National Audit Office

Reducing Healthcare Associated Infections in Hospitals in England

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL | HC 560 Session 2008-2009 | 12 June 2009

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CORRECTION

There is an error contained within the Conclusion on Value for Money in this report. Paragraph 23 line 7 incorrectly stated that:

Text reads

Twenty nine per cent of hospital trusts have reduced *C. difficile* infections by over 29 per cent, but 19 per cent have had an increase in *C. difficile* infection.

Text should read

Twenty nine per cent of hospital trusts have reduced *C. difficile* infections by over 50 per cent, but 19 per cent have had an increase in *C. difficile* infection.

June 2009
LONDON: The Stationery Office

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Amyas Morse
Comptroller and Auditor General
National Audit Office

8 June 2009

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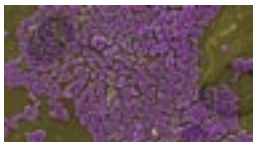
Photographs courtesy of Imperial College Healthcare NHS Trust

1 Main Causes of Healthcare Associated Infections in England

In 2006, a national prevalence survey in England found that eight per cent of patients have an infection that was not present or incubating at the time of their admission. The main causes of infection are as follows:

Type of Infection and Percentage of all healthcare associated infections	Description	Risk factors	Main causative organisms
Urinary Tract Infections 20% 	These occur when bacteria (or sometimes fungi) enter the urinary tract and infect the bladder. Urinary tract infections are usually treatable with antibiotics but antibiotic resistant strains can be a problem in patients with long term catheters.	Eighty per cent of healthcare associated urinary tract infections are associated with urine catheters. Risk is affected by the method and duration of catheterisation and the susceptibility of the patient.	Most urinary tract infections are caused by gram negative bacteria, especially *Escherichia coli (E. coli).*
Lower Respiratory Tract Infections 20% 	Lower respiratory tract infections affect the breathing tubes (trachea and bronchi) and the lungs. Pneumonia is the most severe and life threatening of all respiratory tract infections. It has a case fatality rate approaching 40 per cent.	Mechanical ventilation is the main risk factor for healthcare associated pneumonia. The cumulative risk of infection increases with duration of ventilation.	Bacteria such as *Acinetobacter* species, and *Staphylococcus aureus (S. aureus).*
Gastrointestinal 22% 	Most hospital acquired gastrointestinal infections are caused by *Clostridium difficile (C. difficile).* This organism forms spores which are released in the faeces and can contaminate the environment. The organism is then acquired by ingestion through contact with an infected person or from the contaminated environment. Norovirus is another common pathogen that causes vomiting and diarrhoea and can be highly contagious.	The gut may become colonised with *C. difficile* which may establish infection if the normal gut flora is disrupted by broad spectrum antibiotics. The elderly are particularly at risk of developing this infection.	The 2006 prevalence study found that 70 per cent of healthcare associated gastrointestinal infections were caused by *C. difficile.*
Surgical Site Infections 14% 	Surgical site infections are wound infections that occur after an invasive (surgical) procedure. They range from a limited wound discharge to a life-threatening postoperative complication, such as a sternal infection after open heart surgery.	Risk factors for infection include duration of surgery, surgical technique and preparation, presence of foreign material, length of hospital stay and antibiotic prophylaxis.	*S. aureus* (around 50 per cent of surgical site infections)*; Pseudomonas aeruginosa,* and other gram negative bacteria.
Bloodstream Infections (bacteraemia) 7% 	Bacteria enter the bloodstream via a device inserted into an artery or a vein or as a result of an infection elsewhere in the body. They can cause sepsis, which can result in septic shock. They have high patient mortality.	Around 44 per cent are associated with invasive devices, with two thirds of these due to intravenous access devices such as peripheral and central line catheters.	*E. coli,* and other gram negative bacteria and *S. aureus* (around 13 per cent of bloodstream infections are caused by *S. aureus,* four per cent are MRSA).
Skin & Soft Tissue Infections 10% 	Severity of skin and soft tissue infections is usually determined by how deeply the skin is infected. Deep soft tissue infections may require surgical intervention.	Management of open wounds and pressure sores.	*S. aureus.*
Other 7%	Other types of infection include bone and joints and central nervous system. Often linked to surgical or invasive procedures.		

Source: National Audit Office

NOTE

The percentage of infections are taken from the Hospital Infection Society, 2007: The Third Prevalence Survey of Healthcare Associated Infections in Acute Hospitals in England 2006.

SUMMARY

1 Healthcare associated infections in hospitals are caused by a wide variety of organisms **(Figure 1)** and cause a range of symptoms from minor discomfort to serious disability and in some cases death. In 2007, around 9,000 people were recorded as having died with meticillin resistant *Staphylococcus aureus* (MRSA) bloodstream infections or *Clostridium difficile (C. difficile)* infections as the underlying cause or a contributory factor.[1] Risk factors include the extent of the patient's underlying illness, or treatment, which can make patients more vulnerable. There is no national aggregate data on the total number of healthcare associated infections in England. In 2004, the Department of Health (Department) confirmed that 300,000 was the best estimate of the number of healthcare associated infections per year.[2] The estimated cost to NHS hospitals of caring for people that acquire a healthcare associated infection is over £1 billion a year.[3]

2 The National Audit Office highlighted concerns about the management and control of healthcare associated infections in hospitals in 2000[4] and 2004.[5] Both of these reports were followed by a hearing and critical reports by the Committee of Public Accounts. The Committee's second report,[6] published in 2005, concluded that progress in reducing healthcare associated infection had been patchy, and that there was a distinct lack of urgency on issues such as cleanliness and compliance with good hand hygiene; limited progress in improving isolation facilities or reducing bed occupancy rates; and progress continued to be constrained by a lack of robust data other than on MRSA bloodstream infections, for which mandatory surveillance was introduced in 2001, and a lack of evidence of the impact of different intervention strategies.

3 In 2004, in response to our report, the Department committed to make the control and prevention of healthcare associated infections a top priority. It introduced a target to reduce one specific infection, MRSA bloodstream infection, across all NHS acute hospital and acute foundation trusts by 50 per cent by 2008. The Department told the Committee of Public Accounts that it intended to reduce MRSA bloodstream infection rates by employing the same approach it had used in achieving targets for waiting times; where the Department had secured improvements using a combination of financial incentives, close performance management, and support to trusts.

4 In July 2004 the Department published 'Towards cleaner hospitals and lower rates of infection' and established a Programme Board to provide leadership and direction to its commitment to reduce infection rates. Over the next two years the Department published guidance and enacted new legislation, the Heath Act 2006, supported by a Code of Practice for the Prevention and Control of Healthcare Associated Infections (Code of Practice) and brought in new inspection powers for the Healthcare Commission. In 2004, the Department introduced mandatory surveillance arrangements for *C. difficile* for patients aged 65 and over, which was extended to patients aged two and over from April 2007. In October 2007, a target was set for a 30 per cent reduction in the number of cases of *C. difficile* reported in 2010-11 against a 2007-08 baseline. In January 2008, primary care trusts were told to agree local reduction rates with hospitals as part of local contracts.

1 Office for National Statistics, 2008: Health Statistics Quarterly 39.
2 House of Commons Committee of Public Accounts – Twenty-fourth Report 2004-05: Improving patient care by reducing the risks of hospital acquired infection: A progress report.
3 Plowman *et al* (1999): The Socio-economic Burden of Hospital Acquired Infection – Public Health Laboratory Service London.
4 National Audit Office, 2000: The Management and Control of Hospital Acquired Infection in Acute Trusts in England (HC 230 Session 1999-00).
5 National Audit Office, 2004: Improving patient care by reducing the risks of hospital acquired infection: A progress report (HC 876 Session 2003-04).
6 House of Commons Committee of Public Accounts – 24th Report 2004-05: Improving patient care by reducing the risks of hospital acquired infection: A progress report.

5 Now that the end of the March 2008 target date for reducing MRSA bloodstream infections has passed, we have undertaken a further examination of the progress made on preventing and controlling healthcare associated infections in NHS acute hospital and acute foundation trusts (hospital trusts) in England. We focused on hospital trusts as the risk of acquiring an infection is highest in the hospital setting, and the Department's resources and effort have so far been concentrated there. The prevention and control principles that apply to hospitals do however apply equally to other healthcare settings.

6 This report evaluates the changes since 2003-04 in the extent and impact of healthcare infections; the effectiveness, sustainability and cost of the Department's approach; and the effectiveness of action within hospitals to improve the prevention and control of infections. Our methodology is set out at Appendix 1 and **Figure 3 on pages 12 to 14** summarises the progress in implementing the Committee of Public Account's recommendations.

Key Findings

Progress in reducing the extent and cost of healthcare associated infections

7 By the end of March 2008 the NHS had achieved a 57 per cent reduction in MRSA bloodstream infections against the 50 per cent national target. To achieve this national target by the end of March 2008 (which the Department measured by comparing the first quarter of 2008-09 with the quarterly average for 2003-04), the Department asked all trusts with more than 12 MRSA bloodstream infections to submit trajectories for reducing their infections by 60 per cent by March 2008. While a quarter of trusts have achieved improvements greater than 80 per cent, in 12 per cent of trusts there has been an increase in MRSA bloodstream infections. There are also marked regional variations ranging from a 42 per cent reduction to a 72 per cent reduction.

8 Reports of *C. difficile* in the over 65s peaked in 2006, but since then there has been a 41 per cent reduction. There has also been a reduction in surgical site infections. In 2004 there were 44,563 reports of *C. difficile* in patients over 65 years of age, which by 2006 had risen to 55,635 (a 25 per cent increase). Since the Department's announcement in October 2007 to introduce a national target to reduce incidence of *C. difficile* across all age groups by 30 per cent by 2010-11, the numbers reported in patients aged 65 and over have reduced from the peak of 55,635 in 2006 to 32,628 in 2008 (a 41 per cent reduction). Since 2004, the overall orthopaedic surgical site infection rate has also fallen from 1.44 per cent in 2004 to 0.6 per cent in 2008.

9 There are no national surveillance systems on some of the most common healthcare associated infections, for example: urinary tract infections, pneumonia and skin infections, but the Health Protection Agency receives data and reports back annually to trusts on all bloodstream infections under its voluntary surveillance scheme. The best available data from the voluntary scheme, indicate that the number of reports of bloodstream infections have increased from 80,000 in 2003 to 105,000 in 2007. The reasons for this increase are not clear, but are likely to be due to a mix of improved ascertainment and more efficient IT-based reporting systems as well as evidence of real increases in infections. Not all of these infections will be healthcare associated, but the five most common pathogens which account for 65 per cent of these reports, are usually associated with healthcare infections. Some of these are linked to healthcare provided in community settings. As bloodstream infections have a high mortality and morbidity, there is a need for further work to understand the origin, cause and type of these infections.

10 The Department has provided additional resources since 2004 aimed at tackling healthcare associated infections, and in financial terms the benefits achieved are likely to be commensurate with the costs incurred in reducing the targeted infections and improving hospital cleanliness. We estimate that since April 2004, the Department and its arm's length bodies spent £120 million, comprising of £57 million on national initiatives to tackle healthcare associated infections and a one off allocation of £63 million for the deep clean in 2007-08. Between 2003-04 and 2008-09 we estimate that the NHS has saved between £45 and £59 million in treatment costs by reducing the rates of MRSA bloodstream infections and between £97 and £204 million from 2006 to end of 2008 by reducing the rate of *C. difficile* infections (Appendix 1). There will, too, have been unquantifiable administrative costs and local expenditure on the drive to reduce infections but also potential benefits in terms of better ward management of staff and harm avoided to patients.

The effectiveness and cost of the Department's response since 2004

11 The Government has made the reduction of healthcare associated infections, as measured by MRSA bloodstream and *C. difficile* infections, a top priority for the NHS. The Health Act 2006 introduced new legislation on prevention and control of healthcare associated infections. Until March 2009 compliance was regulated through a statutory inspection regime operated by the Healthcare Commission. From April 2009, this responsibility passed to the new Care Quality Commission (see paragraph 13). The Department also included

targets to reduce both of these infections in its 2007 PSA Agreement. The Department has introduced a number of initiatives to help trusts to achieve their reduction targets and has made healthcare associated infections a 'must-do' within successive NHS Operating Frameworks. **Figure 2 overleaf** summarises our evaluation of the effectiveness of the Department's main national healthcare associated infection reduction initiatives. The Department's approach to governance is strong compared to many other countries.[7]

12 Despite having a national surveillance system for *C. difficile* infections, there were incidents where trusts did not act in a timely manner on the information generated. Since 2006 the Health Protection Agency has operated a real time reporting and feedback system with the prime responsibility for analysing and reporting surveillance data. Healthcare Commission reports on its investigations, in particular two special investigations in 2006 and 2007 which investigated high levels of deaths due to *C. difficile* (Appendix 5) identified that despite the availability of national surveillance data, the trust failed to recognise its significance and act on it in a timely manner. There was also confusion about the roles and responsibilities of external organisations, such as the Health Protection Agency, strategic health authority and the local primary care trust, particularly as to who was responsible for intervening in the event of an outbreak.

13 The Healthcare Commission helped trusts to increase the priority given to tackling healthcare associated infections, but in the past did not always pick up on serious problems in specific trusts. From 2004, the Healthcare Commission assessed trusts on their policies and procedures for preventing and controlling healthcare associated infections as part of its annual health check. From 2007, it also implemented an annual programme of inspections of all hospital trusts against the Code of Practice. The Healthcare Commission concluded that over the four years, hospital trusts' performance against these two measures was improving. Around 87 per cent of trusts considered that the Healthcare Commission helped trusts tackle healthcare associated infections. In the past, however, this approach did not always pick up trusts with high levels of infections or serious outbreaks.

14 In April 2009, 11 hospital trusts failed to meet all the new regulations for healthcare associated infection which are a condition of registration, and the Care Quality Commission has required them to make the necessary improvements promptly. The Care Quality Commission replaced the Healthcare Commission from 1 April 2009 and, whilst it continues the programme of annual inspections of all hospital trusts, the Health and Social Care Act 2008 confers stronger powers to inspect, investigate and intervene on cleanliness and infections. From April 2009, the Care Quality Commission was also given new responsibility for registering all health and social care providers. All NHS trusts had to be registered from April 2009 and independent and social care providers from April 2010. The Care Quality Commission plan to make responding swiftly to events which compromise patient safety an underlying principle to its approach to regulation.

The extent of improvements within hospitals

15 Reducing MRSA bloodstream and *C. difficile* infections has been a top priority for most trust boards, but other infection risks have not been given the same attention. In most hospital trusts, the introduction of targets and direct reporting of MRSA and *C. difficile* data by the Director of Infection Prevention and Control to trust boards has increased the importance given to controlling these two infections. Although 58 per cent of hospital trusts believe that mandatory surveillance of MRSA and *C. difficile* has helped improve surveillance of other healthcare associated infections, they were not able to make meaningful regular comparisons. In addition, 20 per cent of trusts do not carry out surveillance on any other healthcare associated infection. Most trusts do not report data on healthcare associated infections, other than MRSA bloodstream and *C. difficile*, to their board. The 2008 Code of Practice expects NHS trusts to undertake local surveillance on other healthcare associated infections and to have measures to control and prevent them.

16 There has been a cultural change in the way that organisations tackle infection prevention and control and the priority that it is afforded. Many staff and infection control teams identified that the development of a culture of senior management leadership and engagement was the most important action their trust had taken in improving infection prevention and control. Trusts which have seen the greatest reductions in MRSA bloodstream infections and *C. difficile* demonstrate strong board leadership and ward management underpinned by robust performance management.

7 J A Roberts and BD Cookson (January 2009):The management prevention and control of healthcare associated infections: An International Comparison and Review.

2 National Audit Office's assessment of new national initiatives on healthcare associated infection since 2004

Description	Expected Benefits	Cost	Impact	
Modern Matrons Increased numbers and enhanced role (2004)	Improve clinical care standards, ensure best practice in infection control and provide a clean environment for care.	At least £56 million per annum – Infection control is 30 per cent of their workload	Modern matrons have contributed to improvements in cleanliness and infection control compliance.	●
Cleanyourhands campaign (2004)	Improved availability of alcohol hand rub at the point of patient care and increased compliance with hand hygiene and its auditing.	£2.5 million	The campaign has delivered cost effective improvements to hand hygiene practice. Independent research shows that compliance is associated with reductions in rates of MRSA.	●
Saving Lives (2006)	Provides the tools and resources for hospital trusts to embed robust infection prevention and control across their organisation.	Not possible to separately identify	Every hospital trust has signed up to Saving Lives. Producing a national set of guidance and tools was more cost-effective than the situation in 2000 and 2004 whereby each trust was re-inventing wheels. Our trust census shows it has been useful as a source of guidance and in delivery of audit tools for staff.	●
The Code of Practice (part of the Health Act 2006)	Sets out statutory criteria by which managers of NHS organisations are to ensure that patients are cared for in a clean environment, where the risk of healthcare associated infection is kept as low as possible. Inspection of compliance was carried out by the Healthcare Commission until end of March 2009. The Care Quality Commission will be continuing these activities from April 2009.	Not possible to separately identify	The Code of Practice has been effective in clarifying what is expected from trusts and ensuring engagement from chief executives and boards.	●
The Improvement Teams (2006)	Provide support to trusts in achieving reductions in MRSA bloodstream infections. Support ranges from a three day visit to advice down the telephone.	£3 million per annum	The Improvement Teams have worked with 154 hospital trusts. Our census showed that trusts felt that the support they had received was effective.	●
The Deep Clean (2008)	Improvements in cleanliness, patient confidence. Deep cleaning was one element of a wider range of measures introduced to tackle healthcare associated infections and ensure patient safety.	£62.6 million	The deep clean has contributed to on-going improvements in cleanliness and helped improve patient and staff confidence. In terms of reducing infection rates the impact is difficult to measure.	●
Technology Programme (2008) **including the Rapid Review Panel** (2004)	Speed up the assessment and adoption of technologies to further help combat infections.	£25,000 for the panel and £10 million per annum from 2008-09 onwards for the wider programme	The Rapid Review Panel has undertaken systematic assessment of technologies submitted to them but there is limited evidence that it has led to adoption within trusts. It is too early to assess the wider programme.	●
MRSA Screening (from April 2009)	Reduction of the carriage of MRSA colonisation from patients in the community into the hospital.	Approximately £130 million per annum from 2010-11	This has yet to be fully implemented. Costs are higher than other initiatives and the evidence for the cost effectiveness of screening is mixed.	●

● Initiative has delivered benefits in terms of reductions in MRSA and *C. difficile*, and/or improvements in the hospital environment and in patient confidence which are likely to outweigh the cost

● Initiative has delivered some benefits which may justify the cost

● It is not possible to form a judgement on the relative cost and benefit of this initiative

Source: National Audit Office hospital trust census; visits to trusts and evaluation of existing research

17 Compliance with good infection control practice is improving, but doctors remain less likely to comply. Overall, nurses have been quicker to improve their clinical practice in relation to healthcare associated infection than doctors, for example with higher levels of compliance with basic hand hygiene. In our surveys, doctors and in particular junior doctors were viewed by trust staff as less likely to comply with infection control policies including policies on hand hygiene. Infection control teams continue to play an important role in monitoring compliance against good practice. Inspections show that environmental cleanliness in hospitals has improved year on year.

18 An important aspect of embedding good infection control is the extent to which trusts learn from incidents and adopt good practice. Many clinical teams have benefited from using root cause analysis, but the learning is rarely shared within or between trusts. The Department has recommended that hospital trusts should use its Root Cause Analysis tool to examine every MRSA bloodstream infection. All trusts use root cause analysis to investigate MRSA and most also use it for *C. difficile* outbreaks. When root cause analysis is carried out effectively, trusts find that it contributes to improvement of practice on infection prevention, and the use of the tool has provided important insight for local clinical teams. There is, however, variation and disparity in the extent to which learning from root cause analyses is shared within trusts and no evidence of capturing the lessons and sharing them between trusts. The Department does not expect root cause analysis to be shared between trusts seeing it as a tool for local action.

19 Progress in improving information and tracking of hospital antibiotic prescribing has been limited, largely because of delays in developing electronic prescribing. All hospital trusts have antibiotic prescribing protocols which contribute to reducing risks from some healthcare associated infections and, in the majority, the pharmacist is actively involved in enforcing these policies. Antibiotic prescribing in hospitals can provide a marker of healthcare associated infection when linked to patient records, but as yet there is no system for doing so. One way of improving monitoring that was raised in previous National Audit Office reports was electronic prescribing, but there has been a delay in developing electronic prescribing systems in trusts.

20 The most common barriers to further improvement in reducing healthcare associated infections, as reported by trusts, were high bed occupancy and lack of isolation facilities. When asked to identify the most significant barriers to further improvement, 44 per cent of Infection Control Teams identified bed occupancy. Whilst there is some evidence that links high bed occupancy, and its impact on patient movement around the hospital, with increased risk of MRSA and *C. difficile*, some trusts have been able to achieve reductions in these two infections despite high levels of bed occupancy. Twenty-three per cent cited a lack of isolation facilities. Overall, however, we found there had been a large improvement in the use of, and limited improvement in availability of, isolation facilities. Fifty-nine per cent of trusts highlighted concerns that the four hour admission target for accident and emergency meant that it is difficult to diagnose and isolate patients effectively.

21 Primary care trusts' role in tackling healthcare associated infections in community healthcare settings is evolving, but is not as clear as it needs to be. Healthcare associated infections can originate in other care settings. The enhanced surveillance for MRSA bloodstream infections and *C. difficile* has provided some insights, with around a third of MRSA bloodstream infections and 45 per cent of *C. difficile* infections appearing to be acquired outside of hospital or as a result of a previous hospital stay.[8] For all other healthcare associated infections acquired outside of hospital, information is poor. Our census and visits identified that hospital trusts remain unclear about the roles and responsibilities of the primary care trust in relation to healthcare associated infection. From 2010, the Care Quality Commission will check compliance with the Code of Practice in all care settings, including community hospitals and care homes, as part of registration.

8 Health Protection Agency 2009.

Conclusion on value for money

22 The Department, in introducing infection reduction targets, close performance monitoring, support and guidance, has been effective in helping the NHS to improve cleanliness and compliance with infection prevention practices. The Department has improved information on MRSA bloodstream and *C. difficile* infections and helped trusts to achieve aggregate reductions, in both these infections, which have exceeded the target reduction rate. By 2008, the reduction in numbers of MRSA bloodstream infections was 57 per cent and *C. difficile* infection, 41 per cent against their respective baselines. Since 2003-04, the Department have spent some £120 million (including a one-off £63 million in 2007-08 on the deep clean) on these new initiatives. The reductions in these infections, since 2003-04, has led to decreases in treatment costs of between £141 million and £263 million as well as reducing the discomfort, disability and, for some, death that might have been caused by these avoidable infections. The direct intervention by the Department on these two infections has therefore been commensurate with the benefits achieved.

23 There has been a perceptible change in leadership, performance management and clinical practice in most trusts. The impact has not, however, been the same for all trusts. A quarter of hospital trusts have reduced MRSA bloodstream infection rates by over 80 per cent, but 12 per cent had an increase in MRSA bloodstream infections. Twenty nine per cent of hospital trusts have reduced *C. difficile* infections by over 29 per cent, but 19 per cent have had an increase in *C. difficile* infection. Moreover there has not been the same impact on other avoidable infections, where there is still a lack of robust and comparable surveillance information. The information that is available suggests that other healthcare associated bloodstream infections, including ones due to other antibiotic resistant organisms, may have increased. Most staff and patients are less aware of the risks of acquiring these other infections. There is scope therefore for hospitals to improve infection prevention and control further and make savings by tackling other healthcare associated infections.

Recommendations

24 From our work on this and our previous reports on healthcare associated infections in hospitals, we have identified four systemic issues that need to be addressed by the Department, hospital trusts and others to help sustain the progress made in tackling MRSA bloodstream and *C. difficile* infections; and to extend the improvements to other infections. Some of the recommendations are reinforced by the requirements in the Code of Practice 2008.

National targets supported by mandatory surveillance, the Code of Practice and inspections have driven the reductions in MRSA bloodstream infections and *C. difficile*. There have not, however, been the same reductions in other avoidable healthcare associated infections. Progress has been made on reducing *C. difficile* and MRSA bloodstream infections but the NHS needs to strive towards continuous improvement and the goal of eliminating all avoidable healthcare associated infections.

Recommendations:

a **The Department** should require individual hospital trusts to develop a healthcare associated infection mandatory surveillance system for other significant bloodstream infections (using similar technology as for MRSA bloodstream surveillance); and a rolling programme of surveillance for other local infection risks such as device related infections, ventilator associated pneumonia and surgical site infections (including an agreed system of post-discharge surveillance). This surveillance should be based on a transparent assessment of local risk factors with support and guidance by local **Health Protection Units** and the results reported to the **Health Protection Agency**, analysed and fed back to trusts. **Trusts** should ensure feedback to clinical units and a record maintained of actions taken in response to surveillance reports.

b **Primary care trust commissioners'** contracts with healthcare providers should explicitly state expectations of quality and safety with respect to reducing the risk of all healthcare associated infections.

c **Hospital trusts** should extend root cause analysis to all serious infection incidents. **The Department, Health Protection Agency and National Patient Safety Agency** should implement a system for collating and sharing the key lessons from trusts' analyses in the same way as for other serious patient safety incidents.

There remains a lack of clarity on the roles and responsibilities of local and national organisations in relation to healthcare associated infections and a need for a whole system approach to achieve further reductions. A health economy wide approach is needed to deliver further improvements, particularly for infections such as *C. difficile* and other bloodstream infections. It also requires a better understanding of the movement of patients within, and between hospitals, care homes and the community.

Recommendations:

d **The Department** needs to clarify the roles and responsibilities of relevant local and national organisations including for example what they are required to do when information suggests patient safety may be at risk. These roles and responsibilities should be communicated clearly to the NHS. **The Care Quality Commission** should communicate clearly to NHS and social care organisations what they should expect in terms of a swift response to incidents that compromise patient safety.

e **Primary care trusts** should require all providers to put in place assurance systems which demonstrate how they are complying with good infection control practice, for example, clinical audit compliance and root cause analysis.

Whilst staff are more aware of good infection control practice and compliance is improving, compliance is still not universal. Given the delay between failure to comply and infection, some staff still do not see a clear link between their actions and healthcare associated infection. There is a general consensus on good practice, and in order for these improvements to be sustained, staff need to see compliance as fundamental to safe care. Compliance with good infection control practice should be integrated with hospital trusts' ongoing approach to improving quality of care and patient safety.

Recommendations:

f Currently healthcare associated infections are recorded as part of the Health Protection Agency's mandatory reporting scheme but, apart from orthopaedic surgical site infections, these reports are generated through laboratory reporting systems. **Hospital trusts** should require staff to report healthcare associated infections which contribute to death, significant disability or injury, for one or more patients to the trust's patient safety incident reporting system.

g **The Department, strategic health authorities, Health Protection Agency and the National Patient Safety Agency** should share data and intelligence, such as complaints, on healthcare associated infections to facilitate improved reporting and learning from infections and support development of preventative measures.

h **Hospital trusts and primary care trusts** need to agree action plans where necessary to address any shortfall in isolation facilities identified by the trusts' audits of the availability of isolation facilities.

i **Hospital trusts** should have processes to provide their board with assurance that infection, prevention and control is the responsibility of everyone in the trust. For example as required by the Code of Practice, all staff should have performance objectives for complying with good infection control practice.

j **The Royal Colleges and professional bodies** responsible for training and revalidating professional competence should include patient safety, including infection control, as a fundamental part of all healthcare professional and medical training and assess these competencies as part of the new revalidation processes.

One of the biggest threats to infection control is the increase in antibiotic resistance. Data on hospital prescribing is still not robust and the expected electronic prescribing system is still not in place. The lack of data limits hospital trusts' and others ability to monitor whether antibiotics are being used effectively.

Recommendations:

k **Hospital trusts** should have processes in place to assure their boards that there is effective control over the appropriateness of the antibiotics being prescribed. Hospital trusts should also develop links between their hospital prescribing, patient records and pathology and microbiology reporting systems.

l **Primary care trusts** should monitor hospital trusts' and other healthcare providers' antibiotic prescribing and take action to address inappropriate use.

3 Progress against recommendations made by Parliament's Committee of Public Accounts in 2004

Committee of Public Accounts recommendations[1]	Government's Treasury Minute Response (October 2005)[2]	NAO assessment of implementation	
1 The Department hopes to reduce MRSA rates by employing the same approach used in achieving targets for waiting times where improvements were driven through using a combination of financial incentives, performance management and support. The Department will need to clarify what support will be available to trusts, and what incentives will be available to help deliver improvements.	The Department agreed with this recommendation. They were closely monitoring progress towards the target of halving MRSA bloodstream infections. They introduced performance reporting to strategic health authorities and committed to providing support to trusts.	The Department has achieved reductions in MRSA bloodstream infections through a combination of support and performance management. Strategic health authorities monitor progress against the MRSA target and, since 2006, the reduction target on *C.difficile*. Department of Health Improvement teams have worked with 154 trusts to help them improve compliance with good infection control and achieve the reduction targets.	●
2 The Department needs to work with the Health Protection Agency to expand national mandatory surveillance, based on a robust risk assessment with input from clinical staff. Its National Programme for IT needs to include the hardware and software needed to support the collection of national surveillance data, including effective links between pathology, microbiology, prescribing and patient administration systems.	The Department did not accept this recommendation. The mandatory surveillance system would continue to develop but they felt it would not be appropriate to make all new surveillance mandatory. Mandatory surveillance was extended to cover *Glycopeptide Resistant Enterococci* in October 2003, *C. difficile* in January 2004, and orthopaedic surgical site infections in April 2004.	There has been no expansion of the national mandatory surveillance system since the PAC report other than some refinements to develop enhanced surveillance, for example a requirement for trusts to report all cases of *C. difficile* for patients aged two to 64 from April 2007. There are national and local systems for the collection of surveillance data but they are not linked to the National Programme for IT. There is still no link between pathology, microbiology, prescribing and patient administration systems.	●
3 The Department should repeat the 1996 prevalence study to obtain up to date information.	The Department accepted this recommendation.	A four countries national prevalence study was conducted in 2006 and the final report was published in 2008.	●
4 The Department needs to expedite its proposal for hospital acquired infections to be identified on death certificates, and its proposed audit of deaths attributable to all the main types of hospital acquired infection.	The Department noted the Committee's conclusion. They commissioned the Health Protection Agency and the Office for National Statistics (ONS) to undertake a confidential study of suspected deaths from healthcare associated infections.	A study of deaths linked to MRSA was carried out by the Health Protection Agency and the ONS. Guidance was issued to reinforce the importance of including MRSA and *C. difficile* on death certificates. The ONS reports deaths attributable to MRSA, MSSA and *C. difficile* but concerns about completeness and compliance for all healthcare associated infections remain.	●
5 The Department needs to work with the National Patient Safety Agency to develop a better understanding of the reasons why compliance with hand hygiene guidance has not been sustained and how it might best be tackled.	The Department accepted this recommendation in principle. All hospital trusts had implemented the clean**your**hands campaign or their own equivalent.	Independent evaluation of the clean**your**hands campaign concluded that it was associated with higher alcohol hand rub and soap usage, and lower rates of MRSA bloodstream infections.	●

3 Progress against recommendations made by Parliament's Committee of Public Accounts in 2004 *continued*

Committee of Public Accounts recommendations[1]	Government's Treasury Minute Response (October 2005)[2]	NAO assessment of implementation	
6 The Department has still not implemented the National Audit Office's 2000 recommendation to publish a national infection control manual, despite four years of research and consultation. The Department should establish a repository for national evidence based guidelines and good practice examples.	The Department accepted this recommendation. In response to the recommendation in 2000 it carried out a study aimed at establishing what infection control specialists wanted from a manual. This showed a consensus that what was wanted was a reliable and high quality infection control information resource, bringing together national guidance and other source literature relevant to the prevention and control of infection, rather than an infection control manual.	The National Resource for Infection Control was established online and hosts the key guidance on infection control and provides links to other quality assured relevant resources. The Department has also published various good practice guides, for example the Saving Lives initiative which provides tools for improving infection control.	●
7 Despite a small improvement in the ratio of infection control nurses to beds there remains a mismatch between what is expected of infection control teams and the resources available to them. The Department, working with trusts and strategic health authorities, should conduct a survey of the new Directors of Infection Prevention and Control to determine whether they have the authority and resources to fulfil their designated role.	The Department did not accept this recommendation on the basis that infection prevention and control should be everybody's business and cannot be achieved by setting a ratio of specialist infection control staff to beds.	Despite not accepting this recommendation our trust census showed a further improvement in the ratio of infection control nurses to beds: 83 per cent of trusts now exceed the international benchmark of 1 infection control nurse per 250 beds (average ratio has increased from 1:524 in 2000 to 1:315 in 2004 to 1:189 in 2008).	●
8 NHS trusts' implementation of cleaning initiatives should be evaluated by an annual survey to see that they are actually improving cleanliness on the wards.	The Department accepted this recommendation.	Patient Environment Action Team inspections are carried out in every healthcare facility in England at least once a year where cleanliness is assessed, alongside other aspects of the patient environment. These inspections have shown year on year improvements. Since 2007, the Healthcare Commission has inspected trusts against the Code of Practice which includes duties in relation to cleaning standards.	●
9 The design of hospitals can help minimise hospital acquired infection, particularly by ensuring the provision of sufficient single rooms with appropriate ventilation for use as isolation facilities. Infection control teams should be part of the planning team for refurbishments of new buildings.	The Department agreed with the recommendation. To help local planning for isolation facilities, an isolation facilities document was published in February 2005.	Infection control teams reported via our trust census that they are now involved in reviewing plans for alterations and additions to clinical buildings.	●

3 Progress against recommendations made by Parliament's Committee of Public Accounts in 2004 *continued*

Committee of Public Accounts recommendations[1]	Government's Treasury Minute Response (October 2005)[2]	NAO assessment of implementation	
10 There is evidence that wider factors such as bed management policies and the need to meet waiting times targets can compromise infection prevention and control. Trusts need to reduce bed occupancy levels and to adopt more effective bed management practices which avoid patients moving too frequently.	The Department accepted this recommendation in part. Guidance was produced in 2004 in Towards Cleaner Hospitals on the involvement of infection control in bed management.	Our trust census showed that now 89 per cent of infection control teams are regularly consulted on bed management compared to 46 per cent in 2003. Thirty-five per cent of trusts however still see bed occupancy, and 59 per cent see the four hour A&E target, as potential barriers to improvement.	
11 Strategic health authorities should ensure that all trusts have carried out a risk assessment of their isolation facilities and work with them to determine a timetable and resourcing strategy to address identified shortfalls in requirements.	The Department accepted this recommendation in principle. Winning Ways required chief executives to ensure, over time, there is appropriate provision of isolation facilities.	Our census found that 84 per cent of trusts had carried out an assessment of their isolation facilities and two thirds of these concluded they had insufficient facilities.	
12 NHS trusts should inform their strategic health authorities when a recommendation to close a ward is refused. Strategic health authorities should ensure that these incidents are recorded and should work with trusts to identify ways of minimising their impact.	The Department did not agree with this recommendation. The trust chief executive is responsible for the decision to close a hospital ward.	In our census, most trusts reported no incidents where a request to close a ward was refused, and where this did occur there were appropriate reasons. The strategic health authority however, do not have any involvement and therefore this recommendation was not implemented.	

 The Committee's recommendation has been fully implemented

 The Committee's recommendation has been partially implemented

 The Committee's recommendation has not been implemented

Source: National Audit Office

NOTES

1 Committee of Public Accounts – 24th Report 2004-05.

2 HM Treasury 2005.

PART ONE

Healthcare associated infections in hospitals

1.1 The term 'healthcare associated infection' is defined as any infectious agent acquired as a consequence of a person's treatment by a healthcare provider, or which is acquired by a healthcare worker in the course of their duties.[9] These healthcare associated infections are often identified in a hospital setting, but can also be associated with healthcare delivered in the community. In 2006, about eight per cent of in-patients were identified as having a healthcare associated infection[10]. These infections lead to increases in length of stay and hospital costs, and cause a range of symptoms, from minor discomfort to prolonged or permanent disability, and in some cases death. Patients who are at the highest risk of acquiring an infection are the old, very young and patients with weakened immune systems.

1.2 Many healthcare associated infections originate from micro-organisms that people carry safely on their skin or in their body, and only become a problem when the person becomes unwell or when the organisms have an opportunity to enter the bloodstream. Some risk factors for infection transmission include insertion and management of devices and lines and the extent of the patient's underlying illness, or treatment, which can make patients more vulnerable to infection. The majority of infections are caused by bacteria, but some infections are caused by viruses such as Norovirus, commonly known as the winter vomiting disease. Healthcare associated infections commonly affect the urinary tract, the respiratory tract, the gastrointestinal tract, the skin and the bloodstream (see Figure 1).

1.3 Healthcare associated infection pathogens can be spread by healthcare workers. Some of the pathogens that cause healthcare associated infections are airborne, while others have to be ingested. Certain pathogens can remain in the environment for long periods of time. Some infections such as *C. difficile* can be triggered when a course of broad spectrum antibiotics, such as Cephalosporins, reduce the natural flora in a patient's gut and make them more susceptible to infection.

1.4 When penicillin was made commercially available in the 1940s, it was seen as the 'magic bullet' able to kill bacteria without harming the host. This ability to treat infections has meant that clinicians have given prevention a lower priority. The use of antibiotics has led to the selection of resistant strains of bacteria. For example, penicillin resistant strains of *Staphylococcus aureus* began to emerge in the 1940s and meticillin resistant strains identified in 1961 became endemic in hospitals in the 1990s.

1.5 Highly resistant infections are more common in hospitals because the high levels of antibiotic usage allows organisms to evolve and the close concentration of people susceptible to infection allows the organism to spread more readily. The rise of antibiotic resistant organisms, coupled with limited investment in the development of new antibiotics, has meant that medicine has increasingly needed to refocus its attentions on prevention of healthcare associated infections. In practice clinicians have been slow to make prevention a priority.

1.6 There is a wide variety of causative organisms and different types of healthcare associated infection (Summary Figure 1 and **Figure 4 overleaf**). Public awareness of healthcare associated infections has largely been limited to meticillin resistant *Staphylococcus aureus* (MRSA) bloodstream infections (bacteraemia); and *C. difficile*, a gastrointestinal infection. These two infections have been the main focus of the Department's national approach to reducing healthcare associated infections, but represent only 15 per cent of all healthcare associated infections (bloodstream infections represent seven per cent of infections of which 19 per cent are *Staphylococcus aureus* (four per cent are MRSA) and the prevalence study found that *C. difficile* was responsible for around 70 per cent of gastrointestinal infections).[11]

9 Health Act 2006: Code of Practice for the Prevention and Control of Health Care Associated Infections.
10 The Third Prevalence Survey of Healthcare Associated Infections in Acute Hospitals in England 2006: Hospital Infection Society (September 2007).
11 National Audit Office estimate using data from the Third Prevalence Survey of Healthcare Associated Infections in Acute Hospitals in England 2006: Hospital Infection Society (September 2007) and Health Protection Agency data (report on website).

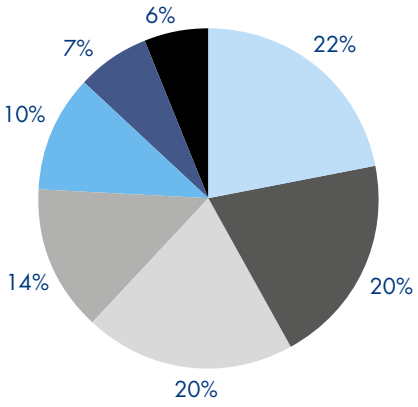
1.7 The first national guidance on infection control in hospitals was published in 1959, and in 1988 the first guidance on the role of the infection control team was published by the Department and the then Public Health Laboratory Service (now part of the Health Protection Agency). In 1995, the Department issued 'Hospital Infection Control: guidance on the control of infection in hospitals', known as the 'Cooke Report', which was acknowledged as the definitive framework for infection control. Since 1995, there has been a plethora of guidance, national advisory structures and expert committees aimed at tackling healthcare associated infections, but compliance with guidance up to 2004 was limited.

The National Audit Office's examination of the management of Hospital Acquired Infection in 2000

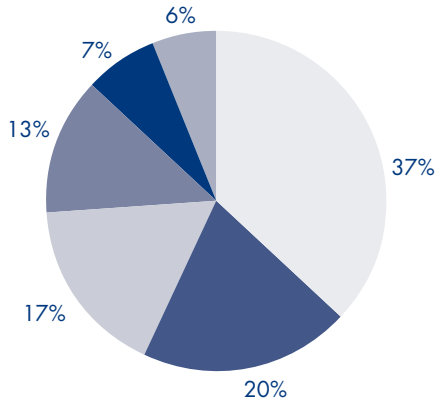
1.8 In January 2000, the National Audit Office carried out its first investigation into the NHS's approach to managing and controlling hospital acquired infections. We concluded that the Department and local hospital trusts had not given sufficient attention to this issue and had only limited understanding of the scale and cost of the problem. The House of Commons' Committee of Public Accounts published its own report in 2000 which concluded that the NHS did not have a grip on the extent and costs, and without robust up-to-date data, it was difficult to see how the NHS could target activity and resources to best effect. It recommended that there should be a shift towards prevention at all levels of the NHS, underpinned by a commitment and philosophy that prevention is everyone's business.[12]

4 Relative prevalence of types of infection (England Prevalence Survey[1]) and the main causative organisms of bloodstream infections (from HPA LabBase[2])

Types of infection from the Third National Prevalence Survey of Healthcare Associated Infections in Acute Hospitals in England



Causative organism of the seven per cent of infections that are bloodstream infections based on Healthcare Protection Agency LabBase data



Source: The Third Prevalence Survey of Healthcare Associated Infections in Acute Hospitals in England 2006: Hospital Infection Society (September 2007) and Health Protection Agency LabBase data

NOTES

1 The survey covered 130 acute trusts and 58,775 patients across England – in total 755 patients had MRSA as causative organism (76 were MRSA bloodstream infections) and 1163 patients had *C. difficile*).

2 Data from Health Protection Agency routine laboratory reporting 2003-2007. Note: not all bacteraemia reported will be hospital acquired or healthcare associated.

12 Committee of Public Accounts – 42nd report session 1999-2000 – The management and control of hospital acquired infection in acute NHS hospitals in England.

1.9 The Department accepted that the incidence of hospital acquired infections could be reduced significantly with associated benefits to patients and cost savings and said that it was putting in place a wide range of initiatives to this end.[13] Between 2001 and 2003 media and public interest in the subject grew, particularly in relation to concerns over identified increases in what the media called the "Superbug" – meticillin resistant *Staphylococcus aureus* (MRSA). In late 2003, the Department introduced the term healthcare associated infection to replace the term hospital acquired infection, as some infections detected in the hospital setting were not acquired there, and infections can also arise as a result of healthcare provided in other care settings.

1.10 In 2004 we undertook a follow-up investigation, which concluded that implementation of the Committee's recommendations had been patchy; that wider factors continued to impede good infection control practice; and that changing behaviours continued to be constrained by limited surveillance data; and a lack of evidence of the impact of different intervention strategies.[14]

1.11 The Committee, in its 2005 report, concluded that there had been a distinct lack of urgency on several key issues such as ward cleanliness and compliance with good hand hygiene; limited progress in improving isolation facilities or reducing bed occupancy rates; and that the NHS still did not have a grip on the extent and cost of hospital acquired infection.[15] Figure 3 details the Committee's 2005 recommendations, the Department's formal response and our evaluation of progress since then.

The Department's national approach to improving prevention and control

1.12 At the same time as our report was published in July 2004, the Department published a new campaign for action 'Towards cleaner hospitals and lower rates of infection' which included plans for a new target to reduce MRSA bloodstream infections year on year. In October 2004, the Secretary of State for Health announced that the top priority of the new Chief Nursing Officer would be to improve cleanliness and tackle MRSA bloodstream and other hospital infections, followed in November 2004, by the announcement of an objective to reduce MRSA bloodstream infections in hospitals by 50 per cent by March 2008. Following consultation, in 2006 the Government introduced legislation for a new Code of Practice for the Prevention and Control of Healthcare Associated Infections (Code of Practice), underpinned by a new national inspection, assessment and review regime by the Healthcare Commission. In October 2007 the Department announced a target to reduce *C. difficile* by 30 per cent by 2010-11 against the 2007-08 baseline. **Figure 5 overleaf** summarises the main roles and responsibilities of organisations in managing healthcare associated infections.

1.13 The Department has made improving cleanliness and reducing healthcare associated infections a top tier 'must do' target for the NHS in its Operating Framework, as measured by MRSA bloodstream and *C. difficile* infections. It has issued a series of further national guidelines, the key guidelines being Saving Lives (published in 2005 and updated in 2007), which provided the tools and resources for acute trusts to embed robust infection prevention and control across their organisation. As part of Saving Lives it introduced the seven High Impact Interventions or Care Bundles. Chief executives of trusts were encouraged to sign-up to the Saving Lives programme (see Appendix 3 for a summary of the Department's development of its strategic approach to tackling healthcare associated infections).

1.14 To coincide with the end of the national MRSA target at the end of March 2008, and the perceived lack of progress in 2004, we decided to re-evaluate the prevention, management and control of healthcare associated infections in the NHS. Again we have focused primarily on tackling healthcare associated infections in hospitals in England. Infections can be community acquired, but most serious healthcare associated infections are identified and treated in the hospital setting.

1.15 This report assesses progress in reducing the extent and impact of healthcare associated infections, and looks at the effectiveness, cost and sustainability of the Department's approach. We also look at what improvements in the management and control of infections have been made from board to ward in hospital trusts. Our methodology can be found in Appendix 1. It included: visits to 12 trusts including staff interviews and first hand observation on wards and around hospitals; our analysis of epidemiological data; a hospital trust census and validation process involving follow up telephone interviews with 15 trusts; surveys of doctors and nurses; a series of focus groups of junior doctors; document review; interviews with stakeholders, and financial analysis.

13 Treasury Minute on the 38th to 42nd reports from the Committee of Public Accounts Session 1999-2000.
14 Report by the Comptroller and Auditor General: Improving patient care by reducing the risk of hospital acquired infection: A progress report (HC 876 Session 2003-04).
15 Committee of Public Accounts; Twenty-fourth Report Session 2004-05 – Improving patient care by reducing the risk of hospital acquired infection: A progress report (April 2005).

5 Roles and responsibilities of bodies in relation to healthcare associated infection in hospitals

The NHS Litigation Authority

- Handles negligence claims made against NHS bodies; and
- Carry out risk assessment of patient safety within trusts in order to calculate their premiums.

The National Patient Safety Agency

- Lead on patient safety across the health sector;
- Stewardship of the clean**your**hands initiative and the PEAT inspections; and
- Provide guidance to the NHS on cleanliness.

Health Protection Agency

- National surveillance (both voluntary and mandatory);
- Specialist laboratory support;
- Investigation of national outbreaks; and
- Stewardship of Rapid Review Panel.

The Department of Health

- Sets targets and puts in place the Operating Framework for the NHS;
- Providing support through Improvement Teams;
- Guidance e.g. Saving Lives; and
- Sets Legislation and Code of Practice.

Strategic Health Authorities

- Monitoring performance at local level; and
- Providing support to trusts.

Primary Care Trusts

- As providers they must comply with the Code of Practice; and
- As commissioners they have a performance monitoring role of providers.

Acute and Foundation Hospital Trusts

Chief Executive – has a statutory responsibility for ensuring there are effective arrangements for infection control as part of the Code of Practice;

Director of Infection Prevention and Control – oversee local infection control arrangements, responsibility for the infection control team and report to the board; and

Infection Control Team – providing advice and support on infection control, carrying out audit and surveillance and providing education and training.

Health Protection Units

- Monitoring and helping to manage local outbreaks of infection; and
- Protecting public health.

Monitor

- Intervene where there are ongoing concerns about performance of foundation trusts; and
- Uses performance against infection targets as a criterion for foundation trust status.

Care Quality Commission/ Healthcare Commission

- Inspections and assessments of NHS trusts against the Code of Practice;
- Carries out the annual health check of trusts;
- Responsible for registering providers of care; and
- Measures targets and national objectives.

National Institute of Health and Clinical Excellence

- Provides clinical guidance on infection control.

Other national bodies with a role in HCAI

- NHS Institute e.g. guidance/toolkits;
- Office of National Statistics e.g. mortality data; and
- The Health and Safety Executive e.g. prosecutions.

National Bodies Local and Regional Bodies

Source: National Audit Office

NOTE

Foundation Trusts are accountable to Monitor.

PART TWO

Extent and cost of healthcare associated infections

2.1 In this part of the report we analyse data on the numbers and rates of healthcare associated infections to determine what changes have occurred since 2003. Our analysis focuses on data from: the most recent national prevalence survey of all healthcare associated infections, carried out in 2006; mandatory surveillance data collected by the Health Protection Agency since 2003 on MRSA bloodstream infections, *C. difficile* and orthopaedic surgical site infections; and data from voluntary surveillance reported to the Health Protection Agency on other blood stream infections. A more detailed analysis is published separately on our website.

2.2 We also analyse how we compare with other countries, based on work that we commissioned on international comparisons; and evaluate Office for National Statistics data on deaths due to healthcare associated infections. We estimate the additional cost to the NHS of treating healthcare associated infections and the savings that may have occurred as a result of reducing MRSA bloodstream and *C. difficile* infections.

Prevalence of Healthcare Associated Infections

2.3 Prevalence surveys help determine the overall burden of disease and the relative importance of different types of infection. In 2004, the Department commissioned the Hospital Infection Society, in collaboration with the Infection Prevention Society to design a national prevalence survey of healthcare associated infections. The survey, which also covered Wales, Northern Ireland and the Republic of Ireland was conducted between February and May 2006.[16] Scotland carried out its own prevalence survey using similar methodologies.[17]

2.4 The survey identified a prevalence rate in England of 8.2 per cent (meaning that 8 out of 100 patients covered by the survey had contracted an infection whilst in hospital). The data identifies the different types of infections (see Figure 4 in Part 1). The survey confirms that the risk of obtaining a healthcare associated infection increases with age. The prevalence of infections in this survey in people under 35 was 3.2 per cent; between the ages of 35 and 64 it was 6.4 per cent; between ages 65 and 84 it was 8.3 per cent and for people over 85 rose to 9.8 per cent. The length of stay in hospitals was also linked to an increased risk of acquiring an infection.[18]

2.5 Comparison of the national prevalence surveys carried out in 2006[19] and one completed in England in 1993-94[20] shows prevalence of healthcare associated infections in England has fallen from nine per cent in 1993-94 to 8.2 per cent. These figures require careful interpretation because of differences in survey methods, definitions and sampling between the two surveys. The last ten years have also seen a gradual decrease in length of hospital stay, which may have affected the number of infections detected in the prevalence surveys. One stark change in the comparison between 1993-94 and 2006 is an almost four-fold increase in patients with gastrointestinal infections which may be due to the fact that the prevalence study methodology had a raised awareness of *C. difficile*.

16 Four Country Healthcare Associated Infections Prevalence Survey 2006: Hospital Infection Society Journal of Hospital Infection (2008): 1-19.
17 Results from the Scottish National HAI Prevalence Survey–Journal of Hospital Infection (2008): 69, 62-68.
18 Four Country Healthcare Associated Infections Prevalence Survey 2006: Hospital Infection Society Journal of Hospital Infection (2008): 1-19.
19 The Third Prevalence Survey of Healthcare Associated Infections in Acute Hospitals in England 2006, Hospital Infection Society 2007.
20 The second national prevalence survey of Infection in Hospitals – over-view of the results Journal of Hospital Infection (1996) 32, 175-190.

International comparison of overall rates of healthcare associated infection

2.6 England faces a similar scale of challenge to other countries in tackling healthcare associated infections. There are, however, differences in the extent to which other countries have used legislation, targets, sanctions, regulation and performance management to help manage this problem. A separate report that we commissioned on the different approaches adopted by other countries is published separately on our website. It found that the approach to governance of healthcare associated infections in England is one of the strongest of any country reviewed.

2.7 Since devolution, the home nations have taken different approaches to reducing healthcare associated infections which are summarised in Appendix 6. The 2006 prevalence surveys found differences in overall prevalence of healthcare associated infections between the home nations with England higher than Wales and Northern Ireland but less than Scotland **(Figure 6)**. Each country has different patient population characteristics so direct comparison is not straightforward.

2.8 Results from similar prevalence surveys in other countries show a wider distribution of infection rates **(Figure 7)**. Some of these are one-off studies, but in some countries more regular prevalence surveys are undertaken. Comparisons of these rates, however, should be treated with caution as definitions, collection methods and range of hospitals or patient conditions often differ. Furthermore, these overall prevalence figures do not provide any indication of the differences in types of infections or causative organisms. What they do show is that healthcare associated infections present a similar problem in other countries. The international comparisons review we commissioned noted that well designed repeated prevalence studies may aid the management of healthcare associated infections.[21]

Estimation of the total number of healthcare associated infections

2.9 Prevalence surveys are important in providing an indication of the extent of healthcare associated infections and are cheaper to carry out than incidence surveillance. Prevalence surveys tend to produce higher rates than incidence surveillance, largely because patients who acquire an infection tend to stay longer in hospital and are therefore more likely to be included. Prevalence rates also mask variations in patient groups (prevalence is usually greatest in intensive care units) and between hospital specialties. As length of stay decreases, prevalence rates move closer to incidence rates, but both miss infections following discharge.

2.10 The national mandatory surveillance provides national data on incidence of MRSA bloodstream and *C. difficile* infections, but currently there are no national incidence surveillance systems on the most common healthcare associated infections, for example: urinary tract infections, pneumonia and skin infections. There is therefore no national aggregate data on the total number of healthcare associated infections in England and a lack of consensus on how to estimate it. In response to questions at the Committee of Public Accounts hearing in 2004, the Department confirmed that 300,000 was the best estimate of the number of healthcare associated infections per year,[22] and it remains the best estimate.

6 Comparison of prevalence of healthcare associated infection in the Home Nations and the Republic of Ireland

Country	Date of Collection	Prevalence
Scotland	2005-06	9.5
England	2006	8.2
Wales	2006	6.4
Northern Ireland	2006	5.4
Republic of Ireland	2006	4.9

Source: Four Country Healthcare Associated Infections Prevalence Survey 2006: Hospital Infection Society Journal of Hospital Infection (2008): 1-19 and Results from the Scottish National HAI Prevalence Survey – Journal of Hospital Infection (2008): 69, 62-68

7 Latest data on international comparison of prevalence of healthcare associated infections

EU	2007	7.6
UK	2006	7.6
Denmark	2003	8.7
France	2006	5.4
Greece	2000	9.3
Italy	2002	7.5
Netherlands	2007	6.9
Portugal	2003	8.7
Sweden	2004-6	9.5
USA	2006	5.0-10.0
Canada	2002	10.5

Source: National Audit Office Commissioned Research: J A Roberts and BD Cookson (January 2009): The management prevention and control of healthcare associated infections: An International Comparison and Review

21 J A Roberts and BD Cookson (January 2009): The management prevention and control of healthcare associated infections: An International Comparison and Review.

22 House of Commons Committee of Public Accounts – Twenty-fourth Report 2004-05: Improving patient care by reducing the risks of hospital acquired infection: A progress report.

Trends in numbers and rates of MRSA bloodstream and *C. difficile* infection for which the Department has introduced national targets

Numbers and rates of MRSA bloodstream infections have been falling since April 2006

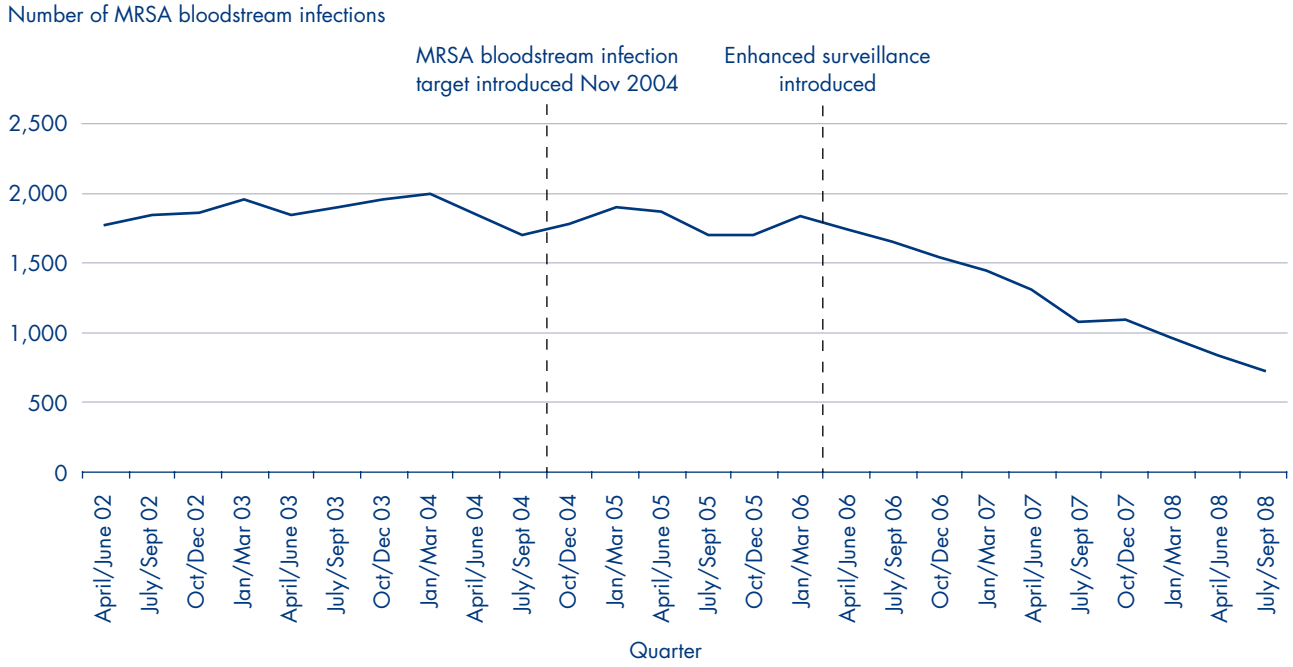
2.11 Mandatory reporting of MRSA bloodstream infections was introduced in 2001, and our 2004 report showed that the number of MRSA bloodstream infections had been increasing up to December 2003. In July 2004, the Department's Planning and Priorities Framework included a target to achieve year on year reductions of MRSA bloodstream infections. In November 2004, the Secretary of State announced a new national target to reduce MRSA bloodstream infections by 50 per cent by 2008, against a 2003-04 baseline.

2.12 To achieve this national target, the Department wrote to strategic health authority chief executives asking them to submit individual acute trust monthly trajectories for reducing MRSA bloodstream infections by 60 per cent by 2007-08 against a 2003-04 baseline. NHS acute foundation trusts did not have to submit trajectories, but the Department's letter said that the Department would be happy to receive them for information and would expect primary care trusts to take this priority into account when working with foundation trusts. The 60 per cent trajectory was introduced because some trusts already had low numbers (less than 12) and were not therefore expected to be able to achieve a 50 per cent reduction.

2.13 Over the last three years the Department has made a number of changes to the mandatory surveillance scheme for reporting MRSA bloodstream infections. Initially reports were published six-monthly, then quarterly and, from April 2005, trusts were required to report monthly. In 2005, the Department also asked the Health Protection Agency to develop a website to facilitate the electronic 'real time' reporting of enhanced information in a more timely and efficient manner. From April 2006 this website became the only vehicle for mandatory MRSA bloodstream surveillance reporting. Trusts were given responsibility for checking the accuracy of their data and the trust chief executive responsibility for formal sign-off.

2.14 **Figure 8** shows that following introduction of the target in 2004, quarterly reports on infections fell slowly until 2006 when a rapid reduction occurred. On aggregate the numbers of MRSA bloodstream infections fell from 7,700 in 2003-04 to 4,450 in 2007-08 (a 42 per cent decrease) and in 2008-09 fell to an estimated 2,984 (a 61 per cent reduction).[23]

8 Number of MRSA bloodstream infections reports to the mandatory surveillance system



Source: Health Protection Agency's healthcare associated infections surveillance system

23 Health Protection Agency 2009 and National Audit Office estimate based on the first three-quarters of 2008-09.

2.15 The Department did not clarify how it would evaluate the target when the target was announced. In 2007, the Department announced that the national target would be measured by comparing the average monthly figure for the quarter April to June 2008 with the baseline average monthly figure in 2003-04.

2.16 Using the Department's baseline reduction target comparing the average monthly figure in 2003-04 with the average monthly figure for the first quarter of 2008-09, the NHS achieved a 57 per cent reduction (from an average of 642 per month to 279 per month). Twenty-four per cent of trusts achieved reductions of over 80 per cent. However, 52 per cent of trusts missed their individual goal of reducing MRSA by 60 per cent, and 15 per cent of trusts had a higher rate in the first three months of 2008-09 than in the baseline year. The reductions have continued as shown by the quarterly figure for October to December 2008, 676 – a 65 per cent reduction on the 2003-04 baseline.[24]

2.17 Prior to April 2004, there were marked variations in the numbers of MRSA bloodstream infections between regions and type of acute trust, with the numbers of MRSA bloodstream infections in the London region almost double those of other regions and some general acute trusts up to seven times higher than others. The reduction in numbers of MRSA bloodstream infections since 2004 has been seen across the majority of trusts (85 per cent of trusts). Regional variations remain, but need to be interpreted with caution, because of variations in the numbers and types of trusts in each region. Nevertheless, the data shows that the East Midlands has the highest percentage reduction and the North West the lowest **(Figure 9).**[25]

The proportion of *Staphylococcus aureus (S. aureus)* that are meticillin resistant has fallen, but infection from the sensitive strain (MSSA) has risen

2.18 The decrease in the rate of MRSA blood stream infections needs to be seen in the context of bloodstream infections caused by *S. aureus* in general. As data on MSSA is not collected by the web-based mandatory surveillance system, we used the best available data reported to the voluntary surveillance system where 70 per cent of trusts have reported consistently. **Figure 10** shows that the total number of *S. aureus* blood stream infections decreased from 11,227 in 2004 to 10,625 in 2008 (five per cent), however, the number of bloodstream infections caused by MSSA increased from 6,765 in 2004 to 7,396 in 2008 (nine per cent).[26] This suggests that actions to reduce MRSA bloodstream infections have not had the same impact on MSSA bloodstream infections, although this is not universal as some trusts have shown similar reductions in both.

2.19 Data published in Scotland, whose mandatory surveillance includes both MSSA and MRSA bloodstream infections, shows MSSA reducing at a similar rate to MRSA.[27] There is currently no research available on these trends. In order to investigate further, better data on the sources of the patients' bloodstream infections and underlying risk factors are needed.

Numbers of cases of *C. difficile* have fallen since 2006

2.20 Voluntary laboratory reporting of *C. difficile* had shown an increasing trend since the mid 1990s, with increases of more than 20 per cent a year between 2001 and 2003. The reasons for this trend are not clear but may reflect a combination of factors in addition to increased transmission, such as changes in prevalent strain types, increased detection, and changes in antimicrobial prescribing. Use of antibiotics, especially multiple antibiotics is an important risk factor for *C. difficile* as they destroy the normal gut flora allowing *C. difficile* to multiply. Patients who develop *C. difficile* have also been found more likely to have been hospitalised in the preceding six months. The Department introduced mandatory surveillance of *C. difficile* in January 2004,

9 Percentage reduction in MRSA bloodstream infections per strategic health authority – 2003-04 compared with first quarter in 2008-09

Region	MRSA % Reduction
East Midlands	72
South Central	66
London	63
West Midlands	62
South West	58
South East Coast	54
East of England	51
Yorkshire & the Humber	49
North East	47
North West	42

Source: Health Protection Agency

24 Health Protection Agency and National Audit Office analysis.
25 National Audit Office analysis of Health Protection Agency data 2009.
26 Health Protection Agency analysis of LabBase data.
27 Health Protection Scotland 2008.

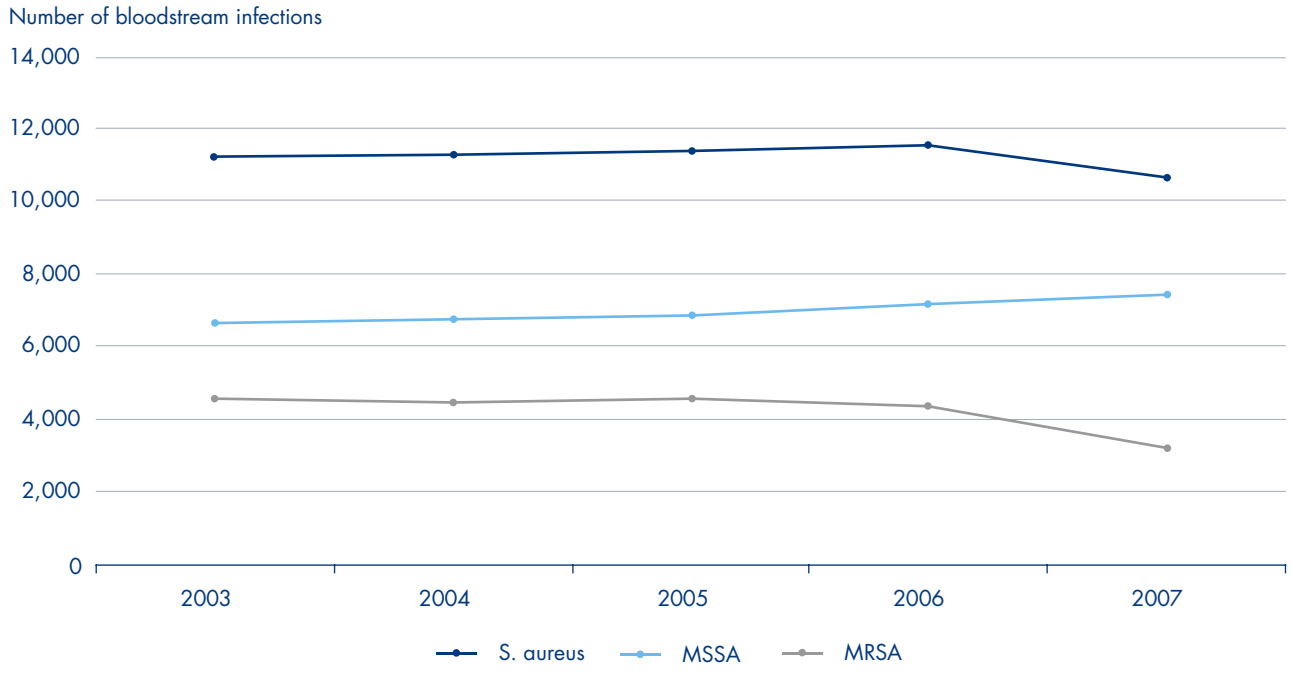
with a requirement for trusts to report the total number of cases in patients of 65 years and over, electronically to the Health Protection Agency every quarter. In 2004, there were 44,563 reports of *C. difficile* in patients 65 years and over. For 2006, reports of *C. difficile* infections in patients 65 and over rose to 55,635 (a 25 per cent increase from 2004).[28]

2.21 In April 2007, the Health Protection Agency developed a new reporting system, based on the enhanced MRSA system, for all patients over the age of two. In October 2007, the Department announced a national target to reduce the number of *C. difficile* infections by 30 per cent across all age groups by 2010-11, against the 2007-08 baseline. *C. difficile* is still largely a disease afflicting the elderly, with data collected in 2007-08 showing that 82 per cent of reports were for people aged 65 or over.

2.22 Current data for 2008 show that following the Department's introduction of the target to reduce *C. difficile* by 30 per cent, the numbers reported in patients aged 65 and over have reduced from 55,635 in 2006 to 32,628 in the 12 months ending December 2008 (a 41 per cent reduction). Twenty nine per cent of hospital trusts have reduced their rates of *C. difficile* infections by over 50 per cent, but 19 per cent had an increase in *C. difficile* infection. Whilst changes to the definition of a single episode of *C. difficile* infection are likely to have affected the number of cases reported, such changes are unlikely to explain the extent of the decreases in the number of *C. difficile* infections between 2006 and 2008.

2.23 Trends in rates of *C. difficile* have traditionally shown a marked seasonal variation, with a peak in the winter months (January to March) in cases reported in patients 65 years and over **(Figure 11 overleaf)**. Reasons for this peak are unclear, but may be related to winter peaks in antimicrobial treatment for elderly patients with pneumonia, making them more vulnerable to infection, and admission to hospital. Similarly, the increased incidence of viral gastroenteritis (such as Norovirus) in elderly people in winter months, may lead to increased detection of *C. difficile* toxin. This peak was less pronounced in January to March 2008.

10 Number of reports of *S. aureus* bloodstream infections, both MRSA and MSSA, taken from the 70 per cent of laboratories reporting to the voluntary surveillance system for both strains



Source: Health Protection Agency: Annual data is from the 70 per cent of labs consistently reporting data to labBase between 2003-07

28 Data in this section is from the Health Protection Agency and further analysis from the National Audit Office.

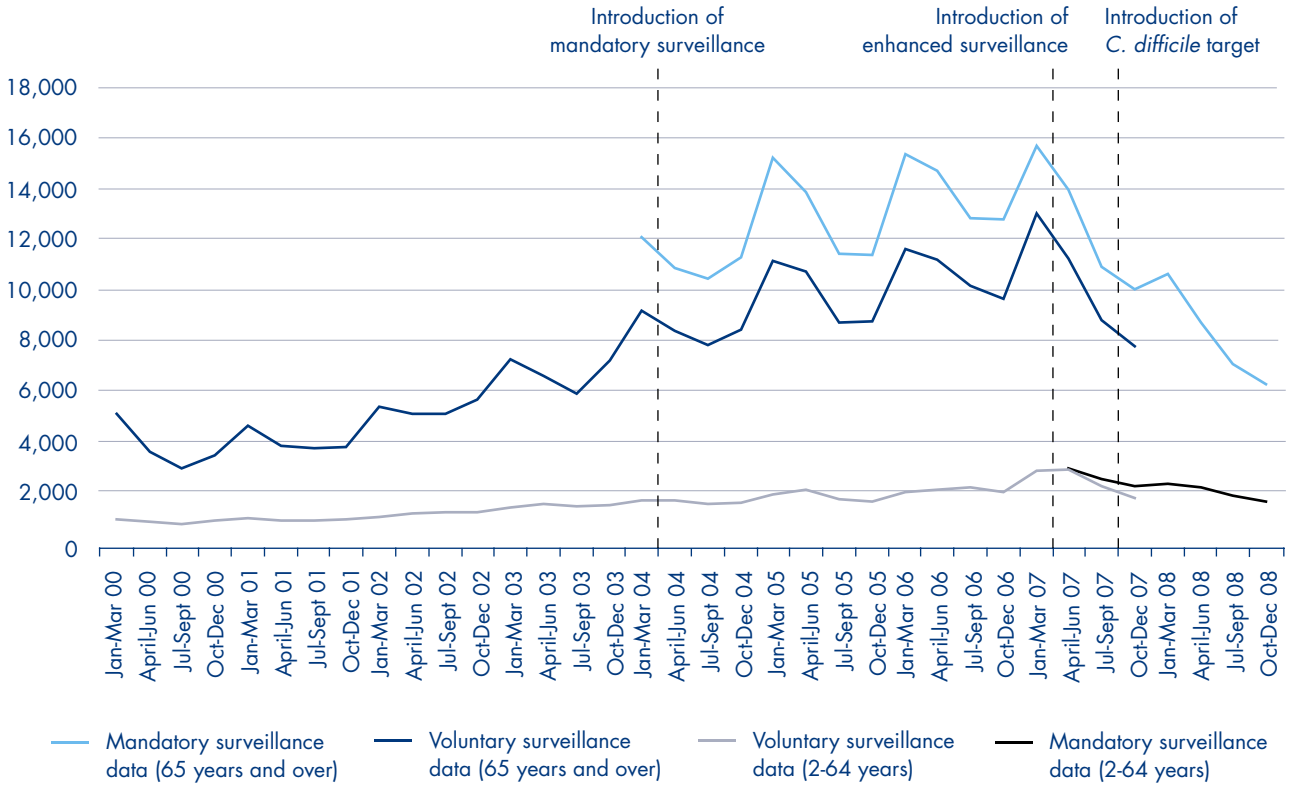
Community versus hospital presentation of *C. difficile*

2.24 Changes to the definition of hospital and community-associated cases of *C. difficile* were made in April 2008 to ensure that attribution of cases was more closely matched to the biology of the infection. It is now assumed that patients who have been in hospital less than three days (including the day of admission) have not acquired the infection in the hospital. Using this definition, approximately 44 per cent of *C. difficile* cases reported between April and December 2008 appear to be acquired outside of hospital. As with MRSA, there are regional variations between the numbers of *C. difficile*, but these are likely to reflect the variations in the types of trusts and demographics of the population. For example, in the London region only 15 per cent of specimens were from non-acute locations compared with 20 per cent in other regions.[29]

The Department's approach to sustaining reductions in MRSA bloodstream and *C. difficile* infection rates

2.25 The Department's Operating Framework for 2009-10 stated that once the MRSA and *C. difficile* targets are achieved, they will become national minimum standards for all NHS organisations. Unlike the waiting times targets, however, which are absolute targets, the new National Quality Board will be consulting on the definition of the minimum standard for MRSA based on reasonable tolerance from best practice. The Care Quality Commission will be monitoring performance against the MRSA standard, *C. difficile* target and compliance with the new Code of Practice.[30]

11 Trends in number of reports of *C. difficile* toxin positive specimens



Source: Health Protection Agency

29 Health Protection Agency 2009.
30 Care Quality Commission 2009.

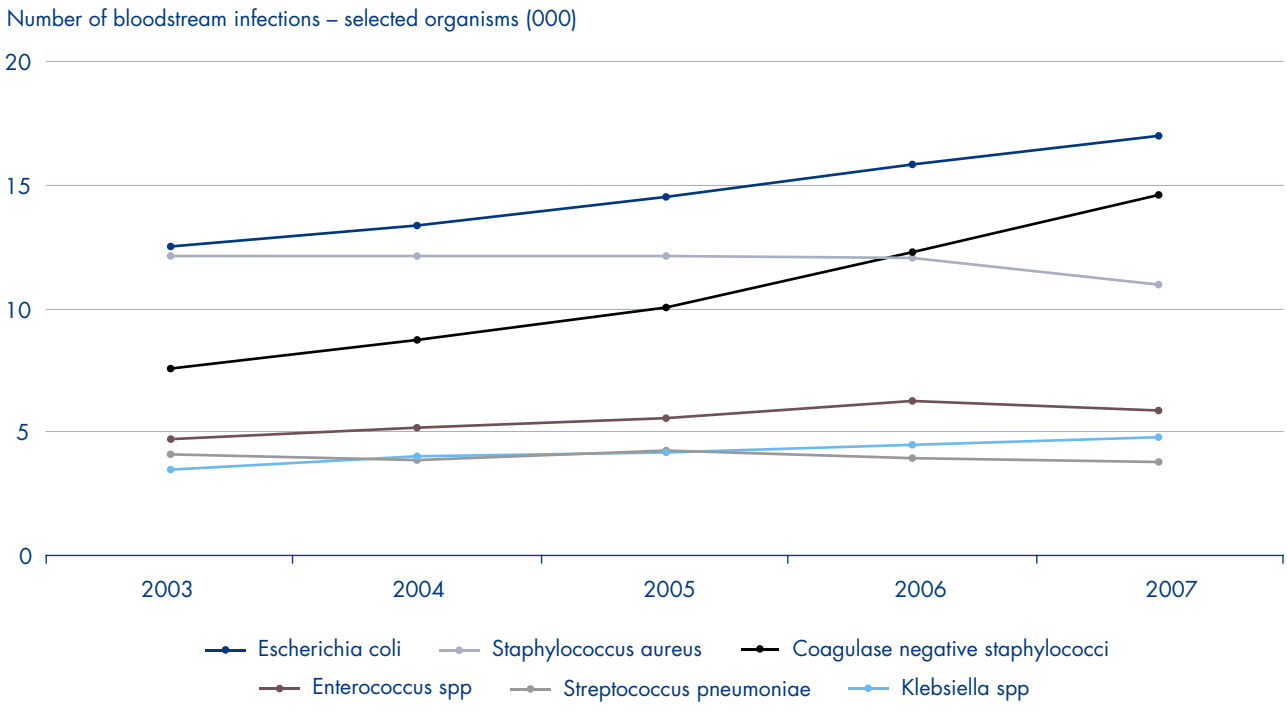
Trends in rates of other healthcare associated infections since 2004

Other causes of bloodstream infections have generally increased over the last four years

2.26 Bloodstream infections account for seven per cent of healthcare associated infections[31]. Whilst the number of bloodstream infections from MRSA was decreasing between 2003 and 2007, the best available data from the voluntary scheme, indicate that the number of reports of bloodstream infections have increased from 80,000 in 2003 to 105,000 in 2007.[32] This trend requires careful interpretation as it is influenced by the reliability and completeness of reporting, and it is difficult to identify where these infections were acquired. Increasing ascertainment has been seen over recent years as laboratories moved from manual to automated data transfer systems. To minimise the effects of changes in reporting we used a subset representing 70 per cent of laboratories which made consistent reports to the Health Protection Agency between January 2003 and December 2007 to evaluate trends. Overall, for these 70 per cent of laboratories, reports of bloodstream infections increased from 66,000 to 84,000 (27 per cent). Not all of these infections will be healthcare associated and some will be linked to healthcare provided in community settings.

2.27 **Figure 12** shows how the contribution of different infective agents has changed over time. The bacterium *Escherichia coli (E. coli)* is the most common cause of bloodstream infection (20 per cent), and is commonly a secondary infection linked to urinary tract infections or surgical site infections. The number of reports of *E. coli* bloodstream infections to the voluntary surveillance system increased by 33 per cent between January 2003 and December 2007 (from 13,000 to 17,000). Reports of *Klebsiella spp*, have also increased by 34 per cent over the same time period (from 3,500 to 4,700). The number of episodes of coagulase negative *Staphylococcal* (CNS) bloodstream infections has doubled since 2003 and now accounts for 17 per cent of all reports. *S. aureus* is the third most common bloodstream pathogen causing 13 per cent of infections in 2007.

12 Pathogens causing bloodstream infection reported to the voluntary laboratory surveillance system (subset of laboratories with consistent reporting in England). Source: Health Protection Agency, LabBase



Source: Health Protection Agency: Annual reports on bloodstream infections

31 Third National Prevalence Survey by Hospital Infection Society and Scottish Prevalence survey.
32 Health Protection Agency Analysis of LabBase 2009.

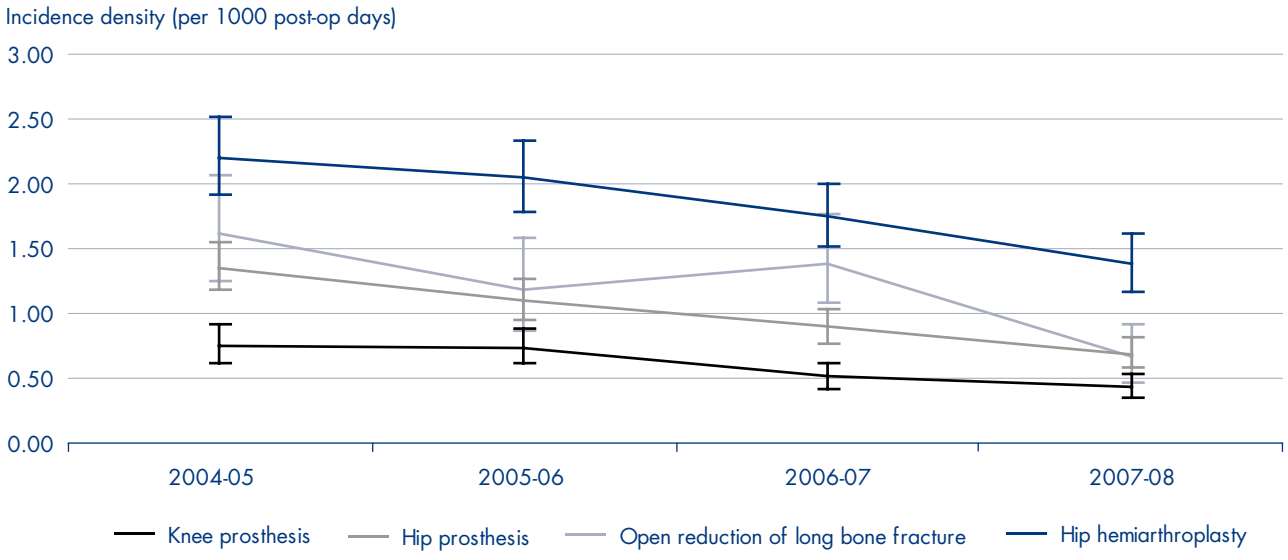
2.28 Not all of the above bloodstream infections will be healthcare associated, but the five most common pathogens which account for 65 per cent of these reports, are usually associated with healthcare infections. The limited evidence that is available suggests that 44 per cent of bloodstream infections in hospitals are associated with invasive devices (two thirds of these being central vascular devices).[33]

2.29 The increase in antimicrobial resistance among these pathogens is causing increasing concern because they account for a significant proportion of bloodstream infections and are difficult to treat. Analysis of surveillance data show dramatic increases in resistance of both *E.coli* and *Klebsiella spp*. to a number of key antibiotics.[34] Since October 2003, glycopeptide resistant *enterococci* bloodstream infections have also been reported under the mandatory surveillance system. The number of reports increased by 30 per cent in the first two years of this surveillance (from 628 in 2003-04 to 903 in 2005-06) and by less than one per cent between 2006-07 and 2007-08.

Surgical site infections collected under the mandatory surveillance scheme

2.30 The Department introduced mandatory surveillance for four types of orthopaedic surgical site infection in April 2004. Since 2004-05 the cumulative incidence rate of surgical site infections per 1000 post-operative inpatient days has declined for all four procedures and overall from 1.44 per cent to 0.6 per cent **(Figure 13)**. To understand more fully the changes in surgical site infection rates there is a need, as we recommended in 2000 and 2004, for robust systems of post-discharge surveillance. Only 14 per cent of trusts have a local system. From July 2008, the Department asked hospitals to establish systems to identify patients re-admitted with a surgical site infection and this data will be used to adjust the rates reported to the mandatory scheme.[35]

13 Changes in incidence per 1000 bed days of orthopaedic surgical site infections, with upper and lower 95 per cent confidence intervals



Source: Health Protection Agency

NOTE

This figure shows the incidence of surgical site infections following four orthopaedic operations reported to the national surveillance system which include knee prosthesis, hip prosthesis, hip hemiathroplasty, and open reduction of long bone fracture.

33 All data in this section is from data provided by the Health Protection Agency (provided as a separate report on our website) and further analysis from the National Audit Office.
34 Health Protection Agency, LabBase data 2008.
35 Health Protection Agency 2009.

Deaths as a result of Healthcare Associated Infections

2.31 Healthcare associated infections can compromise a patient's recovery; cause anxiety and discomfort; and can also lead to permanent disability and, in some cases, death. In our 2004 report we noted that national data on deaths due to healthcare associated infections was poor, and that the only national estimates were published by the Department in the 'Cooke Report' (1995). These estimates suggested that as many as 5,000 deaths may occur each year as a direct result of contracting an infection whilst in hospital, with 15,000 deaths where infection was a contributory factor. Whilst the Office of National Statistics had started to report deaths where MRSA was mentioned on the death certificates, the Committee of Public Accounts' report in 2004 criticised the Department and hospital trusts for not knowing how many patients had died as a result of all types of hospital acquired infections.

2.32 The Committee recommended that the Department should audit the number of deaths from all healthcare associated infections. In response the Department commissioned the Health Protection Agency and Office for National Statistics to undertake a confidential study of deaths following MRSA infection during 2005-07. In the pilot phase 18 deaths from nine hospitals were reviewed, and in the main study 38 deaths from 14 hospitals were reviewed. All the deaths reviewed had a laboratory confirmed MRSA bloodstream infection diagnosis between October 2005 and end of March 2006. The report in November 2007 found as follows.[36]

- Reporting of deaths due to MRSA bloodstream infections was inaccurate.
- The majority of patients who died following MRSA infection were elderly, 80 per cent over 70 years of age and only one under 50. MRSA was considered the main or contributory factor for nearly half the cases reviewed but the death certificates did not always state it as such.
- The patients had significant co-morbidities. Three quarters had at least two and were seriously ill, irrespective of their infections. For over a third of cases the cause of death was not documented in the medical record.
- The most frequently mentioned source of infection was via invasive devices, with deficiencies in the documentation of insertion, review and management, and only half of trusts auditing compliance with policies.
- Three quarters of trusts had problems implementing isolation policies because of inadequacies in numbers and fitness for purpose of rooms.

2.33 The Chief Medical Officer raised the need to improve reporting on death certificates in 2005 and 2007, in view of a widespread belief that the figures underestimate the mortality associated with MRSA and *C. difficile*. Following the above audit of MRSA deaths, he sent out a further letter to all trusts reinforcing the importance of including healthcare associated infection on death certificates, mentioning specifically MRSA and *C difficile*.

2.34 The Office for National Statistics has continued to report trends in deaths when MSSA, MRSA and *C. difficile* are mentioned as the underlying cause of death, or as contributory factor to the death. In the case of MRSA, there is no specific code that can be used to classify the infection, and potential MRSA related deaths must therefore be identified using *S. aureus* and infection codes combined with manual searching.

2.35 The most recent Office for National Statistics report indicates that in England the number of reports where MRSA was mentioned as a contributory factor or underlying cause increased by 73 per cent between 2003 and 2006 (from 902 to 1,556).[37] In 2007, however, the number of reports declined to 1,517 (a 2.5 per cent reduction). MRSA accounts for 78 per cent of all *S. aureus* mentions in death certificates but as this is more than two and half times the proportion of MRSA in bloodstream infections, it seems likely that these data overestimate the impact of MRSA as opposed to MSSA as a cause of death.

2.36 Reports of deaths related to *C. difficile* occur in far greater numbers. In England they increased by 360 per cent (from 1,720 to 7,916) between 2003 and 2007, with approximately half the mentions on death certificates describing *C. difficile* as the underlying cause of death. Some of this is likely to be due to increased reporting of deaths following the Chief Medical Officer's guidance on recording. As with MRSA, the number of deaths related to *C. difficile* increases with age, similarly reflecting increased susceptibility to colonisation and infection in the elderly. There is still no national data on deaths due to other healthcare associated infections.

36 Office for National Statistics and Health Protection Agency 2007: Confidential Study on Deaths Involving MRSA.
37 Office for National Statistics, 2008.

Cost of Healthcare Associated Infections

2.37 Our initial report in 2000 used data from a London School of Hygiene and Tropical Medicine study to identify the economic burden of healthcare associated infection.[38] The study used a rather limited data set which underestimated the cost. Our follow-up report in 2004 found that there had been little progress on cost information on healthcare associated infections, and only 16 per cent of trusts said they had carried out some form of evaluation on the costs of healthcare associated infection. What economic analysis there was generally indicated that the cost of improved prevention was likely to be more than covered by savings in treatment costs. We found little or no improvement in the quality of costing information on healthcare associated infections since 2004.

2.38 By 2008, 37 per cent of hospital trusts had attempted to calculate the financial costs associated with healthcare associated infections. The most popular method was to use the Department's productivity calculator (which is also based on the London School of Hygiene and Tropical Medicine's work) and 17 per cent of trusts were using this costing methodology. Our international comparison report found that cost data was limited and that the work of the London School of Hygiene and Tropical Medicine stands out internationally as one of the most comprehensive studies of costs.

2.39 The best estimate of treating healthcare associated infections therefore remains at least £1 billion, as quoted in our initial report in 2000 and our follow up in 2004. The cost of treating a healthcare associated infection varies, but the Department's productivity calculator estimates that each avoidable healthcare associated infection costs the NHS £4,300. The cost of treating a bloodstream infection such as MRSA is likely to be higher as length of stay is much longer. Applying the Department's cost data to data on MRSA bloodstream infections and *C. difficile* infections we estimate that in 2007-08 the costs to the NHS of treating people that acquired an MRSA bloodstream infection was at least £20 million and for *C. difficile* was £75 million. Details of the assumptions and methodology for calculating these savings from reducing these two infections are at Appendix 1.

2.40 Since the introduction of the MRSA bloodstream infection reduction target in 2003-04, by 2008-09 we estimate the NHS had saved between £45 and £59 million by reducing the numbers of MRSA bloodstream infections and between £97 and £204 million since 2006 by reducing the numbers of *C. difficile* infections (Appendix 1). Since 2003-04, the Department spent £120 million which consists of £57 million on the national initiatives which helped to bring about these reductions (paragraph 3.24) and a further £63 million on the one off Deep Clean.

Litigation costs

2.41 Another potential direct cost arises when patients successfully makes a legal claim for compensation after acquiring a healthcare associated infection. Data provided by the NHS Litigation Authority shows that the number of claims related to healthcare associated infections is rising **(see Figure 14)**. Over £16 million has been paid out in the last four years. As claimants have three years from the date of the incident to bring a claim, the figures from 2005-06 onwards are incomplete, but there are provisions for outstanding claims which total around £37 million.[39]

Public confidence

2.42 Despite the reductions in the numbers of MRSA bloodstream infections and *C. difficile* infections the public remain concerned. In the most recent National Patient Choice Survey in 2008, 74 per cent of patients identified hospital cleanliness and low infection rates as an important factor when choosing a hospital. In research commissioned by the Department in December 2007 only 27 per cent of people agreed with the statement "NHS hospitals are getting infections like MRSA under control".[40] A number of patient organisations report that calls to their help lines continue unabated.

14 Litigation costs associated with healthcare associated infections are rising

Notification Year	Number	Total Paid to date (Damages and Costs) 000s	Total Outstanding 000s
2004-05	77	£8,000	£900
2005-06	110	£4,900	£7,500
2006-07	131	£2,900	£13,000
2007-08	164	£800	£16,000
Total		**£17,000**	**£37,000**

Source: NHS Litigation Authority

38 Plowman *et al* (1999): The Socio-economic Burden of Hospital Acquired Infection – Public Health Laboratory Service London.
39 NHS Litigation Authority 2009.
40 Department of Health MORI Survey 2007.

PART THREE

Managing healthcare associated infections nationally

3.1 In 2004, the Department acknowledged that progress in implementing many of the Committee's recommendations from 2000 within NHS trusts had been 'patchy'. It told the Committee it intended to drive through improvements using the same approach to achieving targets for waiting times: a combination of financial incentives, performance management and support. They subsequently introduced guidance and enacted new legislation, supported by a Code of Practice and bought in new inspection powers for the Healthcare Commission. This part of the report assesses the effectiveness of the Department's approach, including the impact of legislation and inspection by examining the impact of these initiatives in hospital trusts. We also examine the impact that other national and regional bodies have had in tackling healthcare associated infections.

Guidance and advice provided to trusts

3.2 In response to the 2004 report the Department published 'Towards cleaner hospitals and lower rates of infection' and established a Programme Board under the leadership of the Chief Nursing Officer, which set up an improvement programme. As part of this programme the Department has developed a series of high level initiatives such as the 2005 'Saving Lives' document and in 2006 'Going Further Faster – Implementing Saving Lives'. In January 2008, the Department published 'Clean, Safe Care: Reducing infections and saving lives' which draws together recent initiatives to tackle healthcare associated infections and improve cleanliness, and identifies new areas where the NHS should consider spending.

3.3 While the Department have scientific evidence on the theoretical effectiveness of various interventions, there has been very little assessment of individual initiatives following implementation. It is difficult to assess the overall effectiveness of various initiatives and guidance as there was no baseline for measures, or understanding of what hospitals were doing prior to 2000. Assessing the effectiveness of individual initiatives is also complicated by the overlapping timescales in which they were introduced and the multi-faceted approach taken to tackling healthcare associated infections. The Department has now commissioned Thames Valley University to evaluate its programme.

The Department's Improvement Team

3.4 The Department's Healthcare Associated Infection Improvement Team was set up in 2006 to provide support to hospital trusts and help them achieve their contribution to the MRSA target. By the end of 2007, the team had completed its initial review, during which they offered help to all NHS hospital trusts. Support offered ranges from a three day visit including interviews with senior staff, observations of care audits and inspection of the environment on wards, to telephone advice.

3.5 Trusts were positive about the support they received from the Improvement Teams in our trust census, and 87 per cent who had been visited rated them as effective. In trusts we visited we found that the Improvement Team had clearly been a catalyst for change. The Department estimates that expenditure on the Improvement Team was £3 million in 2007-08.

Saving Lives

3.6 Saving Lives was launched in June 2005 following the publication of 'Towards cleaner hospitals and lower infection rates – a summary of action'. It has since been updated and re-launched. It provides the tools and resources for hospital trusts to embed robust infection prevention and control across their organisation. It contains the seven 'High Impact Interventions', or 'care bundles', tools that allow staff to monitor compliance with clinical guidance and provide feedback so that compliance levels can improve consistently. They cover the insertion and management of lines and catheters, ventilation, surgical site infections and the risk of C. *difficile* (see part 4). The Government Office for Science has formally reviewed the use of science in the Department's approach to tackling healthcare associated infections and concluded that the 'seven High Impact Interventions' produced as part of the Saving Lives toolkit all have good research backing.[41]

3.7 Ninety five per cent of Directors of Infection Prevention and Control in hospital trusts felt Saving Lives had been effective. Responses from our census suggested that the programme was becoming part of hospital trusts' processes and governance: 84 per cent had incorporated priority areas from the Saving Lives self assessment questionnaire into their risk register compared with 49 per cent in 2006.[42]

Success of National Initiatives

3.8 **Figure 15** sets out our assessment of the benefits and costs of the national initiatives the Department has funded to tackle healthcare associated infections. It is difficult to judge the impact of individual initiatives on the numbers of infections as there is a lack of baseline information about what was happening in hospitals before initiatives were implemented; a lack of assessment by the Department; and many initiatives were implemented concurrently. The table gives our judgement on cost effectiveness based on the evidence behind the initiatives and our own independent evaluation from visits to hospitals, staff surveys and the trust census.

41 Government Office for Science (2008): Science Review of the Department of Health.
42 National Audit Office analysis of trust census (2009).

15 Evaluation of the Benefits and Costs of National Initiatives

Modern Matrons **Cost:** at least £56 million per annum

What was its purpose?

Public consultation that informed the NHS Plan in 2000 provoked a call for the return of a matron figure, a strong clinical leader at ward level. Their role is focused on:

1 providing a clean environment for care;

2 ensuring best practice in infection control;

3 improving clinical care standards; and

4 treating patients with dignity and respect.

The NHS Plan proposed that 2,000 modern matrons should be in place across the NHS by 2004. This target was subsequently increased, in 2004, to 5,000 modern matrons to be in place by May 2008.

Was it fully implemented?

Across all trusts (including primary care trusts and mental health trusts) there were 5,066 modern matrons as at 2008. Hospital trusts reported that they employed 3,573 modern matrons. Of these 1,527 were new posts created in the trust. The initiative was implemented as intended.

What was its impact?

Infection control teams responding to our trust census were positive about the impact modern matrons have had on infection control and cleanliness: 65 per cent agreed that they had contributed to improved standards of cleanliness in clinical areas and 68 per cent agreed that they had contributed to improved infection prevention and control. This is a significant improvement on the results of our 2003 survey.

How much did it cost?

No extra funding was provided to trusts specifically for modern matrons and the Department has carried out no costing of the programme. Based on NHS pay bands, the cost of the additional 1,527 modern matrons in 2008-09 is at least £56 million[1].

Has it been cost effective?

Trusts believe modern matrons have contributed to improvements in cleanliness, infection control compliance and patient confidence.

We conclude that the benefits are likely to outweigh the costs.

Clean**your**hands **Campaign (ongoing)** **Cost:** £2.5 million (excluding the cost of hand rub)

What was its purpose?

The clean**your**hands campaign has four components:

1 ensuring the availability of alcohol hand rub on wards;

2 distributing materials to be displayed in wards to remind healthcare workers to clean their hands;

3 the provision of 'patient empowerment' materials designed to encourage patients to ask healthcare workers if they have cleaned their hands; and

4 audit and feedback of hand hygiene compliance at least once every six months.

Was it fully implemented?

Three and a half years after the campaign was rolled out it is still considered a high priority in 90 per cent of trusts. Hand hygiene campaigns were running in all the trusts we visited.

What was its impact?

The Department of Health funded an independent four year evaluation of the campaign, the National Observational Study to Evaluate the Clean**your**hands (NOSEC) campaign. This evaluation carried out surveys over the course of the campaign to measure performance against the four criteria set out above.

The main findings were:

1 alcohol hand rub is at the point of care in nearly all wards in 96 per cent of trusts (83 to 90 per cent in earlier surveys);

2 posters are available in all wards in 97 per cent of Trusts (75 to 89 per cent in earlier surveys);

3 only 36 per cent of trusts believe the campaign has encouraged patients to ask healthcare workers if they have cleaned their hands (as in earlier surveys); and

4 regular audit and feedback of hand hygiene compliance occurs in 91 per cent of trusts having risen gradually from 48 per cent.

Overall combined alcohol hand rub and soap procurement has tripled from 20 to 60ml per patient per day. Alcohol hand rub use was strongly associated with reductions in MRSA bloodstream infections. It is not effective for *C. difficile* which requires soap and water[2].

15 Evaluation of the Benefits and Costs of National Initiatives *continued*

Clean**your**hands **Campaign (ongoing)** ***continued***

How much did it cost?	The campaign has cost the National Patient Safety Agency £2.5 million to run over its four years. Further costs such as the cost of alcohol hand rub will have been borne by trusts in implementing the campaign.
Has it been cost effective?	Elements of the campaign have been a success with the exception of 'patient empowerment'. The National Patient Safety Agency are doing more work to address this. Although, it is not possible to disassociate the impact of the clean**your**hands campaign from other interventions, given its low costs, the importance of hand hygiene and the results of the evaluation, it is reasonable to say it has been cost effective.

The Deep Clean (one off) **Cost:** £62.6million

What was its purpose?	The Deep Clean initiative in 2007-08, was a one off thorough clean of all hospitals in trusts: "a more concentrated programme of cleaning, often using new equipment or specialist skills". The main purpose of the deep clean was to provide a better environment for improving patient care and a backdrop to deliver infection control. Trusts were encouraged to continue regular deep cleans. Other intended benefits were an ongoing improvement in cleanliness, a reduction in infection rates and an improvement in patient confidence.
Was it fully implemented?	Our trust census showed that all hospital trusts had carried out a deep clean. Of these, 93 per cent had completed it by the deadline of 31 March 2008. In order to carry out a deep clean properly, experts told us wards should ideally have been closed and a decant ward made available. Only 15 per cent of trusts were able to do so for all wards, and 48 per cent were not able to do so at all.
What was its impact?	The deep clean has had a positive impact on cleanliness in many trusts; 59 per cent of infection control teams in our trust census agreed that cleanliness had improved in their trust since carrying out the deep clean. The deep clean has helped raise the profile of cleaning and cleanliness in many trusts. It has been part of a package of measures that have contributed to an improvement in cleaning standards in the NHS as evidenced by audit results and Patient Environmental Action Team scores. The impact on healthcare associated infection has not been measured. The majority of trusts intend to repeat the exercise at least annually (81 per cent). Sixty five per cent of trusts had changed their cleaning schedule in some way since its completion. Many trusts have spent some of the funds for the deep clean on new equipment, refurbishments or extra cleaning staff which will confer benefits beyond the one-off deep clean. There was an operational impact on trusts of carrying out the deep clean. Fifty two per cent of trusts agreed it had caused 'significant disruption to hospital activity'.
How much did it cost?	The Department allocated £62.6 million, via strategic health authorities, to all trusts.
Has it been cost effective?	Alongside other trust level initiatives, the deep clean has delivered significant improvements in hospital cleanliness and improved patient and staff confidence. Because of other initiatives going on at the same time it is not possible to attribute specific reductions in infection rates to the Deep Clean.

The Healthcare Associated Infections Technology Programme including the Rapid Review Panel **Cost:** £10 million per annum plus £25,000 on the Panel

What is its purpose?	The Rapid Review Panel was set up in 2004 to provide a prompt assessment of new and novel equipment, materials and other products that may be of value in improving hospital infection prevention. In 2008, the HCAI Technology Innovation Programme was launched to both accelerate the development and adoption of technologies and identify new technologies to help combat infections. The programme has also been designed to specifically support the work of the Rapid Review Panel by promoting those technologies. Such products and technologies are examined in Showcase Hospitals where service evaluations are undertaken. Reports are published to provide the NHS with ready-made information to promote adoption and diffusion. Showcase Hospitals also form a local hub network so that other local trusts can easily access performance information concerning RRP1 technologies and other technologies targeted for evaluation for the purpose of gaining a better understanding of their contribution to helping fight infection.

15 Evaluation of the Benefits and Costs of National Initiatives *continued*

The Healthcare Associated Infections Technology Programme including the Rapid Review Panel *continued*

What was its impact?	The Rapid Review Panel has put in place a methodology for assessing the effectiveness of innovations, but the dissemination of these throughout the NHS has not yet occurred. To date seven products have received a 'recommendation one', meaning that efficacy has been proved both scientifically and in use, out of over 200 submitted. The Department was not able to demonstrate sales of products recommended by the panel and has not carried out an assessment of its performance. However, the Technology Innovation Programme has been designed to showcase level 1 recommendations and develop business related cases to help staff make the case locally, thereby helping to facilitate adoption and diffusion of these technologies.
How much did it cost?	The costs of the Rapid Review Panel are approximately £25k per annum. From 2008-09 the Department has allocated £10 million per annum for the Technology Programme.
Has it been cost effective?	Cost effectiveness of this programme has yet to be tested although if it results in more rapid uptake of proven technology, the benefits are likely to outweigh the costs.

MRSA Screening (staged implementation) **Cost:** £130 million per annum from 2010-11

What is its purpose?	Screening is the testing of patients for the presence of MRSA on the most common sites (nose and sometimes armpit or groin) on or before admission followed by decolonisation to reduce the risk of self-infection and help prevent its spread to other patients within hospital trusts. The 'Our NHS, Our Future' interim report, published by the Department in October 2007 announced that all trusts are required to carry out screening for MRSA for all elective admissions by 1 April 2009, and for all emergency admissions as soon as possible within the next three years. Evidence for the cost effectiveness of screening from other countries is mixed. Screening, as part of a search and destroy approach, has been successfully used in other countries such as Holland. The costs, however, are high and a study in Switzerland found that screening did not reduce MRSA infections.
Was it fully implemented?	It is expected that all trusts will be screening by 1 April 2009. At the time of our census in November 2008, 34 per cent of trusts were screening elective patients and 18 per cent all admissions.
What was its impact?	The impact is not yet known.
How much did it cost?	The Department estimates the total cost of screening for MRSA bacteria will be £130 million per annum from 2010-11 onwards. Based on our trust census, we estimate that compliance with screening of all elective patients by March 2009 will cost trusts an additional £29 million.
Has it been cost effective?	The cost effectiveness of this policy has yet to be tested.

Source: National Audit Office

NOTES

1 National Audit Office analysis (2009).

2 All based on National Audit Office and NOSEC analysis (2009).

Other national and regional bodies tackling healthcare associated infections

3.9 A number of different arm's length bodies and NHS bodies have been involved in supporting the Department's national approach. Roles and responsibilities of these bodies have evolved over time with some overlap and duplication, particularly on data collection (Appendix 2). Eighty-three per cent of trusts agreed that they often reported the same data in different formats to different external bodies, and 45 per cent that the data requests are not in a consistent format or easy to complete.[43]

3.10 Our trust census identified concerns about the clarity of the roles and responsibilities of some external agencies. Twenty-three per cent of trusts were unclear about the role of the Health Protection Agency, and 39 per cent were unclear about the role of its Health Protection Units in relation to healthcare associated infection. Twenty-five per cent were unclear about the role of strategic health authorities, and 25 per cent were unclear about the role of the National Patient Safety Agency.

The role of the Health Protection Agency

3.11 The role of the Health Protection Agency, and its regional Health Protection Units, includes surveillance, providing specialist and reference microbiology and microbial epidemiology, co-ordinating the investigation and identifying the cause of national and uncommon outbreaks, helping advise government on the risks posed by various infections, and responding to international health alerts. In relation to healthcare associated infections, the role of the Health Protection Agency has been focused around collection and publication of surveillance data (Appendix 2).

3.12 In July 2007, the Health Protection Agency Board agreed that there was a lack of clarity on the role of the Health Protection Agency in relation to healthcare associated infections, and that there was a need to define and communicate the role, particularly at a local level. In discussions with the Department it was agreed that the Health Protection Agency's role was surveillance, diagnostics, advice and support, and research and development.[44]

3.13 The Healthcare Commission investigations at Stoke Mandeville, Maidstone and Tunbridge Wells highlighted instances where despite the availability of national surveillance data, the trusts failed to recognise its significance and act on it in a timely manner. There was also confusion about the roles and responsibilities of external organisations, such as the Health Protection Agency, strategic health authority and the local primary care trust, particularly as to who was responsible for intervening in the event of an outbreak (Appendix 5).

3.14 Thirty-eight per cent of trusts felt that the Health Protection Agency had been ineffective in helping them to tackle healthcare associated infections, and 48 per cent thought that the local Health Protection Units had been ineffective in this regard. The Health Protection Agency is actively progressing with the Department and the NHS Confederation actions to promulgate its roles and responsibilities and an NHS stakeholder meeting is planned for autumn 2009.

The role of the National Patient Safety Agency

3.15 The National Patient Safety Agency (NPSA) takes the lead on patient safety across the health sector (Appendix 2). In relation to infection control it is responsible for the design, implementation and management of the Patient Environmental Action Team, the clean**your**hands campaign, and the development of the root cause analysis tool that the Department adapted for healthcare associated infections. Many healthcare associated infections meet the NPSA's definition of a patient safety incident, but very few trusts link their approach to healthcare associated infection with patient safety.

3.16 Trusts report patient safety incidents to the NPSA via the National Reporting and Learning System. Reporting to the NPSA is voluntary. In 2007-08 hospital trusts reported 13,386 infection related incidents, which make up less than two per cent of the data they receive. This data has been used to inform patient safety guidance such as the NPSA Patient Safety Alert on hand hygiene in September 2008. Thirty-three per cent of trusts felt the NPSA were ineffective or not applicable on healthcare associated infection.

43 National Audit Office trust census.
44 HPA Board Meeting 25 July 2007.

The role of Monitor

3.17 Monitor has used its statutory powers of intervention when foundation trusts are not achieving their MRSA trajectory, or are failing to comply with the Code of Practice. Performance on MRSA and *C. difficile* are the only non financial measures on which foundation trusts report to Monitor. Monitor also uses performance against these targets as criteria for assessing a trust's application to become a foundation trust. Most foundation trusts reported that they were clear about Monitor's role in relation to healthcare associated infections and were effective in supporting them.

The role of strategic health authorities

3.18 Strategic health authorities are expected to monitor the results of mandatory surveillance and performance management work. They are also expected to record serious untoward incidents involving healthcare associated infections and ensure that trusts are taking actions to prevent a further incident and to support learning. There is no consistent definition of a serious untoward incident in terms of infections, and little dissemination of lessons learnt.[45] A quarter of trusts were unclear about the role of the strategic health authority and a similar number thought they were ineffective in helping them to tackle healthcare associated infections.

The impact of legislation and inspection

The role of the Healthcare Commission

3.19 All NHS trusts in England received an annual health check from the Healthcare Commission. Trusts are assessed on the basis of criteria set out for Core Standards, three of which relate to aspects of healthcare associated infection prevention and control. Trusts are also assessed against national targets relating to healthcare associated infections. The Healthcare Commission in its 2007 national report judged performance overall to be improving.[46]

3.20 The Healthcare Commission were also given the role of inspecting all NHS trusts against the Code of Practice. In an analysis of 51 inspections the Healthcare Commission found that 90 per cent of trusts had at least one breach of the Code, although only three per cent of these were material in nature. Eighty seven per cent of trusts in our census felt that these inspections had been effective in helping their trust in tackling healthcare associated infections. The threat of an Improvement Notice was seen as highly likely to focus a trust's attention, and the inspection programme was taken seriously by senior management in trusts. Fifteen trusts in our census criticised the length of time taken to get feedback from an inspection and felt that they should have known about any concerns found by the inspection at the earliest stage to make any necessary improvements.

3.21 The Healthcare Commission's programme of inspection visits, its reports, Improvement Notices and other assessment and sanctions did draw attention to poor performance. The Healthcare Commission issued seven improvement notices (two had already declared compliance with the core standards on infection control) and has used its statutory powers to report significant failings and recommend 'special measures' to the Secretary of State once. It issued three serious investigation reports on individual trusts following serious outbreaks of infections with high numbers of deaths.[47]

3.22 Regulatory powers have been strengthened by the new Health and Social Care Act 2008 which created the Care Quality Commission in April 2009. The Care Quality Commission continues the Healthcare Commission's work on healthcare associated infections, but with tougher powers to inspect, investigate and intervene on cleanliness and infections. Trusts who fail to adhere to the Code of Practice can be fined. The new registration system provides a means by which the new enforcement powers can be applied to the NHS, and healthcare associated infection was the only registration requirement for 2009-10. Eleven hospital trusts failed to meet the regulations for registration and the Care Quality Commission placed conditions on them to ensure that they made necessary improvements promptly.

45 Healthcare Commission 2008: Final report on emerging themes from root cause analysis on healthcare associated infections (unpublished); and National Audit Office 2006: A Safer Place for Patients: Learning to improve patient safety.
46 Healthcare Commission (July 2007): Healthcare Associated Infection: What Else Can the NHS do?
47 Healthcare Commission: Investigation into outbreaks of *Clostridium difficile* at Stoke Mandeville Hospital, Buckinghamshire Hospitals NHS Trust (July 2006); The management of *Clostridium difficile* – The University Hospitals of Leicester NHS Trust (March 2007); Investigation into outbreaks of *Clostridium difficile* at Maidstone and Tunbridge Wells NHS Trust (October 2007).

Resource devoted to tackling healthcare associated infections in hospitals

3.23 In 2007-08 the Department and its arm's length bodies spent approximately £10 million on tackling healthcare associated infection. Spending is estimated to rise to £25 million in 2008-09. For the period April 2004 to March 2009, the Department and its arm's length bodies have spent nearly £57 million **(see Figure 16)**. Other bodies have had a role in tackling healthcare associated infections but could not separately identify their expenditure.[48]

16 Expenditure on Healthcare Associated Infection by the Department and it arm's length bodies between 2004 and 2008

	2004-05 (£000s)	2005-06 (£000s)	2006-07 (£000s)	2007-08 (£000s)	2008-09[1] (£000s)	Total (£000s)
Department of Health	2,000	2,000	3,000	5,000	16,000	29,000
Health Protection Agency	4,000	4,000	4,000	4,000	4,000	20,000
Healthcare Commission	40	100	100	300	4,000	4,500
National Patient Safety Agency	500	500	500	500	500	2,500
NHS Institute	Nil	700	300	Nil	Nil	1,000
Total	6,500	7,000	8,000	10,000	24,500	**57,000**

Source: National Audit Office

NOTE

1 Estimated expenditure.

48 National Audit Office analysis of Departmental and arm's length body data (2009).

PART FOUR

Improving infection prevention and control

4.1 Previous reports by the Committee of Public Accounts made it clear that there needed to be a shift in responsibility for the prevention, management and control of healthcare associated infection from the infection control team, to everyone in the hospital trust. There was a need for changes in attitude in many hospital trusts, and ultimately for changes in the behaviour of individual staff. We had also identified a need for improved compliance with good infection control practices, cleaning and antibiotic prescribing within trusts, as well as for improvement in isolation facilities and reducing bed occupancy. In this Part we evaluate the extent to which compliance has improved and the key barriers to further improvement.

Responsibility of trusts for infection prevention

4.2 Changing trusts' attitudes to infection prevention and control is important for delivering sustainable improvements. As part of our fieldwork we visited 12 trusts identified as having made significant improvements in their performance on tackling healthcare associated infections, to try and identify the characteristics that contributed to improvement. We identified two key characteristics:

- strong leadership from the hospital trust board and cascaded down to wards; and
- a performance management approach emphasising responsibility, support where necessary and underpinned by robust and appropriate data.

Trust leadership and the role of the chief executive and the board

4.3 The chief executive and the hospital trust board are now legally responsible for signing off compliance against the Code of Practice. Our surveys showed 88 per cent of staff agreed that senior hospital leaders were taking a strong lead on infection prevention and were committed to improving rates in their trust, and that 70 per cent agreed they were acting as positive role models and were making visible efforts to reduce infection rates. Responses frequently gave examples of board members getting involved with hand hygiene audits to demonstrate their commitment to the agenda. Infection control teams responding to our census identified senior management leadership and engagement as the most important action their trust had taken in improving the prevention, management and control of infection.

4.4 The Healthcare Commission investigations at Maidstone and Tunbridge Wells NHS Trust in 2007 and Stoke Mandeville hospital in 2006, highlighted trusts where leadership was not focused on infection prevention (see Appendix 5). In these cases either the advice of the infection control team was ignored or the trust was not aware of the scale of the problem they faced. Negative publicity and the impact on the senior management in these cases have been a key factor in focusing attention in other trusts on healthcare associated infections. An independent evaluation commissioned by the Healthcare Commission showed their investigation had not only resulted in wholesale change at Maidstone and Tunbridge Wells NHS Trust, but had the biggest impact of all their investigations nationally, with other trusts reviewing their procedures in light of the recommendations.

Performance management and making infection prevention everyone's responsibility

4.5 An effective system of performance management requires the following characteristics: defined responsibilities and objectives; relevant metrics; and regular review of performance. Our census found that 61 per cent of trusts always included responsibility for compliance with infection prevention policy and procedures in their job descriptions for all staff.

4.6 The majority of trusts felt that poor performance in infection prevention was challenged always or generally (88 per cent).[49] Trusts have taken differing approaches to managing poor performance. Some have been more willing to use disciplinary routes, or accountability meetings, while others emphasised the need for a co-operative approach and the provision of support.

4.7 Seventy nine per cent of nurses and 58 per cent of doctors agree that they receive data on infection rates for their ward/ clinical area on a regular basis.[50] The data however, has been limited to MRSA and more recently *C. difficile*. Trusts that had effective performance management systems had supplemented mandatory surveillance data with other measures such as results of hand hygiene audits, other infection rates, measures of prescribing or other patient safety data. Trusts that collected good quality data on a wide variety of indicators were more likely to be able to identify outliers, reward good performance, and challenge poor performance.

Others with a direct responsibility for infection prevention

Role of the Director of Infection Prevention and Control

4.8 In 2003 the Department required that all organisations providing NHS services should designate a Director of Infection Prevention and Control (DIPC). They were established to oversee local infection control arrangements, take responsibility for the infection control team, and provide a link reporting to the board. In 2006 the role of the DIPC was reinforced and made mandatory as part of the Code of Practice, to ensure that infection control is handled at an executive level, and that it is made the responsibility of everyone in the trust.

4.9 We found that the DIPC role has been implemented in a variety of ways in different trusts. There is no single 'best practice' model for how the role is performed or whether roles are carried out by nurse, consultant or microbiologist. What matters is their commitment to quality and patient safety, good communication and reporting channels and access to people with expert prevention and control advice (see Appendix 4 Case Study – Reducing healthcare associated infections as part of an overall quality strategy).

The role and work of the infection control team

4.10 Our 2000 and 2004 reports found that infection control teams in hospital trusts were under-resourced in relation to growing expectations placed on them. The Code of Practice and the national targets mean that infection control teams have taken on a much higher profile within trusts and are better resourced. Although infection control needs to be the responsibility of all trust staff, infection control teams provide advice and support, and carry out audit and surveillance. Our trust census showed that staffing of infection control teams has increased since 2004, 83 per cent of hospital trusts now exceed the international guidance of one infection control nurse (ICN) per 250 beds, as reported in our 2000 and 2004 reports. The proportion of time infection control doctors are spending on their role has also increased **(Figure 17)**.

17 Infection Control Team staff resource

	Average from 2008 NAO Census	Average from 2004 NAO Census
Ratio of Whole Time Equivalent (WTE) Infection control nurses to beds (ICN)	1:189	1:315 (1:524 in 2000)
Number of WTE ICN vacancies as at 1 October 2008	0.79	0.30
Number of infection control doctors (WTE)	1.15	n/a
Percentage of working time infection control doctors spend on infection prevention and control	66%	3.5 medical consultant sessions per week (~30%)
Number of clerical or support staff (WTE) for infection prevention and control	0.93	0.90

Source: National Audit Office

49 National Audit Office trust census.
50 National Audit Office staff survey.

4.11 Based on our trust census we estimate that hospital trusts spent nearly £120 million in total in 2007-08 on infection prevention and control. This total is made up of £61 million capital expenditure and £59 million revenue (infection control staff, training and other items of revenue expenditure). On the basis of our analysis of the Department's Estates Returns Information Collection data, expenditure on cleaning in NHS hospital trusts has increased from £355 million in 2003-04 to £522 million in 2007-08. There remains wide variation in expenditure between trusts **(Figure 18 overleaf)**.

4.12 In 2004, 55 per cent of trusts had a separate budget for infection control teams, excluding staff costs. This had increased to 61 per cent in 2008, with an average budget of £46,000, but this varied from £700 to £1.3 million.[51]

4.13 Our data on expenditure at both central Government level (the Department and its arm's length bodies) and within trusts underestimates the full expenditure on preventing and controlling infections. It is not possible to directly apportion all the staff time taken across hospital trusts, arm's length bodies and the Department on this issue. Moreover, as the focus of our study was on hospitals, we did not survey primary care trusts, so we do not have figures for their resource expenditure.

Link practitioners

4.14 Our previous report in 2000 highlighted how infection control link practitioners can be an effective way of disseminating and monitoring compliance with good infection practice on the wards. The Healthcare Commission found that lower rates of coverage by link practitioners were associated with higher rates of *C. difficile*.[52] The proportion of trusts using link practitioners has risen to 94 per cent, from 82 per cent in 2004, and 60 per cent in 2000. The average number per trust has risen from 54 in 2004 to 71 in 2008.

4.15 A lack of protected time (allocated time that must not be sacrificed to other pressures) for link practitioners was found to hinder their abilities to carry out their infection control duties in the Stoke Mandeville investigation. The Healthcare Commission study also analysed the relationship between incidence of infection and the provision of protected time for link practitioners and found evidence to support this finding. We found that only 37 per cent of trusts had protected time for their link nurses.

Reporting of infection incidents

4.16 Ninety four per cent of infection control teams agreed that they had an open and fair culture for reporting infection incidents and near misses.[53] An open and fair culture is important to encourage reporting of incidents. Based on our staff surveys, nurses are more likely to report incidents (91 per cent of nurses compared with 67 per cent of doctors) and thought they would be dealt with more fairly (83 per cent of nurses compared with 51 per cent of doctors). Junior doctors in our focus groups stated they were unlikely to formally report incidents, which they saw as time consuming and unlikely to lead to improvements.

Training in trusts on infection prevention

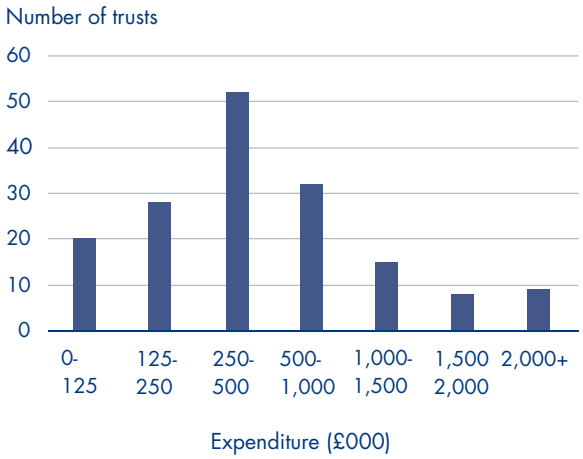
4.17 Staff training on infection control practices has improved since 2004. It is now a mandatory part of training alongside issues such as health and safety and fire training. Trusts believe that the priority given to infection prevention in training has increased over the last four years, and infection control teams felt it had sufficient coverage in the induction programme for new staff and in ongoing training. Eighty six per cent of nurses and 74 per cent of doctors in our surveys agreed that they had received sufficient training in infection prevention in the last 12 months. There are however, a number of areas where staff would like to receive extra training. For instance, 25 per cent of nurses responding to our survey would like to receive extra training in isolation practices, and 36 per cent of doctors in prescribing.

4.18 Trusts we visited highlighted junior doctors as having the least understanding of infection control practice. To counter this, one trust had introduced a web-based test which junior doctors needed to pass before they were allowed on wards. Another had established Friday afternoon as infection control training time and had trained all 7,000 staff from porters to non-executives. Clinical managers and staff feel that good role modelling and local practice on wards was more important as a determinant of behaviour than training. We found some good examples, particularly among nursing staff. Junior doctors indicated that role modelling from their consultants was more mixed (see Appendix 4 Case Study – 'Implementing a "Bare Below the Elbows" dress code' to see how one hospital trust has implemented guidance on dress code for its staff).

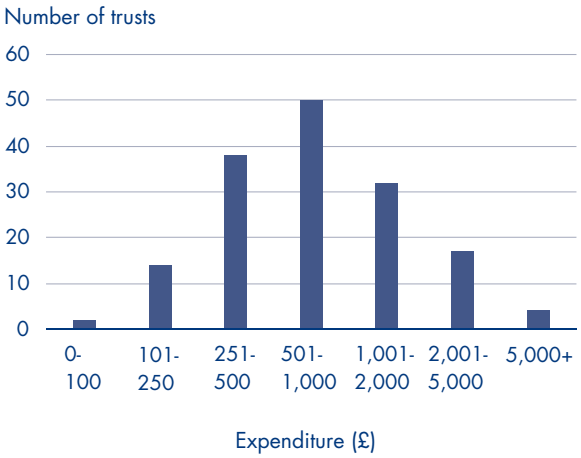
51 National Audit Office trust census 2008 and National Audit Office trust census 2004.
52 Healthcare Commission, July 2007, Healthcare associated infection: What else can the NHS do?
53 National Audit Office trust census.

18 Analysis of expenditure on tackling healthcare associated infection at trust level in 2007-08 based on National Audit Office trust census

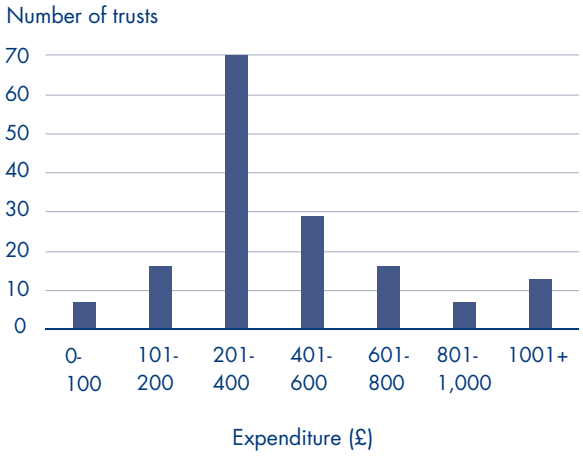
Trusts' total annual expenditure on infection control (Mean = £707,000)



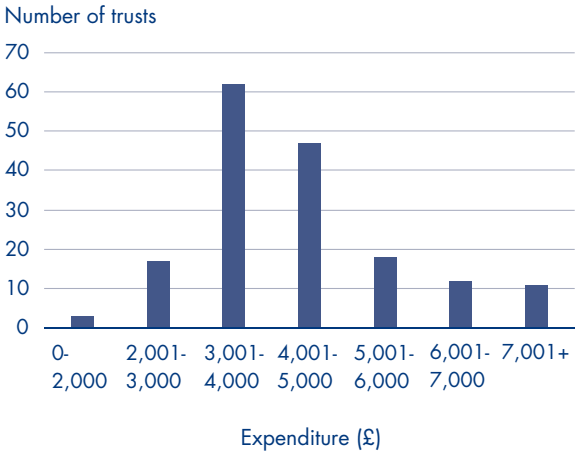
Trusts' total annual expenditure on infection control per bed (Mean = £970)



Trusts' annual revenue expenditure on infection per bed (Mean = £450)



Trusts' spending on cleaning per bed (Mean = £4,300)



Source: National Audit Office and Department of Health (bed data for 2007-08) and Estates Returns Information Collection data

Root Cause Analysis

4.19 Root cause analysis is expected to be carried out when a MRSA bloodstream infection is found. A root cause analysis is a case review to identify the cause and lessons from an incident or problem. Our census found that 86 per cent of hospital trusts are also doing root cause analysis for *C. difficile* outbreaks and 42 per cent of trusts are using the technique for other infections (trusts visits and validation of responses showed that that this was commonly limited to serious outbreaks or MSSA).

4.20 Root cause analysis has also been effective in highlighting individual and team responsibilities for infection prevention, and focusing accountability. Trusts identified the key factors to carrying out effective root cause analyses were: having the time to do it properly; involving of all members of the clinical team; and ensuring that learning is shared. It can also act as a useful tool for surveillance of common themes across a department, trust or health economy.

Cleanliness, antibiotic prescribing and compliance with good infection control practices within trusts

Cleaning

4.21 Improving environmental cleanliness has been a key part of many trusts' improvement strategies for infection control. One trust felt that improving ward design and cleaning had been one of the key improvements they had made that led to reductions in *C. difficile*. Other trusts and ward staff felt that a clean and uncluttered environment was linked to improved behavioural compliance, for instance hand hygiene. The deep clean in 2007-08, was seen by trusts to have contributed to improving the priority of cleaning and improved patient confidence.

4.22 Patient Environment Action Teams (PEAT), established in 2000, assess hospitals' cleanliness on a self-assessment basis. The Teams consists of various staff including nurses, matrons, doctors, catering and domestic staff, estates managers, and executive and non-executive directors. They also include patients, patient representatives and members of the public. The Healthcare Commission (2007) found an association between PEAT cleaning scores and reduction in *C. difficile* infections. The majority of trusts were carrying out PEAT inspections on a monthly basis (71 per cent)[54]. Standards of cleaning, measured through PEAT inspection scores, have improved since 2000, but cleaning is nevertheless the area where the Healthcare Commission has found the most breaches of the Hygiene Code to date. In an analysis of 51 unannounced inspections, 27 trusts did not comply with the duty that premises were suitable, clean and well maintained. Only one of these, however, was considered to be material, where there was a possible risk to patient safety.

4.23 Since our last report in 2004 and the end of 2007-08 there has been a 47 per cent increase in expenditure on cleaning within trusts.[55] This upward trajectory in expenditure predates, and does not include, the funding provided for the deep clean. We have also seen year on year improvements in audit scores within trusts for cleaning, although there are issues with the comparability of this data.

Hand hygiene

4.24 The link between hand hygiene and infection rates has been acknowledged by the Department since 2000. The difficulty has been ensuring compliance. The clean**your**hands campaign run by the National Patient Safety Agency has given a national lead on raising levels of hand hygiene compliance within trusts. At a local level, trusts have either taken on this campaign directly, or run their own hand hygiene campaigns.

54 National Audit Office trust census.
55 Departmental Estates Return Information Collection (ERIC).

4.25 Our survey of nurses showed that they felt their compliance with the World Health Organisation's Five Moments for Hand Hygiene, used by the National Patient Safety Agency, was high (above 90 per cent on all aspects). Doctors and nurses were in agreement that staff in their trusts understood the importance of hand hygiene in preventing the risk of transmission of infections (94 per cent agreed). When asked why staff might not comply with hand hygiene, the most cited reasons were lack of time (38 per cent) and dry skin/irritation (33 per cent).

Prudent antibiotic prescribing

4.26 Drug resistant infections are more common in hospitals where high levels of antibiotic use encourage organisms to develop resistance, and where close concentrations of people with increased susceptibility allow infections to spread. Inappropriate use of antibiotics is a key factor. Controlled and appropriate prescribing of antibiotics within trusts is therefore an essential part of any infection prevention strategy (see Appendix 4 Case Study – Ongoing monitoring and control of antibiotic prescription and *C. difficile* through a link physician system). The Code of Practice emphasises the importance of prudent antibiotic prescribing. Appropriate prescribing helps prevent the build up of antibiotic resistance and the selection of resistant strains of bacteria, such as MRSA, and helps prevent establishment of *C. difficile* infections.

4.27 Trusts are improving compliance with good practice on antimicrobial prescribing by developing trust wide policies, and default prescriptions for antibiotics. Over 90 per cent of trusts are actively engaging their pharmacists to reinforce prescribing policy. In our survey of doctors, 85 per cent agreed that they know and follow the prescribing guidance for their area. Nearly a third of trusts do not have an effective system for reviewing prescriptions of antimicrobials after a defined period. The Department did not implement the Committee of Public Accounts recommendation that the National Programme for IT should include the hardware and software to support the collection of national surveillance data, including effective links between pathology, microbiology, prescribing and administration systems.

Zero tolerance to avoidable infections

4.28 The Department's 'Saving Lives' initiative introduced seven High Impact Interventions which are simple evidence-based tools that reinforce practical steps to reduce avoidable infections, for example, a tool for providing safe catheter care. Infection control teams are often involved in auditing against High Impact Interventions (67 per cent of trusts). Our trust census focused on clinical audit of compliance **(Figure 19)** which suggests that audit is being effectively fed back, leading to changes in process and having an effect on compliance. However, many infection control teams felt they did not have time to carry out their full plan of clinical audit.

19 Trust infection control team's views on clinical audit

	Strongly agree or agree %	Neither agree nor disagree %	Disagree or strongly disagree %
We (the infection control team) were able to carry out our full plan of clinical audit for the last year	51	9	40
Results of clinical audits were fed back to individual staff/ clinical units and led to improvements in practice	88	6	6
Processes have been changed where appropriate as a result of infection control audit	95	5	0
Based on the results of our audits, compliance with High Impact Interventions in our trust is high	63	27	10

Source: National Audit Office

4.29 Some trusts are now taking a zero tolerance approach to avoidable infections. The Institute for Healthcare Improvement in the USA has shown that hospitals have been able to reduce their incidence of central line associated infections to zero. In the USA, the Centers for Medicare and Medicaid Services now withhold payments to providers for these infections. This approach requires an important change in culture where there is a full acceptance that these types of infection are preventable and not tolerated. The NPSA has launched a programme 'The Matching Michigan' initiative based on a model which achieved a large and sustained reduction in catheter related blood stream infections in intensive care units.[56]

4.30 We visited trusts which were implementing systems for safe insertion and management of lines, as part of Saving Lives, which is fundamental to zero tolerance. These trusts used aseptic non-touch technique, and systems for monitoring the length of time lines were in place and recognising the risks of infection. Some trusts had also had a dedicated team for insertion and management of lines.

Potential barriers to sustained and future improvements in infection rates

4.31 Respondents to our trust census and staff surveys identified a number of potential barriers to both sustained and further improvement in infection rates. In common with our previous reports the most commonly identified barriers for improvement were: bed occupancy and staffing levels; the availability of isolation facilities; and the management and prevention of infections outside of hospitals.

Bed occupancy and staffing levels

4.32 In our trust census 72 per cent of Directors of Infection Prevention and Control believed that bed occupancy was a barrier to improvement, of these, 61 per cent said it was a significant or very significant problem in respect of reducing infection rates. When asked to name the three biggest barriers to creating sustained improvement, 44 per cent of Infection Control Teams cited bed occupancy/low staffing numbers as an issue. There has been no significant reduction in the overall levels of bed occupancy. Average bed occupancies, as produced by the Information Centre, for 2007-08 were 85.3 per cent, and for Elderly Care, a high risk group for healthcare associated infection, were 90.8 per cent. Average bed occupancy levels in 26 per cent of trusts are over 90 per cent. Bed occupancy levels in the UK are high by international standards.[57]

4.33 There is some evidence to suggest that high bed occupancy levels and low staffing levels are linked to higher infection rates, and some evidence against. The Department carried out an investigation over two separate periods of time 2001-04 and 2004-06. In the first of these they found a positive relationship between MRSA and bed occupancy levels but did not find a relationship for the second period. No significant relationships with staffing levels were found.[58] The Department has not repeated this analysis for *C. difficile*.

4.34 High bed occupancy can put pressure on staff at busy times. Low levels of staff compared to patients is a commonly cited reason for patient safety incidents, and a reason for non-compliance on infection control. Some trusts believe that a focus on other targets affects infection control practice. In particular, 59 per cent of trusts experienced some difficulty in reconciling the management of healthcare associated infection with the fulfilment of the four hour Accident and Emergency target, which compares with 34 per cent in 2004 and 45 per cent in 2006.[59]

Availability of isolation facilities

4.35 Twenty three per cent of hospital trusts identified having enough isolation facilities as a key barrier to improvement, again an issue which has been raised in previous reports and where there has been some improvement in overall levels. Since 2003-04, the percentage of beds that are in single rooms in hospitals has increased from 17 per cent to 19 per cent in 2007-08.[60] Our trust census asked whether trusts had conducted a review of the adequacy of their isolation facilities since 2004: 85 per cent had done so and two thirds of these concluded that they had insufficient facilities.

4.36 We found evidence that isolation facilities were being used more effectively in relation to infection control. Our census showed that 89 per cent of infection control teams felt that bed managers were seeking and following their advice before making decisions around patient isolation, compared to 46 per cent in our 2004 census.

56 National Patient Safety Agency (2009).
57 Health at a Glance 2007: OECD Indicators.
58 Department of Health (2007).
59 National Audit Office trust census 2008 and 2004, Healthcare Commission census 2006.
60 Departmental Estates Return Information Collection (ERIC).

The Healthcare Commission in its inspections against the Code of Practice found that in its first round of inspections in 2008 only six out of 48 trusts breached the Code's requirement on the provision of suitable isolation facilities. Reasons ranged from a lack of an assessment to identify the overall need for isolation facilities, to not having enough isolation facilities. Theoretical models constructed by the London School of Economics have identified the time to isolate as one of the most important factors in reducing the spread of *C. difficile* infections, rather than just the number of isolation facilities (available on the NAO website).

Management and prevention of infections acquired outside of hospital

4.37 The focus of our study has been on the prevention, management and control of healthcare associated infections in hospitals, but many infections arise in other settings and only manifest themselves within hospitals. Conversely, patients are infected or colonised within hospitals but symptoms are not apparent until after discharge and potentially infections can arise outside of hospitals. The same systems and standards are not yet in place for community healthcare and some trusts (11 per cent of hospital trusts in our census) believe that this disparity is a barrier to improvement on infection rates.

4.38 A 'health economy' wide approach is needed to deliver further improvements, particularly for infections such as *C. difficile*. It requires a joined-up approach from the hospital trust, primary care trust and the regional Health Protection Units. Our trust census found that 65 per cent of trusts had done some work to estimate the prevalence of healthcare associated infections in their local health economy (see Appendix 4 Case Study – Improving compliance with good practice guidance in care homes). This work was however, largely limited to MRSA and *C. difficile* and only 19 per cent had looked at other types of infection. In January 2008, the Department published guidance "Clean Safe Care" which highlights the importance of a whole health economy approach.

4.39 Primary care trusts have been given additional powers in the 2008-09 NHS contract to fine trusts for their performance on *C. difficile*, and are expected to hold monthly clinical review meetings between providers and commissioners covering performance. Thirty seven per cent of hospital trusts are unclear about the role of primary care trusts in tackling healthcare associated infections and 49 per cent felt they were ineffective. Understanding the interaction between patients in care homes, trusts and the community will be required to deliver sustainable improvements in infection rates.

APPENDIX ONE

Methodology

1 Outlined below are the main elements of the methodology we used to produce this report.

Census of acute and acute foundation trusts

2 We conducted a census in October/November 2008 of all 170 NHS hospital trusts. The census comprised of three questionnaires to be completed by chief executives, Directors of Infection Prevention and Control and infection control teams respectively. The objective of this census was to capture the views of trusts on the initiatives launched by the Department of Health, as well as exploring what has been successful at tackling healthcare associated infections at trust level, and what barriers to improvement remain. We had a 98 per cent response rate and there were only four trusts which failed to respond. A summary of the responses to the census is published on our website.

3 We collaborated with a Medical Research Council funded project named I-STRAT and the NOSEC study. The I-STRAT project was led by Professor Barry Cookson and Dr Sheldon Stone and was exploring interest in a randomised clinical trial of an isolation intervention. The NOSEC study, funded by the Patient Safety Research Programme and led by Dr Sheldon Stone was the final part of the evaluation of the clean**your**hands campaign 2004-08. We worked with both these teams on our analysis of the census responses.

4 In order to verify the data this survey yielded, 15 trusts were randomly selected and asked to participate in telephone interviews to discuss the responses given. The resulting interviews covered responses on working with external bodies, surveillance and expenditure. This gave us an opportunity to validate the data we had received, and to ask further questions where appropriate. It also gave trusts an opportunity to raise any other issues they felt were relevant to our study. Other financial results from the survey have not been subject to a full audit and could be subject to variation due to the different interpretation of the survey guidance by individual organisations. These figures were, however, signed off by the chief executive as accurate.

Visits to hospital trusts

5 We visited 12 hospital trusts identified by the Department and other stakeholders as displaying good practice on infection control or making improvements in their infection control performance. We used our visits to triangulate our findings through interviews with staff and managers, making our own observations on wards and around hospitals.

6 We shadowed the Department of Health on a visit of their Improvement Team, and the Healthcare Commission on one of their Code of Practice inspections. We also visited certain primary care trusts who were identified to us as having a good working relationship with hospital trusts in their area on infection control.

Analysis of data on infection rates

7 We contracted with the Health Protection Agency to carry out a review of the data they hold and of other relevant sources, such as the National Prevalence Study, and to produce a report looking at changes and trends in infection rates since our last report in 2004. The aim of this was to go beyond what was known about MRSA and *C. difficile* and determine what trends there were in other infection rates and types, and to investigate what gaps in surveillance existed. This report is published on our website.

Staff surveys

8 We drafted questions with a consultant from Imperial College NHS Trust. These were aimed at addressing some of the cultural and behavioural issues that are relevant to tackling healthcare associated infections. The key constructs underlying this were: leadership; performance management; reporting; communications; teamwork; and compliance. The survey also contained open ended questions that gave respondents to supply their own comments on developments or issues with infection control. A summary of the responses to these surveys is published on our website.

Survey of doctors

9 We commissioned Medix to conduct an online survey of hospital doctors from across the NHS in England. We collected data on their strategic health authority region, whether they were a junior doctor or a consultant, or whether they were a specialist in infection control. This enabled us to ensure that we had a representative sample, and to explore any significant differences between groups.

10 In total 1,050 doctors completed our survey. Responses broke down as follows:

- Consultants: 76 per cent/Junior doctors: 24 per cent.

11 In total, 83 infection control doctors completed the survey representing 30 per cent of all infection control doctors in hospital trusts based on results from our census.

Survey of nurses

12 We ran an online survey of nurses in collaboration with the Royal College of Nursing which helped publicise it. We also contacted each strategic health authority to ask them to cascade the survey link to the hospital trusts in their region.

13 In total 1,551 nurses completed our survey. Responses broke down as follows:

- Qualified nurse: 1,434/Healthcare Assistants: 117.

14 From our trust census we estimated that there are currently 740 infection control nurses working in hospital trusts. Nearly a third (247) of these responded to our nurses' survey.

Junior doctor focus groups

15 Our scoping work identified engagement and compliance of junior doctors as a potential issue. We therefore held a series of focus groups with junior doctors aimed at exploring further some of the constructs identified above, and to find out further about issues such as role modelling within trusts and undergraduate and ongoing education and infection control. Focus groups were held with junior doctors at: University College London Hospital, Royal Surrey County Hospital, Nottingham University Hospitals NHS Trust and Portsmouth Hospitals NHS Trust.

Interviews with key stakeholders

16 Between May and November 2008, we visited and interviewed a range of stakeholders, including:

- Staff in the Healthcare Associated Infections and Cleanliness Division, and other relevant staff, within the Department of Health;
- Key staff involved with healthcare associated infections at the Healthcare Commission, the Health Protection Agency, the National Patient Safety Agency, the Health and Safety Executive, the NHS Litigation Authority and Monitor;
- The lead on healthcare associated infections at each of the strategic health authorities;
- The Hospital Infection Society and the Infection Prevention Society;
- Other stakeholders (UNISON, The NHS Confederation, The Royal College of Nursing); and
- The Government Office for Science.

International comparisons

17 We contracted J A Roberts and B Cookson to carry out a review of international comparisons covering: organisational structures and strategies; data on infection rates; and barriers to improvement and costs. This work also provided an update to the review of academic work on healthcare associated infections undertaken by R Pratt. This report is published on our website.

System dynamics modelling

18 We worked with David Lane, Diogo Quintas and Alec Morton (Operational Research Group at the London School of Economics), to develop a system dynamics model looking at the underlying mechanisms that operate during an outbreak of *C. difficile* and uncover potential policy leverages. The model was used to simulate different scenarios. A summary of this is published on our website.

Document review

19 As part of our scoping and fieldwork we carried out an extensive review of publications by the Department and its arm's length bodies on healthcare associated infections, as well as various academic publications where relevant.

Expert panel

20 We used a panel of experts from a range of organisations with an interest in healthcare associated infections to review our report. The following were members of this panel:

- Dr Adam Fraise – Chairman, Hospital Infection Society, Consultant Microbiologist and Director of Infection Prevention and Control, University Hospital Birmingham Foundation Trusts
- Dr Andrew Pearson – Consultant Epidemiologist, Head of the Healthcare Associated Infections and Anti-Microbial Resistance, Health Protection Agency
- Professor Barry Cookson – Director of the Laboratory of Healthcare Associated Infection, Health Protection Agency
- Jennie Wilson – Programme Leader, Surgical Site Surveillance, Health Protection Agency
- Martin Kiernan – President of the Infection Prevention Society, Nurse Consultant for Prevention and Control of Infection, Southport and Ormskirk Hospital NHS Trust
- Professor Roger Finch – Professor of Infectious Diseases at the University of Nottingham and Chair of the Advisory Committee on Antimicrobial Resistance and Healthcare Associated Infection
- Rose Gallagher – Royal College of Nursing, Infection Control Adviser

Methodology for calculation of savings from reductions in MRSA and *C. difficile*

21 The calculation of the cost and saving figures related to MRSA in Part 2 of the report are set out in **Table 1**. This sets up a counterfactual scenario where the number of MRSA bloodstream infections continues to increase after the introduction of the target in 2003-04 at the same annual rate seen between 2001-02 to 2003-04 (2.8 per cent). We also calculate a saving compared to the situation in the baseline year (2003-04).

22 The number of infections in 2008-09 is estimated based on data publicly available at the time. The cost per MRSA bloodstream infection used in the calculation is £4,300. This figure is taken from Plowman *et al*, 'The Socioeconomic Burden of Hospital Acquired Infection', uprated using healthcare deflators. It is the figure used by the Department in their 'HCAI productivity calculator'.

23 The cost and saving figures related to *C. difficile* in Part 2 are calculated on the same basis **(Table 2 overleaf)**. Here we use 2006 as the baseline year and develop a counterfactual scenario where the number of infections continues to increase at the same annual rate as between 2004 and 2006 (11.7 per cent). Here we use a figure of £4,200 as cost of infection. This is based on a review of evidence available carried out by the Department. We also calculate a saving based on the baseline year (2006).

TABLE 1

We estimate that reductions in MRSA bloodstream infections have led to between £45 and £59 million savings to the NHS

Year	Number of infections	Year on year change %	Cost	Saving compared to baseline of 2003-04	Infections in counterfactual scenario	Counterfactual scenario cost	Saving in counterfactual scenario
2001-02	7,291	n/a	£31,351,300	0	7,291	£31,351,300	0
2002-03	7,426	1.85	£31,931,800	0	7,426	£31,931,800	0
2003-04	7,700	3.69	£33,110,000	0	7,700	£33,110,000	0
2004-05	7,233	-6.06	£31,101,900	£2,008,100	7,913	£34,026,021	£2,924,121
2005-06	7,096	-1.89	£30,512,800	£2,597,200	8,132	£34,967,385	£4,454,585
2006-07	6,383	-10.05	£27,446,900	£5,663,100	8,357	£35,934,793	£8,487,893
2007-08	4,444	-30.38	£19,109,200	£14,000,800	8,588	£36,928,965	£17,819,765
2008-09 estimated	2,984	-32.85	£12,831,300	£20,278,800	8,826	£37,950,642	£25,119,442
Total saving				**£44,548,000**			**£58,805,806**
Infections 'avoided'				**10,360**			**13,676**

Source: National Audit Office

TABLE 2

We estimate that reductions in *C. difficile* infections have led to between £97 and 204 million savings to the NHS

Year	Number of infections	Year on year change %	Cost	Saving compared to baseline of 2006	Infections in counterfactual scenario	Counterfactual scenario cost	Saving in counterfactual scenario
2004	44,563	n/a	£187,164,600	0	44,563	£187,164,600	0
2005	51,829	16.31	£217,681,800	0	51,829	£217,681,800	0
2006	55,635	7.34	£233,667,000	0	55,635	£233,667,000	0
2007	50,461	-9.30	£211,936,200	£21,730,800	62,163	£261,086,381	£49,150,181
2008	32,628	-35.34	£137,037,600	£74,898,600	69,458	£291,723,258	£154,685,658
Total				**£96,629,400**			**£203,835,839**
Infections 'avoided'				**28,181**			**48,532**

Source: National Audit Office

APPENDIX TWO

Roles and responsibilities of other bodies involved with healthcare associated infection

Body	Description of their role	Is their role clear to hospital trusts?
Health Protection Agency	The Health Protection Agency's (HPA) role on healthcare associated infections includes: collection and publication of mandatory and voluntary surveillance; providing specialist and reference microbiology and microbial epidemiology; co-ordinating the investigation and identifying the cause of national and uncommon outbreaks; helping advise government on the risks posed by various infections and responding to international health alerts. The HPA has been responsible for providing multidisciplinary specialist advisory teams to a large number of trusts in England to support them in tackling healthcare associated infections. The local Health Protection Units (HPU) monitor health issues in their local area and responding to incidents as they happen. Their role is both proactive, helping prevent healthcare associated infections, as well as reactive, carrying out risk assessments to find out how outbreaks occurred, and recommending ways to prevent them happening again, and compiling statistics on notifiable diseases.	Some trusts responding to our census were unclear about the role of the HPA (22 per cent felt it was unclear) or the regional HPUs (38 per cent). Fifty per cent of trusts agreed that monitoring and feedback from the HPAs mandatory surveillance system has helped to improve infection control in their trust. Following board agreement within the HPA, the HPA has clarified its role in relation to healthcare associated infections with the Department. It recognises that there is more work to do to communicate this role with the wider NHS. The HPUs now receive mandatory surveillance data for MRSA and *C. difficile* each month for the trusts in their region for discussion at Infection Control Committee meetings. Training Workshops have been provided for HPU staff to help them with interpretation of the data. A set of standards was introduced to measure HPUs compliance with the agreed roles and responsibilities and an audit was performed against these standards in late 2008. The HPA has acknowledged in the HCAI Strategic Plan that there is a need to strengthen healthcare epidemiology for 2008-2013. The HPA established the *C. difficile* Ribotyping Network for England (CDRNE) in 2007 which provides typing information to enable the identification and management of outbreaks of *C. difficile*. The CDRNE also collects antibiotic risk and outcome data.

Body	Description of their role	Is their role clear to trusts?
The Healthcare Commission	Until 31 March 2009 the Healthcare Commission had a detailed role with regard to healthcare associated infections through their Code of Practice inspections and their annual health checks. In January 2008, the Healthcare Commission began a programme of unannounced inspections at all NHS trusts to check their compliance with the Code of Practice. All NHS trusts in England receive an annual health check from the Healthcare Commission. Trusts are assessed based on criteria set out for Core Standards (Core Standards C4a, C4c and part of C21 relate to the prevention and control of healthcare associated infections) and progress against national targets (including national targets relating to healthcare associated infections). The Healthcare Commission also carried out investigations into poor performance within NHS trusts. They carried out three investigations where performance on infection control has been inadequate at Maidstone and Tunbridge Wells and Stoke Mandeville.	Trusts were clear about the role of the Code of Practice inspections (91 per cent felt they were clear), and felt that the threat of an Improvement Notice has focused trust attention on tackling healthcare associated infections (74 per cent agreed). However, some trusts did not feel that the inspections were leading to improvements (19 per cent felt they had been ineffective). Trusts understood the role of the annual health checks (97 per cent felt they were clear) and felt they were effective in helping tackle healthcare associated infections (87 per cent agreed). Their investigations at Stoke Mandeville and Maidstone and Tunbridge Wells, and the subsequent dismissal of senior staff caused significant political and media attention. Seventy five per cent of trusts in our census felt that this had focused their attention on tackling infection rates.
Care Quality Commission (replaced the Healthcare Commission in April 2009)	On 1 April 2009 the Care Quality Commission took over the roles of the Healthcare Commission for carrying out inspections against the Code of Practice and the annual health check, as set out above. It is operating a new registration system for NHS providers and has new powers to prosecute providers for repeated or serious breaches of registration requirements – which could result in fines of up to £50,000, and to suspend or cancel, or impose conditions on a provider's registration. Registration for 2009-10 relates to healthcare associated infection, although more criteria will be added in future years.	Too early to assess.
Monitor	Where there are ongoing concerns about performance of foundation trusts against infection targets or compliance with the Code of Practice, Monitor has used its statutory powers to intervene and require rapid improvement. Performance on infection rates is one of the criteria Monitor use to assess applications for foundation trust status.	Where applicable, trusts felt that the role of Monitor was clear (93 per cent felt it was clear) and it was effective in helping their trust tackle infections(88 per cent felt they were effective).
National Patient Safety Agency	The National Patient Safety Agency (NPSA) takes the lead on patient safety across the health sector. Trusts report patient safety incidents via the National Reporting and Learning System. Patient safety incidents are defined as any unintended or unexpected incident which could have harmed or did lead to harm for one or more patients being cared for by the NHS. The NPSA is also responsible for the clean**your**hands campaign and Patient Environment Action Team inspections, as well as providing expert advice and guidance on cleanliness and hand hygiene.	Some trusts are unclear about the role of the NPSA in relation to healthcare associated infections (24 per cent of trusts felt it was unclear) and do not feel that the NPSA has been particularly effective on healthcare associated infections (33 per cent of trusts felt they were ineffective).

Body	Description of their role	Is their role clear to trusts?
NHS Litigation Authority	The NHS Litigation Authority handles the Clinical Negligence Scheme for Trusts, which established standards in 1999 to provide a framework for clinical risk management, including infection control. These have since been revised on a number of occasions. There are currently two that directly relate to infection prevention: ■ Standard 4, criterion 7 – infection prevention; and ■ Standard 2, criterion 8 – hand hygiene training. Based on inspections the NHS Litigation Authority uses a risk management based approach to calculate the level of discount available to trusts on their premium. This provides a financial incentive for trusts to demonstrate compliance with infection prevention and control.	Did not directly ask questions on the role of the NHS Litigation Authority in our trust census. Some trusts did not feel that the Clinical Negligence Scheme for Trusts provided a strong incentive to improve infection prevention standards, with only 36 per cent agreeing or strongly agreeing with the statement that, "Scope to reduce our premium paid under the Clinical Negligence Scheme for Trusts has helped to improve infection prevention and control in our trust", and 25 per cent disagreeing.
NHS Institute for Innovation	Provides guidance, support and toolkits for the NHS. Introduced the Productive Ward.	Did not directly ask questions on the NHS Institute in our trust census.
The Health and Safety Executive	Carried out investigation at Stoke Mandeville and Maidstone and Tunbridge Wells into the health and safety issues. Did not prosecute.	Did not directly ask questions on the Health and Safety Executive in our trust census.
Office for National Statistics	Publishes data on deaths where MRSA, MSSA or *C. difficile* is listed on the death certificate.	Did not directly ask questions on the Office of National Statistics in our trust census.

Source: National Audit Office

APPENDIX THREE

The development of the Department's strategic approach to tackling healthcare associated infections

July 2000	Publication of the NHS Plan setting out proposals for unannounced inspections of hospital cleanliness and the introduction of national standards of cleaning.
April 2001	Introduction of mandatory surveillance for MRSA bloodstream infections.
June 2002	Publication of "Getting Ahead of the Curve: a strategy for infectious diseases" (Department of Health).
September 2003	Mandatory surveillance extended to cover Glycopeptide Resistant *Enterococci* (GRE) bloodstream infections.
December 2003	Publication of "Winning Ways: working together to reduce healthcare associated infection in England" by the Department (Department of Health).
January 2004	Mandatory surveillance extended to cover *C. difficile*.
April 2004	Mandatory surveillance extended to cover orthopaedic surgical site infections.
July 2004	Publication of "Towards cleaner hospitals and lower rates of infection – a summary of action" (Department of Health).
	Responsibility for healthcare associated infections transfers from the Chief Medical Officer to the Chief Nursing Officer.
	The first meeting of the Rapid Review Panel held.
September 2004	The National Patient Safety Agency published the patient safety alert 04 instructing NHS trusts to install alcohol based hand rub at all staff-patient contact points.
October 2004	Publication of 'A Matron's Charter: an action plan for cleaner hospitals'.
	England pledges to address healthcare associated infections at the launch of the World Health Organisation's (WHO) Global Patient Safety Challenge: Clean Care is Safer Care.
November 2004	The Secretary of State for Health announces a target to halve the number of MRSA bloodstream infections in hospitals by 2008.
June 2005	The Department launches "Saving Lives – a delivering programme to reduce healthcare associated infection, including MRSA".
May 2006	Publication of "Going further faster: implementing the Saving Lives delivery programme" (Department of Health).
October 2006	The "Health Act 2006: Code of Practice for the prevention and control of healthcare associated infections" comes into effect.
April 2007	Advisory Committee on Antimicrobial Resistance and Healthcare Associated Infection established as a merger of the Steering Group on Healthcare Associated Infection and the Specialist Advisory Committee on Antimicrobial Resistance.
	The National Patient Safety Agency reviews and re-issues "The national specifications for cleanliness in the NHS: a framework for setting and measuring performance outcomes".

June 2007	Publication of "Essential steps to safe, clean care" (Department of Health).
July 2007	The Chief Medical Officer recommended that the clean**your**hands campaign involves patients in his 2006 Annual Report. He proposed a pilot programme to enpower patients to ask staff about their hand hygiene.
September 2007	Publication of "Uniforms and Workwear: an evidence base for developing local policy" (Department of Health).
	Publication of new clinical guidance on the isolation of infected patients.
	The Secretary of State for Health announces a range of new measures to tackle healthcare associated infections, including quarterly direct reporting by matrons and clinical directors to trust boards, extension of the clean**your**hands campaign and a legal requirement for trust chief executives to report MRSA bloodstream and *C. difficile* infections to the Health Protection Agency.
October 2007	Publication of "our NHS our future" (Department of Health) which announced new powers for the Care Quality Commission, annual infection control inspections of all acute trusts and introduction of MRSA screening.
	PSA agreement with target to reduce the number of *C. difficile* infections by 30 per cent by 2010-11 against a 2007-08 baseline.
	The Secretary of State for Health announces a 'Deep Clean', to be completed by all NHS trusts by the end of March 2008.
January 2008	Publication of "Clean, safe care: reducing infections and saving lives" (Department of Health).
	The Healthcare Commission begins its programme of unannounced inspections of NHS trusts against the Code of Practice.
April 2008	The National Patient Safety Agency's clean**your**hands campaign is extended to primary care, mental health, ambulance and care trusts.
September 2008	The National Patient Safety Agency updates and re-issues its Patient Safety Alert: Clean hands save lives, to focus hand hygiene improvement at the point of patient care, provide guidance on when soap and water should be used and advocate the World Health Organisation Five Moments for hand hygiene approach.
January 2009	Publication of "*Clostridium difficile* infection: How to deal with the problem" (Health Protection Agency/Department of Health) updating current guidance on *C. difficile*.
April 2009	All NHS healthcare providers are required to be registered with the Care Quality Commission and comply with registration requirements.

APPENDIX FOUR

Good practice case studies

CASE STUDY ONE

Improving Compliance with Infection Control Guidance in Care homes

Milton Keynes Primary Care Trust Provider Organisation identified that a high proportion of their MRSA bloodstream infections had been in cases from long term care homes. As a result of this the project nurse worked intensively with six care homes in the local area. Baseline audits were conducted which revealed a lack of consistent training, low levels of hand hygiene and poor knowledge of catheter care and sampling.

Initial educational sessions on hand hygiene, catheter care and *C. difficile* were provided by the primary care trust, and additional support was given during outbreaks of Norovirus. At the request of the care home managers, the remainder of the project focused on hand hygiene.

Around 75 per cent of care home staff received hand hygiene training. The hand hygiene audit was repeated towards the end of the project, and overall demonstrated an 11 per cent improvement in hand hygiene practice, with some homes improving by 40 per cent.

During the project a Long Term Nursing and Care Homes Forum was established for link practitioners from all homes across Milton Keynes. This forum has continued to grow and is used to provide education, discuss and problem solve infection control issues and to share and develop best practice.

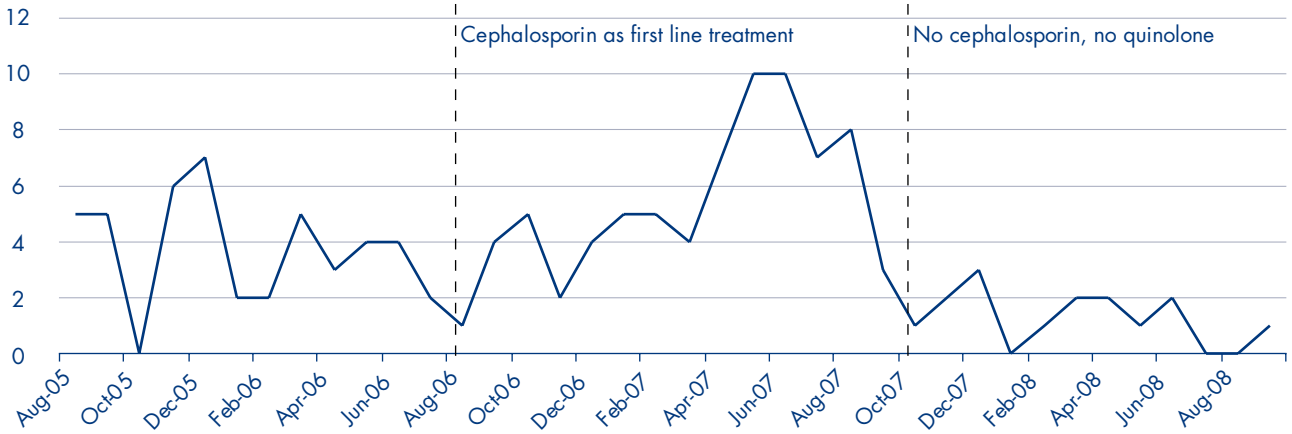
CASE STUDY TWO

Ongoing Monitoring and Control of Antibiotic Prescription and *Clostridum Difficile* Infection through a link physician system

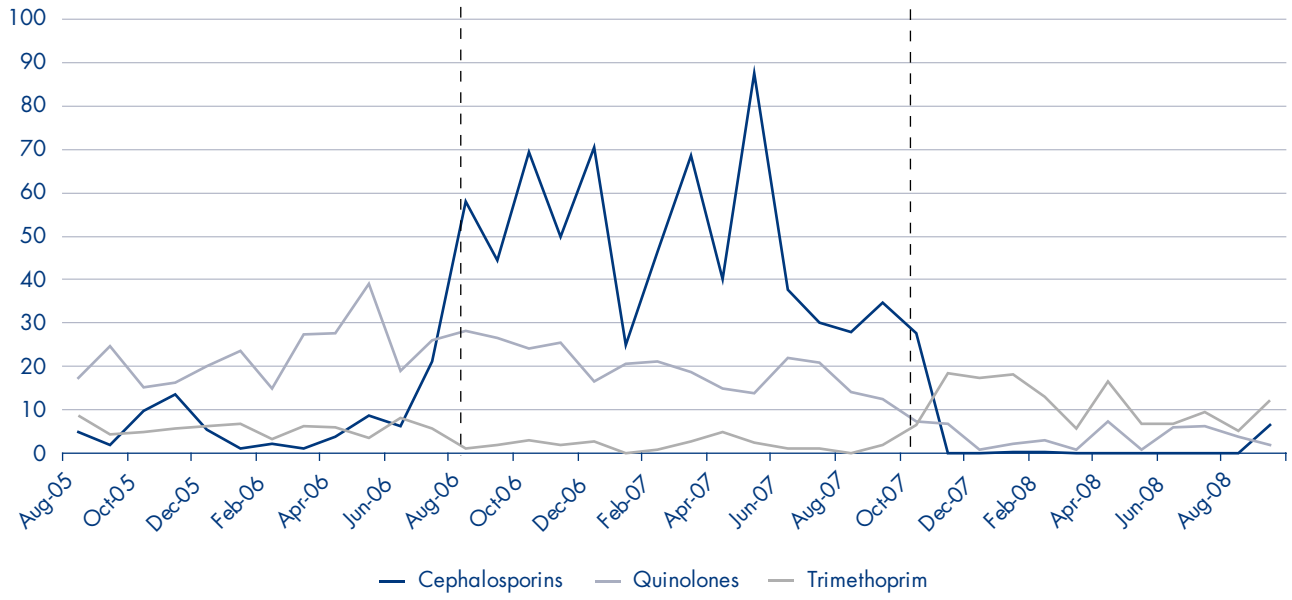
At the Royal Free Hospital, London, a combined *C. difficile* and MRSA outbreak in 1994-5 resulted in closure of all general medical and acute elderly wards. A 'low cephalosporin' antibiotic policy was introduced on the acute care of the elderly wards, co-ordinated by a designated link physician working with a consultant microbiologist. This was reinforced by regular feedback to junior staff of antibiotic usage and *C. difficile* rates by one of the unit's registrars. In 2001, the policy was further tightened and became a 'narrow spectrum antibiotic policy' further limiting the use of broad spectrum aminopenicillins and was reinforced by requiring junior staff to carry a pocket sized card with the unit's antibiotic policy printed on it.

The antibiotic policy is reviewed annually by the antibiotic pharmacist and microbiologist with the designated link physician, taking into account local sensitivity and resistance patterns of common pathogens. In August 2006, this resulted in use of a first generation cephalosporin (cephradine) for first line treatment of urinary tract infection (shown by the first dotted line on the figure). *C. difficile* infection rates rose along with use of cephradine. The policy was revised in October 2007 to a 'no cephalosporin, no quinolone policy'. There was a major reduction in prescription of these antibiotics and in *C. diffiicle* infection from five to ten cases a month to just over one (shown by the second dotted line on the figure).

C. difficile infections



Notional Seven day Antibiotic Course per month



The policy of restricted antibiotic prescription reinforced by a pocket sized laminated card, and use of a designated link physician, has ensured that levels of *C. difficile* have been amongst the lowest of any teaching hospital since mandatory reporting began, and is a model recommended in the national *C. difficile* guidelines.

CASE STUDY THREE

Implementing a 'Bare Below the Elbows' Dress Code

Having phased out the older style long sleeved coats, Guy's and St Thomas' NHS Foundation Trust staff were consulted on how best to comply with the 'bare below the elbows' requirement. Many doctors were keen on having an appropriate uniform so that they were still clearly identifiable to patients.

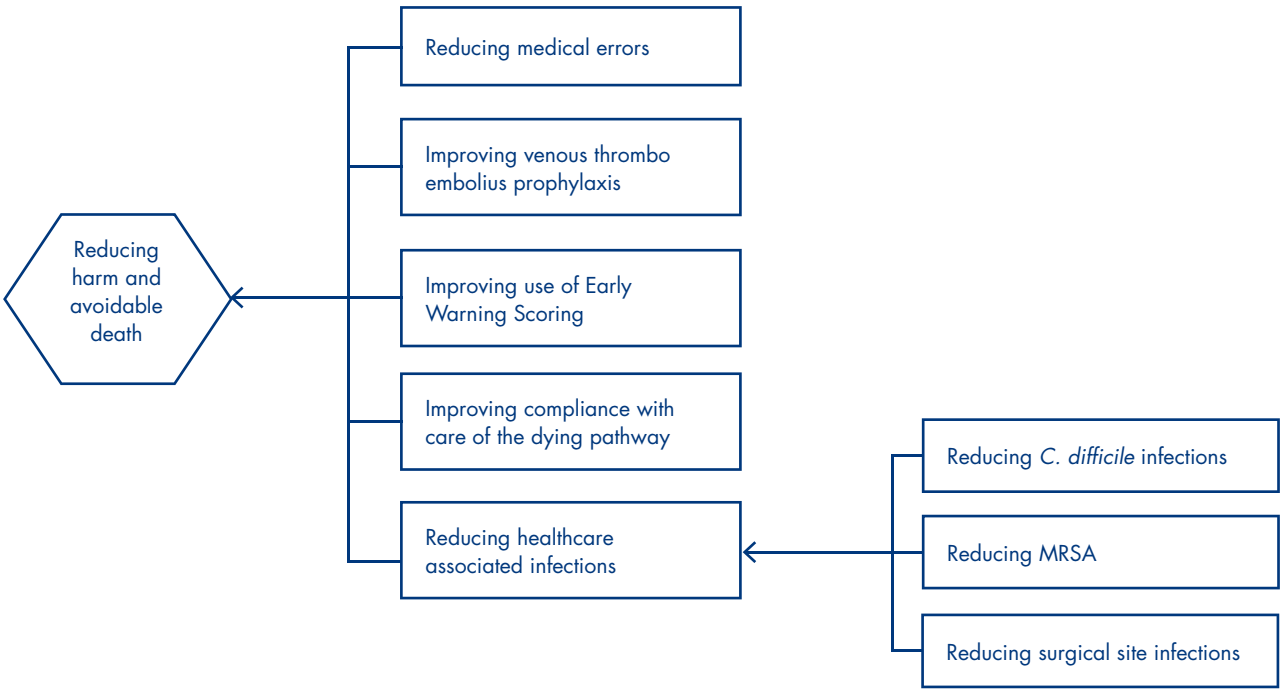
Following consultation, a tunic was designed for use by all clinical staff. These were piloted in one area of the trust before being rolled out to all clinical staff from August 2007. The dress code was revised to include policy on 'bare below the elbows'. It was circulated to all staff and reinforced with a poster campaign and articles in the internal staff magazine. Junior doctors are able to pick up their laundered tunic daily from a vending machine whereas consultants are provided with their own embroidered tunics. The trust has also been able to increase lockers and changing facilities.

By March 2009 there was good compliance with the dress code. It was introduced as part of a package of measures including zero tolerance to poor hand hygiene and full implementation of Saving Lives. Since the introduction of these measures, infection rates have fallen, building on the improvements achieved since 2004; MRSA bloodstream infections and *C. difficile* infections are at an all time low.

CASE STUDY FOUR

Reducing Healthcare Associated Infections as Part of an Overall Quality Strategy

The medical director at Stockport NHS Foundation Trust has taken the lead on implementing a quality strategy aimed at reducing harm and avoidable death. Reducing healthcare associated infection forms one component of this. The main elements of the strategy are shown below:



Under each of these elements are component parts, with complimentary work streams. For instance reducing *C. difficile* is broken down into five component parts, each with a complementary work stream:

- Prudent antibiotic prescribing – the formulary is available on the intranet and compliance is audited quarterly. This information is then disseminated, with 'on the spot' feedback when non conformities are detected;
- Increase hand hygiene – hand hygiene training has been delivered to staff of all grades. This is reinforced with weekly hand hygiene audits with immediate feedback;
- Isolation of patients with diarrhoea and electronic side room management; and
- All patients testing positive for *C. difficile* are reviewed by the medical microbiologist and the clinical team and are managed jointly.

This has led to a fall in *C. difficile* infections from over 30 cases a month, to less than ten, in two years.

APPENDIX FIVE

Lessons from Healthcare Commission investigations at Stoke Mandeville and Maidstone and Tunbridge Wells

1 Healthcare Commission investigations into serious failings at Stoke Mandeville and Maidstone and Tunbridge Wells following outbreaks of *C. difficile* between 2003 and 2007 identified a number of key learning points. There were a number of similarities between these reports which are summarised below:

- Management teams were focused on Government targets and finances, at the expense of patient safety;
- Poor arrangements for clinical governance and reporting to the board, with inadequate internal systems for surveillance and reporting of *C. difficile*;
- Instances where the advice of the infection control team was either ignored, or overruled;
- Lack of, and poor management of, isolation facilities;
- Poor quality environmental hygiene on wards;
- Financial pressures led to low numbers of nursing staff and a pressure to take beds 'out of the system' leading to high bed occupancy levels;
- Excessive movement of patients, often due to pressures based on capacity, rather than clinical reasons; and
- Confusion of the roles and responsibilities of external organisations (the Health Protection Agency, the Strategic Health Authority and the local primary care trust), particularly in relation to who was responsible for intervening in the event of an outbreak.

2 At the time of their publication these investigations generated a significant amount of negative publicity. The blame largely fell on the management teams of the trusts involved and the trusts were represented as very poor performers. However, in terms of rates of infection they were not significant outliers. Surveillance data shows that, at the time, over 90 trusts had worse *C. difficile* rates than Stoke Mandeville and more than a dozen have had more deaths than Maidstone and Tunbridge Wells. Investigations were launched at these trusts as the Healthcare Commission felt that, after initial probing, there was not sufficient reassurance that the trusts involved had the commitment, or capacity to look into the underlying factors and make the required changes.

APPENDIX SIX

Comparisons of approach to tackling healthcare associated infections across the United Kingdom

Comparison of Prevalence

Country	Prevalence %
England	8.19
Wales	6.35
Scotland	9.50
Northern Ireland	5.43

Source: Four County Healthcare Associated Infections prevalence survey 2006: Hospital Infection Society and NHS Scotland 2007

Wales

Surveillance and data

1 Wales' mandatory surveillance programme for healthcare associated infection is run by the Welsh Healthcare Associated Infection Programme team within the National Public Health Service for Wales. Surveillance of *S. aureus* bloodstream infections was introduced in Wales in 2001. This has since been expanded to include surgical site infection surveillance for orthopaedic surgery and caesarean sections; surveillance of central line infections and ventilator associated pneumonias on intensive care units, *C. difficile* infections, outbreaks of healthcare associated infection and each hospital and locality's ten most common bloodstream infections.

2 MRSA rates have fallen since 2005 although there is no similar fall in MSSA. The most recent data on *S. aureus* bloodstream infections (for the year up to 30/09/2008) show MRSA rates of 0.9 per 10,000 bed days and MSSA 1.6 per 10,000 bed days. The most common bloodstream infections in Wales were with *Escherichia coli* followed by MSSA. MRSA is the sixth most common bloodstream infection in Wales.

National approach

3 'A Strategy for hospitals in Wales' sets out the approach to tackling Healthcare Associated Infections within hospitals in Wales. A Framework is set out in the strategy document that outlines the items to be delivered, actions to be taken and responsibility with timescales where appropriate. There is a requirement within the strategy for trusts to set Infection Reduction Targets, which are chosen from the trust's own healthcare associated infection priority areas. There are no national targets set for reducing MRSA or *C. difficile* in Wales. In 2007 a Community Strategy for tackling healthcare associated infection was published in Wales setting out a broad approach to reducing all healthcare associated infections across the healthcare services in Wales. The Wales Audit Office reviewed the implementation of the Hospital Strategy in Wales during 2007, publishing their findings in the report 'Minimising Healthcare Associated Infections in NHS Trusts in Wales', *Wales Audit Office November 2007*.

Accountability and governance

4 Corporate responsibility resides with chief executives and their boards who will be responsible for the delivery of these strategies for Wales. One unique feature of the system of governance in Wales is the requirement for a non-executive director to be nominated to take a statutory role with responsibility for the management of infection and hospital cleanliness.

Scotland

Surveillance and data

5 National surveillance is carried out by Health Protection Scotland and has been put in place for surgical site infections, neurosurgical surgical site infections, all *S. aureus* bloodstream infections, catheter-associated urinary tract infection infections in intensive care units, paediatric respiratory syncytial virus surveillance (a virus which causes bronchitis), *C. difficile* and outbreaks of any healthcare associated infection are reported. Data on all *S. aureus* bloodstream infections, and infections recorded as being associated with a device are reported at a National and Board level. Surveillance is accompanied with advice about practice from Health Protection Scotland. Guidance and advice for each surveillance group are also available.

6 NHS Boards are also required to complete a national reporting template to give the public access to local hospital level data on infection rates. NHS Boards publish the data on websites and the template is discussed at their public bi-monthly Board meetings.

7 A separate Healthcare Associated Infection Point Prevalence study was published in Scotland in July 2007. Prevalence was estimated to be 9.5 per cent in the acute sector. This was higher than other rates in the UK although a different methodology was used and the rates are not directly comparable.

8 The overall rate of MRSA bloodstream infections is decreasing, although the decline appears to have commenced later than in England, from about April 2007. Rates of MSSA have also begun to decline although to a lesser extent than MRSA. In addition, latest data in Scotland on *C. difficile* shows that cases have come down by 9 per cent on the previous quarter. A target has been set for a 30 per cent reduction in *S. aureus* bloodstream infections by 2010 and a new target has been set to reduce *C. difficile* infections among patients aged 65 and over by at least 30 per cent by 31 March 2011.

9 Hand hygiene compliance by NHS Staff is also monitored by local hand hygiene co-coordinators and bi-monthly reports are published by Health Protection Scotland.

Recent developments

10 Following an independent review undertaken in August 2008, the Cabinet Secretary for Health and Wellbeing announced that she intends to hold a public inquiry, subject to the outcome of ongoing Police and Health & Safety Executive investigations, into the events at the Vale of Leven Hospital, where 55 patients contracted *C. difficile* between December 2008 and June 2009 and 18 died.

Accountability and governance

11 Accountability is not directly to the chief executive but to the NHS Board: the chief executive is responsible on behalf of the NHS Board. It is set out in a framework showing action required, an auditing function and bibliographical source material.

12 In governance terms the Scottish Government's Healthcare Associated Infection Task Force is responsible for overseeing implementation of a healthcare associated infection work programme. The Task Force was formed in January 2003 and is led by the Chief Nursing Officer. Its third programme of work covers the period from March 2008 to April 2011; and its remit is to:

- Co-ordinate the development and implementation of the Healthcare Associated Infection Action Plan;
- Review progress in its implementation across the NHS in Scotland;
- Monitor the levels of healthcare associated infection and assess the impact on them of control measures;
- Take forward amendments to the action plan or its component initiatives; and
- Report on progress to the Cabinet Secretary for Health and Wellbeing and annually to the general public.

13 The Taskforce is supported by an HAI Stakeholders Group, which is responsible for overseeing the development and implementation of the work streams contained within the HAI Delivery Plan; and who ensure the Task force is kept fully informed of progress and issues.

National initiatives

14 NHS Quality Improvement Scotland carried out a Health Technology Assessment into MRSA Screening. This found that routine testing of patients could significantly reduce infection rates. A pilot programme to test the cost effectiveness of screening all admissions began in 2008-09 and the Cabinet Secretary for Health and Well Being has recently announced that national roll out of MRSA screening for planned admissions to acute specialities (excluding paediatrics, obstetrics and psychiatric specialities) and all emergency admissions in the four specialties of nephrology, vascular surgery, dermatology and care of the elderly will begin in 2009-10.

Northern Ireland

Infection rates

15 Mandatory surveillance for *S. aureus* began in April 2002 and for *C. difficile* in November 2005. *C. difficile* surveillance focused initially on the 65 year old and over population, and in April 2008, was extended to cover all individuals aged over two years. Numbers peaked in 2006 partly because of reporting changes and then fell slightly.

Governance and accountability

16 Final accountability resides with the trust chief executive. In addition, a person to be a 'lead for infection and prevention and control' is identified in each trust board. They have the responsibility of reporting to the trust board and convening and chairing the Infection Prevention and Control Committee. It was also recommended that another person be named as responsible to the trust board for antibiotic prescribing.

Recent developments

17 In January 2008 an outbreak of *C. difficile* was identified in the Northern Trust. Nearly 300 cases were reported in the twelve months following June 2007. An independent review was instigated which reported in October 2008.

18 Many of the issues reported were similar to those identified in England following outbreaks at Maidstone and Tunbridge Wells and Stoke Mandeville: delays in obtaining surveillance data and responding to the outbreak; pressure on beds and a shortage of nursing staff; deficiencies in the number of infection control staff; insufficient cleaning processes; and dilapidated buildings. The review recommended that a system be put in place to provide the rapid deployment of isolation wards in the event of an outbreak. It also recommended carrying out a root cause analysis whenever *C. difficile* is listed as the main cause of death on a death certificate.

19 Renewed efforts have been put in place following the review. One such measure is the introduction of a care bundle for C.difficile. Many of these events and responses resonate well with the experiences in England following similar outbreaks.

20 Further initiatives to deal with healthcare associated infections have been announced since including: a programme of unannounced inspections of hospitals; restrictions on visiting times for patients; a dress code for healthcare staff; and funds to provide every trust with a pharmacist to ensure safer prescribing of antibiotics. Renewed effort has been put into hand hygiene and screening of high risk patients for MRSA has continued. The Department of Health's Improvement Team has extended its work to Northern Ireland at the invitation of the Northern Ireland Department of Health, Social Services and Public Safety and the National Patient Safety Agency's clean**your**hands campaign was launched in Northern Ireland to all acute health and social care bodies in June 2008.

GLOSSARY

Acinetobacter	A gram-negative bacterium that is readily found throughout the environment including drinking and surface waters, soil, sewage and various types of foods. Commonly found as a coloniser on the skin of healthy people and usually poses very few risks. Hospital acquired strains are sometimes resistant to antibiotics and are increasingly difficult to treat.
Acute hospital trust	Hospitals, which are managed by their own boards and which provide acute beds linked to medical and surgical intervention.
Antibiotic	A substance that selectively destroys certain other organisms or inhibits the growth of certain bacteria.
Antibiotic resistance	Resistance to antibiotics that develops in micro organisms that were previously sensitive.
Arm's length body	Stand-alone, national organisations that are sponsored by the Department to deliver specialised services and functions.
Bacteraemia	Presence of bacteria in the bloodstream.
Bacteria	A simple microscopic single-celled organism(s) that lacks a true nucleus.
Care Bundle	A group of evidence based interventions that should all be completed to ensure best practice is observed.
Catheter	A tubular flexible instrument passed through body channels for withdrawal or introduction of fluids.
Clinical audit	A quality improvement process that aims to improve patient care and outcomes by carrying out a systematic review and implementing change. Aspects of patient care are selected and evaluated against explicit criteria and, where necessary, changes are implemented at an individual, team or service level.
Clinical governance	A framework through which NHS organisations are accountable for continuously improving the quality of their services and safeguarding high standards of care by creating an environment in which excellence in clinical care will flourish.
Clostridium difficile	A bacterium which can cause severe diarrhoea or enterocolitis. This most commonly occurs following a course of antibiotics which has disturbed the normal bacterial flora of the patient's gut.

Committee of Public Accounts	The senior Select Committee of the House of Commons. The main work of the Committee is the examination of the Reports produced by the Comptroller and Auditor General on his value for money studies of the economy, efficiency and effectiveness with which Government Departments and other bodies have used their resources to further their objectives. About 60 of these reports are adopted by the Committee, either by taking oral evidence or, occasionally, by sending written questions to the Government departments concerned. The Committee's objective is to draw lessons from past successes and failures which can be applied to future activity by the Department examined or more generally.
Compliance	The degree to which healthcare workers follow an infection control policy.
Commissioning	The processes primary care trusts undertake to make sure that services funded by them meet the needs of the patient and improve quality of life and health outcomes.
Director of Infection Prevention and Control	Are responsible for the infection control team within a healthcare organisation and report directly to the trust board. They are responsible for local control of infection policies and their implementation.
Enterococcus	A bacterium commonly associated with bladder, skin and wound infections.
Epidemiology	The study of the occurrence, cause, control and prevention of disease in populations, as opposed to individuals.
Escherichia coli	A rod shaped gram-negative bacterium that normally resides in the human colon. Most strains are harmless but some are capable of causing disease, and mortality.
Foundation trust	A new type of trust in England created to dissolve decision-making from central government to local organisations. Foundation trust status is open to acute, specialist, mental health and care trusts.
Gastrointestinal	Adjective referring collectively to the stomach and small and large intestines.
Gram staining	The Danish bacteriologist J.M.C. Gram devised a method of staining bacteria using a dye called crystal (gentian) violet. Gram's method helps distinguish between different types of bacteria. The gram-staining characteristics of bacteria are denoted as positive or negative, depending upon whether the bacteria take up and retain the crystal violet stain or not.
Gram-negative bacteria	Gram-negative bacteria lose the crystal violet stain in Gram's method of staining. This is characteristic of bacteria that have a cell wall composed of a thin layer of a particular substance (called peptidoglycan).
Healthcare associated infection	An infection acquired via the provision of healthcare in either a hospital or community setting.
Hospital acquired infection	An infection that was neither present nor incubating at the time of a patient's admission which normally manifests itself more than three nights after the patient's admission to hospital.
Immune	Being highly resistant to a disease due to the formation of antibodies, the development of immunological competent cells, or both, as the result of another mechanism.
Incidence	The number of new events/episodes of a disease that occur in a population in a given time period.
Infection	Invasion and multiplication of harmful micro organisms in body tissues.

Infection Control Committee	The main forum for routine consultation between the infection control team and the rest of the NHS Trust. It is required to approve and lend support to the infection control team's programme.
Infection control doctor	Normally a consultant medical microbiologist, with knowledge of aspects of infection control, which should include epidemiology.
Infection control nurse	Normally a registered general nurse, with knowledge of all aspects of infection control.
Infection control team, or infection prevention and control team	A team within an NHS Trust which has prime responsibility for all aspects of surveillance prevention and control of infection. The members of the team include and infection control doctor and infection control nurse(s) and may include surveillance nurses and clerical support staff.
Infectious agent	An agent capable of producing an infection.
Inspection	A visit carried out as part of a review, investigation or study to inspect premises or documents, or to require explanation.
Intravascular (device)	Catheter/cannula inserted into a vein or artery.
Isolation	To remove a patient from the general ward setting to a place away from normal contact with other people.
Klebsiella	A species of rod shaped-bacteria that are found in the environment and also in the human intestinal tract.
Link Nurses	Ward-based nurses who receive regular and appropriate training in infection control, which they then apply in the ward setting. In some cases, they are also trained to collect surveillance data for the infection control team.
Lower respiratory tract	The portion of the respiratory system from the trachea to the lungs.
Micro-organism	An organism too small to be seen with the naked eye. The term includes bacteria, fungi, protozoa, viruses and some of the algae.
Microbiology	The science of the isolation and identified of micro organisms. Medical microbiology is concerned with those micro-organisms which cause diseases in human.
Morbidity	The state of having a disease, or reduced state of health.
Mortality	Death.
MRSA (Meticillin Resistant Staphylococcus aureus)	A strain of *Staphylococcus aureus* that is resistant to meticillin and has various patterns of other antibiotic resistance.
MSSA (Meticillin Sensitive Staphyloccus aureus)	A strain of *Staphylococcus aureus* that is sensitive to meticillin and other antibiotics.
Multi resistance	Resistance to two or more unrelated anti-microbial agents.
NHS Operating Framework	Sets out the specific business and financial arrangement for the NHS for the year.
Normal flora	The micro-organisms that normally live on the body, also called commensal organisms. When antibiotics are used to treat infectious disease they can affect the normal flora and their ability to provide protection against infection.

Norovirus	The most common cause of infectious gastroenteritis (diarrhoea and vomiting) in England. The illness is generally mild and people usually recover fully within two to three days. The disease is commonly known as 'winter vomiting disease' due to its seasonality and typical symptoms.
Orthopaedics	The branch of surgery broadly concerned with the skeletal system.
Outbreak	An incident in which two or more people have the same disease, similar symptoms or excrete the same pathogens, and in which there is a time/place/person association. Also a situation where the observed number of cases unaccountably exceeds the expected number.
Performance management	An assessment of an employee, process or institution to gauge progress toward predetermined goals.
Prevalence	The total number of cases of a specific disease in existence in a given population at a certain time.
Primary Care Trust(s)	A statutory body and part of the NHS responsibly for delivering healthcare and health improvements to local residents, for example by commissioning care from providers such as hospitals.
Prophylaxis	Any means taken to prevent disease. For example, vaccination, or giving antibiotics when patients undergo surgery.
Quality assurance	The planned and systematic production process that provide confidence in a product's suitability for its intended purpose.
Root cause analysis	A class of problem solving methods aimed at identifying the root causes of problems or events.
Screening	Involves taking swabs from patients and staff which are then subject to microbiology testing to determine whether they are colonised or infected by specific micro-organisms, e.g. MRSA.
Staphylococcus aureus	A bacterium that is a common coloniser of human skin. It can cause disease, particularly if there is an opportunity for the bacteria to enter the body.
Strain	A group of organisms within a species or variety, characterised by some particular quality.
Strategic Health Authority	The ten Strategic Health Authorities are local headquarters of the NHS. They performance manage acute trusts and primary care trusts.
Surveillance	Systematic collection of data from the population at risk, identification of infections using consistent definitions, analysis of these data and dissemination of the results to those responsible for the care of the patients and to those responsible for implementation of prevention and central measures.
Urinary tract	The organs of the body that produce and discharge urine.
Virus	A very small micro-organism of simple structure, only capable of surviving within a living host cell.

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A report by the Comptroller and Auditor General

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