

Antimicrobial Therapy & Infection Control

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Introduction I

- **Antibiotics were hailed as “miracle drug” after their initial introduction in the 1940s**
- **In 1967 US surgeon General William H. Stewart reportedly declared that it was time to “close the book” on infectious diseases**
- **However, the emergence of new infectious diseases & development of AR underscored the continued importance of Rx of infectious diseases**



Introduction II

- **Antimicrobial consumption costs more than \$ 7 billion annually in the US (\$ 4 billion for HAI due to AR bacteria)**
- **Antimicrobials account for up to 30% of hospital drug budget**
- **Up to 50% of antimicrobial usage in US hospitals is inappropriate in spite of strict control measures**



Antimicrobial Resistance

- **AR is increasing worldwide despite efforts to minimize the problem**
- **AR is a naturally occurring phenomenon, but the process is amplified by misuse of antimicrobials**
- **Resistance commonly stems from inadequate Rx or overuse**
- **Interventions are centered on reduction of antibiotic use**



Increase in
antibiotic use

Increase in
resistant strains

Limited treatment
alternatives

- more antibiotics
- increased mortality

Ineffective empiric
therapy

- increased morbidity
- more antibiotics

Increased
healthcare
resource
use

Increased
hospitalisation

- more antibiotics



Antimicrobial Resistance

- **50% of antibiotic consumption in developing countries is in humans & 50% is in animals**
- **80% of human consumption occurs in the community & 20% in hospitals**
- **Within the community, 80% of antibiotic use is for treatment of RTI (the majority being viral in etiology)**
- **Many of the major resistance emanate from the hospital environment**



Impact of increasing HAI due to AR bacteria

- Prolonged hospitalisation
- Increased risk of death
- More toxic/expensive therapy needed
- Increased chance of inappropriate therapy
 - independent risk factor for increased mortality
- Increased costs

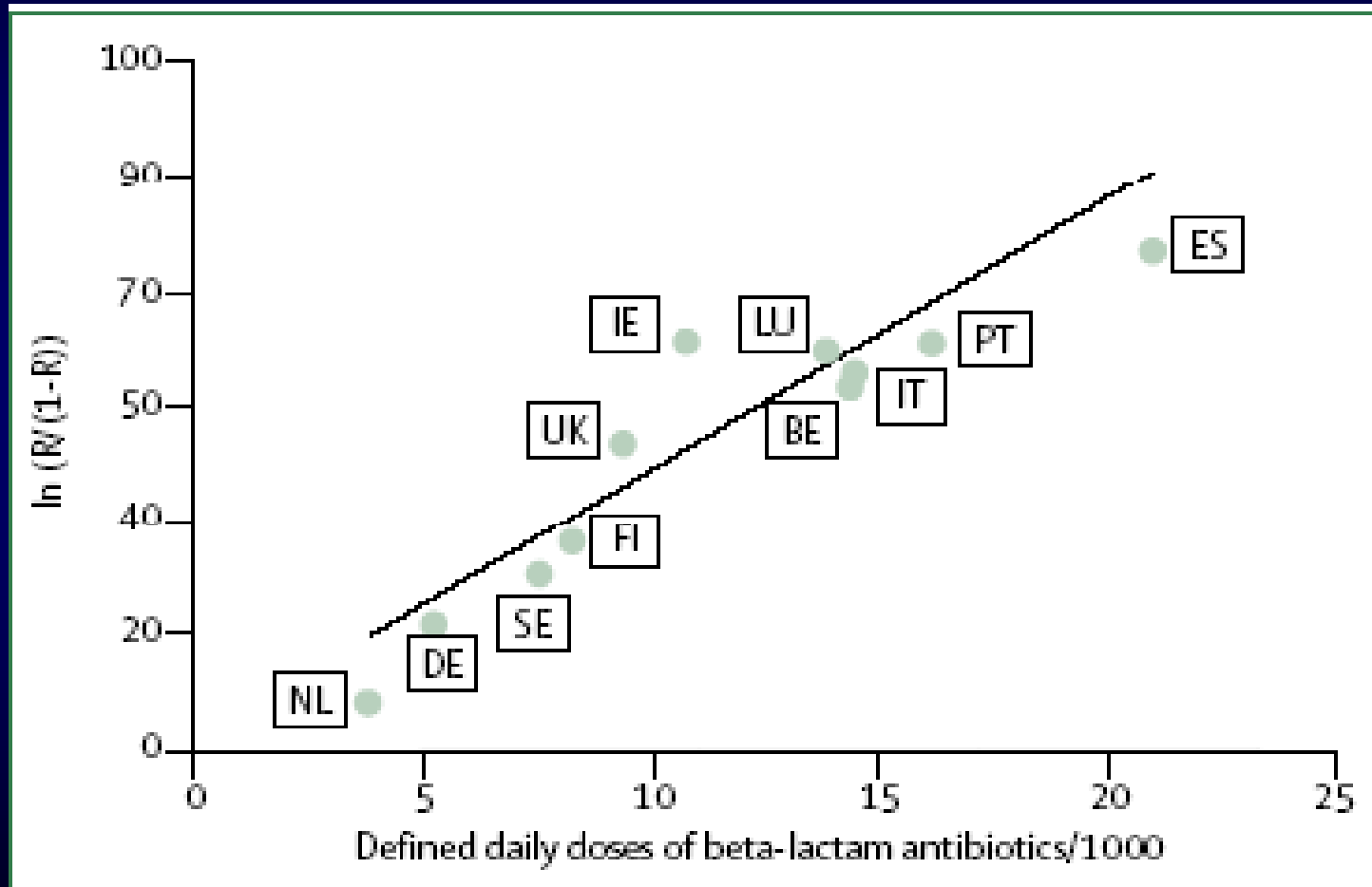


Antibiotic resistance: implications for treatment

- Start with the appropriate empiric antibiotic first in nosocomial infections
- Administer antibiotics at the right dose for the appropriate duration
- If appropriate, change antibiotic dosage or therapy based on resistance and pathogen information
- Recognise that prior antimicrobial administration is a risk factor for the presence of resistant pathogens
- Know the unit's resistance profile and choose antibiotics accordingly



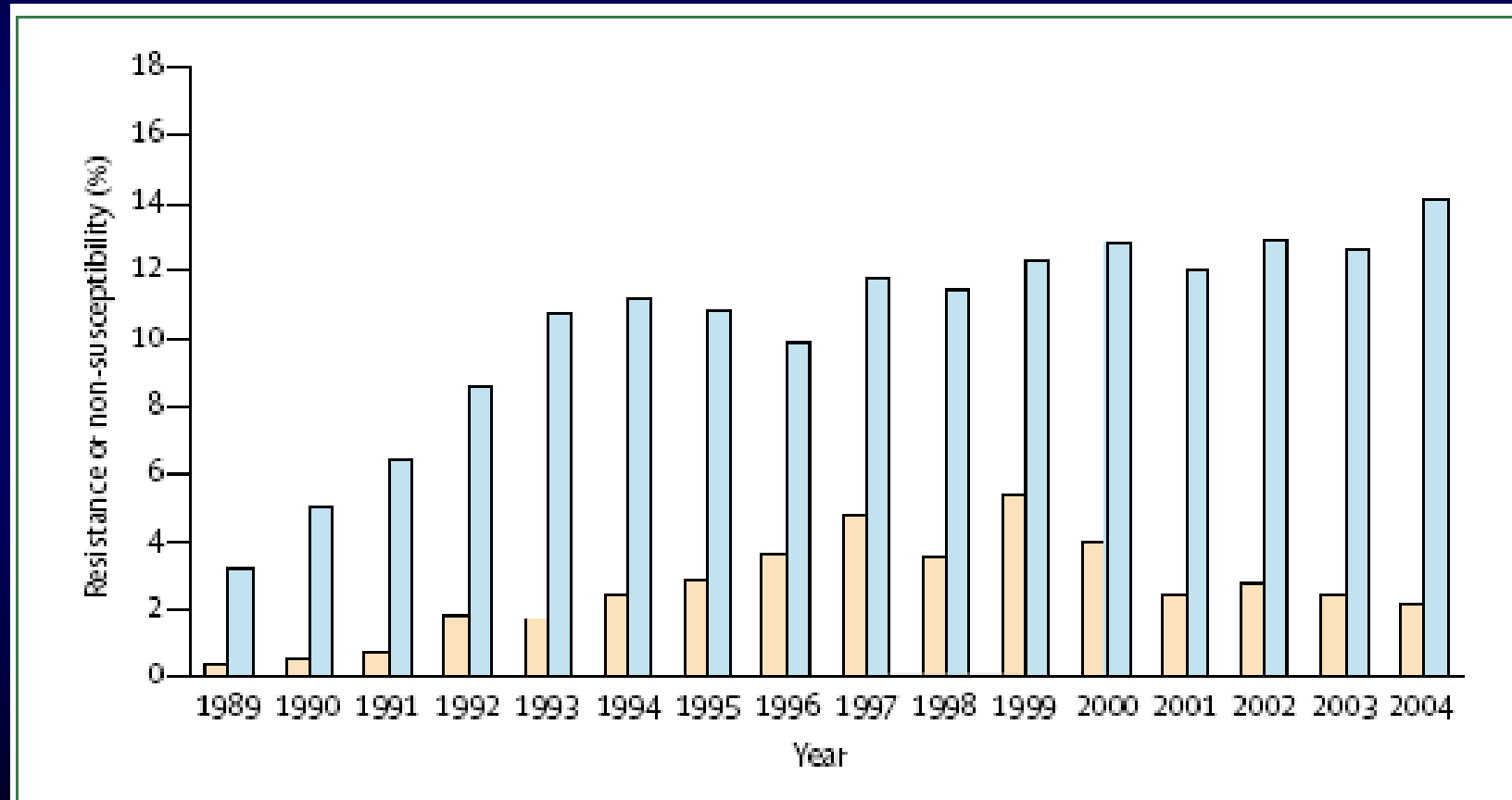
Penicillin Resistance in Pneumococci Versus outpatient Beta-lactam Sales



Livermore DM Lancet Infect Dis 2005; 5: 450-59



Resistance Trend to Penicillin (Yellow) & Macrolides (Blue) among *S.pneumoniae* from Bacteremias in England and Wales

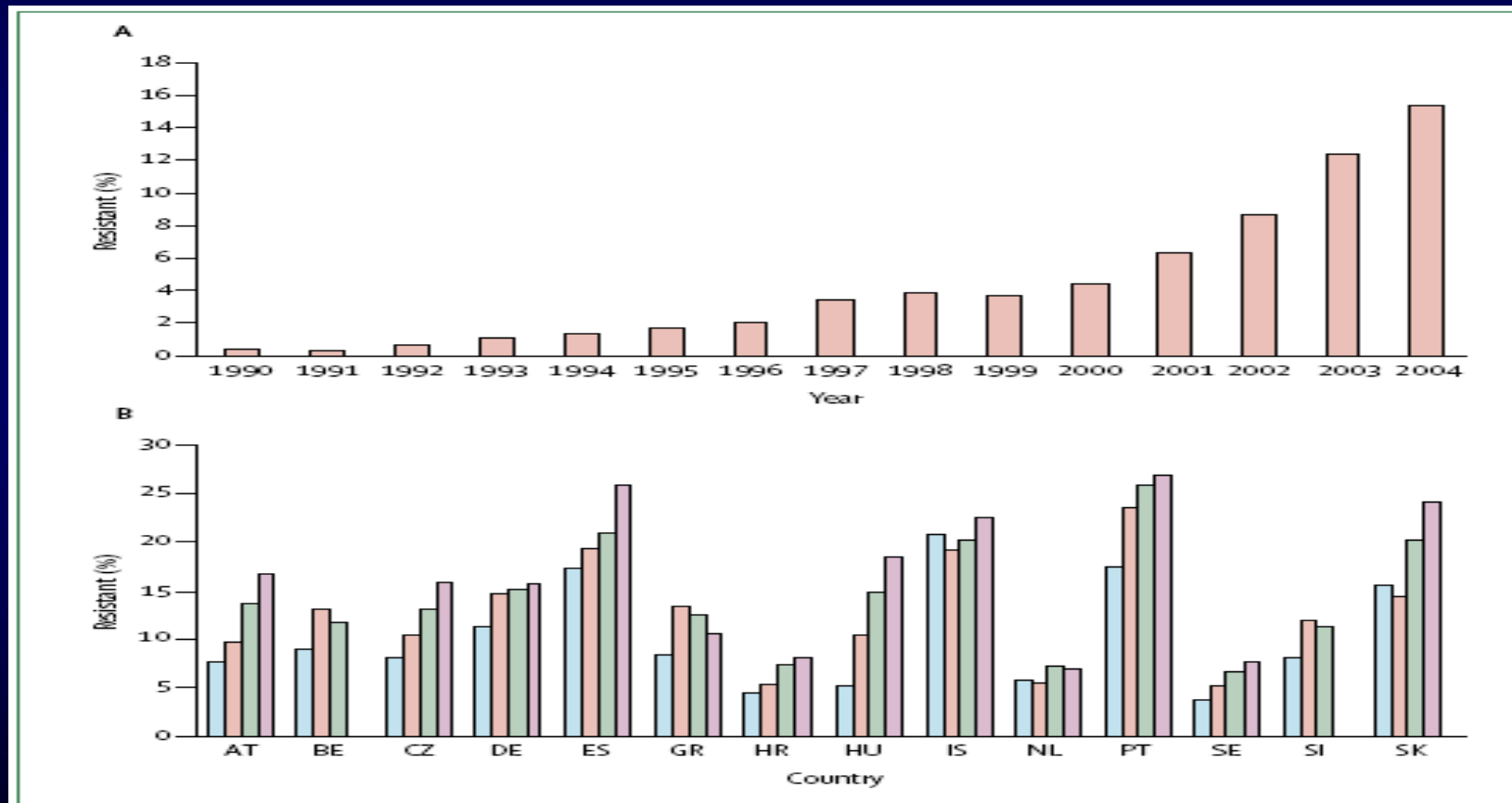


Livermore DM *Lancet Infect Dis* 2005; 5: 450–59



(A) Resistance trends to ciprofloxacin in *E coli* from bacteraemias in England and Wales, 1990–2004.

(B) Resistance trends to fluoroquinolones in *E coli* from European countries, 2001–04



Recommendations from the European Union conference on 'the Microbial Threat', held in Copenhagen in 1998 (the Copenhagen Recommendations 1998)

The EU and Member States must recognize that antimicrobial resistance is a major European and global problem.

The EU and Member States should set up a European surveillance system of antimicrobial resistance.

The EU and Member States need to collect data on the supply and consumption of antimicrobial agents.

The EU and Member States should encourage the adoption of a wide range of measures to promote prudent use of antimicrobial agents.

The EU, Member States, and national research councils should make co-ordinated research on antimicrobial resistance a high priority.

Pharmaceutical companies should be encouraged to develop new antimicrobial agents.

A way should be found to review progress with these recommendations and proposals.



Why The Unnecessary Use of Antimicrobials

- **Inadequate knowledge and support for prevention, diagnosis, and treatment of infectious diseases**
- **False expectation of the benefits of antimicrobials to health**
- **Unawareness of effects of antimicrobial use on emergence of resistant microbes**
- **Economic benefits to drug sellers and prescribers**



Factors Contributing to Increased Antimicrobial Resistance

- **Sicker patient population**
- **Larger immunocompromised population**
- **New procedures and instrumentation**
- **Emerging pathogens**
- **Complacency regarding antibiotics**
- **Ineffective infection control and compliance**
- **Increased antibiotic use**



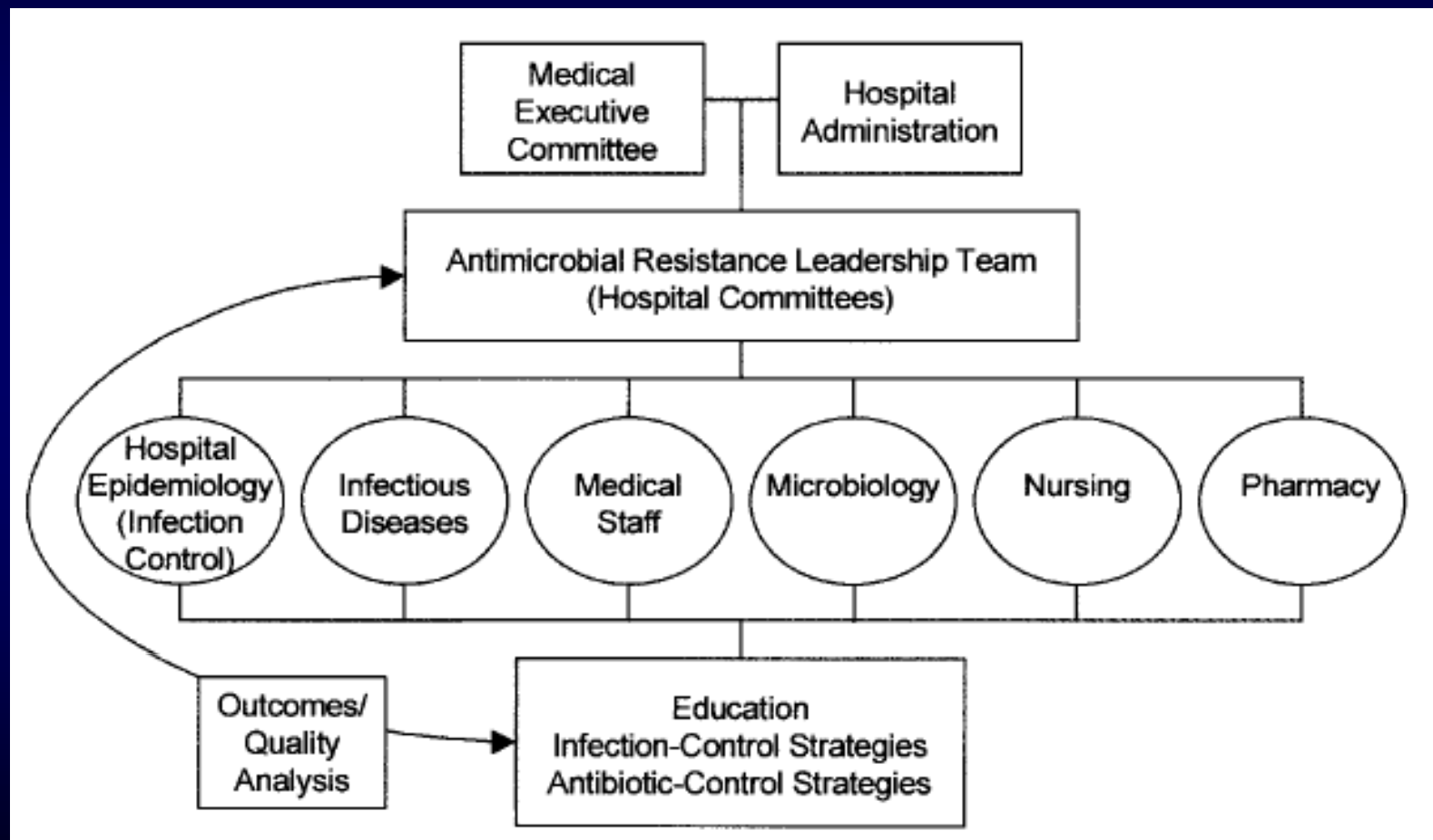
Recommendations for Prevention & Reduction of Antimicrobial Resistance in Hospitals

- **Implementation of a system for periodic monitoring of AR in community and nosocomial isolates**
- **Implementation of a system for periodic monitoring of antibiotic use according to hospital location and/or prescribing service**
- **Monitoring of relationship between antibiotic use and AR; assignment of responsibility through practice guidelines**
- **Application of contact isolation precautions in patients known or suspected to be colonized or infected with epidemiologically important microorganisms**

Shales DM, et al Clin Infect Dis 1997; 95: 584–599



Structure of a Hospital-Wide Quality-Improvement Program to Address AR



Use of Antimicrobial Agents

- **The most important factors contributing to the misuse of antimicrobial agents :**
 - Inadequate availability of trained personnel**
 - Excessive variety, poor quality, and public misconception about antimicrobial drugs**
 - Lack of diagnostic and epidemiologic information and facilities**
 - Healthcare system disincentives for appropriate use**



Inadequate Availability of Trained Personnel

- **No published data systematically address this important problem**
- **In countries with limited resources, insufficient number of:**

Infectious Disease physicians

Clinical pharmacists

Microbiologists

Hospital epidemiologist



Problems With Antimicrobial Drugs

- **Excessive variety (competitive business promotion, confuse prescribers and patients alike)**
- **Poor or inconsistent quality of drugs**
- **Public misconception about antimicrobial agents**



Lack of Diagnostic and Epidemiologic Information & Facilities

- **Physicians are forced to treat infections presumptively when they do not have sufficient info**
- **Funds to buy antimicrobial discs are unavailable**
- **Weakness in epidemiology capabilities lead to lack of AR surveillance data**



Health System Disincentives for Rational Use

- **“Over-the-counter” drugs**
- **Financial incentives for physicians and institutions to over prescribe**
- **Antimicrobial use in animal husbandry**



Controlling Antibiotic Resistance

- **Controlling Antibiotic use:**
 - 1) prescriber intervention
 - 2) Consumer intervention
 - 3) Regulatory intervention
 - 4) Restricting use of antibiotic in animals
- **Reducing disease burden and bacterial colonization**
 - 1) Public health measures
 - 2) Infection control in hospitals
 - 3) Vaccination programs
 - 4) Use of alternate nonantimicrobial therapies



Controlling Antibiotic Use

1) Prescriber Interventions

- **Improved diagnosis**
- **Practice or prudent use guidelines**
- **Practice profiling and feedback**
- **Education programs**
- **Delayed prescriptions**
- **Multifaceted physician directed interventions**



Controlling Antibiotic Use

2) Consumer Intervention

- **Educational in nature**
- **Types of intervention include use of:**
 - 1) Written material**
 - 2) Prescriber explanation**
 - 3) Presentations at day-care centers/ PHC/ school**
 - 4) Print and TV media**



Controlling Antibiotic Use

3) Regulatory Intervention

- **Drug Licensing**
- **Access to antimicrobials**



Controlling Antibiotic Use

4) Animal Use

- **Use of avoparcin banned in:**
 - Sweden in 1986
 - Denmark in 1995
 - Germany in 1996
 - EU in 1997
- **Further bans were introduced in the EU in 1998 on:**
 - Virginiamycin**
 - Tylocin**
 - Spiramycin**
 - Bacitracin**



Disease Burden & Colonization

1) Public Health Measures

- **Day care exclusions**
- **Sanitation**



Disease Burden & Colonization

2) Infection Control in Hospitals

- **Hand hygiene**
- **Barrier precautions:** (gloves, gowns, face masks, drapes)
- **Decontamination protocols:** (disinfection of equipment and environment)
- **Patient isolation/cohorting**
- **Traffic control**



Prevention of Resistance For The New Millennium

Hand-washing/
infection control



How Do Hands Contribute?

VRE can be recovered from hands

- 30 minutes after inoculation
- after hand washing with bland soap

VRE can NOT be recovered from hands

- after hand washing with CHG or
- 60 % isopropyl alcohol

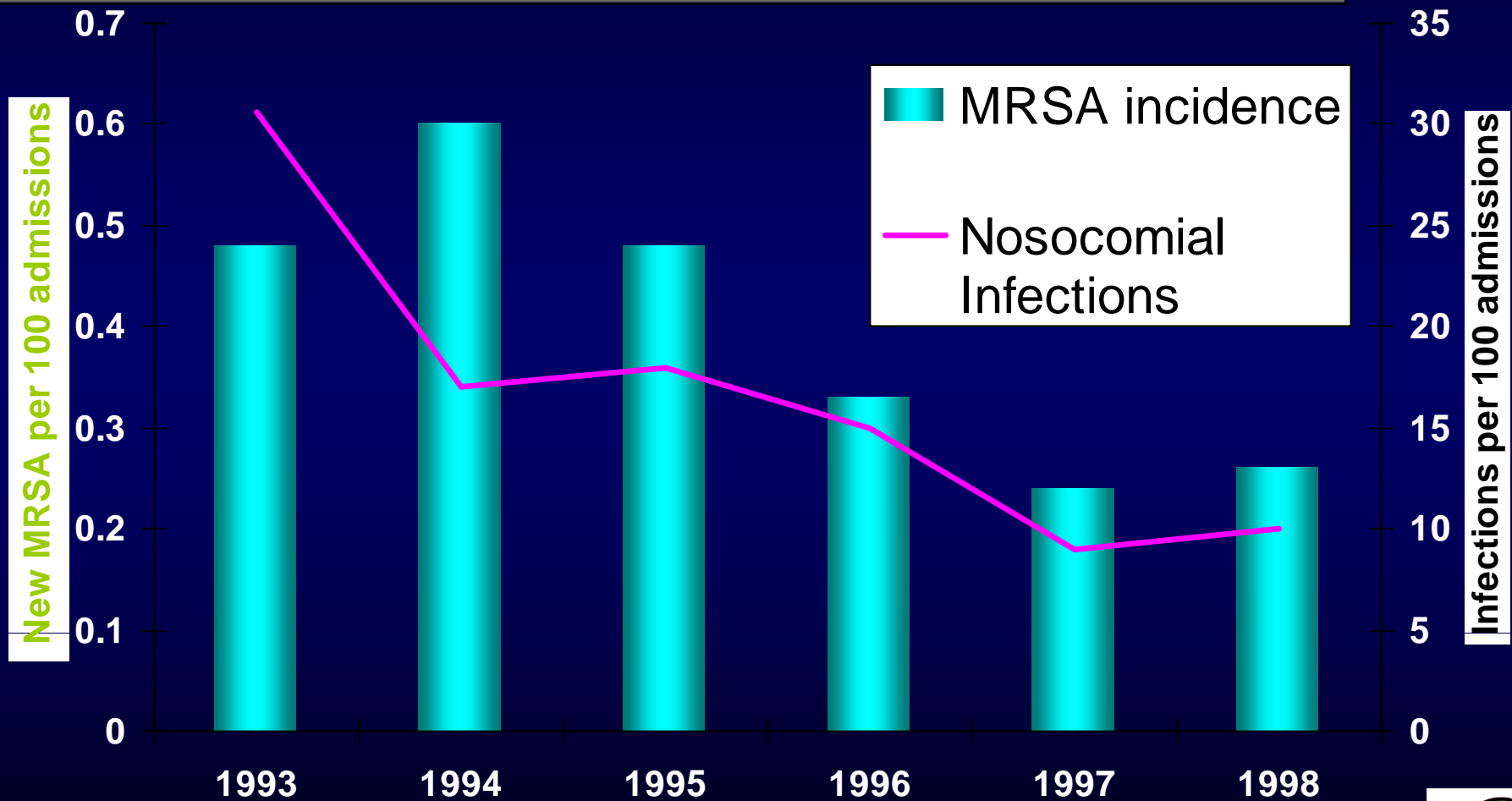


Handwashing compliance By Profession

Profession	Compliance
Registered Nurses	26%
Physicians	21%
Nurses Aides	14%
Respiratory Therapists	10%
Radiology Technicians	0%
Environmental Staff Services	0%
Medical Students	83%



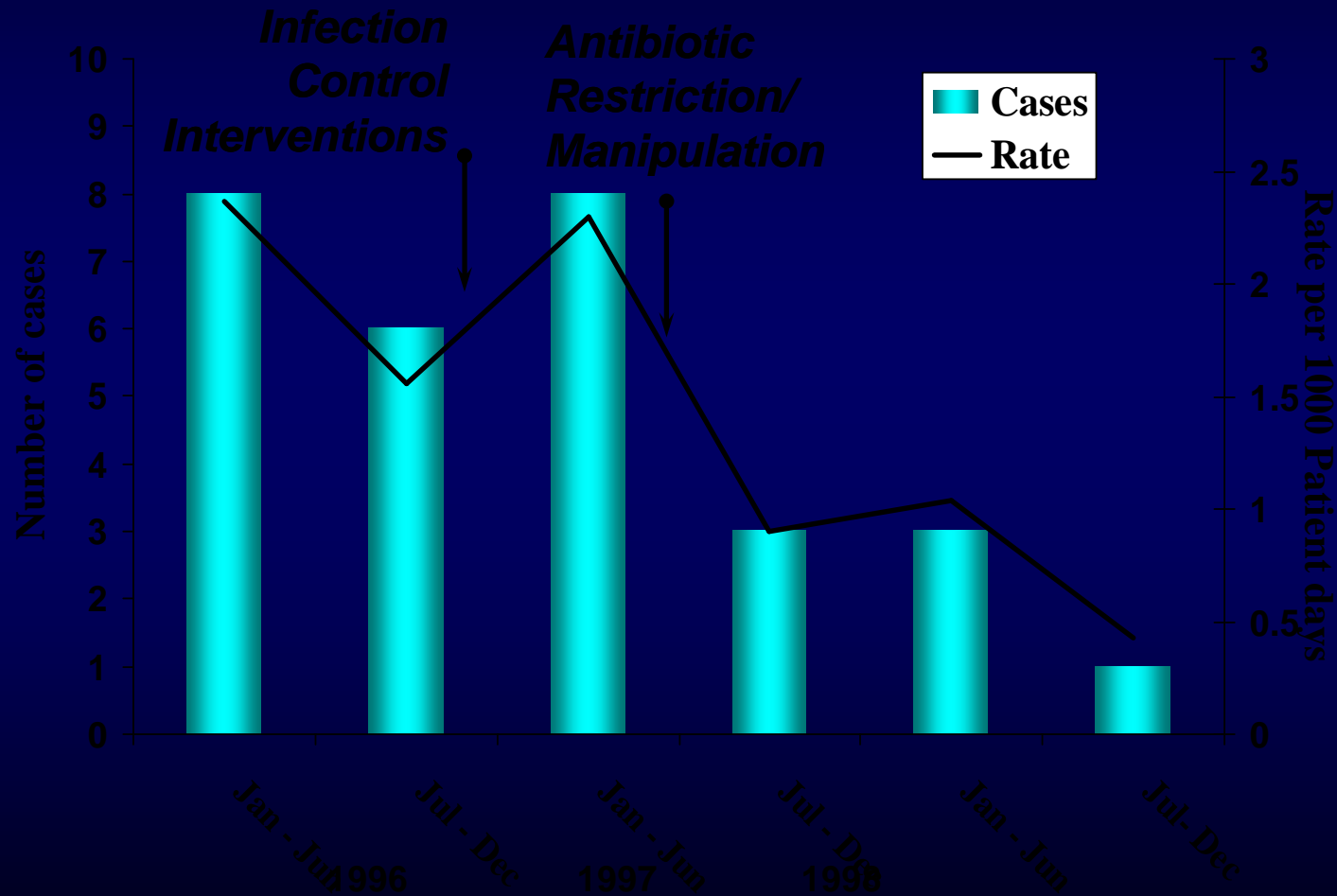
Infection Rates With Improved Hand hygiene



Pittet D, et al Lancet 2000; 356: 1307-12



JHH Transplant Service Nosocomial VRE BSI: 1996 - 1998



Hand Decontamination and Resistance

Year	Author	Setting	Impact on organisms
1982	Maki	Adult ICU	Decreased
1984	Massanari	Adult ICU	Decreased
1990	Simmons	Adult ICU	No effect
1992	Doebbeling	Adult ICU	Decreased with one versus another hand hygiene product
1994	Webster	Neonatal ICU	MRSA eliminated
1999	Pittet	Hospital	MRSA decreased



Global Patient
Safety Challenge
for 2005-2006: to
reduce health
care-associated
infections worldwide



**“Clean Care
is Safer Care”**



The Guidelines

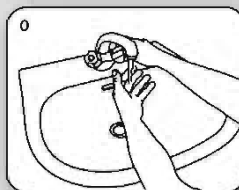


Key issues for action

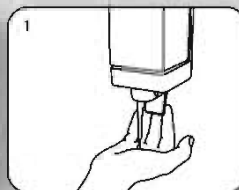
- Handwashing with soap and water when hands are visibly dirty
- Adoption of alcohol-based hand rub as the *gold standard* in all other clinical situations, whenever possible



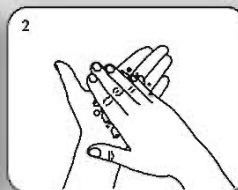
Handwashing Technique with Soap and Water



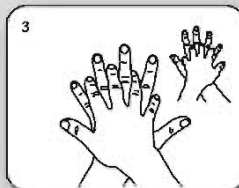
Wet hands with water



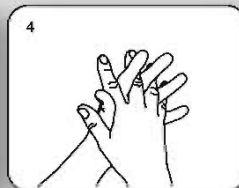
apply enough soap to cover all hand surfaces



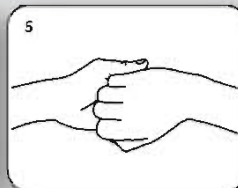
rub hands palm to palm



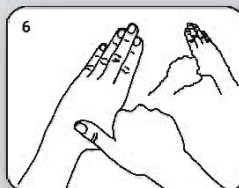
right palm over left dorsum with interlaced fingers and vice versa



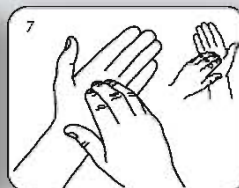
palm to palm with fingers interlaced



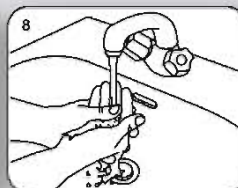
backs of fingers to opposing palms with fingers interlocked



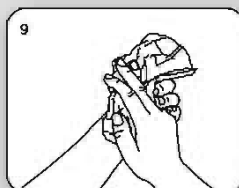
rotational rubbing of left thumb clasped in right palm and vice versa



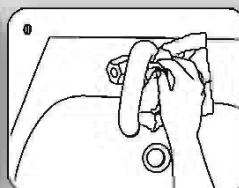
rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa



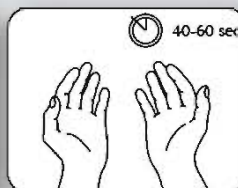
rinse hands with water



dry thoroughly with a single use towel



use towel to turn off faucet

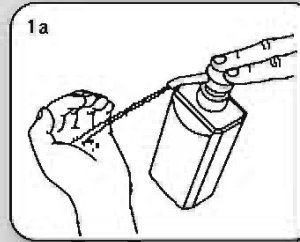


...and your hands are safe.

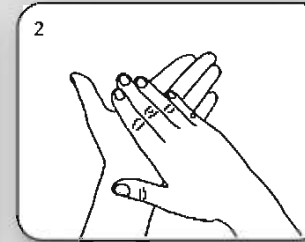
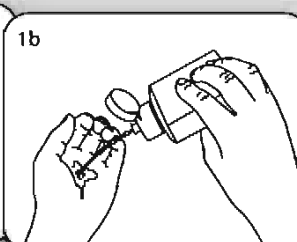
Modified according to EN1500



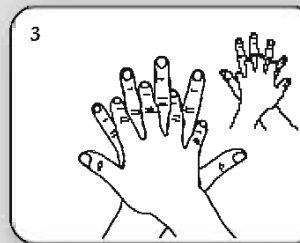
Hand Hygiene Technique with Alcohol-Based Formulation



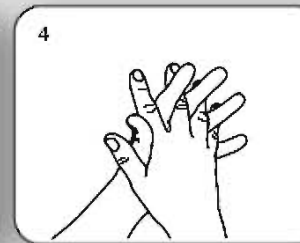
Apply a palmful of the product in a cupped hand and cover all surfaces.



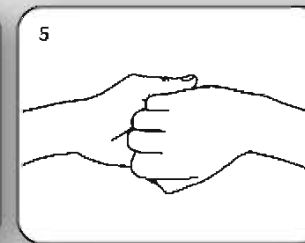
Rub hands palm to palm



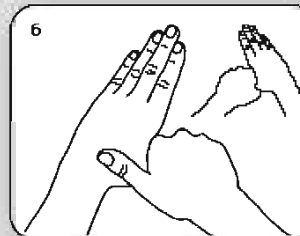
right palm over left dorsum with interlaced fingers and vice versa



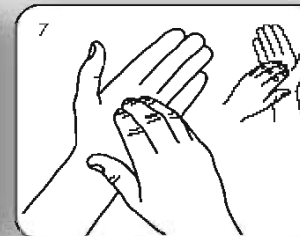
palm to palm with fingers interlaced



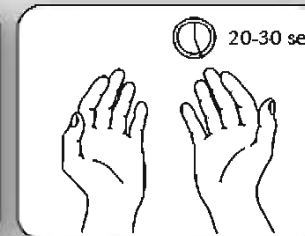
backs of fingers to opposing palms with fingers interlocked



rotational rubbing of left thumb clasped in right palm and vice versa



rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa

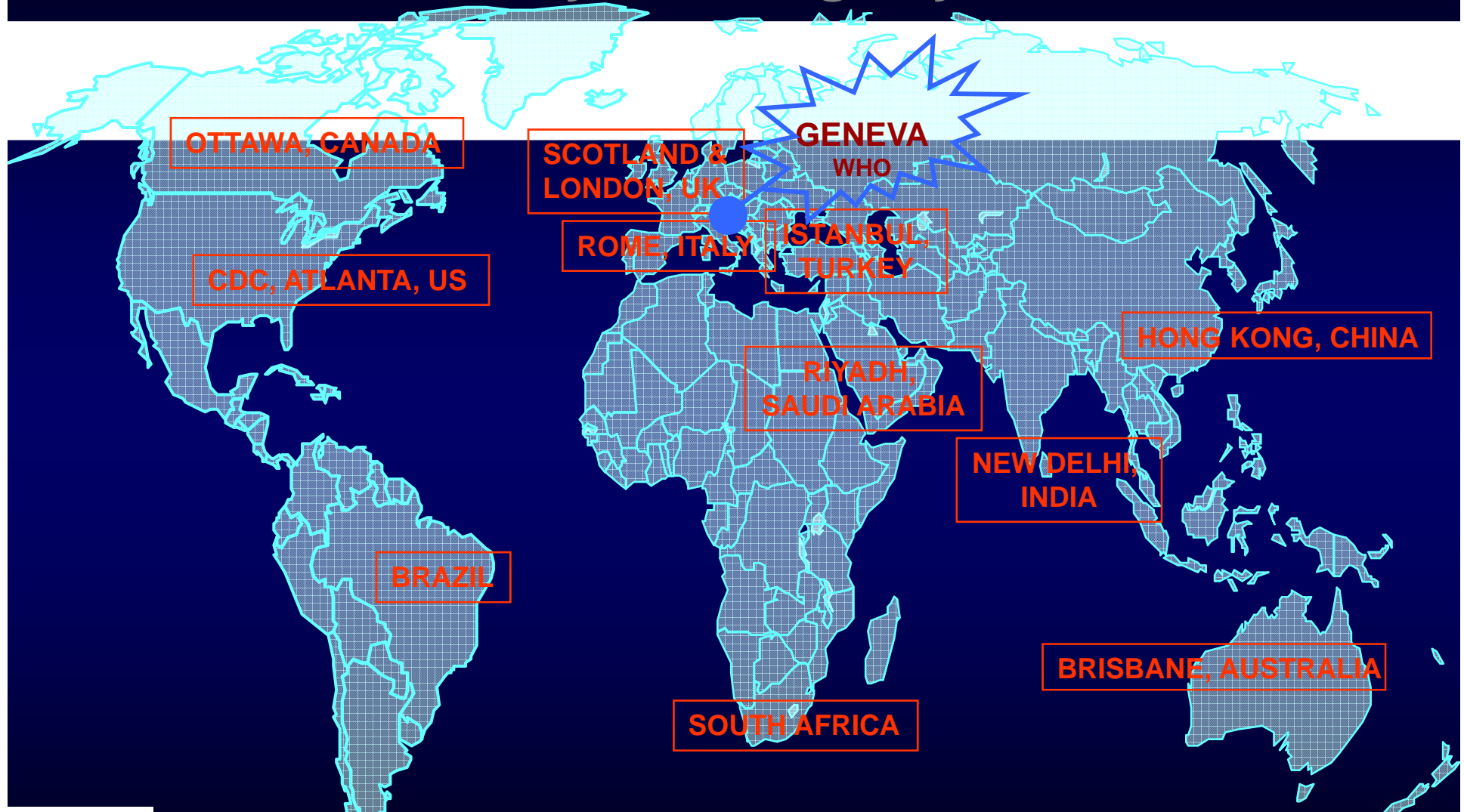


...once dry, your hands are safe.

Modified according to EN1500



Countries participating in the launch of the Global Patient Safety Challenge by video link







Countries to Launch the WHO Hand Hygiene

✿ Ireland	March 06
✿ China	April 06
✿ Malaysia	May 06
✿ India/Russia	July 06
✿ Spain	Oct 06
✿ Malta	Nov 06
✿ Pakistan	Dec 06



Disease Burden & Colonization

3) Vaccination Programs

- **Prevention of disease by vaccination reduces the overall burden of disease**
- **There is evidence that vaccines may reduce carriage of resistant organisms**



Disease Burden & Colonization

4) Alternate Nonantimicrobial Therapies

- Use of probiotics or bacteriotherapy (e.g. *Lactobacillus rhamnosus*, Cranberry juice)
- The mechanism by which probiotic therapy is thought to work include:

Immunomodulation

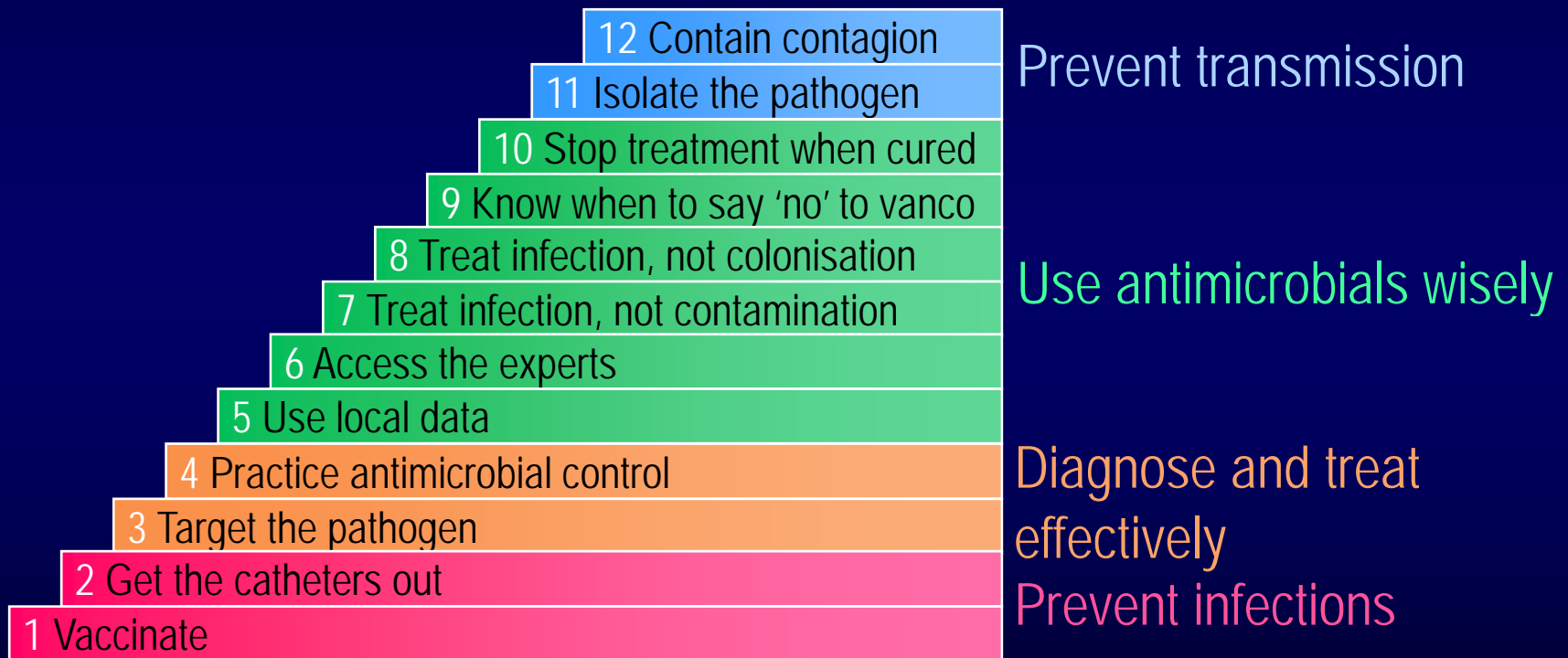
Competition with pathogenic organisms

Production of antimicrobial agents

Lactose digestion



The Steps to Redemption



Conclusions

- **Antimicrobial resistance is an increasing global problem**
- **Reducing the emergence of and preventing the spread of antimicrobial-resistant pathogens worldwide will require:**
 - **Antimicrobial stewardship**
 - AND**
 - **Improved infection control measures**



TH/



Implications of antibiotic resistance

- Negative impact on patient outcomes
 - decreased clinical response (treatment failures)
 - higher mortality
- Increased cost associated with antibiotic resistance (USA)
 - estimated unnecessary cost of resistance
 - \$4 billion annually
 - estimated \$100 million–\$30 billion
 - \$1–3 million per premature death



Costs associated with antibiotic resistance (USA)

Estimated unnecessary cost of resistance/year

1995
\$4 billion



2003
\$5.4 billion

1982
\$100 million–\$30 billion



2003
\$185 million–\$56.2 billion

Saravolatz LD et al. 1982
ASM 1995 Task Force Report
Phelps CE et al. 1989

