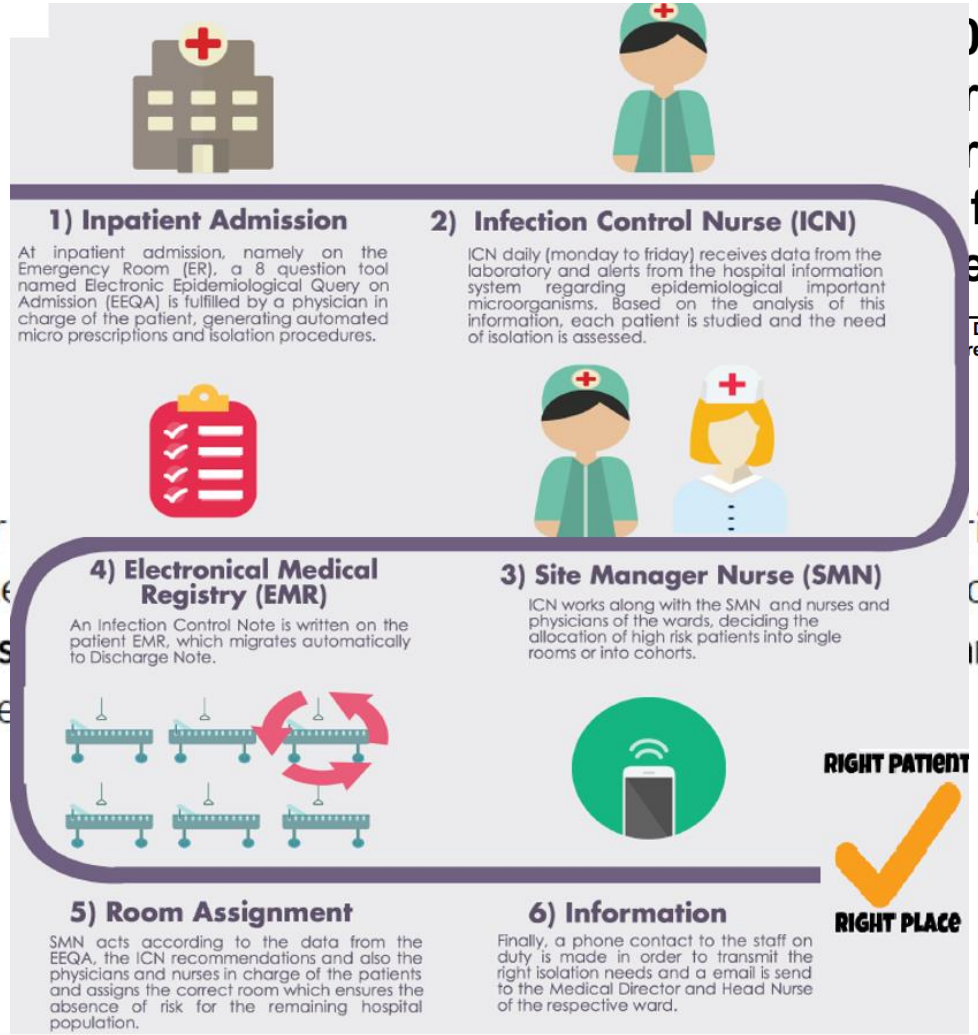
- **Why?**

2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings

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

Develop and implement systems for early detection and management (e.g., use of appropriate infection control measures, including isolation precautions, personal protective equipment [PPE]) of potentially infectious persons at initial points of patient encounter in **outpatient settings** (e.g., **triage areas, emergency departments, outpatient clinics, physician offices**) and at the time of admission to hospitals and long-term care facilities (LTCF)

•Why?



007 Guideline for Isolation recautions: reventing Transmission of fectious Agents in Healthcare ettings

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

Develop and implement systems for iate infection control measures, including isolation precautions, personal prote ons at initial points of patient encounter in **outpatient settings** (e.g., **triage areas n offices**) and at the time of admission to hospitals and long-term care facilitie

•But, screening is not enough!

Cost and Effects of Different Admission Screening Strategies to Control the Spread of Methicillin-resistant *Staphylococcus aureus*

Tanya Gurieva[1]*, Martin C. J. Bootsma[1,2], Marc J. M. Bonten[1,3]

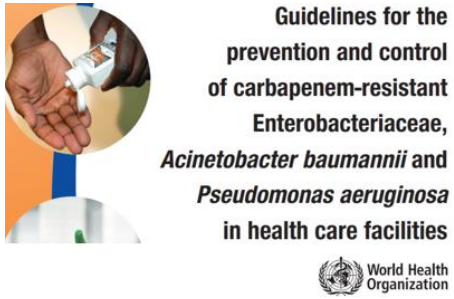
OPEN ACCESS Freely available online
PLOS | COMPUTATIONAL BIOLOGY

The (cost)-efficacy of admission screening strategies critically depends on the effectiveness of the infection prevention measures taken when a carrier of MRSA is detected.

If these measures are not very effective, it may not be wise to invest lots of efforts in detecting carriers.

What?

- **Whar?**
  - Dependent of setting
    - Identified problems
      - MRSA, CRE, CR *Pseudomonas*, CR *Acinetobacter*, ESBL Enterobacteriacea, VRE, others
    - Capability of intervention
      - Time to ward patient allocation
      - Financial resources
    - Endemic vs Epidemic

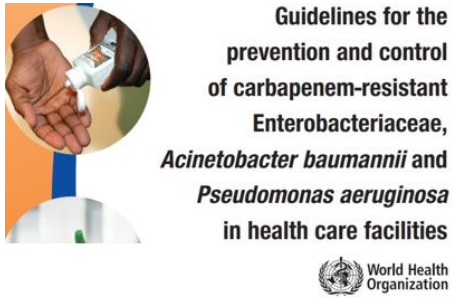


ESCMID guidelines for the management of the infection control measures to reduce transmission of multidrug-resistant Gram-negative bacteria in hospitalized patients

E. Tacconelli[1], M. A. Cataldo[2], S. J. Dancer[3], G. De Angelis[4], M. Falcone[5], U. Frank[6], G. Kahlmeter[7], A. Pan[8,9], N. Petrosillo[2], J. Rodríguez-Baño[10,11,12], N. Singh[13], M. Venditti[5], D. S. Yokoe[14] and B. Cookson[15]

Clin Microbiol Infect 2014; **20 (Suppl. 1)**: 1–55

- **Whar?**
  - Dependent of setting
    - Identified problems
      - MRSA, CRE, CR *Pseudomonas*, CR *Acinetobacter*, ESBL Enterobacteriacea, VRE, others
    - Capability of intervention
      - Time to ward patient allocation
      - Financial resources
    - Endemic vs Epidemic



ESCMID guidelines for the management of the infection control measures to reduce transmission of multidrug-resistant Gram-negative bacteria in hospitalized patients

E. Tacconelli[1], M. A. Cataldo[2], S. J. Dancer[3], G. De Angelis[4], M. Falcone[5], U. Frank[6], G. Kahlmeter[7], A. Pan[8,9], N. Petrosillo[2], J. Rodríguez-Baño[10,11,12], N. Singh[13], M. Venditti[5], D. S. Yokoe[14] and B. Cookson[15]

Clin Microbiol Infect 2014; **20 (Suppl. 1)**: 1–55

- **Whar?**
  - Dependent of setting
    - Identified prob
      - MRSA, CRE,
        Enterobacte
    - C
    - Endemic vs Ep

Definitions of epidemiological setting

Endemic	Settings where there are constant challenges from admissions of patients due to MDR-GNB already isolated in the hospital or an emergence of cases of infection due to a new MDR-GNB, with or without molecular analysis of strains

MDR-GNB, multidrug-resistant Gram-negative bacteria.

- The evidence available on surveillance cultures for CRAB and CRPsA colonization concluded that it was not sufficiently relevant to extend the recommendation to these two microorganisms.

Guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, *Acinetobacter baumannii* and *Pseudomonas aeruginosa* in health care facilities

World Health Organization

ESCMID guidelines for the management of the infection control measures to reduce transmission of multidrug-resistant Gram-negative bacteria in hospitalized patients

E. Tacconelli[1], M. A. Cataldo[2], S. J. Dancer[3], G. De Angelis[4], M. Falcone[5], U. Frank[6], G. Kahlmeter[7], A. Pan[8,9], N. Petrosillo[2], J. Rodríguez-Baño[10,11,12], N. Singh[13], M. Venditti[5], D. S. Yokoe[14] and B. Cookson[15]

Clin Microbiol Infect 2014; **20 (Suppl. 1)**: 1–55

Where?

- **Where?**
  - MRSA: nasal+stomas or wounds/devices/other body places
  - CRE or CR *Pseudomonas:* rectum+stomas or wounds/devices
  - ESBL Enterobacteriacea: rectum+stomas or wounds/devices
  - CR *Acinetobacter*: skin+stomas or wounds/devices

All medical and high-risk surgical patients were screened for methicillin-resistant *Staphylococcus aureus* colonization over 3.5 years. The sensitivities of nasal and rectal swabs were 68% and 62%, respectively. Naris and open-skin-site swabs detected 467 (74%) of 627 adult carriers identified. Rectal swabs detected an additional 160 (26%) carriers.

Sensitivities of Nasal and Rectal Swabs for Detection of Methicillin-Resistant *Staphylococcus aureus* Colonization in an Active Surveillance Program[▽]

Andrea Currie,[1] Linda Davis,[1] Ewa Odrobina,[1] Suzanne Waldman,[2] Diane White,[1] Joanne Tomassi,[2] and Kevin C. Katz[1,2,3]*

JOURNAL OF CLINICAL MICROBIOLOGY, Sept. 2008, p. 3101–3103

Who?

•Who?

Cost-effectiveness of national mandatory screening of all admissions to English National Health Service hospitals for meticillin-resistant *Staphylococcus aureus*: a mathematical modelling study

Julie V Robotham, Sarah R Deeny, Chris Fuller, Susan Hopkins, Barry Cookson, Sheldon Stone**

Published online November 23, 2015 http://dx.doi.org/10.1016/S1473-3099(15)00417-X

Interpretation Our results show that screening all admissions for MRSA is unlikely to be cost effective in England at the current NHS willingness-to-pay threshold, and our findings informed modified guidance to NHS England in 2014. Screening admissions to high-risk specialties is likely to represent better resource use in terms of cost per QALY gained.

•Who?

Patients at high risk

- known to have been infected or colonized with MRSA in the past (Category 1b);
- frequent re-admissions to any healthcare facility (Category 1b);
- direct interhospital transfers (Category 1b);
- recent inpatients at hospitals abroad or hospitals in the UK which are known or likely to have a high prevalence of MRSA (Category 1b); and
- residents of residential care facilities where there is a known or likely high prevalence of MRSA carriage (Category 1b).

injecting drug users, patients infected with human immunodeficiency virus, and members of professional contact sport teams

Guidelines for the control and prevention of meticillin-resistant *Staphylococcus aureus* (MRSA) in healthcare facilities☆

J.E. Coia [a], G.J. Duckworth [b], D.I. Edwards [c], M. Farrington [d], C. Fry [e], H. Humphreys [f,*], C. Mallaghan [g], D.R. Tucker [h], for the Joint Working Party of the British Society of Antimicrobial Chemotherapy, the Hospital Infection Society, and the Infection Control Nurses Association

Journal of Hospital Infection (2006) 63S, S1–S44

intensive care, neonatal intensive care, burns, transplantation, cardiothoracic, orthopaedic, trauma, vascular surgery, renal, regional, national and international referral centres (all Category 1b), and other specialist units as determined by the infection control team and as agreed with the senior clinical staff of the units and relevant hospital management structure.

•Who?

Accuracy of American Thoracic Society/Infectious Diseases Society of America criteria in predicting infection or colonization with multidrug-resistant bacteria at intensive-care unit admission

S. Nseir[1,2], G. Grailles[1], A. Soury-Lavergne[1], F. Minacori[1], I. Alves[1] and A. Durocher[1,2]

Clin Microbiol Infect 2010; **16**: 902–908

Patients at risk for colonization or infection
current hospitalization of 5 days or more, prior antibi-
otic therapy, prior hospitalization, residence in a nursing home
or extended-care facility, home infusion therapy within 30
days, chronic dialysis within 30 days, home wound care, family
member with an MDR pathogen, and immunosuppression.

•Who?

Multidrug-Resistant Organisms in Dialysis Patients

David P. Calfee
Department of Medicine and Public Health, Weill Cornell Medical College, New York, New York

Seminars in Dialysis—Vol 26, No 4 (July–August) 2013 pp. 447–456

One study that obtained serial surveillance cultures from patients attending an ambulatory hemodialysis unit reported that 28% of patients were colonized with one or more multidrug-resistant organisms (MDROs), including methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* species (VRE), and multidrug-resistant gram-negative bacilli (MDR-GNB)

Studies conducted in both inpatient and ambulatory dialysis settings have demonstrated MRSA carriage rates ranging from 1.4% to 27%

Vancomycin-resistant *Enterococcus* colonization is also relatively common among dialysis patients, with reported carriage rates ranging from 0% to 16%

16% of patients were colonized with MDR-GNB (defined as GNB resistant to ≥ 3 specific antibiotics with in vitro activity against aerobic gram-negative bacilli).

•Who?

Facility Guidance for Control of Carbapenem-resistant *Enterobacteriaceae* (CRE)
November 2015 Update - CRE Toolkit

This could include everyone admitted to the facility, pre-specified high-risk patients (e.g., those admitted from long-term acute-care facilities, patients who received medical care in endemic regions), and/or patients admitted to high-risk settings (e.g., intensive care units [ICUs]).

in the last six to twelve months.

•Who?

Risk factors for acquisition of CRE in healthcare settings are similar to those reported for acquisition of other multidrug-resistant bacteria. These include, for example, admission to an intensive care unit (ICU), long ICU stay, critical illness, invasive device use and prior antimicrobial therapy

Patients who had recently been hospitalised in a country or region known as having a high CRE prevalence – or who were transferred from an individual hospital with a high CRE prevalence – should be considered at high risk of digestive tract carriage of CRE.

•Who?

ESCMID guidelines for the management of the infection control measures to reduce transmission of multidrug-resistant Gram-negative bacteria in hospitalized patients

E. Tacconelli[1], M. A. Cataldo[2], S. J. Dancer[3], G. De Angelis[4], M. Falcone[5], U. Frank[6], G. Kahlmeter[7], A. Pan[8,9], N. Petrosillo[2], J. Rodríguez-Baño[10,11,12], N. Singh[13], M. Venditti[5], D. S. Yokoe[14] and B. Cookson[15]

Clin Microbiol Infect 2014; **20 (Suppl. 1):** 1–55

risk factors for colonization due to MDR-GNB at hospital admission

recent antibiotic usage, residency or recent travel in a country with high incidence of MDR-GNB, hospitalization in a healthcare facility where MDR-GNB are endemic, advanced age, dialysis and residency in long-term care facilities or nursing homes

•Who?

ESCMID guidelines for the management of the infection control measures to reduce transmission of multidrug-resistant Gram-negative bacteria in hospitalized patients

E. Tacconelli[1], M. A. Cataldo[2], S. J. Dancer[3], G. De Angelis[4], M. Falcone[5], U. Frank[6], G. Kahlmeter[7], A. Pan[8,9], N. Petrosillo[2], J. Rodríguez-Baño[10,11,12], N. Singh[13], M. Venditti[5], D. S. Yokoe[14] and B. Cookson[15]

Clin Microbiol Infect 2014; **20 (Suppl. 1):** 1–55

Recommendations

Epidemic setting

Strong recommendation: Implement a programme of active screening culture at hospital admission followed by contact precautions to reduce the spread of extended-spectrum β-lactamase-producing Enterobacteriaceae, multidrug-resistant (MDR)-*Klebsiella pneumoniae*, MDR-*Acinetobacter baumannii* (moderate level of evidence); and MDR-*Pseudomonas aeruginosa* (very low level of evidence)

Recommendations

Endemic setting

Strong recommendation: Implement contact precautions (CP) for all patients colonized with extended-spectrum β-lactamase (ESBL)-Enterobacteriaceae (with the exception of *Escherichia coli*), multidrug-resistant (MDR)–*Klebsiella pneumoniae*, MDR-*Acinetobacter baumannii*, and MDR-*Pseudomonas aeruginosa* (moderate level of evidence)

Summary

Screening and isolation

- **Who?**

Guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, *Acinetobacter baumannii* and *Pseudomonas aeruginosa* in health care facilities

World Health Organization

Recommendation 3: Surveillance of CRE-CRAB-CRPsA infection and surveillance cultures for asymptomatic CRE colonization

- Surveillance screening should be based on patient risk assessment The following patient risk categories should be considered:
  - patients with a previously documented history of CRE colonization or infection;
  - epidemiologically-linked contacts of newly-identified patients with CRE colonization or infection (this could include patients in the same room, unit or ward);
  - patients with a history of recent hospitalization in regions where the local epidemiology of CRE suggests an increased risk of CRE acquisition (for example, hospitalization in a facility with known or suspected CRE);
  - based on the epidemiology of their admission unit, patients who may be at increased risk of CRE acquisition and infection (for example, immunosuppressed patients and those admitted to intensive care units (ICUs), transplantation services or haematology units, etc.).

- **Who?**
  - In summary:
    - Previous colonization or infection by Epidemiologic Important Microorganisms (at least in previous 6 months)
    - Previous hospital or LTCF admission (at least in previous 3 months)
    - Presence of stomas, medical devices or wounds at admission
    - Recent dialysis or immunossupression
    - Recent travel to places with high prevalence of Epidemiologic Important Microrganisms (at least in previous 3 months)

•Who?

- En la Comunidad de Madrid existe un programa informático (de nombre Viras) donde Medicina Preventiva esta obligada a incluir a todos los pacientes con infección o estado de portador de enterobacterias portadoras de carbapenemasas, MRSA, Pseudomonas multirresistentes…
-
- A la llegada del paciente a Urgencias, una vez introducidos los datos de su filiación (nombre, dirección….) salta una alarma informática si el paciente esta incluido en ese programa de manera que desde Urgencias se inicia el aislamiento del mismo.
- Si el paciente tiene que ingresar, se ingresa en regimen de aislamiento, independientemente de que la causa de ingreso sea o no infecciosa.
- Medicina Preventiva acudirá el siguiente día para dar las recomendaciones de aislamiento a la enfermería que atiende al paciente y valorar si es preciso tomar nuevas muestras para valorar el estado de portador, independientemente de las muestras clínicas que pidamos por la enfermedad por la que acude el paciente.
- En cuanto al screening del estado de portador se realiza únicamente en Cuidados Intensivos al ingreso del paciente. El resto de casos detectados se realizan habitualmente a través de muestras clínicas que se solicitan a los pacientes. En cuanto hay un aislamiento en Microbiología de uno de estos patógenos se avisa a Medicina Preventiva y al médico responsable del paciente.

How?

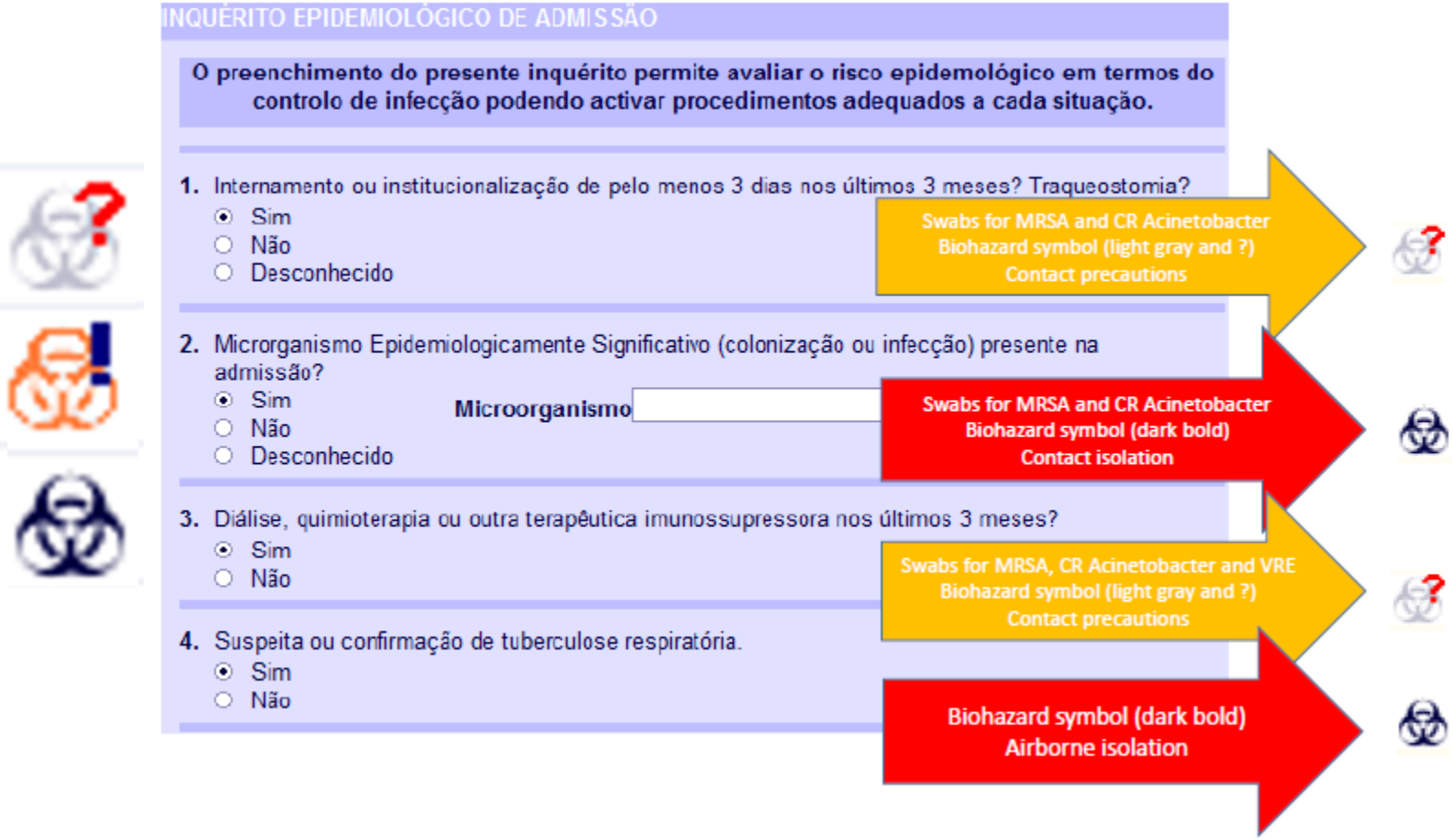
•How?

•Step 1: risk assessment

Electronic Epidemiological Questionnaire on Admission.

Carlos Palos, MD, Ana Bispo, RN. Infection Control and Antibiotics Committee. Hospital Beatriz Ângelo. Portugal

HOSPITAL BEATRIZ ÂNGELO



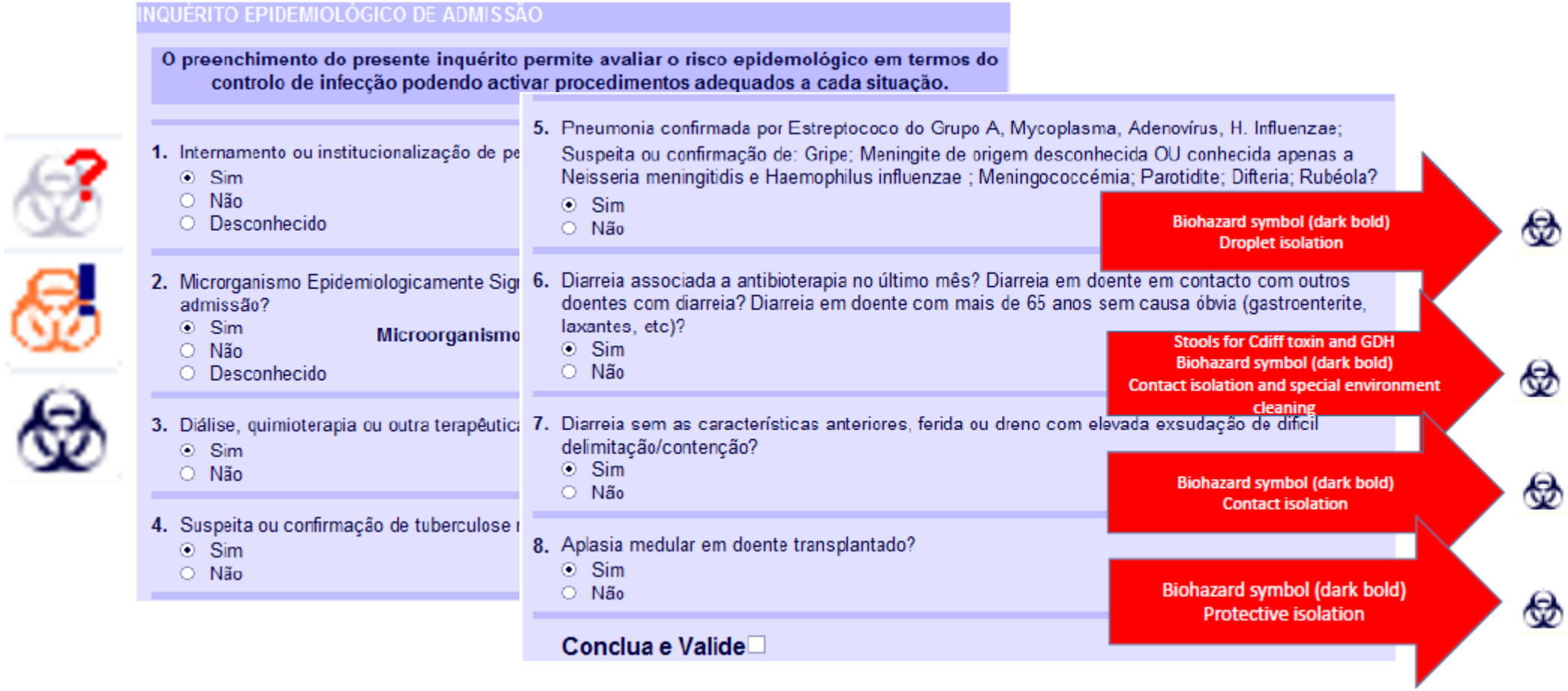
•How?

•Step 1: risk assessment

Electronic Epidemiological Questionnaire on Admission.

Carlos Palos, MD, Ana Bispo, RN. Infection Control and Antibiotics Committee. Hospital Beatriz Ângelo. Portugal

HOSPITAL BEATRIZ ÂNGELO



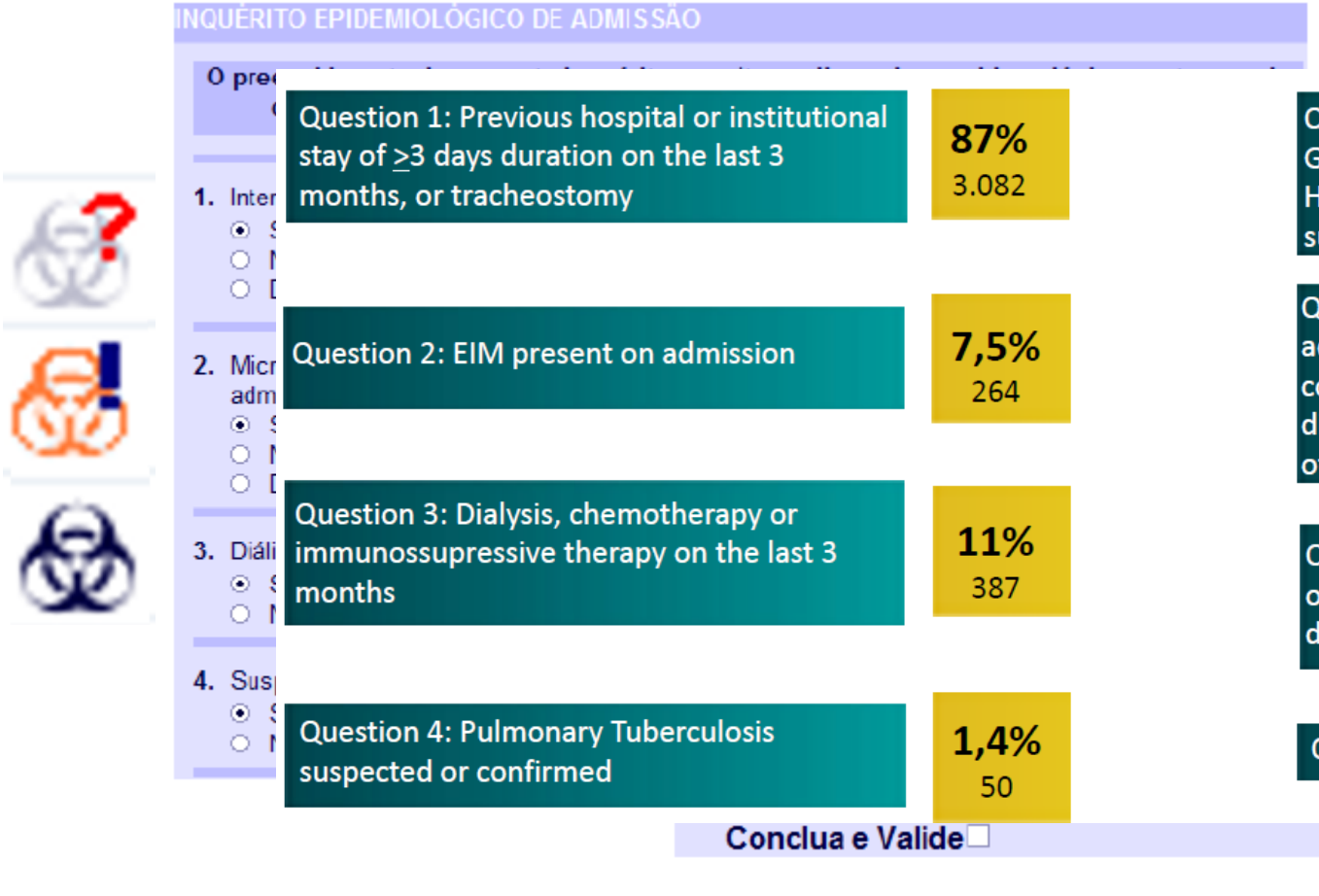
•How?

•Step 1: risk assessment

Electronic Epidemiological Questionnaire on Admission.

Carlos Palos, MD, Ana Bispo, RN. Infection Control and Antibiotics Committee. Hospital Beatriz Ângelo. Portugal

HOSPITAL BEATRIZ ÂNGELO



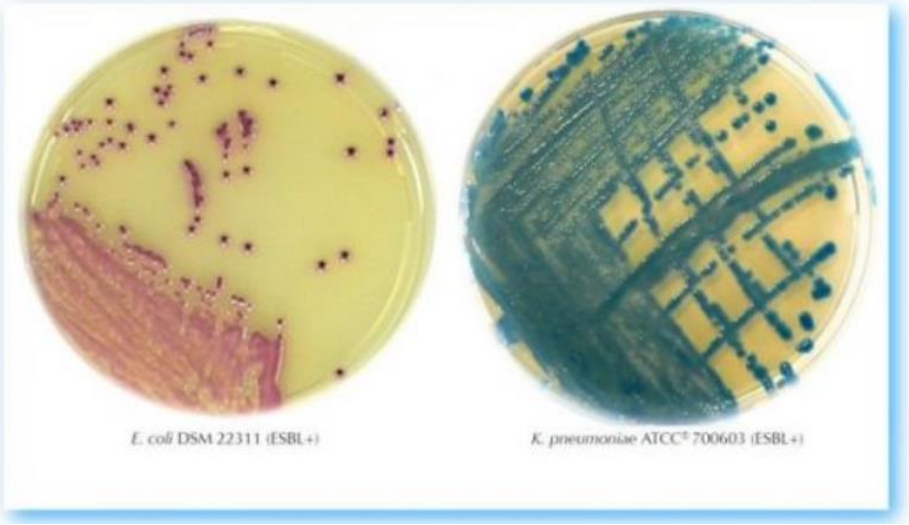
Question 1: Previous hospital or institutional stay of ≥3 days duration on the last 3 months, or tracheostomy	87% 3.082
Question 2: EIM present on admission	7,5% 264
Question 3: Dialysis, chemotherapy or immunossupressive therapy on the last 3 months	11% 387
Question 4: Pulmonary Tuberculosis suspected or confirmed	1,4% 50
Question 5: Confirmed pneumonia caused by Group A Strepto, Mycoplasma, Adenovirus or H. influenza. Flu, Meningitis… confirmed or suspected	0,7% 25
Question 6: Diarrhea associated with antibiotic administration on the last month, or in the context of contact with other patients with diarrhea, or in patients older than 65y without other cause for it	3,6% 123
Question 7: Diarrhea without context defined on question 6, or any exsudative wound or drain without containing	3,1% 109
Question 8: Post-transplant medullar aplasia	0,2% 7

- **How?**
  - Step 1: risk assessment
    - We moved from VRE and CR Acinetobacter baumanii towards CRE
    - We must include travelling as a risk factor

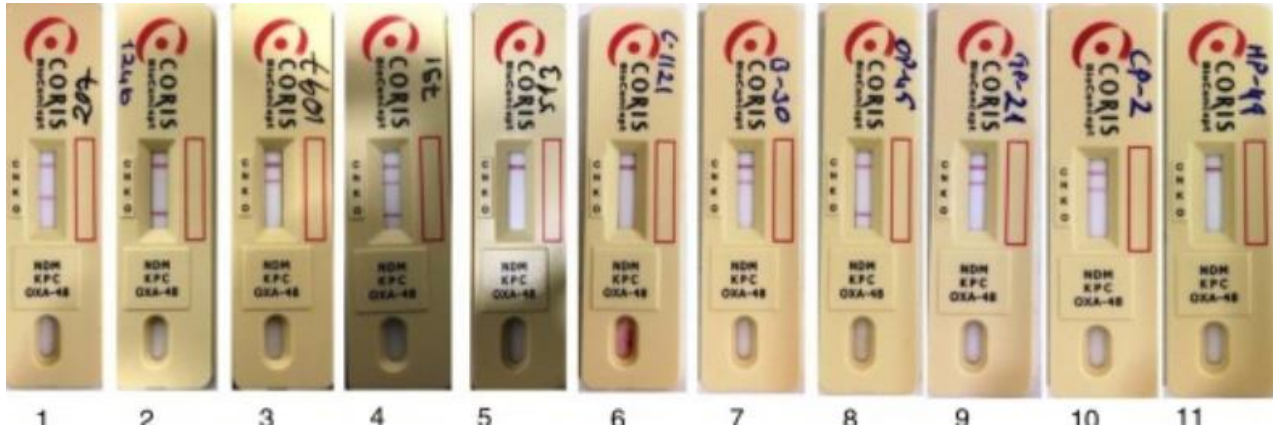
- **How?**
  - Step 2: laboratory testing
    - Appropriate technique
    - Tip should be dirty for rectal swabs

- **How?**
  - Step 2: laboratory testing
    - Phenotypic testing
      - Conventional plate testing (chromogenic media)
        - 2-3 days
        - Possibility of knowledge of resistance pattern
        - False positive and false negative results
        - Less expensive

Colony appearance on Chromatic™ ESBL and Chromatic™ ESBL+AmpC plates.



- **How?**
  - Step 2: laboratory testing
    - Phenotypic testing
      - Immunochromatography testing
        - Minutes
        - Need for previous culture
        - Intermediate expensive



- **How?**
  - Step 2: laboratory testing
    - Genotypic
      - PCR
        - 4-6 hours
        - No need for previous culture
        - Simple to use
        - More expensive (10x)
        - No detection of mutations

Isolation considerations

- **Type of Isolation**
  - Contact isolation for CRE, CR *Pseudomonas*, CR *Acinetobacter*, MRSA, VRE, *Clostridium difficile, scabies, others*
  - Airborne isolation for respiratory tuberculosis
  - Droplet isolation for meningococcus disease (meningitis, meningococcemia), SRV
  - Combined isolation (droplet+contact): flu
  - Combined isolation (airborne+contact): measles, H1N1 flu virus
  - Special isolation (airborne+contact with special PPE): coV-MERS, Ebola

- **Isolation improvement**
  - Early recognition of special stituations by administratives and triage nurses (travellers, community outbreaks)
  - Easy recognition of previously infected or colonized patients (alerts)
  - High suspicion for Clostridium difficile diarrhea and respiratory tuberculosis
  - Fast circuits
  - Dedicated rooms and spaces for patient allocation
  - Correct use of PPE, adequate hand washing and environmental cleaning
  - Ward admission ASAP

Take home messages

- **Take home messages**
  - ER are central for infection prevention and control
  - Screening for colonization should be based on risk assessment tools, local or regional needs and resources, and should integrate all targeted bacteria, while minimizing discomfort
  - Screening for both MRSA and CRE are useful on an Iberian perspective
  - Nasal and rectal swabs are appropriate for both MRSA and CRE
  - Screening is only the kick off for isolation, bed management and decolonisation procedures
  - Dedicated areas, circuits and procedures are essential for early recognition and adequate implementation of measures