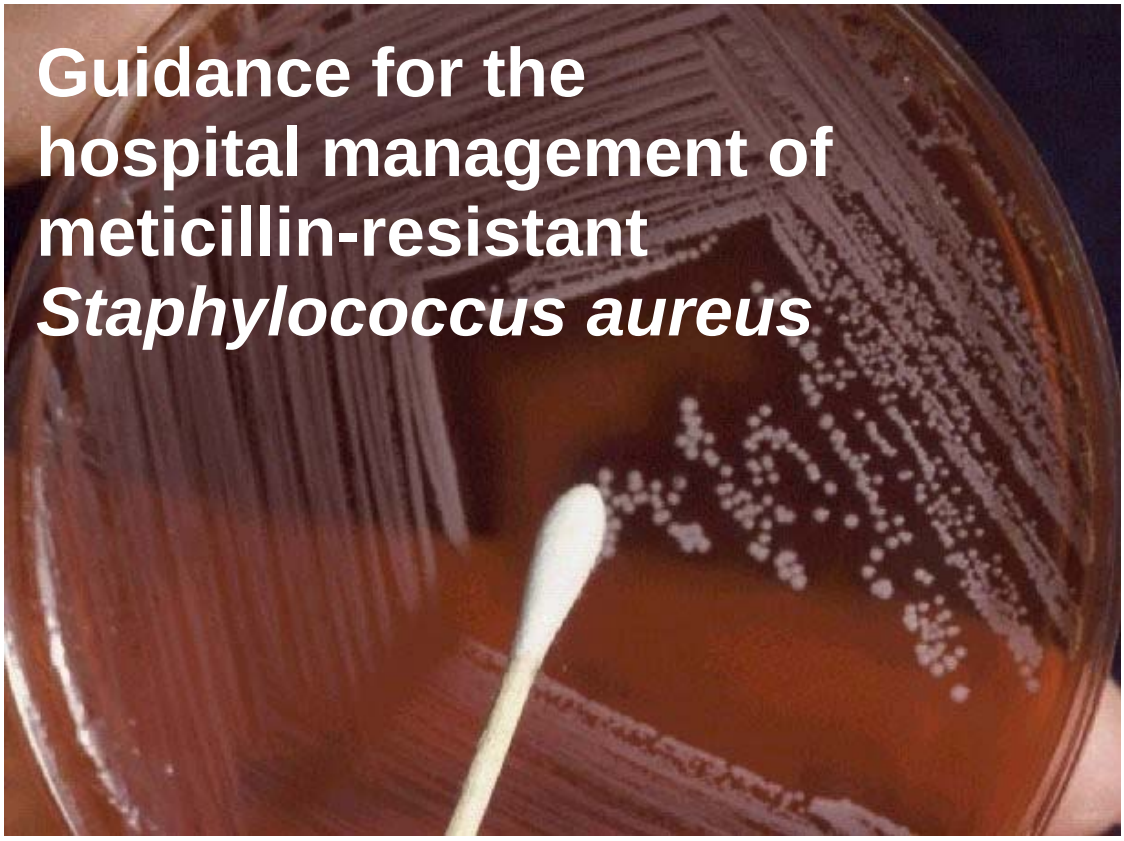
Guidance for the hospital management of meticillin-resistant *Staphylococcus aureus*



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CONTENTS

1. INTRODUCTION

Throughout this document the term 'meticillin' replaces the more familiar 'methicillin', in accordance with the new recommended international names.

The MRSA problem

The appearance, spread, and clinical significance of meticillin-resistant *Staphylococcus aureus* (MRSA) is thoroughly documented[1]. There are no simple answers to the control of MRSA, which has become endemic in healthcare institutions in Europe and many other parts of the world, with the notable exceptions of the Scandinavian countries and the Netherlands.

The impact of this situation on the delivery of healthcare is now very significant, both in terms of human morbidity and mortality, and financial costs. In Scotland, healthcare-associated infection, to which MRSA is a highly significant contributor, is a major factor in an estimated 457 deaths each year and a contributory factor in a further 1372. The cost to the NHS in Scotland is greater than £186 million per year – and over £1 billion in the UK[2].

Concern over healthcare-associated infection (HAI) resulted in the publication of the Ministerial HAI Action Plan in October 2002, and the establishment of the HAI Task Force, whose work is ongoing. Several important documents have already emerged from this Group, including the Code of Practice for the Local Management of Hygiene and Healthcare Associated Infection (see below).

Notwithstanding this generic guidance, the Scottish Infection Standards and Strategy Group (SISS) considered that it would be helpful to take a fresh look at the problems specifically surrounding MRSA in hospitals and suggest new guidance for its control. Despite ongoing professional debate[3] we believe that Scotland and the UK should now adopt a more proactive attitude towards control of MRSA[4].

The SISS Guidance

The SISS MRSA Sub-Group now offers this discussion paper as a robust contribution to the MRSA debate. Its suggested guidance has one aim: to reduce the incidence of MRSA infections in patients vulnerable to them. It is impossible to know whether adoption of the proposed measures would result in a fall in the total burden of MRSA in hospitals or even in the community, but as a bonus this desirable situation might result in time.

The guidance is intended for all staff working in hospitals, on whose shoulders falls the responsibility of trying to minimise cross-infection. It is intended to be very much a 'hands-on' document, and is therefore addressed principally to clinical nursing and medical staff, infection control teams and bed managers, although of course hospital administrators would have a key role in support and facilitation.

We cannot stress too strongly that for this guidance to have any chance of success, its key points, namely, risk assessment of all patients and targeted surveillance (microbiological screening) of those patients admitted to acute clinical units who are identified to be at higher risk of being MRSA carriers, must be grafted on to a robust and high quality infection control infrastructure. Unless adequate resources, both human and environmental, are in place, any attempts to control healthcare-associated infections are bound to fail. Worse, the measures we propose could add meaningless extra burdens on to the shoulders of already hard-pressed clinical, infection control and laboratory staff. There must be adequate numbers of trained staff who meticulously observe best infection control practices, in spotlessly clean wards equipped with adequate numbers of single rooms and a plentiful and accessible supply of wash hand basins. The Scottish Executive Health Department has recognised this, and the guidance now being produced by various working groups of the Healthcare-Associated-Infection Taskforce will hopefully impact profoundly on the burden of infection which is in part an inevitable consequence of modern medicine.

It is for others to decide whether the MRSA problem is by itself of sufficient gravity to justify the considerable resources that implementation of our suggestions would necessarily entail. In the face of future threats such as emergence on a large scale of 'community' MRSAs which are more virulent than current 'hospital' strains, and the inevitable emergence and spread sooner or later of glycopeptide-resistant staphylococci, we believe that a more proactive approach to MRSA is fully justified.

The guidance has been kept as simple in principle as possible. The feasibility of the principles on which it is built has been demonstrated, not just when concerted efforts have been applied to control outbreaks, but also and crucially in the endemic situation[5-7]. Successful programmes have been based on early identification of the MRSA reservoir and prompt implementation of contact precautions. The most efficient strategy to detect occult MRSA carriage is targeted screening of patients on admission, and this has proved to be cost effective in various acute care endemic settings[8].

In Scotland, a Grampian hospital introduced a package of infection control measures in 2001, including risk assessment, screening (some 40% of all admissions), isolation and upgraded cleaning, without extra resources. This has halved the percentage of clinical *Staphylococcus aureus* isolates that are MRSA from around 30% to 15%, which is the same as in the community (Figure 1). In other words, the only patients with MRSA now seen in the hospital are those admitted with it. This has been confirmed by discharge screening, which shows negligible acquisition during hospital stay (I.M.Gould, personal communication). In addition, there has been a concomitant reduction in MRSA bacteraemia rates in NHS Grampian[9].

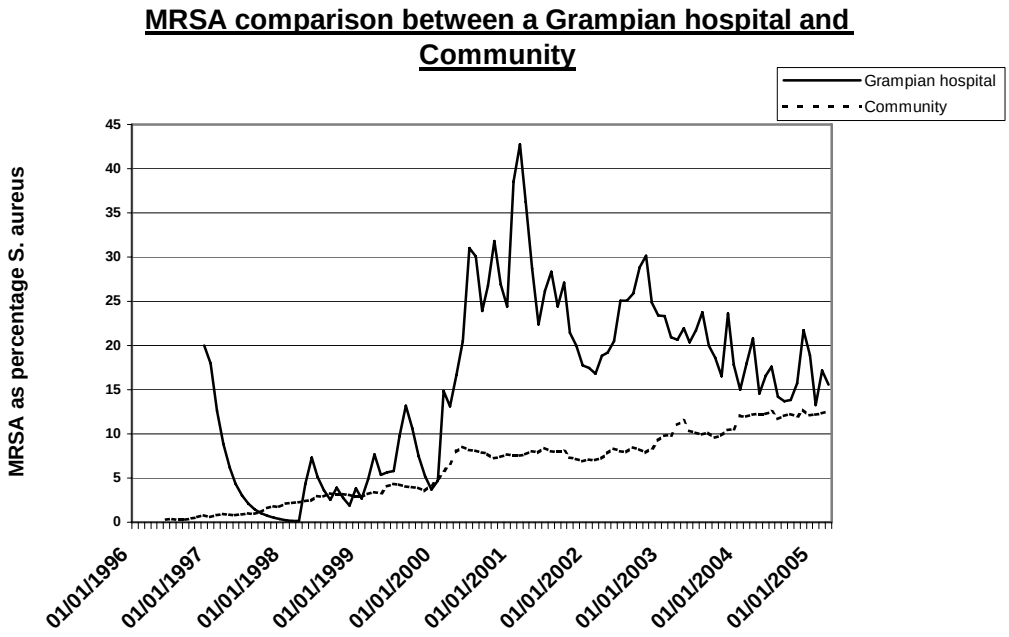

Figure 1. Fall in percentage of clinical *Staph. aureus* isolates that were MRSA, following the introduction of a package of infection control measures, including targeted screening, in 2001.

Principles of this Guidance

The measures advocated in this discussion paper can be summarised as follows.

1. *A documented clinical risk assessment* of all newly admitted patients must be done to identify patients for whom infection with MRSA could be especially dangerous, and also those who are more likely to be carriers of MRSA. A patient can of course belong to both categories.

2. This clinical risk assessment must be supplemented by *targeted surveillance for MRSA*.

3. Patient care management must conform to best practice infection control guidance.

4. Carriage of MRSA by healthcare workers must be considered in certain situations, such as failure to control outbreaks, or the unexplained appearance in a clinical area of new or especially pathogenic strains of MRSA.

5. Each healthcare institution should review its antimicrobial formulary and prescribing practices, and amend them if necessary in line with best practice guidance. Some suggestions are given in Appendix V.

6. Cleaning of healthcare environments and equipment must conform to best practice guidance.

7. The microbiology laboratory identification of MRSA in a specimen must be as rapid as possible, given the absolute requirement for accuracy.

Throughout this document the term 'high risk' has been avoided because of the ambiguity that sometimes arises between whether one is referring to patients *at* risk, or *posing* a risk. The terms used, '*vulnerable patients'*, '*unlikely MRSA carriers'* and '*possible MRSA carriers'* are not ideal, but unambiguously convey the meanings intended.

These suggestions are intended to complement existing best practice guidance on infection control, both local and national. To avoid unnecessary duplication therefore we refer wherever possible to existing generic good practice guidance, for example to 'A Code of Practice for the Local Management of Hygiene and Healthcare Associated Infection' produced by the Chief Medical Officer's Task Force on Healthcare Associated Infection:

(http://www.scotland.gov.uk/publications/hai1).

We also regard the highest possible standards of hospital cleanliness as fundamentally important. Full guidance on cleaning standards is contained in the NHSScotland National Cleaning Services Specification:

(http://www.scotland.gov.uk/publications/hai2).

Implementation of the Guidance

We are aware that some hospitals are already using essentially the same approach as we recommend, at least in some clinical units. Our advice is that hospitals should ultimately aim to implement this guidance for all patients. Clearly, this is however for many not an immediate possibility. We have therefore made a distinction between what we call 'acute clinical units' and 'non-acute clinical units', which is simply intended to distinguish between clinical units where invasive procedures of all types are routinely performed, and those where such procedures are less common. Clearly the distinction is not absolute, and each hospital would decide on its own categorisation.

We believe that a useful way forward would be the establishment of fully funded pilot studies to ascertain the practicality and effectiveness of what we recommend. Such pilot schemes could take various forms, either by implementing the guidance in all acute clinical units in a few hospitals, or alternatively, in selected units in most hospitals. The units chosen for this second approach could for example be those with the greatest number of especially vulnerable patients, those with the greatest number of patients with MRSA, or even those with the least number of patients with MRSA. Each of these pilots would yield important information – for example, just what proportion of potential carriers in a local population does in fact carry MRSA? This knowledge would then allow the guidance to be adapted to local circumstances, for example in setting priorities for the use of single rooms.

Literature Search Strategy

The SISS group considered at the outset that given the scanty nature of the evidence base for much of infection control, it would not be possible to assign a weighting to each recommendation, as is done in the SIGN guidelines, for example. Instead, the guidance was developed from an extensive review of the literature in the light of accepted good practice, the increasing experience of the value of targeted screening, and in some cases, common sense[10].

Relevant data for the preparation of this Guidance were identified by searching the PubMed database (National Library of Medicine), various general search engines and the Reservoirs of Antibiotic Resistance Network (ROAR) bibliography:

http://www.tufts.edn/med/apua/ROAR/biblio.htm.

The search terms 'methicillin-resistant Staphylococcus aureus', 'MRSA', 'antimicrobial resistance', 'infection control', 'isolation', 'treatment', 'outbreaks', 'management', 'topical decontamination', 'staff' and 'screening' were used in varying combinations. Search criteria encompassed any article, in any language, demonstrating aspects of MRSA control and/or management of multiply-resistant organisms in general. There were no limitations imposed on publication date. Particularly useful publications included the most recently published UK MRSA guidelines[11], and work from the staphylococcal pioneers of the 1950's and 1960's such as REO Williams, RA Shooter, WC Noble and OM Lidwell. In addition, current publications from national bodies on infection control, and particularly those emanating from the HAI Taskforce, were consulted and incorporated into references as appropriate.

Contents of this document

Section 2 is background information and highlights many of the issues surrounding the prevalence and significance of MRSA. Section 3 contains our practical guidance, with recommendations for the initial management of all admissions with respect to MRSA. Appendices I – III contain examples of risk assessment and initial patient management strategies; appendices IV and V give suggestions for the management of MRSA carriage in patients and the treatment of MRSA infections, respectively; appendix VI tackles the thorny issue of screening healthcare workers; appendix VII offers recommendations for laboratory practice. Appendix VIII consists of Good Practice Statements arising from the Guidance. It is suggested that these could be used as a ready reference checklist, while they could also be helpful to Infection Control Teams for their own internal audit purposes.

Acknowledgements

The members of the Group thank all the many people who contributed valuable comments and criticisms of the earlier drafts, and hope that most of these have now been addressed to their satisfaction.

2. BACKGROUND

Antibiotic-resistant strains of *Staphylococccus aureus* seem always to have shown increased transmissibility in patients receiving antibiotics[12]. Intense debate has taken place over the years as to whether MRSA contributes an extra burden of hospital-acquired staphylococcal infection, or simply replaces other *Staphylococcus aureus*, and whether MRSA infection is potentially more dangerous than infection with less resistant strains. The answer to both is now clear: MRSA is a pathogen that causes illness additional to cases of infection due to meticillin-sensitive strains, is more difficult to treat, and has greater attributable mortality[13-18]. In addition, MRSA continues to evolve into new and potentially very dangerous strains - glycopeptide-intermediate[19], glycopeptide-resistant[20] and 'community' (i.e. non-hospital-based) that carry the Panton-Valentine leucocidin[21,22], are examples. Even without these new threats, the burden of morbidity and mortality due to MRSA is well documented, and shows no signs of abating.

Factors involved in the introduction and spread of MRSA within a healthcare institution include the following:

1. MRSA enjoys a selective advantage in healthcare settings, where antibiotics are used heavily and sometimes inappropriately.
2. Many patients carrying MRSA go unrecognised unless active surveillance to detect them is employed; these patients may then act as sources of cross infection to others.
3. Transfer of patients with MRSA between hospitals, wards and departments is a major cause of dissemination.
4. Healthcare workers contribute to the spread of MRSA when appropriate infection control measures are not followed, or sometimes because they are themselves MRSA carriers.
5. The clinical environment can become contaminated with MRSA and act as a source for acquisition by patients and staff.
6. The inevitable delay between the laboratory receipt of a specimen and the identification of a new patient with MRSA allows time for cross-infection to occur.

These factors are considered in more detail in what follows.

1. Antibiotic usage

MRSA would not enjoy a selective advantage without antibiotic usage[23]. Several publications specifically identify the quinolones, macrolides and cefalosporins as being implicated in driving MRSA outbreaks[24,25], and in predisposing to MRSA colonisation in individual patients[26,27]. Several studies suggest that modification of antibiotic policies has had a beneficial impact on MRSA levels in some healthcare settings[28-31]. However, close surveillance is necessary to detect the emergence of other resistant pathogens consequent on a radical change of antibiotic policy[32].

Antibiotics will of course continue to be used on a huge scale in healthcare, but we have received repeated warnings that prudence is now necessary if their efficacy and reliability are to continue[33]. Good practice guidance for hospital antimicrobial prescribing was prepared by the SISS Group[34], and more recently a guidance document on the prudent use of antimicrobials has been prepared for NHS Scotland

by the Scottish Medicines Consortium and forms part of the HAI Action Plan[35]. We regard compliance with, and auditing of, appropriate antibiotic prescribing as an essential component of our guidance. General advice on the management of MRSA infections is contained in Appendix V.

2. Unrecognised colonisation of patients

MRSA has now been endemic in most UK hospitals for at least a decade, and this has allowed a significant build up of carriers in the population here as elsewhere[36,37]. The literature identifies high risk groups who are more likely to be MRSA carriers than the normal population, for example, residents of care homes[38], and a sizeable body of evidence published over the past few years stresses that *active* surveillance for patients carrying MRSA is necessary if control efforts are to become more successful[39-42]. Transmission of MRSA from carriers has been shown to be much less when contact precautions are employed rather than standard precautions[43]. This means that carriers have to be actively sought, since only a minority will be detected from specimens taken for purely clinical reasons[44].

Success in controlling MRSA has been greatest in those countries which have adopted active surveillance together with rigorous adherence to transmission-based control policies.

This guidance therefore advocates *risk assessment* of all admissions, supplemented by screening of certain categories of patient (*targeted surveillance*) to identify MRSA carriers, using a single nasal swab supplemented by swabs of any areas of broken skin, and a urine sample if the patient is catheterised. Screening for nasal carriage alone will detect between 75-97% of MRSA carriers[45-47].

The introduction in recent years of preadmission assessment clinics offers an excellent opportunity to perform both clinical risk assessment and microbiological screening prior to the patient's admission, thus permitting appropriate management right from the beginning. Clearly it is important that the delay between assessment and admission is not too long. Conversely, too short a period between assessment and admission will not allow the laboratory to complete its work and reports to reach the case record.

3. Transfer of patients between hospitals, wards and departments

Patients are transferred between hospitals, and once admitted, frequently moved between and within wards. This leads to the importation of MRSA into clinical areas previously free of them. This is a difficult management issue given the pressures on bed utilisation in today's hospitals, but the whole concept of 'bed management' and its relationship to the opportunities for spread of pathogens probably requires local and national re-evaluation. There must be the closest possible collaboration between bed managers and infection control teams to ensure that patients are not inappropriately housed, even short-term, e.g. a patient with an enhanced likelihood of being an MRSA carrier next to an especially vulnerable patient.

4. Healthcare Workers

Healthcare workers contribute to the spread of MRSA, passively by transferring the organisms on their hands or clothing between patients, by contaminating the

environment (equipment, dissemination while bedmaking, etc), or actively, by acting as dispersers if they themselves are MRSA carriers. Such carriage by staff may be transient or longer term[48], and has probably not always received the attention it deserves.

Screening of staff for MRSA has always been controversial[49-51], but used selectively it has proved to be valuable in controlling outbreaks[52-54], and we advocate that it be considered early in certain circumstances. A working group of the Healthcare-associated Infection Taskforce is addressing the issue of staff screening ('Management of Incidents and Outbreaks of Healthcare Associated Infection, Including Guidance on Staff Screening'). Our specific recommendations regarding MRSA are contained in Appendix VI.

Other staff issues include adequacy of numbers for particular clinical areas and appropriate skill mix, and the adequacy of training in infection control procedures. A clinical area that has inadequate numbers of nursing and other staff is likely to experience lapses in basic infection control procedures such as hand hygiene before and after each patient contact, use of appropriate protective clothing, decontamination of equipment etc[55]. Also, there should be sufficient trained staff to ensure compliance with these procedures. Staff in all disciplines who have not undergone adequate training in infection control procedures appropriate to their areas of work are likely to increase the risk of MRSA transmission between patients. This includes locum and agency staff. The introduction of the Cleanliness Champions programme in Scotland should improve the situation:

(http://www.nes-hai.info).

5. Environmental contamination and cleaning

The general perception that hospital environments are often not clean is of major concern, not just to infection control specialists but also to the public at large. Quite apart from the infection risk from a dirty environment, patients expect a clean uncluttered hospital[56], criticise hospitals they consider dirty, and associate them with a general lack of care[57]. It is entirely possible that visual soil represents a reservoir of potential pathogens, including MRSA, and therefore basic cleaning could have an impact on the rate of MRSA as well as other healthcare-associated infections. Florence Nightingale's legacy has never been questioned, but unfortunately, the squeeze in domestic services as part of the overall tightening on NHS resources, happened to coincide with a rising tide of MRSA.

There is currently little evidence demonstrating a *direct* link between MRSA in the healthcare environment and increased risk of MRSA acquisition by patients. Evidence for the efficacy of hospital cleaning in the control of MRSA has to be approached in a different way. If we consider the physical properties of the organism and each stage of the transmission cycle, there is evidence to substantiate most, if not all, of these individual stages. Taken as a whole, basic cleaning could very well have a valuable role in reducing MRSA acquisition.

The individual components of the dynamic relationship between healthcare staff, patients and the environment regarding the transmission of staphylococci are listed as follows. The accompanying references are by no means exhaustive.

1. People carry *Staphylococcus aureus*[58];
2. People transmit their staphylococci to others[59];
3. People shed staphylococci into the general environment[60-64];
4. *Staphylococcus aureus* (including MRSA) can contaminate specific items in hospitals[64-83];
5. Staphylococci can survive long term in the inanimate hospital environment[65,77,79,81,84,85];
6. Heathcare staff acquire MRSA from positive patients and/or their environment[61,81,86];
7. Various cleaning methods reduce MRSA in the environment[67,76,87,88];
8. General cleaning with or without ward closure reduces MRSA/ staphylococcal infection rates[88-90].

Until hard evidence for the role of cleanliness in the healthcare environment is forthcoming, good practice statements must rely on available evidence such as referenced above, and on common sense[91]. Only one of the above recent studies suggests that increased cleaning (together with other standard infection control practices) has a significant impact upon the numbers of new MRSA patients[88]. This study also costed the cleaning intervention. The amount of money saved more than justified further studies in cleaning as a potential MRSA control strategy.

There is a danger that should we wait for conclusive evidence for basic cleaning, it might be too late for any control activity to have much effect. Considering the implications for human health and well-being, it would be wise to prioritise cleaning, both general and specific, whilst the evidence for an environmental role is sought. Lack of evidence is not a convincing argument for abandoning hygiene[92].

Recently, standards for the microbiological assessment of hospital hygiene have been proposed[93]. Standards for cleaning services have been addressed in a series of documents, of which the NHSScotland National Cleaning Services Specification is the most recent. To avoid duplication, our guidance does not contain good practice statements for cleaning, but it should be clear that we regard the highest standards of cleanliness as essential components of our control strategy.

6. Laboratory practice

After the clinical risk assessment, the first line of defence against MRSA is the prompt and accurate identification by the microbiology laboratory of staphylococci in specimens as MRSA. This allows precise identification of carriers and thus the optimum use of appropriate nursing precautions as soon as possible.

Current laboratory methodology, involving conventional culture and antibiotic susceptibility testing, has a built in two or three day turn-round time for reports. New molecular technologies such as PCR can shorten the turn round time, and will be increasingly used in routine diagnostic laboratories[94,95]. Meanwhile, we advise that as a minimum, clinical microbiology laboratories should be funded for the out-of-hours processing of screening specimens to minimise delay in identifying MRSA carriers.

3. MANAGEMENT OF PATIENTS AT THE TIME OF ADMISSION

3.1 Aim

To identify as quickly as possible which newly admitted patients:

1. are vulnerable to MRSA infection;
2. are especially vulnerable;
3. are possible MRSA carriers;
4. are unlikely MRSA carriers;

and then to nurse these groups apart.

3.2 Definitions

Acute Clinical Units	A clinical area where patients are at increased risk of infection with MRSA because of invasive procedures, wounds or skin/soft tissue lesions.
Non-acute Clinical Units	Clinical areas where the above do not apply. Examples might be long-stay Care of the Elderly Units, Psychiatric Units, etc, but local categorisation of units is required.
Clinical Risk Assessment	Assessment of a patient as 'vulnerable', 'especially vulnerable', 'unlikely MRSA carrier' or 'possible MRSA carrier' by questioning the patient/relative and/or perusal of the case record. It should form part of the general admission assessment for infection. In the case of elective admissions, these procedures could have been performed prior to admission, at preadmission assessment.
Vulnerable patient	A patient admitted to an Acute Clinical Unit; also patients in Non-acute Units who have significant organic medical or surgical conditions.
Especially vulnerable patient	A patient who is to undergo surgery to implant foreign material of any type.
Possible MRSA carrier	A patient with one or more risk factors for MRSA carriage identified by clinical risk assessment.
Unlikely MRSA carrier	A patient with no risk factors for MRSA carriage identified by clinical risk assessment.

…….continued

Targeted surveillance	Microbiological screening of patients identified as possible MRSA carriers to find out if they do in fact carry MRSA.
Isolation	Placing a patient in a single room and using appropriate infection control precautions either to prevent spread of MRSA from the patient, or to prevent the patient acquiring MRSA, as appropriate.
Cohorting	Placing a patient in a designated area of the ward together with other similar patients, i.e. either known/suspected to be carrying MRSA, or known to be free of MRSA, as appropriate.
Topical Clearance Regimen	A course of nasal ointment plus skin antiseptic given to a patient in order to attempt to remove MRSA carriage.

3.3 Clinical Risk Assessment.

3.3.1 *All patients should undergo a clinical risk assessment for possible infection, including MRSA, as part of the routine admission process (unless already done at a recent preadmission assessment clinic).*

3.3.2 In most cases the risk assessment can be performed by a simple questionnaire or perusal of the patient case record. A suggested proforma is contained in Appendix I, and a few illustrative examples in Appendix II.

3.4 Targeted surveillance (Selective screening for MRSA)

3.4.1 *Patients admitted to acute clinical units whose risk assessment suggests they are 'possible MRSA carriers' should be screened for MRSA (targeted surveillance).*

3.4.2 Targeted surveillance for MRSA should also be done in 'non-acute clinical areas' if the clinical risk assessment and/or local factors dictate, e.g. the presence of vulnerable patients in the ward, or if local policy is to attempt eradication/exclusion of MRSA from these clinical areas.

3.5 Risk Factors for MRSA Carriage

Patients who are 'possible MRSA carriers' are those who:

◊ are known to be carrying MRSA, or to have done so previously;
◊ are admitted from care homes;
◊ have been in hospital within the past 12 months;
◊ are transferred from other hospitals or from abroad;
◊ have received repeated course of antibiotics;
◊ have renal disease or diabetes;
◊ have skin breaks (e.g. pressure sores, leg ulcers, i.v. line sites, PEG tubes);

◊ have certain active dermatological conditions, e.g. psoriasis or eczema.

3.6 Nursing Management

3.6.1 *Patients with known or possible MRSA must be nursed away from those without MRSA as much as facilities allow*. The clinical risk assessment will help to guide appropriate nursing management (e.g. the use of isolation rooms or cohorting, transmission based precautions) right from the beginning of the patient's admission.

3.6.2 *In addition, it is good practice to nurse especially vulnerable patients who are unlikely MRSA carriers away from possible MRSA carriers, and isolation should be considered for them if there are known or suspected carriers on the ward*.

3.6.3 When the results of the screening for MRSA are known, it may then be possible to modify individual management in order to make best use of scarce resources such as isolation facilities. If preadmission screening for MRSA has been done and the results are known at the time of admission, optimum use of these facilities can be made immediately.

3.6.4 Single rooms are generally a scarce resource, and when isolation facilities are unavailable or inappropriate, patients with and without MRSA should wherever possible be cohorted separately. Suggestions for priority for isolation rooms are given in paragraph 3.8.

3.7 Summary of Management

This is summarised in the following and in the Flow Chart in Appendix III. Some illustrative examples are given in Appendix II.

3.7.1 Newly admitted patients.

1. *Patients who are already known to be MRSA carriers* should be isolated (cohorted), a *full MRSA screen* performed (paragraph 3.9.2), and started on the topical clearance regimen (Appendix IV) unless this is contraindicated.

2. *Patients whose MRSA status is unknown but who are regarded as possible carriers* (by the above criteria) should be isolated (cohorted) and an *admission screen* performed (paragraph 3.9.1). When the result of this screen is known, patients who are negative can usually be nursed in the open ward. Patients found to be positive should continue to be isolated, have a full MRSA screen performed, and be commenced on the topical clearance regimen (Appendix IV) unless this is contraindicated. When non-isolated patients are found to be positive their contacts should then be screened (paragraph 3.11).

3. *Patients who are regarded as unlikely carriers* by these criteria and also those *known to be recently negative* can be nursed in the open ward and need not be screened, although consideration should be given to screening and isolating especially vulnerable patients in these groups, for example if there are known MRSA carriers in the same clinical unit.

3.7.2 Subsequent management.

1. It is usual to advise that patients who have undergone one or more courses of MRSA clearance treatment remain in isolation until three consecutive negative full screens at intervals of not less than 48 hours have been obtained.

2. *Vulnerable patients* should be rescreened (nose, skin breaks) weekly if there are patients in the same clinical area with MRSA.

3. Patients moved from a non-acute to an acute clinical area should undergo the MRSA screen if not already performed.

3.8 Isolation

Isolation facilities are usually limited. Priority should therefore be given to two distinct categories of patients:

1. *Especially vulnerable patients who are unlkely MRSA carriers*, if there are patients with MRSA in the same clinical area;

2. *Patients who are more likely to be shedders of MRSA*, i.e. who have MRSA on the skin as well as in the nose, or who are catheterised.

When isolation facilities are unavailable or inappropriate for particular patients, those *with* MRSA and those *without* MRSA, should wherever possible be cohorted separately.

3.9 Practical Aspects of Screening for MRSA.

3.9.1 Initial screen

Nasal swabs are taken in all cases. A single swab should be used, inserted into both anterior nares in turn to a depth of 1cm and gently rotated, then placed into the transport medium, labelled and bagged immediately, and sent without delay to the microbiology laboratory.

In addition, swabs should be taken from any areas of broken skin, and a specimen of urine taken from catheterised patients.

Request forms should indicate that they are for MRSA screening, and the microbiology laboratory will ‘fast-track’ these specimens.

3.9.2 Full screen

Further swabs should be taken from patients who are positive on initial screening, i.e. throat, perineum, any skin breaks, and urine if catheterised.

Following a course of clearance therapy, a further full screen should be done as above. Three consecutive negative screens taken at intervals of not less than 48 hours are usually accepted for practical purposes as successful clearance, at least in the short-term.

3.10 Clearance of MRSA Carriage.

This should normally be attempted in all patients carrying MRSA who are in acute clinical units. See Appendix IV for details.

3.11 Contact Patients

Contact patients are defined here as inpatients who have been cared for in close proximity to the positive patient ('index case'), i.e. in adjacent beds, or in the same 4-bedded room, for example, for a minimum of 12 hours. (There are no data on the minimum time that contacts have to share the same environment to have a high risk of acquiring MRSA, but it is suggested that a minimum of 12 hours is realistic. This may need to be modified in the light of local experience, and may differ in different clinical settings).

Contact patients who are screened and found positive are then managed as for index cases.

3.12 Screening of Staff.

Screening of staff whose work involves close physical contact with patients (e.g. nurses, doctors, physiotherapists) for MRSA carriage should be considered when an unexplained persistent increase in the number of patients with MRSA occurs in an acute clinical unit, or when new or especially pathogenic strains appear. Details are given in Appendix VI.

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APPENDIX I

ADMISSION RISK ASSESSMENT PROFORMA

Suggested proforma based on the criteria in Section 3 for risk assessment for MRSA, incorporated into the NHSGreaterGlasgow draft Admission Assessment for Infection protocol.

Admission Assessment for Infection

Objective: to identify through assessment of the patient's presenting signs and symptoms any infections, overt and concealed, which must be diagnosed early, for the benefit of the patient and to ensure that appropriate precautions are implemented to prevent any individual becoming a possible source for healthcare acquired infection.

PATIENT DETAILS

PLACE OF RISK ASSESSMENT:
.....

PERSON CARRYING OUT RISK ASSESSMENT: .....

DATE OF RISK ASSESSMENT: .....

Admission assessment question	***Action to take if answer yes***
Is the patient being admitted to one of the following clinical areas? *Medical: Intensive Care/High Dependency; Haematology/ Oncology; General Medicine; Renal; Dermatology; Rheumatology; Special Care Baby Unit.* *Surgical: Transplant; Orthopaedics; Vascular; Cardiothoracic; Neurosurgery; General Surgery; Plastics; Burns; Ear Nose and Throat; Ophthalmology; Urology; Gynaecology.*	The patient is in the 'Vulnerable' category for MRSA infection.

Admission assessment question	***Action to take if answer yes***
Is the patient to undergo implant surgery, e.g. joint, heart valve, vascular graft?	The patient is in the 'Especially Vulnerable' category for MRSA infection. Consider isolating the patient for his/her own protection, if there are known MRSA carriers on the ward.
Is the patient known to be carrying MRSA or to have done so in the past?	The patient is in the 'Possible Carrier' category for MRSA. He/she should be isolated (cohorted), a full MRSA screen performed and started on the topical clearance regimen unless this is contraindicated. See local Transmission Based Precautions Policy.
Has the patient been admitted from a care home? *Has the patient been in hospital within the past 12 months?* *Has the patient been transferred from another hospital or from abroad?* *Has the patient received repeated courses of antibiotics?* *Does the patient have renal disease or diabetes?* *Does the patient have any breaks/wounds in their skin?* *Does the patient have any exfoliating skin condition, such as psoriasis?*	The patient is in the 'Possible Carrier' category for MRSA. He/she should be isolated (cohorted) and an admission screen performed. Document type and size of break/wound and if swabs taken. Take swabs if there are visible signs of infection, e.g. redness or pus. Inform medical staff for assessment. See local Transmission Based Precautions Policy.
Does the patient have a rash, spots or abscess, which could indicate infection?	Inform medical staff for assessment. See local Transmission Based Precautions Policy.
Does the patient have any invasive devices, e.g. urinary catheter, intravenous catheter?	Ask medical staff if they can be removed. Inspect and document the condition of any insertion sites. Commence appropriate care plans.
Does the patient have a fever and/or symptoms of respiratory tract infection – new cough, new or changed sputum production, fever or febrile symptoms?	Obtain a sputum specimen. Enquire if there has been: Travel abroad in the last 4 weeks; Contact with others with similar illness; Exposure to animals or birds. Consider TB if symptoms have lasted longer than 3 weeks, particularly if there is weight loss. Consider isolation.
Does the patient have, or recently had, any illness attributable to contaminated food or water, or recent episodes of loose or bloody stools?	Send two stool specimens and commence stool chart. Implement policy for loose stools. Consider isolation. Document details of frequency, duration, and if any family contacts have same symptoms.
Does the patient have any urinary tract symptoms, e.g. frequency, dysuria, cloudy or offensive urine?	Send a specimen of urine. Describe and document the urine drainage/output, colour, flow, cloudiness.

Admission assessment question	***Action to take if answer yes***
Can the patient be expected to	Follow standard precautions policy and consider

maintain a safe environment, i.e. is he/she likely to contaminate the environment with faeces or other body fluid, including blood?	carefully where to nurse the patient.

MRSA Evaluation

As a result of this risk assessment the patient is regarded as (tick all that apply):

VULNERABLE	
ESPECIALLY VULNERABLE	
POSSIBLE MRSA CARRIER	
UNLIKELY MRSA CARRIER	

Priority for isolation

4. The Patient:	
is known to be carrying MRSA on the skin	
is catheterised	
has one or more breaks in the skin (e.g. pressure sore, leg ulcer)	
is especially vulnerable and there are known patients with MRSA in the ward	

Yes to any of the above means that the patient should be given priority for isolation

APPENDIX II

EXAMPLES OF INITIAL MANAGEMENT

1. *A patient in good general health is admitted at 10 am from home for elective joint replacement surgery. She had attended preadmission assessment, was screened for MRSA, and found to be negative.*

Clinical risk assessment put the patient into the '*Especially Vulnerable'* category and therefore nursing staff have precise information on which to plan management. A single room is available, and isolation is indicated because the staff know that there is/are one or more patients in the ward with MRSA.

2. *A patient with a chronic medical condition and many previous admissions is admitted as an emergency at 9 pm to an acute medical receiving ward. Many patients admitted at the same time have similar medical histories. There is no recent information on MRSA status, and single rooms are unavailable.*

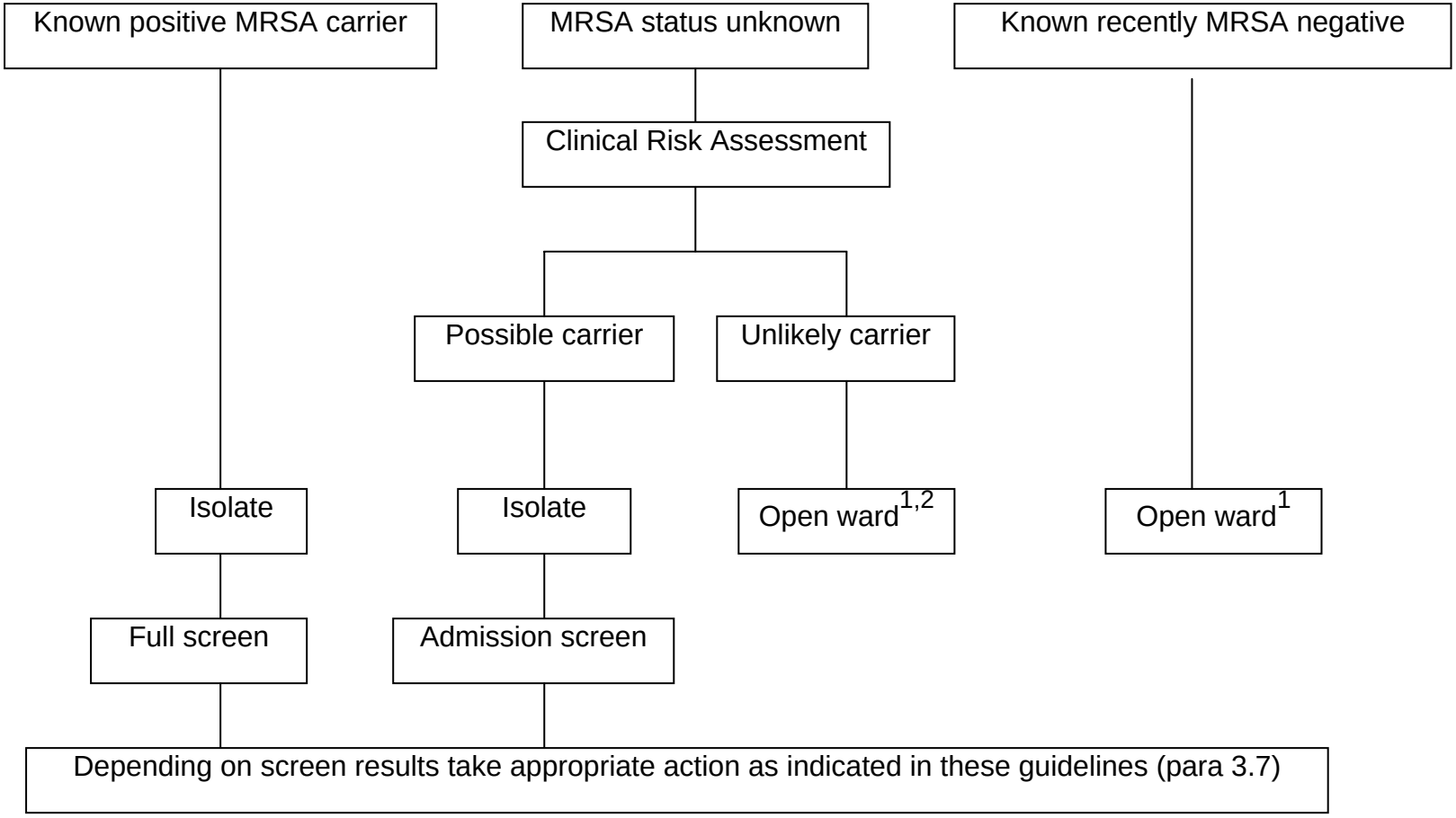
Clinical Risk Assessment puts the patient into the '*Possible MRSA Carrier*' category'. Nursing staff will attempt to cohort nurse the patient in an area of the ward with similar patients, and are aware of the importance of meticulous attention to strict infection control precautions to prevent transmission of MRSA to other patients, if the patient is in fact a carrier. Screening swabs will be taken and sent immediately to the microbiology laboratory.

3. *An elderly lady from a care home is admitted through Accident and Emergency having fallen and suffered a fractured neck of femur at 10 pm.*

Clinical Risk Assessment puts the patient into both the '*Vulnerable Patient*' and '*Possible MRSA Carrier'* category'. Nursing staff will therefore isolate or at least cohort the patient. Strict observance of infection control precautions are essential to prevent either acquisition of MRSA if she is free of MRSA, or transmission of MRSA to other patients, if the patient is in fact a carrier. Screening swabs will be taken and sent immediately to the microbiology laboratory.

APPENDIX III

INITIAL MANAGEMENT OF PATIENTS ON ADMISSION TO ACUTE CLINICAL UNIT



[1] Consider isolation for own protection if especially vulnerable

[2] Consider screening if especially vulnerable

APPENDIX IV

MANAGEMENT OF MRSA CARRIAGE IN PATIENTS

Any patient found to be a carrier of MRSA should be assessed for evidence of infection, e.g. sepsis syndrome, skin and soft tissue infection, pneumonia, bone/joint infection, device related infection, endocarditis, etc[96]. Indwelling catheters and intravascular devices should be avoided or removed when possible to minimise risk of subsequent infection.

There are limited randomised controlled data on the success of decolonisation therapy in preventing infections with MRSA[97]. However, there may still be benefit in reducing MRSA burden and shedding, and thus the risk of cross infection. An attempt therefore should normally be made to eradicate carriage[96].

Patients carrying MRSA on their skin as well as the nose should be given priority for attempted clearance.

Eradication of MRSA from catheterised patients usually requires catheter removal or at least change, with or without systemic antibiotic therapy. Advice should be sought from a clinical microbiologist or infectious diseases physician.

Patients carrying MRSA in their throats, and those with i.v. lines may also be difficult to clear using topical agents, and should be considered for systemic antibiotic therapy if attempted clearance is indicated and there are no contraindications.

Topical Treatment

A typical regimen consists of a combination of a topical antibiotic/antiseptic preparation applied to the anterior nares (e.g. mupirocin 5%), plus body and hair washing with a skin disinfectant,(e.g. chlorhexidine) for 3 - 5 days. Local policy should be consulted for details. Such a regimen may be unsuitable for patients with certain skin conditions.

Patients should be re-screened 48 hours after completion of a course of topical therapy. The laboratory request form should clearly indicate that these swabs are a test of clearance.

Patients in whom MRSA are not detected on this screening may be screened again at intervals to assess the long-term success of clearance, depending on local policy.

Patients who remain positive on this screen may undergo a second course of topical therapy if this is not contra-indicated. Third courses are not recommended because of the risk of resistance to the topical agents developing.

Systemic Treatment

This often consists of a combination of oral antibiotics given for not longer than five days. Local policies should be available and be consulted for details.

APPENDIX V

MANAGEMENT OF MRSA INFECTIONS

1. Who is at Risk?

The following categories of patient are at particularly high risk of developing an MRSA infection:

1. Patients with previous carriage or infection even when 'negative screens' are reported subsequently;
2. Patients with prolonged hospital admission and those with chronic medical conditions leading to recurrent admissions;
3. Patients undergoing (cardio) vascular surgery;
4. Patients in Intensive Care and High Dependency Units;
5. Patients with indwelling vascular (particularly central) lines, or urinary catheters.

Any patient found to be a carrier of MRSA should be assessed for evidence of infection, e.g. sepsis syndrome, skin and soft tissue infection, pneumonia, bone/joint infection, device related infection, endocarditis, etc[96].

2. Diagnosis of Infection

MRSA (as with meticillin-sensitive *Staphylococcus aureus*) isolated from a normally sterile site should always be regarded as significant, e.g. from blood, CSF, joint aspirate and intra-operative tissue specimens. When MRSA is isolated from blood, an underlying focus of infection should always be sought (intra-vascular device, vascular graft, prosthetic device, heart valve, portal shunt etc).

MRSA isolated from a clinically infected wound or *inflamed* ulcer should be regarded as significant.

MRSA isolated from sputum (in the context of a lower respiratory tract infection, ventilator-associated pneumonia) or from urine, usually represents colonisation but patients should be carefully assessed for failure to respond to first line antimicrobial therapy, and if there is evidence of clinical failure or worsening condition, rapid institution of anti-MRSA therapy should be considered.

MRSA isolated from *non-inflamed* skin or ulcers, or from other sites where there are no overt signs of infection implies carriage rather than infection and should be managed as such, without antibiotics.

3. General Measures

In patients with bacteraemia any underlying condition should be identified, assessed and managed. Intravascular devices should be removed. It is essential to involve surgical specialists when there are deeper foci of infection, e.g. infected orthopaedic devices, spinal abscess, (prosthetic) valve endocarditis. If the focus is not removed or irremovable the chances of successful antimicrobial therapy are small. Surgical debridement in some soft tissue infections may be required.

4. Choice of Antimicrobial Agent(s)

Appropriate and responsible antimicrobial prescribing is an essential element of any programme attempting to control MRSA. Local advice should be sought from the microbiologist or infectious diseases physician, and what follows is a general guide.

Glycopeptides (vancomycin or teicoplanin) are the mainstay of therapy, and close liaison with the microbiology laboratory is essential. Vancomycin trough concentration should be monitored and advice sought as required regarding dosing modification. Teicoplanin may be used in patients with renal impairment or those at high risk of deterioration in renal function, e.g. due to concurrent administration of other nephrotoxic agents. Teicoplanin may also be used in the outpatient setting due to the long half-life which enables extended dosing intervals. When managing deep-seated infections with teicoplanin, consideration should be given to teicoplanin therapeutic dose monitoring.

In severe or deep-seated infections a glycopeptide should be used in conjunction with another active agent e.g. gentamicin (intravenous) or rifampicin (oral) or sodium fusidate (oral or intravenous).

For uncomplicated wound and skin/soft tissue infections vancomycin or teicoplanin may be used alone. In mild infections a combination of oral agents, depending on the organism's sensitivity pattern, may sometimes be successful. Oral *monotherapy* is contra-indicated due to the risk of resistance developing.

4. Duration of Therapy

There is a lack of good data on optimum duration of therapy. However it is recognised that MRSA infection may relapse, particularly following short course therapy, in deep-seated infections and where there is a non-removable focus of infection[16,97].

In general, primary bacteraemias (no underlying focus) should receive two to three weeks of therapy. This is longer than is routinely recommended for meticillin-sensitive *Staphylococcus aureus* bacteraemias because of the higher mortality associated with MRSA[14,16] and also the theoretical concerns over the bactericidal activity of glycopeptides compared to flucloxacillin[97].

Deep-seated infections with MRSA should be treated for longer (i.e. 6-12 weeks) and in patients with a non-removable focus of infection, long-term suppressive therapy with two (usually oral) agents should be considered. Management of such patients should be undertaken in conjunction with a microbiologist or infectious diseases physician[98].

Shorter courses may be given for MRSA infections of the skin and soft tissues, uncomplicated wound infections, and respiratory or urinary tract infections, depending on their severity.

5. Use of Newer anti-MRSA Agents

Linezolid and Synercid (Quinopristin-Dalfopristin) are licensed for use in multi-resistant Gram- positive infections. As with other MRSA agents these drugs require close monitoring for toxicity and efficacy. Linezolid has high oral bioavailability which may allow early switch from intravenous to oral therapy and facilitate early hospital discharge. Other parenteral agents currently approved for treatment of skin and soft tissue infections in North America (Daptomycin and Tigecycline) are likely to be available in Europe in the near future. The use of all new anti-MRSA agents should be carefully restricted in order to:

◊ minimise the emergence of further resistance in Gram positive organisms;
◊ preserve activity for difficult-to-treat patients/ organisms;
◊ minimise escalating costs of antimicrobials in hospital.

In the context of MRSA infection the new agents should only be used on the recommendation of a microbiologist or infectious diseases physician for patients with infections with glycopeptide-resistant *Staphylococcus aureus* (GRSA) and glycopeptide-intermediate *Staphylococcus aureus* (GISA), or in those unresponsive to, allergic to, or intolerant of, glycopeptides. Emerging data from clinical trials will further define how these new agents will be positioned within formularies.

Each healthcare institution must have in place a mechanism whereby the use of these agents can be strictly controlled and audited (refer to the SEHD paper on antimicrobial prescribing and practice).

APPENDIX VI

SCREENING OF HEALTHCARE WORKERS FOR MRSA AND MANAGEMENT OF CARRIERS

What follows refers specifically to MRSA, and should be read in conjunction with the comprehensive generic guidance on screening contained in the forthcoming Healthcare Associated Infection Task Force document 'Management of Incidents and Outbreaks of Healthcare Associated Infection, Including Guidance on Staff Screening'.

1. Carriage of MRSA by Healthcare Workers

One of the most contentious issues in the healthcare-associated infection is the role of screening of healthcare staff for carriage. There is no doubt however that on occasions healthcare workers can unwittingly pose a real hazard to patients in their care, by being carriers of potentially dangerous micro-organisms, and in these circumstances the nettle of screening must be grasped firmly. The issue of staff screening is one that must be approached with the utmost respect for confidentiality and the welfare of those whose livelihood may be affected by what some would regard as intrusion into privacy.

Healthcare workers may themselves acquire MRSA and this carriage may be transient or longer term[48]. There has usually been understandable reluctance to screen healthcare workers for MRSA, but identification and treatment of colonised staff has been successful in eradicating colonisation and interrupting transmission of epidemic strains [99].

The following considerations apply particularly to MRSA carriage by healthcare workers:

- ◊ in some acute units (e.g. ICUs), carriage rates of MRSA by staff have been reported as very high[100];
- ◊ some persistent dermatological conditions are associated with a higher risk of long-term MRSA carriage;
- ◊ the use of transient or temporary staff (agency nurses, medical locums, students, etc) carries a potential risk of introducing MRSA into acute units, since such staff may have worked in clinical areas with a high burden of MRSA, e.g. care of the elderly, immediately prior to working in acute settings;
- ◊ colonised staff frequently transmit infection within their own household[101,102].

2. MRSA Strategy for Healthcare Workers

1. All prospective healthcare employees who will be involved in direct patient care should undergo pre-employment health assessment. This normally consists of completion of a health questionnaire which is assessed by a suitably qualified occupational health nurse. This assessment should be sufficient to identify risk factors for long-term MRSA carriage, particularly persistent skin conditions.

2. All prospective employees, especially those who have such risk factors, should be reminded of the need for careful attention to normal infection control procedures. If the pre-employment health assessment identifes the presence of skin lesions which could be colonised a consultation should be offered and a swab taken prior to commencement in post to exclude MRSA. The need for such a swab should be based on a clinical assessment. Stable, minor long-term skin conditions may not normally require this in the absence of recent deterioration or clinical signs of infection.

3. Staff working with patients should be under a professional obligation to report persistent dermatological conditions (e.g. eczema, psoriasis) to their occupational health service; this should apply equally to temporary and to permanent staff, and include medical, nursing and paramedical students. Management support is essential, since staff with such dermatological conditions and/or MRSA carriage may require a period off work, or redeployment, pending necessary treatment.

4. Acute clinical units that have patients especially vulnerable to dangerous infections with MRSA should consider very carefully the potential risks of employing temporary staff. Judgement needs to be made whether the risk of importing MRSA is greater than working for periods with sub-optimal staffing levels.

5. Human Resources departments or line managers should be able to keep track of staff deployment, particularly for temporary or bank staff, so that an audit trail of who has worked where, may be performed at any time.

6. Screening of staff whose work involves close physical contact with patients (e.g. nurses, doctors, physiotherapists) for MRSA carriage should be considered by the Infection Control Team when an unexplained persistent increase in the number of patients acquiring of MRSA occurs in an acute clinical unit, and rigorous attention to infection control measures fail to reverse the situation. The unexplained appearance of new or especially pathogenic strains should also prompt early consideration of staff screening. Such screening should only be undertaken after discussion with the occupational health service provider to ensure that confidentiality is maintained and appropriate arrangements for treatment and follow-up are in place.

7. Staff who remain positive for MRSA in spite of all efforts may require indefinite redeployment to lower risk clinical areas. A clear policy needs to be agreed locally by Occupational Health, Infection Control, staff side

representatives and management. The decision for redeployment should only be made after a suitable and sufficient risk assessment is made of the likelihood of further transmission, and not made purely on the basis of evidence of persistent carriage. Evidence of transmission of MRSA from a health care worker to a patient despite enhanced attention to infection control measures would suggest that the risks of further transmission are not controlled. This may require bacteriological confirmation that the same strain of MRSA is present in both the health care worker and a newly-infected patient.

3. Screening as Part of Outbreak Investigation

1. Screening of staff whose work involves close physical contact with patients for MRSA carriage should be considered by the Infection Control Team when an unexplained persistent increase in the level of patient acquisition of MRSA occurs in an acute clinical unit, or when new or especially pathogenic strains appear unexpectedly. Such screening should only be undertaken following consultation with the occupational health service provider to ensure that staff confidentiality is maintained. Appropriate arrangements must be put in place for the confidential handling of swab results, treatment and follow-up of colonised staff.

2. Staff members should be given an explanation of the reasons why a screening programme is considered necessary.

3. The initial consultation should aim to identify any staff with infected skin lesions or extensive skin conditions where shedding of scales is prominent. These staff members should be sent off duty or redeployed to a non-acute unit pending the results of swabbing of the skin lesions.

4. A decision to allow such staff to remain at work in an acute setting should be based on a suitable and sufficient assessment of the risks of further transmission during the period when the results of swabbing are awaited.

5. Screening swabs should be taken *prior* to commencing a spell of duty. They should include the anterior nares and perineum, and any skin lesion such as skin breaks, patches of eczema or psoriasis. The results must be kept confidential and consent to divulge the results to infection control staff must be obtained.

6. Staff with negative swabs may continue working after they have been reminded of the importance of strict adherence to infection control procedures.

7. If any of the swabs are positive for MRSA then the screening should be repeated.

8. No action is required for staff whose swabs are all negative on the second screen.

9. A risk assessment approach is required to determine whether staff members found on the second set of swabs to be nasal carriers only may continue working in acute units without treatment intended to eradicate carriage. The advice of a microbiologist or infectious diseases physician should be sought, with the consent of the staff member, and there should be evidence that the staff member is carrying the outbreak strain.

10. Staff found to be carrying MRSA on the second skin swab should be sent off duty or temporarily relocated to a non-acute unit pending satisfactory clearance. They should be commenced promptly on a topical clearance regimen, if there are no contraindications.

11. Such a regimen typically consists of a 3 – 5 day course of a topical antibiotic preparation to the nose plus an antiseptic washing preparation for the skin and hair. Screening swabs should be repeated 48 hours after finishing the course.

12. Persistence of carriage should be followed by a repeat course of treatment and rescreening.

13. If topical treatments fail, it may sometimes be considered justifiable to offer the persistent staff carrier treatment with systemic antibiotics (e.g. oral fusidic acid plus rifampicin). This must only be undertaken after full consultation with the staff member and his/her general practitioner and an occupational health specialist.

14. It is worth asking staff who are persistent carriers about the possibility of their acquisition of MRSA from sources other than the work environment[103].

15. Staff who remain positive for MRSA on the skin in spite of all efforts may require indefinite redeployment to lower risk clinical areas. This should only be undertaken where a risk assessment identifies a significant continuing risk of transmission to patients. The views of the staff member must be carefully considered and consultation with an occupational health specialist must be offered. Redeployment of staff is to be seen as a last resort, as it may be wasteful of trained staff and cause significant distress to the individual.

16. It may be acceptable, following a risk assessment, to allow a staff member who is a persistent carrier of MRSA to return to work with enhanced adherence of infection control procedures and bacteriological surveillance. Evidence of further transmission would however suggest that the risk of transmission had not been adequately controlled by such measures and should lead to a review of the control measures, including their deployment. Bacteriological evidence linking the strain present in the staff member and in the patient should be sought.

APPENDIX VII

LABORATORY PRACTICE

The Microbiology Laboratory and Control of MRSA

Results of screening need to be available as quickly as possible. With conventional culture methods it is accepted that the more rapid the laboratory methods, the less sensitive, so that some carriers will inevitably be missed on initial screening. However, identifying *most* carriers within two working days is probably more helpful for control purposes than identifying *all* carriers within 72 hours or longer. The Infection Control Team and the laboratory need to agree on a local strategy.

Until such time as genomic techniques are more generally available for the rapid identification of MRSA in specimens, we propose that positive results of the initial screening should be available to the Infection Control Team within two working days from receipt of the specimen, and positive results from a 'full' screen within 72 hours. Meeting these targets may require a revision of working practices in many laboratories, for example the provision of a 24-hour service for the setting up of screening cultures.

1. Screening

Two types of screening are done and they need different methods. *High-throughput, low sensitivity screening* is designed to detect patients with significant carriage of MRSA in a large population such as all patients admitted to a hospital. *High sensitivity screening* would typically be used to assess the effectiveness of attempts to clear carriage in a single patient.

1.1 High-Throughput, Low Sensitivity Screening

A small number of specimens are taken from each patient, selective media are used without enrichment, and it is accepted that low level carriage may be missed. After antibiotic treatment a 'screen-negative' patient may become positive without being newly colonised. This kind of screening can be done quickly and relatively cheaply but only local knowledge can decide when it is useful.

Recommendations

1. Single nasal swabs supplemented by swabs from broken skin, and a specimen of urine if catheterised.

2. Most successful selective media depend on detection of mannitol fermentation, such as ORSAB[104]. Some isolates are mannitol negative (one European Community Acquired MRSA strain and occasional isolates of EMRSA16 and EMRSA15).

1.2 High-Sensitivity Screening

Multiple specimens are taken from the patient and enrichment is used before selective media are used to identify MRSA. When specific strains are being sought, 'short cuts' may sometimes be taken.

Recommendations

1. Nose/throat, axillae, perineum, sputum if produced, urine if catheterised, broken skin.

2. Enrichment including salt (swabs from same patient together). Mannitol fermentation should only be depended on if patient's strain is known to be a fermenter.

2. Identification of MRSA in Specimens Not Specifically Sent For MRSA Detection

This requires *Staphylococcus aureus* to be recognised and reliable sensitivity testing to be done, even when other staphylococci are present or even when the patient has previously been shown to have a meticillin-sensitive strain. Competent bench microbiology is essential and time constraints are potentially dangerous.

Recommendations

1. An isolate should not be dismissed as a coagulase-negative staphylococcus on the basis of a single test – even a slide test and a DNAse will miss a very few isolates.

2. Borderline oxacillin resistance *(MIC less than 0.12mg/l)* is not a reliable indicator of the mecA gene and should be confirmed (PBP2' detection, cefoxitin e-test and *mecA* PCR are possibilities but are not infallible). Rarely mecA positive isolates, even EMRSA15 variants, look fully sensitive to oxacillin on disc testing – particularly on media without added salt. Cefoxitin is a better inducer and not affected by hyper- betalactamase production

3. Detection of Glycopeptide-resistant (GRSA) and Glycopeptide-intermediate (GISA) *Staphylococcus aureus*

These can be missed using standard susceptibility testing methods. Too few glycopeptide-resistant *Staph. aureus* (GRSA) (vanA type) have so far been detected to suggest that they should be sought routinely. Laboratory suspicion of reduced susceptibility may result from routine susceptibility testing (e.g. discs, Vitek), or clinically from failure to eradicate an infection with prolonged glycopeptide treatment. Routine screening should not be undertaken lightly

Recommendations

Isolates suspected of reduced susceptibility can be examined by e-test in a routine laboratory but follow up in a specialist laboratory is appropriate.

4. Typing and Use of Reference Laboratories

Antibiogram and biotyping can provide quick local typing but need to be confirmed by genotypic methods, preferably in a Reference Laboratory. Formal genotyping should only be undertaken if the results are going to be used: investigation of a suspected outbreak, local or national surveillance.

Recommendations

Suspected outbreaks should be investigated by genotyping in a Reference Laboratory

Planned surveillance included genotyping will help the understanding of spread of MRSA and should be undertaken as part of a systematic local or national programme.

5. Additional Sensitivity Testing

This should involve all antibiotics recommended in local formularies for the treatment of MRSA.

APPENDIX VIII

GOOD PRACTICE STATEMENTS

SECTION 3 MANAGEMENT OF PATIENTS AT THE TIME OF ADMISSION

3.3, 3.5 Clinical Risk Assessment

Good Practice Statement	Reasons	Action at local level
1. Risk assessments should be performed at the preassessment session, or if not then, by the staff admitting the patient, if necessary in consultation with a member of the Infection Control Team.	To enable a newly admitted patient to be placed in a risk category as either a *vulnerable* or *possible MRSA carrier* (or both), so that the appropriate infection control measures can be adopted immediately.	A risk assessment proforma should form part of the risk of infection assessment in the patient care planning documentation.
2. Risk assessments should consider both the type of clinical area and patient factors.	Either the clinical setting or individual patient factors may be the principal determinant in assigning a patient to a risk category.	Clinical units should be categorised as *acute* or *non-acute* with respect to the possible dangers of MRSA.
3. The assessment should be documented in the patient care plan/integrated care pathway.	So that there is no ambiguity as to the result of the risk assessment.	Patient care plan/integrated care pathway should be available to all Health Care Workers involved in the patient's care and reviewed regularly.
4. If the risk assessment indicates that a patient should be isolated, but patient factors, or lack of facilities makes this impossible, then the reason for nursing the patient in the open ward should be documented.	So that there is no ambiguity as to the result of the risk assessment and the infection control measures to be adopted.	All those involved in patient care and contact should be aware of this decision.

3.4 Screening for MRSA (Targeted Surveillance)

Good Practice Statement	Reasons	Action at Local Level
1. Surveillance cultures should be taken at the preassessment session, or as soon as possible after admission, from patients admitted to acute clinical units and certain patients admitted to non-acute units, who fall into the 'possible MRSA carrier' category.	To identify every new patient in acute clinical units who is colonised with MRSA, so that appropriate management can be instituted promptly.	Patient care plans/ integrated care pathways should include section on screening. It should be clearly documented in care plan/integrated care pathway that cultures have been taken, including results.
2. Surveillance cultures for MRSA should always include samples from the anterior nares, any areas of skin breakdown, and urine if the patient is catheterised.	These specimens are a good compromise between sensitivity and practicability.	It should be clearly documented in care plan/integrated care pathway that these cultures have been taken, including results.
3. Further swabs should be taken from patients found positive on initial screening - e.g. perineum and throat.	To determine the extent of MRSA colonisation and thus decolonisation strategy.	Patient care plan/integrated care pathway should include section on follow up action on receipt of initial screening results.
4. Periodic (e.g. weekly) surveillance cultures should be taken from *especially vulnerable* patients remaining in the hospital.	To identify the acquisition of MRSA as quickly as possible, and allow appropriate management to be instituted promptly.	The Infection Control Team should agree the protocol on frequency of follow up monitoring of patients, including sites to be screened.
5. Patients in close contact with previously unknown positive patients should be screened for MRSA.	To identify any cross infection and prevent further spread.	The Infection Control Team should advise individual clinical areas.

3.6 Nursing Management

Good Practice Statement	Reasons	Action at Local Level
1. All patients with known or possible MRSA should be isolated if possible.	To prevent the spread of MRSA to other patients.	Isolate or cohort positive patients.
2. In areas where isolation facilities are limited, a risk assessment should be carried out by clinical staff and a member of the Infection Control Team to determine which patients or group of patients should be isolated.	To prevent the spread of MRSA to other patients.	Local risk assessment should be carried out as required.

Good Practice Statement	Reasons	Action at Local Level
3. Transmission based precautions should be implemented for all positive patients irrespective of isolation facilities.	To prevent the spread of MRSA to other patients.	All organisations should have policies in relation to transmission-based precautions/barrier nursing techniques available.
4. MRSA positive patients should be started on a clearance protocol unless contraindicated.	To clear the individual and thus reduce the chance of infection with MRSA and also of spread to other patients.	A clearance policy should be locally agreed.
5. The needs of the individual patient should always be considered in any advice or risk assessment process.	To ensure holistic nursing (gestalt) care.	Risk assessments should always include the needs of the individual.
6. All nursing management should conform to local infection control policies and the Good Practice Statements in the Task Force Code of Practice.	To ensure equity and standard of care.	Local policies should reflect the Good Practice statements in the Task Force Code of Practice. The Infection Control Team should develop clear nursing management guidance.

APPENDIX IV MANAGEMENT OF MRSA CARRIAGE IN PATIENTS

Good Practice Statement	Reasons	Action at Local Level
1. Any patient found to be a carrier of MRSA should be assessed for evidence of infection, e.g. sepsis syndrome, skin and soft tissue infection, wound infection, pneumonia, bone and joint infection, device related infection or endocarditis etc and treated appropriately.	To ensure that early signs and symptoms of infection are detected and appropriate interventions put in place to minimise the risk of invasive infection.	Assessment protocols for patients identified as carriers of MRSA should be in place.
2. Intravascular or other indwelling devices should be removed whenever possible.	To minimise the risk of MRSA infection.	Should form part of local management guidelines.

Good Practice Statement	Reasons	Action at Local Level
3. In the absence of contraindications, initial treatment of carriers should be with a topical preparation to the nose and a skin and hair antiseptic washing preparation for 3-5 days, after which screening should be repeated.	This regimen is often successful in eliminating MRSA carriage, at least in the short term, which will reduce risk to the patient and to others.	Treatment protocol should be developed by Infection Control Team, consultant microbiologist or infectious diseases physician and relevant others. Initiation of treatment and follow up action should be agreed by the Infection Control Team and relevant others and clearly documented in care plan/integrated care pathway/medical record.
4. Persistence of carriage should be followed by a repeat course of topical treatment and rescreening.	A repeat course is sometimes successful when the first has failed.	As above.
5. More than two courses of topical treatment in patients failing decolonisation therapy should not be recommended routinely.	Because of poor response and the risk of emergence of mupirocin resistance.	As above.
6. If topical treatments fail or are contraindicated, a course of systemic antibiotics (e.g. oral fusidic acid plus rifampicin) is sometimes successful.	When the risks of persistent MRSA carriage are considered to be greater than the small risks of systemic antibiotic therapy.	Systemic treatment protocol should be developed by Infection Control Team, consultant microbiologist and relevant others. Initiation of systemic treatment should be based on an individual patient risk assessment and clearly documented in care plan/integrated care pathway/medical records.
7. If the patient is carrying MRSA in the throat, then a course of systemic antibiotics should be considered early on, if it is important to attempt eradication.	Topical treatment is unlikely to be successful in these patients.	As above

APPENDIX V ANTIBIOTIC PRESCRIBING AND MANAGEMENT OF MRSA INFECTION

Good Practice Statement	Reasons	Action at Local Level
1. Antibiotics should only be prescribed when a patient's clinical condition indicates infection	Antibiotic use encourages the proliferation of resistant organisms, including MRSA.	Ensure the provision of guidelines for appropriate antimicrobial prescribing. Education on both the diagnosis of infection and appropriate antimicrobial prescribing should be available for all prescribers.
2. The use of antibiotics associated with MRSA selection should be avoided or minimised as far as possible.	Certain antibiotics (cefalosporins, macrolides and fluoroquinolones) are associated with MRSA selection.	As above
3. Antibiotics may also be prescribed in the context of prophylaxis and decolonisation in special circumstances (see Appendix IV Statement 7).	It is well established that certain patients benefit from prophylaxis targeting specific organisms; also MRSA clearance.	Antimicrobial prophylaxis, and systemic and topical clearance, should be clearly documented in infection control guidelines.
4. Use of glycopeptide antibiotics (vancomycin, teicoplanin) should be carefully monitored.	Glycopeptide resistance has appeared and could threaten the future use of these antibiotics.	Systems should be in place to audit the use of glycopeptides and other new MRSA agents in hospitals (see Statement 11 below).
5. MRSA infection should be considered in the following scenarios: hospitalised patients with previous MRSA infection or colonisation, surgical site infection, skin/soft tissue infection, sepsis syndrome, bone and joint infection, vascular infection, endocarditis and hospital acquired pneumonia.	MRSA is increasingly implicated in such infections in both the hospital and the community. There is a high incidence of subsequent MRSA infection in patients currently or previously colonised or infected with MRSA.	Local guidelines should be developed for the empirical management of sepsis, including suspected MRSA infection.
6. In suspected MRSA infection appropriate samples (most importantly tissue and blood) should be obtained and forwarded to the laboratory before starting treatment whenever practicable.	Microbiological yield is improved substantially if specimens are taken prior to antibiotic therapy.	Ensure the provision of a 24-hour microbiology service for the critically ill, with prioritisation of samples from patients suspected at being of risk from MRSA.

Good Practice Statement	Reasons	Action at Local Level
7. When MRSA is suspected as the cause of an infection a 'best-guess' antibiotic effective against MRSA should be included in empirical management.	Delays in administration of appropriate therapy are associated with worse patient outcome.	Antibiotic guidelines should cover the empirical treatment of MRSA with oral, parenteral and topical drugs. Ensure there is 24-hour advice available from a microbiologist or infectious diseases physician.
8. Intravenous therapy is required in initial management of potentially bacteraemic patients and others with serious MRSA infection Oral therapy may be used usually on the advice of a clinical microbiologist or infectious diseases physician.	Oral therapy has not been evaluated in the initial management of MRSA infection.	The microbiologist or infectious disease physician should be involved in the management of patients with MRSA infection and advise therapy accordingly, including advice on toxicity and monitoring if required.
9. Adequate dosage of glycopeptides and other agents must be used when treating MRSA infections. Therapeutic drug monitoring is mandatory when using vancomycin and should be discussed with a clinical pharmacist. Duration of therapy should be discussed with a clinical microbiologist or infectious diseases physician.	Drug concentration below the therapeutic range is unlikely to eradicate MRSA infection and may promote further resistance. Concentrations above the therapeutic range are associated with toxicity. Short course therapy may be associated with relapse (particularly in bacteraemia and deep seated infection) and unnecessarily long courses are associated with resistance in deep seated infections.	Ensure that guidelines contain advice on dosage and duration. The microbiologist or infectious diseases physician and pharmacist should be involved in the development of such guidelines.
10. Change should be made to a more appropriate agent if necessary, once antimicrobial susceptibilities are known.	It is important to streamline antimicrobial therapy as accurately as possible to ensure good patient outcome and to minimise the ecological impact of antibiotic pressure.	Good pathways of communication are required between the microbiology laboratory and clinical staff.
11. Prescribing of newer anti-MRSA agents should be firmly controlled by reserving for glycopeptide failure, resistance or intolerence.	To minimise the emergence of resistance against these new agents.	Hospital systems should be developed to monitor and control the use of new agents eg through formulary restriction and "alert" antimicrobial policies.

Good Practice Statement	Reasons	Action at Local Level
12. *In-situ* devices (catheters, PEG tubes, etc) should be removed or changed when embarking on antimicrobial therapy for a patient with MRSA.	MRSA are difficult to eradicate with prosthetic devices in place; their retention may also encourage the selection of more resistant strains.	Education for clinical staff is required regarding this issue; the microbiologist or infectious diseases physician has a responsibility to advise on management.
13. Topical therapy for superficial MRSA infections must never be used without advice from the microbiologist or infectious diseases physician.	MRSA quickly become resistant to topical agents, especially if there is a prosthesis *in situ*.	Ensure stringent authorisation of laboratory reports, i.e. suppression of topical agents if not appropriate.

APPENDIX VI: SCREENING OF HEALTHCARE WORKERS FOR MRSA AND MANAGEMENT OF STAFF CARRIERS

MRSA Strategy for Healthcare Workers

Good Practice Statement	Reasons	Action at Local Level
1. All prospective healthcare employees who will be involved in direct patient care should undergo pre-employment health assessment sufficient to identify present or potential MRSA carriage.	To detect staff potentially more liable to become longer-term MRSA carriers.	The Occupational Health Service should be advised in good time so that pre-employment health assessment can be undertaken before such employees commence duty.
2. Prospective employees should be reminded of the need for careful attention to infection control procedures. Those with certain skin lesions should be offered consultation and appropriate swabs taken to exclude MRSA.	All staff working with patients can potentially transmit MRSA. Those with certain skin conditions are especially likely to do so.	Local policy to be agreed.
3. Staff working in contact with patients should be under a professional obligation to report persistent dermatological conditions to their Occupational Health Service; this should apply equally to temporary and to permanent staff, and include medical, nursing and paramedical students.	Staff with persistent skin conditions have a greater chance of becoming longer term MRSA carriers.	Management (and where relevant, academic) support is essential, since staff with persistent skin conditions and/or MRSA carriage may require a period off work, or redeployment, pending necessary treatment.

Good Practice Statement	Reasons	Action at Local Level
4. Acute clinical units that have patients especially vulnerable to dangerous infections with MRSA should consider very carefully the potential risks of employing temporary staff. Judgement needs to be made whether the risk of importing MRSA is greater than working with possibly less than ideal staffing levels.	Temporary staff may have recently worked in clinical units with a high prevalence of MRSA.	A clear policy needs to be agreed locally by Occupational Health, Infection Control, staff side representatives and management.
5. Human Resources departments or line managers should be able to keep track of staff deployment, especially temporary staff, so that an audit trail of who has worked where and when, may be performed at any time.	To facilitate the investigation of outbreaks of MRSA in a clinical unit.	Human Resources departments need to develop a policy, in consultation with Occupational Health and Infection Control.

Screening as Part of Outbreak Investigation

Good Practice Statement	Reasons	Action at Local Level
1. Screening of staff whose work involves close physical contact with patients for MRSA carriage should be considered by the Infection Control Team when an unexplained persistent increase in the level of patient acquisition of MRSA occurs in an acute clinical unit, or when new or especially pathogenic strains appear unexpectedly.	Healthcare workers who are persistent carriers may be responsible for the dissemination of MRSA.	Screening should be coordinated by the Infection Control Team in collaboration with the Occupational Health Service and the microbiology laboratory. Confidentiality must be ensured and suitable arrangements for confidential handling of swab results, treatment and follow-up must be in place before staff screening commences.
2. Staff should be given an explanation of why a screening programme is considered necessary. It should only be undertaken following consultation with the occupational health service provider to ensure that staff confidentiality is maintained. Appropriate arrangements must be put in place for the confidential handling of swab results, treatment and follow-up of colonised staff.	Assurance of confidentiality is of the utmost importance in encouraging and maintaining staff cooperation in the struggle against MRSA.	A clear policy needs to be agreed locally by Occupational Health, Infection Control, staff side representatives and management.
3. Initial consultation should aim to identify any staff with infected skin lesions or active skin conditions with prominent shedding of scales, who should be sent off duty or redeployed to a non-acute unit pending the results of screening.	Staff who are persistent carriers and have an active skin condition may require specialist management before MRSA can be eradicated.	Occupational Health guidance should be developed with relevant bodies for the management of persistent carriers, including fast tracking specialist input. Management should confirm that exclusion of staff for infection control purposes is not deemed sick leave.

Good Practice Statement	Reasons	Action at Local Level
4. A decision to allow such staff to remain at work in an acute setting should be based on a suitable and sufficient assessment of the risks of further transmission during the period when the results of swabbing are awaited.	As above	As above
5. Screening swabs should be taken *prior* to commencing a spell of duty. They should include the anterior nares and perineum, and any skin lesion such as skin breaks, patches of eczema or psoriasis.	Acquisition of MRSA by healthcare staff is sometimes transient and presumably this is less significant than longer term carriage. The sites to be swabbed are those where *Staph.aureus* is particularly likely to be found.	Occupational Health Staff Screening guidance should be developed in consultation with the Infection Control Team. Staff screening and follow up should be clearly documented in the healthcare worker's Occupational Health record.
6. Staff with negative swabs may continue working after they have been reminded of the importance of strict adherence to infection control procedures.	These staff are not likely to be active sources of MRSA.	
7. If any of the swabs are positive for MRSA then the screening should be repeated.	Carriage may be transient.	
8. No action is required for staff whose swabs are all negative on the second screen.	These staff are not likely to be active sources of MRSA.	
9. A risk assessment approach is required to determine whether staff members found on the second set of swabs to be nasal carriers only may continue working in acute units without treatment intended to eradicate carriage.	The risk of dissemination of MRSA from purely nasal carriers is regarded as lower than from those carrying MRSA on the skin. Those carrying a strain of MRSA not associated with patient acquisition are no more hazardous than those without nasal MRSA.	The advice of a microbiologist or infectious diseases physician should be sought, with the consent of the staff member, and there should be evidence that the staff member is carrying the outbreak strain.

Good Practice Statement	Reasons	Action at Local Level
10. Staff found to be carrying MRSA on the second skin swab should be sent off duty or temporarily relocated to a non-acute unit pending satisfactory clearance. They should be commenced promptly on a topical clearance regimen, if there are no contraindications.	These staff may have been responsible for patient acquisition of MRSA by virtue of their longer-term carrier status.	A clear policy needs to be agreed locally by Occupational Health, Infection Control, staff side representatives and management.
11. Such a regimen typically consists of a topical preparation to the nose and a skin and hair antiseptic washing preparation for 3 – 5 days, after which screening swabs should be repeated 48 hours after finishing the course.	This is a generally accepted, often effective regimen.	Topical decontamination protocol should be available in all hospitals.
12. Persistence of carriage should be followed by a repeat course of treatment and rescreening.	Second courses are sometimes successful where one course has failed.	As above.
13. If topical treatments fail, it may sometimes be considered justifiable to offer the persistent staff carrier treatment with systemic antibiotics (e.g. oral fusidic acid plus rifampicin). This must only be undertaken after full consultation with the staff member and his/her general practitioner and an occupational health specialist.	Systemic therapy is sometimes successful. There are however potential adverse reactions, and the ethics of offering potentially toxic drugs must be carefully considered.	A clear policy needs to be agreed locally by Occupational Health, Infection Control, staff side representatives and management.
14. It is worth asking staff who are persistent carriers about the possibility of their acquisition of MRSA from sources other than the work environment.	Household acquisition of MRSA has been reported.	A clear policy needs to be agreed locally by Occupational Health, Infection Control, staff side representatives and management.

Good Practice Statement	Reasons	Action at Local Level
15. Staff who remain positive for MRSA on the skin in spite of all efforts may require indefinite redeployment to lower risk clinical areas. This should only be undertaken where a risk assessment identifies a significant continuing risk of transmission to patients. The views of the staff member must be carefully considered and consultation with an occupational health specialist must be offered. Redeployment of staff is to be seen as a last resort, as it may be wasteful of trained staff and cause significant distress to the individual.	In an acute clinical area with an ongoing problem of MRSA acquisition by patients, a member of staff is found to be a persistent carrier of the outbreak strain, this may be the only way of terminating the outbreak.	A clear policy needs to be agreed locally by Occupational Health, Infection Control, staff side representatives and management.
16. It may be acceptable, following a risk assessment, to allow a staff member who is a persistent carrier of MRSA to return to work with enhanced adherence of infection control procedures and bacteriological surveillance. Evidence of further transmission would however suggest that the risk of transmission had not been adequately controlled by such measures and should lead to a review of the control measures, including their deployment. Bacteriological evidence linking the strain present in the staff member and in the patient should be sought.	In an acute clinical area with an ongoing problem of MRSA acquisition by patients, a member of staff is found to be a persistent carrier of the outbreak strain, this may be the only way of terminating the outbreak.	A clear policy needs to be agreed locally by Occupational Health, Infection Control, staff side representatives and management.

APPENDIX VII LABORATORY PRACTICE

Good Practice Statement	Reasons	Action at Local Level
1. Positive results of initial screening should be available to the Infection Control Team within two working days from receipt of the specimen.	The laboratory uses selective media without enrichment. Low level carriage may be missed.	The laboratory Standard Operating Procedure should define a selective medium based on mannitol fermentation.
2. Positive results from a 'full' screen, i.e. nose, throat, perineum, sputum if produced, urine if catheterised, broken skin, should be available within 72 hours of receipt of specimens.	The laboratory uses an enrichment technique which detects small numbers of MRSA.	The laboratory Standard Operating Procedure should define a sensitive enrichment technique.
3. Isolates of MRSA suspected of reduced susceptibility to glycopeptide antibiotics can be examined in a routine laboratory but follow up in a specialist laboratory is appropriate.	These MRSA are sometimes very difficult to identify accurately.	The laboratory Standard Operating Procedure should define the criteria for sending suspected isolates to the Reference Laboratory.
4. Formal genotyping should only be undertaken if the results are going to be used: investigation of a suspected outbreak, local surveillance or national surveillance.	Antibiogram and biotyping can provide quick local typing but need to be confirmed by genotypic methods, preferably in a Reference Laboratory.	The microbiology laboratory and the Infection Control Team should agree a policy for the typing of MRSA isolates.
5. Suspected outbreaks should be investigated by genotyping in a Reference Laboratory	Planned surveillance included genotyping will help the understanding of spread of MRSA and should be undertaking as part of a systematic local national programme.	The microbiology laboratory and the Infection Control Team should agree a policy for the typing of MRSA isolates.
6. Additional sensitivity testing of MRSA isolates should involve all antibiotics recommended in local formularies for the treatment of MRSA.	So that reports of antibiotic susceptibilities are consistent with local formulary guidance.	The Drug and Therapeutics Committee should prepare a policy for the management of different types of MRSA infections.