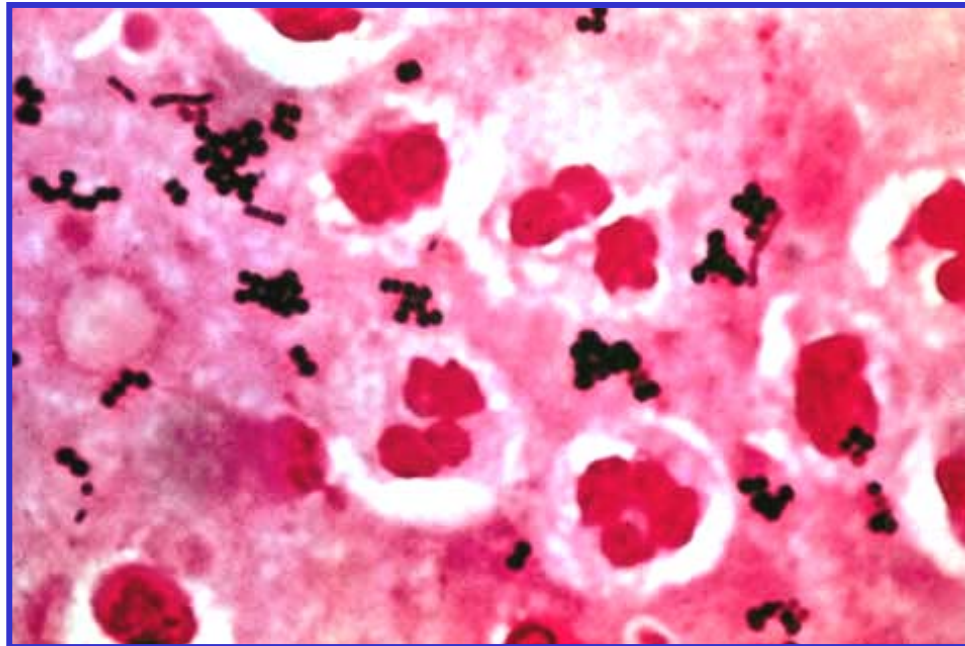


MRSA: Where are we now?



Gary French

Guy's & St Thomas' Hospital,

King's College London

Gary.french@kcl.ac.uk

Staphylococcus aureus is a major human pathogen

- Colonises the nose (\pm throat, gut, perineum) of ~30% of normals
- The commonest cause of minor and major skin sepsis etc
- Now ~90% resistant to penicillin by production of beta-lactamase
- Susceptible to methicillin
 - (oxacillin, cloxacillin, flucloxacillin) & ~10 other antibiotic classes

Staphylococcus aureus is a major cause of hospital infection

- The commonest
 - wound isolate
 - and surgical site and bone & joint infection
 - significant bacteraemia
 - dialysis shunt site infection
 - IV access site infection
- Increasing cause of ventilator-associated pneumonia

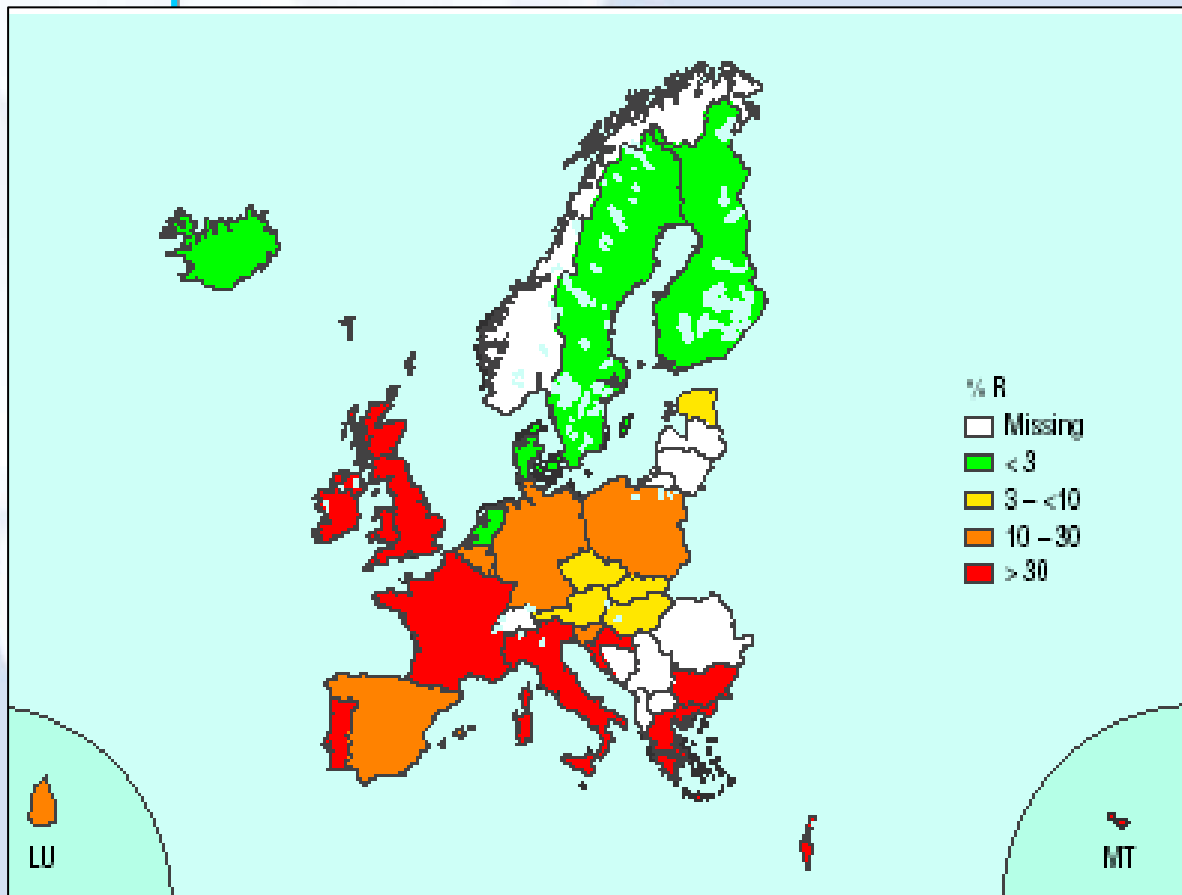
Methicillin-resistant *Staphyococcus aureus* (MRSA)

- Resistant to methicillin and all other β -lactams by cell wall changes
 - Encoded by *mecA*
- Often resistant to other antimicrobials
 - Hence Multi-Resistant *Staph aureus*
- MRSA have emerged by insertion of *mecA* into the chromosome of MSSA
 - new clones are emerging spontaneously

Methicillin-resistant *Staph aureus* (MRSA)

- Rare in 1960s, sporadic in 1970s, epidemic in 1980s, endemic from 1990s
- Mainly hospital- or healthcare-associated
- Prevalence is increasing worldwide

UK has one of the highest rates of methicillin-resistance in *Staph aureus* bacteraemias in Europe



UK ~45%,
Greece 55%

Netherlands,
Scandinavia <1%

MRSA Hospital Prevalence rates* in Europe 2001-2005⁽¹⁻²⁾

	2001	2005		2001	2005
Austria	8	13%	Denmark	0.8	2.0%
Belgium	22	31%	Finland	0.4	3.0%
Cyprus	na	56%	Sweden	0.9	1.0%
France	33	27%	Norway	na	<1%
Germany	18	21%	Netherlands	0.5	<1%
Greece	39	42%			
Ireland	42	42%			
Italy	41	37%			
Portugal	32	47%			
Romania	na	61%			
Spain	23	27%			
UK	45	44%			

*% of SA isolates that are MRSA

1. European Antimicrobial Resistance Surveillance System (EARSS) Annual Report 2001.

2. EARSS Annual Report 2005. (1-2) Interactive database results. Available at: www.rivm.nl/earss/result/Monitoring_reports/.

MRSA: A growing UK problem

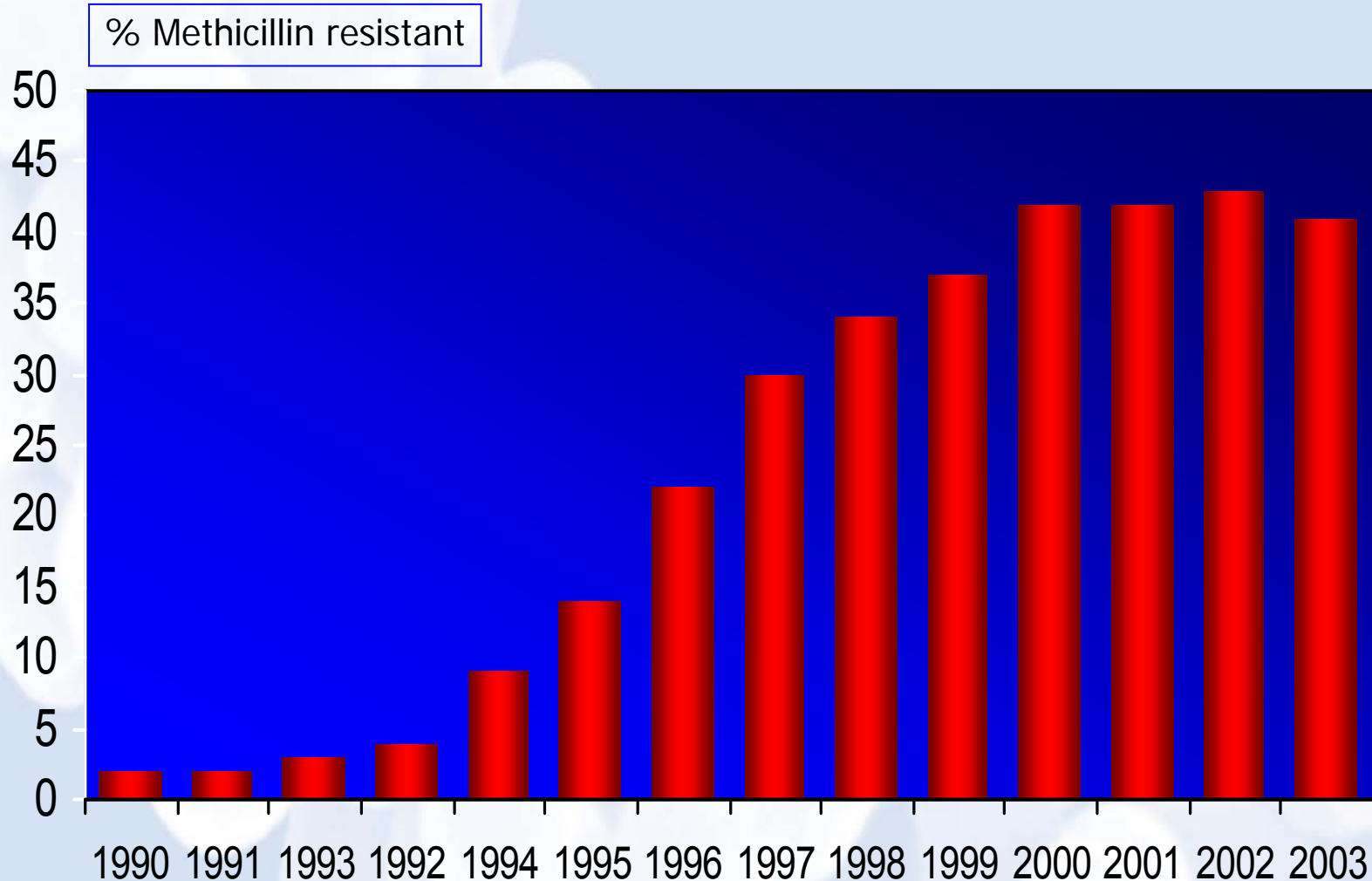
- The proportion of *S. aureus* bacteraemias due to MRSA rose from ~2% in 1992 to ~40% in 2003¹
- In 1997-98 nearly a quarter of all surgical-site infections were caused by MRSA²
 - Almost twice those caused by any other pathogen

1. National Audit Office. Improving patient care by reducing the risk of hospital acquired infection: A progress report. 14th July 2004. 2. Public Health Laboratory Service: Surgical Site Infection; analysis of a year's surveillance in English hospitals 1997-1998. London 1999.

Percentage of *Staph aureus* bacteraemia isolates that were MRSA

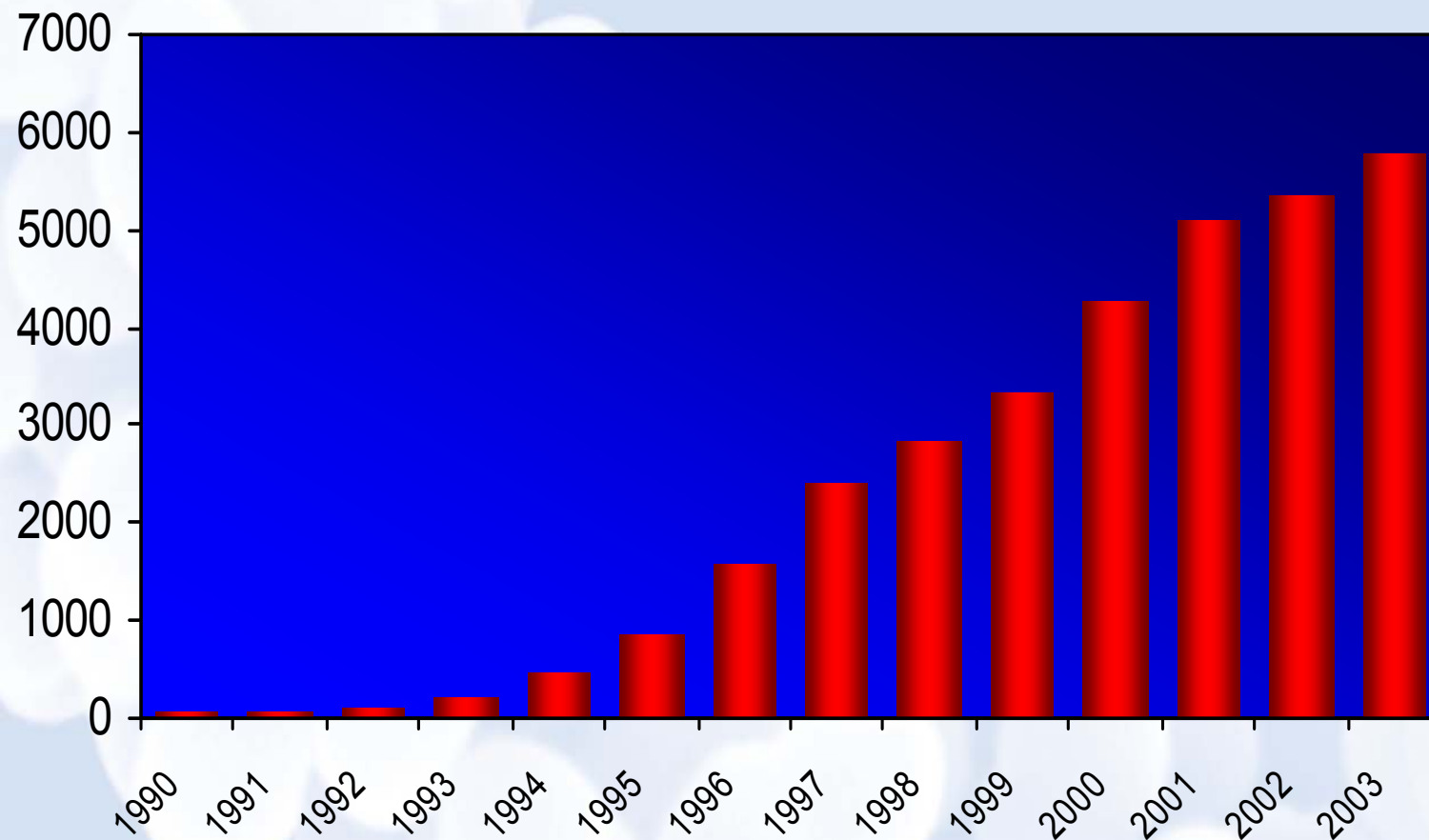
England & Wales 1990-2003

HPA website



No of MRSA bacteraemia isolates reported to the HPA England & Wales 1990-2003

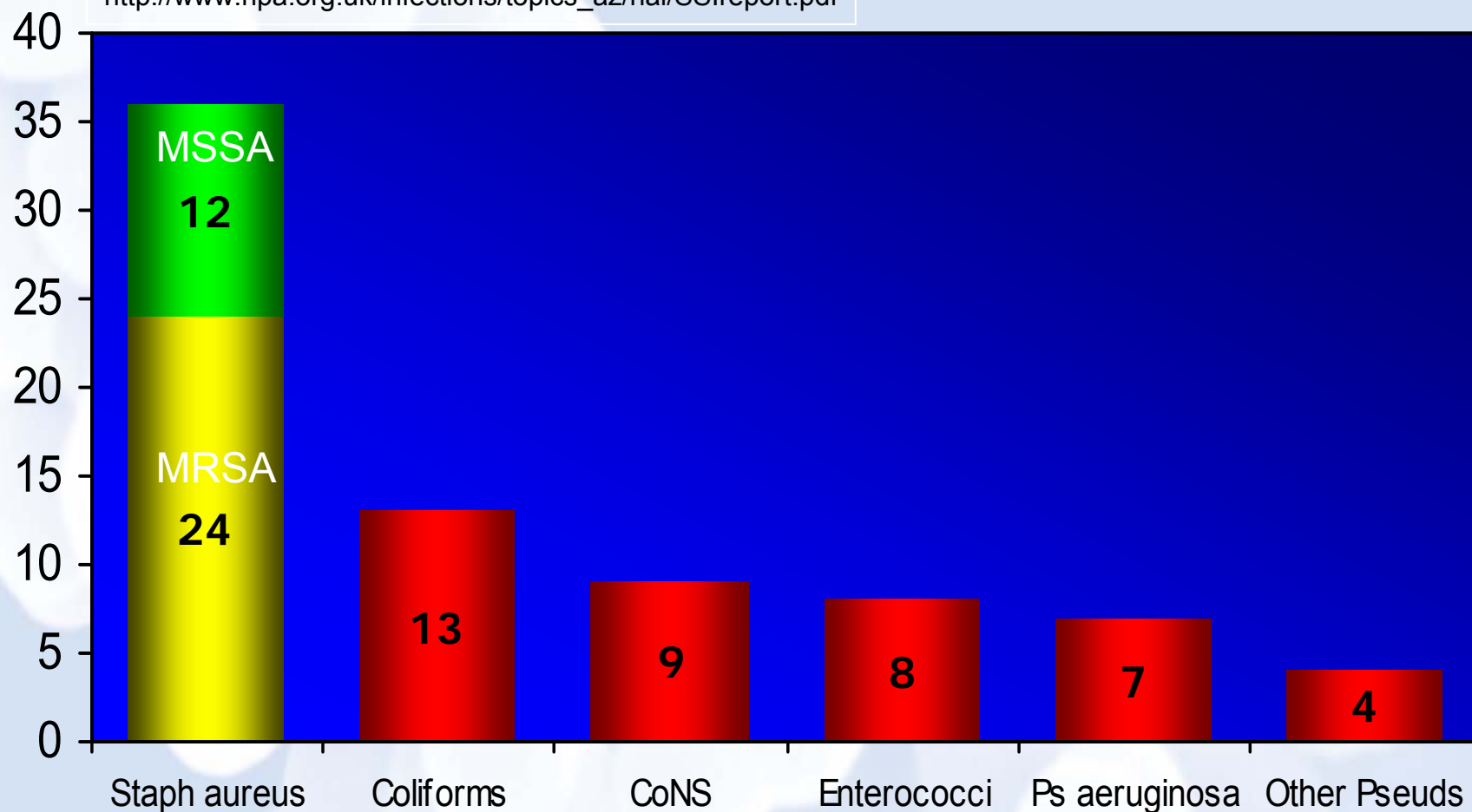
HPA website



MRSA is the leading cause of surgical site infection (SSI)

Distribution of micro-organisms (%) isolated from SSIs, England 1997-2002

http://www.hpa.org.uk/infections/topics_az/hai/SSIreport.pdf



Serious Consequences of MRSA Infections:

- Serious hospital SA infections are now usually MRSA & are associated with poor outcomes

Serious Consequences of MRSA Infections:

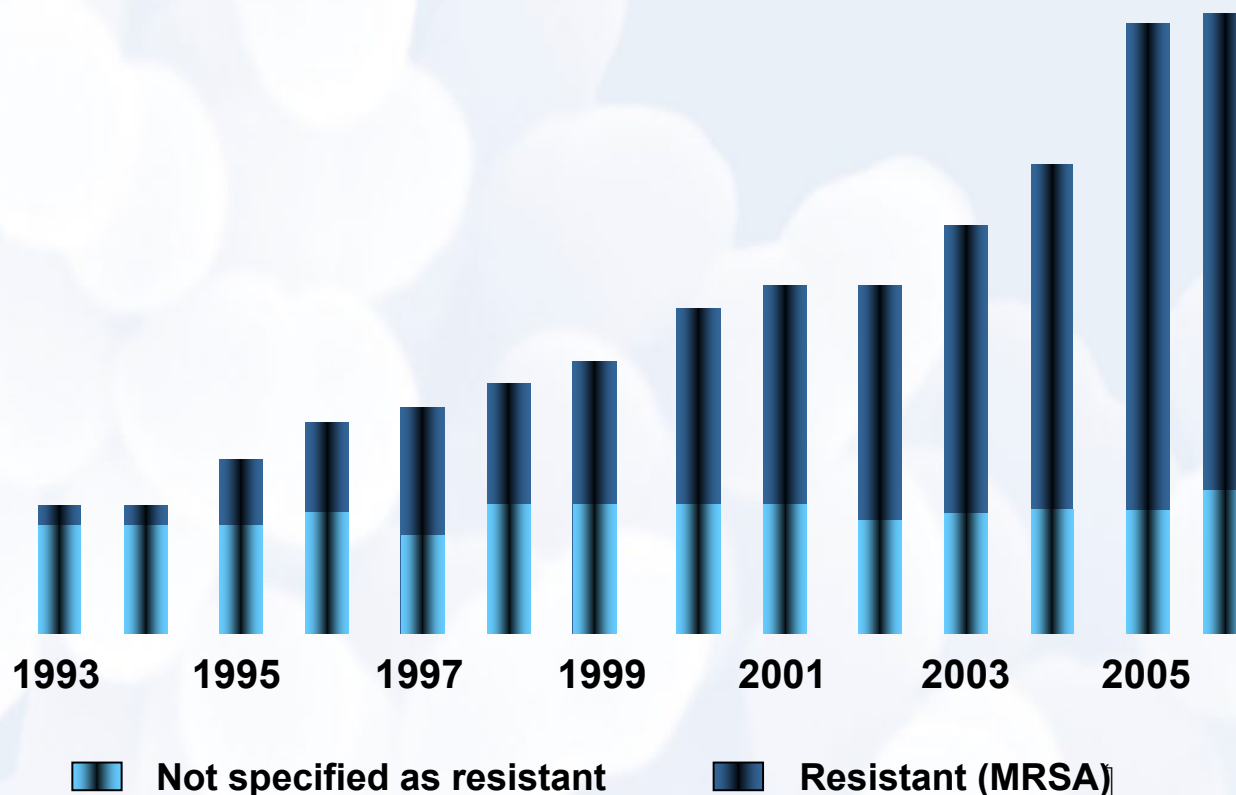
- Compared with MSSA, MRSA infections (controlled) have increased risk of:
- Mortality (x2)^(1,2), morbidity^(2,3), prolonged hospitalization⁽³⁾, increased healthcare costs and hospital resource utilization^(2,4)

- Cosgrove SE et al. Clin Infect Dis 2003;36:36:53–9.
- Engemann JJ et al. Clin Infect Dis. 2003;36:592-598.
- Stevens DL *et al.* Clin Inf Dis 2002;34:1481-90.
- Li Z *et al.* Pharmacotherapy 2001;21(3):263-74.

Death Certificates Mentioning *Staph aureus* By Meticillin Resistance, England & Wales

Office For National Statistics Feb 2008

Number of Deaths



Epidemiology of MRSA

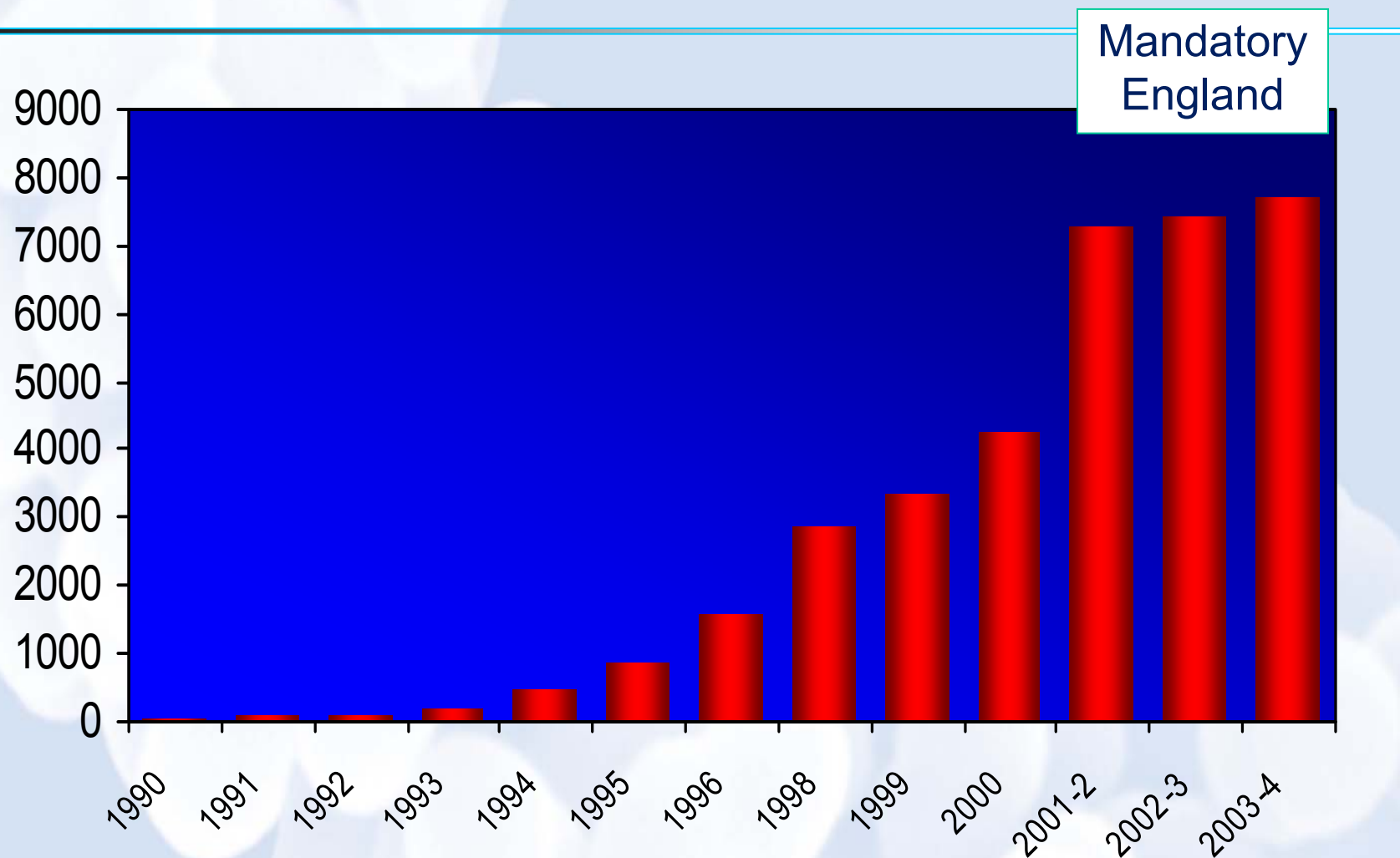
- Nearly always (in UK) hospital or healthcare associated
- Most are hospital acquired

Mandatory surveillance of MRSA bacteraemias

- MRSA = ‘dirty’ hospitals and poor hygienic practice
- Growing national public, media and political concern about MRSA
- The need to compare Trusts and assess what rates are ‘acceptable’
 - the ‘irreducible minimum’

No of MRSA bacteraemia isolates reported to the HPA England & Wales 1990-2004

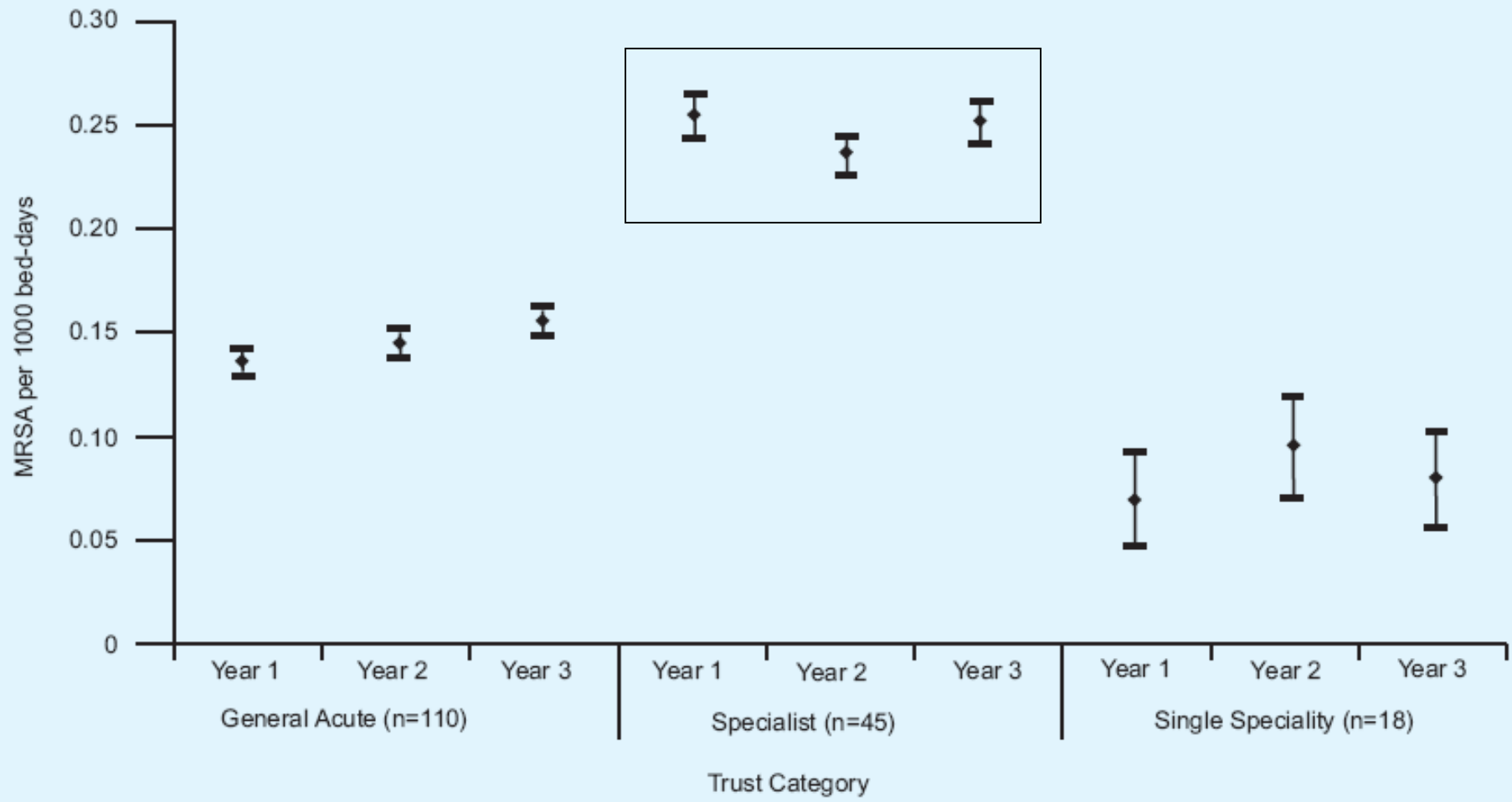
HPA website



The meaning of bacteraemia

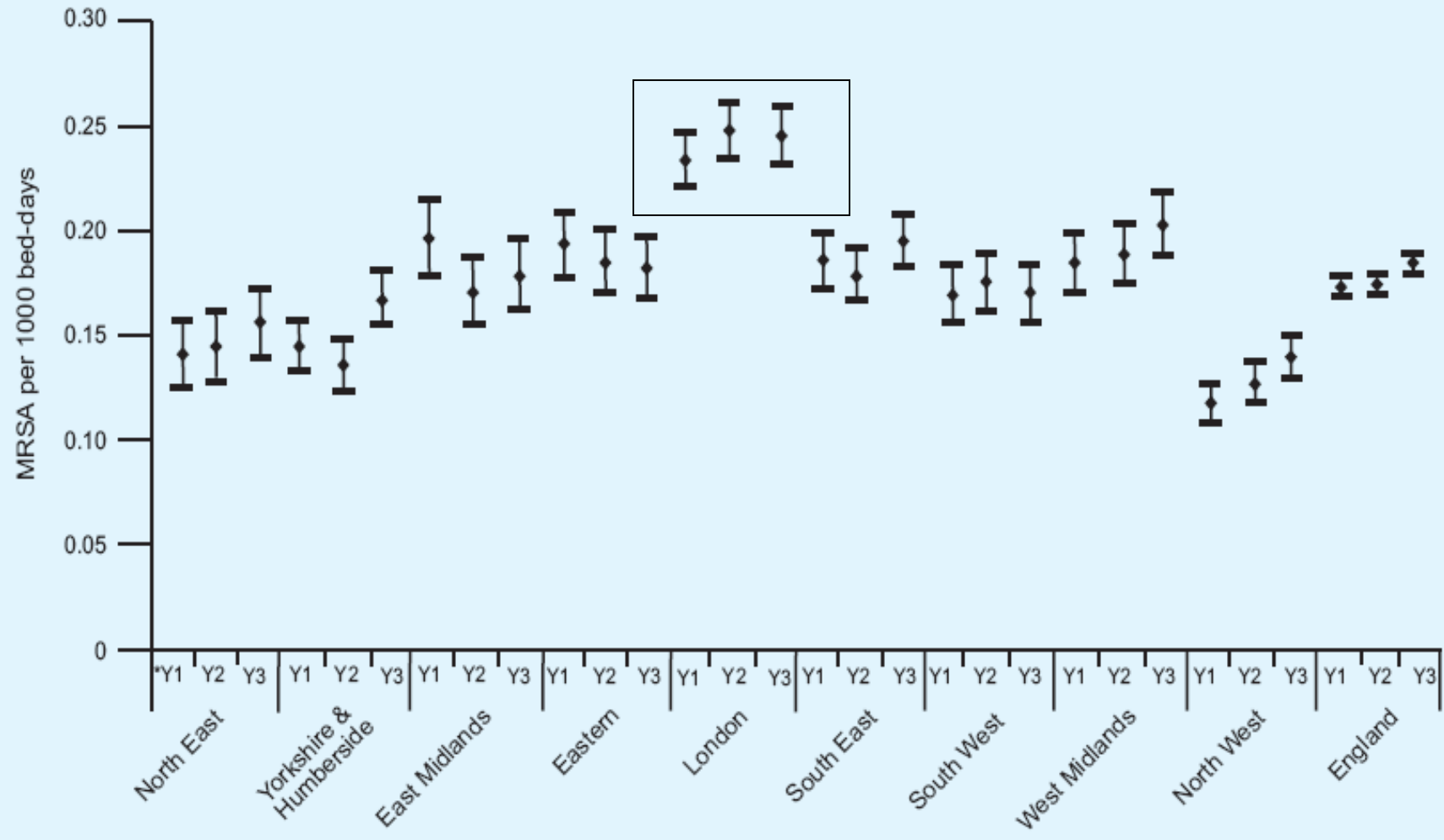
- **700 deaths**
- 7000 bacteraemias annually in England
- = 70,000 serious MRSA infections
- = 700,000 MRSA acquisitions
- **Many/most avoidable**

Figure 6 MRSA rates in different trust categories - the first three years of mandatory surveillance



*y = year

Figure 4 MRSA Rates from the first three years of mandatory surveillance by region



*y = year

Prevention and control of Healthcare-Associated Infections

- If we know the epidemiology of transmission
- We can intervene to break the chain of infection
- And prevent and control the HCAI

We know the epidemiology of MRSA

- Nearly always (in UK) hospital or healthcare associated
- MRSA is usually brought into hospital by patient carriers
- Colonisation precedes infection
- Organisms are usually transferred via staff hands

Mulligan ME et al, *Am J Med* 1993; 94: 313-328.

Boyce JM et al. *Infect Control Hosp Epidemiol* 1994;15(2):105-15.

Combined Working Party Report. *J Hosp Infect* 1998;39:253-290.

We know the epidemiology of MRSA

- Colonisation may last months/years
- Re-admitted/transferred patients are sources for new cross-colonisation/infection
 - ~3-5% of admitted patients are colonised
- This 'revolving door' has made national and international control difficult

Prevention and control of MRSA

- Identify and isolate infected/carrier patients
- Attempt to decolonise
- Decontaminate hands between each **and every** patient contact
- Clean the environment
- Ensure **strict** adherence to accepted hygienic practice
- **THIS IS A BUNDLE**

Reasons for failure

- Since the epidemiology is understood, the failure to control MRSA is due to a **failure of standard hygienic practice**
- Aggravated by
 - poor staff ratios, Increasing workload
 - Crowded wards, Lack of/poor facilities
 - Inadequate cleaning

MRSA data shocked many Trusts into taking serious action

- Priority/investment
- MRSA care pathway/Hand hygiene
- Education, audit, feedback, monitoring
- Zero tolerance of poor clinical practice
- Change of culture

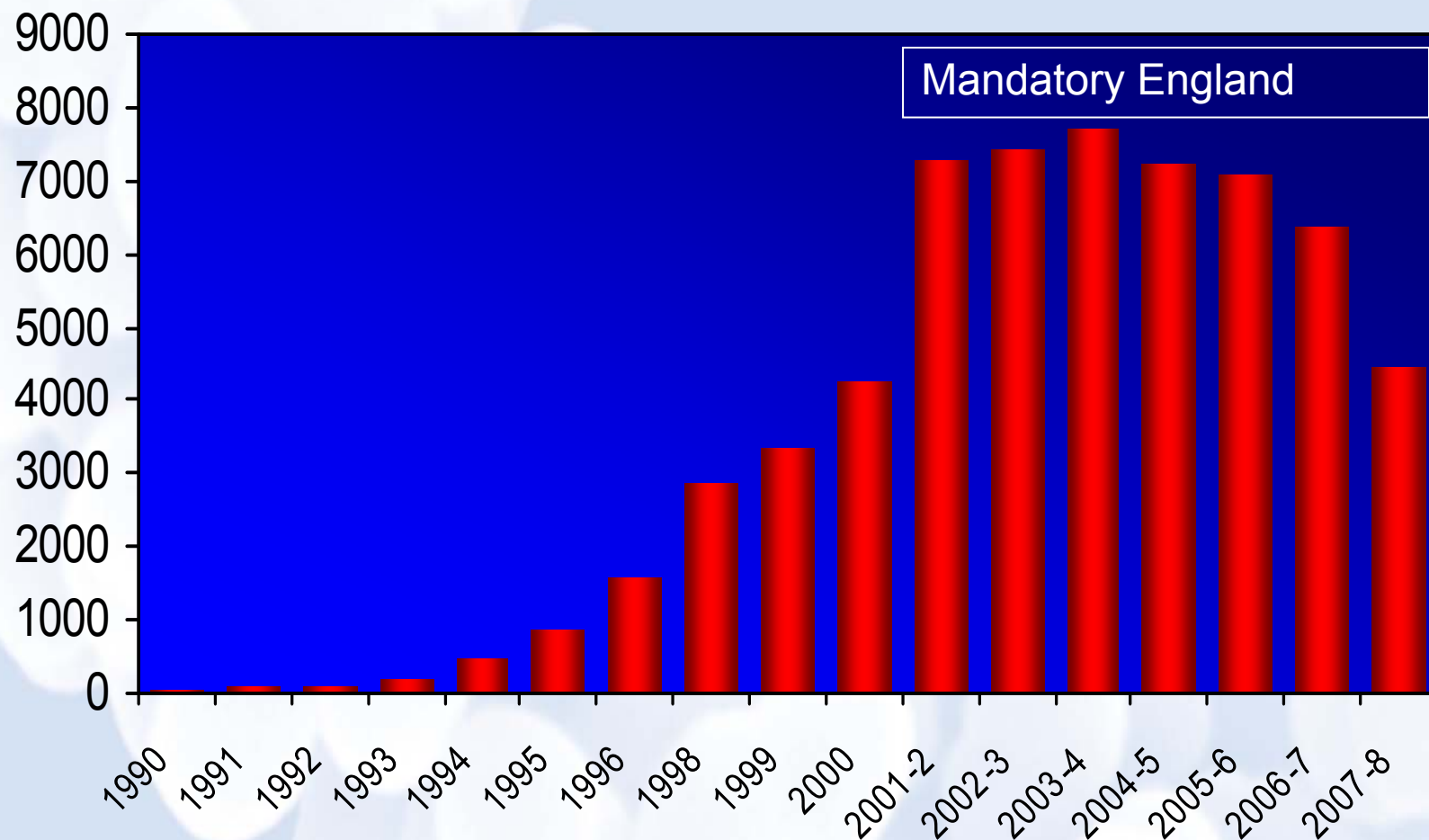
MRSA Bacteraemia episodes

England, 2001-2008 HPA website

Apr-Mar	MRSA Bacteraemia Episodes	Rate per 10,000 OBDs
2001-2	7,291	1.71
2002-3	7,426	1.78
2003-4	7,700	1.83
2004-5	7,233	1.76
2005-6	7,096	1.78
2006-7	6,383	1.67
2007-8	4,448	1.16
Fall since 2003	- 2978 - 40.1%	- 0.62 - 34.8%

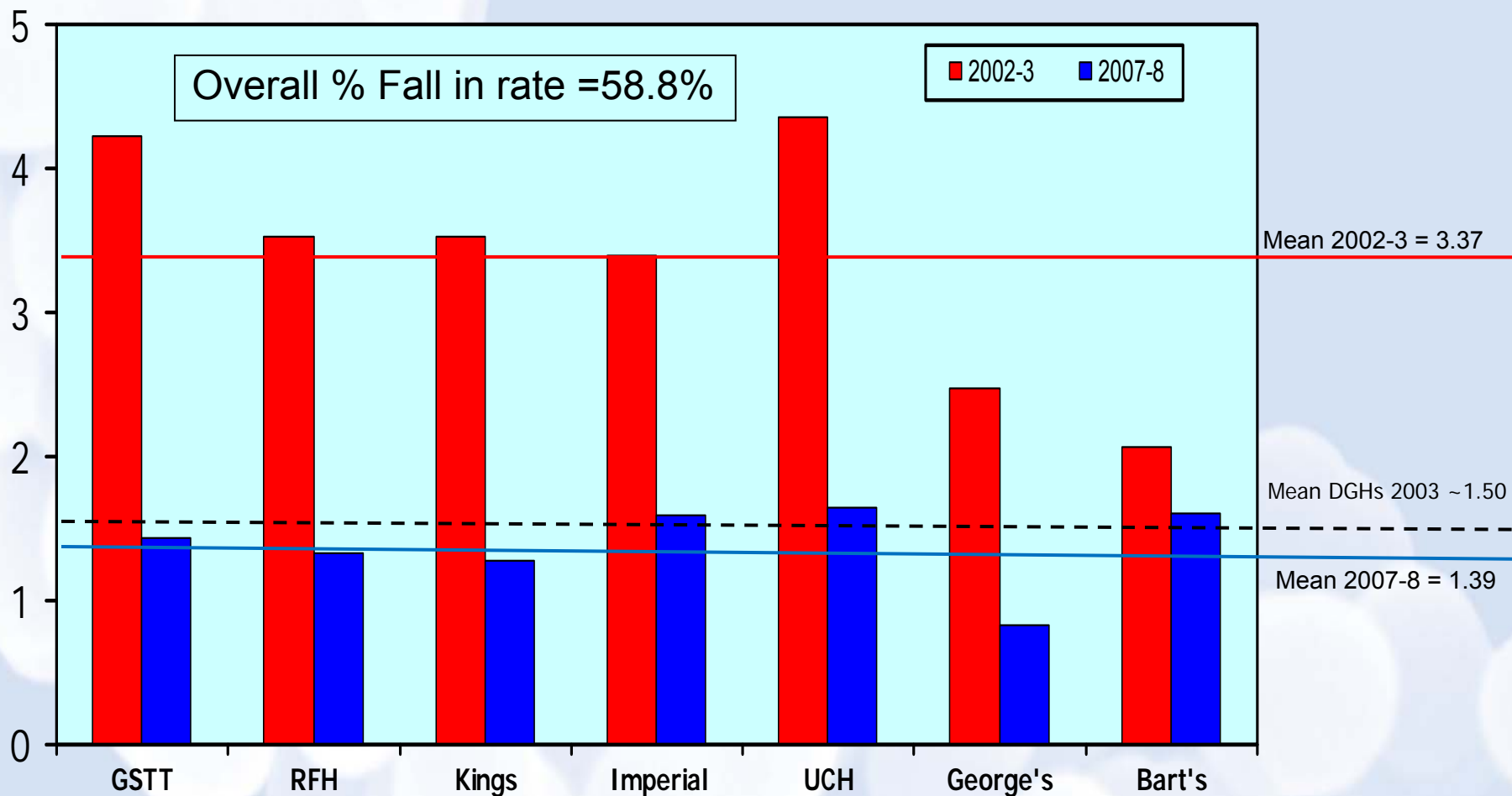
No of MRSA bacteraemia isolates reported to the HPA England & Wales 1990-2008

HPA website



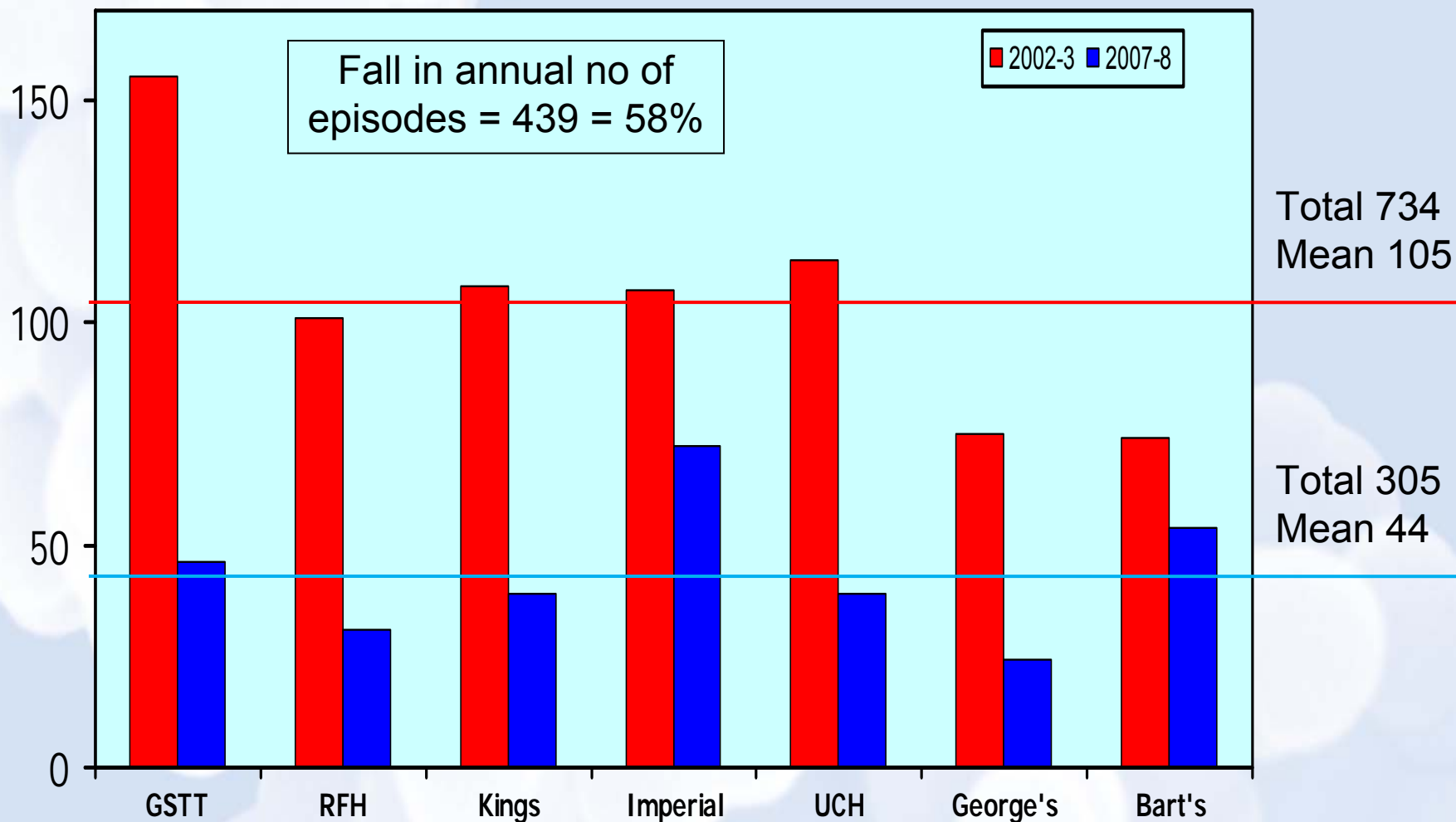
London specialist Trusts: MRSA bacteraemia rates 2003–2008

HPA website



London specialist Trusts: MRSA bacteraemia nos. 2003–2008

HPA website



Prevention and control of MRSA

- Identify and isolate infected/carrier patients; Attempt to decolonise; Decontaminate hands between each **and every** patient contact; Clean the environment; Ensure **strict** adherence to accepted hygienic practice
- **This is a bundle**
- **AND IT WORKS**

Where now?

- We still have 4,500 MRSA bacteraemias a year in England
- = 45,000 serious MRSA infections
- = 450,000 MRSA acquisitions
- 450 deaths

Where now?

- Must work until we have reached the irreducible minimum
- We should not worry about bumping along the bottom – but should get on and apply appropriate bundles to other pathogens/problems

BUT....



Community-associated MRSA (CA-MRSA)

Zetola N et al. Community-acquired methicillin-resistant *S. aureus*: an emerging threat. *Lancet Infect Dis* 2005; 5: 275–86.

- Cases of MRSA infection are now appearing in patients with no history of hospital or healthcare contact
 - True community-acquired MRSA
 - Strains distinct from HA-MRSA
 - Often producing PVL
- **In parts of the US now the most common cause of SA infection**

CA-MRSA are new strains, sometimes highly virulent

- Aggressive infections in young, healthy people.
- Suppurative skin infections
- Epidemics of furunculosis
- Severe necrotising pneumonias
- Septic shock

CA-MRSA likely to become increasingly common cause of HCAI

Otter JA, French GL. Lancet Infect Dis 2006;6:753-5

- The shuttling of CA-MRSA between hospital and community may result in
 - more frequent community MRSA infections
 - more severe hospital MRSA infections
 - spread of MRSA to previously spared hospital specialties such as paediatrics & obstetrics
 - more frequent MRSA infections in less compromised patients and in HCWs
 - The emergence of multiply resistant CA-MRSA

What now?

- HA-MRSA is preventable & controllable
- CA-MRSA has a different epidemiology and requires new control measures, both in hospitals & the community
- We must do this urgently before CA-MRSA becomes established like HA-MRSA

THANK YOU

