The Control and Prevention of MRSA

RCPI Clinical Advisory Group on HCAI & AMR, Subgroup MRSA Guidelines Committee
April 2013
Summary/Overview

Methicillin-resistant *Staphylococcus aureus* (MRSA) is responsible for about 10% of all the healthcare-associated infections. Some of these infections are life-threatening, e.g. bloodstream infection, and many result in considerable patient suffering and morbidity. While there has been a welcome decline in the number of cases of MRSA bloodstream infection in recent years, developments have occurred since the last set of national guidelines were issued in 2005 and an updated set of guidelines is overdue. A multi-disciplinary team has reviewed the last set of guidelines together with other guidelines published abroad in the interim, as well as the scientific literature, and produced a set of recommendations which reflect best practice and are drafted to improve the quality of patient care. The group is grateful to all those who provided constructive and helpful feedback during the review stage. This set of guidelines will be reviewed again in 2016.

Aim of guidelines

To provide guidance on control measures and treatment of MRSA in order to improve patient care, minimise patient morbidity and mortality and to help contain healthcare costs.

Objectives of guidelines

The objectives of these guidelines are –

- to enhance and further improve the prevention and control of MRSA since the publication of previous guidelines in 2005.
- to improve the safety and quality of patient care through reducing further the prevalence of MRSA BSI and to prevent other serious infections such as surgical site, respiratory tract, bone and joint infections caused by MRSA.
- to improve the use of antibiotics specifically for MRSA infections and to contribute to other aspects of antibiotic stewardship.
- to raise awareness of HCAI, amongst the public and all healthcare professionals about the measures required for prevention and control, e.g. standard precautions and the importance of their implementation.

Target population

The guidelines are relevant and have been developed for all healthcare staff involved in the care of patients, residents or clients who may be at risk of or have MRSA in acute hospitals,
nursing homes/long stay residential units, other institutions and general practices. Such members of staff include medical doctors, nurses and nursing aids, biomedical scientists and allied healthcare professionals. The public and patients will find these guidelines of interest as they outline the general and specific measures required to prevent and control MRSA and how these can and should be incorporated into quality measures to safeguard the quality of patient care.

**Key recommendations**

The recommendations are graded and categorised under various headings, e.g. screening, infection prevention and control measures in the acute hospital setting, etc. In addition, there are appendices which compliment the guidelines, e.g. a list of abbreviations, details of the consultation process and a template letter to general practitioners. Amongst the key recommendations of the guidelines are:

- Screening should be targeted, i.e. identifying those patients most at risk of MRSA, rather than universal screening, i.e. screening all patients admitted to hospital. In addition to the anterior nares and perineum, a throat swab is recommended as part of the routine screening set, but there is insufficient evidence to routinely recommend the use of molecular laboratory methods.

- Isolation facilities are important and all newly built acute hospitals should accommodate 100% single rooms. All MRSA cases should be isolated or cohorted with contact precautions and weekly screening thereafter.

- The movement and transfer of patients with MRSA both within and between hospitals should be kept to a minimum.

- In the non-acute setting, routine screening for MRSA is not recommended and decolonisation is rarely required. The emphasis on preventing MRSA in that setting is the application of standard precautions.

- Good communication between the clinical team and the patient, informing him/her of their MRSA status, and communications between hospitals, general practitioners and other healthcare providers are essential in preventing spread.
• Mothers with MRSA, even with mastitis, can usually continue to breast feed a healthy term baby. Neonates in high-risk units should be screened for MRSA, similar to all other high-risk patients.

• Community-acquired MRSA has emerged and should be suspected in patients with persistent skin and soft tissue infections or severe pneumonia, especially associated with haemoptysis.

• MRSA decolonisation is not required in all patients and the excessive use of mupirocin (used to eradicate MRSA from the nose) will result in resistance. Combined topical and oral antimicrobial therapy to eradicate MRSA carriage may sometimes be necessary but should be on the advice of a clinical microbiologist or an infectious disease physician.

• The rational, careful and responsible use of antibiotics, underpins all guidelines to prevent and control antibiotic resistant bacteria, including MRSA.

• While glycopeptides remain the antibiotics of choice for the treatment of serious MRSA infection, there are new alternatives available with some advantages. However, a multi-disciplinary approach that involves the removal of an infected source, e.g. pus or a vascular catheter, together with appropriate investigations, e.g. transoesophageal echo-cardiography, is advised. Expert advice should be sought for complicated infections or where combined or prolonged treatment is required.

• The support and expertise of an occupational health department is essential in the management of healthcare workers colonised or infected with MRSA. In most situations, the colonised MRSA healthcare worker can continue to work and should not be penalised for being MRSA positive. The routine screening of healthcare workers for MRSA is not recommended.

• All healthcare facilities should maintain a record of new cases of MRSA, preferably in an electronic format. All acute hospitals should report rates of new cases of hospital-onset and community-onset MRSA colonisation and infection twice per year to hospital management.

Monitoring of implementation of guidelines
Audits of important components will be promoted and encouraged, with feedback of the results, to highlight successes as well as challenges in their full implementation, e.g. hand hygiene audits.
Contents

Section 1: Introduction

1.1 Background
1.2 Clinical and Financial Impact
1.3 Need for Revised Guidelines

1.4 Aim of Guidelines
1.5 Objectives
1.6 Target Population
1.7 Methodology
1.8 Implementation of guidelines
1.9 Barriers and facilitators to implementation

Section 2: Recommendations and rationale

2.1 Screening
2.2 Infection prevention and control measures in the acute hospital setting
2.3 MRSA in the non-acute healthcare setting
2.4 MRSA in obstetrics and neonates
2.5 Community associated MRSA
2.6 Eradication of MRSA carriage (Decolonisation)
2.7 Role of antibiotic stewardship in the prevention and control of MRSA
2.8 Management of MRSA including treatment and prophylaxis
2.9 Occupational health aspects of MRSA

2.10 Reference laboratory facilities
2.11 Reduced susceptibility to glycopeptides - hGISA, GISA and VRSA

2.12 MRSA surveillance and key performance indicators
Section 3: Appendices

I. Abbreviations
II. Glossary
III. Committee membership & conflicts of interest
IV. Consultation process
V. How to obtain a nasal swab
VI. Template letter to consultant and copied to the general practitioner
VII. Risk stratification tool for isolation and cohorting of MRSA patients
VIII. Infection prevention and control measures advised when caring for residents colonised or infected with MRSA in residential care facilities.
IX. MRSA – Information for schools and day care facilities for children
X. Matrix for work restrictions in colonised healthcare workers
XI. MRSA surveillance definitions
XII. MRSA-related process indicators
XIII. Areas of further research
XIV Ambulance transportation of patients colonized/ infected with MRSA

Section 4: References for each section

Section 1: Introduction

1.1 Background

*Staphylococcus aureus* (*S. aureus*) is a Gram-positive organism that commonly colonises the skin and nose. In the majority of cases this organism acts as a harmless commensal. However, in the right setting it can cause severe and at times fatal infections such as bloodstream infection (BSI), infective endocarditis, pneumonia, skin and soft tissue infections (SSTI) and bone and joint infection. *S. aureus* is one of the commonest causes of BSI, which may be fatal, and in many hospitals and in scientific studies it is only superseded in frequency by *Escherichia coli*. A full set of abbreviations and a glossary are provided in appendices I and II.
β-lactam antibiotics, such as flucloxacillin are the antibiotics of choice in treating staphylococcal infection. Methicillin is an example of a β-lactam antibiotic first used in the treatment of *S. aureus* infections in the 1950s and 1960s. In 1961 the first strain of methicillin-resistant *Staphylococcus aureus* (MRSA) was identified (1). This organism was also found to be resistant to all other β-lactam antibiotics. Although methicillin is no longer in clinical use all β-lactam resistant *S. aureus* isolates are referred to as MRSA. MRSA has been prevalent in Irish hospitals for over thirty years with significant accompanying mortality, e.g. from BSI, morbidity and additional health care costs, e.g. post-operative SSI. Much work was carried out in this country on MRSA in the 1970s and ‘80s which has enhanced our understanding of the virulence features, clinical effects and epidemiology of this pathogen (2-5). Much of this work continues to this day (6-10).

The prevention and control of MRSA is a global challenge and is important generally in the control of healthcare associated infection (HCAI). Whether it is possible to fully eradicate MRSA in hospitals, where it is endemic, is debatable. However, it is possible to control the spread of MRSA, minimize rates of superficial and deep infections and to contain healthcare costs. MRSA BSI rates have been shown to correlate with the hospital–wide prevalence of MRSA, and efforts to reduce the number of patients colonised with MRSA will also reduce BSI rates (11). MRSA control measures have additional merits to those of merely addressing MRSA as they increase the awareness of the importance of all HCAI and their implementation decreases the rates of other HCAIs (12).

Control of MRSA is a multidisciplinary task, involving surveillance, patient screening, decolonisation, isolation and cohorting of patients, environmental cleaning, antimicrobial stewardship, maintaining adequate staffing levels and hand hygiene. The prevention and control of MRSA is the responsibility of all those who work in the healthcare sector and not just those professionally involved in infection prevention and control.

### 1.2 Clinical and financial impact

Assessing the impact in terms of the true numbers of cases of MRSA, the morbidity and associated mortality, and the cost of MRSA infections is difficult in the absence of
comprehensive national surveillance. Currently, the main focus of MRSA surveillance is on BSI but this excludes other infections such as SSTI, bone and joint infections and pneumonia. One of the most comprehensive studies of the prevalence of MRSA ever done was the North/South Study of MRSA in Ireland conducted in 1999, when 508 cases, (colonisation and infection) of MRSA were identified in the South of Ireland, representing a prevalence rate per 100,000 population of 14.0 (13-17). In a survey of HCAI in the UK and Ireland in 2006, the prevalence in the Republic of Ireland (ROI) was 4.9% and of these 0.49% i.e. approximately 10% of all HCAI, were due to MRSA (18). In a more recent survey carried out in 2012 in Ireland and in other European countries, the prevalence of HCAI in RoI was 5.2%, varying from 16.5% in critical care units to 1.1% in obstetrical and gynaecology units. *S. aures* accounted for 15% of the causative microbes of which 37% were MRSA (19).

A varying proportion of cases die from MRSA BSI. This can be 30% or higher in debilitated patients such as those with one or more significant underlying chronic diseases, e.g. diabetes mellitus, and in patients requiring organ support in critical care units. Patients with other non-fatal infections are often left with lifelong suffering such as bone pain arising from chronic osteomyelitis and other infections such as SSTI that result in additional hospital stay and a delayed return to work and to other activities. Therefore the true clinical, financial and psychological impact of MRSA is not known.

Regarding the healthcare costs of MRSA, the Health Service Executive (HSE) has calculated that over 25,000 patients may acquire a HCAI annually at a cost of €118 million (Table 1.1). If 10% of all HCAI are due to MRSA this represents a figure of €23 million per annum spent on MRSA alone. If one third of HCAI in Ireland could be prevented then approximately €7.6 million per year would be saved from those due to MRSA. Similarly, an expert group in 2010 reviewed the above and other data and calculated that the costs in Ireland of MRSA in the hospital setting alone were also €23 million annually and that a pro rata figure of the impact at national level resulting in costs to careers and to the general economy for Ireland could be calculated from those estimated to apply to the UK, which are £3-8 billion annually (20).
Table 1.1 Estimation of the costs of HCAI in Ireland for 2011 extrapolated from national and international sources

<table>
<thead>
<tr>
<th>2011</th>
<th>Hospital admissions</th>
<th>Patients with HCAI</th>
<th>Extra hospital days</th>
<th>Estimated cost for all HCAIs</th>
<th>Deaths expected if 3.68% or 13% mortality rate</th>
<th>If 10% of HCAI were prevented there would have been a cost saving of:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>587,753</td>
<td>29,388</td>
<td>117,552 or 411,432</td>
<td>€118,257,312</td>
<td>1,081 or 3,820</td>
<td>€11,825,731</td>
</tr>
<tr>
<td>West</td>
<td>147,547</td>
<td>7,377</td>
<td>29,508 or 103,278</td>
<td>€29,685,048</td>
<td>271 or 959</td>
<td>€2,968,505</td>
</tr>
<tr>
<td>South</td>
<td>150,345</td>
<td>7,517</td>
<td>30,068 or 105,238</td>
<td>€30,248,408</td>
<td>277 or 977</td>
<td>€3,024,841</td>
</tr>
<tr>
<td>Dublin Mid-Leinster</td>
<td>173,285</td>
<td>8,664</td>
<td>34,656 or 121,296</td>
<td>€34,863,936</td>
<td>319 or 1,126</td>
<td>€3,486,394</td>
</tr>
<tr>
<td>Dublin North-East</td>
<td>116,576</td>
<td>5,829</td>
<td>23,316 or 81,606</td>
<td>€23,455,896</td>
<td>215 or 757</td>
<td>€2,345,590</td>
</tr>
</tbody>
</table>

2. European Centre for Disease Prevention & Control, Annual Epidemiological Report 2008, reference 21
*for comparison purposes 552 deaths due to suicide; 238 due to road traffic accidents; 59 due to murder/manslaughter. Data from the 2009 Garda Síochána Annual Report, reference 23.

Data from the European Centre for Disease Prevention & Control (ECDC), Annual Epidemiological Report 2008 have been used to calculate length of stay and the number of deaths (21). Although the Plowman report was published 13 years ago (22) it is very comprehensive and is based on the UK health system which is similar in many respects to the Irish health system. The ECDC report is based on all of Europe. The cost estimate includes longer term and wider societal costs (e.g. ongoing healthcare needs, disability costs, litigation, loss of productivity etc.). The Plowman report (22) also calculated that patients in the UK, who acquire an infection in hospital, when compared with uninfected patients, were estimated to take an additional 8.7 million days to resume normal daily activities. Savings have been calculated based on a preventable reduction in HCAIs of 10% but this may be an underestimate as most device-related infections, e.g. catheter-related BSI and catheter-associated urinary tract infection including those caused by MRSA, are very preventable, and for these, the potential preventable proportion may be 50-70%.

1.3 Need for revised guidelines
Since the publication of the last set of guidelines in 2005, there have been a number of changes necessitating a review on what was recommended then. For example, over the past four years the number of invasive infections caused by MRSA has decreased: the 2011 annual report from the National MRSA Reference Laboratory reported 225 cases of BSI due to MRSA, compared with 280, 325, 407 and 467 in 2010, 2009, 2008 and 2007, respectively (24). This decrease in the number of MRSA BSI most likely represents a decrease in the total number of cases of MRSA. The reason for this decline is unclear but it does follow international trends. For example, in the UK the rate of MRSA BSI between 2003 and 2008 halved (25). In addition, increasing rates of resistance, not only to glycopeptides, (e.g. vancomycin) but to older antimicrobials such as fusidic acid and rifampicin are a concern. The prevalence of community acquired MRSA (CA-MRSA) is increasing in some countries, e.g. the emergence of livestock-associated MRSA (ST398-MRSA-V) among farmers in some European countries has highlighted the versatility of this pathogen (26, 27).

However, there is some progress in the battle against MRSA. A number of drugs have been introduced in recent years for the treatment of MRSA infections such as daptomycin and tigecycline and more recently ceftaroline. The previous set of guidelines did not include recommendations on the treatment of infection or the use of antibiotic prophylaxis in MRSA patients undergoing surgery, which are both important components in the management of MRSA. Finally, the governance relating to the prevention and control of HCAI has changed with the establishment of the Health Information and Quality Authority (HIQA). This has resulted in the production of important documents that are changing the healthcare landscape, including national standards for safer better healthcare and infection prevention and control. In the case of the latter, i.e. relating specifically to HCAI, this has been followed up by institutional audits of local governance arrangements and practice.

1.4 Aim of guidelines
To provide guidance on control measures for MRSA to improve patient care, minimise patient morbidity and mortality and to help contain healthcare costs.

1.5 Objectives
The objectives of these guidelines are –
to enhance and further improve the prevention and control of MRSA since the publication of previous guidelines in 2005.

to improve the safety and quality of patient care through reducing further the prevalence of MRSA BSI and to prevent other serious infections such as SSTI, respiratory tract, bone and joint infections caused by MRSA.

to improve the use of antibiotics specifically for MRSA infections and to contribute to other aspects of antibiotic stewardship.

to raise awareness of HCAI, amongst the public and all healthcare professionals about the measures required for prevention and control, e.g. standard precautions and the importance of their implementation.

Table 1.2 gives an overview of what these guidelines want to achieve in terms of MRSA prevention and control and in terms of quality and patient/resident safety issues.

Table 1.2. Elements of a programme to prevent and control MRSA to ensure that patient and resident care is reliable, safe and of high quality

<table>
<thead>
<tr>
<th>Quality</th>
<th>Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient/resident-centred care</td>
<td>Prevention and control of MRSA is a key priority for all healthcare providers</td>
</tr>
<tr>
<td></td>
<td>Patient/resident information on MRSA prevention and control</td>
</tr>
<tr>
<td></td>
<td>Governance and reporting systems to provide assurance</td>
</tr>
<tr>
<td></td>
<td>Implementation of National standards in Infection Prevention and Control(IPC)</td>
</tr>
<tr>
<td>Effective care</td>
<td>Systems and controls in place to</td>
</tr>
<tr>
<td></td>
<td>- Monitor compliance with National IPC standards &amp; other national standards relevant to this area</td>
</tr>
<tr>
<td></td>
<td>- Analyse and learn from MRSA incidents when they occur with dissemination of learning and institution of controls to prevent recurrence</td>
</tr>
<tr>
<td>Safe care</td>
<td>Implementation of national MRSA, antimicrobial stewardship and hand hygiene guidelines</td>
</tr>
<tr>
<td></td>
<td>Audits and assessment of guideline compliance</td>
</tr>
<tr>
<td>Better health and well being</td>
<td>Healthcare provider education about the prevention of HCAI and MRSA</td>
</tr>
<tr>
<td></td>
<td>Patient/resident education about the prevention of MRSA</td>
</tr>
</tbody>
</table>

**Ensure that the healthcare system is designed to do the above**

<table>
<thead>
<tr>
<th>Governance, leadership &amp; management</th>
<th>Accountability and responsibility for MRSA clearly defined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Performance monitoring is undertaken and regularly reviewed</td>
</tr>
<tr>
<td></td>
<td>Cluster/outbreak management</td>
</tr>
<tr>
<td></td>
<td>Communication regarding MRSA with other healthcare providers, patients, residents and the public</td>
</tr>
<tr>
<td></td>
<td>Microbiological services to support MRSA prevention are appropriate</td>
</tr>
<tr>
<td></td>
<td>HCAI surveillance is a key component of the system</td>
</tr>
<tr>
<td></td>
<td>Antimicrobial stewardship is a key component of safe and effective care</td>
</tr>
</tbody>
</table>

| Workforce                         | Skills & competencies are defined                                                                         |
|                                    | Education and training                                                                                    |
**Use of resources**

Strategies to prevent MRSA are cost effective

Strategies to promote appropriate antimicrobial use are cost effective

HCAI Education

**Use of information**

MRSA surveillance, in conjunction with other relevant indicators, e.g. hand hygiene compliance is fed back, reviewed and monitored.

The guidelines that follow do not address issues relating to antibiotic resistance, including MRSA in the agri-farming sector, the challenges in developing new drugs for the treatment of invasive MRSA infection and finally these guidelines do not address any of the potential implications of laboratory modernisation which will include rationalization and the centralization of some services, including the laboratory diagnosis of and screening for MRSA.

### 1.6 Target population

The guidelines are relevant and have been developed for all healthcare staff involved in the care of patients, residents or clients who may be at risk of or have MRSA in acute hospitals, nursing homes/long stay residential units, other institutions and general practices. Such members of staff include medical doctors, nurses and nursing aids, biomedical scientists and allied healthcare professionals. This new set of guidelines also acknowledges changes in the epidemiology, i.e. the emergence of CA-MRSA. The public and patients will find these guidelines of interest as they outline the general and specific measures required to prevent and control MRSA and how these can and should be incorporated into quality measures to safeguard the quality of patient care.

### 1.7 Methodology

#### 1.7.1 Working Group

The working group that drafted the guidelines was multi-disciplinary (appendix III) and included a range of experience and expertise. It met on a number of occasions over three years, with teleconferencing facilities being available to assist those contributing from outside Dublin. However, much of the work was carried out by email with the exchange of draft documents, comments and opinions on issues as they arose. Efforts were made to ensure that all the relevant professional groups were represented and that the background of those involved included the acute hospital and community care settings.
Membership of the working group was voluntary, no member was paid a fee for his/her contribution, and the input of working group members was usually done out-of-hours, e.g. during evenings/weekends and at their own expense, e.g. using their own personal computer. The work was not funded by any public or private agency but did receive clerical and administrative support from the Health Protection Surveillance Centre (HPSC), the Royal College of Physicians of Ireland (RCPI) and the Royal College of Surgeons in Ireland. The working group members’ names and any potential conflicts of interest are outlined at the end of this document in appendix III.

When reviewing the evidence and coming to decisions on what should be recommended, this was done through a process that initially reviewed the literature (see below) and the previous 2005 guidelines. The preparation of a draft was carried out after achieving consensus amongst the working group members. All the recommendations, and for those areas where no recommendations were made, were agreed to by all members of the working group. Potential conflicts of interest, as outlined in appendix III, did not impact on agreeing what was or was not appropriate to recommend.

The draft guidelines were actively distributed and made available for a wide consultation exercise which involved the active soliciting of feedback from a variety of groups (i.e. Colleges, professional societies, etc) and from patients (appendix IV) and was designed to be comprehensive to ensure that any gaps in representation on the working group were compensated for. This consultation exercise included health service managers and all ensuing feedback was considered and if deemed appropriate incorporated into the final draft document.

1.7.2 Literature review

The methodology and approach to developing these guidelines included reviewing the scientific evidence in the form of published scientific papers, concentrating on the literature since the last set of guidelines was published in 2005. Due to restrictions in time and expertise a meta-analysis was not possible. Computerised literature searches of PubMed were performed. Human studies in the English language literature were searched from 1st January 2005 to 30th December 2011 and a subsequent search was performed for
the calendar year 2012 after the initial National Clinical Effectiveness Committee (NCEC) review to ensure that all relevant literature was captured before the final version was agreed in early 2013. Individual terms and combinations, such as MRSA, *Staphylococcus aureus*, antibiotic resistance, multidrug resistance bacteria, screening, infection prevention and control, occupational MRSA in healthcare workers, MRSA and pregnancy, decolonization, treatment, mupirocin, vancomycin, linezolid, daptomycin antibiotic stewardship, healthcare-acquired, community-acquired, hygiene and decontamination, were used. Each reference cited as supporting the guidelines has been categorized, e.g. outbreak report, guideline document, etc.

The working group also reviewed the last set of national guidelines which arose from the Strategy for the Control of Antimicrobial Resistance in Ireland (SARI), Infection Control Subcommittee, in 2005 (28). A number of other international guidelines have been produced since then, which were reviewed and these include guidelines by the Infectious Diseases Society of America (IDSA) on the treatment of adults and children with infections caused by MRSA (2011) and guidelines produced in the UK by the Healthcare Infection Society, British Society for Antimicrobial Chemotherapy (BSAC) and the Infection Control Nurses Association (now the Infection Prevention Society) on the control and prevention of MRSA in healthcare facilities (2006) and on the prophylaxis and treatment of MRSA infections (2009) (29-31).

A new development since 2005 has been the publication of guidelines on the management of community acquired MRSA which recently appeared in Australia, America, Canada and the UK, and guidelines have also been developed for the management of Panton-Valentine Leucocidin (PVL) toxin positive MRSA infections (32-37). The groups that have published these guidelines have made their recommendations, largely on the basis of expert opinion and observation, rather than on the basis of randomized controlled trials (RCTs), which are relatively rare in this area.

It should be noted that the scientific literature on healthcare infection prevention and control including on MRSA is largely based upon descriptions of outbreaks, observational
and in vitro studies and retrospective analyses rather than on RCTs. Furthermore, few studies, reviews or other guidelines provide much evidence or data on the economic aspects of the various recommended measures or interventions. Hence, the data already outlined is extrapolated from available documents and studies but not from studies primarily designed to assess the economic impact of MRSA.

A review of various different international guidelines for the prevention and control of MRSA published in 2007 found that similar measures were recommended in all the guidelines, even if the aim of the individual set of guidelines differed depending on the country’s ability to fully implement them and on the local prevalence of MRSA (38). Countries in which MRSA rates are low, e.g. the Netherlands, aim to keep their healthcare institutions free of MRSA while countries where MRSA is endemic, e.g. the UK, aim to minimize its spread. Consequently, there is still research required on key components of MRSA prevention and control in Ireland and in other countries where MRSA is endemic, e.g. should screening be targeted or universal and clinical trials of alternatives to mupirocin for nasal decolonisation.

Therefore the guidelines that follow expand on and update the Irish guidelines published in 2005 where relevant, and incorporate other international guidelines such as those listed above, relevant published literature and the consensus expert opinion of the working group itself. In addition, the comprehensive consultation exercise (appendix IV) that included a wide range of professional groups (e.g. Academy of Medical Laboratory Science), healthcare agencies (e.g. the Health Service Executive), patient groups (e.g. (Irish Patients Association) and experts from abroad has improved the final draft.

1.7.3 Grading of recommendations

The recommendations are followed by a grade which indicates the strength of the evidencesupporting the recommendation as in the previous guidelines (27). There are a number of grading systems used in the literature but that below was felt to best meet the needs of the guidelines and the working group, given the absence of RCTs in many of the areas covered, and the inability of the working group to conduct a systematic literature review, due to time and resource limitations. Therefore the grades used
throughout the guideline document are as follows;

- **Grade A** - Evidence from a meta-analysis of RCT or from at least one RCT.
- **Grade B** - Evidence based on one controlled trial without randomisation, a quasi-experimental study, or extrapolated from RCT.
- **Grade C** - Evidence from comparative studies, correlation studies, case control studies or extrapolated from category A or B.
- **Grade D** - Evidence from expert committees, reports or opinions, the clinical experience of respected authorities, and the conclusions of the working group.
- **No recommendation**

1.7.4 **Review date**

The last set of guidelines were published in 2005, a seven year interval between this current set of guidelines. This interval was longer than is desirable but changes in the health service, uncertainty about the status of guidelines and the heavy commitments of those with expertise in the area, all probably contributed to this delay. This current set of guidelines will be reviewed in 2016 and this will be overseen by the RCPI Clinical Advisory Group on the Prevention of Healthcare-Associated Infection and Antimicrobial Resistance. This will be done in accordance with the specifications set out by the NCEC regarding clinical guideline development.

1.8 **Implementation of guidelines**

The guidelines will be circulated and disseminated through the professional networks that assisted in the drafting and in the review of an earlier version of this document. The document will also be upload on to relevant websites, e.g. HPSC. This will help ensure professional buy-in from healthcare professionals, including from the experts in the field, e.g. infection prevention and control nurses. Educational sessions will take place at local and at national level to update all healthcare professionals on the implications of these revised guidelines, especially the changes from those issued in 2005. Short summaries of the key recommendations will be prepared for specific groups, e.g. general practitioners, nursing home staff and critical care units to highlight those aspects that are especially important in their particular setting. Audits of important components will be promoted
and encouraged, with feedback of the results, to highlight successes as well as challenges in their full implementation. The guidelines will be circulated to patient groups, including those that participated in the consultation exercise, and they will also be made available on public websites. Issues that arise from the perspective of patients or healthcare professionals can be communicated to the RCPI – Advice and Guidance for Healthcare Workers (joannaholly@rcpi.ie).

1.9 Barriers and facilitators to implementation

There are some obstacles that will impact on the full implementation of these guidelines. Most measures are cost neutral as they represent a re-iteration of previous guidelines with some minor additional measures, e.g. throat samples as part of a set of MRSA screening samples. While many of the measures recommended are generic, e.g. hand hygiene, and will also contribute to the prevention of other HCAIs such as norovirus infection, some are specific and have some resource implications.

Many acute hospitals have insufficient isolation rooms, access to microbiology laboratories and antimicrobial pharmacists are limited in some areas and expertise in HCAI prevention and control is not readily available to all healthcare professionals at all times, especially in the non-acute sector. Also, many healthcare professionals still do not see themselves as having a key role in infection prevention and control, believing that this is an issue that should be addressed by experts in the field and by the health authorities. Consequently, while there has been some progress in recent years, e.g. the fall in MRSA BSI, a culture change is required to ensure that every healthcare professional understands his/her responsibility and ensures that his or her practice is optimal in not contributing to HCAI, including MRSA. Then all preventable HCAI would be reduced to a minimum.

The implementation of the guidelines can be facilitated by ensuring that all healthcare professionals understand and appreciate that the guidelines contribute to the quality and safety of patient care. A preventable case of intravascular catheter MRSA BSI reflects poor practice and is a professional failure. The increasing awareness of patients themselves on the importance of infection prevention has helped drive improvements in
practice and their demands for the highest standards of healthcare has a positive impact on guideline implementation.

Those professionals involved in the drafting of this document will promote their implementation locally and nationally and they will engage with opinion leaders to facilitate that. In some situations it will not be possible to implement the guidelines in part but by highlighting the associated barriers, this will facilitate the implementation of the changes necessary to ensure full implementation. Anticipated barriers to the implementation of particular recommendations are discussed in the relevant sections.

1.10 Key audit criteria

To ensure that these guidelines positively impact on patient care, it is important that they are audited. The following are examples of suitable audit criteria and the associated questions that might be addressed.

- the screening of at-risk groups; *what proportion of patients with risk factors for MRSA are screened?*
- isolation of known positives or high-risk groups of patients for MRSA; *what proportion of known or suspected MRSA patients are isolated or cohorted?*
- hand hygiene compliance; *what is the level or % of compliance locally or institution-wide?*
- general environmental hygiene; *is dirt/dust visible in clinical areas?*
- decolonisation and follow-up screening of those MRSA patients where decolonisation is indicated; *what proportion of confirmed MRSA colonized patients are decolonized and followed up to ensure eradication?*
- communication of MRSA status to patients, general practitioners and other healthcare professionals, e.g. on patient transfer; *is there written documentation of patients being informed of their MRSA positive status?*
- appropriate use of personnel protective equipment (PPE); *is appropriate PPE, i.e. gloves and apron used when caring for patients with MRSA?*
• optimal empiric antibiotics for patients with suspected MRSA infection; what proportion of known MRSA positive patients are covered with vancomycin or equivalent when they develop a suspected systemic infection?
• incorporation of an antibiotic with activity against MRSA for routine surgical prophylaxis in those patients known to be MRSA positive or at-risk of MRSA; are at-risk patients screened pre-operatively and does the prophylactic antibiotic regimen reflect the results of screening?

Section 2: Recommendations and rationale

2.1 Screening

Effective strategies for the prevention and control of MRSA rely on early detection so that appropriate measures may be implemented. Screening, linked to patient isolation and the use of Contact Precautions (CP). These are precautions intended to prevent transmission of infectious agents i.e. MRSA, which are spread by direct or indirect contact with a patient or the patients environment and have been shown to be effective in reducing the transmission of MRSA (1-4). Successfully detecting MRSA carriage is influenced by many factors including the laboratory methods used, the number of times the patient is screened, the types of samples obtained, and when they are obtained. It is generally accepted that instituting CP is appropriate for those patients known to be colonised with MRSA in the acute setting (5) although there is conflicting evidence on this particular topic (6) What follows in this section largely relates to the acute healthcare setting. However, screening may be a component of the prevention and control of CA- MRSA as outlined in section 2.5.

2.1.1 Who to screen and when

Recommendations

• Continue with targeted MRSA screening (i.e. patients at risk of acquiring MRSA), and not universal screening (i.e. all patients on admission to acute hospitals), pending further data on its efficacy and feasibility.

Grade D
• The taking of screening samples to determine MRSA status should not adversely affect the individual patient’s access to clinical care, e.g. urgent surgery should be carried out with appropriate precautions and surgical prophylaxis, and not be delayed by the taking of specimens or by waiting for results.

  Grade D

• Patients who should be screened on admission for MRSA because they are at risk of having acquired MRSA (i.e. targeted screening) include the following:

  1. Patients known to be previously positive and who are being re-admitted to an acute hospital.

  Grade C

  2. Patients admitted directly from another hospital or health-care facility, e.g. nursing home

  Grade C

  3. Patients who have been an in-patient in another healthcare facility, i.e. in acute hospital or long term care facility, in the last six months.

  Grade C

  4. Patients transferred from a hospital abroad or patients who have been an in-patient in a hospital abroad during the previous 12 months.

  Grade C

  5. Patients with non-intact skin, including wounds and ulcers and also exfoliative skin conditions, percutaneous endoscopic gastrostomy tubes, urinary catheters and central venous catheters.

  Grade C

  6. Patients due to undergo elective high and medium risk surgery (e.g. cardiothoracic and vascular surgery, orthopaedic implant surgery). In addition, hospitals should assess which patient groups undergoing surgery have a relatively high risk of MRSA infection and consider pre-operative screening for those particular patient sub-sets. For example, it may be appropriate for hospitals to screen emergency orthopaedic
admissions as many of these patients are elderly and have frequent contact with the healthcare system. **Grade C**

7. Patients admitted to critical care areas, e.g. intensive care unit (ICU) and special care baby unit (SCBU) with at least weekly screening thereafter. **Grade D**

8. Patients requiring renal dialysis. **Grade C**

9. Any healthcare worker involved in direct patient contact, being admitted to an acute healthcare facility. **Grade D**

**Patients who require screening for MRSA subsequent to hospital admission include:**

1. During an outbreak or cluster **Grade D**

2. Other patients, as determined by local risk assessment. **Grade D**

3. Patients transferred to critical care areas e.g. ICU and SCBU with at least weekly screening thereafter. **Grade D**

4. Patients requiring renal dialysis require quarterly screening **Grade C**

5. Patients who have been successfully decolonised, i.e. three negative follow-up samples at least 48 hours apart, should continue to be screened at weekly intervals while in an acute hospital setting. **Grade C**

**Rationale**

The NHS Scotland MRSA Screening Pathfinder Programme identified the following patients requiring screening for MRSA (7):

- Patients who are not admitted to hospital from their own home
- Patients with a previous history of MRSA
• Patients with any prosthetic device (e.g. urinary or vascular catheter) *in situ* or who have broken skin (e.g. ulcers)

Currently, there is an on-going discussion between the advantages and disadvantages of targeted *versus* universal screening, and our conclusions based on the evidence currently available are as follows (8).

A. **Targeted screening** – i.e. screen patients with risk factors (see above) for MRSA carriage that are likely to be positive.

Previous Irish and UK guidelines have advocated this approach.

The justification for targeted screening is that up to 75% of patients with MRSA will remain unrecognised if clinical cultures alone, e.g. swabs to confirm the diagnosis of surgical (wound) site infection, are used to detect them (8-10).

B. **Universal screening** – i.e. screening all patients on admission to hospital.

This approach has been recommended in the UK i.e. Scottish Health Technology Assessment and by the NHS in England and Wales (8,9). The latter states that “*From April 2009, all elective admissions must be screened for MRSA in line with Department of Health guidance. This should be extended to cover emergency admissions as soon as possible and definitely no later than 2011*”. The NHS Scotland MRSA Screening Pathfinder Programme reported on the results of a one year programme for universal screening in NHS Scotland (7). They found that 3.9% of patient admissions were colonised with MRSA. Short length of stay prevented patients from completing decolonisation regimens and in only one of 33 patients who were MRSA positive on admission was decolonisation completed. Only half of the patients found to be MRSA positive on admission could be isolated. This was due to a combination of factors including short length of stay and a lack of isolation rooms. The report suggested that clinical risk assessment may be a cost-effective first stage screening process for specialties with large numbers of patients, such as medicine and general surgery. A report on the sensitivity and specificity of this screening method is expected in the near future. In a recent study of targeted versus universal screening in 892 patients in a large Irish hospital, 8% of at risk patients were MRSA positive on screening compared to 1% of non-risk patients, i.e. an additional four patients were detected in that cohort that would not normally be screened (11). This was also associated with significant additional costs, i.e. approximately 33%
increase in cost. A review of screening for MRSA in Newcastle-Upon-Tyne, England, where universal screening is now routine found that the additional laboratory costs to detect those patients not detected by targeted screening were £20,000 and the authors concluded that screening based upon clinical risk was more pragmatic and cost-effective (12).

Ideally at-risk patients for MRSA should be screened before admission if possible, such as when the admission is elective (i.e. at outpatients) and no more than three months before admission, or at the very least, on admission if emergency or urgent admission. However, every effort should be made to ensure that the process of screening before admission per se does not adversely impact on patient care such as resulting in delays in the emergency department (10). Periodic e.g. weekly surveillance cultures, should continue to be taken from patients remaining in high-risk areas of the hospital, e.g. ICUs, SCBUs, orthopaedic units, solid organ or bone marrow transplant, especially where MRSA is epidemic or where it has been endemic in the past, or in wards with long-stay patients, wards receiving transfers from high risk areas or wards where patients have devices. This will assist in minimising transmission from patients who although negative on admission, have subsequently acquired MRSA while an in-patient.

Patients, with MRSA, who have had three consecutive negative sets of screening samples, at least 48 hours apart after decolonisation regimens, can be removed from isolation. However, such patients should continue to be screened while in hospital to allow for re-acquisition of MRSA but currently there are no clear indications as to how often this should be and currently this is best decided locally according to risk assessment and laboratory resources. It is difficult to decolonise patients, with MRSA, who have wounds or large areas of non-intact skin (e.g. decubitus ulcers) or devices (e.g. urinary catheters) and may require isolation until the wound is healed. When re-admitted to hospital in the future, these patients should be placed in isolation pending the results of screening samples.

All screening is dependent upon adequate laboratory infrastructure and for some units, there is not ready access to laboratories or the available laboratory is not resourced to carry out current recommendations.

**Screening samples**
Recommendations

- Swabs from the anterior nares, perineum or groin, throat, catheter specimen of urine (CSU), sputum if productive cough and any skin lesions (e.g. surgical site, PEG tube site) should be obtained.  
  Grade C

- Additional samples to diagnose infection (e.g. blood, vascular catheter tip) should be taken as clinically indicated.  
  Grade D

Rationale

The anterior nares is the most important site to sample but omitting sampling of the throat and perineum will miss a proportion of patients who are colonised with MRSA (13-18). While some authors suggest that the addition of throat swabs does not increase sensitivity significantly, we consider it appropriate to include screening the throat, notwithstanding the additional expense, to maximise the detection of MRSA in screened patients (14,18,19,20-23). This becomes especially important if there is a decline overall in the number of patients detected with MRSA when detecting additional cases to drive down the numbers further becomes relevant.

(See Appendix V for details on how to obtain a nasal swab)

2.1.2. Laboratory methods

Recommendations

- Laboratories should continue with culture-based methods for the detection of MRSA.  
  Grade D

- Ideally, broth-enrichment should be used but this results in an additional delay in the issuing of results and the decision needs to be assessed locally.  
  Grade B
• The advent of rapid diagnostic testing for MRSA with the polymerase chain reaction (PCR) is a welcome development and it may be appropriate for individual laboratories/hospitals to introduce rapid diagnostic testing for certain patient groups, e.g. emergency surgical or ICU admissions and to evaluate its impact.

Grade D

Rationale

The screening methods currently most commonly used are:

A. **Broth enrichment culture followed by agar subculture**

Broth enrichment is followed by sub-culture to chromogenic media and is probably the current ‘gold’ standard as it is the most sensitive method. The disadvantage is the time delay (up to 48 hours) to a positive result.

B. **Chromogenic agar plating, direct culture**

This method is less sensitive than broth-enrichment culture but has the benefit of a more rapid result (preliminary results after overnight incubation), due to the use of a selective medium.

C. **Polymerase chain reaction, i.e. rapid testing**

There are a number of commercially available rapid diagnostic tests that perform well and are comparable to broth enrichment culture (24). Recent evidence suggests that more rapid results can impact on MRSA transmission and may improve compliance with screening recommendations (25,26). Some of these techniques have been evaluated to detect common circulating strains of MRSA in Ireland and have been shown to be accurate (27). Nonetheless, these laboratory methods are more expensive than conventional culture based methodologies and the benefits, in terms of decreased MRSA acquisition and decreased MRSA infections have not yet been conclusively shown (28). However, it is possible that the selective use of PCR may increase the efficiency of healthcare resources, due to the availability of a more rapid result but this awaits confirmation.

Barriers to the implementation of recommended screening policies include inadequate laboratory facilities and on-going pressures on clinical staff, e.g. increased patient turn over
and relative staff shortages. However, the active involvement of IPCTs can assist in ensuring that those patients that should be screened are screened in a timely manner. On-going research is required to confirm that targeted screening remains the appropriate approach as well as indicating the role and especially the cost-effectiveness of molecular methods for MRSA detection.

2.1.3 Informing patients of MRSA status

Recommendations

- All patients (in-patients, out-patients and other patients in the community) identified with MRSA should be informed as soon as possible of their MRSA status, which should be documented in the patients’ clinical notes and information should be provided about eradication/treatment options, as appropriate. 
  
  Grade D

- The responsibility of informing patients of their MRSA status lies with the clinical team (i.e. consultant) caring for the patient during their in-patient stay. 
  
  Grade D

- Where a new MRSA case is diagnosed following patient discharge or when a patient is attending an outpatient clinic, it is the clinical team’s responsibility (i.e. consultant) to inform the patient’s general practitioner of his/her MRSA status and to follow up as required. 
  
  Grade D

- If MRSA is detected upon the patient’s admission to a particular healthcare facility, the facility from where the patient was originally transferred needs to be informed. 
  
  Grade D
• An information leaflet (e.g. HPSC leaflet) should be given to all patients colonised or infected with MRSA and this should be documented in the patient’s clinical notes.

Grade C

Rationale

Many complaints from patients, their relatives and the public about HCAI and MRSA relate to poor communication including when and if positive MRSA status was conveyed. Patient advocacy groups have prioritized the provision of enhanced information about MRSA to patients and as rapidly as possible, i.e. once confirmed. This is also consistent with clinical governance, professional and ethical standards, and is endorsed by professional bodies (29). Knowledge of positive MRSA status by patients themselves can inform when screening is required, e.g. subsequent admission to hospital. Reductions in the spread of MRSA can be accomplished by sharing information, educating personnel about MRSA, and improving hygiene practices for everyday living. If the patient has been discharged a letter should be sent to the GP (Appendix VI).

Barriers to ensuring that patients are informed of their MRSA status and that this is documented include a lack of knowledge on the part of some clinical staff on MRSA and its implications, embarrassment that the patient has acquired MRSA and time pressures. However, this can be partly rectified by education, simplification of the documentation process and the feeding back of audits on the proportion of patients that have been notified.

2.2 Infection prevention & control measures in the acute hospital setting

A multifaceted approach in infection prevention and control interventions aid in preventing and controlling the spread of MRSA (1). These interventions include contact isolation, patients cohorting, hand hygiene campaigns environmental cleaning, active surveillance and antimicrobial stewardship programs.

2.2.1. General issues

Recommendations

• The health service provider must take steps to prevent patient overcrowding and understaffing, in order to minimise the risk of MRSA transmission. Grade B
• Staff members of all grades should receive appropriate training i.e. on induction and annually, and education on hand hygiene and the appropriate use of personal protective equipment (PPE) etc

Grade B

Rationale

Every effort should be taken to minimise the transmission of MRSA, and other pathogens, even in the absence of specific isolation facilities. Overcrowding and understaffing have lead to failures of MRSA control programmes via decreased healthcare worker hand hygiene compliance, increased movement of patients and staff between hospital wards, decreased levels of cohorting and the overburdening of screening and isolation facilities (2,3). Increased patient/staff ratios are associated with increased transmission rates of infection as are the increased use of temporary or locum nursing staff even if this may be mitigated in part by good compliance with hand hygiene (4-7). A high MRSA incidence leads to increased inpatient length of stay and delayed discharge, exacerbating overcrowding and leading to a vicious cycle characterised by further infection prevention & control failures (3). The closure of some facilities for financial and other reasons and staff shortages are all a major barrier to the prevention and control of all HCAI and not just MRSA. Staff members should receive education and training in infection prevention & control initiatives i.e. hand hygiene (8). This training is delivered during orientation/induction with regular updates.

Recommendation

• Multi-bedded general wards or units should be a minimum of 19m² around each bed in a multi-bedded room. If this is currently not the case, future refurbishment should address this.

Grade D

Rationale

The risks of HCAI are greatly increased by high bed occupancy and by an absence of suitable facilities to isolate infected patients (9).
The NHS recommends a minimum space of 3.6m bed centre-to-centre to minimise spread of infection (10,11). Multiple-bedded rooms should not contain any more than three beds including shower and toilet facilities and be designed in a way that allows for future reconfiguration. In Ireland, the recommendation has been made that there should be a minimum floor space of 19m² around each bed (12). Sufficient space accommodates clinical activities, patient movement and visitors. This also allows for the fact that droplet spread of pathogens is generally only a risk within one meter of the source patient (13,14).

**Recommendations**

- Newly built acute hospital inpatient accommodation should comprise 100% single rooms.

  **Grade C**
  
  - All single rooms should have *en suite* shower and toilet facilities, and an additional clinical hand wash sink, and have a minimum floor area of 25m².

  **Grade C**

**Rationale**

Experience with epidemic strains of MSSA in the 1960s demonstrated that isolation was a key component in controlling the spread of staphylococci (15,16). A study from France found that MRSA infections decreased by 17.9% with the introduction of isolation precautions (17). Jernigan *et al* demonstrated a 15.6-fold lower MRSA transmission rate when colonised patients were cared for using strict isolation precautions, compared to standard precautions (18,19). The choice of isolation facility depends on hospital size, activity and the local MRSA rates.

Single rooms should have their own toilet en-suite, including dedicated washing/bathing facilities for patients. There should be a separate clinical hand-washing sink and alcohol hand rub dispenser in the room.
Where sufficient single rooms, or a dedicated isolation unit, are not available colonised patients may be cohorted in designated areas. This approach has been effective in controlling MRSA outbreaks (20).

Negative pressure (airborne isolation) rooms are not generally required for the care of patients colonised or infected with MRSA as MRSA transmission is generally via contact or droplet spread, rather than airborne spread.

Current financial pressures in the health sector may mean that the conversion of multi-bed rooms on older wards to single rooms is delayed but all refurbishment projects and new builds should prioritise the provision of single room accommodation.

**Recommendations**

- Risk stratification must be performed locally to identify areas where MRSA infection results in high morbidity and mortality and where patient isolation or cohorting is essential (Appendix VII– Risk stratification tool). Isolation or cohorting is essential in high-risk areas, i.e. ICUs, orthopaedic units, vascular surgery units, transplant units, SCBUs and other specialised clinical areas with vulnerable patients. **Grade B**

- Hospitals with endemic MRSA may consider the establishment of a dedicated isolation unit or control of infection ward. Control of infection wards should not be sited away from the main hospital environment to ensure that patients are not distanced from specialist care. **Grade D**

**Rationale**

Dedicated isolation units, also known as control of infection wards, allow patients to be nursed in an open ward, avoiding some of the psychological impact of isolation in a single room. It also means that colonised patients are cared for by designated staff, using designated shared patient equipment. Such units are particularly useful in hospitals where MRSA is endemic, as is the case in many Irish and UK hospitals, or during large hospital outbreaks. A
purpose built MRSA cohort unit in a hospital has proven effective in controlling MRSA transmission, while maintaining the overall quality of care (21). The introduction of dedicated isolation units was associated with significant reductions in MRSA transmission in a number of UK hospitals during the 1980s, although other priorities subsequently led to most of these being closed (22-25). Control of infection wards should not be sited away from the main hospital environment, to ensure that patients are not distanced from specialist care (26).

Recommendations

- Where single rooms or a dedicated isolation unit are not available, colonised patients may be cohorted in designated areas with designated staff according to local risk assessment and the facilities available.
  
  Grade C

- All national and international patient transfers to an acute setting should be isolated until MRSA screens are negative.
  
  Grade C

- Every effort should be made to ensure that all patient transfers into high-risk units (critical care areas, SCBU, cardiothoracic units, orthopaedics, trauma, vascular surgical units and transplant units) from non-high risk areas (medical and care of elderly units) within the same institution should be isolated/cohorted with contact precautions CP until MRSA screens are negative. If this is not feasible a risk assessment should be carried out before the patient is moved into the high-risk unit.
  
  Grade B

- All known MRSA cases on admission and all new MRSA cases upon identification in high-risk areas (critical care units, orthopaedics, surgical wards and transplant units) should be isolated/cohorted with CP and screened accordingly thereafter.
  
  Grade B
• Patients with exfoliative skin conditions who are likely to shed MRSA in high numbers should be isolated until advised by the local infection prevention & control team.

Grade B

• Where a new case of MRSA is identified in a general ward area, i.e. non-single room, patients in that vicinity (e.g. ward bay) should be screened for MRSA.

Grade C

• Patients awaiting the results of MRSA screening should be nursed in a single room with CP if any of the following apply:

1) Previously colonised or infected with MRSA
2) Recent and frequent hospital admissions i.e. within 6 months
3) Transferred from another healthcare institution, i.e. hospital or nursing home
4) Inpatients in another healthcare institution within the previous six months
5) Patients with skin ulcers or chronic wounds.
6) Patients transferred from hospitals abroad

Grade C

• The number of healthcare staff who have direct contact with patients in isolation who are colonised or infected with MRSA should be kept to a minimum. Staff with persistent exfoliative skin lesions should be excluded from the care of patients colonised or infected with MRSA.

Grade D

Rationale
Placing patients with MRSA who are colonised or infected under CP with designated nursing staff helps reduce patient-to-patient spread of the microorganism within the hospital (27). Healthcare associated infections are a serious patient safety issue and staff must adhere to good infection control practices in particular hand hygiene.
Recommendation

- Isolation and CP can be discontinued if patients with MRSA have three consecutive negative sets of screening sample, at least 48 hours apart and two days after decolonisation treatment has been concluded.  
  Grade C

Rationale

The patient is no longer considered infectious after three negative screens but while in hospital such patients should continue to be screened at weekly intervals as MRSA may recur, especially if the patient is exposed to the selective pressures of broad-spectrum antibiotics.

2.2.2 Hand hygiene

Recommendations

- Hand hygiene must be carried out according to the World Health Organisation (WHO) 5 moments of hand hygiene, i.e.
  1. Before patient contact
  2. Before aseptic task
  3. After body fluid exposure risk
  4. After patient contact
  5. After contact with patient surroundings  
  Grade A

- Cuts or breaks in the skin of healthcare workers should be covered with impermeable dressings.  
  Grade B

- National recommendations on hand hygiene must be followed.  
  Grade D

- Hand hygiene should also be carried out regularly by the patients themselves  
  Grade C
• Patients/residents/visitors should be encouraged to decontaminate their hands at regular intervals with assistance given if necessary

  Grade C

Rationale

The transmission of HCAI pathogens from one patient to another via the hands of healthcare workers is well established (28, 29). Expert groups agree that the major focus on MRSA control is the prevention of hand transfer of MRSA (30-33). A recent Irish study showed that MRSA was recovered from 38/822 (5%) fingertips of 523 healthcare workers after contact with patients and their environment (34). The World Health Organisation (WHO) 2009 states that hand hygiene is concentrated in activities known as the five moments for hand hygiene www.who.int/gpsc/tools/Five_moments/en/index.html (35). All senior medical, nursing, allied health professional and administrative personnel, whose staff have clinical involvement, must ensure that staff understand the importance of hand hygiene, are familiar with, adhere to the national recommendations and participate in hand hygiene audit.

Another study has highlighted the role of patients and their relatives as unidentified transient MRSA carriers (36). The study showed that by encouraging patients and visitors to participate in regular hand hygiene, MRSA nosocomial rates could be reduced.

Barriers to sub-optimal compliance with hand hygiene include the lack of access to alcohol hand rubs and wash hand basins in some units, a belief that hand hygiene is not as important as it is and lack of leadership amongst opinion leaders. There is a need to change the culture on hand hygiene amongst some key healthcare staff, e.g. medical doctors through education, the feedback of audit results and through individuals and units taking responsibility for their own results. National initiatives on the publication of hand hygiene compliance in acute hospitals have been helpful in this regard. Finally, further research on psychological issues and behaviour patterns that affect hand hygiene practice is needed.

2.2.3 Personal protective equipment (PPE)

Recommendations
• A risk assessment should be undertaken on activities undertaken in a patient’s room and appropriate PPE selected.  

  **Grade C**  

• The use of PPE should be determined by:  

  **Grade B**  

  o Nature of anticipated patient care intervention  
  o Nature of procedure  
  o Risk of exposure to blood or body fluids  
  o Risk of contamination of skin/clothes  

• Gloves should be changed and the hands decontaminated between several procedures, such as surgical site care, followed by IV line inspection on the same patient.  

  **Grade C**  

• PPE should be removed prior to leaving the isolation room, discarded into appropriate healthcare waste stream and hand hygiene performed.  

  **Grade B**  

• There is often no need for visitors to wear PPE. The most important element for the visitor is to ensure they perform hand hygiene before and after patient contact.  

  **Grade D**  

• Face masks not normally required unless airborne or droplet precautions are required for other reasons e.g. viral RTI  

  **Grade D**  

**Rationale**

Personal protective equipment is required for potential contact with blood and/or body fluids. Gloves are used to prevent contamination of healthcare personnel hands when anticipating direct contact with blood or body fluids, mucous membranes, non-intact skin and other potentially infectious material (37). Having direct contact with patients who are colonised or infected with pathogens transmitted by the contact route e.g. MRSA or handling or touching visibly or potentially contaminated patient care equipment and environmental surfaces is a significant risk (37). However, gloves must be worn appropriately as illustrated in a study by Moore et al. (38) whereby gloves should be single use and failure to remove gloves after patients contact and/or to change them between patients can increase the risk of cross
transmission via contaminated gloved hands.

Clothing and uniforms may become contaminated with potential pathogens after the care of a patient colonised or infected with an infectious agent i.e. MRSA. Although contaminated clothing has not been implicated directly in transmission, the potential exists for soiled garments to transfer infectious agents to successive patients (37,39). The value of wearing aprons and gowns to control the spread of MRSA is generally accepted (39-41).

Many expert groups advise that staff clothing should be protected in isolation rooms, as clothing will have contact with the patient, environmental surfaces or items within the patient’s room and protection will limit the transfer of micro-organisms to other patients from such a source (30-33). The protective apron/gown is removed before leaving the patient environment (31,40). Long sleeved gowns may be recommended for very close patient contact (e.g. lifting), prolonged patient contact or contact with patients with exfoliative skin conditions or extensive colonisation with MRSA (31).

The use of facemasks for the control of MRSA transmission is controversial (40). In Canada it is suggested that a facemask may be required if a patient with MRSA has a superimposed respiratory viral infection (40). The routine care of patients with MRSA does not require the use of facemasks. Hand hygiene should always be performed following removal of PPE (28, 29).

### 2.2.4 Education

**Recommendations**

- All HCWs should receive adequate training at induction and annually on standard and transmission-based precautions on hand hygiene and the appropriate use of PPE
  
  **Grade D**

- Patients should be educated on the importance of hand hygiene while they are an in-patient.
  
  **Grade D**

- Hospital management should ensure that all hospital staff (including supervisory staff) involved in environmental decontamination must be trained, and certified as
competent. Training should commence within the first week of employment.

**Grade D**

- The Chief Executive Officer, or equivalent, of every healthcare facility must take corporate responsibility providing adequate resources for training for those involved in cleaning.

**Grade D**

**Rationale**

Adequate training for all HCWs is essential. Staff should receive training on hand hygiene and the appropriate use of PPE when they commence their employment and regular refresher courses should be available. Staff involved in cleaning should be adequately trained prior to commencement of their employment. Evidence now suggests that poor patient hand hygiene is a contributory factor in the spread of pathogens such as MRSA (41). Educating patients on the importance of hand hygiene has been shown to be beneficial.

Patient and healthcare staff education can be facilitated through the increasing use of on-line and web-based material that does not require face-to-face sessions and that can be accessed in the staff or patient’s own time. It is not possible for all educational sessions of healthcare staff to be conducted by the local infection prevention and control staff and greater consideration needs to be given to a ‘teach the teacher’ approach where such education can be cascaded locally.

**2.2.5 Patient movement and transfer**

**Recommendation**

- The movement and transfer of patients with MRSA both within a hospital and between hospitals should be limited to prevent spread but the patient should not in the process be deprived of necessary care.

**Grade C**

**Rationale**
If the movement/transfer of the patient is necessary (including transfer to another facility), staff should ensure that the area is notified in advance of the patient’s MRSA status and that precautions are maintained to minimise the risk of transmission to other patients (42). If in doubt, the local infection prevention and control team should be contacted. The receiving departments are required to clean and disinfect surfaces and equipment after they come into contact with patients with MRSA. During transportation between departments it is important to maintain patient confidentiality. If the patient requires lifting onto a trolley then the HCW should wear appropriate PPE. Once the task is completed, the HCW should remove PPE and perform hand hygiene. As patients are not normally in direct contact with the surrounding environmental surfaces or staff members’ clothes during transportation, aprons or gloves are not required unless indicated by standard precautions. Transport equipment (trolley, wheelchair) used for transferring the patients should be cleaned and disinfected immediately after use paying particular attention to areas touched by the patient i.e. hand rails.

2.2.6 Operating Theatre

Recommendations

- Patients colonised or infected with MRSA do not need to be placed last on the theatre list provided the theatre is adequately cleaned and disinfected afterwards.
  
  Grade D

- A sign should be placed on the theatre door to notify staff of CP.
  
  Grade D

- Staff and stock equipment within the operating theatre must be kept to a minimum.
  
  Grade D

- The operating theatre should be cleaned & disinfected before the next patient.
  
  Grade B

- Patient recovery should be in a designated area within the recovery department using CP.
  
  Grade D
Rationale

MRSA positive patients do not need to be put last on the theatre list as a conventionally ventilated theatre should have a minimum of 20 air changes per hour of filtered air. This number of air changes results in very little ‘contaminated’ air being present after approximately 10 minutes (43). This provides sufficient protection against potential airborne spread of MRSA.

2.2.7 Equipment & environmental hygiene

Recommendations

- Patient care equipment such as blood pressure cuffs and stethoscopes should be designated for use only on a single patient who is colonised or infected with MRSA
  
  Grade C

- Patients’ charts including observation charts and drug charts should be kept outside the patients’ room.
  
  Grade D

- All equipment should be cleaned and disinfected after use.
  
  Grade B

- All healthcare staff should comply with best practice for the insertion of invasive medical devices such as intravascular catheters and urinary catheters.
  
  Grade B

Rationale

Dedicated equipment should be used where possible and only essential equipment and supplies should be taken into the room (27). All patient care equipment/supplies must be effectively cleaned and disinfected before use on another patient (44,45). An outbreak of community-acquired MRSA in a hospital new-born nursery was facilitated by breaches in
hygienic rules, especially when mothers changed their babies (changing table was positive for MRSA) (46).

**Recommendations**

- The hospital environment must be visibly clean, free of dust and acceptable to patients, visitors and staff.
  
  *Grade C*

- All hospital surfaces should be intact and made of a durable, washable material. This is fundamental to the control of all healthcare-associated infections, including MRSA.
  
  *Grade C*

- Daily cleaning of an isolation room with detergent and water is sufficient with a terminal clean i.e. cleaning and disinfection being completed on transfer or discharge of the patient, paying particular attention to hand touch surfaces.
  
  *Grade C*

- Additional cleaning and disinfection measures are necessary on the discharge of MRSA patients and in outbreak situations.
  
  *Grade C*

- The correct colour coded system should be used for cloths/mops in isolation rooms. The National Hospitals Office Cleaning Manual for Acute Hospitals and equivalent Irish guidelines recommend white cloths for isolation rooms (47).
  
  *Grade C*

**Rationale**

Dry conditions with dust on environmental surfaces act as reservoirs for MRSA, which facilitates the transfer to hands when such surfaces are touched. Conversely, MRSA acquired on hands and/gloves may be transferred to environmental surfaces and equipment when they come into contact with for example curtains, equipment, switches/buttons (ventilators,
infusion pumps, feeding pumps), phones, touch panel screens, door handles, light switches, bed tables, bed rails, mattresses and even pens (27,30,42,48-50).

A recent study highlighted the large numbers of MSSA and MRSA from hand-touch sites with the bed, locker and over bed table being the most commonly contaminated surfaces (51). One study ascertained that computer keyboards can harbor organisms and act as potential reservoirs for nosocomial spread, another study stated that 24% of computer terminals were contaminated with MRSA (52). A Canadian study showed that 11.8% of surfaces sampled were positive for MRSA (53). These areas included chair backs, hand rails, isolation carts and sofas.

The most probable mode of transmission is via ‘hand-touch’ sites, since these sites offer a niche to microorganisms deposited from the hands, particularly fingertips. MRSA can survive for long periods in the environment and could present an infection risk for patients.

High bed occupancy levels, including the placing of additional beds in clinical areas to reduce over-crowding and long waiting times in emergency departments result in clutter and are a barrier to ensuring effective hygiene. Further research is required on more effective methods to decontaminate heat sensitive items of equipment and on general ward decontamination methods that do not require the area to be vacated of patients and staff for some hours.

### 2.2.8 Laundry and healthcare waste

**Recommendation**

- All laundry should be treated as potentially infectious and placed directly into an alginate or water-soluble bag at the bedside.

  **Grade C**

**Rationale**

All laundry should be managed as per national guidelines (54). Curtains should be changed on terminal cleaning of a room of a patient with MRSA.

**Recommendation**
• risk waste i.e. gloves and aprons, unless contaminated with infectious body substances i.e. blood or sputum.

Grade C

Rationale

The management of healthcare waste should be in line with national guidelines on the segregation, packaging and storage of healthcare risk waste (55).

Patients with MRSA, following a risk assessment, should be cared for in a single room using contact precautions especially in high-risk units. Contact precautions are associated with activities likely to reduce transmission of microorganisms such as better hand hygiene by healthcare workers (56).

2.3 MRSA in the non-acute healthcare setting

Changes in the way healthcare is delivered over the past ten to fifteen years have resulted in increases in the number of patients who are cared for in non-acute healthcare settings including adult day care centres, facilities for the homeless and special schools. A clear dividing line between acute and subacute hospitals does not exist. MRSA positive patients may be encountered in non-acute healthcare settings including long term care facilities, such as nursing homes, residential homes and mental health services. Also MRSA colonised and infected patients may be cared for in the home. Although the management of patients in these settings is very different to the management of patients in the acute hospital setting, as the risk of invasive infection is low, efforts, as detailed below should still be made to prevent transmission of MRSA in these settings. There is a different emphasis in these settings as the risk of invasive infection is considerably less than in acute hospitals and often, as in the case of nursing homes, the facility also represents the individual’s home. For both these reasons, efforts to decolonise individuals or residents with MRSA are usually discouraged (unless as part of a work up for elective surgery), but general measures to reduce all infections such as personal and hand hygiene, remain important. However, it is not possible to be prescriptive for all settings or for all individuals and what follows is designed to highlight the main principles but further advice should be sought as required from infection prevention and control professionals.
2.3.1 Screening

Recommendations

- Good communication between healthcare facilities is essential to prevent and control MRSA. 
  Grade D

- Healthcare facilities should be informed on admission and discharge of recent MRSA screening results, decolonisation treatments received and any requirement for post decolonisation screening. This should be included in the transfer documentation. Grade D

- Routine screening for MRSA in non-acute healthcare settings is not recommended. 
  Grade D

- Expert advice should be sought before embarking on screening for MRSA. 
  Grade C

- Carriage of MRSA is not a contraindication to the transfer of a patient to a non-acute healthcare setting. 
  Grade C

- Routine screening before discharge to a non-acute healthcare facility or home is not required. 
  Grade D

- Screening before admission to an acute hospital setting may be required, especially, pre operatively for an elective procedure. The need for screening prior to admission should be determined by the patients’ consultant in conjunction with the hospital infection doctor, prevention and control team. 
  Grade D

- Screening after decolonisation treatment will not normally be required after discharge. However, screening after decolonisation treatment may be requested in certain cases for example;
1. pre-operatively on the advice of the hospital admitting physician/surgeon
2. where a patient is to be readmitted to hospital for further treatment  

**Grade D**

Refer to 2.6.1. for recommendations on decolonisation

**Rationale**

Healthcare associated infections such as MRSA are not limited to acute care hospitals. A high prevalence of MRSA amongst residents and staff of some long term care facilities (LTCFs) is making these facilities a substantial reservoir for MRSA. The prevalence of MRSA amongst residents of LTCF varies significantly from low rates of 1.1% in Germany to rates of over 20% in the United Kingdom and 30% in the United States. (1,2). A prevalence rate of 8.6% was reported in an Irish study in nursing homes in 2000 (3). Vast differences in rates of colonisation have been identified between different LTCFs, ranging from 0 - 73% (2). Rates of colonisation may depend on various factors including the prevalence of MRSA in the referring facilities, the resident population, the percentage of staff colonised with MRSA and the infection prevention and control practices in the facility (1-3).

Risk factors identified as predictive of MRSA colonisation and infection amongst residents of LTCFs include host factors such as advancing age, antibiotic use, poor functional status, hospitalisation and the presence of invasive medical devices (4-7).

Carriage of MRSA other than in the nose increase with the use of invasive devices and admissions of greater than 10 days to acute healthcare facilities have been shown to increase the risk (7,8). Antibiotic use has been shown to be independently associated with MRSA colonisation (1). In LTCFs persistent carriage with MRSA between 47% and 65% has been reported, with between 19% and 25% having transient carriage and between 9% and 23% having intermittent carriage of MRSA (8,9).

Despite the high prevalence of MRSA carriage amongst residents of LTCFs the frequency of infection with MRSA in these settings appears to be low whilst colonised residents remain at the facility (10). Colonisation amongst residents of nursing homes in Belgium was associated with a higher mortality rate, but the excess mortality rate was restricted to residents with impaired cognitive function. The findings showed that no excess mortality was found
amongst residents with normal or moderately impaired cognitive function (9). A longitudinal prevalence study in the UK found that MRSA was associated with previous and subsequent MRSA infection but was not significantly associated with subsequent hospital admission or mortality (11).

Greater integration between the acute and non-acute healthcare sectors is required to optimize MRSA prevention and control through the provision of structures that provide a seamless interface, involving staff that cross-cover both. Currently, this is not possible due to inadequate numbers of personnel and current arrangements in terms of health provision.

2.3.3 **Infection prevention & control measures**

**Recommendations**

- Non-acute healthcare facilities should have an infection prevention and control program which incorporates
  1. Monitoring for problems, including outbreaks of infection.
  2. Routinely assessing all residents for their risk of acquisition or transmission of infection
  3. Education of employees in infection prevention and control precautions.
  4. Policy and procedure development and review.
  5. Monitoring of care practices.
  7. Antibiotic stewardship.  

**Grade D**

- Standard Precautions (Table 2.1) are advised for the care of all residents regardless of their MRSA status.

**Grade B**

Table 2.1  Key components of Standard Precautions
During the delivery of healthcare hand hygiene must be performed by all staff in line with the WHO moments for hand hygiene i.e.

1. Before patient contact
2. Before clean/aseptic procedures
3. After body fluid exposure risk
4. After patient contact
5. After contact with patient surroundings

**Grade A**

- All residents should be encouraged to practice good hygiene and be assisted with this if their physical or mental condition makes this difficult.

**Grade C**

- Laundry should be managed as per Standard Precautions
  - Linen soiled with bodily fluids should be treated as contaminated by placing in a water-soluble or alginate stitched bag prior to placing in a laundry bag which is designated for contaminated linen by label or colour.
  - Personal clothes should be machine-washed, preferably on a hot wash setting.
  - There must be no manual washing of soiled clothing.

- Isolation of a resident colonised with MRSA is not generally required as this may adversely affect rehabilitation of the resident.

**Grade C**
• The potential for transmission of infection should be considered in resident placement decisions. Local risk assessment of the individual and the environment will be required prior to placement, i.e. in the presence of an exudating wound which can not be covered single room placement may be appropriate.

**Grade C**

• Contact Precautions may be required where a resident has an infection caused by MRSA or to control outbreaks of MRSA infection.

**Grade C**

**Rationale**

A Cochrane review of the infection control strategies for preventing the transmission of MRSA in nursing homes for older persons did not find any studies meeting its criteria. The background for this study stated that nursing homes for the elderly provide an environment likely to promote the acquisition and spread of MRSA, putting residents at increased risk of colonisation and infection. The review found no studies specific to the long term care setting (12). However the authors acknowledged that infection prevention and control practices work to prevent the spread of MRSA in acute health care, and that general advice based on well established principles of infection prevention and control i.e Standard Precaution could be applied to all healthcare environments including LTCFs (12,13).

Data on the prevalence of MRSA in non acute healthcare settings such as in mental health services are limited. However, a study of prevalence and risk factors for MRSA found prevalence of MRSA colonization was 5.2%(26 of 498) amongst patients admitted to a psychiatric unit in the United States. Risk factors for MRSA colonisation included a history of abscess on admission, HIV infection and previous isolation, due to mental health (14). In general patients or clients of such services are not at high risk of MRSA infection or colonisation. A recent investigation into the management of MRSA in a closed mental health unit found that hand hygiene seemed to be sufficient to prevent the spread of MRSA (15).

In non-acute healthcare and residential settings, adherence to standard precautions are required for the care of all patients including those known to be colonised with MRSA (16). A recent study of nursing homes in Northern Ireland highlighted that compliance with
standard precautions was suboptimal in the nursing homes studied, despite an intervention which included education on infection prevention and control and associated audit. The authors highlighted the importance of a full infection prevention and control programme to enhance compliance with standard precautions as a means of reducing transmission of MRSA within the nursing home setting (17).

A recent study showed a substantial decrease in the rate of MRSA nosocomial infections following an intervention which encouraged hand hygiene for patients and visitors. MRSA infections decreased by 51% and the intervention may have prevented up to 51 cases of MRSA infection over a period of one year (18).

Two clustered randomized controlled trials in Long term care facilities showed that the implementation of the WHO multimodal strategy to promote hand hygiene increased compliance with hand hygiene and reduced the risk of infection. Ho at al showed that the risk of MRSA infections which required hospitalization was reduced along side an increase in hand hygiene compliance by staff (19). The study by Yeung showed an increase in hand hygiene compliance with a reduction in the incidence of serious infection (20). Pocket sized containers of alcohol hand rubs were provided to staff in both studies as a part of a multifaceted hand hygiene program.

Similarly a comprehensive hand hygiene program which involved the use of alcohol based hand rubs showed a statistically significant reduction in lower respiratory tract infections (LRTI). Rates of LRTI were reduced from 0.97 to 0.53 infections per 1,000 resident days (P0.01), reductions in skin soft tissue infection (SSTIs) were also observed (21).

The removal of MRSA from clothing has been shown to occur at low temperatures of 30° with the addition of a detergent (22).

2.3.4 Facilities

Recommendations

- Routine facilities in all non-acute healthcare facilities should include adequate sinks for staff hand washing, liquid soap and paper towels in wall mounted dispensers,
alcohol hand rub and hand cream.

**Grade D**

- In non-acute healthcare facilities, single rooms with hand hygiene facilities should be available which can be used for infection prevention and control purposes.

  **Grade D**

- Newly built non-acute hospital inpatient accommodation should comprise a minimum of 50% single-patient rooms.

  **Grade C**

**Rationale**

National and international guidance on hand hygiene highlights the importance of the availability of hand hygiene facilities at the point of care to optimise compliance (21, 22). National guidance recommends that non-acute hospitals have 50% single room (23).

**2.3.5 Education**

**Recommendations**

- Education on standard precautions and relevant national infection prevention and control on national policies should be provided for all staff in non acute healthcare settings.

  **Grade D**

- Education on the use of invasive devices such as urinary catheters, enteral feeding tubes and tracheostomies should be provided to healthcare staff in non-acute healthcare facilities.

  **Grade D**

**Rationale**

A recent trial to assess the impact of an infection prevention and control education and training programme on MRSA prevalence in nursing homes in Northern Ireland found that the intervention did not reduce the prevalence of MRSA amongst staff or residents (17).
However, a significant improvement was seen in the infection control audit score for the intervention nursing homes. The authors highlighted the need for more intensive training in infection prevention and control in nursing homes. Compliance remained poor, particularly in the area of hand hygiene and equipment cleaning, measures which are essential to the control of MRSA (17). Hand hygiene remains essential in this setting as well as in the acute care environment (24-26). A large prospective study assessed the effectiveness of improving infection prevention knowledge on MRSA colonization in UK care homes for the elders (11). Authors reported that the intervention improved knowledge and practice of staff but did not reduce the prevalence of MRSA and suggested that additional measures will be required to reduce endemic MRSA colonization in care homes. As the aged population increases there is a great need for more research on infection prevention measures in nursing homes and other non-acute units as to date control strategies have been guided by what has been considered appropriate in the acute setting without allowing for differences in risk and the fact that such units also represent a home for the individual. Appendix VIII provides some information for staff in LTCF.

2.3.6 MRSA in the home

Recommendations

- Good communication between hospitals discharging patients home with MRSA and carers or family members, community and public health nurses and general practitioners is essential in minimising spread.
  
  Grade D

- Patients should be asked to inform their appropriate healthcare providers, e.g. public health nurse or GP, that they have previously tested positive for MRSA, particularly when attending different/new, healthcare providers.
  
  Grade D

- There is little risk of transmitting MRSA to healthy people who are at low risk of becoming infected. Patients should be informed that the risk to healthy relatives or others outside the hospital setting is extremely small, unless they are healthcare workers with patient contact when they may pose a risk to other patients.
  
  Grade B
• Eradication of MRSA carriage in the community is generally not required.
  
  **Grade D**

• If decolonisation treatment has been commenced prior to discharge it should be completed.
  
  **Grade B**

• The need for decolonisation after discharge should be determined by the patients’ consultant/doctor in conjunction with the hospital infection prevention and control team. Decolonisation may be required in certain circumstances, e.g. pre-operatively on the advice of the admitting physician/surgeon where a patient is to be readmitted for further treatment. Please refer to section 2.6 – Decolonisation.
  
  **Grade C**

• In the home, the following general precautions should be followed:
  
  1. Good hand washing practice including soap and water is the single most important infection prevention and control measure.
  2. Patients should be instructed to wash their hands with soap and water before and after touching any dressings or wounds.
  3. Care-givers should wash their hands with soap and water or use alcohol hand rub before and after physical contact with the infected or colonised person and before leaving the home.
  4. Disposable gloves should be worn by care givers if contact with body fluids or dressings are expected. Hands should be washed after removing gloves.
  5. Cuts or breaks in the skin of patients and carers should be covered with impermeable dressings.
  6. Linen should be changed and washed if it is soiled and on a routine basis.
  7. The patient’s environment should be cleaned routinely and when soiled with blood or body fluids, using a general purpose detergent and warm water.
  8. Cutlery and crockery should be washed as normal. Separate cutlery & crockery is not required
  9. Items for personal hygiene such as razors, tooth brushes, face cloths, body lotions/creams, towels and soap should not be shared under normal circumstances.
10. Dressings and other disposable waste such as disposable gloves should be disposed of promptly by placing in a bag, and tied before disposing into the waste bag or container.

11. Healthcare non-risk waste should be wrapped in a bag before disposing into the domestic waste bag.

12. Healthcare workers should adhere to standard infection prevention and control precautions when providing care to patients in their home at all times.

Grade C

Rationale
People with MRSA colonisation can be returned safely to their own homes without significant risk to the community. Simple hygienic precautions usually suffice in the home setting (27). As in the acute healthcare setting, patients at home should be informed of their positive MRSA status and provided with a patient information leaflet (28). See also Appendix IX.

2.4 MRSA in obstetrics and neonates

2.4.1 MRSA during pregnancy

Recommendations

- If MRSA carriage is detected in a pregnant woman during the antenatal period, decolonisation is recommended before delivery.

1. A standard decolonisation regimen (see section 2.6) including topical nasal mupirocin should be considered between 35-37 weeks gestation, or earlier if risk of preterm birth. Grade D

2. If known MRSA carriage ante-natally, surgical prophylaxis for caesarean section (elective and emergency) should include a glycopeptide antibiotic as
part of the prophylaxis regimen.

**Grade A**

**Rationale**

The prevalence of MRSA carriage in pregnant women in Ireland was found to be 1.6% following a three year study in the Coombe Women’s and Infants University Hospital (personal communication, Dr. N O’Sullivan). A large study in the U.K. found 0.5% of pregnant women were nasal carriers of MRSA (1). In the USA, carriage rates generally vary from zero to 4%, although one study reported a rectovaginal MRSA carriage rate of 10.4% (2-10). Where analysed, most of the pregnant women in the USA found to be carrying MRSA had community-acquired-MRSA (CA-MRSA) (2,6). These studies may have limited relevance to Ireland where CA-MRSA (see section 2.5) remains relatively uncommon and few women without traditional risk factors are expected to carry MRSA.

MRSA is associated with surgical site infection following caesarean section, mastitis and late-onset infections in the neonatal intensive care unit (NICU) (3,11-18). There may be a benefit to both mother and baby in attempting to decolonise the MRSA colonised pregnant woman before delivery. Decolonisation may also reduce transmission within the hospital. MRSA is rarely implicated in antenatal infection, chorioamnionitis, puerperal sepsis or early-onset sepsis in the newborn (3,14,18-19). Thus, with regard to the optimal timing of decolonisation, ideally one should avoid this during the first trimester and wait until close to term at 35-37 weeks gestation to attempt de-colonisation (or earlier if risk of preterm delivery). Topical nasal mupirocin is not licensed for use in pregnancy and the manufacturer advises against its use in pregnancy and during lactation unless the benefit outweighs the risk. However, in the U.K. a full risk assessment of decolonisation regimens in pregnancy concluded that nasal mupiricin should be used for MRSA decolonisation in pregnancy (17). If the pregnant woman is colonised with MRSA in the
throat, ensure any oral antibiotics used for eradication are compatible with pregnancy. Consult a microbiologist or infectious disease physician on a case-by-case basis. See section 2.6 for decolonisation regimen.

If a mother is known to be MRSA positive ante-natally, antibiotic prophylaxis for caesarean section (elective and emergency) should include a glycopeptide antibiotic and should be discussed with a clinical microbiologist or infectious disease physician. Standard antibiotic prophylaxis for caesarean section operations do not provide cover against MRSA and must be modified for a known carrier.

2.4.2 Breast feeding and MRSA colonisation/infection

Recommendations

- If a lactating mother has known MRSA mastitis,
  1. The mother can usually continue to breast-feed a healthy term baby in the community, receiving antibiotic therapy (unless the antibiotics prescribed are contraindicated in lactation).
     
     Grade C
  
  2. If the baby is in the NICU and at significant risk of developing an invasive MRSA infection, consider withholding breast milk until the MRSA mastitis has resolved.
     
     Grade C

  3. In other circumstances such as a baby in a special care nursery, a risk assessment should occur based on the likelihood that the baby will develop an invasive MRSA infection. Risk factors such as IV catheters, ventilation, recent surgery or being immunocompromised should be considered.
     
     Grade D
If a lactating mother is colonised or infected with MRSA at another site,

1. The mother can continue to breast-feed a healthy term baby in the community.
   
   **Grade C**

2. In other circumstances such as a baby admitted to a healthcare institution, clinical staff caring for the baby should be informed of the mother’s MRSA status as soon as possible. In the absence of mastitis, it is usual for a lactating mother to continue to breast feed her baby. Individual cases should be risk-assessed and discussed with the neonatologist and/or infection prevention and control team.
   
   **Grade D**

**Rationale**

Mothers with known MRSA carriage, with and without mastitis, can continue to breast-feed a healthy term baby in the community (20-21). Acquisition of MRSA by the infant is expected, but the vast majority of such acquisitions are not followed by infection, unless the baby is in the intensive care setting. For treatment of MRSA mastitis antibiotic therapy that is considered safe in lactation e.g. clindamycin, should be used if the organism is susceptible (22). Therapeutic options should be discussed with a clinical microbiologist or infectious disease physician. If susceptibility results necessitate prescribing an antibiotic which should not be used during lactation, the mother should be advised to express breast milk and discard for the duration of the treatment course. Breast milk has been associated with the transmission of MRSA to neonates in the NICU and subsequent infection (23-24). Mothers with known MRSA mastitis may be advised not to feed a baby in the NICU who is at risk of developing an invasive MRSA infection, until maternal symptoms have resolved and antibiotic therapy is complete. Individual cases should be discussed with the neonatologist, clinical microbiologist or infectious disease physician.

**2.4.3 MRSA screening in neonates**
**Recommendation**

- Neonates in high risk units should be screened for MRSA, similar to all high risk patients
  (on admission and weekly thereafter). Screening in neonates < 28 days old should include the umbilical site, in addition to other recommended sites.

**Grade B**

**Rationale**

Skin colonisation with *S. aureus* can occur within 24-48 hours of birth from contact with the skin of carers and the environment. Although MRSA is not endemic in most maternity and neonatal units in Ireland, vigilance is recommended because;

(a) MRSA is endemic in many other healthcare institutions in Ireland.

(b) Infants known to be colonised with MRSA are more likely to develop MRSA infection than those without colonisation (26% vs 2%) and therefore appropriate empiric antibiotic therapy should be commenced in MRSA colonised infants who develop signs of sepsis (15).

(c) Clinical MRSA isolates are indistinguishable from the colonising isolate in >90% of episodes in a NICU (15).

(d) *S. aureus* is the second most common cause of late-onset (>48-48 hours of age) sepsis in NICUs (25-26).

(e) MRSA-negative infants in a neonatal ICU are at increased risk of acquiring MRSA if a sibling (e.g. twin) is colonised or from other patients if they share nursing care (27)

MRSA screening should occur on admission and at least weekly thereafter in NICU, paediatric ICUs and in other high risk units. In neonates, as in older patients, the nares are the most important site of colonisation. Screening at multiple sites provides significantly improved sensitivity and specificity compared to one site. In neonates, the combination of nasal and umbilical sites achieves a sensitivity > 90% (25-28). A USA
consensus paper only recommends screening of the nares in neonates < 28 days (29). However, the paper states that many centres screen multiple sites including various combinations of the nares, throat, umbilicus, and rectum. Overall, the evidence favours inclusion of the umbilicus as a screening site in infants <28 days in addition to screening sites used for all other patients.

There have been reports of the emergence of community-associated Panton-Valentine Leukocidin-positive (PVL) MRSA in neonatal ICU’s in Ireland and the U.K. which may be associated with international transmission (30-31). Vigilance should be observed for MRSA cases associated with significant skin and soft tissue infection, severe pneumonia and also during an outbreak. Where appropriate, MRSA isolates should be typed including testing for PVL-MRSA.

### 2.5. Community-associated MRSA

With the emergence of CA-MRSA strains in healthcare settings and vice versa, the difficulty in distinguishing healthcare-associated and CA-MRSA based on case definitions and microbiological features, and the rapidly evolving molecular features of CA-MRSA, means it is difficult to define CA-MRSA based solely on demographic, clinical and epidemiological factors. However, for practical purposes a definition is required (1,2). The committee believes that CA-MRSA has the following characteristics:

1. The isolate must be confirmed as MRSA
2. Patients with CA-MRSA usually reside in the community as opposed to the healthcare environment and have no risk factors for the acquisition of MRSA.
3. CA-MRSA isolates are usually resistant to β-lactam antibiotics but are relatively susceptible to most other classes of antibiotics, compared to healthcare associated MRSA strains.
4. In many cases, a patient with CA-MRSA usually presents with skin and soft tissue infection. However, other clinical manifestations may present, e.g. pneumonia.
5. When typed, CA-MRSA is predominantly Staphylococcal Chromosomal Cassette (SCC) mec type IV or V.
2.5.1 Surveillance and screening

Recommendations

- Patients with CA-MRSA in the following categories should be reported to the Director of Public Health.
  
  **Grade D**
  
  1. Clusters/outbreaks of skin and soft tissue infection (SSTI).
  2. Cases with severe invasive disease or cases resulting in death.
  3. Cases in at-risk groups such as healthcare workers or those involved in gym or close contact sports.
  4. Cases in a closed community where there may be potential for onward transmission (e.g. prison, military camps, nursing home).

- Screening for CA-MRSA should only be considered in the following circumstances;
  
  **Grade D**
  
  1. To investigate clusters or an outbreak in a closed population, e.g. prison inmates
  2. Post-decolonisation screening is not recommended routinely for all cases but is advisable if;
    - the case is at high-risk of developing infection, e.g. indwelling device or immunocompromised
    - there is recurring infection in an index case or infection occurs in close contacts following two decolonisation courses
    - the case is a risk to others e.g. healthcare worker, household contact of a healthcare worker or a carer of at-risk people
  
  - There is no clear evidence on the optimal sites to screen for CA-MRSA in community settings. A minimum swab set should include:
    
  **Grade D**
  
  - Nostrils - (both anterior nares)
  - Throat
  - Skin lesions - discharging wounds/lesions, dry lesions or broken skin.
• Additional sites, i.e. perineum, axillae (armpits) and the umbilicus for neonates may be included after discussion with the Director of Public Health or the consultant microbiologist/ infectious disease physician.

Rationale

In Ireland there is no formal surveillance system to monitor CA-MRSA cases or SSTI clusters. However, some countries have such systems, e.g. in Switzerland, and in Western Australia (2,3). In England, the focus is specifically on Panton-Valentine leukocidin (PVL)-positive \textit{S. aureus} infection rather than CA-MRSA, especially in at-risk groups, i.e. health care worker, residential/care home staff, those involved in gyms or close contact sports such as wrestling and rugby, and cases in a closed community where there may be potential for onward transmission, e.g. prison, military camps, nursing home (4,5).

Neither PVL nor SCC\textit{mec} IV (clone associated with CA-MRSA in other countries) carriage can be used in Ireland as sole markers for CA-MRSA as a significant proportion of CA-MRSA strains are PVL negative (6,7). A CA-MRSA carriage rate of 0.57\% was reported in healthy Irish volunteers, all of whom were PVL negative and there was an association with sport (8). Although CA-MRSA is not currently endemic in Ireland, it is essential that cases are appropriately managed, the potential for ongoing spread is minimised, and that SSTI clusters, cases in high risk groups or cases in closed communities are reported to the director of Public Health.

Screening after attempted decolonisation evaluates the effectiveness of the decolonisation treatment. In general, with the exception of specific circumstances outlined above, screening is not routinely indicated in non outbreak settings. If the case has no active infections and/or negative screening results are achieved one and three months after decolonisation, then no further action is recommended in a community setting unless further infections occur.

2.5.2. Prevention

Recommendation

• Prevention of transmission of CA-MRSA requires the consistent application of good hygienic practices, i.e. standard precautions, with an emphasis on hand hygiene, not
sharing potentially contaminated personal articles (e.g. towels, razors, brushes, water bottles and clothing) and covering draining skin lesions to prevent direct or indirect contact with the infected secretions of another person. 

Grade C

Rationale
The aim of community control of CA-MRSA is to prevent spread from an infected/colonised individual to other persons in the family and in the community. Drainage from CA-MRSA infections, wound dressings and other materials contaminated with wound drainage are infectious and therefore should always be contained with clean dry dressings that completely cover lesions, i.e. adherence to standard precautions.

2.5.3 Diagnosis of suspected CA-MRSA infection

Recommendations

- CA-MRSA infection should be suspected in the following groups:
  
  Grade B
  
  1. Patients with SSTI such as furunculosis, impetigo and folliculitis (or other infections) that do not respond to empiric β-lactam antibiotic therapy, e.g. flucloxacillin
  2. Patients presenting with recurrent SSTI (two or more in six months)
  3. Clusters of SSTI within a household or social group
  4. Patients with rapidly progressive pneumonia – haemoptysis should be an alerting sign
  5. Patients with necrotising SSTI

- Microbiological culture of appropriate clinical specimens is the only way of detecting CA-MRSA cases and should be performed in the above patient groups. Appropriate specimens include:

  Grade D
  
  1. Fluid from a purulent lesion or abscess cavity
  2. Respiratory secretions (e.g., sputum, tracheal aspirations)
3. Blood cultures from a moderately or severely ill patient with signs and symptoms of systemic infection
4. Other specimens from a normally sterile site suspected to be a focus of infection (e.g., joint or bone)

- The routine collection of nasal specimens in patients presenting with possible CA-MRSA infection is not recommended. This does not make a diagnosis of infection as a positive result merely indicates the patient is colonised.

**Grade D**

**Rationale**

The diagnosis of CA-MRSA infection is frequently difficult as the infection often occurs sporadically in otherwise healthy people, including children or young adults, without identifiable risk factors. Exposure to one or more antibiotics in the past year and the use of quinolones or macrolides are potential treatment-related risk factors for CA-MRSA infection (9). As PVL-positive MSSA infection may present with a similar picture, microbiological culture is the only way of detecting CA-MRSA cases, and is particularly relevant in the patient groups described above.

**2.5.4. Treatment of confirmed CA-MRSA Infection (Table 3, Figure 1)**

**Recommendations**

- Incision and drainage should be considered and may be the only treatment required in mild SSTI. This is especially important for abscesses or necrotic infected tissue as antimicrobial agents poorly penetrate such sites.

  **Grade A**

- Local antibiotic susceptibility data should be used to guide treatment.

  **Grade C**

- Patients should be advised to seek prompt medical assessment if there is no improvement of the infection within 48 hours of treatment, the infection worsens,
systemic symptoms develop, or the infection recurs after initial treatment.

**Grade C**

- Non-severe CA-MRSA SSTI should be treated with doxycycline or co-trimoxazole if susceptible except where such infections occur in pregnant women or children less than 12 years of age (Table 3).

**Grade A**

- A glycopeptide is recommended for severe SSTI.

**Grade A**

- Alternatives for severe SSTI include linezolid, daptomycin or clindamycin.

**Grade B**

- Severe CA-MRSA causing SSTI or pneumonia with toxic shock or necrotising disease should be treated intravenously with a combination of linezolid and clindamycin with the addition of rifampicin if necessary.

**Grade D**

- Early surgical debridement should be carried out where possible in more severe cases of CA-MRSA SSTI.

**Grade D** The use of adjunctive therapy such as intravenous immunoglobulin (IVIG) may be considered in severe disease on the recommendation of a microbiologist or infectious diseases consultant.

**Grade D**

- Patients with CA-MRSA infection should be excluded where possible from participation in activities involving close skin-to-skin contact until the infection has cleared and any wounds have healed.

**Grade D**

**Rationale**

The management of confirmed CA-MRSA infection involves treatment of infection (drainage of abscess and antibiotic therapy), decolonisation of the index case, increased individual and
environmental hygiene, investigation of close contacts and notification of the case to the public health specialist if the case meets the criteria outlined earlier.

Patient education is a critical component of CA-MRSA case management. Patients and their carers/household members should be educated on methods to limit further spread within their household and among other close contacts with an emphasis on covering wounds at all times and hand washing.


Although there is no unequivocal evidence to support the combination of linezolid, clindamycin and rifampicin the high mortality (>60%) in necrotising pneumonia supports the use of this combination. Linezolid and clindamycin suppress PVL and alpha toxin production while rifampicin is added for *in-vitro* synergy to enhance the intracellular clearance of staphylococci. Serum levels of linezolid are reduced by rifampicin, therapeutic monitoring of linezolid levels should be considered to ensure effectiveness when this combination is used. Further details on the treatment of MRSA are outlined in section 2.8. Initial options for CA-MRSA are outlined in table 3 and figure 1.

There is a theoretical benefit in using IVIG in the management of severe CA-MRSA infection where toxins are involved. Clinical data is sparse and it is unlicensed for this indication but clinical improvement and a sustained fall in inflammatory markers have been noted in case reports. The UK Health Protection Agency (HPA) guidelines recommend that IVIG “should be considered” for patients with necrotising pneumonia as an addition to intensive-care support and high-dose antimicrobial therapy because it neutralises toxins and the expected benefits outweigh the risks in a condition with a mortality rate over 60%. The recommended dose is 2g/kg, repeated once after 48 hours if the patient has not responded (10). US guidelines on the treatment of MRSA infections do not routinely recommend IVIG as adjunctive therapy for the management of invasive MRSA disease. However, they do recognise that some experts may consider these agents in selected scenarios (11).

Table 3: Recommendations on antibiotic choices for the management of moderate CA-MRSA SSTI*
(Adapted from Guidelines for the management of community-associated methicillin resistant
*Staphylococcus aureus* clones in Western Australia for community settings
Government of Western Australia. Department of Health, WA Communicable Disease Control Directorate©

<table>
<thead>
<tr>
<th>Antibiotic (also confirm susceptibility)</th>
<th>Adult**</th>
<th>Pregnancy</th>
<th>Children</th>
<th>Infants &amp; neonates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clindamycin 1</td>
<td>450mg orally, 4 times daily x 7 days</td>
<td>450mg orally 4 times daily x 7 days</td>
<td>Check BNF</td>
<td></td>
</tr>
<tr>
<td>Trimethoprim/sulphamethoxazole 2</td>
<td>160+800mg orally twice daily x 7 days</td>
<td>Discuss with clinical microbiologist or infectious diseases physician</td>
<td>Check BNF</td>
<td>Discuss with a pediatrician, clinical microbiologist or infectious diseases physician</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>100mg orally twice daily x 7 days</td>
<td>Not recommended</td>
<td>Child over 12 years ONLY: Check BNF</td>
<td></td>
</tr>
<tr>
<td>Linezolid</td>
<td>Discuss with a clinical microbiologist or infectious diseases physician. Reserve for patients who are not able to take or tolerate the above regimens</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CA-MRSA RESISTANT to antibiotics above

* Or

Patient’s drug allergy or potential drug interaction precludes the use of antibiotics above

---

*BNF=British national Formulary

**If the patient requires treatment in hospital with intravenous therapy, please refer to Section 2.5.4 and Fig 1

** Doses refer to adults with normal renal and hepatic function

1 Clindamycin should NOT be used for MRSA isolates RESISTANT to erythromycin.

2 Trimethoprim-sulphamethoxazole is not recommended in infants and neonates under 6 weeks of age.

---

**Fig 1: Management of suspected CA-MRSA infection**

(Adapted from Guidelines for the management of community-associated methicillin resistant
*Staphylococcus aureus* clones in Western Australia. For community settings
Government of Western Australia. Department of Health, WA Communicable Disease Control Directorate©
2.5.5 Prevention of cross-infection & management of household and lower risk contacts

- Household contacts of an index case, i.e. those with frequent skin-to-skin contact, or those who share items in common with a patient with CA-MRSA infection, should be provided with an information leaflet. Others at less risk of acquisition should also be provided with an information leaflet as required.

- Clinicians should routinely ask about similar cases of SSTI in household members and other close contacts of an index case with CA-MRSA infection. If a potential cluster/outbreak of cases in a defined cohort is suspected, the Director of Public Health should be notified.

Grade D

Decolonisation for household contacts is outlined in section 2.6.3.3.1
The Centre for Disease Control (CDC) defines conditions promoting CA-MRSA spread as the “5 C’s”:

i. Contact - Frequent skin
ii. Compromised skin – i.e. cuts and abrasions, skin infections
iii. Contaminated items and surfaces
iv. Crowding
v. Cleanliness – lack of

A sixth C, antimicrobial use (Capsules) has also been proposed (11). Cases and household contacts should be provided with an information leaflet (link to be included) which explains how to prevent cross infection. Good hygiene and frequent hand washing should be promoted. All wounds, cuts and abrasions on all persons should be covered with an impermeable dressing. Sharing of personal items should be discouraged e.g. towels, lotions, uniforms, clothing. Commonly used surfaces, items and equipment should be cleaned regularly with detergent and water. All persons should be excluded from participation in group activities if they have infected wounds that are draining and cannot be adequately covered or contained. Decolonisation of cases and contacts is outlined in sections 2.6.3.3.1 and 2.6.3.3.2.

2.6. Eradication of MRSA carriage (decolonisation)

2.6.1 Justification for decolonisation

Recommendations

- MRSA decolonisation is not sufficiently effective to warrant routine use in all colonised patients.

  Grade A

- Excessive use of mupirocin, should be avoided as this will select for resistance.

  Grade B
• Decolonisation may be considered in certain cases but the likely success or impact of such therapy should be risk assessed to evaluate the aim, the required agents and whether it is likely to be successful.

**Grade C**

• An attempt at decolonisation may be considered in the following groups

1. Patients colonised with MRSA who are due to undergo an elective operative procedure especially high risk surgery e.g. cardiothoracic surgery, orthopaedic implant.
2. Patients in a clinical area where there is a high risk of colonisation leading to invasive infection, e.g. the ICU/NNU.
3. If the risk of infection is high and the consequences severe e.g. immunosuppressed patients.
4. As part of a strategy to address uncontrolled transmission despite the use of other measures.

**Grade C**

• In patients with colonisation at non-nasal sites there is a high possibility that decolonisation therapy will fail. Therefore use, in such populations, should be carefully considered and the aim and likely outcome taken into account before such therapy is initiated.

**Grade C**

• Attempts at decolonisation are unlikely to be successful in patients with chronic skin conditions, ulcers, indwelling urinary catheters and therefore use in such populations should be carefully considered and the aim and likely outcome taken into account before such therapy is initiated.

**Grade C**

**Rationale**

68
Decolonisation of MRSA refers to the use of either topical and or systemic agents for the purpose of eradicating carriage. Such a strategy may be used in an attempt to prevent the spread of the organism or to reduce the risk infection in the individual patient carrying MRSA. Decolonization is also used in patients colonised with methicillin-susceptible Staphylococcus aureus (MSSA), however the aim in such cases is to reduce the risk of infection in the colonised patient.

The optimal strategy for controlling MRSA infection remains unclear. A Cochrane systematic review in 2003 concluded that there was insufficient evidence to support use of topical or systemic antimicrobial therapy for eradicating nasal or extra-nasal MRSA (1). There was no demonstrated superiority of either topical or systemic therapy, or of combinations of these agents and they also concluded that potentially serious adverse events with the development of antimicrobial resistance can result from therapy.

However, a Cochrane review in 2008 suggested a benefit to the screening and decolonisation of patients at high risk of MSSA infection e.g. cardiac surgery, implant surgery (2). A subgroup analysis showed a pronounced effect on surgical patients and patients undergoing dialysis, confirming previous findings in relation to dialysis patients. In a more recent study from the Netherlands a reduction in S. aureus hospital acquired surgical site infection was found by the use of rapid screening and decolonization of S. aureus carriers on admission (3). The rate of S. aureus infection was 3.4% (17 of 504 patients) in the mupirocin-chlorhexidine group compared with 7.7% (32 of 413 patients) in the placebo group (relative risk of infection, 0.42; 95% confidence interval [CI], 0.23 to 0.75). The effect was most pronounced for deep surgical-site infections (relative risk, 0.21; 95% CI, 0.07 to 0.62). The length of hospital stay was also shortened. Although showing benefits for patients with MSSA, and not MRSA due to the relative absence of MRSA in that country, it is plausible that the same result would have occurred had MRSA been endemic.

Factors that appear to affect the efficacy of available strategies include whether MRSA is endemic in the institution, the presence of mupirocin resistance, the number of patient sites colonised with MRSA, in particular throat colonisation, the presence of wounds, extensive skin lesions, whether the gastrointestinal is colonised and the presence of foreign bodies such as urinary catheters, percutaneous endoscopic gastrostomy (PEG) tubes, haemodialysis lines, etc. In such cases the risk of failure is higher.
A number of studies have shown that short term decolonization can be achieved and that this can be beneficial. An observational study of mupirocin and chlorhexidine baths in an intensive care unit by Sandri et al found a significant reduction in the incidence of MRSA nosocomial infection (4). Ridenour, after an intervention utilizing nasal mupirocin and chlorhexidine baths, also found a significant 52% decrease in colonization/infection; all MRSA isolates remained susceptible to chlorhexidine and the overall rate of mupirocin resistance was low (4.4%) (5).

Other studies however, despite achieving short term decolonisation, have not demonstrated an impact on infection rates. Robicsek et al, in a retrospective cohort study, found that the use of mupirocin did not affect the risk of infection although there was a trend towards delayed infection in the treated patients (6).

The possible role of decolonisation in the reduction of MRSA rates in both Scotland and the UK has recently been reviewed (7,8). The authors conclude that the evidence is incomplete but it is possible that the widespread use of decolonization has contributed to the significant reductions in MRSA BSI observed in recent years. However, in high risk groups e.g. haemodialysis, although decolonisation may be effective in the short term, there are data to demonstrate that the risk of recolonisation is high and more recent data support that this is still the case and many questions remain unanswered (9,10).

Apart from the role of decolonization in the endemic setting such as in most acute Irish hospitals, decolonization has also been used as an adjunct to other control transmission in a medical surgical intensive care unit after the initiation of decolonisation therapy for all colonised patients (11).

Although questions regarding MRSA decolonisation still exist, it is now generally accepted that treatment of proven carriers reduces the risk of infection in patients undergoing surgical procedures and in other high risk groups. Most experts agree that MRSA decolonisation is not sufficiently effective to warrant routine use in all colonised patients and that excessive use of nasal decolonisation agents should be avoided as this will select for resistance (12,13,14). There is also a consensus that more studies are needed both in terms of the benefit to the patient from MRSA decolonisation and also the role that decolonising therapy might play in the control of MRSA transmission and outbreak control measures within institutions (15,16).
2.6.2 Decolonisation protocols

Recommendations

- The following decolonisation protocol is recommended:

  A. Apply a small amount of 2% mupirocin in paraffin base (with cotton swab or gloved tip of little finger) to the inner surface of each nostril (anterior nares) three times daily for five days. Apply enough to cover the inner surface.

  B. Pinch the distal end of nose gently after application, the patient should be able to taste mupirocin at the back of the throat a minute or so later. Other agents that may be considered include naseptin (0.5% neomycin + 0.1% chlorhexidine), chlorhexidine cream, bacitracin, or povidone iodine ointment although data on their use is lacking and suggest that they are less effective than mupirocin.

  C. Patients should bathe daily for five days with an antiseptic detergent, if the patient’s skin condition allows. Agents such as 4% chlorhexidine, 7.5% povidone-iodine, 2% triclosan or octenidine dihydrochloride (0.1%) can be used. There are also data demonstrating the effectiveness of tea tree oil for skin carriage.

  D. Antiseptic detergents should be used as per manufacturer's instruction with appropriate contact times. The skin should be moistened and the antiseptic-detergent applied thoroughly to all areas before rinsing in the bath or shower. Special attention should be paid to known possible carriage sites including axilla, groin, perineum and buttock area. The antiseptic detergent should also be used for all other washing procedures and for bed bathing.

  E. Daily application of 1% chlorhexidine powder to axillae and groins following body washing may be considered.

  F. Hair should be washed twice weekly with an antiseptic detergent.

  G. The value of local treatment for throat carriage such as antiseptic gargles or sprays is uncertain, but may reduce the organism load.

  H. During a course of treatment, clean clothing, bedding, towels and flannel should be provided, in addition to regular changes of clothing, bed linen etc.

  Grade
  C
Combined topical and oral antimicrobial therapy may be considered, under the supervision of a clinical microbiologist or an infectious disease physician, for the eradication of MRSA in certain patient groups e.g. extranasal sites of colonisation and about to undergo high risk surgery. If eradication of throat carriage is required, rifampicin and fusidic acid, or trimethoprim combined with either rifampicin or fusidic acid, according to susceptibility results, may be given for 5 to 7 days. The potential for drug interactions and drug toxicity should be considered. Liver function tests should be monitored.

**Grade C**

**Rationale**

In the case of the decolonisation regimen, the optimal regimen remains unclear and the length of treatment has varied from 5 to 14 days and the agents used have also varied. In 2009, Ammerlaan et al reported a systematic review to determine the effectiveness of different approaches for eradicating methicillin-resistant *Staphylococcus aureus* carriage (17). Twenty-three clinical trials were selected. Seven evaluated oral antibiotics, 12 trials evaluated topically applied antibiotics and 4 trials both. Subgroup analysis of studies with similar study populations was performed because of the clinical heterogeneity of the trials selected. They found that short-term nasal application of mupirocin was the most effective treatment for eradicating methicillin-resistant *S. aureus* carriage, with an estimated success rate of 90% one week after treatment and approximately 60% after a longer follow-up period. The development of drug resistance during treatment was reported in 1% and 9% of patients receiving mupirocin and oral antibiotics, respectively.

In terms of topical agents mupirocin is well established as the most effective topical agent for the removal of staphylococci from the anterior nares (18-20). Data have shown that initial clearance following mupirocin use is high but recolonization after three months is also high. There are now data available on a number of other agents including povidone-iodine cream, tea tree oil, and extract of green tea but further studies are needed to determine the potential of these products. Topical 4% chlorhexidine bodywash/shampoo or 7.5% povidone iodine are equally efficacious for decolonisation of non-nasal sites. A review of the use of octenidine hydrochloride was also recently published (21).
Resistance has been associated with the increased use of mupirocin and high level mupirocin resistance has been associated with decolonisation failure (22). The clinical significance of low level resistance remains unclear. A recent review has recommended that laboratories should ensure that appropriate methods are in place to detect such resistance and to monitor the impact of mupirocin use (23,24).

Full body decolonization is recommended, irrespective of which site or sites are colonized to maximize prevention and control measures. Eradication of carriage of MRSA, from sites other than the nose, is associated with a higher failure rate (25,26). In patients with MRSA in non-nasal sites, e.g. wounds higher success rates have been achieved when topical decolonisation is either accompanied by or followed by the use of a systemic agent. Although such a strategy can be useful if appropriately used e.g. if one is trying to achieve short term decolonisation for a procedure or during hospitalisation, the risks of resistance and adverse events need to be considered.

Chlorhexidine is now being used in many centres for an increasing number of indications including MRSA decolonisation, universal patient bathing in ICU, oropharyngeal antisepsis in ventilated patients and as part of the routine care of vascular catheter sites. In two studies, one a multi-centre study in six ICUs and the other in four general medicine units, the use of chlorhexidine bathing compared with soap and water resulted in reduced infections and colonisation with MRSA and vancomycin-resistant enterococci (27,28). Further work is required to determine if the widespread use of chlorhexidine to reduce HCAI and MRSA colonisation is indicated or should be confined to high risk areas such as ICU. Chlorhexidine resistant MRSA strains have been described but the significance and the likely clinical impact is poorly understood (29). The use of chlorhexidine baths in ICU may be a reasonable alternative to the use of mupirocin or systemic agents given the adverse events associated with their use.

It is generally agreed that prolonged repeated courses of decolonisation regimens are not likely to be effective and may lead to the development of resistance to some topical disinfectants, antiseptics and antibiotics, or may result in side effects for the patient. A suggested approach on how to decide to decolonize or not is outlined in figure 3.
Figure 3: Flow chart for the management of meticillin resistant *Staphylococcus aureus* (MRSA)

**Purpose:** To provide guidelines for staff on the care and management of patients who have MRSA

**Known MRSA Patients**

- Explain to patient.
- Isolate in a single room utilising Contact Isolation Precautions.

**High Risk Patients Requiring Screening e.g.**

- Admitted from another healthcare organization, abroad.
- People with indwelling devices e.g. supra-pubic catheter
- Long-term debilitated patients, ulcers etc

**MRSA Positive**

- Risk assess the patient in conjunction with the IPC CNM/Consultant Microbiologist.
- Discuss therapeutic options with the patient

**MRSA Negative**

- No follow-up necessary

**Treatment Depends On:**

- Patients age, condition and clinical status
- Presence of wounds/broken skin
- Presence of indwelling devices
- Whether the patient is Infected or colonized?
- Location of the MRSA e.g. presence of throat colonization
- Whether patient likely to return to residential unit e.g. nursing home
- Is Surgical Intervention planned
- Is the patient in a high risk area

**Patient for Decolonization /Treatment**

- Topical Treatment:
  - Apply Mupirocin 2% (Bactroban®) nasal ointment to both nostrils TDS for 5 days
  - Wash with Chlorhexidine Gluconate 4% (Hydrex®) daily for 5 days, washing the hair with this solution on day 2 and day 5.
  - Depending on the location of colonisation CX powder may be recommended to be applied to the skin after washing e.g. axilla or groin area.
  - Consider a mouth wash if throat colonisation
  - All treatment must be continued immediately and discussed with the IPCT.
  - Re-screen Patient 48hrs after the
2.6.3 Decolonisation in special groups

2.6.3.1 Decolonisation of patients in non-acute healthcare facilities

Recommendations

- Non-acute healthcare facilities should seek expert advice before embarking on decolonisation for MRSA
  
  Grade C

- MRSA carriers will not normally require decolonisation following discharge from an acute hospital to a non-acute healthcare setting, the community or home.
  
  Grade B

- If decolonisation treatment has been commenced prior to discharge it should be completed.
  
  Grade B

- The need for decolonisation after discharge should be decided on by the patients’ consultant in conjunction with the hospital infection prevention and control team. Decolonisation may be required in certain circumstances e.g. pre-operatively on the advice of the admitting physician/surgeon where a patient is to be readmitted for further treatment.
  
  Grade D

---

**MRSA Positive**

- Discuss with the IPC CNM

**MRSA Negative**

- Contact the IPC CNM
- Before Isolation Precautions are discontinued the patient must have 3 consecutive negative MRSA body screens.
- Do not discontinue Isolation Precautions unless advised to do so by the IPCN CNM or the Consultant Microbiologist.
• The need for decolonisation treatment must be communicated to the non-acute healthcare facility, and general practitioner on discharge.  

  **Grade D**

**Rationale**

The effectiveness of decolonisation with nasal mupirocin has not been demonstrated in the non-acute healthcare setting. A high rate of recolonisation has been reported in a study examining the use of mupirocin for decolonisation of *S. aureus* in residents of two long term care facilities. At 90 days post treatment, 39% of residents were recolonised with MSSA (28). Also prolonged use and multiple courses of mupirocin have been associated with the development of mupirocin resistance and prolonged or repeated courses are to be avoided in long stay patients (29).

### 2.6.3.2 MRSA decolonisation in neonates

**Recommendations**

- Decolonisation of infants outside of high risk units is not usually required, unless recommended by the infection prevention and control team.  
  **Grade D**

- For infants in the NICU and other high risk units, nasal mupirocin is recommended for decolonisation if the MRSA isolate is susceptible.  
  **Grade D**

- If the neonate is >26 weeks gestation strongly consider gentle skin bathing with octenidine dihydrochloride.  
  **Grade D**

- 1% chlorhexidine powder may be used on the umbilical and nappy area.  
  **Grade D**

- Chlorhexidine 4% disinfectant should not be used on the skin of premature infants, on account of the risk of burns and dermatitis.  
  **Grade C**
Rationale

MRSA sepsis in the paediatric population is uncommon. The incidence of MRSA BSI in Irish children <16 years is 1.1 per 100,000 child population (30).

Neonates who are MRSA positive and in a high risk unit (e.g. NICU, special care baby unit, paediatric ICU, haematology-oncology unit, cardiothoracic surgery, neurosurgery, transplant) or pre-elective surgery, should be decolonised. Clinical MRSA isolates are indistinguishable from the colonising isolate in >90% of episodes in a NICU (31). Decolonisation may reduce the subsequent infection rate and may reduce transmission within the NICU.

There is evidence that mupiricin has been used for many years in neonatal units without cause for concern. In a US National survey of MRSA eradication in NICU’s, 100% of respondents who attempted to decolonise MRSA carriers used topical mupiricin (32). The use of octenidine dihydrochloride baths (especially if >28 weeks corrected gestation) can be considered as well as the use of 1% chlorhexidine powder on the groin and umbilical area. Topical 4% chlorhexidine wash is not recommended for premature infants, as it may cause dermatitis or burns.

2.6.3.3.1 Decolonisation of cases of CA-MRSA

Recommendations

- Decolonisation is recommended for all index colonised/infected CA-MRSA cases once any infection has cleared and wounds are healed or almost healed and is outlined in fig 1, section 2.5.4.  
  Grade D
- Decolonisation is unlikely to be successful and is not recommended where there are open wounds or permanent indwelling devices in-situ. Decolonisation should not be commenced in patients with active exfoliative skin conditions, until the underlying condition is treated first in consultation with a dermatologist.
  Grade D
Rationale

Current North American guidelines do not recommend decolonisation of cases nor contact tracing of CA-MRSA cases. (33,34). Decolonisation is recommended only in certain situations such as multiple (two or more cases within six months) recurrences of MRSA infection, ongoing transmission in a well-defined, closely-associated cohort such as a household, and only after documenting that reinforcement of standard preventative measures has been unsuccessful. In contrast many European countries and Australia have taken a different approach recommending decolonisation and contact tracing albeit with different strategies (See section 2.5). The difference in prevalence of CA-MRSA between countries could support the differing approaches, i.e. CA-MRSA is very prevalent in North America. The evidence base to support decolonisation is poor. Decolonisation has been recently shown to be effective in settings with sporadic CA-MRSA infections (34). CA-MRSA is not endemic in Ireland at present and therefore a similar approach as taken in other European countries in terms of decolonisation is recommended (Fig 4).

Decolonisation is recommended for all index infected CA-MRSA cases, especially if in a close community or if severe disease to reduce the risk of recurrent CA-MRSA infections and transmission. Decolonisation of cases should only commence once any infection has cleared and wounds are healed or almost healed. Standard precautions, e.g. environmental cleanliness, are important in reducing the potential risk of recolonisation from the environment.

Fig 4: Algorithm for decolonisation of confirmed CA-MRSA infection

2.6.3.3.2 Decolonisation of Contacts

**Recommendations**

- Screening and decolonisation is not routinely recommended for lower-risk contacts unless transmission is identified i.e. at least one other case is identified in that group of contacts.

**Grade D**

- Decolonisation is recommended for household contacts with:
  - A history of recurrent SSTI (two or more in the last six months)
  - Ongoing spread within the household
  - Increased risk for infection, e.g. immunocompromised individuals such as those on cancer chemotherapy

**Grade D**

**Rationale**

The approach to management of contacts differs significantly from country to country in the absence of hard scientific data and or clinical trials. There is little information concerning the effectiveness of decolonisation in the community and an evidence-base to support
recommendations is lacking. Guidelines on defining contacts and their risk of CA-MRSA acquisition are outlined in Table 4.

**Table 4: Definition of contacts of CA-MRSA index cases**

<table>
<thead>
<tr>
<th>Definition</th>
<th>CA-MRSA contact</th>
<th>Higher-risk (household) contacts</th>
<th>Lower-risk contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CA-MRSA contact</strong></td>
<td>People with frequent close skin-skin contact with an MRSA index case and/or share items that come in close contact with the skin of the index case.</td>
<td>Persons who regularly live in the same household as the index case and therefore have frequent close skin contact or are likely to share items that come in close contact with the skin of the index case. This includes dormitory room contacts, group homes etc. where people live together.</td>
<td>Closely-associated cohorts outside of a single household. These groups include day-care centres or contact sports teams (football, wrestling) where there is close skin-skin contact (especially with skin abrasions), sharing of personal hygiene items (e.g. towels) or shared surfaces or items that come into contact with skin (e.g. equipment).</td>
</tr>
</tbody>
</table>

Household transmission of CA-MRSA is commonly reported. As discussed above, decolonisation of cases should only commence once any infection has cleared and wounds are healed or almost healed. If decolonisation is indicated for cases and household contacts, the treatment for that household should commence simultaneously. If a contact requiring decolonisation has any pre-existing dermatological conditions this should be discussed with a dermatologist prior to starting the course of treatment. Contacts should be provided with information about measures to prevent the spread of CA-MRSA (http://www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/EuropeanAntimicrobialResistanceSurveillanceSystemEARSS/ReferenceandEducationalResourceMaterial/SaureusMRSA/Factsheets/).

Lower-risk contact groups, e.g. those attending the same day-care centre, (Table 4), should be identified and provided with information. Screening and decolonisation is not routinely recommended for lower-risk contacts unless transmission is identified i.e. at least one other case is identified in that group of contacts. Key staff from a group (e.g. home) should be informed when a CA-MRSA carrier is identified in the group, maintaining confidentiality of the person’s details, and providing information to prevent spread or dissemination to members. Enquiries should be made about any other cases of SSTIs that may have been
noted. The group should be instructed to report any further infections arising to the local public health specialist. If there is suspicion of spread of CA-MRSA infections in a group, the public health specialist will assess potential risk, and the practicalities of screening and decolonisation, to determine action.

2.6.3.3.3 Follow-up after decolonisation of CA-MRSA

Recommendations

- Patients with CA-MRSA infection should be instructed to seek medical assessment if infections recur.
  
  Grade D

- Screening after decolonisation is not recommended unless:
  1. The case is at high-risk from infection, e.g. on cancer chemotherapy
  2. Infections are recurring in cases or close contacts following decolonisation
  3. The case is a risk to others e.g. healthcare worker, household contact of a healthcare worker, or a carer of high-risk people.

  Grade D

- The decolonisation regimen should be repeated if decolonisation fails after the first course of treatment and after assessing the patient and rectifying any obvious reasons for decolonisation failure, e.g. underlying skin condition.

  Grade D

Rationale

Decolonisation should not be commenced in patients with active exfoliative skin conditions, such as psoriasis, as it is likely to fail and the skin treatments may exacerbate their condition. The underlying condition should be treated first in consultation with a dermatologist. In the case of failure following a second course of treatment, the advice of a microbiologist, infectious diseases physician and dermatologist (as indicated) should be sought.

Pets colonised with MRSA have been implicated in ongoing household transmission (35-39). Treatment of pets is not indicated and colonisation tends to be short-term. Therefore, investigations and interventions with pets should occur only in exceptional circumstances
where the household is at risk and following reinforcement of hygiene measures. Consultation with a veterinarian, in addition to a clinical microbiologist/infectious disease physician and public health specialist, is recommended. Leaflets on the HPSC website provide

- Information for people and their close contacts, who have been informed they have CA-MRSA.
- Information for groups when there is a case of CA-MRSA e.g. sports teams, day care
- Infection prevention and control recommendations for CA-MRSA in primary care settings – reducing the risk of transmission.
- Information for day-care centres and schools

### 2.7 Role of antimicrobial stewardship in the prevention and control of MRSA

#### 2.7.1 Antimicrobial use in the acute hospital setting

**Recommendations**

- Unnecessary or prolonged antibiotic use, particularly of broad-spectrum agents, should be avoided.
  
  **Grade A**

- Healthcare institutions should implement the recommendations included in the SARI Guidelines for Antimicrobial Stewardship in Hospitals in Ireland issued in 2009 (www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/InfectionControlandHAI/Guidelines/)
  
  **Grade B**

- Healthcare institutions should implement the Centre for Disease Control and Prevention (CDC) HICPAC recommendations (1995) on the prudent use of glycopeptide antibiotics

**Grade B**
Rationale

Antibiotic use promotes the spread of existing strains of MRSA through reduction in colonisation resistance in individual patients and by negative ecological effects on MRSA acquisition, persistence and transmission, giving such resistant strains a survival advantage in the hospital environment (1,2).

MRSA prevalence in hospitals has been linked to overall levels of antibiotic consumption and to consumption of specific antibiotic classes, most notably fluoroquinolones, cephalosporins, amoxicillin/clavulanate and macrolides (3-6). A systematic review and meta-analysis found that antibiotic exposure in individual patients was associated with a 1.8-fold increase in the risk of subsequent acquisition of MRSA, and that the relative risk was higher for specific antibiotic classes, i.e. fluoroquinolones 3; glycopeptides 2.9; cephalosporins 2.2; and other beta-lactams 1.9 (7). Antibiotic exposure has been identified as a risk factor for carriage of community-acquired CA-MRSA strains (8).

Antibiotic stewardship programmes are strongly associated with a reduction in MRSA colonisation and infection rates, particularly after reduction in beta-lactam and/or quinolone use (2,9-12). More emphasis needs to be put on antibiotic stewardship to control MRSA (9). Please refer to the 2009 SARI antibiotic stewardship guidelines for further details http://www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/StrategyforthecontrolofAntimicrobialResistanceinIrelandSARI/KeyDocuments/File,4116,en.pdf.

There is also greater interest in the social and behavioural aspects of antibiotic resistance and antibiotic prescribing. Recent studies and reviews have highlighted the cultural, contextual and behavioural aspects that need to be explored further, i.e. differences within and between countries (13,14).

Colonisation or infection with glycopeptide-intermediate and glycopeptide-resistant Staphylococcus aureus (GISA and GRSA) is strongly associated with prolonged exposure to glycopeptides and prior colonisation or infection with MRSA. Promotion of prudent glycopeptide use has been shown to reduce the prevalence of vancomycin-resistant enterococci (VRE) in intensive care units and it follows that prudent glycopeptide use should
also be promoted to prevent glycopeptide resistance in staphylococci (15). See also section 2.11.

2.7.2 Antimicrobial use in long term care facilities

Recommendations

• Antibiotic stewardship programmes should be implemented for long term care facilities.
  
  Grade B
• When antibiotics are prescribed to treat MRSA, local advice should be sought from the consultant microbiologist or infectious diseases physician.
  
  Grade D
• The use of antibiotics associated with MRSA selection or resistance should be avoided or minimised as much as possible. These include cephalosporins, macrolides and fluoroquinolones.
  
  Grade B
• Topical therapy for superficial MRSA skin infections should not be used without advice from a consultant microbiologist or an infectious diseases physician.
  
  Grade D

Rationale

The development of antibiotic resistant organisms has been strongly associated with antibiotic use. Prudent antimicrobial use is important in the prevention and control of MRSA (16).

Infection prevention and control measures, antibiotic restrictions and appropriate therapy for infection were successful in controlling an outbreak of community acquired MRSA in a residential setting for adults with developmental disabilities. No host risk factors were identified for the acquisition of MRSA. However, excessive antibiotic use was observed in the facility affected (17).

As in the acute hospital sector challenges remain in the successful implementation of antibiotic stewardship programmes. These include inadequate numbers of personnel with the necessary background and training and a belief amongst the public and some healthcare
professionals that more antibiotics are being developed that will address antibiotic resistance. Also, there is the dilemma for the individual prescriber between doing what is best for the individual patient, e.g. using a broad-spectrum agent or using multiple antibiotics in iller patient and acknowledging the need to contribute to reducing the pressure on antibiotic resistance in the wider health community. This can be partly addressed by public health campaigns explaining to the wider public the issues relating to antibiotic resistance and the feeding back of prescribing data to prescribers so that they can see how they compare with equivalent colleagues. In addition, the provision of greater financial details about costs associated with prescribing, especially when this is linked with accountability through clinical directorates in acute hospitals and community care units will drive changes in lower rates of antibiotic use.

2.8 Management of MRSA including treatment and prophylaxis

Please note in the section below that the guidelines refer to the hospital management, including antibiotic treatment of HA- and CA-MRSA (please also refer to Section 2.5) but that no evaluation or assessment has been made of the pharmacoeconomic implications of the recommendations which are outside the scope of these guidelines. In the case of complicated infections or of infections that fail to resolve with first line agents, expert advice from clinical microbiology, infectious diseases and antimicrobial pharmacists should be obtained.

Much of the advice that follows has been derived from other treatment guidelines, consensus among the working group and some clinical trials. While new agents have become available in the last decade, e.g. linezolid and daptomycin, the original trials, as required by regulatory agencies were designed to show non-inferiority with recognised agents such as vancomycin and not superiority. Consequently, there is a need for larger, multi-centre trials to determine if newer alternatives are superior in key areas, e.g. BSI. While there has been increased emphasis on improving prescribing in Ireland in the last decade the limited access to clinical microbiology, infectious diseases or antimicrobial pharmacist expertise is a significant barrier to the effective implementation of this section in some areas. The wider availability of advice from such sources together with education at local and national level can optimise the treatment of MRSA infections.
2.8.1 Initial approach before treatment

Recommendations

- Healthcare associated MRSA (HA-MRSA) infection should be considered in any patient exhibiting signs and symptoms of infection and who is known to have been previously infected or colonised with MRSA or to have risk factors for same.
  
  **Grade A**

- In patients with MRSA BSI, a thorough history and examination is necessary with appropriate investigations, e.g. echocardiogram, to identify the underlying source of infection.
  
  **Grade C**

- Serious consideration should be given to the removal where feasible of *in-situ* devices/prosthetic material such as intravascular catheters, infected pacemakers, shunts, prosthetic joints and valves.
  
  **Grade C**

- Patients with SSTI due to MRSA, and especially if severe or due to CA-MRSA may require surgical incision, drainage, and antibiotics. Patients with localised CA-MRSA SSTI infection may be cured with surgical drainage alone.
  
  **Grade B**

- Pus should be drained surgically or under imaging control and where possible necrotic material should be removed and sent for culture and antibiotic susceptibility testing.
  
  **Grade B**

- It is essential to involve the appropriate specialists, e.g. surgeon, particularly when deeper foci of infection are identified and where intervention is likely to be required such as drainage of a deep-seated abscess/removal of a prosthetic joint.
  
  **Grade C**
Rationale

MRSA is increasingly implicated as a cause of infection in hospital and the community and there is a high incidence of subsequent MRSA infection in patients currently or previously colonised or infected with MRSA (1). Risk factors for the acquisition of MRSA infection include previous hospitalisation, admission to an intensive care unit, prolonged hospital stay, proximity to another patient with MRSA, older age, invasive procedures, the presence of wounds or skin lesions, and prior antimicrobial therapy (2).

In suspected MRSA infection, appropriate samples e.g. pus, exudates and sputum should be obtained before starting treatment whenever possible. In particular, surgical intervention where required, reduces the bioburden and provides optimal specimens i.e. pus/tissue rather than swabs. Microbiological yield is improved substantially if specimens are taken prior to antibiotic therapy (3,4). MRSA isolated from a normally sterile site should always be regarded as significant e.g. blood, cerebrospinal fluid, joint aspirate and intra-operative tissue specimens. In adults, to investigate a source, transoesophageal echocardiography (TOE) is preferred to transthoracic echocardiography (TTE) (3). When MRSA is isolated from blood, an underlying focus of infection should always be sought from other sources, e.g. intravascular device, vascular graft, heart valve, portal shunt etc (5).

MRSA is difficult to eradicate with prosthetic devices in place and their retention may also encourage the selection of more resistant strains. If the focus is not removed or is irremovable, the chances of successful antimicrobial therapy are small. Surgical debridement may be required in some soft tissue infections (5).

A recent review of the clinical management of S. aureus BSI, the conclusion from which could apply to MRSA and other invasive infections, was that many issues remain unanswered but there is strong evidence that infective foci should be removed and prolonged treatment is required for persistent BSI or a deep, irremovable focus of infection (6).

2.8.2 Choice of antimicrobial agents

Recommendations

- For patients with suspected serious/life-threatening MRSA infection, timely empiric intravenous therapy with a glycopeptide is the recommended treatment. It is safer to
commence treatment with an antibiotic with activity against MRSA, with subsequent step-down to a beta-lactam, if the isolate is methicillin-susceptible unless the proportion of hospital acquired and community acquired MRSA infection is low as established by local surveillance.

**Grade C**

- Intravenous therapy is required in the initial management of patients with BSI and in patients with serious MRSA infection requiring hospitalisation.

**Grade A**

- Vancomycin trough concentrations should be monitored and advice sought as required regarding dosing modification. Adequate doses of glycopeptides and other agents must be used when treating MRSA infections.

**Grade D**

- Teicoplanin, instead of vancomycin, may be considered in patients with significant renal impairment or in those at high risk of deterioration in renal function. Specialist advice should be sought regarding the indications for teicoplanin therapeutic drug monitoring.

**Grade A**

- For severe SSTIs, when patients are initially treated with IV antibiotics effective against MRSA, it may be possible to step down to oral treatment with doxycycline, clindamycin, linezolid or co-trimoxazole, after an initial clinical response, based on results of susceptibility tests, following discussion with a consultant microbiologist or infectious diseases physician.

**Grade D**

- Topical therapy for superficial MRSA infections should not be used without advice from a consultant microbiologist or an infectious diseases physician.

**Grade D**

- The use of antibiotics associated with MRSA selection or resistance should be avoided or minimised as much as possible. These include cephalosporins, macrolides and fluoroquinolones.
Rationale

There are few clinical trials to determine the optimal antimicrobial therapy for MRSA infections, and even fewer specifically for CA-MRSA. In many studies, vancomycin is the “gold standard” against which other agents are compared (7,8). Alternative agents should be considered if a glycopeptide is not suitable e.g. due to adverse reactions, or if the infection is due to an organism with reduced susceptibility to vancomycin (4,5,7,8). Delays in the administration of appropriate therapy are associated with poorer outcomes (9).

Co-trimoxazole is not licensed for staphylococcal infections, but it has become an important option as 95 to 100% of CA-MRSA strains are susceptible to this agent (3). Advice recommending restricted use of co-trimoxazole pre-dates the emergence of CA-MRSA (10). Table 5 summarises treatment recommendations for MRSA infection in adults in hospital.

Table 5: Treatment recommendations for MRSA infections in adults

<table>
<thead>
<tr>
<th>Indication</th>
<th>First line agent</th>
<th>Alternative</th>
<th>Comments</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-severe MRSA SSTI</td>
<td>Doxycycline PO 100mg every 12 hours OR co-trimoxazole PO 960mg every 12 hours</td>
<td>Clindamycin¹ PO 450mg every 6 hours</td>
<td>May consider linezolid PO 600mg every 12 hours (expert advice required)</td>
<td>5 to 10 days</td>
</tr>
<tr>
<td>Non-severe MRSA SSTI</td>
<td>Clindamycin PO 450mg every 6 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe or complicated MRSA SSTI</td>
<td>Glycopeptide IV (see text for dose)</td>
<td>Linezolid PO/IV 600mg every 12 hours (expert advice required) OR daptomycin IV 4mg/kg every 24 hours</td>
<td>May consider clindamycin¹ PO 450mg every 6 hours OR IV 600mg to 1.2g every 6 to 8 hours</td>
<td>7 to 14 days</td>
</tr>
<tr>
<td>SSTI with toxic shock, necrotising fasciitis, purpura fulminans or suspected PVL positive isolate</td>
<td>Linezolid IV 600mg every 12 hours PLUS clindamycin¹ IV 1.2g every 6 hours +/- rifampicin² PO/IV 600mg every 12 hours</td>
<td></td>
<td>Consider IVIG</td>
<td>10 to 14 days</td>
</tr>
<tr>
<td>Condition</td>
<td>Treatment</td>
<td>Duration</td>
<td>Note</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
<td>------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>IV line related infection</td>
<td>Glycopeptide IV (see text for dose)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Daptomycin$^3$ IV 6mg/kg every 24 hours. Doses up to 10mg/kg used off-licence.</td>
<td></td>
<td>The IV line should be removed if possible.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>See SARI IV catheter guidelines (Ref 10)</td>
<td>Review empiric treatment at 48 hours once susceptibility data available.</td>
<td></td>
</tr>
<tr>
<td>HA-MRSA pneumonia</td>
<td>Linezolid IV/PO 600mg every 12 hours (expert advice required) OR Glycopeptide IV (see text for dose)</td>
<td>7 to 21 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA-MRSA necrotising pneumonia</td>
<td>Linezolid IV 600mg every 12 hours PLUS clindamycin$^1$ IV 1.2g every 6 hours +/- rifampicin$^2$ PO/IV 600mg every 12 hours</td>
<td>Consider IVIG 10 to 14 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bronchiectasis</td>
<td>Linezolid IV/PO 600mg every 12 hours (expert advice required)</td>
<td>Optimal treatment is unresolved–seek advice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bloodstream infection</td>
<td>Glycopeptide IV (see text for dose)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Daptomycin$^3$ IV 6mg/kg every 24 hours. Doses up to 10mg/kg used off-licence.</td>
<td></td>
<td>Uncomplicated: minimum 2 weeks</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Complicated: 4 to 6 weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persistent bloodstream infection or vancomycin treatment failure</td>
<td>Consider high dose daptomycin$^3$ IV 10mg/kg once daily PLUS gentamicin IV 5mg/kg every 24 hours OR rifampicin PO/IV 300mg to 450mg every 12 hours OR linezolid PO/IV</td>
<td>Expert advice required 4 to 6 weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If reduced susceptibility to vancomycin and daptomycin consider linezolid PO/IV 600mg every 12 hours OR co-trimoxazole IV 30mg/kg every 12 hours +/- other</td>
<td>Expert advice required</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^1$ clindamycin $^2$ rifampicin $^3$ daptomycin
600mg every 12 hours OR a beta-lactam antibiotics.

**Endocarditis, native valve**
Vancomycin IV (see text for dose)  
Daptomycin$^3$ IV 6mg/kg every 24 hours. Doses up to 10mg/kg used off-licence.  
Minimum 4 weeks

**Endocarditis, prosthetic valve**
Vancomycin IV (see text for dose) PLUS rifampicin PO/IV 300mg every 8 hours PLUS gentamicin IV 1mg/kg every 8 hours  
Minimum 6 weeks vancomycin and rifampicin. Stop gentamicin after 2 weeks.

**Severe sepsis with toxic shock**
Glycopeptide IV (see text for dose) PLUS clindamycin$^1$ IV 1.2g every 6 hours +/- rifampicin$^2$ PO/IV 600mg every 12 hours  
Linezolid IV 600mg every 12 hours PLUS clindamycin$^1$ IV 1.2g every 6 hours +/-rifampicin$^2$ PO/IV 600mg every 12 hours  
Consider IVIG

**Osteomyelitis and septic arthritis**
Glycopeptide IV (see text for dose) +/- rifampicin PO/IV 300mg to 450mg every 12 hours OR sodium fusidate PO 500mg every 8 hours  
Add rifampicin after clearance of bloodstream infection  
Linezolid IV 600mg every 12 hours (limit to 4 weeks) OR daptomycin$^3$ IV 6mg/kg every 24 hours +/- rifampicin$^2$ PO/IV 300mg to 450mg every 12 hours  
May consider combination of rifampicin PO/IV 300mg to 450mg every 12 hours PLUS co-trimoxazole IV 24mg/kg every 12 hours OR clindamycin$^1$ IV 600mg to 1.2g every 6 to 8 hours OR sodium fusidate PO 500mg every 8 hours  
Osteomyelitis: minimum 8 weeks. Consider an additional 1 to 3 months, possibly longer, with oral rifampicin based combination therapy.  
Septic arthritis: 3 to 4 weeks
Prosthetic joint/spinal infection

See IDSA guidelines (Ref 3)

CNS Infection

See Ref 3

Uncomplicated MRSA UTI

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doxycycline PO 100mg every 12 hours OR nitrofurantoin PO 50mg to 100mg every 6 hours OR trimethoprim PO 200mg every 12 hours if susceptible</td>
<td>5 to 7 days</td>
</tr>
<tr>
<td>Co-trimoxazole PO 960mg every 12 hours</td>
<td>5 to 7 days</td>
</tr>
</tbody>
</table>

Complicated MRSA UTI

Glycopeptide IV (see text for dose)

Daptomycin3 IV 4mg/kg every 24 hours

SSTI, skin and soft tissue infection; PVL, panton valentine leucocidin, IVIG, intravenous immunoglobulin; SARI, Strategy for the control of Antimicrobial Resistance in Ireland. HA, healthcare-acquired; CA, community-acquired; CNS, central nervous system; UTI, urinary tract infection.

1Check clindamycin susceptibility and inducible resistance

2Rifampicin reduces serum levels of linezolid

3Check daptomycin susceptibility following vancomycin therapy

Please note the following:

- If the patient is being treated empirically they may also require antibiotic therapy for other potential causes of infection such as Gram negative bacteria, anaerobes, fungi.

- All doses quoted are for adults with normal renal function; modifications may need to be made for patients with impaired renal and hepatic function

- It is recommended to check the British National Formulary (BNF) for paediatric doses.

Further guidance on treatment can be obtained from other sources (3,5,7,10-14)
2.8.3 The role of glycopeptides

Recommendations

- An initial vancomycin dose of 15mg/kg (based on actual body weight), not to exceed 2g, every 12 hours is suggested for patients with normal renal function. A loading dose of 25mg/kg (based on actual body weight), should be considered for seriously ill patients. It is essential that patients are given a dose appropriate to their weight and not just 1g every 12 hours when using vancomycin.  
  
  **Grade D**

- Subsequent dose adjustment should be based on trough serum vancomycin concentrations in order to achieve effective targeted therapeutic concentrations of vancomycin.

  **Grade C**

- Trough levels should always be maintained above 10mg/L in adults and children (no evidence for neonates) to avoid the development of resistance.

  **Grade D**

- Trough serum vancomycin concentrations of 15 to 20mg/L are recommended to ensure improved clinical outcomes for serious infections, such as BSI, endocarditis, osteomyelitis, meningitis, pneumonia and severe SSTI caused by MRSA.

  **Grade C**

- Check the first trough serum vancomycin level before the fourth dose, then once weekly in hemodynamically stable patients. More frequent monitoring is advisable in patients with serious infection, morbid obesity, renal dysfunction, who are haemodynamically unstable, or on concomitant nephrotoxins. Serum creatinine should also be monitored.

  **Grade D**
• The patient’s clinical and microbiological response, including the vancomycin minimum inhibitory concentration (MIC), will guide the continued use of vancomycin and expert advice should be sought in any patient not responding to treatment.  

**Grade D**

• Vancomycin or teicoplanin are equally effective for most MRSA infections. It is unclear whether the lower adverse event rate associated with teicoplanin, including nephrotoxicity, should influence the choice of glycopeptides.  

**Grade A**

• An initial teicoplanin dose of 10mg/kg every 12 hours for three doses, then 10mg/kg once daily is recommended for severe infections. The recommended target trough level is greater than 10 mg/L for the majority of severe infections and greater than 20 mg/L for endocarditis and bone or prosthetic infection. Therapeutic monitoring is not recommended routinely but may be indicated for deep seated infections where higher maintenance doses of teicoplanin may be necessary to achieve appropriate trough levels.  

**Grade C**

**Rationale**

A glycopeptide is currently the treatment of choice for severe invasive MRSA infections and vancomycin remains the most commonly used glycopeptide. There is ongoing debate about the place of vancomycin in the management of serious MRSA infections (15,16). The shortcomings of vancomycin include poor tissue and intracellular penetration, lack of activity against organisms growing in biofilm, slow bactericidal effect, lack of interference with toxin production, and poor activity against some *S. aureus* isolates, including heteroresistant and VISA strains (17). Therapeutic drug monitoring is required when prescribing vancomycin to ensure effective concentrations and to minimise the occurrence of toxicity (18).

The emergence of vancomycin-intermediate and vancomycin-resistant *S. aureus* (see section 2.11) is of ongoing concern (19). Recently, a number of studies have established a relationship between vancomycin treatment failures and infections caused by MRSA isolates.
displaying an MIC of 2mg/L (20). Increased mortality occurred in patients infected with MRSA strains having an MIC of 1.5 or 2mg/L compared with patients infected with low-MIC strains, despite achieving target trough vancomycin concentration of 15 to 20mg/L (21).

Guidelines on the therapeutic monitoring of vancomycin treatment for *S. aureus* infections in adults were published in 2009 by an expert panel of the Infectious Diseases Society of America (IDSA), the American Society of Health-System Pharmacists, and the Society of Infectious Diseases Pharmacists, recommending larger vancomycin doses and higher trough serum concentrations of vancomycin to achieve a target area under the curve (AUC/MIC) of 400. The potential benefit of increased dose for adults was felt to be worth the risk of mostly reversible adverse events, but they advise close monitoring of vancomycin trough levels (19).

Limited data suggest that there is a relationship between vancomycin in Ireland exposure and nephrotoxicity and that the vancomycin trough level best indicates this (21,22). Alternatively, it has been suggested that the increased rates of nephrotoxicity observed with aggressive vancomycin dosing may be due to selection bias and confounding other factors. Clinicians unwilling to use vancomycin aggressively at higher doses in accordance with clinical practice guidelines should use an alternative agent (23).

Vancomycin-induced nephrotoxicity is defined as multiple (at least two or three consecutive) high serum creatinine concentrations, i.e. increase of 44 micromol/L or ≥ 50% increase from baseline, whichever is greater after several days of vancomycin therapy, in the absence of an alternative explanation (20).

The appropriate dose of teicoplanin will depend on the clinical indication. Higher doses e.g. 10mg/kg have been suggested for septic arthritis and osteomyelitis. Therapeutic monitoring is not necessary to avoid toxicity but can be helpful to ensure that dose regimens are optimised to achieve target trough concentrations (24-28).

Currently teicoplanin is significantly more expensive than vancomycin in Ireland. A pharmacoeconomic analysis is needed to evaluate the overall cost benefit of using teicoplanin or vancomycin.
2.8.4 Duration of Therapy

Recommendation

The duration of therapy will depend on the type of infection and the clinical response, and should be discussed with a consultant microbiologist or infectious diseases physician.

Grade D

Rationale

There is an absence of high quality data on the optimum duration of therapy. Short course therapy may be associated with relapse and the seeding of distant foci particularly in cases of deep seated infection. However, unnecessarily long courses are associated with the development of resistance (5).

The duration of therapy should be individualised depending on the patient’s clinical response (3). In general, primary uncomplicated MRSA BSI, i.e. no underlying focus, should be treated for at least two weeks and up to 4 to 6 weeks for complicated infection (3). Pneumonia should be treated for 7 to 21 days, depending on the extent of infection (3). Deep-seated infections with MRSA should be treated for longer (e.g. 3 to 12 weeks). In patients with a non-removable focus of infection long-term suppressive therapy with oral agents may be considered (3).

Treatment duration for less severe infections such as SSTI and UTI should be guided by clinical response and infection markers such as the C-reactive protein (CRP). Non-severe SSTI will require five to ten days of treatment (3). Uncomplicated UTI can be treated for 5 to 7 days (3).

2.8.5 Combination therapy

Recommendations

- The adjunctive use of rifampicin is not recommended for the treatment of SSTI. Grade A
Some experts recommend the addition of rifampicin or sodium fusidate as adjunctive therapy for bone and joint infections. \textbf{Grade D}

Despite recent guidelines produced by the IDSA that recommend the use of single agent therapy for the treatment of BSI infection or native valve endocarditis, combination therapy may be deemed necessary in certain clinical situations. Expert advice should be sought in these situations. \textbf{Grade D}

Combination therapy with high dose daptomycin (10mg/kg) and a second agent may be considered for persistent MRSA BSI and vancomycin treatment failure, but susceptibility to daptomycin needs to be confirmed after prior vancomycin treatment. Combination therapy may be considered when isolates have reduced susceptibility to both vancomycin and daptomycin. \textbf{Grade D}

\textbf{Rationale}

There is no evidence that the adjunctive use of rifampicin for SSTI provides benefit (3,29). Studies of MRSA BSI and endocarditis have shown increased risk of nephrotoxicity with low dose gentamicin in combination with vancomycin and a longer duration of BSI with rifampicin in combination with vancomycin, compared to vancomycin monotherapy (30,31).

The use of a second antibiotic (e.g. gentamicin, rifampicin or sodium fusidate) is not recommended for the initial treatment of MRSA infection, in the absence of data to support use (32).

The favourable pharmacokinetics of rifampicin and sodium fusidate, with excellent penetration into bone and biofilm, support their use as adjunctive therapy in bone and joint infection (3,12).

Data are very limited on combination therapy in the setting of persistent MRSA BSI and reduced susceptibility to vancomycin and daptomycin (3,15).
2.8.6 Surgical prophylaxis

Recommendations

- A glycopeptide should be included as surgical prophylaxis in any adult patient undergoing implant surgery, e.g. prosthetic hip, aortic graft and who is known to be positive for MRSA or in any patient at high risk of MRSA where screening has not excluded MRSA. **Grade B**

- Patients undergoing non-implant surgery where surgical prophylaxis is indicated should be prescribed a glycopeptide as part of their prophylaxis regimen if they are confirmed as being MRSA positive. **Grade A**

- For elective procedures, either implant or non-implant surgery, every effort should be made to screen at-risk patients to determine if they are MRSA positive or negative prior to surgery. **Grade C**

Rationale

A meta-analysis of antibiotic prophylaxis showed that glycopeptides are more effective than beta-lactams in preventing SSI caused by MRSA in cardiac surgery (33).

2.8.7 Use of newer anti-MRSA agents

Recommendation:

- The prescribing of newer anti-MRSA agents should be firmly controlled by reserving for glycopeptide failure, resistance or intolerance, or on the recommendation of a consultant microbiologist or infectious diseases physician. **Grade D**
Rationale

Linezolid, daptomycin, quinopristin-dalfopristin (where available) and tigecycline are active against MRSA. They are licensed to treat infection due to Gram-positive bacteria, e.g. complicated skin and soft tissue infection. As with other MRSA agents these drugs require close monitoring for toxicity and efficacy. In the USA, the Food and Drug Administration (FDA) issued a warning in 2010 to consider alternatives to tigecycline in patients with severe infection following an increased risk of all-cause mortality in a pooled analysis of 13 clinical trials (34).

The use of all new anti-MRSA agents should be carefully restricted to (5):

1. minimise the emergence of further resistance amongst Gram-positive organisms
2. preserve activity for patients with difficult-to-treat infections and/or organisms
3. minimise escalating costs of antimicrobials in hospital

Ceftaroline was approved in 2012 for the treatment of complicated SSTI, and community acquired pneumonia in adults, but patients with confirmed/suspected MRSA pneumonia at baseline were excluded from clinical trials. Phase III trials are underway for dalbavancin and oritavancin. Despite initial promise, three other antibiotics with activity against MRSA are not available for clinical use. Telavancin had its EU marketing authorization suspended in 2012, ceftobiprole was not granted marketing approval and the filing has been withdrawn for iclaprim (35).

Dalbavancin has a very long half-life, allowing for weekly dosing, which may prove useful for out-patient treatment (36). These new agents may prove valuable as resistance evolves to the currently available anti-MRSA drugs

2.9 Occupational health aspects of MRSA

2.9.1 Role of occupational health (OH)

Recommendations
• Individual employees need to act responsibly with regard to their own health and seek advice from OH when appropriate.

  **Grade C**

• Managers should facilitate OH when relevant issues of personal health or MRSA exposure arise.

  **Grade C**

• OH staff providing services to the healthcare sector should be familiar with the multifaceted approach required to manage MRSA in their workplace setting and of the need for a risk assessment approach in understanding the complex interplay between staff, patients and the environment.

  **Grade C**

• The appropriate elements of an OH strategy for managing MRSA are risk assessment, risk control, education and evaluation.

  **Grade D**

• OH practice and guidance should be informed by the hierarchy of risk controls incorporating knowledge of standard precautions as an administrative control.

  **Grade D**

**Rationale**

There is an expanding literature on the role of the healthcare worker (HCW) and MRSA (1). Many questions remain unanswered as there have been no controlled intervention studies specifically addressing the role of HCWs in MRSA transmission (1). These are needed as the issues of HCW colonisation and decolonisation are different to those that relate to patients and there is an on-going controversy as to how extensive HCW screening should be. In countries where MRSA rates are low, e.g. the Netherlands, there is a more proactive approach to HCW screening, compared to those countries such as Ireland when HCW screening tends to be more reactive such as during outbreaks.

For the purposes of this document the term HCW is used to include any individual who has the potential to acquire or transmit an infectious agent during the course of his or her work in health care. This includes the three categories of employee identified by the Association of National Health Occupational Physicians (ANHOPS) in their guidelines on immunisation of
HCWs, i.e. clinical, laboratory staff and non-clinical ancillary (2). However, in Ireland, not every healthcare facility has access to an OH service and advice is often provided by IPCTs with clinical microbiologists and others in its absence. This is unsatisfactory as the issues can be complex and may involve re-deployment which needs to be handled sensitively. Consequently, this gap in OH service provision is a significant barrier to the implementation of this section.

Both asymptomatic carriers of MRSA and those with symptoms of infection have been causally associated with outbreaks in the healthcare setting (1). The more recent threat of community-associated MRSA (CA-MRSA) which affects young healthy people without traditional risk factors has additional implications for HCWs. Furthermore, there have been several reports of HCWs acquiring MRSA infection from colonised patients (3).

Though this guideline addresses MRSA, it is worth noting that MSSA has similar characteristics and mechanisms of spread. It was established some time ago that nasal carriers of *S. aureus* who have concurrent respiratory tract infection can disperse bacteria into the air causing outbreaks (4,5). Known *S. aureus* shedders can reduce the risk of spread to patients by wearing a surgical mask while symptomatic from URTI (4). There is no reason to believe that staff colonised and/or infected with MRSA should present a transmission risk that is any different to spread of MSSA.

The role of OH is to protect, promote and maintain employee health in a healthy work environment. In the context of infection prevention and control the objective is to reduce the transmission of infection to or from the HCW in accordance with best practice and in a legally compliant manner. The employer’s legal responsibility is defined in relevant workplace health and safety legislation and the Employment Equality Act (6-8). Close collaboration between OH and the IPCT is essential in achieving this objective as responsibilities can overlap especially in the area of education, during an outbreak situation, or when the HCW has duties in a high risk clinical area.

Professionals in OH should be familiar with the principles of good infection prevention and control practice as well as the relevant occupational safety concepts within the industrial hygiene hierarchy of risk controls (9,10). The four components necessary for an effective OH programme targeting MRSA are risk assessment, risk control, education and evaluation (11). Risk assessment includes assessing the risk of transmission to HCWs as well as considering
the risk of transmission to patients from infected or colonised HCWs. Risk factors for MRSA amongst HCWs are outlined in table 6 (1).

All HCWs need to be aware of their responsibility to report relevant health conditions to their occupational health provider both at the pre-employment health assessment (PEHA) stage and thereafter as conditions arise. All HCWs in managerial positions need to be aware of their responsibility to be alert to the possibility that staff with relevant health complaints may have MRSA infection and should refer them promptly for OH assessment. Furthermore, all health professionals (including OH professionals) who provide clinical care to HCWs as patients need to be aware of the particular implications of MRSA infection/colonisation in HCWs. Poor infection control practices have been implicated in both acquisition and transmission of MRSA (and MSSA) by healthcare staff. However, good adherence to infection control practice does not entirely prevent transmission from heavily colonised staff to patients, since staff may unwittingly shed MRSA into the air, and/or contaminate surfaces, both of which may act as reservoirs within the healthcare environment (12).
### Table 6: Risk Factors for MRSA in HCWs

#### MRSA carriage

- **Comorbidities**
  - Cutaneous lesions or conditions (e.g. dermatitis, eczema, psoriasis, pemphigus)
  - Sinusitis, rhinitis (chronic, allergic, infectious)
  - Chronic otitis externa, earlobe dermatitis
  - Recent urinary tract infection
  - Cystic fibrosis

- **Other endogenous factors**
  - Recent antibiotic use

- **Work related factors**
  - Previous work abroad
  - Work experience (e.g. student HCW, longer duration of service)
  - Area of service (e.g. medicine, surgery, long-term care facilities, decreasing risk from ward to ICU to operating theatre)
  - Employment in areas of high patient MRSA prevalence (e.g. patients from high-prevalence countries)
  - Close contact with patients (e.g. dressing changes, wound contact)
  - Poor attention to infection control (e.g. poor hand hygiene)
  - High work load

#### MRSA persistence despite eradication

- Comorbidities: cutaneous lesions / conditions
- Sites of colonisation: pharynx, rectum, perineum, extensive skin
- Household and environmental contamination
- Mupirocin resistance

#### Relapse after eradication

- Sites of colonisation: pharynx, rectum, genitals (vagina, prepuce), skin, ear lobes
- Infections: upper respiratory tract infection, chronic otitis externa
- Mupirocin resistance

### 2.9.2 Risk control
Draft MRSA Guidelines April 2013

Recommendations

• Good management is required in the effective implementation of an MRSA control programme in any health care setting. Grade D

• OH should identify healthcare workers with risk factors for MRSA as early as possible and should provide education on workplace risks in both formal and informal educational sessions. Grade C

• OH should liaise closely with the IPCT during outbreaks and ensure that individual HCWs receive appropriate investigation, treatment and follow-up where colonisation or infection is suspected or confirmed. Grade C

• Personal protective equipment should be readily available for use as a barrier in appropriate circumstances and includes gloves, masks etc. Grade C

• OH should assist the IPCT in the education of HCWs on the prevention and management of exposure to or infection with MRSA where resources allow. Grade D

• OH should implement ongoing systematic evaluation to ensure that programmes achieve their stated objectives, that policies remain current, and are legally compliant. Grade D

• Staff with persistent exfoliative skin lesions should be excluded from the care of patients colonised or infected with MRSA. Grade C

Rationale

Measures to prevent HCW exposure to or acquisition of infection with MRSA can be categorised under the headings, e.g. engineering controls, administrative controls, work practices and PPE (11).
Engineering controls reduce the hazard at source e.g. hand washing facilities, antiseptic hand gel dispensers, facilities for decontaminating patient care equipment. Administrative controls include the development and adoption of policies which support and provide resources for programmes aimed at defined objectives. Also included are the support of a confidential records management programme, the provision of appropriate advice where infection or colonisation is suspected or confirmed and the implementation of fitness for work recommendations in individual cases. Healthcare managers should also ensure that external service providers also comply with the workplace OH programmes and that this is outlined in contractual agreements.

Work practices include the support of the IPCT’s endeavours to reduce the transmission of infection as outlined in its policies. Open and clear communication with the HCW is essential to minimise unnecessary anxiety. The role of the OH team is paramount here. In addition, communication with line managers in a way which facilitates good management decisions while protecting HCW confidentiality is essential. The concept of work adjustment (rather than seeking to impose sickness absence) is recommended in cases where continuing in the current role is considered to pose a risk to the HCW or patient.

Personal protective equipment (PPE) is considered the final and least effective step in the hierarchy of risk controls as it requires user compliance to achieve its goal.

Should these controls fail, OH must assess the HCW exposed to MRSA following direct or indirect contact of skin or mucous membrane with colonised or infected body sites, wound exudates or respiratory secretions. OH should also, in collaboration with IPCT, undertake assessment of the source of HCW exposure in order to assess the potential for transmission. The number of healthcare staff who have direct contact with patients colonised or infected with MRSA should be kept to a minimum. Staff with persistent exfoliative skin lesions should be excluded from the care of patients colonised or infected with MRSA (13,14).

2.9.3 MRSA colonisation and infection in HCWs and the need for laboratory support

Recommendations
• When investigating the involvement of HCW in outbreaks, or when HCWs
themselves are colonised or infected, there should be ready access to appropriate
laboratory facilities.

**Grade B**

• Molecular analyses to establish distinguishability of MRSA isolates are useful in
determining the link between healthcare worker colonisation/infection and
transmission to patients.

**Grade C**

**Rationale**

MRSA-colonised and infected patients readily contaminate their environment and a HCW
coming into contact with either will readily contaminate their hands, clothing and equipment.
Colonisation in healthcare workers is usually found in the nose and on the hands with other
body sites less frequently reported (perineum, pharynx). In a recent comprehensive review
where over 30,000 HCWs were tested for MRSA, 4.6% were found to be positive (1).

Recent studies have shown that neckties, white coats and mobile phones may be
contaminated with bacteria including MRSA but there is as yet no evidence that either has
resulted in transmission to patients (15-17).

Three types of MRSA carriage by HCWs have been described: non carriers, persistent
carriers, who are chronically colonised with the same strain and intermittent or transient
carriers who are colonised with varying strains for short periods of time. Transient carriage
(after a work shift but cleared before the next shift) was found in one small study to be mainly
nasal (1). Persistent carriage is less common than for MSSA and usually involves extranasal
carriage. Care is needed to distinguish between transient and persistent carriage (18,19).
Hand carriage is usually transient and is greatly influenced by hand hygiene compliance. The
transient or persistent colonisation of HCWs with MRSA has been shown to be the source of
several hospital outbreaks. Molecular analyses to establish distinguishability of MRSA
isolates has been useful in such situations (18). Strains identified on contaminated hands
usually match nasal strains (20). A recent review identified 27 studies where transmission
occurred and another 52 where it was considered likely (1). One report described an outbreak
in a newborn nursery where a healthy nasal carrier was implicated and another identified a HCW with nasal MRSA colonisation and upper respiratory infection which caused transmission to eight surgical ICU patients (21,4). Heretofore, MRSA has been regarded as a nosocomial pathogen but recent literature cites it as an occupational disease (22). The latter is particularly pertinent for patients colonised and/or infected with CA-MRSA, since HCW acquisition of these strains is more likely to be clinically significant.

2.9.4 Screening of HCW for MRSA

2.9.4.1. Recommendations

- The screening of staff on a routine basis is not indicated. Staff screening may be considered for institutions without endemic MRSA, or for specific high-risk units, as determined by the local IPCT. Grade C

- If new MRSA cases are found among patients on a ward, staff should be asked about skin lesions. Those with lesions and other potential positive sites, e.g. ears, should be referred for screening and for consideration of treatment by the relevant occupational health department. Topical clearance will not eradicate MRSA in HCWs if there is an underlying focus of infection Grade C

- HCW screening should be taken before a shift. Taking specimens at the end of a shift will detect transient carriers who are rarely a cause of transmission. Grade B

- A swab from the anterior nares and from any abnormal or broken skin is usually sufficient when initially screening HCW for MRSA. Full screening is necessary after an initial MRSA positive site including the perineum Grade B

- A minimum of three full screens at least 48 hours apart, while not undergoing decolonisation, should be performed before a previously positive HCW can be
considered to be clear of MRSA.

Grade D

Rationale

While both symptomatic and asymptomatic HCWs have been implicated in the transmission of MRSA in the healthcare setting, and decolonisation as part of a multi-faceted approach has contributed to successful termination of outbreaks, there is some debate about when HCW screening should be undertaken. A systematic review suggests that asymptomatic HCWs are only rarely the likely source in nosocomial outbreaks (1.6%) and recommends that a more effective approach in this context is to identify infected HCWs (23).

By contrast, another paper identified 44 studies with either proven or likely transmission to patients from HCWs who were not clinically infected with MRSA (1). They suggest that screening should not be restricted to outbreaks because there is a trend for higher colonisation rates in settings with endemic MRSA.

Screening of staff on a routine basis is not indicated (20). It may be considered for institutions without endemic MRSA, or for specific high-risk units, as determined by the local infection prevention and control team (IPCT). Ironically, though colonisation rates tend to be higher where MRSA is endemic, the benefit of more regular HCW screening is greater where MRSA prevalence is lower. Thus, it may be expected that if prevalence rates go down, more widespread staff screening may be advocated.

Regardless of whether units have endemic MRSA, the identification of new patient carriers on a ward should prompt local IPCTs and managers to remind staff of their responsibility to report skin lesions or indeed, any other low-grade infections. Such staff should be referred for evaluation and screening to the OH department (19). Staff with persistent carriage at sites other than the nose (e.g. pharynx, perineum, ear and/or skin) should be referred for appropriate specialist management and follow–up screening (13,19).

Staff screening is indicated if transmission continues on a unit despite active control measures, i.e. if epidemiological aspects of an outbreak are unusual, if there is suspicion of persistent carriage of MRSA by staff, if one or more patients demonstrate severe infection, or
if a particularly pathogenic or resistant strain is found from either one or more patients and staff in a specific clinical area (19).

HCW screening should be taken before a shift or after at least 12 hours (ideally one day) after a period of duty (19). HCWs must be fully informed of the context in which screening is taking place and be reassured that regardless of the outcome, they are not culpable. For practical and logistical purposes, the anterior nares are considered the most appropriate sampling site for initial staff screening along with swabbing of any areas of abnormal or broken skin (13). Screening of other body sites (e.g. throat, groin/perineum) should be considered only in those found to be MRSA positive. The perineum is better than the groin but problems with obtaining perineal swabs in generally fit and mobile staff can be surmounted by asking the HCW to take the swab themselves.

It is recommended that a minimum of three screens at least 48 hours apart, while not receiving antimicrobial therapy, should be performed before a previously positive staff member can be considered to be clear of MRSA (13).

2.9.4.2 Pre-employment health screening

Recommendations

- Pre employment screening of healthcare staff is not routinely recommended. It may be considered where MRSA is not endemic or for specific units on the basis of local risk assessment
  Grade C
- Pre employment screening may be deemed necessary depending upon the location (unit, hospital, country) of prior workplace if relevant, if this location is recognized to have specific problems with high rates of MRSA, or if there are unusually pathogenic strains of MRSA (e.g. CA-MRSA)
  Grade D
- Healthcare worker risk factors identified at PEHA should be used by OH professionals to determine whether clinical HCWs deployed in certain high risk areas should be screened
  Grade D
• HCWs should not be denied employment because of MRSA colonisation or infection though they may be restricted from working in certain roles

**Grade D**

**Rationale**

Unlike screening and surveillance of existing staff, PEHA screening has the advantage of being a ‘once off’ assessment. When a colonised HCW (or those with risk factors, table 6) is identified, decisions can be taken at the outset either to ensure that they are deployed in low risk units or to enhance their training and surveillance if deployed in higher risk areas. If screening is undertaken as part of the PEHA process, it should be clear that the outcome of the test does not determine the employability of the candidate.

While some units with low MRSA prevalence consider it useful to undertake PEHA screening, it is a costly exercise. When OH staff identify individual risk factors during a new recruit’s PEHA they may consider whether clinical staff with such risk factors should be screened prior to their deployment in higher risk units.

### 2.9.4.3 Screening during outbreaks

**Recommendations**

- HCW should be screened for MRSA infection or colonisation only if they are epidemiologically linked to a cluster of MRSA infections. **Grade C**
- Staff screening is indicated if transmission continues on a unit despite active control measures, if epidemiological aspects of an outbreak or strain are unusual, or if they suggest persistent MRSA carriage by staff. **Grade C**
- Nurses, doctors, physiotherapists and other allied health professionals and non-clinical support staff (e.g. porters) should be considered for screening, and the implications for onward spread by staff working in other wards should also be considered. **Grade C**
Agency and locum staff should be screened if permanent staff are screened as part of outbreak management, for example.

**Grade C**

### 2.9.4.4 Screening, surveillance and decolonisation where MRSA is endemic

**Recommendations**

- Those involved in decisions regarding the decolonisation of HCWs must understand its limitations and all decisions should be based on a comprehensive risk assessment.
  
  **Grade D**

- Clinicians (including GPs) involved in the treatment or decolonisation of healthcare workers should inform their local OH service to ensure that local protocols are adhered to and they should also seek advice on fitness for work.
  
  **Grade D**

- The decolonisation protocol used for patients is also recommended for HCWs. However, particular care should be taken in prescribing any treatment which might compromise skin integrity.
  
  **Grade A**

- Specialist advice from a consultant microbiologist or infection disease physician should be sought for HCW with MRSA infection depending on the site of infection. Decolonisation therapy will usually be required along with treatment.
  
  **Grade D**

**Rationale**

The screening of healthcare workers is not routinely recommended in settings where MRSA is endemic unless they have been epidemiologically linked to new cases or there is on-going spread despite conventional control measures, e.g. patient screening and enhanced compliance with standard precautions. Furthermore, a recent review that assessed the case for routine healthcare worker screening concluded that further research is required before such a step is taken in NHS Scotland (24).
Decolonisation of HCWs is complex and must be handled with great sensitivity by all concerned. Screening itself has limitations. It is advised that those involved in making decisions to prescribe decolonisation therapy for HCWs familiarise themselves with Section 2.6. This emphasises the limitations of decolonisation which must also be borne in mind when treating colonised HCWs.

While it may be appropriate at times to decide against decolonising patients in certain settings it is virtually always the case that decolonisation of colonised HCW will be attempted (25). Indeed, to do otherwise would undermine the effort of screening and question its legitimacy.

The decision to decolonise a HCW must be taken by a specialist occupational physician in consultation with a consultant microbiologist or infectious disease physician. The risk assessment on which treatment decisions are based should be recorded. This must consider the individual HCW (and their risk factors), their occupation/role and the patient care context. Awareness of HCW risk factors (both personal and occupational) may help to identify those at risk of failed decolonisation. Where HCWs are identified as being colonised (or infected) with MRSA by their general practitioner, they should notify their occupational health service to ensure that local decolonisation and treatment protocols are adhered to.

The decolonisation protocol for HCWs is identical to that used for patients although chlorhexidine bathing has not been well studied in the context of HCWs (see section 2.6). Healthcare workers who are infected with MRSA require particularly careful management and it is advised that specialist advice be sought (e.g. dermatological, ENT) depending on the infection site (13). Decolonisation therapy will usually be required along with treatment.

### 2.9.5 Fitness for work

**Recommendations**

- OH should recommend exclusion of clinical HCWs and food handlers from work (having obtained appropriate cultures) if they have dermatitis, chronic skin condition, a draining lesion on hand(s), or other exposed site where MRSA colonisation is likely until the infection has been ruled out or they have received adequate therapy and their infection has resolved.
Grade C

- OH may recommend exclusion of clinical HCWs with MRSA if they are found to be epidemiologically linked to patient transmission until antibiotic treatment and medical assessments are complete and appropriate control measures and/or work restrictions have been agreed.

Grade C

- In principle, only HCWs with colonised or infected lesions at exposed sites should be off work while receiving courses of clearance therapy, but decisions on fitness for work or the necessity for work adjustments should be based on local risk assessment.

Grade D

- Unless a HCW identified as carrying MRSA work in high-risk wards, i.e. intensive care units, neonatal, orthopaedic or haematology units, solid organ or bone marrow transplant unit, they should not be excluded from work. Staff working in these areas should be excluded from work, or reassigned to a low-risk area, for 24 hours only from the start of decolonisation therapy.

Grade D

- Decisions on fitness for work in complex or unusual cases of infected or colonised HCWs can only be arrived at by close collaboration between a specialist occupational physician and a consultant microbiologist/infectious disease physician using a risk assessment approach.

Grade D

Rationale

An assessment of fitness for work of a HCW colonised or infected with MRSA must be based on objective assessment and must consider the following:

1. Whether or not s/he feels ‘ill’.
2. Individual risk factors for MRSA.
3. Site(s) of colonisation (or infection).
4. History of previous infection or association with transmission.
5. Job tasks required of them in their role or occupation.
6. Their understanding of and ability to comply with standard precautions.
7. Local epidemiology of MRSA and risk to patients (in consultation with the IPCT).

Informed decision on fitness to work will have a positive impact on patient care and worker health and will facilitate efficiency and optimise productivity. Those with MRSA infections who are clinically unwell or who have draining lesions should be certified unfit for work by their GP and be reviewed by the OH team prior to returning to clinical or food handling duties. Appropriate cultures and susceptibility testing should inform treatment protocols.

Those with MRSA infections who are clinically well and able for work (e.g. skin infections, furuncles, otitis externa) should be excluded from all clinical work and food handling until they have been fully treated. Their resumption of clinical and food handling duties should be dictated by the OH team who will liaise closely with the IPCT. Every effort should be made to keep them at work undertaking alternative duties (e.g. non clinical administrative duties) for the duration of their infectivity.

Decisions regarding fitness for work of HCWs colonised with MRSA are more challenging and can only be made following risk assessment by the OH team in consultation with the IPCT. Those with nasal carriage and normal skin are likely to decolonise easily while those with risk factors may take longer. Occasionally, a HCW may prove impossible to decolonise.

Unless staff identified as carrying MRSA work in high-risk wards, i.e. intensive care units, neonatal units, orthopaedic units, haematology units, solid organ or bone marrow transplant unit they should not be excluded from duty. Staff working in high-risk wards should be excluded from work unless this compromises patient care, or reassigned to a low-risk area, for 24 hours only from the start of decolonisation therapy (13). It may be prudent to delay their return to regular duties until the results of the first post treatment screening is available to obviate the need for further restrictions if the result does not confirm clearance.

The term ‘exclude from duty’ should be taken to mean exclusion from similar work in all healthcare settings, including relevant community settings (14). Many HCWs, particularly NCHDs, move readily between units in one healthcare setting and also move frequently to other enterprises. OH professionals should be aware of the need to communicate with the OH
service of the next employer where an infected or colonised worker is due to rotate elsewhere. Other doctors, e.g. consultants, may work in other public hospitals or in the private sector.

While it is possible to provide general guidance on work restrictions in a range of scenarios of HCW/patient contact, a combination of issues should be considered (see Appendix X) but this should not be interpreted as prescriptive. Decisions on complex cases require close collaboration between OH, microbiology/infectious diseases and the IPCT, with the involvement of the individual HCW and responsible treating clinician, if there is one. The decisions and their rationale should be recorded carefully in the employee’s OH file and reviewed as further information unfolds.

There is a need for a confidential database of information on HCWs, their MRSA status and other details that are relevant in an occupational health setting and that can facilitate their movement within an institution and from one employer to another. This would reduce unnecessary repeat screening and enable information to be made available quickly to avoid delays in HCW deployment.

2.9.6 Sick Pay Entitlements

Recommendation

- Standard sick pay entitlements apply to those who are too ill to work, for the duration of the illness and incapacity.  
  
  **Grade D**

- It is desirable that those required to be absent from work on ‘infection prevention and control’ grounds be able to access payment without resorting to use of the sick pay scheme provided that alternative work (accommodation) is not available  
  
  **Grade D**

Rationale

In general, HCWs who become colonised or infected with MRSA will not become clinically septic, and as such, may well present themselves for work. For those who are not ill, but who
may pose a risk to others (i.e. patients) because of their MRSA colonisation or infection, there should normally be no need to invoke the sick pay scheme since every effort should be made to accommodate individuals in a non – clinical (or non food-handling) work area pending clearance of the organism. This approach encompasses the principles of employment equality legislation (8). In the unlikely event that this proves impossible, and where absence from work is imposed on ‘infection prevention and control’ grounds, the employee should not be penalised financially as this might make them less likely to report health conditions and to submit to treatment in the future.

However, there is currently no facility within the HSE whereby an individual may be paid for ‘infection prevention and control’ leave through any mechanism other than by invoking the sick pay scheme. The absence of such a scheme could potentially result in a limited numbers of HCWs not seeking advice earlier because of fears over their employment status, potentially compromising patient care. However, in practical terms, this is unlikely to affect most employees, and certainly not those who have made little or no use of their sick pay entitlements. For those who have already exhausted such entitlements, the management of absence imposed on ‘infection control’ grounds is likely to be challenging.

2.10 Reference laboratory facilities

Recommendations

The National MRSA Reference Laboratory (NMRSARL) currently provides the following services and these should continue:

- Communicating with users, e.g. referring laboratories, state agencies and the public, on the work of NMRSARL through annual reports scientific papers, symposia, etc.
- Assisting in the confirmation of *S. aureus* identification and methicillin resistance
- Epidemiological typing of MRSA strains, especially those from the bloodstream, in order to monitor different types of MRSA circulating in Ireland, and for the investigation of outbreaks.
- Investigating and confirming antimicrobial resistance among MRSA.
- Detection of virulence factors of staphylococci, e.g. PVL.
• Advising on the treatment of patients with MRSA infections.
• Advising on infection prevention and control aspects.
• Providing support on laboratory aspects of MRSA such as the use of selective media and other laboratory aspects of MRSA.
• Providing education on aspects of MRSA.
• Conducting research on aspects of MRSA with local, national and international partners.
• Collaborating with international colleagues (e.g. European Centre for Disease Control) in the study of the epidemiology, virulence and antimicrobial resistance of MRSA, especially within the EU.
• Developing and providing typing methodologies consistent with international best practice within a European context.
• Introducing further services for users including the typing of methicillin-susceptible \textit{S. aureus} consistent with clinical need and within the resources provided.
• Introducing further assays for the detection of virulence factors as these become relevant and readily available.

\textbf{Rationale}

The NMRSARL was established in 2001 and is located at St. James’s Hospital, Dublin. The laboratory was established to provide a resource for hospitals and microbiology laboratories around the country in their efforts to investigate and control MRSA. It is now internationally accepted that there is a requirement for a resource to provide specialist laboratory support (1,2).

\section*{2.11 Reduced susceptibility to glycopeptides - hGISA, GISA and VRSA}

\textbf{2.11.1 Introduction}

Glycopeptide resistance among \textit{Staphylococcus aureus} is an area of potential concern and complexity. Isolates with reduced susceptibility to glycopeptides may be categorised as follows:
1. **Vancomycin resistant S. aureus (VRSA)**

   These isolates exhibit vancomycin MICs that are > 8 mg/L and resistance is usually mediated by the *vanA* gene from enterococci that codes for an altered binding site (1).

2. **Vancomycin-intermediate or glycopeptide-intermediate resistant Staphylococcus aureus (VISA or GISA)**

   These isolates exhibit lower MICs, usually between 4 and 8 mg/L, and reduced susceptibility is probably caused by vancomycin binding or trapping in the cell wall (2).

3. **Hetero-glycopeptide intermediate resistant Staphylococcus aureus (hGISA)**

   These isolates exhibit vancomycin MICs of 1-2 mg/L but have a resistant sub-population occurring at frequencies of $10^{-6}$ following selection with vancomycin (3).

Detection of isolates with reduced susceptibility to glycopeptides may be problematic especially isolates exhibiting MICs of 4-8 mg/L.

**Definitions**

Both US (Clinical and Laboratory Standards Institute) and European (European Committee on Antimicrobial Susceptibility Testing) bodies define a strain as having reduced susceptibility to vancomycin if the MIC is > 2 mg/L (4,5). The USA has an intermediate category where the MIC is between 4 or 8 mg/L. European definitions do not include an intermediate category. Both organisations stress that reference broth microdilution is the most appropriate test to confirm an MIC as Etests® tend to produce MICs of about 0.5 to 1 mg/L higher than broth dilution.

**2.11.2 Recommendations regarding laboratory detection**

- An agar screening plate BHIv6 (i.e. brain heart infusion agar containing 6 mg/L of vancomycin) is recommended for the detection of reduced susceptibility to glycopeptides in addition to standard method;

   The standard method is one of the following:
   
   a) Disc diffusion
b) Automated method

If possible, laboratories should incorporate the vancomycin agar screen plate for testing all *S. aureus* isolates. Alternatively, the screening may be limited to MRSA isolates, since nearly all VISA and all VRSA are MRSA.

**Grade D**

An MIC method should be used to check the MIC on all serious infections caused by *S. aureus* where a glycopeptide is used for treatment.

**Grade D**

- If clinical failure is suspected with glycopeptide therapy;
  - a. An MIC should be performed and any isolate with an MIC of $> 2$ mg/L referred to the Reference Laboratory.
  - b. A macro-method using both vancomycin and teicoplanin should be performed.

**Rationale**

Disc diffusion and some of the automated systems do not reliably detect isolates with reduced susceptibility to vancomycin, i.e. MICs of 4-8 mg/L (6). Hence, it is prudent to include a screening plate if any of these methods are routinely used. In the USA, the use of BHIV6 is recommended. This screening plate may miss up to 30% of isolates with MICs of 4 mg/L and further work is being undertaken to determine the most appropriate screening methodology.

There is much discussion regarding the correct breakpoint for glycopeptides and *S. aureus*; a number of studies suggest that isolates with an MIC of $>1$ mg/L have a poorer outcome than isolates where the MIC is $< 1$ mg/L (5,7,8). It is therefore prudent to check the MIC for all serious infections caused by *S. aureus* where glycopeptides are used as therapy. An Etest® is acceptable but all suspected VISA should be confirmed by reference broth microdilution methodology.

The clinical relevance of the hGISA phenotype is uncertain but there are studies that suggest that patients infected with these isolates have a poorer outcome compared to vancomycin
susceptible isolates (9-12). Detection of hGISA is difficult. The reference method is to use population analysis profiling area under the curve (PAP-AUC) to determine the proportion of cells with reduced susceptibility compared to reference strains. This method is not suitable for the routine laboratory. A number of screening methods have been suggested but none are in routine use. The most established method is to perform an Etest® ‘macro method’ i.e. use a 2 McFarland turbidity standard and refer any isolate with a reading of ≥ 8 mg/L for vancomycin and or ≥ 12 mg/L for teicoplanin alone for further investigation.

2.11.3 Treatment of isolates with reduced susceptibility to glycopeptides

Please refer to the treatment section of the guidelines (Section 2.8).

2.11.4 Infection Control precautions of patients infected or colonised with *S. aureus* exhibiting reduced susceptibility to glycopeptides

Details can be found elsewhere (section 2.2) and http://www.cdc.gov/ncidod/dhqp/pdf/ar/visa_vrsa_guide.pdf (13).

2.12 MRSA surveillance and key performance indicators

**Recommendations**

- Outbreaks of infection (see Appendix XI for definitions) caused by MRSA must be notified to the local Medical Officer of Health, Department of Public Health (*statutory requirement*).
- The local Department of Public Health should be informed of individual cases of CA-MRSA (see Appendix XI for definitions) infection under the categories listed below:
  1. Severe invasive disease (See appendix XI) for definitions or cases resulting in death
  2. Cases in high risk groups, i.e. healthcare workers working in the community or in hospitals, those involved in gym or close contact sports and teachers.
  3. Cases in a closed community where there may be potential for onward transmission e.g. prison, military camps, nursing home.

  Grade C
• *Staphylococcus aureus* BSI must be reported to the HPSC on a quarterly basis, based on EARS-Net case definitions (*statutory requirement*)

• All healthcare facilities should maintain a record of new cases of MRSA. Where possible, this should be maintained in an electronic format. The list should include the following details or core data:
  1. Patient identification
  2. Specimen site
  3. Where MRSA was isolated from
  4. Date of first positive result
  5. Hospital/facility location at time of specimen collection (e.g. ward name)
  6. Date of admission

  **Grade C**

• All acute hospitals should participate in the *S. aureus* component of the EARS-Net enhanced bloodstream infection surveillance system. Cases should be classified using the clinical case definitions detailed in Appendix XI.

  **Grade D**

• All acute hospitals should report rates of new cases of hospital-onset and community-onset MRSA colonisation/infection at least twice per year to hospital management, clinical directors, clinicians and ward/unit managers, using the temporal surveillance definitions detailed in Appendix XI. Rates should be expressed as new cases per 100 bed-days used.

  **Grade C**

• All acute hospitals should carry out local surveillance of process indicators related to the control and prevention of MRSA, as detailed in Appendix XI.

  **Grade B**

• All acute hospitals should carry out local surveillance of invasive infections caused by *S. aureus*, including root cause analysis of hospital-acquired cases.

  **Grade C**

**Rationale**

Surveillance is often defined as “information for action”. MRSA surveillance is required at local level to:
1. Inform and assess local MRSA policies for prevention and control
2. Identify potential clusters and outbreaks

At national level MRSA surveillance is required to:
1. Inform and assess national strategies for the control and prevention of MRSA
2. Identify potential regional and national outbreaks
3. Identify emerging patterns of resistance and changes in MRSA epidemiology

National surveillance of MRSA in Ireland is based on EARS-Net (formerly known as the European Antimicrobial Resistance Surveillance System (EARSS), which collects data on the first invasive isolate of a given pathogen per patient per quarter. EARS-Net provides reliable national-level data on MRSA BSI, but has limitations when applied to regional or individual hospital-level data. Notification of *S. aureus* BSI to EARS-Net, via HPSC, has been mandatory, under Infectious Diseases legislation, since 2004. A number of acute hospitals in Ireland also report additional demographic, clinical and outcome data on *S. aureus* BSI reported to EARS-Net, as part of a voluntary enhanced bloodstream infection surveillance system.

The simplest method of surveillance of MRSA in healthcare facilities is maintaining a line listing of new cases of MRSA colonisation/infection. A list of patients with a previous history of MRSA is also useful. The line list provides identification of patients with a history of infection or colonisation, for calculating prevalence or incidence rates, and can be used to trigger and follow outbreak investigations. An increase in the number of cases in a healthcare facility may signify a growing problem and may require the additional collection of data to confirm a rise in incidence or incidence density (1).

With the increasing shift towards outpatient management, the blurring of the distinction between acute and non-acute healthcare institutions and the emergence of CA-MRSA, the traditional division between hospital and community acquisition has become less valid. Nevertheless, it is important to be able to identify cases of MRSA colonisation/infection that may be related to care in a given institution, and therefore a potential target for local infection prevention and control interventions. Likewise, it is important to be able to identify cases of MRSA colonisation/infection that are not related to healthcare exposure. For surveillance
purposes, cases of MRSA colonisation/infection may be classified using temporal (i.e. the
timing of MRSA-positive samples relative to the hospital/institution admission date) or
clinical definitions (i.e. combining the timing of specimen collection with an assessment of
whether or not the patient has had recent significant healthcare exposure).

Temporal definitions These classify MRSA cases as either hospital or community onset.
These have the advantage that they are only dependant on data routinely available from
diagnostic laboratories and do not require a detailed clinical or chart review of each case.
They have the disadvantage that they may be less specific for identifying true nosocomial
infections, because the assessment of recent healthcare exposures or of whether an infection
may have been incubating at the time of admission is lacking (1).

Clinical definitions These classify MRSA cases by likely acquisition source, i.e. hospital-
acquired, community-acquired or healthcare-associated. They have the advantage of
providing more detailed information on the likely source of MRSA colonisation/infection
and, therefore, identifying potential targets for interventions (2). They have the disadvantage
of being more labour-intensive than temporal definitions, as they require clinical or chart
review of every case, and of being more prone to variations in case classification between
different observers.

To ensure as many healthcare institutions as possible are able to carry out surveillance, using
common surveillance definitions that minimise bias and are straightforward to apply
temporal definitions should be used for routine MRSA surveillance. However, clinical
definitions may still be used for targeted local surveillance, e.g. in specific high-risk units or
during outbreak situations, and are also recommended for national enhanced surveillance of
*S. aureus* bloodstream infection.

Key performance indicators (KPIs) are specific and measurable elements of health and social
care that can be used to assess the quality of care (3). According to the Joint Commission on
Accreditation of Healthcare Organizations (JCAHO) in the United States, KPIs are not
intended to be direct measures of quality but instead act as alerts to identify opportunities for
improvements in the quality of patient care (4). The Health Information and Quality
Authority have published guidance on developing KPIs for healthcare settings (5). KPIs are
ideally based on standards determined through evidence-based academic literature or through
the consensus of experts when evidence is unavailable. However, there is a paucity of high quality evidence for KPIs relating to MRSA and other multidrug-resistant organisms (1). Thus, the recommendations for surveillance and KPIs in this document are based on international experience and consensus guidelines.

The use of KPIs in Ireland is not currently widespread and deficiencies in IPCTs, especially in the non-acute health sector, are a factor. Furthermore, the arrival of other challenges such as carbapenem-resistant Enterobacteriaceae (CREs) has meant that IPCTs have had less time to focus on some aspects of MRSA prevention and control including the use of KPIs to improve patient care. However, the provision of improved information technology facilities and education at local and national level may help to improve this (1,6-9).
Section 3: Appendices

Appendix I - Abbreviations

ANHOPS Association of National Health Occupational Physicians
BHIV6 Brain Heart Infusion with Vancomycin at 6 mg/l
BNF British National Formulary
BSAC British Society for Antimicrobial Chemotherapy
BSI Bloodstream Infection
CA-MRSA Community-Acquired MRSA
CDC Centre for Disease Prevention & Control (USA)
CRP C-Reactive Protein
CURB Score Severity score for community-acquired pneumonia, i.e. based on Confusion, Urea, Respiratory rate and Blood pressure.
CVC Central Vascular Catheter
EARS-Net European Antimicrobial Resistance Surveillance Network
EARSS European Antimicrobial Resistance Surveillance System
ECDC European Centre for Disease Control
ED Emergency Department
EMEA European Medicines Agency
ENT Ear, Nose and Throat
EU European Union
FDA Food and Drug Administration (USA)
GISA Glycopeptide-Intermediate Resistant Staphylococcus aureus
GRSA Glycopeptide-Resistant Staphylococcus aureus
HA-MRSA Healthcare-Associated MRSA
HCAI Health Care-Associated Infection
HCW Health Care Worker
hGISA hetero-Glycopeptide-Intermediate resistant Staphylococcus aureus
HICPAC Healthcare Infection Control Practices Advisory Committee (USA)
HIQA Health Information and Quality Authority
HIS Healthcare (Hospital) Infection Society (UK)
HPA Health Protection Agency (UK)
HPSC Health Protection Surveillance Centre
HSE Health Service Executive
ICU Intensive Care Unit
IPCT Infection Prevention and Control Team
IV IntraVascular
IDSA Infectious Diseases Society of America
IVIG IntraVenous ImmunoGlobulin
JCAHO Joint Commission on Accreditation of Healthcare Organisations (USA)
KPI Key Performance Indicators
LTCFs Long Term Care Facilities
MIC Minimum Inhibitory Concentration
MRSA Methicillin-Resistant Staphylococcus aureus
MSSA Methicillin-Susceptible Staphylococcus aureus
NICU Neonatal Intensive Care Unit
NMRSARL National MRSA Reference Laboratory
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>OH</td>
<td>Occupational Health</td>
</tr>
<tr>
<td>PAP-AUC</td>
<td>Population Analysis Profiling the Area Under the Curve</td>
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<tr>
<td>PVL</td>
<td>Panton-Valentine Leukocidin</td>
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<tr>
<td>PEG</td>
<td>Percutaneous Endoscopic Gastrostomy</td>
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<td>PEHA</td>
<td>Pre-Employment Health Assessment</td>
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<tr>
<td>PO</td>
<td>Per Oralis (oral administration of a drug)</td>
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<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
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<tr>
<td>RCPI</td>
<td>Royal College of Physicians of Ireland</td>
</tr>
<tr>
<td>RCSI</td>
<td>Royal College of Surgeons in Ireland</td>
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<tr>
<td>RCT</td>
<td>Randomised Controlled Trials</td>
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<tr>
<td>RoI</td>
<td>Republic of Ireland</td>
</tr>
<tr>
<td>SARI</td>
<td>Strategy for the control of Antimicrobial Resistance in Ireland</td>
</tr>
<tr>
<td>SCBU</td>
<td>Special Care Baby Unit</td>
</tr>
<tr>
<td>SCC</td>
<td>Staphylococcal Chromosome Cassette</td>
</tr>
<tr>
<td>SSTI</td>
<td>Skin and Soft Tissue Infection</td>
</tr>
<tr>
<td>TOE</td>
<td>TransOesophageal Echocardiography</td>
</tr>
<tr>
<td>TTE</td>
<td>Trans Thoracic Echocardiography</td>
</tr>
<tr>
<td>URTI</td>
<td>Upper Respiratory Tract Infection</td>
</tr>
<tr>
<td>UTI</td>
<td>Urinary Tract Infection</td>
</tr>
<tr>
<td>VISA</td>
<td>Vancomycin Intermediate Resistant <em>Staphylococcus aureus</em></td>
</tr>
<tr>
<td>VRE</td>
<td>Vancomycin-Resistant Enterococci</td>
</tr>
<tr>
<td>VRSA</td>
<td>Vancomycin-Resistant <em>Staphylococcus aureus</em></td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
</tr>
</tbody>
</table>
Appendix II - Glossary

Antibiotic stewardship
A programme to ensure the effective use of antibiotics such that patients are treated appropriately but antibiotics are not abused resulting in resistance.

β-lactam antibiotics
A group of antibiotics that includes penicillin, cephalosporins, monobactams and carbapenems, that all have the β-lactam ring, which is important for their antimicrobial activity.

Bloodstream infection
The presence of bacteria in the blood with clinical significance, i.e. the patient has a raised temperature, rigors, low blood pressure, etc.

Carrier
An individual who has MRSA on their skin or in their nose, but is not infected or ill due to MRSA. The term may be synonymous with being colonised.

Chlorhexidine
A topical antibiotic used to remove MRSA from the skin. This is also used in hand hygiene.

Chorioamnionitis
This is an infection that occurs late in pregnancy when the amniotic fluid, which surrounds the foetus, becomes infected and results in infection of the mother and the child.

Cohorting
In the absence of sufficient single rooms, patients with MRSA are grouped together and physically separated from patients without MRSA such as in a bay of a ward.

Colonisation
Carriage of MRSA without evidence of infection, i.e. the absence of fever, inflammation, etc. See also ‘Carrier’.

Combination treatment
The use of two or more antibiotics to treat an infection, e.g. vancomycin and rifampicin, to treat some MRSA bloodstream infections.

Contact precautions
Contact precautions are intended to prevent transmission of infectious agents i.e. MRSA, which are spread by direct or indirect contact with a patients or the patients’ environment.

Critical care areas
This includes intensive care units, special care baby units, neonatal intensive care units, and other areas with patients especially vulnerable to infection, e.g. specialist ICUs.

Decolonisation
A process by which efforts are made to remove MRSA from the patient who is colonised or is carrying MRSA through the use of topical antibiotics to the nose (e.g. mupirocin) and body washes (e.g. chlorhexidine).

**Endocarditis**
Infection of the inside lining of the heart, specifically the heart valves.

**Glycopeptides**
Antibiotics, i.e. vancomycin and teicoplanin, currently the agents of choice used to treat MRSA infections.

**Hand hygiene**
Decontamination of the hands either with soap or a liquid antiseptic with water or through the use of alcohol hand rubs.

**Hand-touch sites**
There are areas in the hospital that are commonly touched by the hands of healthcare workers, e.g. lockers, drip stands, beds.

**Healthcare-associated Infection**
Infections acquired in hospitals, i.e. 48 hours or more after admission, and also infections acquired following contact with other aspects of the health service, e.g. nursing homes, residential care units, day centres, renal dialysis, etc.

**High risk surgery**
This refers to major surgery where life threatening infection can occur if caused by MRSA, e.g. bloodstream infection. This would include cardiothoracic, vascular, orthopaedic implant surgery and neurosurgery.

**Infection**
The presence of MRSA with associated symptoms and signs of infection, e.g. pyrexia, rigors, productive sputum (e.g. pneumonia), pain and discharge (e.g. osteomyelitis).

**Isolation**
This refers to the physical separation of patients with MRSA from others who don’t have MRSA, typically in a single room.

**Key performance indicators**
Specific and measurable elements of health that can be used to assess the quality of care, e.g. maintaining a record of all new cases of MRSA.

**Long-term care facility**
This includes residential units, nursing homes and other units where the elderly or others reside permanently and is their home.

**Mastitis**
Infection of the breast. This is most commonly seen during breast feeding.

**Methicillin (meticillin)**
The β-lactam antibiotic first used for the treatment of *S. aureus* in the 1950s. It is no longer used clinically, but a related antibiotic, i.e. flucloxacillin, is the agent of choice to treat methicillin-susceptible *S. aureus*. MRSA implies resistance to flucloxacillin and other β-lactam antibiotics.

**Mupirocin**
A topical antibiotic used to remove/decolonise MRSA from the nose.

**Occupational health**
Services provided for healthcare workers, e.g. pre-employment screening, vaccination, etc by medical, nursing and other staff.

**Osteomyelitis**
Infection involving the bone.

**Outbreak**
Where there are more cases of MRSA than would be expected e.g. four cases on a ward where there would normally be at most 1-2.

**PCR**
The polymerase chain reaction is a molecular technique that can detect the presence of genetic components of microbes without the necessity for culture. It can also do so in hours rather than days.

**Personal protective equipment**
This includes gloves, plastic aprons or gowns and eye or face protection to protect healthcare workers and to prevent cross-infection.

**Reference laboratory**
A specialised laboratory that provides additional support and expertise to routine laboratories, e.g. molecular typing of MRSA isolates.

**Screening samples**
These are samples, usually swabs, taken from a patient to detect carriage of MRSA. A standard set would include nose, perineum/groin, throat, areas of broken skin and urine if a urinary catheter is present.

**Septic arthritis**
Infection involving the joints.

**Skin and soft tissue infection**
A range of infections affecting skin and associated structures, e.g. surgical site infection, cellulitis, etc.

**Standard precautions**
This is the most basic series of measures used to prevent infection and includes hand hygiene, use of PPE, environmental decontamination, safe disposal of waste, etc. It is required when in contact with every patient, irrespective of whether he/she is suspected of having infection.
Staphylococcus aureus (S. aureus)
This is a Gram positive bacterium that normally resides in the nose in about one third of healthy individuals and on moist areas of skin, e.g. perineum. In most individuals, the bacterium acts as a harmless commensal, i.e. it does not cause disease. MRSA is the antibiotic resistant derivative of this bacterium.

Surgical prophylaxis
The use of antibiotics, given within an hour of surgery, to minimise infective complications arising from the surgery, specifically surgical site (wound) infection.

Targeted screening
The screening of all patients known to be at risk for MRSA, e.g. patients previously MRSA positive or patients transferred from other hospitals.

Teicoplanin
A glycopeptides antibiotic (like vancomycin), used to treat MRSA infection

Universal screening
The screening of all patients on admission to hospital irrespective of risk.

Vancomycin
A glycopeptide antibiotic, currently the drug of choice to treat MRSA infections.
Appendix III - Committee membership & conflicts of interest

The following is a list of active members who contributed to the drafting and amendments of the guidelines.

- **Ms Patricia Coughlan**, Infection Prevention & Control Nurse, HSE South - Disability Services, St. Finbarr’s Hospital, Cork
  Conflicts of interest – Nothing to declare

- **Dr Robert Cunney**, Consultant Microbiologist, Health Protection Surveillance Centre (HPSC) & The Children's University Hospital, Temple Street, Dublin
  Conflicts of interest – Nothing to declare

- **Dr Fidelma Fitzpatrick**, Consultant Microbiologist, Health Protection Surveillance Centre (HPSC) & Beaumont Hospital, Dublin and National Clinical Lead in Healthcare-Associated Infection and Antimicrobial Resistance
  Conflicts of interest – Nothing to declare

- **Dr Blánaid Hayes**, Consultant Occupational Physician, Beaumont Hospital, Dublin
  Conflicts of interest – Clinical Director of Partner Health which provides occupational health services to Pfizer, Newbridge, Co. Kildare.

- **Prof Hilary Humphreys**, Professor of Clinical Microbiology, Royal College of Surgeons in Ireland & Consultant Microbiologist, Beaumont Hospital, Dublin (Chair)
  Conflicts of interest - Research funding from Steris Corporation, 3M, Inov8 Science, Pfizer & Cepheid in the last four years. Lecture or consulting fees from 3M, Novartis, AstraZeneca & Astellas.

- **Dr Phil Jennings**, Director of Public Health - Midland Area HSE Area Office, Co. Offaly
  Conflicts of interest – Nothing to declare
• **Dr Susan Knowles**, Consultant Microbiologist, The National Maternity and The Royal Eye and Ear Hospitals, Dublin

Conflicts of interest - Received sponsorship to attend medical meetings from Abbott Laboratories, GlaxoSmithKline and Pfizer

• **Ms Lenora Leonard**, Infection Prevention & Control Nurse Specialist, UPMC Beacon Hospital, Dublin

Conflicts of interest – Nothing to declare

• **Dr Olive Murphy**, Consultant Microbiologist, Bon Secours Hospital, Cork

Conflicts of interest – Nothing to declare

• **Dr Sinéad McNicholas**, Lecturer in Clinical Microbiology, Royal College of Surgeons in Ireland, Dublin

Conflicts of interest - Received research funding from Pfizer in the last two years. Received sponsorship to attend medical meetings from Novartis and Pfizer

• **Dr Brian O’Connell**, Medical Director, National MRSA Reference Laboratory & Consultant Microbiologist, St James Hospital, Dublin

Received research funding from Wyeth in the last three years. Received sponsorship to attend medical meetings from Novartis, Pfizer, Astellas and Wyeth

• **Ms Marie Tierney**, Antimicrobial Pharmacist, Galway University Hospital, Galway (representing Irish Antimicrobial Pharmacists Group)

Conflicts of interest - Received sponsorship to attend medical meetings from Novartis and Pfizer

**Others:**

**Mr. Sean Egan**, Antimicrobial Pharmacist, Adelaide and Meath Hospital Dublin incorporating the National Children’s Hospital
Dr Patrick Gavin, Consultant Infectious Diseases Physician, The Children’s University Hospital, Temple Street and Our Lady’s Children’s Hospital, Crumlin

Ms Mary Kelleher, Surveillance Scientist, St James Hospital, Dublin

Dr Karina O’Connell, Specialist Registrar, The Children’s University Hospital, Dublin

Ms. Laura Smith, Midlands Area HSE Office, Co. Offaly
Appendix IV – Consultation process

The draft document was placed on the HSE and HPSC websites for general consultation in June 2011 with a six week period allowed for individuals and groups to feedback comments and suggested amendments. In addition, a draft of this document was sent to the following groups with a covering letter actively seeking feedback and comment:

- Academy of Medical Laboratory Science
- Cystic Fibrosis Registry of Ireland
- HSE HCAI Governance Group
- HSE Directors of Nursing
- Haematology Association of Ireland
- Irish Antimicrobial Pharmacists Group
- Irish Association of Critical Care Nurses
- Irish Association for Emergency Medicine
- Irish Association for Nurses in Oncology
- Irish Association for Paediatric Nursing
- Intensive Care Society of Ireland
- Irish College of General Practitioners
- Infectious Diseases Society of Ireland
- Irish Nephrology Nurses Association
- Irish Society of Clinical Microbiologists
- Irish Patients Association
- Infection Prevention Society
- Occupational Health Nurses Association of Ireland
- Public Health Medicine Communicable Disease Group
- Royal College of Physicians of Ireland (RCPI)
- RCPI Faculty of Occupational Health
- RCPI Faculty of Pathology
- RCPI Faculty of Paediatrics
- RCPI Faculty of Public Health Medicine
- Royal College of Surgeons in Ireland (RCSI)
- RCSI Faculty of Radiologists
- SARI National Committee
- SARI Regional Committees
- Surveillance Scientists Association of Ireland

Feedback was received from the following:

<table>
<thead>
<tr>
<th>Individual</th>
<th>Group</th>
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</table>
Bernie McArdle, CNS in Infection Control, Cavan General Hospital

Richard Drew, Research Fellow in Clinical Microbiology, St. Patrick Dun’s Laboratory, Trinity College, Dublin 2.

Teresa Farrell, Assist DoN, Infection Prevention & Control, Sligo General Hospital

Peter Jenks, Plymouth Hospitals, NHS Trust, UK

Michelle Bergin, ADON Infection Prevention/Control, HSE, Midlands Regional Hospital, Tullamore

Caroline Marshall, Infectious Disease Physician, Victorian Infectious Diseases Service, Royal Melbourne Hospital, Grattan St, Parkville, Victoria, Australia

Teresa Graham, Stop Infection Now Campaign, Co. Waterford

Carmel Fallon, Infection Control Nurse, Public Health, HSE West, Merlin, Galway

Anne Marie Howard, A/CNM3, Occupational Health Dept, Waterford Regional Hospital

Elaine Brabazen, Surveillance Scientist, Dept of Health, HSE North East

Deirdre Lenehan, Antimicrobial Pharmacist, Mater Misercordiae University Hospital, Dublin
Irish Antimicrobial Pharmacists Group (IAPG)
Special Interest Group of the Hospital Pharmacists Association of Ireland (HPAI)

Dympna McDonnell, Infection Prevention & Control Specialist, AMNCH, Dublin 24

Tracey Doherty, CNS, Infection Prevention & Control, Drogheda, Co. Louth

Sheena Notley, Inspector Health & Safety Authority, Dublin

Eileen Hickey, Infection Control Nurse, Kerry General Hospital

Sheila Donlon, Infection Control Nurse Manager, HPSC, Dublin

Noreen Quinn, Pharmacist, Dept of Health, Dublin 2

Cathal O’Sullivan, Consultant Microbiologist

Karen Burns, Consultant Microbiologist, Beaumont Hospital, Dublin

CUH, CUMH, St. Finbarr’s, St. Mary’s Orthopaedic Hospital, Cork Community Services, Cork/Kerry Disability Services – Infection
### Control team members and other healthcare professionals

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<tbody>
<tr>
<td>Marena Burd, IPCN (retired)</td>
<td></td>
</tr>
<tr>
<td>Grainne McHale &amp; Rose Cafferky – Infection Prevention &amp; Control</td>
<td>Clinical Nurse Specialist, Antimicrobial Pharmacist</td>
</tr>
<tr>
<td>Margaret O’Riordan, Head of Quality &amp; Standards, Irish College of</td>
<td>General Practitioners, Dublin 2.</td>
</tr>
<tr>
<td>Lelia Thornton, Specialist in Public Health, HPSC, Dublin</td>
<td></td>
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<tr>
<td>Colm Power, Senior Scientist, Microbiology, Kerry General Hospital,</td>
<td>Tralee, Co. Kerry</td>
</tr>
<tr>
<td>James Powell, Surveillance Scientist, Microbiology, MWRHL, Limerick</td>
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<tr>
<td>Ruth Hobson, Centre of Nurse &amp; Midwifery Education, Mayo/Roscommon</td>
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<tr>
<td>Aisling Purcell, Clinical Nurse Specialist, Occupational Health Dept</td>
<td>St. Vincent’s University Hospital , Elm Park, Dublin 4.</td>
</tr>
<tr>
<td>Helen Lamass &amp; Berna Walshe, CNS Infection Prevention and Control,</td>
<td>Portiuncula Hospital, Ballinasloe, Galway</td>
</tr>
<tr>
<td>Health Service Executive Hospital Group, South/South East Network</td>
<td>Infection Prevention &amp; Control Team for Waterford, Carlow, Kilkenny and</td>
</tr>
<tr>
<td>Helen Murphy, Infection Control/Communicable Diseases Nurse Manager,</td>
<td>South Tipperary</td>
</tr>
<tr>
<td>Niamh O’Sullivan, Consultant Microbiologist, Our Lady’s Hospital for</td>
<td>Sick Children</td>
</tr>
<tr>
<td>Martin Cormican, Consultant &amp; Professor of Bacteriology, HSE,</td>
<td>Galway</td>
</tr>
<tr>
<td>Deirbhile Keady, Consultant Microbiologist, Lead for Infection</td>
<td>Control team, Microbiology Departments, Galway University Hospitals,</td>
</tr>
<tr>
<td>Eilish Creamer, Infection Prevention &amp; Control Nurse</td>
<td>Galway</td>
</tr>
<tr>
<td>Susan McGovern, Infection Control, Clinical Nurse Manager 2,</td>
<td>Clontarf Hospital (Rehabilitation), Dublin</td>
</tr>
<tr>
<td>Breida Boyle, Clinical Microbiologist, James’s Hospital, Dublin</td>
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The feedback was initially collated by two members of the working group (Professor Hilary Humphreys and Dr Sinead McNicholas, HH & SMcN) and those suggestions that were non-contentious and easy to address, were incorporated into the next draft of the document. Where it was not clear whether a suggestion could or should be addressed, this was highlighted for consideration by all members of the Working Party. Subsequent to this initial re-drafting, a full meeting of the Working Party took place where the revised set of guidelines with the queries were tabled together with a full set of the feedback documents from the above organisations and groups, as well as another document highlighting what other generic issues need to be addressed, e.g. a review date. At that meeting decisions were taken on what further changes could and should be made, e.g. clarifying points or re-organising the order of the document and what issues could not be addressed, e.g. providing recommendations for very precise clinical settings. After that final meeting of the Working Party, certain members agreed to revise and review fully a limited number of sections or components, e.g. decolonisation regimens. When these changes had been made and received by HH and SMcN, the penultimate document was sent to all members of the Working Party for final review and approval. Given the extensive feedback from many individuals and groups, it was not felt feasible to include in this document all the feedback and how the working group responded to each issue. A further draft of the document was prepared after feedback was received from the National Clinical Effectiveness Committee (NCEC).
Appendix V – How to obtain a nasal swab

Gather together the equipment needed to obtain a nasal swab:

- Gloves
- Apron*
- Swab/specimen collection device
- Appropriate documentation

*The need for an apron should be risk assessed

The procedure

- Obtain informed consent (oral suffices) from the patient. Answer any questions and allay any anxieties that the patient may have.
- Clean hands thoroughly. Use appropriate PPE.
- Open swab packaging, checking expiry date
- Remove swab from packaging, moisten with sterile water if required (to prevent any discomfort to the patient)
- Insert the swab into the anterior nostril by about 2 cm
- Rotate for about three seconds
- Repeat the procedure with the same swab in the other nostril
- Without contaminating swab, place in the culture medium provided
- Remove and dispose of PPE appropriately and clean hands
Appendix VI – Template letter to consultant and copied to the general practitioner

Hospital Name & Address

Date:

GP name:

GP address:

Patient name:

DOB:

Address:

Dear Dr (name),

The above named patient was an in-patient in this hospital on (date)……….

MRSA was isolated from the (state location) ……….

The patient was discharge home on (date) ………….

A copy of this letter is being forwarded to the consultant under whom the patient was an in-patient.

Tick as appropriate

The patient was prescribed a 5 day regimen of chlorhexidine washes and Bactroban (mupirocin) nasal ointment. MRSA was not isolated from 3 consecutive swabs post treatment.

The patient was prescribed a 5 day regimen of chlorhexidine washes and Bactroban (mupirocin) nasal ointment. MRSA was not
isolated from the 1st repeat swab post treatment. The patient was discharged home prior to repeat swabs after treatment.

The patient was prescribed a 5 day regimen of chlorhexidine washes and Bactroban (mupirocin) nasal ointment. No repeat swabs after treatment were taken as the patient was discharged home before the recommended follow up period.

No treatment was commenced as we received these positive results after the patient’s discharge. No action is required unless the patient is scheduled soon (within 3 months) for surgery.

This information will be important for screening in the event of any future hospital admissions.

Please contact me if you have any queries.

Regards,

..............................................

cc Consultant’s name, department and address

Appendix VII - Risk stratification tool for the isolation and cohorting of MRSA patients
The following tool for risk stratification of patients with MRSA for isolation and cohorting is based on the Lewisham Isolation Prioritisation System (LIPS). The LIPS was developed in 1999 as a scoring system based on factors likely to influence transmission. It was modified by one of the original authors in 2009, following extensive feedback from users.
### Table 2. Score card

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Classification</th>
<th>Score</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient name:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name and designation of person scoring</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significant details, e.g. microorganism(s)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Criteria</strong></td>
<td><strong>Classification</strong></td>
<td><strong>Score</strong></td>
<td><strong>Comments</strong></td>
</tr>
<tr>
<td>ACDP</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Route</td>
<td>Airborne</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Droplet</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contact/faeco-oral</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blood-borne</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Evidence of transmission</td>
<td>Strong (published)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moderate (consensus)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poor</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nil</td>
<td>–10</td>
<td></td>
</tr>
<tr>
<td>Significant resistance</td>
<td>Yes</td>
<td>5</td>
<td>Such as MRSA, VRE, ESBL, Gent resistance.</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>High susceptibility of other patients with serious consequences</td>
<td>Yes</td>
<td>10</td>
<td>Specific for various infections and patient populations.</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Prevalence in hospital</td>
<td>Sporadic</td>
<td>0</td>
<td>This reflects the burden of infection in the hospital and cohort measures may be more applicable. See above.</td>
</tr>
<tr>
<td></td>
<td>Endemic</td>
<td>–5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Epidemic</td>
<td>–5</td>
<td></td>
</tr>
<tr>
<td>Dispersal</td>
<td>High risk</td>
<td>10</td>
<td>This includes diarrhoea, projectile vomiting, coughing, confused wandering, infected patients etc.</td>
</tr>
<tr>
<td></td>
<td>Medium risk</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low risk</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL SCORE</strong> (document score in patient’s notes):**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Using the score to determine the priority for isolation:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Score</td>
<td>Priority for isolation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–20</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25–35</td>
<td>Med</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35+</td>
<td>High</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ACDP = Advisory Committee on Dangerous Pathogens; ESBL = Extended-spectrum beta-lactamases; MRSA = Meticillin-resistant Staphylococcus aureus; VRE = Vancomycin-resistant Enterococcus.
Example for a patient with MRSA:

<table>
<thead>
<tr>
<th>Patient colonised with MRSA identified on a nasal swab in the ICU of a hospital with endemic MRSA</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACDP=2</td>
<td>5</td>
</tr>
<tr>
<td>Route=contact</td>
<td>5</td>
</tr>
<tr>
<td>Evidence of transmission=published</td>
<td>10</td>
</tr>
<tr>
<td>Significant resistance=yes</td>
<td>5</td>
</tr>
<tr>
<td>High susceptibility of other patients with serious consequences of infection=yes</td>
<td>10</td>
</tr>
<tr>
<td>Prevalence=endemic</td>
<td>-5</td>
</tr>
<tr>
<td>Dispersal=high risk</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total score</strong></td>
<td>35 =category of priority for isolation=high</td>
</tr>
</tbody>
</table>

References

Appendix VIII- Infection Prevention And Control Measures Advised When Caring For Residents Colonised Or Infected With MRSA In Residential Care Facilities.

Standard Precautions have been designed to reduce the risk of cross infection from both recognized and unrecognized sources of infection. It is not always possible to identify people who may be a source of infection thus Standard Precautions are advocated for the care of all patients/clients at all times. Standard Precautions are the foundation for preventing transmission of infection during patient/client care in all healthcare settings.

Standard Precautions are work practices required for a basic level of infection control and prevention. They can be applied as Standard principles by

- ALL healthcare practitioners to the care of
- ALL clients
- ALL the time

Standard Precautions include
1. Hand hygiene
2. Personal protective clothing
3. Respiratory hygiene/cough etiquette
4. Safe use and disposal of sharps
5. Blood and body fluid spills management
7. Management of laundry & linen
8. Environmental hygiene
9. Client-care equipment/medical devices
10. Resident/client placement, movement & transfer
11. Safe injection practices
12. Infection control practices for lumbar punctures

Standard Precautions should be used for the care of all residents who are colonised or infected with MRSA.

Isolation of residents with MRSA is not generally recommended. Within long-term care facilities residents are encouraged to take part in-group activities and eat in a common dining/day room. It would be contrary to the philosophy and policy of these facilities to isolate ambulatory residents with MRSA. Therefore, the routine use of isolation/single room placement is not encouraged. The exceptions might be a resident with wounds heavily colonised with MRSA, or a resident with a tracheostomy who is unable to control their secretions.

The decision to isolate a resident must be considered carefully and should take into account the risk to the individual, other residents and staff. The psychological affects of isolation must
be considered carefully. Where available advice should be sought from the local infection control team/nurse.

When published, national Guidance on Standard Precautions and Transmission based Precautions will be available at www.hpsc.ie and will supersede this appendix

Hand Hygiene as per Standard Precautions

• Hand hygiene is the single most important element of preventing the transmission of MRSA and must be performed appropriately by all staff according to the WHO Moments for Hand Hygiene.
• Hand hygiene should be carried out using an alcohol based hand rub - on visibly clean hands only - plain soap and water is required when hands are visibly soiled.
• Encourage and assist residents to carry out hand hygiene.

Patient Placement as per Standard Precautions

• Consider the potential for transmission of infection in resident placement decisions. Local risk assessment of the individual and the environment will be required prior to placement.
• Visitors should be encouraged to clean their hands before and after visiting all residents.

Placement of Residents known to be colonised or infected with MRSA

• Residents known to be colonised with MRSA should be allowed to participate in group activities provided wounds are covered and good hand hygiene is adhered to.
• Residents known to be colonised with MRSA may share a room with another resident who is at low risk of acquiring MRSA. Hand hygiene facilities should be available.
• Residents known to be colonised with MRSA, where facilities are available, should not share bedrooms with or in a shared room be placed adjacent to residents who are at increased risk of acquiring MRSA e.g. residents with open wounds, invasive devices.
• It is preferable that residents colonised or infected with MRSA should receive physical care in their own room, for example
  o wound dressing changes for residents with colonised wounds
  o chest physiotherapy, suctioning for residents colonised in their respiratory tract.
Residents known to be colonised with MRSA in a wound which can not be covered by dressings or clothing should be in a single room if available and if this will not adversely affect the resident or their rehabilitation.

Visitors of residents colonised or infected with MRSA do not need to wear PPE and should be encouraged to wash their hands before and after visiting.

**Personal Protective Equipment (PPE) as per Standard Precautions**

- Disposable gloves (nitrile or suitable alternative) should be worn for all contact with blood or body fluids, non-intact skin, mucus membranes and items contaminated with blood or body fluids.
- Disposable aprons should be worn where there is a risk of splashing of clothing with blood or body fluids or direct contact of clothing with non-intact skin or items contaminated with blood or body fluids.
- Hand hygiene should be performed after removing PPE.

**Decontamination of Medical /Care Equipment as per Standard Precautions**

- Medical equipment should be dedicated to the resident e.g. hoist slings or must be decontaminated between each resident e.g. stethoscope.
- Reusable equipment must not be used for the care of other residents until it has been decontaminated and reprocessed appropriately.
- Single use items must not be reused and must be discarded appropriately
- Chemical disinfection is not required for routine decontamination of low risk items i.e. items which only come in contact with intact skin and are not soiled with body fluids (bathing aids, mattresses)
- All items for personal hygiene must be dedicated for the residents own use.

**Decontamination of the Environment as per Standard Precautions**

- Cleaning of the environment should be carried out using warm water and detergent with attention to hand contact surfaces (bed rails, hand rails, bed tables, door handles etc).
- Baths and showers should be cleaned between uses by all residents.
- Chemical disinfection is not required for routine decontamination of the environment.
• Where the environment is soiled with blood or body fluid, following cleaning, chemical disinfection is recommended.
• Cutlery and crockery should be washed in a dishwasher. Separate or disposable cutlery or crockery is not required.

**Management of Laundry as per Standard Precautions**

• Clean linen should be stored in a clean dry area.
• All linen soiled with bodily fluids should be treated as contaminated by placing in a water-soluble or alginate stitched bag prior to placing in a laundry bag which is designated for contaminated linen by label or colour.
• There must be no manual washing of soiled clothing.
• Personal clothes should be machine-washed.
• Hand washing after handling all used linen is essential.

**Management of healthcare waste -as per Standard precautions**

• Waste unless soiled with blood or with body fluids assessed as infectious should be discarded as health care non-risk waste, including PPE.

---

**Appendix IX - MRSA- Information for Schools and Day Care Facilities for Children**

**What is MRSA?**

• MRSA stands for meticillin resistant *Staphylococcus aureus*. 
- *Staphylococcus aureus* (pronounced staf-ill-ok- us -aur-ee-us), or “Staph aureus” for short, is a common bacterium (germ) that lives harmlessly on the skin or in the nose of about one in three people.
- MRSA is a type of *Staph aureus* that has become resistant to a number of different antibiotics. ‘Resistant’ means it is not killed by antibiotics.
- Most people who carry MRSA on their bodies or in their noses don’t suffer any ill effects. Carrying the germ harmlessly like this is called “colonisation”.
- However MRSA sometimes causes infections if it enters the body.

**What is the difference between “colonisation” and “infection”**?

- MRSA colonisation means that the germ is simply “sitting on the skin” (in any site) but is causing no harm to the person.
- In a MRSA infection, the germs cause signs of infection, for example, fever and/or pus discharging from a wound and the person will feel unwell. This is more likely to happen to people who are already unwell, particularly those who are in hospital with a serious illness.

**What are the symptoms of an infection caused by *Staph aureus* or MRSA?**

- *Staph aureus* bacteria, including MRSA, can cause skin infections that may look like a pimple or boil and can be red, swollen, painful or discharge pus.
- People with infection may also have a temperature or fever and feel generally unwell.
- More serious infections may cause pneumonia, bloodstream infections or surgical wound infections.
- MRSA should be considered in someone with repeated skin infections or with a wound that is taking longer to heal than normal.
- A laboratory test is the only way to tell if someone is carrying MRSA.

**Who is at risk of infection?**

- The following reasons make people vulnerable to any infection, including infection caused by MRSA:
  - Their underlying condition
  - How frequently they have used antibiotics
  - The number of operations they have had
  - The presence of open wounds
  - Those who have been in hospital/long-term care facility for a long time
  - People with a long-term illness

**How do people get MRSA?**

- MRSA is usually spread by direct skin-to-skin contact.
• The people most at risk of becoming colonised with MRSA are those who have been in hospital for a long time, have a lot of contact with hospitals, have a long-term illness, or have had a lot of antibiotics.
• Where healthcare is provided, MRSA may be passed from one person to another on the unclean hands of staff or visitors, through the use of care equipment which is inadequately cleaned, or by contamination of the healthcare environment.
• MRSA is most likely to spread in healthcare settings where there is overcrowding and where a lot of antibiotics are used.
• Outside of healthcare settings, there is little risk of transmitting MRSA to healthy people who are at low risk of becoming infected.

What precautions should all schools take to prevent transmission of MRSA?

• To prevent MRSA infections and the transmission of other germs such as those which can cause colds, flu, vomiting or diarrhoea, the following general precautions should be followed:
  • Wash your hands regularly
  • Encourage all children to wash their hands after using the bathroom and before meals – assist children to do this where necessary
  • Care for all wounds properly, ensuring wounds are covered at all times.
  • Inform the family if there is any concern about the clinical status of any child (e.g. potential skin infection that needs antibiotic treatment). The family can then consult their general practitioner for advice.

What precautions can special school/classroom settings take to prevent transmission of MRSA?

For settings such as special schools or classrooms where children require physical care (such as assistance with toileting or feeding) the following is recommended for all children regardless of whether or not a child is known have MRSA:

Hand Hygiene

• Caregivers should wash their hands with soap and water before and after providing physical care to all children.
• Disposable gloves should be worn only if contact with body fluids, areas of broken skin or dressings are expected and hands must be washed after removing the gloves.
• Cuts or breaks in the skin of care givers should be covered with a waterproof dressing.

Cleaning of the Environment

• Routinely clean the environment using detergent and water and clean immediately if soiled (dirtied) with body fluids. Pay attention to frequently used and touched surfaces.
• The routine use of disinfectants for environmental cleaning is unnecessary unless there is a higher risk of infection, such as where surfaces become soiled with body fluids.
• Routinely clean equipment, such as sensory equipment and toys, and clean immediately if soiled with body fluids.
• Where disinfection is required a bleach based disinfectant* is advised.

Equipment/products used in providing personal care

• Equipment used in providing personal care (changing mats, beds, toilet aids etc) should be cleaned with detergent and water between uses for different children.
• Do not share personal care items e.g face cloths, towels creams, lotions.
• Chemical disinfection is not routinely required unless equipment is soiled with body fluids.
• Where disinfection is required a bleach based disinfectant* is advised.

Linens (bedding, blankets etc)

• Change and wash linens between uses by different children.

Preventing and controlling infection where additional care activities are necessary in the school setting:

Where children require additional care such as enteral feeding, respiratory care e.g. suctioning, care of urinary catheters or other devices, it is recommended that:

• care givers have infection prevention and control education relevant to the care they provide,
• hand hygiene facilities, including hand washing sinks, liquid soap and paper towels and alcohol hand rubs, are available and
• personal protective equipment (disposable gloves and aprons) is available.

Who needs to know when a child has MRSA?

• In general, only staff involved in the child’s health care need to know that he/she has MRSA. These include public health nursing, GP and the nursing and medical staff who are responsible for care during a hospital stay.
• If a person had MRSA in the past it is helpful to tell the doctors and nurses looking after them as it will assist in planning care.

Can a child who is known to have MRSA attend school?

• Children known to be colonised with MRSA in the nose or skin or other sites do not need to be excluded from school or activities within the school.
• Children who have wounds or skin sores which can be covered (by a dressing or by clothing) do not need to be excluded from school.

• Exclude children who have wounds or skin sores which are wet or producing pus and which can not be covered or contained by a dressing and/or the dressing cannot be kept dry and intact. Exclude children until the wounds can be covered sufficiently or are healed.

* Manufacturers’ instruction should be followed (safety of use, dilution, and rinsing if required, suitability for the use on equipment/surface)

Further information on infection control for school settings available in:


Further information on


Hand Hygiene at http://www.hpsc.ie/hpsc/A-Z/Gastroenteric/Handwashing/

**Appendix X: Matrix for work restrictions in colonised healthcare workers**

(This is provided as general guidance and may be useful initially, where expert opinion is not immediately available. Expert opinion based on local risk assessment may justify deviation from this).

<table>
<thead>
<tr>
<th>HCW Patient</th>
<th>Level 1 Nasal colonisation</th>
<th>Level 2 Nasal and skin colonisation</th>
<th>Level 3 Nasal and throat colonisation</th>
<th>Level 4 Multiple sites of colonisation (&gt;2)</th>
<th>Level 5 Multiple sites of colonisation (&gt;2) with individual HCW risk</th>
</tr>
</thead>
</table>
### Key to table:

**Blank:** Low risk of transmission from HCW to patient

**Horizontal lines:** Moderate risk of transmission from HCW to patient

**Trellis lines:** High risk of transmission from HCW to patient
Appendix XI - MRSA surveillance definitions

(Please see Section 2.12 for original sources and references)

An outbreak of infection
This is defined as two or more cases where the observed number of cases exceeds the normally expected number for that unit or clinical area.

Severe invasive disease
This includes:
- infection at a normally sterile site, e.g. blood, cerebrospinal fluid, joint fluid etc.
- necrotizing pneumonia
- community-acquired pneumonia with a CURB-65 score of 4 or 5
- skin or soft tissue infection requiring ICU care or extensive surgical debridement

Local surveillance of invasive infections
These should include any infection at a normally sterile site (e.g. bloodstream infection, meningitis, septic arthritis). Other invasive infections (e.g. deep surgical site infections) may also be included, but this should be determined by local risk assessment.

Temporal surveillance definitions

Hospital-onset
The first MRSA-positive specimen was collected from the patient three or more days after admission to the hospital, where the first day is the date of admission (the “three midnight rule”). For example, if a patient is admitted to the hospital at any time on a Monday, only specimens taken after midnight Wednesday night would be considered to represent hospital-onset infection. All hospital-onset infections are considered healthcare-associated.

Community onset
The MRSA-positive specimen was collected within three days of hospital admission. However, a subset of community-onset infections may be healthcare-associated, i.e. MRSA was acquired in another healthcare facility such as a nursing home.
Clinical surveillance definitions

The following are adapted from surveillance definitions currently in use in Australia, Canada and USA. Clinical case definitions should be applied in addition to temporal case definitions for the purposes of targeted local surveillance, e.g. surveillance in high-risk units or during outbreak situations. Clinical case definitions must be applied to cases of *S. aureus* BSI reported to the enhanced EARS-Net surveillance programme.

Healthcare-associated MRSA

This is a newly identified MRSA infection or colonisation with MRSA that satisfies at least one of the following criteria:

- Acquired during hospitalisation and not documented as present or incubating on admission: i.e. occurring three or more days after admission. For patients admitted to hospital via the emergency department (ED), the date of attendance at the ED should be counted as the date of admission, even if this includes one or more overnight stays in the ED.
- MRSA-positive specimens taken within three days of hospital admission or admitted via the ED (see first bullet point) in a patient who was admitted from a long term care facility, e.g. skilled nursing home, hospice or non-acute hospital, or from another acute hospital.
- A complication of the presence of an indwelling medical device, e.g. intravascular catheter, urinary catheter.
- A surgical site infection, or related BSI, within 30 days of a surgical procedure.
- Instrumentation or incision related to the infection was performed within 48 hours before onset of the infection. If the time interval was longer than 48 hours, there must be compelling evidence that the infection was related to the invasive device or procedure.
- Associated with neutropenia (<1000 neutrophils x 10⁶/L) contributed to by cytotoxic therapy.

Healthcare-associated MRSA infection or colonisation should be subdivided into:

a. Associated with care at this hospital/healthcare facility.

b. Associated with care at another hospital/healthcare facility, e.g. nursing home, dialysis unit, other hospital.
Community-associated MRSA (CA-MRSA) infection
For the purposes of epidemiological investigation and public health interventions, CA-MRSA infections are defined as MRSA infections occurring in persons where all of the following apply:

- Diagnosis of MRSA was made in the outpatient setting or by an MRSA-positive specimen taken within three days of admission to the hospital/ED (see above)
- No medical history of MRSA infection or colonisation.
- No medical history in the past year of:
  - Hospitalisation
  - Admission to a nursing home, skilled nursing facility, or hospice
  - Dialysis
  - Surgery
- No permanent indwelling catheters or medical devices that pass through the skin into the body

Undetermined source
Cases of MRSA infection or colonisation that do not fit the above criteria, or where the relevant clinical data is unavailable, should be classified as “undetermined source of MRSA”.
Appendix XII - MRSA- Related Process Indicators

The following process indicators for control and prevention of MRSA have been adapted from recommendations produced by the US Society for Healthcare Epidemiology.

*Compliance with hand-hygiene guidelines*

Monitor healthcare personnel compliance with hand hygiene guidelines both before and after contact with the patient or environment, using a standardised hand hygiene observation tool. A standardised hand hygiene observation tool has been developed by the HPSC and may be downloaded from [www.hpsc.ie](http://www.hpsc.ie). Note that HSE-funded acute hospitals are now required to use this tool for six-monthly national reporting of hand hygiene compliance. Compliance is calculated by:

- Numerator, number of observed adequate hand hygiene episodes performed by healthcare personnel
- Denominator, number of observed opportunities for hand hygiene
- Multiply by 100 so that the measure is expressed as a percentage

*Compliance with contact precautions (CP)*

This assessment should be performed only as an internal measure within acute hospitals, as this measure has not been validated for, and should not be used for, inter-hospital comparisons. This is calculated by,

- Numerator, number of observed patient care episodes in which CP are appropriately implemented.
- Denominator, number of observed patient care episodes in which CP are indicated.
- Multiply by 100 so that the measure is expressed as a percentage.

*Compliance with MRSA active surveillance screening*

This assessment should be performed only as an internal measure within acute hospitals, as this measure has not been validated for, and should not be used for, inter-hospital comparisons. This is calculated by:
• Numerator, number of persons from whom surveillance specimens were appropriately collected.

• Denominator, number of persons meeting the selected criteria for surveillance testing.

• Multiply by 100 so that the measure is expressed as a percentage.
Appendix XIII - Areas for Further Research

Does universal admission screening for MRSA result in fewer new acquisitions of MRSA? Is it cost-effective, particularly at a time of falling MRSA rates?

Does inclusion of patients with non-intact skin (e.g. wounds, ulcers), exfoliative skin conditions, PEG tubes or urinary catheters, and patients who are healthcare workers, in admission screening for MRSA result in fewer new acquisitions of MRSA?

What is the cost-effectiveness of culture versus molecular-based detection methods for screening patients for MRSA carriage?

Are control of infection wards a cost-effective means of reducing the rate of new MRSA colonisation or infection?

What is the minimum time period between screening swabs, after MRSA decolonisation therapy, that will effectively demonstrate that a patient is no longer carrying MRSA (for purposes of discontinuing isolation precautions)?

Do healthcare workers, who are found to be colonised with MRSA but not epidemiologically linked to acquisition of MRSA by patients, need to avoid patient contact in high risk units and, if so, for how long after starting decolonisation therapy?

How many repeated attempts at decolonisation should be made for patients or healthcare workers persistently colonised with MRSA?

What is the effectiveness of alternative approaches to decolonisation, for patients or healthcare workers persistently colonised with MRSA?

What is the effectiveness of adding an antiseptic mouthwash, to reduce or eliminate throat carriage of MRSA, to decolonisation regimens?

Are healthcare workers with exfoliative skin lesions at increased risk of acquiring and transmitting MRSA and, if so, should their contact with patients be restricted?

Does the wearing of face masks by healthcare workers reduce the transmission of MRSA, if worn for (1) every contact with an MRSA-colonised patient or (2) only for contact with MRSA-colonised patients with an intercurrent respiratory tract infection?
Does promoting hand hygiene compliance by patients reduce the incidence of new MRSA acquisition, or the incidence of MRSA infection?

What level of additional environmental cleaning/decontamination is required in operating theatres, after a procedure on an MRSA-colonised patient, to prevent transmission to subsequent patients?

What is the risk of transmission of MRSA via laundry, and does the risk justify designating all laundry associated with a patient colonised with MRSA as potentially infectious?

Does routine MRSA screening in non-acute healthcare settings result in fewer new acquisitions of MRSA and, if so, under what circumstances is it indicated?

What is the most effective choice of antibiotic therapy for MRSA SSTI or pneumonia?

Do adjunctive therapies, such as intravenous immunoglobulin, result in improved outcomes for MRSA SSTI or pneumonia?

Does decolonisation of index cases of CA-MRSA in non-hospital settings result in fewer new acquisitions of CA-MRSA?

Does routine monitoring of vancomycin or teicoplanin trough levels result in improved outcome for patients with invasive MRSA infections?

What duration of therapy is required for specific MRSA infections to maximise therapeutic efficacy while minimising unnecessary drug exposure?

Is exclusion of healthcare workers, found to be carriers of MRSA, from patient contact in high risk areas required (in the absence of an epidemiological link to MRSA transmission) and, if so, for how long should they be excluded following the initiation of decolonisation therapy?

Appendix XIV

Ambulance Transportation of Patients Colonised/Infected with MRSA
There is no evidence that ambulance staff/hospital drivers or their families are put at risk by transporting patients with MRSA. The risk of cross-infection from a MRSA colonised or infected patient to other patients in an ambulance is minimal. Good infection control practices and routine cleaning (i.e., Standard Precautions) are sufficient to prevent cross-infection. No additional cleaning of the ambulance is required after transporting a MRSA positive patient.

- The ambulance service should be notified in advance by the ward staff of the patient’s MRSA status.
- To minimise the risk of cross infection with any infectious agent, ambulance staff should use an alcohol based hand rub after contact with all patients, as part of Standard Precautions.
- Every effort should be made to minimise the need to handle wounds and invasive devices by the transporting staff.

Patients colonised/infected with MRSA can be classified into two categories for transportation by the ambulance services

1. **Can be transported with other patients:** In general, most patients may travel with other patients without additional precautions other than changing the bedding of the carrier. If the patient has skin lesions these should be covered with an impermeable dressing. Hands of ambulance staff should be decontaminated with alcohol gel/rub but aprons and gloves should only be worn for direct care.

2. **Need to be transported individually – there are two reasons why this will occur**
   a. **The patient is deemed at high risk of transmission of MRSA** (e.g., discharging lesions which cannot be covered with an impermeable dressing, patients with extensive psoriasis or eczema etc)
      In these cases staff should wear a disposable apron and gloves, decontaminate their hands with alcohol hand rub following removal of apron/gloves and wipe down surfaces in contact with the patient with detergent wipes.

      *Or*

   b. **If the patient or other patients requiring transport are especially vulnerable,** e.g., immunocompromised
Section 1: Introduction


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189


