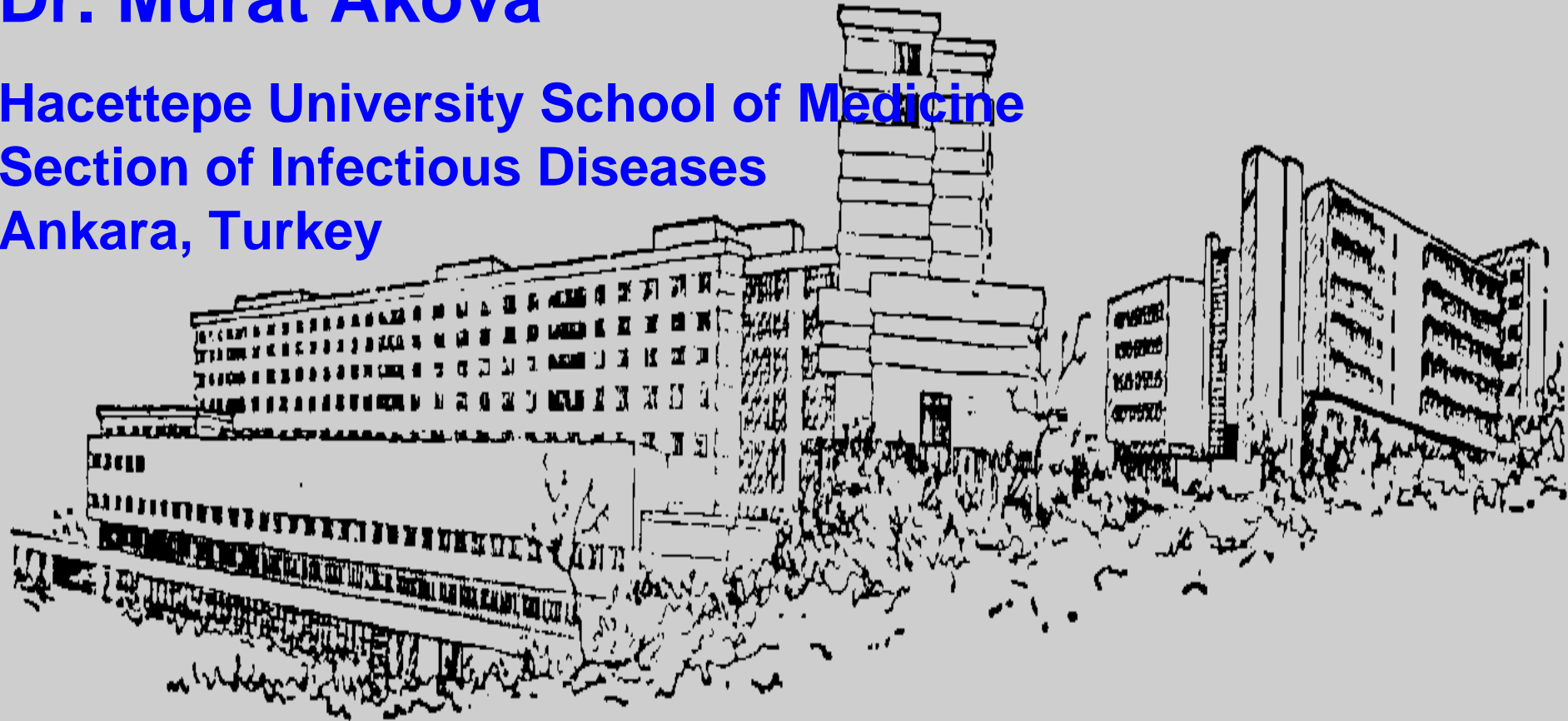


Infection Management in Intensive Therapy Unit (ITU) Patients

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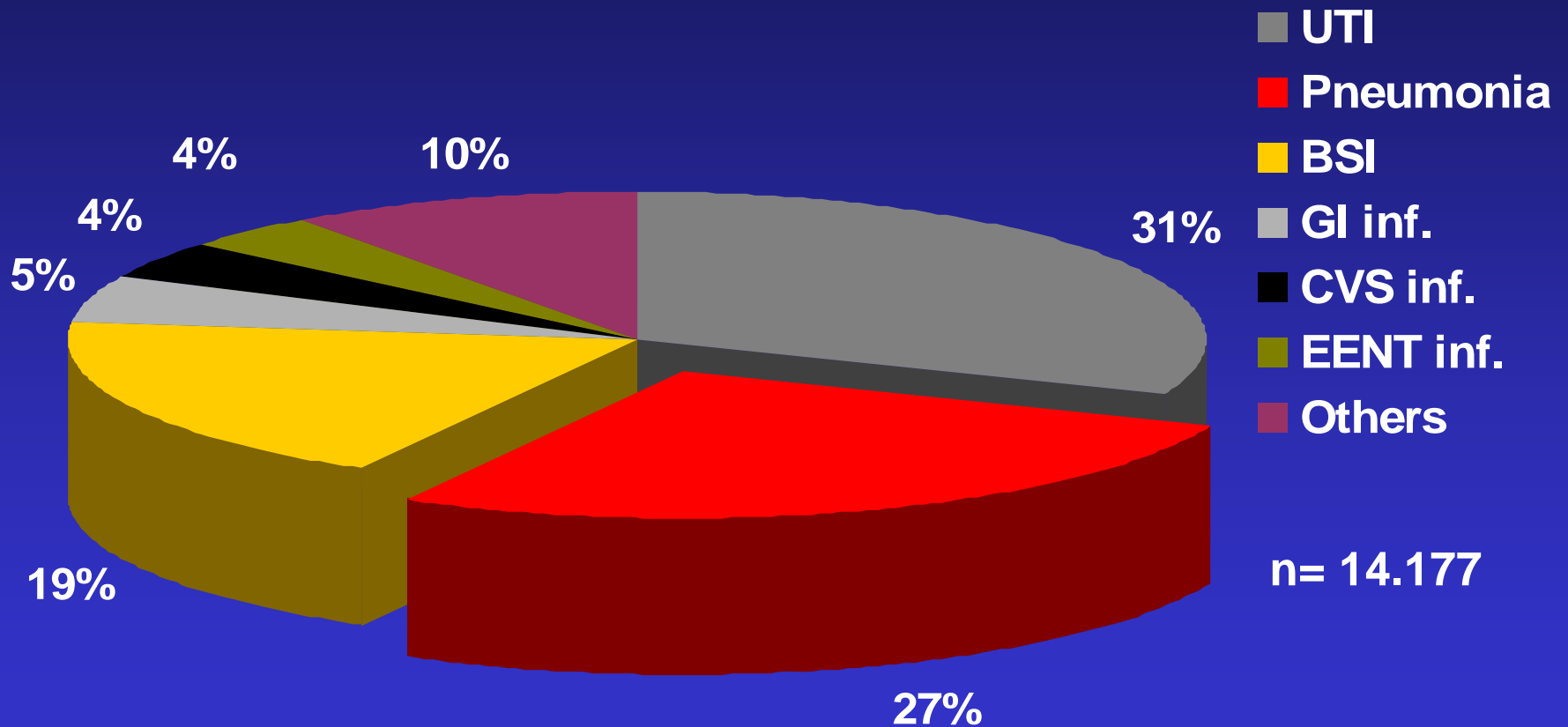
Health-Care Associated Infections

Definition

- **An infection that is not present or incubating when the patient is admitted to hospital or other health-care facility**
 - **In general infections developed after 48-72 h after admission**

Sites of Infection in ICU

NNIS 1992-97



Factors that predispose to nosocomial infection

Related to underlying health status

Advanced age

Malnutrition

Alcoholism

Heavy smoking

Chronic lung disease

Diabetes

Related to acute disease process

Surgery

Trauma

Burns

Related to invasive procedures

Endotracheal or nasal intubation

Central venous catheterisation

Extracorporeal renal support

Surgical drains

Nasogastric tube

Tracheostomy

Urinary catheter

Related to treatment

Blood transfusions

Recent antimicrobial therapy

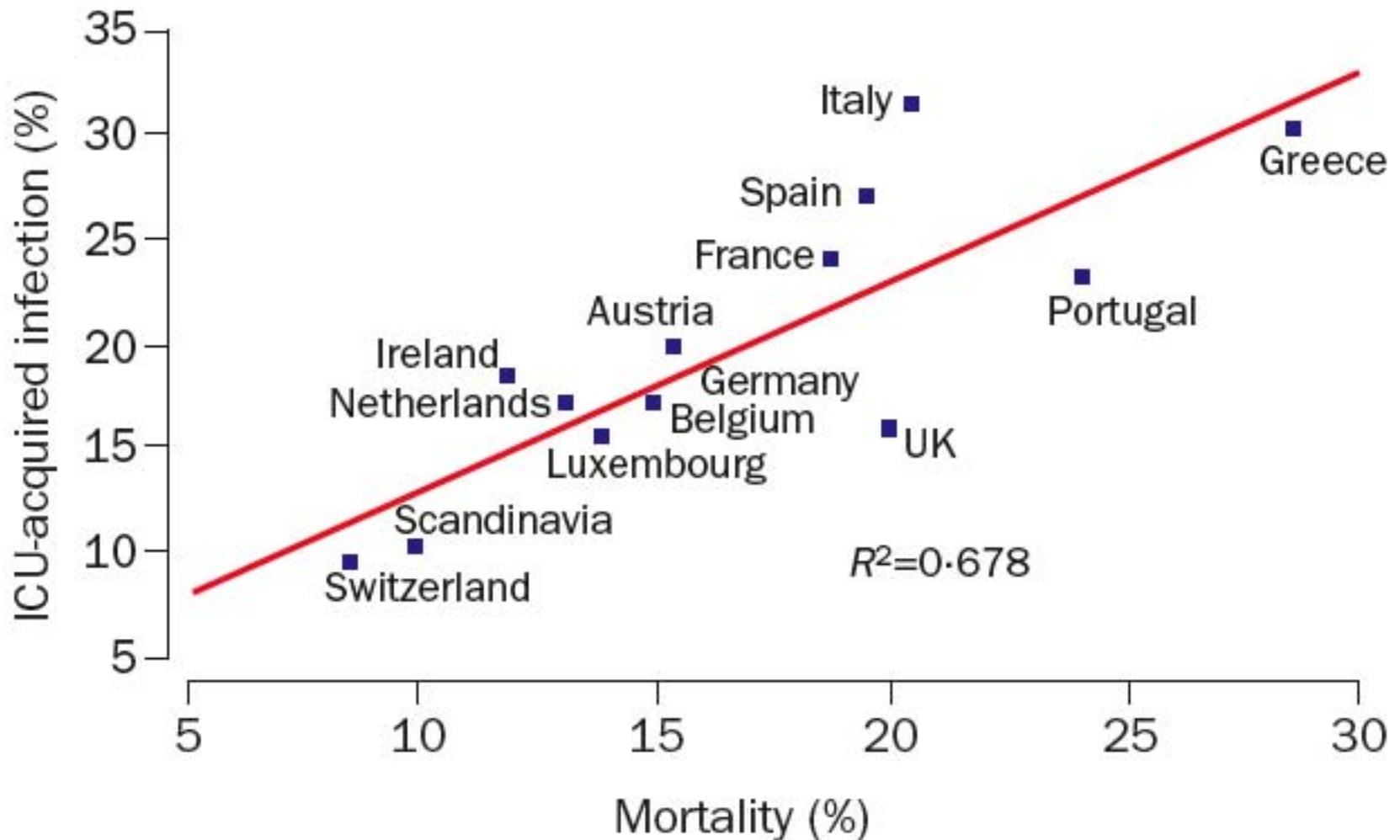
Immunosuppressive treatments—eg, corticosteroids

Stress-ulcer prophylaxis

Recumbent position

Parenteral nutrition

Prevalence and Mortality



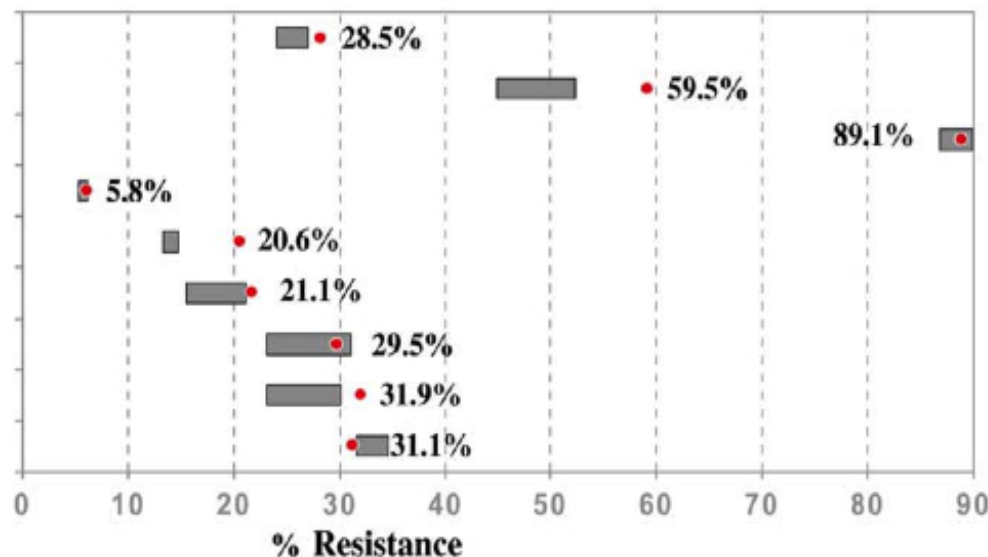
Effect of Nosocomial Infection

- **Increased length of stay (LOS)**
 - **Additional cost of \$ 3.5 billion per year w/o antibiotic and other therapy costs**
 - **In a Spanish study with catheter infection**
 - **LOS increased 20 days**
 - **Excess cost €3000 per episode**

Antimicrobial Resistance in ICU

NNIS 2003 vs 1998-2002

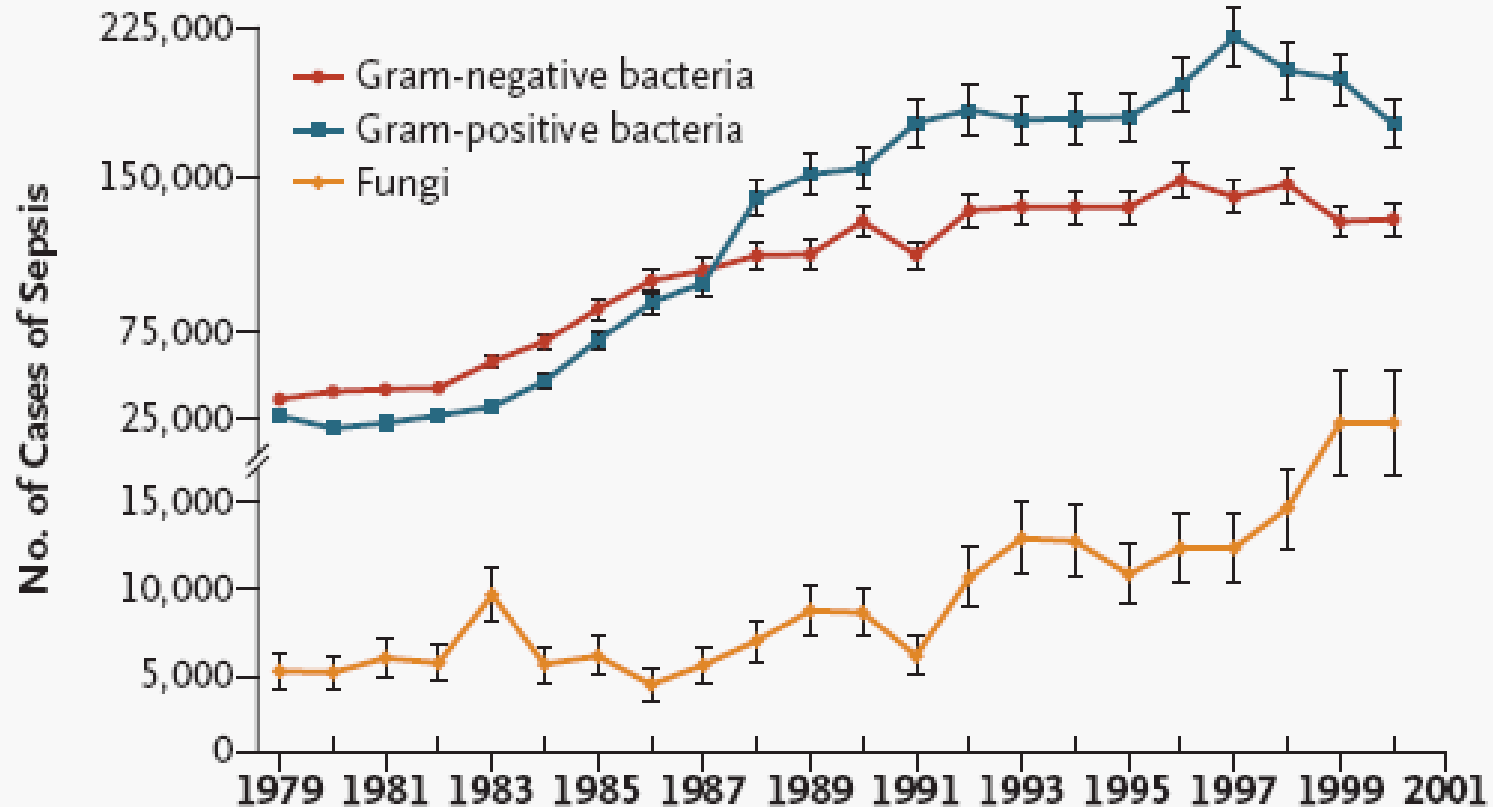
Vancomycin/enterococci
 Methicillin/*S. aureus*
 Methicillin/CNS
 3rd Ceph/*E. coli***
 3rd Ceph/*K. pneumoniae***
 Imipenem/*P. aeruginosa*
 Quinolone/*P. aeruginosa*
 3rd Ceph/*P. aeruginosa*
 3rd Ceph/*Enterobacter* spp.



• January through December 2003
 ■ 1998 through 2002 (+/- standard deviation)*

| Jan-Dec 2003 No. of Isolates | % increase in resistance (2003 vs 98-02*) |
|------------------------------|---|
| 2048 | 12% |
| 4100 | 11% |
| 3336 | 1% |
| 1355 | 0% |
| 1068 | 47% |
| 1392 | 15% |
| 1825 | 9% |
| 2119 | 20% |
| 1411 | -6% |

Epidemiology of Sepsis in the US 1979-2000

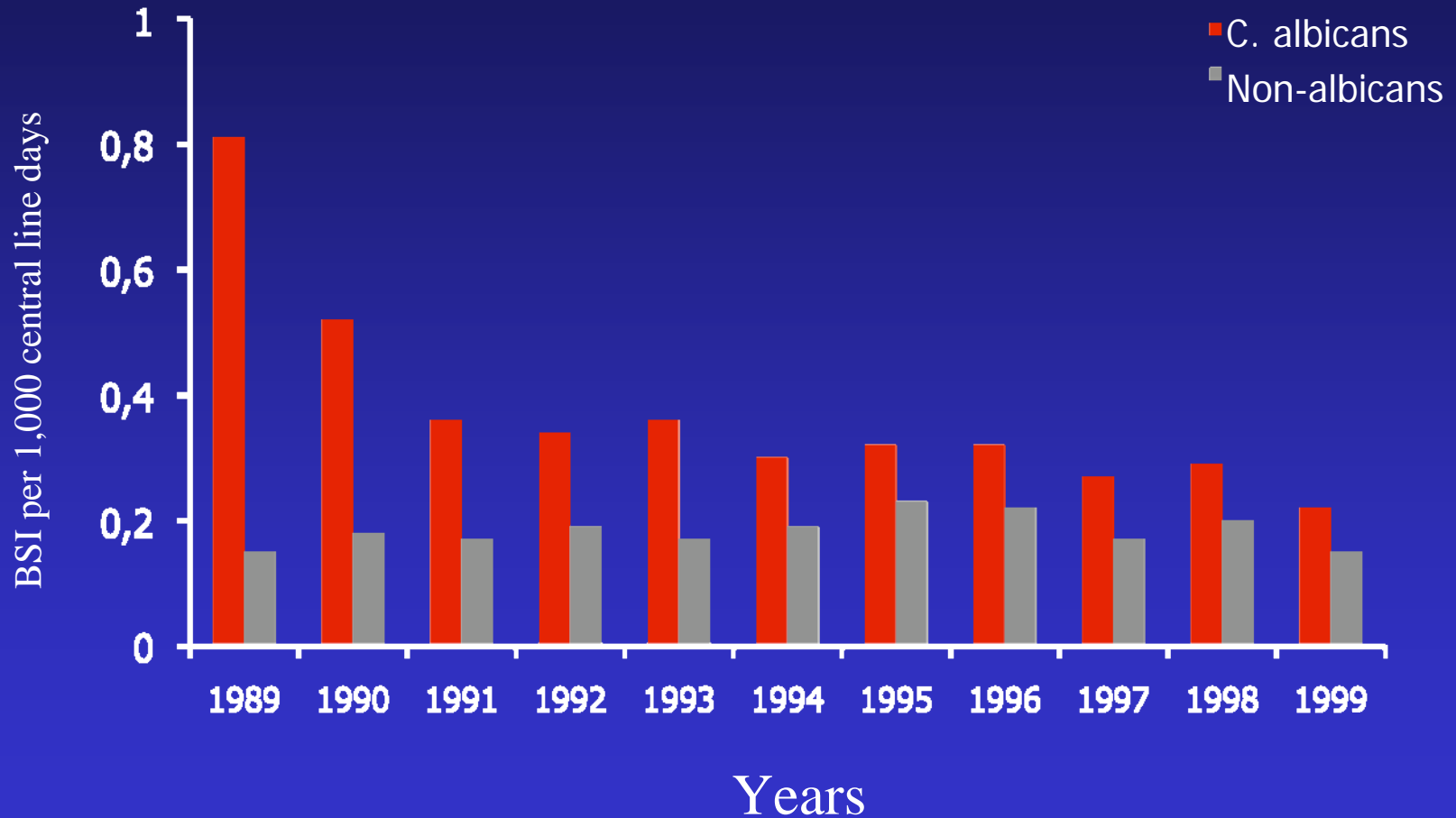


Martin GS, et al. N Engl J Med 2003;348:1546

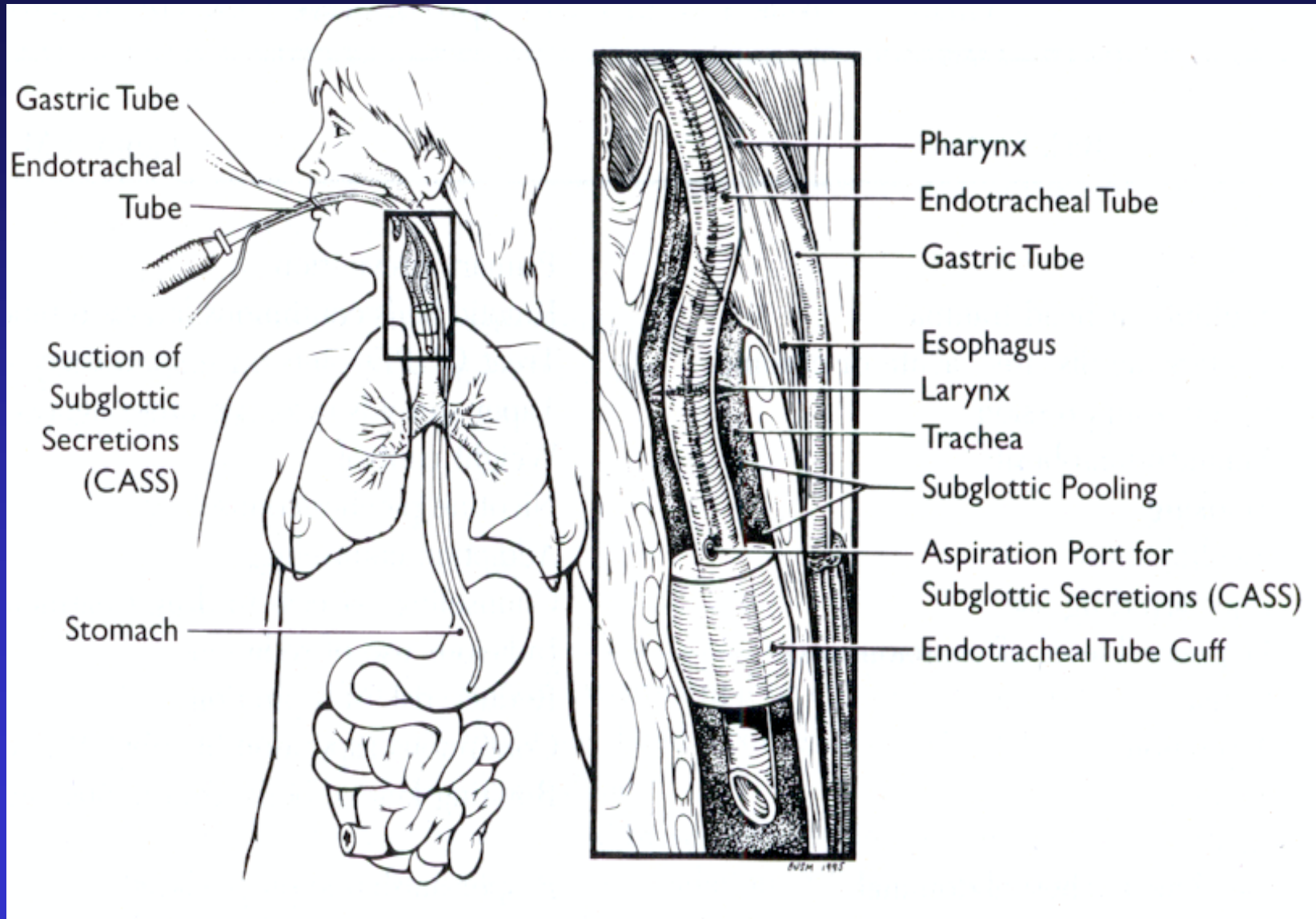
Candida as a Nosocomial Pathogen

| Rank | Pathogen | BSI per 10,000 admissions | Total (n=20,978) | % BSI | | % Crude Mortality | | |
|------|------------------|---------------------------|------------------|----------------|--------------------|-------------------|------|---------|
| | | | | ICU (n=10,515) | Non-ICU (n=10,515) | Total | ICU | Non-ICU |
| 1. | CoNS | 15.8 | 31.3 | 35.9 | 26.6 | 20.7 | 25.7 | 13.8 |
| 2. | S aureus | 10.3 | 20.2 | 16.8 | 23.7 | 25.4 | 34.4 | 18.9 |
| 3. | Enterococcus spp | 4.8 | 9.4 | 9.8 | 9.0 | 33.9 | 43.0 | 24.0 |
| 4. | Candida spp | 4.6 | 9.0 | 10.1 | 7.9 | 39.2 | 47.1 | 29.0 |
| 5. | E coli | 2.8 | 5.6 | 3.7 | 7.6 | 22.4 | 33.9 | 16.9 |
| 6. | Klebsiella spp | 2.4 | 4.8 | 4.0 | 5.5 | 27.6 | 37.4 | 20.3 |
| 7. | P aeruginosa | 2.1 | 4.3 | 4.7 | 3.8 | 38.7 | 47.9 | 27.6 |
| 8. | Enterobacter spp | 1.9 | 3.9 | 4.7 | 3.1 | 26.7 | 32.5 | 18.0 |
| 9. | Serratia spp | 0.9 | 1.7 | 2.1 | 1.3 | 27.4 | 33.9 | 17.1 |
| 10. | A baumannii | 0.6 | 1.3 | 1.6 | 0.9 | 34.0 | 43.4 | 16.3 |

Incidence of Nosocomial Candidemia in ICU (NNIS)



Pathogenesis of VAP



Management of VAP

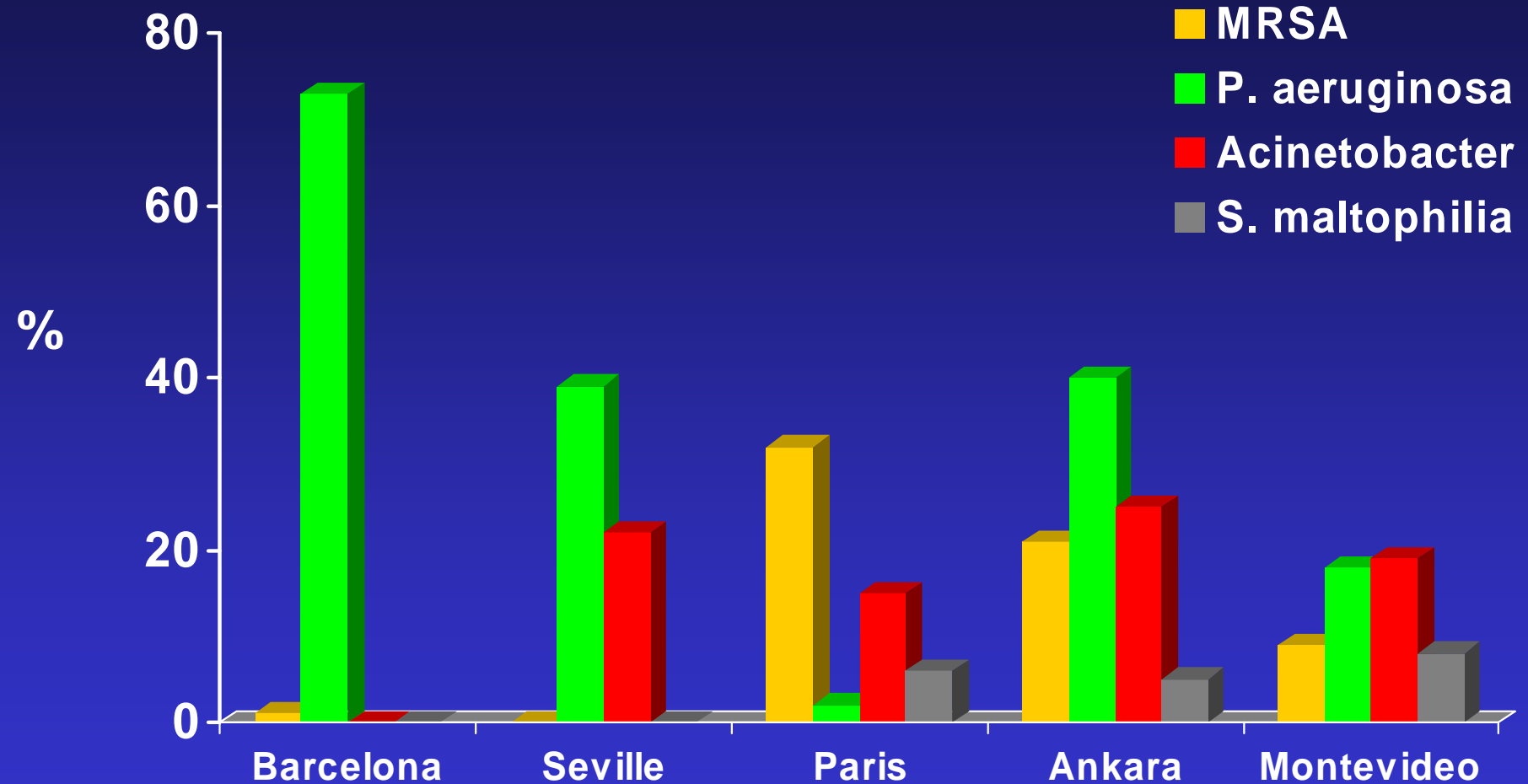
“The Tarragona Strategy”

- What microbes should be covered?
- Role of microbiological tests
- When to start antibiotics?
- Dose and duration
- Which initial agents should be chosen?

Etiological Agents of Nosocomial Pneumonia

- Commonly caused by aerobic gram-negative bacilli
 - *P. aeruginosa*
 - *K. pneumoniae*
 - *Acinetobacter spp.*
- MRSA is the most common gram-positive
- MDR pathogens are common
- Anaerobes are uncommon

Regional Variations in Pathogens



Rello, et al. Am J Respir Crit Care Med 1999;160:608
Hacettepe University MICU, 2000

Risk Factors for MDR Pathogens HAP / VAP / HCAP

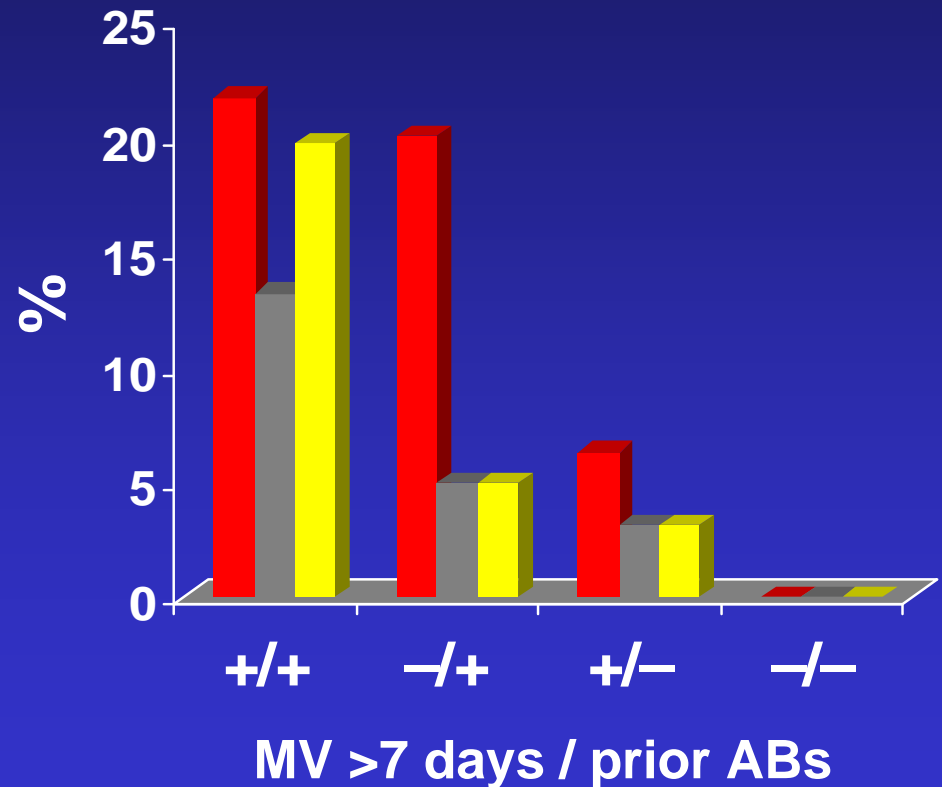
- **Antimicrobial therapy in preceding 90 days**
- **Current hospitalization of 5 d or more**
- **High frequency of antibiotic resistance in the community or in the specific hospital**
- **Presence of risk factors for HCAP**
 - Hospitalization for 2 d or more in the preceding 90 d
 - Residence in a nursing home or extended care facility
 - Home infusion therapy
 - Chronic dialysis within 30 d
 - Home wound care
 - Family member with MDR pathogen
- **Immunosuppressive disease and/or therapy**

Risk Factors for Resistant Pathogens in Patients with VAP

- 135 episodes in ICU

| Variable | OR | P |
|------------------|------|-------|
| Prior MV >7 days | 6.0 | .009 |
| Prior Abs | 13.5 | <.001 |
| Broad ABs | 4.1 | .025 |

■ P. aeruginosa ■ A. baumannii ■ MRSA



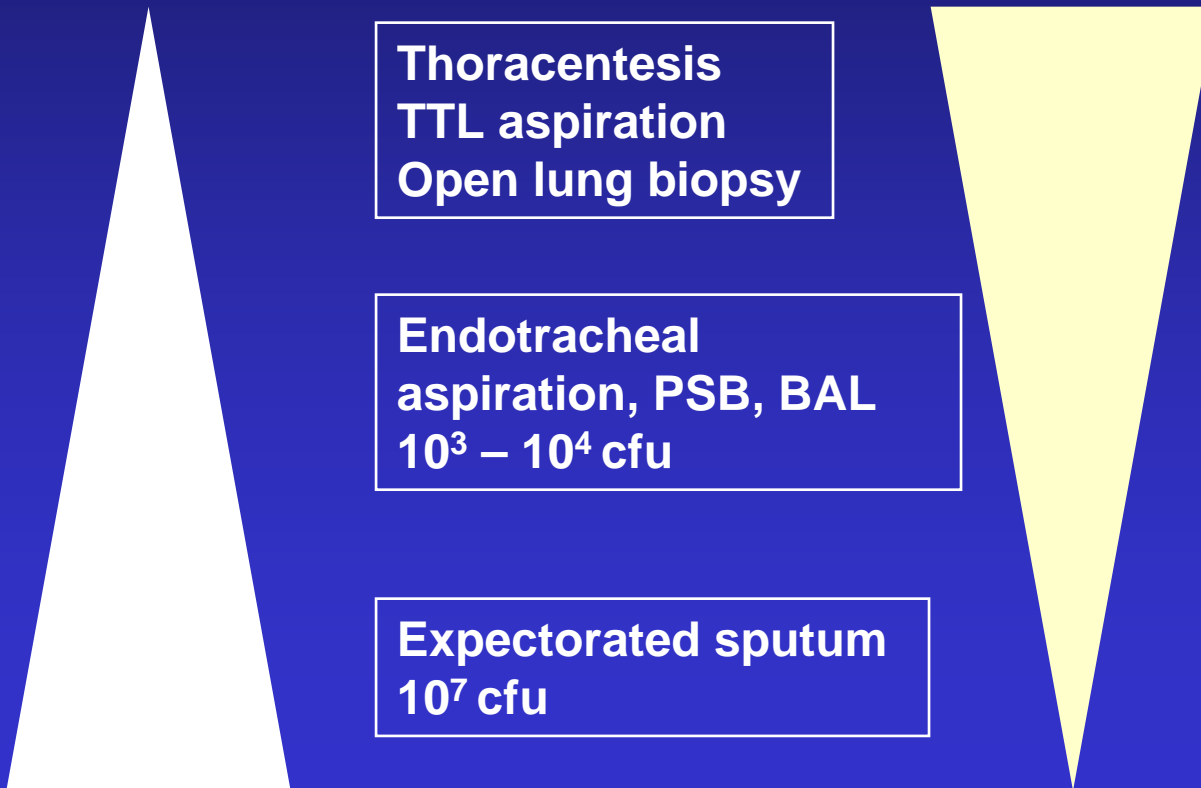
Risk Factors for Mortality due to Nosocomial Pneumonia

- Inappropriate antibiotic therapy
- Prior antibiotic therapy
- Duration of prior hospitalization
- Infection with high-risk pathogens
 - *Pseudomonas aeruginosa*
 - *Acinetobacter spp.*
- Bilateral pulmonary infiltrates
- Severity of underlying disease
- Advanced age

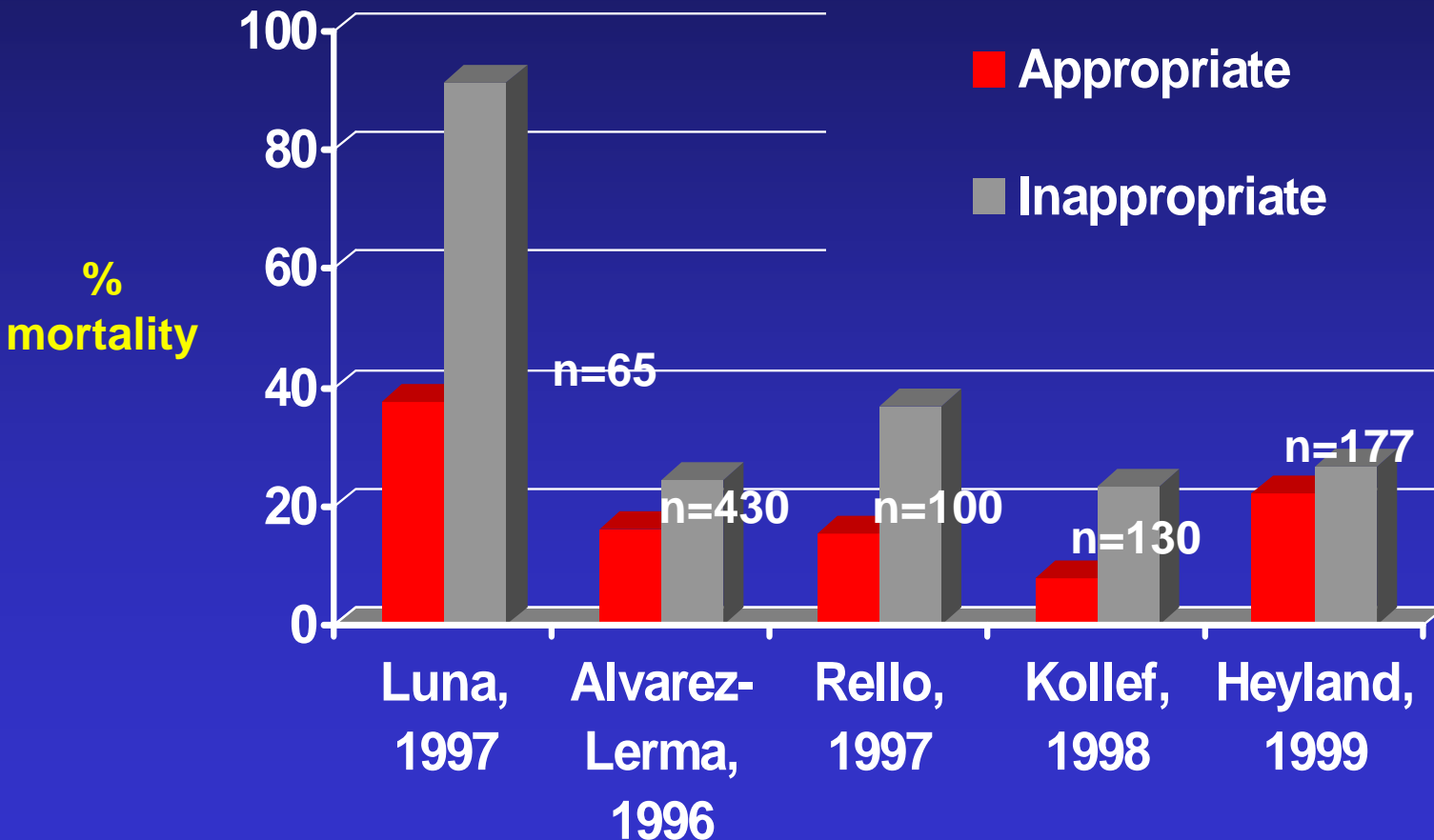
Diagnostic Methods in Nosocomial Pneumoniae

Contamination with saliva

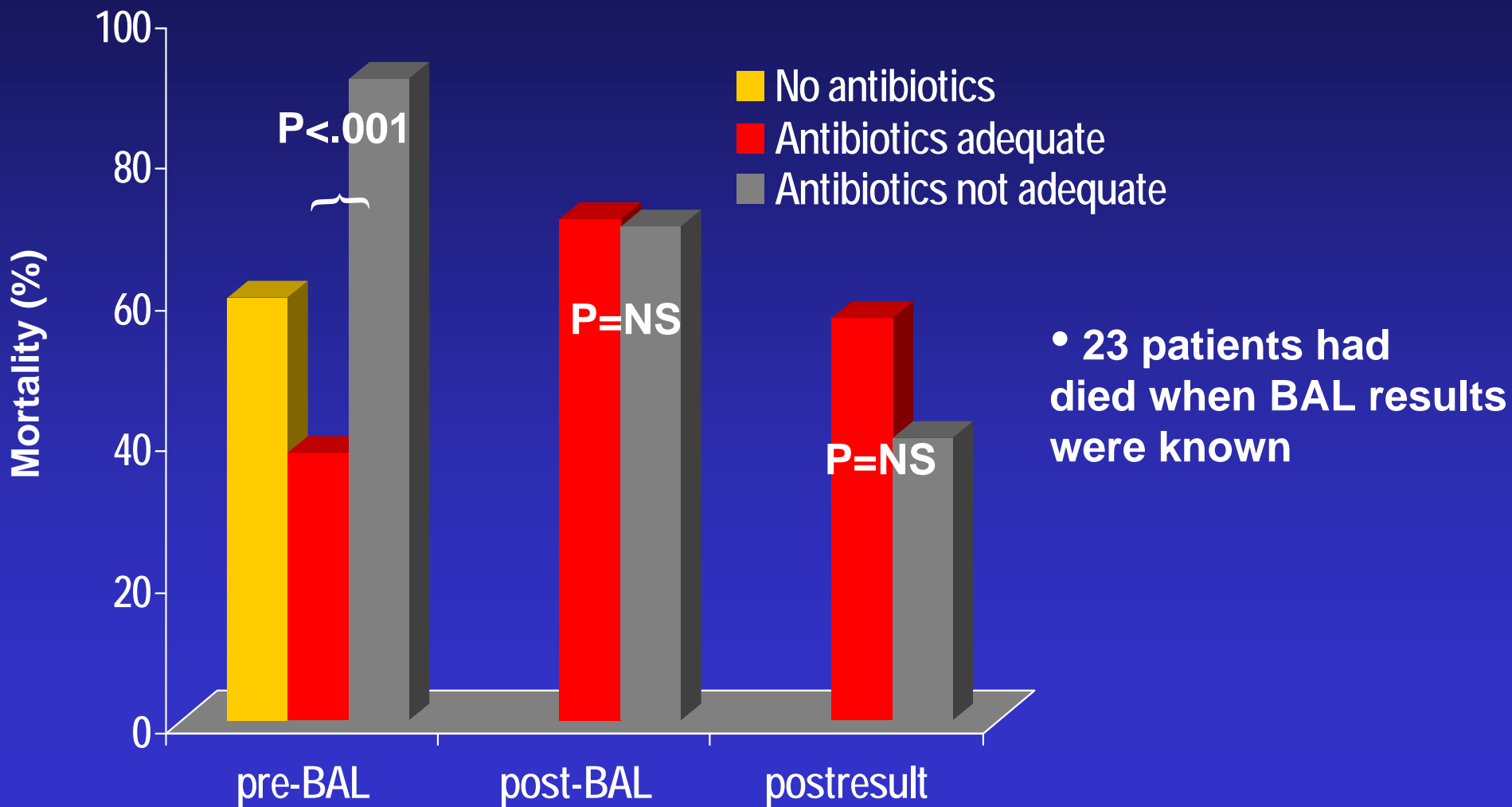
Invasiveness



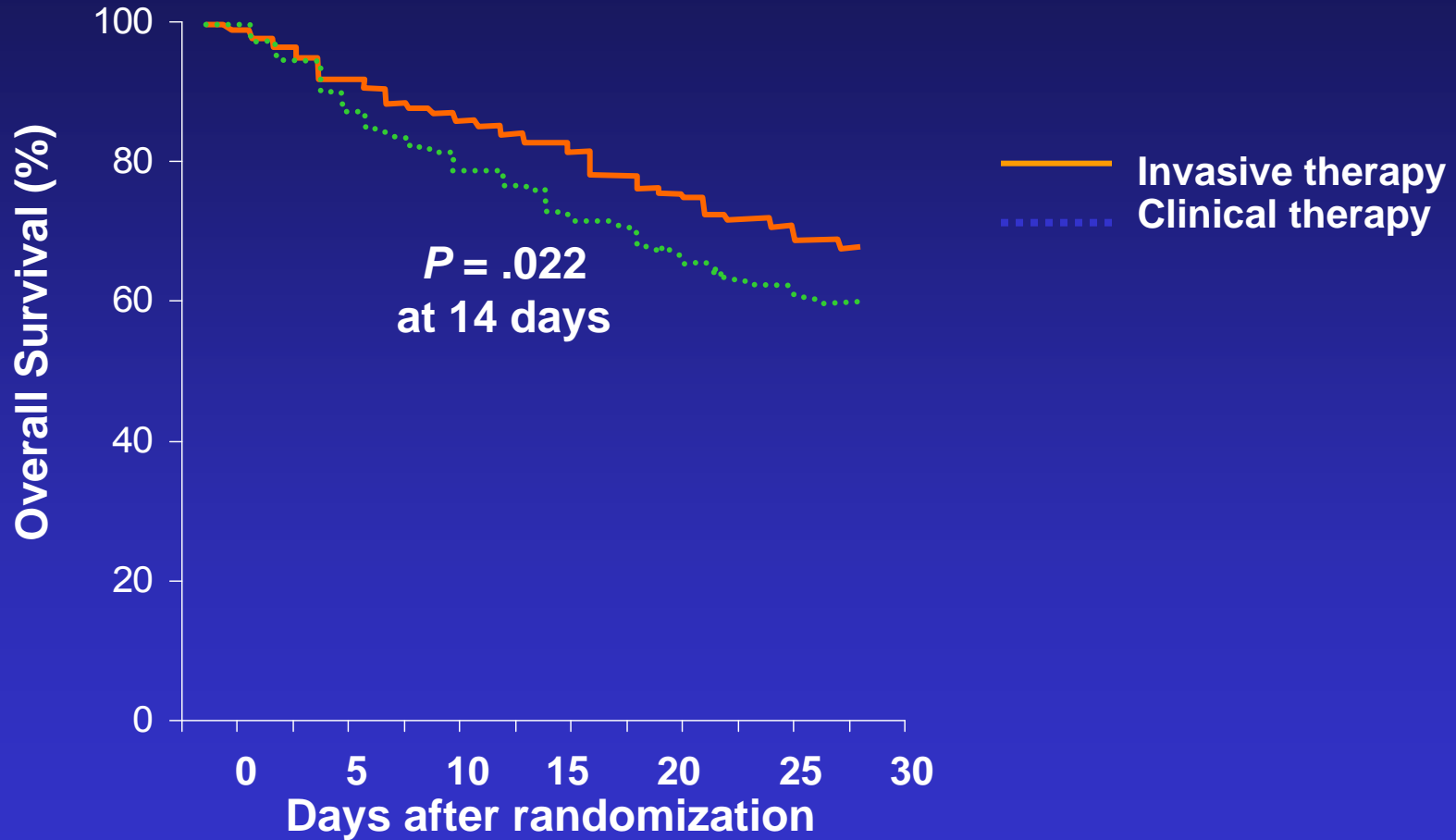
Effect of Appropriate Antibiotics on Mortality in Nosocomial Pneumonia



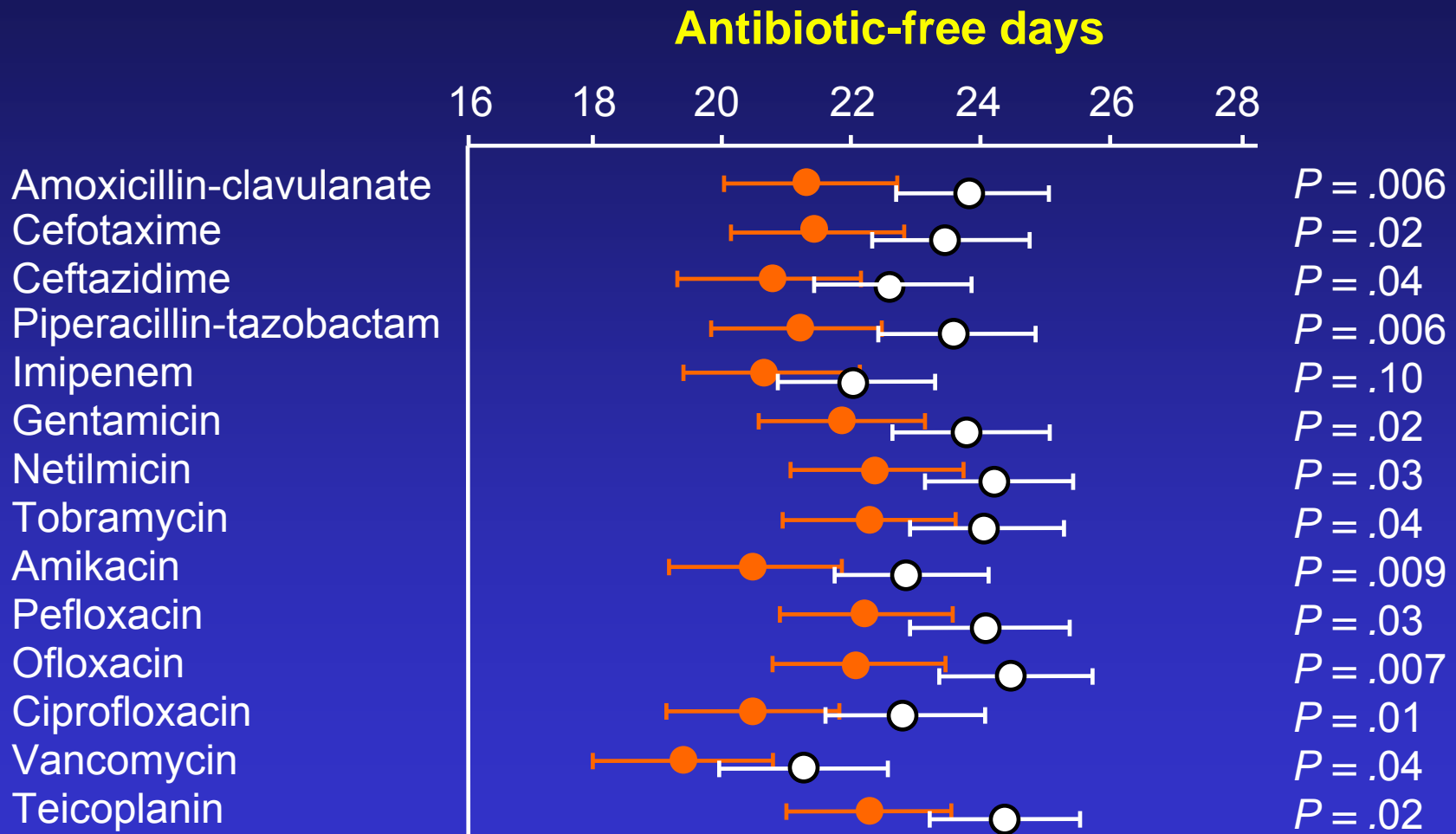
Mortality in Patients with BAL-positive Nosocomial Pneumonia



28-day Survival in Patients with Different Management Strategies



Survival without Antibiotics



● Clinical management
● Invasive management

Fagon, et al. *Ann Intern Med* 2000;132:621

Algorithm for Initiating Empiric Antibiotic Therapy

Empiric Antibiotic Therapy for HAP

**HAP, VAP, or HCAP suspected
(all disease severity)**

**Late onset (>5 days) or
risk factors for
MDR Pathogens**

No

Yes

**Limited Spectrum
Therapy**

**Broad Spectrum
Therapy for MDR Pathogens**

Control of Cephalosporin Resistance

| | 1995 | 1996 | % change |
|----------------------------------|------|------|---------------------|
| All cephalosporins (grams) | 5558 | 1106 | - 80 [†] |
| Imipenem (grams) | 197 | 474 | + 141 ^{††} |
| – Ceftazidime-resistant | | | |
| <i>K. pneumoniae</i> (incidence) | 150 | 84 | - 44 [†] |
| Per 1,000 patient days | 0.75 | 0.48 | - 36 |
| – Multidrug-resistant | | | |
| <i>K. pneumoniae</i> (incidence) | 8 | 0 | |
| – Imipenem-resistant | | | |
| <i>P. aeruginosa</i> (incidence) | 67 | 113 | + 69 ^{††} |

Management of Sepsis in ITU

- **Obtain appropriate cultures**
 - Two blood cultures
 - From vascular access inserted >48 h
 - Other relevant cultures
- **Begin iv, broad spectrum antibiotics ASAP, always within the 1st hour of diagnosis**
 - Reassess spectrum daily
 - Duration 7-10 days, longer if undrainable foci are present
- **Implement source control measures**

Strategies to Prevent Emergence of Resistance in ITU

- Antibiotic cycling has limited value
- Successful interventions
 - Antibiotic heterogeneity
 - Shorter courses of treatment
 - De-escalation therapy depending on the culture results

Conclusions

- **Management of infection in the ITU is a multitask approach**
- **Local surveillance data are necessary**
- **Invasive vs non-invasive diagnostics should be decided on patient basis**
- **Initial empirical antimicrobial regimen should be initiated ASAP and should be appropriate**
 - **“Hit hard” then “focus & de-escalate”**
 - **Cover resistant pathogens**