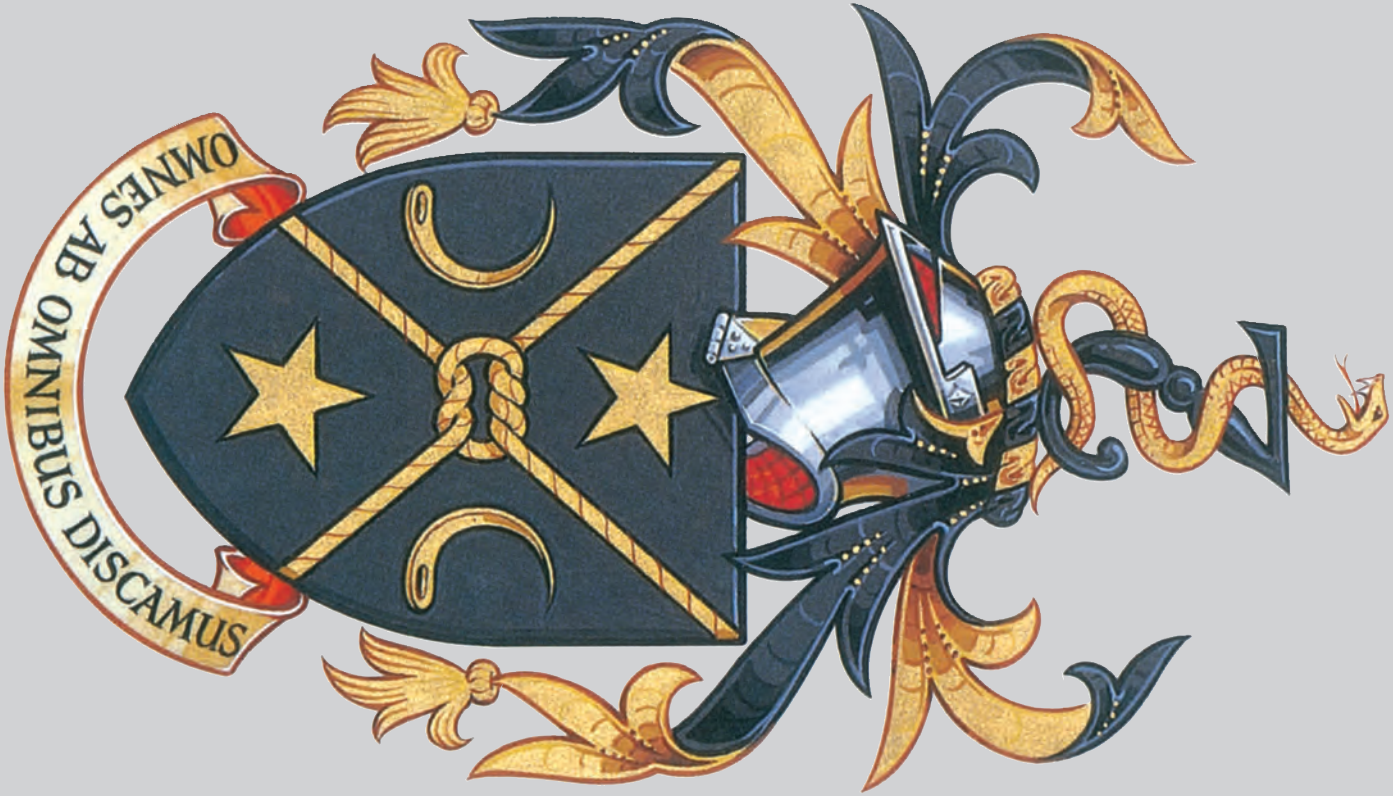

Association of Surgeons of Great Britain and Ireland

HEALTHCARE ASSOCIATED INFECTIONS: A CONSENSUS STATEMENT

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CONSENSUS STATEMENT ON HEALTHCARE ASSOCIATED INFECTIONS

This Statement is based on presentations delivered at a Consensus Conference facilitated by the Association of Surgeons of Great Britain and Ireland held at the Royal Institute of British Architects on Friday 31st October 2008, discussions arising from them, and a final interactive session.

Documentation considered by the Consensus Conference can be viewed at:

www.asgbi.org.uk/HAI-consensus

This Consensus Statement includes feedback from those who contributed to the conference and those who were invited to comment on earlier drafts. The document is, therefore, a statement arising from a conference, rather than the proceedings of a conference. Not everyone will agree with all the recommendations or conclusions. ASBGI have actively encouraged all stakeholders to submit individual responses to this document, and many have done so.

FOREWORD

Healthcare associated infection (HCAI) has been at the forefront of both clinical and political agendas over recent months. Rates of HCAIs in hospitals throughout Great Britain and Ireland have been described as "excessive" and measures to reduce them introduced, often with little perceived evidence of effectiveness. Nevertheless, with the development of programmes such as the **Clean your Hands** campaign, **Saving Lives** clinical protocols, **Care bundles** for high impact intervention and **Bare below the elbows**, we have seen a steady decline in HCAIs, especially those involving MRSA and *C.difficile*.

This Statement reports the conclusions of a Consensus Conference held at the Royal Institute of British Architects in October 2008, and entitled *"**The Relevance of Healthcare Associated Infection in Modern Surgical Practice**"*. The programme was designed to examine in detail the available evidence regarding HCAIs, and to present a consensus as to their relative effectiveness in modern day surgical practice.

The conference involved stakeholders from across all healthcare disciplines, including surgery, anaesthesia, intensive care, nursing, epidemiology, infection control, NHS management and the Department of Health. The conclusions presented are those of the stakeholders and reflect the evidence available on the day. Where evidence is lacking, guidelines are presented reflecting best medical practice.

We have asked representatives of all the Surgical Specialty Associations and Societies, the Surgical Royal Colleges and the Department of Health to comment on the document and have incorporated these comments where necessary. We are extremely grateful to all of those who have contributed to this Consensus Statement and would like to thank Professor David Leaper, who commented on the evolving versions of this statement, and Ethicon who generously provided an educational grant to sponsor the event.

Although not all will agree entirely with the conclusions, we hope this document will help you in the fight against HCAI and will encourage you all to continue the battle to make our hospitals and clinics clean, safe and fit for purpose in the treatment of patients in the UK and Ireland. We hope you will use the evidence provided, observe the best practice described, and try and fill the gaps in the knowledge of HCAIs, which are all too evident in much of our modern day surgical practice.

Michael Wyatt
Honorary Editorial Secretary

INTRODUCTION

The problems of healthcare associated infections (HCAIs), and particularly hospital acquired infections, have become a major concern to patients, healthcare workers and, more recently, politicians. There has been a great deal of publicity, both on national radio/television and the national press, with regards to apparent increasing rates of infection and more deaths associated with *Meticillin resistant Staphylococcus aureus* (MRSA) *Clostridium difficile associated diarrhoea (*CDAD).

It is no surprise to most clinicians that the increased rate of infection has been associated with an ever increasing number of admissions to hospital, a reduction in the length of stay and a reduction in the number of beds available to treat these patients. This has resulted in bed occupancies of 100% in many NHS hospitals with decreased opportunity to clean the wards and the beds between one patient and the next.

There has been a lack of clarity to explain why these infections have continued to increase and also a lack of clarity as to why some of the remedies put in place have been introduced without a good evidence base.

This document has been written following a Consensus Conference where experts presented the evidence for many aspects of healthcare associated infections. We were pleased to have evidence from many disciplines outside of surgery to try and obtain a comprehensive global review of the many problems.

The participants were asked to address issues related specifically to MRSA and its screening, infection prevention - particularly in the operating theatre - factors which might reduce the development of surgical site infection with particular reference to the timing and type of antibiotic use, issues related to hospital associated pneumonia and ways in which this might be reduced. Specific issues related to different surgical specialties were also explored and guidelines reviewed. The issues of surgical infection and nutrition were also addressed as were the guidelines on supplemental nutrition.

There have been Department of Health guidelines issued with regard to infection prevention in hospitals, much of which seem to have little evidence base. The experts were asked to look at further evidence required for preventing healthcare associated infections, particularly with regard to the policy of dress code.

This document is specifically aimed at hospital managers and clinicians, but should be valuable to all those who share the responsibility for looking after patients in hospital. The evidence, where available, has been cited, and where no evidence is available then best practice based on common sense has been endorsed.

We would like to thank all those involved with the conference, particularly those from other non-surgical specialties, who added much to our knowledge about healthcare associated infections and shared their evidence with us.

Association of Surgeons of Great Britain and Ireland
June 2009

KEY PRINCIPLES

General considerations

1. The Health Act of 2006 introduced a code of practice for the prevention and control of healthcare associated infections (HCAIs). This states that Trusts have a legal responsibility to protect patients, staff and others from HCAIs. Trusts must implement the code and put key policies and procedures in place to ensure that patients are cared for in a clean environment and that HCAIs are kept as low as possible. They are also required to audit these policies. Effective infection prevention and control must be embedded into everyday practice.

2. HCAIs are an inevitable risk of surgical practice. It is a duty of care for all surgical and associated healthcare staff to reduce this risk to a minimum. This is the responsibility of each and every individual and all of the specialties and disciplines involved with patient care. This includes hospital managers and administrators, consultants, junior doctors, nurses and all laboratory and support staff involved in patient care and contact. It also includes patient carers and staff in Primary Care who look after surgical patients before admission and after they leave hospital.

3. A key factor for the high incidence of HCAIs in the UK is the lack of coordination between clinical and organisational processes. This must be addressed by clinicians and managers working together and producing guidance based on best available evidence.

4. There is evidence that the incidence of HCAIs is associated with the duration of surgery, inadvertent hypothermia during surgery, inappropriate antibiotic prophylaxis, high body mass index, length of post-operative stay and the presence of indwelling materials. The establishment of "enhanced recovery protocols" may minimise these risks and should be encouraged nationwide.

Organisational issues

5. Most complications and deaths from HCAIs follow emergency surgery. It is essential, therefore, that adequate resourcing and staffing of a consultant-led emergency service is provided in all acute hospitals.

6. There is consensus to separate "clean" from "dirty" procedures in the post-operative period; similarly to separate acute from elective care. This will require adequate resourcing (see: *The Impact of EWTD on Delivery of Surgical Services: A Consensus Statement*, ASGBI 2008).

7. Patients should be admitted to the ward which can offer the most appropriate care according to clinical priority.

8. All patients with prosthetic implants (Vascular/Orthopaedic) should be nursed in "ring-fenced" post-operative environments to reduce the risk of HCAI acquisition. This should not be compromised by hospital targets.

9. "Care bundles" for HCAIs involving appropriate prophylactic antibiotic use, timing and duration, patient warming, adequate tissue oxygenation, and antiseptic policy should be encouraged. Tight glucose control is controversial and more research is required (ref: NICE guidelines). At present, tight glucose control in theatres with the specific aim of decreasing the SSI rate is only required for diabetic patients.

10. There is consensus that high quality and well coordinated managerial and clinical leadership is essential for the identification, control and treatment of HCAIs.

11. There is a consensus that definitions and scoring systems for Surgical Site Infections (SSIs) should be standardised and simplified; for example, those published by the North American Centers for Disease Control.

12. Mandatory reporting of SSIs will require surveillance systems and adequate resourcing. These costs could be offset against reduced length of stay and fewer complications.

13. For all surgical patients, adequate nutrition, control of sepsis, "no touch" line care and adherence to peri-operative care protocols are essential to minimise HCAIs.

14. Patients admitted with urinary catheters have a higher incidence of colonisation with antibiotic resistant organisms, particularly extended spectrum beta-lactamases (ESBLs), and should be recognised as a significant risk for cross infection.

MRSA

15. Pre-operative screening for *Meticillin resistant Staphylococcus aureus* (MRSA) should be introduced for all patients, but is essential for high risk groups such as those undergoing joint replacement surgery or having foreign materials implanted.

16. There is little evidence to support the introduction of rapid screening except in high risk (ITU/emergency) patients.

17. There is no evidence to support the screening of staff unless there is a major outbreak of MRSA.

18. Screening for MRSA is not a substitute for good quality infection control.

19. For patients undergoing elective surgery, decolonisation of MRSA should be instigated prior to hospital admission, even if this results in a delay to non-urgent surgery. This period of decolonisation should "stop the clock" for these patients to ensure MRSA eradication.

20. High risk patients requiring emergency surgery should be managed as if they have MRSA. High risk patients are defined as those who are systemically unwell, septic, immuno-compromised (e.g. renal, transplant or oncology patients) and require critical care facilities.

21. The relative importance of different modes of transmission of MRSA is incompletely understood and needs further investigation.

22. Patients from Residential Homes have a high prevalence of MRSA colonisation. All such patients must be screened prior to admission, or isolated until their MRSA status is known.

Use of antibiotics

23. If appropriate, most surgical procedures should have prophylaxis using a single intravenous dose of antibiotics given within 1 hour prior to surgery. All antibiotics should be given for the minimum effective time. Treatment with intravenous antimicrobials should be reviewed every 24 hours and a stop date given at the time of starting medication.

24. The prescription of all hospital antibiotics for treatment should involve teamwork between Surgeons, Microbiologists, Nurses and Pharmacists.

25. The conference endorsed the World Health Organisation (WHO) *"Safe Surgery Saves Lives"* safer surgery checklist. This ensures that prophylactic antibiotics are prescribed according to the local hospital antibiotic policy and given "on time" by the anaesthetist, and thereafter as treatment. On occasions there may be difficulty in completing the antibiotic administration prior to the start of surgery due to a long infusion time or in an emergency but this should be the exception with correct timing being the norm.

26. Hospital antibiotic use should be strictly controlled. Broad spectrum monotherapy should be discouraged and the use of simple antibiotic groups such as an anti-aerobic aminoglycoside (e.g. gentamicin) and an anti-anaerobic agent (e.g. metronidazole) should be encouraged.

27. Prolonged peri-operative antibiotic use is associated with higher levels of resistance and the development of infections with organisms such as *C.difficile*.

SUMMARY OF CONSENSUS DISCUSSION

1. Severe Surgical Sepsis

1.1 At least two thirds of patients on a surgical ward are, or have been, septic from their initial disease process. Most sepsis and mortality follows emergency surgery or emergency surgical illness. Most are associated with emergency care and many involve complex surgery and result in prolonged patient stay.

1.2 The duration of hypotension before initiation of effective antimicrobial therapy is a critical determinant of survival in human septic shock. Each hour of delay in antimicrobial administration over the ensuing six hours is associated with an average decrease in survival of 7.6% per hour.

1.3 Early diagnosis and resuscitation impact significantly on survival outcome from severe sepsis. The policies and timescale of the 'Surviving Sepsis Campaign' should be adopted.

1.4 Severe sepsis predominantly affects complex emergency patients who require structured, ongoing, multi-faceted care. Training, seniority and location of care will directly impact on this.

1.5 The management of sepsis includes:

a. Speedy protocol based fluid resuscitation.
b. Cultures before antibiotics (within one hour).
c. Inotropic support for full but failing circulation (CVP).
d. Adequate source control.
e. The use of the least invasive method possible and the adequate debridement of dead tissue (defer in pancreatitis).

1.6 In severe sepsis there must also be adequate glycaemic control. Steroid and activated protein C can also be of benefit. Timely and adequate source control (antibiotics, radiology, surgery) impact on survival and require adequate medical staffing in terms of numbers, seniority of input and training in surgery and related disciplines.

1.7 Sepsis management is not resuscitation alone, but requires teams and leaders. Patients and their families want an identifiable doctor in charge as the ongoing care is complex and may take days or weeks. Attention to detail is essential in order to avoid a catastrophic outcome.

1.8 Surgical sepsis should be managed by a dedicated, consultant-led, surgical team comprised of adequately trained junior and senior doctors according to guidelines laid down by CCrISP (Care of the Critically Ill Surgical Patient).

1.9 Threats to good management of the septic patient include "Hospital at Night", the European Working Time Directive, inappropriate wards and a shortage of nurses. All of these may impact on HCAIs.

1.10 National educational efforts to promote bundles of care for severe sepsis and septic shock are associated with improved guideline compliance and lower hospital mortality. However, compliance rates are still low, and the improvement in the resuscitation bundle requires ongoing teaching and training.

2. Nutrition and surgical sepsis

2.1 Malnutrition is a problem in patients with sepsis. Guidelines are available to indicate when and how to feed patients. Enteral nutrition reduces infective complications, length of stay and serious complications, but tolerance of full enteral feeding will take some days in a significant proportion of patients. Where critical delay occurs, combined enteral/parenteral feeding can be useful. A poor response to adequate delivery of feed is strongly suspicious of continuing sepsis.

2.2 Nutritional support should be considered at an early stage in all complex patients in line with the BSG and NICE guidelines. Simple techniques (oral nutritional supplements) lie within the remit of all surgical teams. The least invasive but effective technique should be used appropriate. A Hospital Nutritional Team can be helpful in advising on enteral tube feeding and parenteral nutrition.

2.3 Expertise in line care reduces the frequency of line-associated infections. Adoption of simple protocols can be effective. Total parenteral nutrition (TPN) requires adequate infection control for central feeding lines, but can be used to supplement enteral feeding regimes. The major problem with TPN is the development of feeding line infection and expertise in line care reduces the frequency of line-associated infections. There is a requirement for dedicated nurse led management and adoption of simple protocols.

3. Reducing HCAIs in Clinical Practice

3.1 The Department of Health (DH) is encouraging "*Zero Tolerance*" of preventable or avoidable infections, of poor clinical practice including hand hygiene, aseptic procedures and imprudent antibiotic prescribing.

3.2 The MRSA target has been achieved with a 57% reduction in reported cases of MRSA bacteraemia between 2003/4 (7,700) and 2007/8 (4,438), whereas *C.difficile* rates have remained static (~ 45,000 cases per year).

3.3 For MRSA bacteraemia, the target is to achieve year-on-year reduction. Screening and decolonisation are essential.

3.4 MRSA Screening applies to all elective admissions from March 2009, with the exception of many maternity, ophthalmic, dental or endoscopy procedures. The full list of DH exceptions to elective screening is as follows:

a. Day case ophthalmology.
b. Day case dental.
c. Day case endoscopy.
d. Minor dermatology procedures, eg, warts or other liquid nitrogen applications.
e. Children/paediatrics unless already in a high risk group.
f. Maternity/obstetrics except for elective caesareans and any high risk cases, i.e. high risk of complications in the mother and/or potential complications in the baby, (e.g. likely to need SCBU, NICU because of size or known complications or risk factors).

The DH also released a letter to Trusts in December 2008 which clarified these exceptions by stating "There are no other exemptions, so any local plans which exempt other groups, such as all day cases, will not be compliant". DH monitors have been implemented from October 2008 with a target to screen all admissions by 2010-11.

3.5 MRSA positive patients should be isolated for treatment and decolonisation.

3.6 To reduce the incidence of MRSA and *C.difficile* good clinical practice protocols should be adopted to monitor cleanliness, hygiene, training and infection targets.

3.7 Improving clinical care can be achieved by:

a. "Cleanyourhands" campaign: (http://www.npsa.nhs.uk/cleanyourhands/)

b. Cleanliness inspections & standards: (http://www.healthcarecommission.org.uk/_db/_documents/04021935.pdf)

c. "Saving Lives" clinical protocols: (http://www.clean-safe-care.nhs.uk/index.php?pid=2)

d. Care bundles for high impact interventions: (www.clean-safe-**care**.nhs.uk/toolfiles/79_SL_HII_7_v2.pdf)

e. Root cause analysis: (http://www.npsa.nhs.uk/nrls/improvingpatientsafety/patient-safety-tools-and-guidance/rootcauseanalysis/).

Figure 1: Care Bundle to reduce the risk of C.difficile.

3.8 All MRSA bacteraemias and *C.difficile* outbreaks must be reported.

3.9 High impact interventions include central venous catheterisation, peripheral line care, dialysis catheters, surgical site management, urinary catheters, ventilator management and any procedure on a patient with *C.difficile or* MRSA.

3.10 Guidance has included MRSA screening from October 2006, blood culture protocol and antimicrobial prescribing framework from June 2007 and isolation and cohorting of infected patients from September 2007.

3.11 The antibiotic policy for *C.difficile* prevention includes restriction of the use of broad spectrum antibiotic agents with the promotion of aminoglycosides, the recording of reasons for prescribing, the use of stop dates with regular pharmacist's review, single dose prophylaxis, and the introduction of audit, training and regular review. An Antimicrobial Prescribing Team/Committee should play a major role in all prescribing.

3.12 An isolation and cohorting policy is essential for the control of HCAIs. This involves physically separating the infected from the vulnerable using single rooms and en-suite or commode facilities as appropriate. If capacity is exceeded, cohort wards/rooms and isolation ward should be utilised with separate staff and specialist expertise.

3.13 "*Making it happen*" is both a management and personal responsibility. This involves compliance assurance, a Board to ward policy, recognition in job descriptions and plans, mandatory training, CPD for clinical staff, appraisal and individual performance review, disciplinary measures and credit towards clinical excellence awards.

3.14 Compliance assurance involves surveillance data (cases, outbreaks and deaths), audit results (hand hygiene, clinical protocols for high impact interventions, isolation protocols, antibiotic prescribing, cleanliness inspections) and regular management review at all levels (unit, ward, directorate, division, board).

3.15 It is no longer acceptable to regard these infections as 'normal'. Significant NHS resources can be better used and "Zero Tolerance" is a professional obligation.

4. MRSA and Screening

4.1 MRSA infections are endemic in United Kingdom hospitals. In England, MRSA accounts for approximately 36% of hospital *Staphylococcus aureus* bacteraemias and 64% of *Staphylococcus aureus* SSIs.

4.2 MRSA infections have higher morbidity and mortality rates, longer hospital stays and increased costs compared to those due to meticillin sensitive *Staphylococcus aureus* (MSSA).

4.3 MRSA was rare in the 1960s, sporadic in the 1970s, epidemic in the 1980s, and has become endemic from the 1990s. Until recently, most instances of MRSA were recorded in hospitals or in patients with hospital or healthcare contact.

4.4 The epidemiology of Hospital Associated MRSA (HA-MRSA) is well understood. MRSA is usually brought into hospital by patient carriers. Colonisation precedes infection and organisms are usually transferred via staff hands.

4.5 Patients may remain colonised for months or even years, hence patients with a history of healthcare contact may be colonised on admission (approximately 6% of hospital admissions in England). Admitted colonised patients are at risk of endogenous infection to themselves (especially following surgery/invasive procedures) and transmission to others.

4.6 Control of HA-MRSA is reasonably well understood although evidence is limited. Colonised patients should be identified and isolated. Infected patients and carriers should be decolonised. The highest standards of hygienic practice should be ensured at all times, including hand decontamination between each patient contact, environmental cleanliness, adequate space between beds, adequate staffing ratios and adequate isolation facilities.

4.7 There are low levels of MRSA in the Netherlands and Scandinavia. This is due to a combination of "search and destroy" policies, the presence of adequate isolation facilities and a higher doctor/nurse to patient ratio.

4.8 All available MRSA screening methods to identify carriers have false-positive and false-negative results. The nose is the most common carriage site, but multiple site screening has a greater yield.

4.9 Screening should be performed before or at admission to identify carriers who must then be isolated and decolonised in order to prevent transmission to others and to prevent endogenous infection during surgery and procedures.

4.10 Surgery should be delayed until decolonisation using anti-MRSA prophylaxis is complete. For elective patients this is best done in pre-admission clinics.

4.11 Screening can also be used to identify asymptomatic carriers during outbreaks, to allow release of MRSA negative patients from unnecessary pre-emptive isolation and to identify patients who may need empirical anti-MRSA therapy in severe, undiagnosed sepsis. Similarly, it can also be used to de-escalate such therapy in patients who screen negative for MRSA.

4.12 There is little evidence that exclusion of MRSA-positive staff will lead to reduction in MRSA rates. The exclusion of MRSA-positive staff is time consuming, costly, has an emotional and professional impact and makes the formulation of on-going strategy difficult. Screening of Healthcare Workers in the absence of an uncontrolled outbreak is not current practice.

4.13 Risk factors for MRSA carriage at hospital admission and HCAI include; previous MRSA colonisation, prior hospital admission (especially to high risk units), prior antibiotic therapy, skin ulcers, diabetes mellitus, age >75 and the presence of a urinary catheter. A multivariate questionnaire leading to targeted admission screening may be the most cost effective strategy.

4.14 Conventional culture-based screening takes 24-72h to produce a result. New, rapid molecular, polymerase chain reaction (PCR) screening takes 2-4 h. PCR testing is expensive, but potentially can reduce time to isolation and decolonisation and thence the delay of surgery, with associated reductions in MRSA transmission and infection.

4.15 Rapid MRSA screening does not have a significant impact where pre-emptive isolation and infection control are in place and is not a substitute for good universal infection control.

4.16 Rapid screening may be useful for high risk patients such as those in ICU or undergoing emergency surgery. More data from well designed studies is needed to assess the effectiveness of rapid screening.

4.17 Good universal infection control and hygiene practice is more important than screening, however rapid. Screening without prompt action and good practice is pointless.

5. Infection prevention in theatre

5.1 The Health Act of 2006, see: (http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_081927) introduced a code of practice for the prevention and control of HCAIs. This states that Trusts have a legal responsibility to protect patients, staff and others from HCAIs. Trusts must implement the code, put key policies and procedures in place to ensure that patients are cared for in a clean environment and HCAIs are kept as low as possible. These policies must be audited. Effective infection prevention and control must be embedded into everyday practice.

5.2 The "*Saving Lives Campaign*" has provided tools and resources to help reduce HCAIs. This campaign illustrates a series of evidence based practices presented in "Care Bundle" format (***Table 1***). Infection rates are reduced when all elements of a bundle are used on every occasion for every patient.

5.3 High impact interventions are associated with the risk of acquisition of HCAIs. These include central venous catheters, peripheral lines, renal dialysis, surgical site infection, ventilated patients and urinary catheters. For each of these interventions a specific "Care Bundle" is required in order to reduce this risk.

5.4 Trusts are required to implement these evidence based measures and to audit compliance with them. 100% compliance is often difficult to achieve, and, as part of any audit cycle, ways to improve compliance and, therefore, patient safety need to be observed.

5.5 Improving patient safety is essential to every surgical practice. Recent high profile cases have received widespread publicity.

5.6 Less dramatic errors are more common but equally important. Checklists (e.g. "time out" in theatre) are required to improve safety in theatres.

5.7 The WHO global patient safety challenge "Safe surgery saves lives" see: (http://www.who. int/patientsafety/safesurgery/en/) should be supported. This involves the introduction of a surgical safety checklist, the concept of 'time out', and improved communication before and after surgery.

5.8 The contents of these checklists should include not only higher profile checks such as patient and side of surgery identification but also those less obvious procedures which ensure safe surgery such as antibiotic prophylaxis and the avoidance of inadvertent peri-operative hypothermia.

6. Surgical Site Infections (SSIs)

6.1 There is good evidence that the use of prophylactic antibiotics reduces the risk of HCAIs, particularly SSIs. The major risk in the injudicious use of antibiotics is the development of resistance. There is evidence that resistance may develop when antibiotics are used inappropriately to reduce colonisation and contamination.

6.2 Too many antimicrobials have been used empirically; broad spectrum agents are used when narrow spectrum agents will do; and antimicrobials are often used for too long. It must be remembered that many antibiotics are toxic and that cure, prevention and eradication must be balanced against hypersensitivity, nephrotoxicity, ototoxicity, *C.difficile* emergence, resistance and cost.

6.3 Prophylactic antibiotics need to be used wisely. Recommendations include starting them promptly (initial dose within 1 hour before the incision) and the use of an appropriate antimicrobial at an appropriate dose.

6.4 The empirical choice of antibiotic type will depend on the surgery and local pathogen environments. The initial prophylactic dose should only be repeated if there is excessive blood loss, a long operation or prosthetic implants are required. If a longer course is needed, this is *"therapy"*.

6.5 There is significant evidence that the development of HCAIs results in extended length of stay and increased cost. Reduction of MRSA, *C.difficile* and HCAIs in the UK result in significant reduction in both patient stay and cost.

6.6 Organisms involved in HCAIs include *S.epidermidis, S.aureus* (including MRSA*), Streptococcus spp., Enterococcus spp*, aerobic Gram negative organisms (such as *E.coli*) and anaerobes. These often act in synergy and are opportunistic contaminants and transients.

6.7 Biofilms and slime production are important to the healing of HCAIs. A further understanding of biofilms is required in both acute and chronic HCAIs.

6.8 SSI rates vary between procedures from 1.4% to over 15%. In clean surgery the rates should be below 5%. Reported rates also depend on the level of surveillance (telephone or close follow up) and where surveillance is undertaken (inpatient only or extended into primary care). The role of antibiotics in the prevention of SSIs after clean wound surgery remains controversial.

6.9 There is evidence that hypothermia during and after surgery increases the risk of surgical site infection. Causes of hypothermia (<36^{o}C) in the operating theatre are a cold operative environment (21^{o}C), open exposure of body cavities (particularly an open abdomen), cold intravenous fluids, cold anaesthetic gases, vasodilatation (or inhibited vasoconstriction), anaesthetic agents, increased BMR with increased oxygen requirements and poor oxygen delivery with hypoxia and acidosis. There is a strong link between local warming and tissue viability as it improves perfusion and tissue oxygenation.

6.10 There is evidence that peri-operative warming benefits patients resulting in a reduction in wound infection rate, blood transfusion requirements, cardiac events, intensive care and hospital stay, morbidity and mortality. There is also evidence that supplemental perioperative oxygen may reduce the incidence of SSIs.

6.11 The use of antiseptics for preoperative showers, whole body washing, hand washing, patient skin preparation and in open surgical wounds can reduce SSIs and results in no antimicrobial resistance.

6.12 There is also a potential benefit for sutures coated in an antimicrobial agent for the prevention of deep and superficial SSIs. These may be of particular benefit in surgery involving the implantation of prosthetic materials.

7. Hospital and Ventilator Associated Pneumonia

7.1 Hospital Associated Pneumonia (HAP) is defined as pneumonia that is not incubating at the time of hospital admission and begins more than 48 hours after admission. Ventilator Associated Pneumonia (VAP) is nosocomial pneumonia in patients who are on mechanical ventilation (via an endotracheal tube or tracheostomy) for more than 48 hours.

7.2 VAP involves inflammation of a number of airspaces. Blood or pleural fluid cultures are frequently positive and correlate with clinical findings. The absence of other explanations can also be used to diagnose VAP if cultures are negative.

7.3 VAP has been diagnosed over many years using the following clinical criteria; presence of two or more new and progressive chest infiltrates (diagnosed on chest X-ray); with two or more of fever (temperature > 38.3°C), leukocytosis (> 10 x 10^9), leukopenia (< 4 x 10^9) or purulent tracheobronchial secretions. These criteria may not be reliable as there are many non-infective causes of CXR shadowing which present with fever. Tracheal aspirates commonly represent colonization and new pulmonary cavitation or a positive response to antibiotics may be misleading. A Clinical Pulmonary Infection Score (CPIS) can improve accuracy.

7.4 Brochoscopic diagnosis using a protected specimen brush (PSB) and broncho-alveolar lavage (BAL) can help in diagnosis and avoids contamination by saliva. Non-bronchoscopic, non-directed mini-BAL is an alternative, less invasive and more cost effective technique.

7.5 The decision to treat patients with VAP should be based on clinical criteria with or without a CPIS; a short-term evolution of the patient's condition; and a search for non-infectious conditions and non-pulmonary sites of infection. There is a large discord between clinical and microbiological results with the risk of over-treatment weighed against the risk of insufficient antimicrobial treatment.

7.6 Protocols are required for ventilated patients to limit the administration of sedation, accelerate weaning, prevention of aerodigestive tract colonization and to prevent aspiration of contaminated secretions.

7.7 Measures to reduce bacterial aspiration should including chlorhexidine mouthwashes and a semi-recumbent positioning should be implemented in all patients. There is evidence that these low cost and low risk measures result in a three times reduction in VAP with a trend to reduced hospital mortality.

7.8 The avoidance of gastric over-distention may reduce VAP. This can be achieved by reducing narcotics and anti-cholinergic agents, using gastrointestinal motility agents and by monitoring gastric residual volumes. No studies have demonstrated a mortality benefit from naso-jejunal feeding

7.9 Unnecessary stress ulcer prophylaxis (H2 receptor antagonists and protein pump inhibitors) should be avoided as there is evidence that decreasing intragastric acidity increases VAP. This must be balanced against the risk of a gastrointestinal bleed. Cytoprotective agents are an alternative.

7.10 Antibiotic use is associated with VAP and if unnecessary, should be avoided. Prophylactic antibiotics can delay VAP, but there is an increased incidence of VAP caused by resistant Gram-negative organisms and an increased overall incidence of nosocomial infections.

7.11 Blood transfusions are associated with HCAIs including VAP and should be avoided if unnecessary.

7.12 Bacteria settle on surfaces such as ET tubes and form bio-films, a protective microenvironment for bacteria such as Pseudomonas spp. These biofilms can be prevented by surface coatings or by using nebulized antibiotics. Further research is required in this field.

7.13 MRSA is assuming a greater prominence in VAP. Isolation cubicles are poorly provided in the majority of ICUs. Current recommendations for ITU MRSA-control include hand washing, the wearing of gloves, gown and apron, screening and isolation.

8. Infection related to the Urinary Tract

8.1 The main areas of concern in urinary tract HCAIs are centred on catheter related infection and arguments for and against the use of pre-operative prophylactic antibiotics.

8.2 The commonest site for MRSA colonisation in urological patients is urinary catheters (32%) and open wounds (18%). Risk factors for MRSA bacteraemia include hospitalisation in the preceding 6 months, the presence of an indwelling catheter and residence in a nursing home.

8.3 There is currently no agreement about screening for MRSA, even in "at risk" groups. The British Society for Antimicrobial Therapy (2006) recommended that "*in patients with normal renal function, tetracyclines be considered as first-line agents for the treatment of urinary infections caused by susceptible MRSA, with trimethoprim or nitrofurantoin as alternatives*".

8.4 Key recommendations to reduce risk of *C.difficile* infection in urological patients include: that the indication and duration of antimicrobial therapy should be stated on the prescription charts, and that intravenous antibiotics should only be given for 48 hours before daily review. Antimicrobials should be chosen carefully and stopped when infection is resolved or absent. Their duration of use should be minimised where possible.

8.5 Up to 24% of hospital patients may have a catheter inserted during their hospital stay and 10 – 27% develop a urinary tract infection (UTI). UTI accounts for 40% of nosocomial infection in these patients and are usually associated with highly resistant organisms (such as those producing ESBLs). In addition, 80% of nosocomial UTIs are associated with the presence of a catheter. Once a catheter is in place, the daily bacteruria rate is 3 – 10%.

8.6 The aims of antimicrobial prophylaxis in urology are to prevent infective complications resulting from diagnostic and therapeutic procedures. These include SSI, remote infection, bacteraemia and sepsis.

8.7 The risks of antimicrobial prophylaxis in urology include adverse drug reactions, secondary infections (eg. *C.difficile*), colonisation with resistant organisms, dissemination of resistant organisms and prophylactic failure. Prophylaxis should, therefore, only be used when the benefit outweigh the risk.

8.8 The use of antimicrobial prophylaxis should be based on evidence of efficacy. Guidelines should determine which procedures require prophylaxis, which antimicrobials should be used and the duration of therapy. These guidelines should be reviewed and updated regularly in each hospital.

8.9 Risk factors for SSIs in urological patients include older age, high ASA grading, obesity, diabetes, preoperative chemotherapy, a long procedure time and the quantity of blood loss. MRSA is the most frequently isolated organism in urological SSIs, followed by *E.faecalis and Pseudomonas spp*.

8.10 The European Association of Urology Guidelines for Urolithiasis require that for all patients with infection and stones or a recent history of urinary tract infection or bacteriuria, antibiotics should be administered before the stone-removing procedure and continued for at least four days afterwards.

8.11 The incidence of SSIs in radical cystectomy and urinary diversion is approximately 33%, despite prophylaxis. The commonest of these SSIs is superficial. MRSA is frequently isolated and is thought to be causative in 38% of cases.

8.12 It is recognised that urological diagnostic and therapeutic procedures can induce SSIs. Clean procedures not involving a prosthetic device may not require prophylaxis, whereas clean-contaminated wounds benefit from prevention.

9. Surveillance and SSIs

9.1 Sites and relative percentages of HCAIs are shown in a Hospital Infection Society and Infection Control Nurses Association prevalence survey (HIS/ICNA) 2007 (***Figure 2***: http://www.documents.hps.scot.nhs.uk/hai/sshaip/publications/national-prevalence-study/report/full-report.pdf). There is evidence that SSIs result in a significant increase in hospital stay with additional mortality and associated costs.

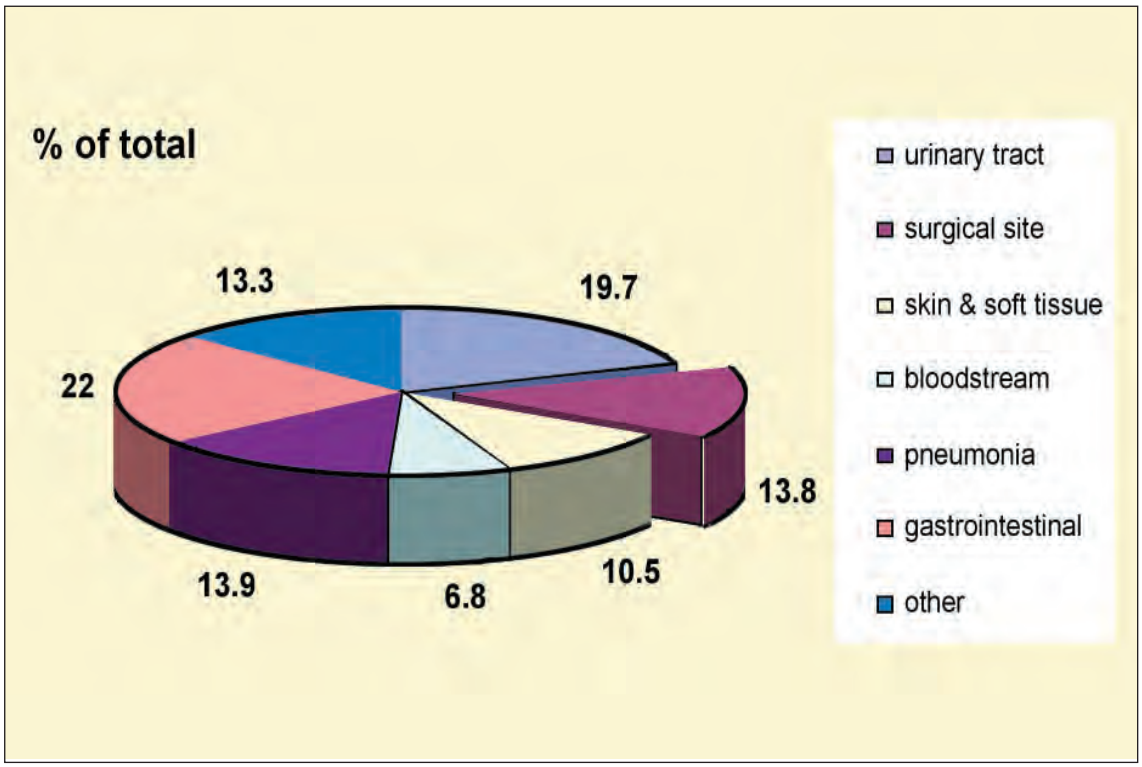

Figure 2: Percentage of total HCAIs identified in the HIS/ICNA study in 2007.

9.2 The Surgical Site Infection Surveillance Service (SSISS) was established by the Health Protection Agency in 1997. Its aims were to establish a national database (and benchmark rates of SSI) to enable comparisons within and between hospitals and to encourage hospitals to use surveillance data to improve the quality of patient care. (http://www.hpa.org.uk/webw/HPAweb&Page&HPAwebAutoListName/Page/1191942150156?p=1191942150156).

9.3 Orthopaedic surveillance is mandatory, with 350 hospitals in England registered. Basic methodology is targeted at categories of clinically similar operative procedures. A data collection form is completed for each relevant operation following which systematic surveillance is undertaken to detect infections. Data management is web-based, with on-line generated reports.

9.4 Key findings are that the efficiency of the method depends on the healthcare system employed and that there is a poor response rate with a low sensitivity and specificity for community-based reporting (Primary Care, GPs and nurses). Outpatient clinic reporting has a high response rate but a low sensitivity and specificity. Patient reporting has a high response rate (70-80%), but may be affected by age and ethnicity. There is a poor positive predictive value (over-report wound problems as SSI), but a good negative predictive value (report no problem with wound as no SSI).

9.5 The risk of SSI increases with age. For hip prosthesis, the risk of SSI doubled in patients aged >85 years when compared to those aged <45 years ($p<0.001$).

9.6 The micro-organisms reported as causing SSI in all categories between 2002-07 are shown in ***Figure 3:***

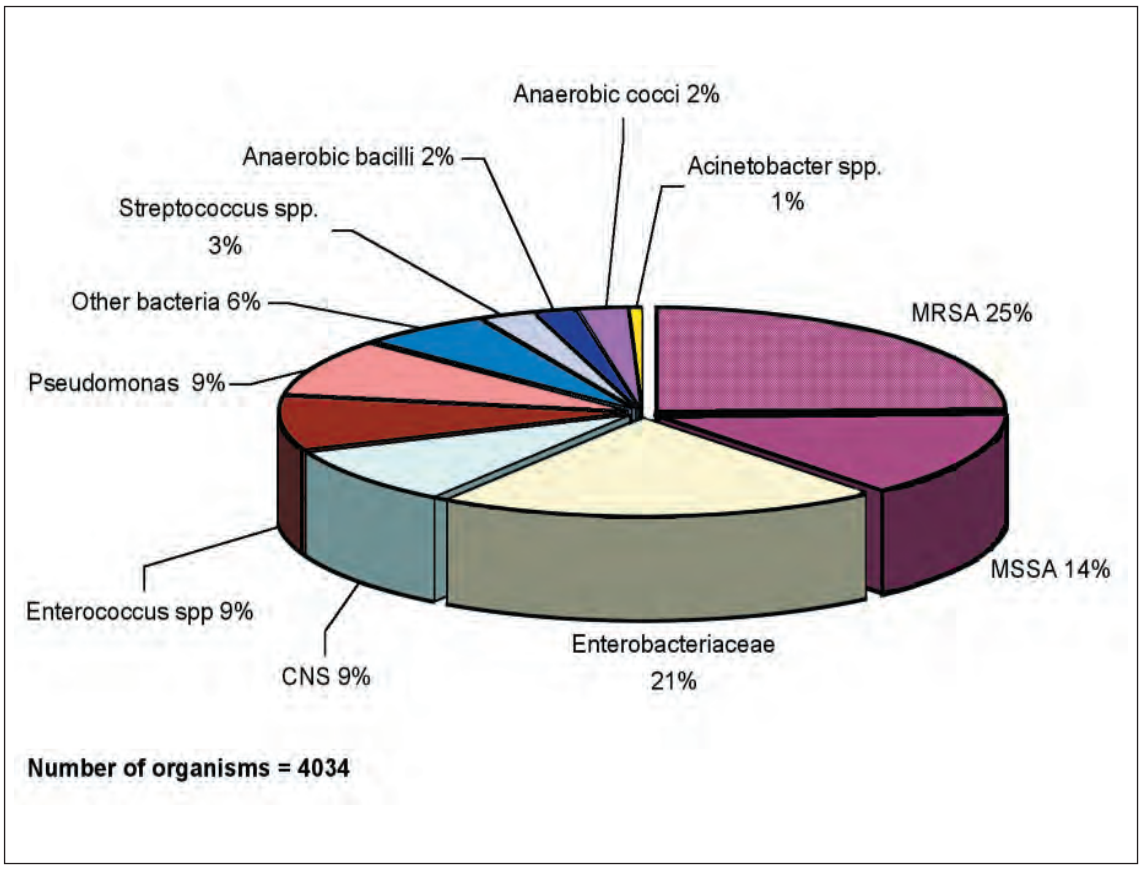

Figure 3: Percentage of micro-organisms causing SSI (HIS/ICNA study 2007).

9.7 The database can also be used to construct funnel plots which can be used to identify "outlying" hospitals (***Figure 4***).

9.8 Making surveillance work involves accurate data, systematic collection, knowledge (e.g. engage clinicians, active feedback and training) and action (e.g. audit and evaluation of practice).

9.9 Surveillance data can be used to improve practice in areas such as theatres and ward environments, pre-operative preparation, surgical technique, wound management and the management of patients with MRSA.

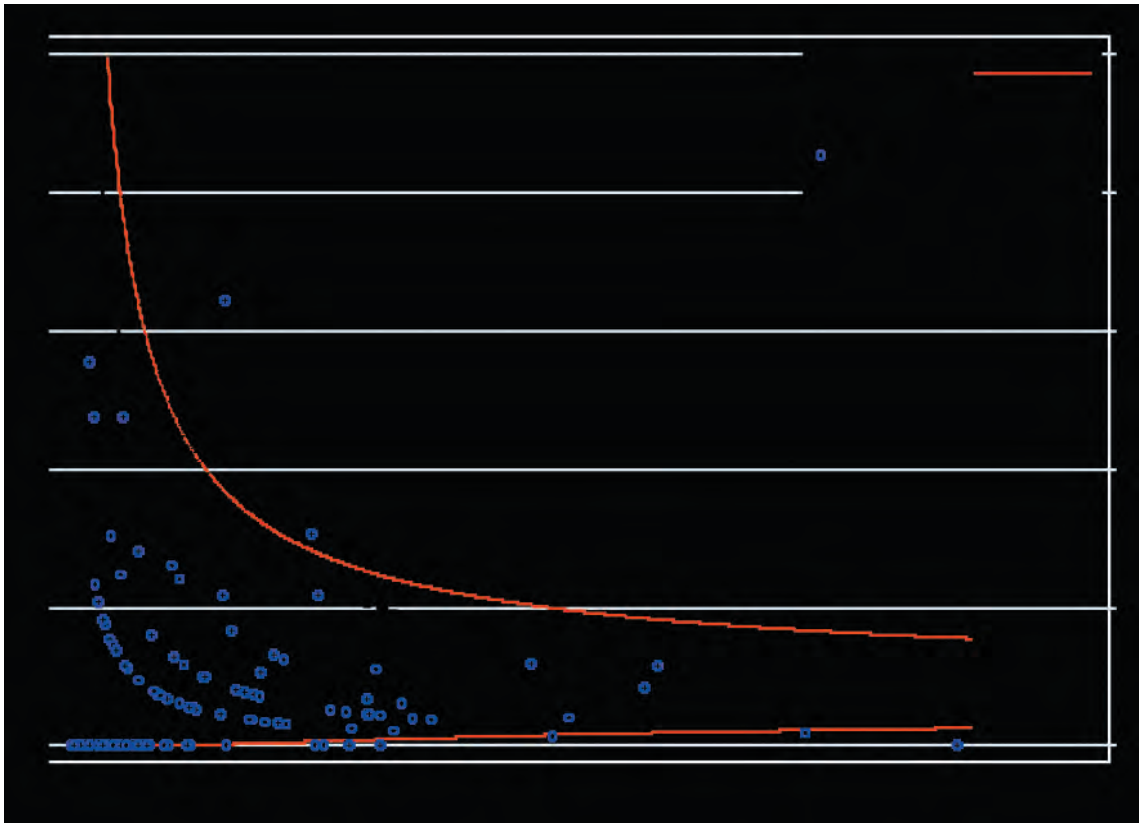

Figure 4: Funnel plot for SSIs following hip replacement between April 2006 and March 2007.

9.10 Strategic programmes such as the "Saving Lives" campaign (http://www.clean-safe-care.nhs.uk/index.php?pid=2) can reduce the incidence of SSIs. They work by creating a disciplined culture, encourage staff to challenge poor practice, allow for training and supervision of junior staff, facilitate the establishment of theatre and ward audit, raise awareness of infection control, help with the development of partnerships between clinical and intensive care staff and drive education and training on infection control.

10. Further Evidence Required for Prevention of HCAIs

10.1 The Consensus Conference considered the evidence for "bare below the elbows", hand hygiene, cleanliness and deep clean (http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_078433). The document concluded that it was impossible to prove that these measures made a difference scientifically, but that they restored some pride to the workplace and had identified much old and obsolete equipment in need of replacement.

10.2 The RCS England Policy Statement was supported: "*Intuitive interventions that have no evidence base and whose implementation does not harm patient safety or outcomes should be accommodated where practically possible, though priority should be given to evidence-based best practice*".

10.3 There is some evidence that high bed occupancy leads to higher transmission rates and that low staffing levels leads to higher transmission. Further studies are required, but a policy of adoption of sensible high profile methods to reduce HCAIs is supported.

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