Infection Prevention and Control

MRSA and PVL *Staphylococcus aureus* Policy

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1. Introduction

Staphylococcus aureus is a bacterium that commonly lives on healthy skin. About one third of healthy people carry it quite harmlessly, usually on moist surfaces such as the nostrils, armpits and groin. This is known as colonisation. Many people may be colonised without being aware.

Meticillin resistant *Staphylococcus aureus* (MRSA) is a type of bacteria which is resistant to the antibiotic Meticillin (similar to Flucloxacillin). This makes it harder to treat with antibiotics. MRSA colonisation and infection is covered in Section 5.

The risk of soft tissue and bloodstream infection caused by MRSA is increased when there is colonisation in the presence of broken skin. This may be due to surgical wounds, skin damage, and invasive medical devices such as peripheral venous catheters or urinary catheters.

MRSA is shed on skin cells into the environment, and can survive for long periods.

Some types of *Staphylococcus aureus* produce a toxin called **Panton-Valentine Leukocidin (PVL)**. These can either be MRSA strains or strains which respond to Meticillin (MSSA). **PVL-SA** (PVL *Staphylococcus aureus*) infections have specific treatment, public health and management precautions, and are covered in Section 7.

2. Aim of the policy

- To provide health care workers (HCWs) with details of the necessary actions to minimise the risk of MRSA and PVL-SA cross-transmission in the healthcare environment
- To ensure consistency in management of MRSA and PVL-SA in healthcare settings across NHS Lothian
- To provide an MRSA screening reference

3. Key objectives

NHS Lothian will support staff to achieve the overall aims of this policy.

4. Policy scope

This policy applies to all NHS Lothian staff, in all locations, who are involved in the care, treatment and provision of services to patients.

5. Identification, Care and Management of a Patient with MRSA

5.1 Overview

Causative Organism	*Staphylococcus aureus*
Clinical Manifestation	• Patients may be colonised without any signs or symptoms. • MRSA can cause a wide range of infections • Wound, skin and soft tissue infection • Bloodstream infections • Endocarditis • Osteomyelitis
Incubation Period	Variable
Period of Infectivity	• As long as MRSA can be isolated from the patient's specimens. • Until three consecutive negative screens after undergoing a suppression regimen (whilst the patient is not on antibiotics and taken at least 24 hours apart). • Over time re-colonisation is likely to occur.
Mode of Transmission	• Direct Contact. MRSA can colonise the superficial layers of the skin and may be transferred from patient to patient via hands. Good hand hygiene with liquid soap and water or alcohol based hand rub can remove MRSA. • Indirect contact: with equipment or the environment. MRSA can be spread to the environment, often on skin scales, particularly during procedures such as bed-making and during wound dressings but can also be transmitted by inanimate objects like towels or contaminated equipment.
Reservoirs	Humans Environmental reservoirs Animals (e.g. cats may carry MRSA)
Population at Risk	Patients most at risk of colonisation • Patients who require frequent hospitalisation. • Patients admitted from care homes, institutions or another hospital or long term care facility etc. • Patients with invasive devices, skin breaks, pressure sores, underlying skin diseases or recent antibiotic therapy. Persons most at risk of infection • Patients, who are colonised, have surgical wounds, pressure ulcers or invasive devices.

	• Patients nursed in Intensive Care Units (ICU) have a higher risk of developing an infection or acquiring colonisation.
Vaccine available	No
Notifiable Disease	No (except PVL positive MRSA or PVL positive MSSA which is notifiable)

5.2 Risk Assessment

A key part of preventing infection and cross infection from MRSA is early identification along with appropriate placement and management of patients who may carry MRSA (MRSA colonisation).

There is mandatory Clinical Risk Assessment (CRA) that should be completed on all patients either on pre-admission or within 24 hours of admission.

As part of a national MRSA screening policy, all adult patients (excluding mental health, maternity, obstetrics and paediatrics) who are admitted to an acute hospital and are expected to stay overnight must be assessed for their risk of MRSA by completing a simple clinical risk assessment (CRA). This is found on Trak in the Questionnaire section

5.3 Screening

All patients admitted to high risk specialities should be screened on admission:

- Intensive Care
- Orthopaedic surgery
- Renal Medicine
- Vascular Surgery
- Cardiothoracic Surgery

In addition, in NHS Lothian, some specialities have local MRSA sampling protocols. These include:

Neonatal units

- All babies admitted to RIE (SCRH) NNU and SJH SCBU will be screened on admission by nose swab only.
- All babies in the RIE (SCRH) NNU and SJH SCBU will be screened weekly on Mondays by nose swab only. At the RIE only a list of babies screened should be provided to the lab with the batch of swabs.
- Neonates will be managed and treated in line with local protocol.

The full protocol is available at: http://rie-neo1/nnuintranet/mainframe.htm

Ophthalmology

Policy currently under development, not available on intranet at this time. Patients will have both eyes swabbed for MRSA rather than a perineal swab

Cardiothoracics

A local protocol is in place in Cardiothoracics, all patients will have MRSA screening and suppression therapy prescribed (regardless of MRSA screen result). This protocol is not currently available on the intranet.

This is not an extensive list and other areas may undertake more than the required minimum screening

ALL Elective admissions (except Maternity services) who are expected to stay for longer than 23 hours:

- Should be screened at a pre-assessment or outpatient clinic where possible, or on admission to hospital.
- If elective patients are not screened at pre-admission, they should be managed using the same protocol as emergency admissions.

All Emergency admissions (except Maternity Services, Mental Health, Paediatrics)

- Should have the CRA completed on admission, or as soon afterwards as possible within 24 hours, followed by swabbing of high risk patients.
- It is not recommended that screening is undertaken in front door areas such as Accident and Emergency.

All Patients admitted or transferred into high impact specialities (see list above) and expected to stay longer than 23 hours:

- Should have the CRA completed and should be swabbed if required as soon as possible after transfer, within 24 hours.

If the patient has previously been swabbed and the results are awaited from the laboratory, then there is no requirement to swab the patient again.

MRSA CRA:

1. Has the patient any previous history of MRSA colonisation or MRSA infection at any time in the past?
2. Has the patient been admitted from somewhere other than their own home?
3. Does the patient have a wound/ulcer or indwelling medical device which was present **before** admission to hospital?

If the answer to any of these questions is **YES** then the patient should have swabs taken from:

- nose, and

- perineum, **plus**
- If a wound or urinary catheter is present - wound swab or specimen of urine from urinary catheter.

If perineal swabs cannot be obtained, a throat swab may be taken instead. However the diagnostic effectiveness of nasal and throat swabbing is significantly lower than nasal and perineal swabbing.

If patients are unable to answer the CRA questions, then the following sources of information can be used:

1. Ward staff can review data from laboratory systems (e.g. Trak or Apex) for previous history of MRSA colonisation or infection
2. Check Trak to determine if the patient was admitted from their own home
3. Check if the patient has a Trak alert, and what it is for
4. Physical inspection for wounds and invasive devices.

5.4 How to Screen

- Explain procedure to patient.
- Provide a patient information leaflet – available on HPS website.
- Discuss any patient questions.
- Gain verbal consent prior to screening.

If it is not possible to gain patient consent for swabbing

If the patient does not have the capacity to consent, the clinician should consider whether it would be appropriate for CRA +/- screening swabs to be taken under Section 47 of the Adults with Incapacity (Scotland) Act 2000.

If so, this action should be included in their Annex 5 management plan - after consulting any Welfare Power of Attorney, or Guardian, or Person authorised under intervention order, or next of kin. This may incur a necessary delay in taking the swabs.

Equipment required for MRSA screening samples

Sterile swabs for culture in Amies charcoal transport medium (single sterile tippled applicator swab with black top/ plastic outer transport case with transport medium), or Amies transport medium; i.e. blue top swab for culture

- Laboratory request form (specimen for culture) or Trak label;
- Plastic specimen bag.

- Disposable plastic apron and non sterile clinical examination gloves (personal protective equipment –PPE).

If a patient has a productive cough a sputum sample for MRSA screening can be obtained.

Sampling for clinically suspected infection
If a patient has clinical signs of infection, please ensure appropriate samples are taken to diagnose the cause and source of the infection. A sample taken for MRSA screening and ordered through Trak for MRSA screening will only be processed for the presence or absence of MRSA.

If clinical samples are required separate specimens should be collected and investigations ordered through Trak for culture and sensitivity.

Collection procedure – standard MRSA screen

Please note that of all the body sites being swabbed, the perineum should always be collected last.

Nasal swab

- If patient has nasal discharge, request that they blow their nose into a non-scented tissue. Do not attempt to clear the discharge with swabs
- Decontaminate hands and put on clean PPE
- Open and remove sterile swab
- Taking care to avoid other contact with the swab, insert swab approximately 1-2 cm (approx ¾ inches) into the first nostril next to the nasal septum
- Rotate the swab against the anterior nasal mucosa for 3-5 seconds
- Using the same swab, repeat for the other nostril
- Place used swab back into transport tube and secure
- Remove PPE and decontaminate hands

Perineal swab

- Ask the patient to loosen their clothing;
- Decontaminate hands and put on clean PPE
- Open and remove sterile swab
- Taking care to avoid other contact with swab, rotate the swab against the perineal skin (the area between the anus and external genitalia) for 3-5 seconds
- Place used swab back into transport tube and secure.
- Remove PPE and decontaminate hands

Throat swab – if required
Throat swabs are only required if a perineal swab cannot be obtained or are specifically relevant to assessment of the patient (e.g. prior to ENT surgery). The collection procedure is as follows:

- Decontaminate hands and put on clean PPE
- Open and remove sterile swab
- Taking care to avoid other contact with swab, rotate the swab against the tonsil area and back of mouth for 3-5 seconds (this may cause the patient to gag);
- Place used swab back into transport tube and secure.

Sputum sample – if required
A sputum sample is only required if the patient has a productive cough.

- Provide the patient with a sterile container, encourage them to open this only when ready to cough and spit into it.
- Ensure the lid is secured once used

Wound swab – if required
A wound swab is only required if the patient has broken skin.

- Position the patient comfortably, ensuring that their privacy and dignity are maintained throughout.
- Decontaminate hands and put on clean PPE
- Remove the swab from the sterile packaging, taking care not to contaminate it
- If the area to be swabbed is relatively dry, the swab may be moistened using sterile sodium chloride
- Gently pass the swab over the area, ensuring minimal discomfort for the patient
- If there is exudate, ensure it thoroughly wets the swab
- Remove the top from the culture tube and place the swab inside, closing firmly
- Label with patient details and location of the wound
- Note that dressed healing post operative surgical wounds that do not exhibit signs of infection should not be disturbed or have dressings removed solely for the purposes of MRSA screening/swabbing.

Urinary Catheter Sample – if required (only if urinary catheter in situ)

- If no urine is visible in the tubing, apply a non-traumatic clamp a few centimetres distal to the sampling port
- Decontaminate hands and put on clean PPE
- Once sufficient urine has collected in the tube, wipe the sampling port with a 2% Chlorhexidine swab. Allow to dry.
- Insert a sterile syringe into the sampling port according to the manufacturer's recommendations.
- Aspirate the required amount of urine and remove syringe.
- Deposit urine into sterile specimen pot.
- Wipe the sampling port with a 2% Chlorhexidine wipe, allow to dry.
- Unclamp the catheter tubing if it has been clamped.

Collection procedure – all swabs

1. Fill in patient details as requested or affix patient label.

2. If not using a Trak label, complete the specimen request form, this should include:

a. Name;
b. Age;
c. Date of Birth;
d. CHI number if available;
e. Location (ward, pre-assessment clinic, etc.);
f. Anatomical site of swab (nasal, perineum, wound etc.), identify anatomical location of any wound swabs taken;
g. Test requested: culture and sensitivity or MRSA screening;
h. Purpose / rationale: MRSA Screening (it is important to define this clearly as a screening swab, either on the generic form or through use of a dedicated MRSA screening form);
i. Date and time sample collected;
j. Antibiotics currently prescribed;
k. Reason for admission.

3. Place swab specimens and laboratory request form in specimen bag and secure;

4. Send specimen to the local microbiology laboratory.

5.5 Patient placement:

Patients with previous MRSA positive results and patients identified as high risk MRSA from CRA

Patients with a past history of MRSA infection or colonisation are at a higher risk of remaining MRSA colonised or infected in the future even if they have undergone what appeared to be a successful suppression procedure. They should be assumed to be MRSA positive and isolated on readmission.

Previously positive patients should be isolated until 3 negative screens (performed at least 24 hours apart and off antimicrobial therapy) have been returned.

Patients admitted with clinically infected wounds are a high priority for isolation but if isolation rooms are not available the NHS Lothian Isolation Prioritisation Protocol should be used to inform an assessment of the risks of not isolating the MRSA colonised patient and the additional measures that would be required to be in place to reduce the risk of onward transmission of MRSA. The situation must be discussed during working hours with your local Infection Prevention and Control Team... Document this risk assessment in the patient notes and/or Trak.

Patient management

Patients should be isolated and cared for using appropriate transmission based precautions.

Increased cleaning of the patient environment should be implemented using Chlor-Clean twice daily, with particular focus on frequently touched areas.

Once the patient has been discharged or transferred a terminal clean should be undertaken.

5.6 Communication of MRSA status on transfer or discharge to other wards department/sites.

Prior to transfer, Healthcare Workers from the ward where the patient is nursed **must** inform the receiving ward, theatre or department of the patient's MRSA status and precautions required.

5.7 Last Offices

Infection	Is a body bag needed	Can the body be viewed	Hygienic preparation?	Embalming
MRSA; or PVL-SA	No	yes	yes	Yes

Complete an 'Infection and Contamination Control Notification Form' for all deceased patients – available via Clinical Guidance Documentation.

Further information please see Appendix 12 of the National Infection Prevention & Control Manual.

When providing care after death, all staff should apply Standard Infection Control precautions (SICPs) for any contact with the deceased or the care environment.

5.8 Suppression therapy

Steps to be taken for considering suppression therapy after identification of MRSA:

MRSA colonisation identified pre-admission:

1. Patient identified as MRSA colonised on receipt of a positive microbiology report.
2. Patient's test results sent to admitting area
3. Patient should be discussed with the consultant. If suppression therapy is required then this should be discussed with the appropriate clinician and arrangements made. Please check the antimicrobial resistance pattern of the MRSA before prescribing suppression therapy – see information below for information.
4. When the patient is admitted ensure appropriate transmission based precautions are in place (if any queries please contact the Infection Prevention and Control Team)

MRSA colonisation identified during inpatient period:

1. Patient is identified as MRSA colonised on receipt of a positive microbiology report.
2. Ensure appropriate transmission based precautions are initiated promptly (if any queries please contact the Infection Prevention and Control Team)
3. Agreement to commence suppression therapy should be obtained from the patient and clinician managing the patient;

4. MRSA positive patients should receive suppression therapy in accordance with the resistance pattern of the MRSA - please check whether MRSA is Mupirocin or Gentamicin susceptible or resistant (note this may require discussion with a microbiologist) and prescribe according to the table on page 17.
5. If the patient remains in hospital, rescreen 48 hours following completion of suppression therapy
6. If the results of the second screen are positive, further suppression therapy can be considered
7. If the patient remains in hospital, the third screening sample should be taken two days after completion of the second suppression therapy;
8. If the results from the third screening samples are positive, any plan to perform further decolonisation of the patient should be discussed with a consultant microbiologist or infectious diseases physician.
9. Discharge should not be delayed in order to complete re-screening.

Likelihood of successful suppression therapy

Patients with active infections, chronic skin lesions, tracheostomies and indwelling devices are unlikely to have their MRSA eradicated after topical suppression therapy.

Therefore suppression therapy may need to be delayed until lesions have healed or not initiated at all.

In addition, a proportion of 'successfully' decolonised patients will become re-colonised with MRSA at a later date.

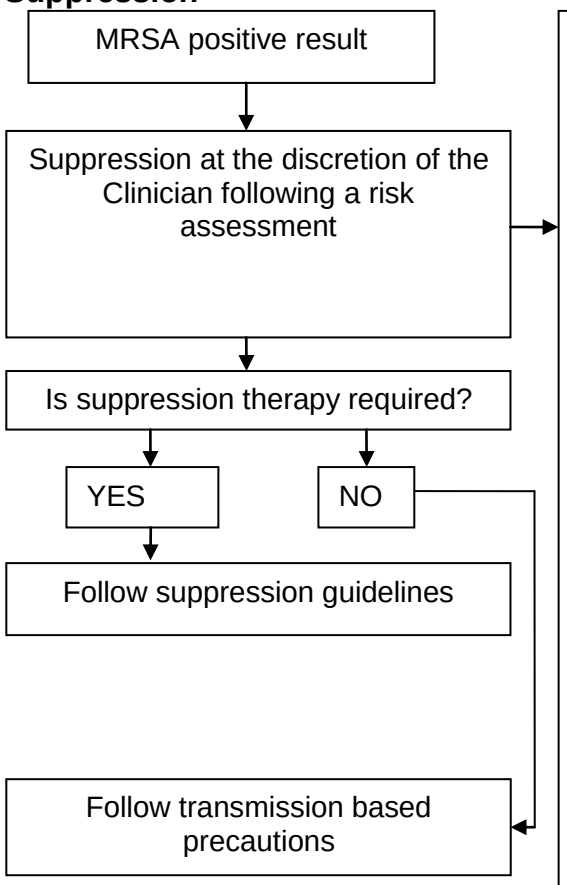
Despite these limitations it is thought that MRSA suppression therapy can reduce organism load, which may reduce the risk of MRSA infection in the patient and cross-transmission to other patients. It should be considered for all patients undergoing surgery.

Where does this suppression protocol not apply?

This protocol does not apply or may be contraindicated in the following situations:

- Mupirocin or Gentamicin resistant MRSA
- Where patients have allergic reactions to mupirocin or chlorhexidine, there are alternative products available from pharmacy – please see details below;
- Patients with dermatitis or other skin conditions may not tolerate topical antiseptics. Discuss with Microbiology and Dermatology;
- Children 13 years of age and under. Suppression therapy for children may be required but should be discussed on an individual basis with the patient's clinical team.

Suppression therapy regimen



Reasons against suppression

Suppression therapy may be complicated by the following situations:

- Mupirocin or Gentamicin resistant MRSA (see alternative regimens);
- Patients with allergic reactions to Mupirocin or Chlorhexidine; there are alternative products available from pharmacy
  Patients with skin conditions may not tolerate topical antiseptics. Discuss with dermatology.
- Children 13 years old and under.
  Suppression should be discussed on an individual basis with the patients' clinical team.

Patients with active infections, chronic skin lesions, urinary catheters, tracheostomies, long lines or other medical devices are unlikely to have their MRSA eradicated after topical suppression.

In addition, a proportion of 'successfully' MRSA suppressed patients will relapse.

Reasons supporting suppression

MRSA suppression can reduce organism load, which in turn may reduce the risk of MRSA infection in the patient and reduce the risk of transferring MRSA to other patients.

Should be considered for all patients undergoing surgery.

MRSA Suppression regimen (Mupirocin Susceptible isolates)

The following combination of topical agents for 5 days is recommended:

(a) Nose

Mupirocin 2% nasal ointment applied to the inner surface of each nostril (anterior nares) three times daily for 5 days. The patient should be able to taste Mupirocin at the back of the throat after application.

(b) Body

Chlorhexidine gluconate 4% (Hibiscrub) solution as soap / shampoo substitute once daily for 5 days. Chlorhexidine solution must be kept in contact with the skin for at least 30 seconds and should be used as a shampoo at least twice in the 5 days. The skin should be moistened and the antiseptic solution applied thoroughly to all parts of the skin with a disposable cloth or flannel before rinsing in a bath or shower. An emollient and/or hair conditioner may be used if skin drying occurs. Do not dilute in bath water, as the concentration would be insufficient.

Please note: MRSA screens undertaken whilst a patient is on antibiotics may give false negative results; therefore screening should be undertaken 48 hours after completion of antibiotics.

Suppression therapy involves the use of topical medications to reduce MRSA colonisation, please see section 6 quick reference guide.

- Patients who have been identified as MRSA positive should be isolated or cohorted where possible and suppression therapy should be considered by their clinician.
- Patient information leaflets should be provided upon MRSA positive result as appropriate to allow the patient or significant other an opportunity to discuss any queries they may have. Patient information leaflets are available at: http://intranet.lothian.scot.nhs.uk/Directory/InfectionPreventionAndControl/Printables/MRSA%20PIL.pdf
- The aim of suppression therapy is to reduce the burden of MRSA carried by the patient and reduce the likelihood of cross transmission of MRSA from patient to patient.
- Suppression therapy will not necessarily eradicate the MRSA.
- All patients identified as MRSA positive by screening should be considered for suppression therapy.
- The clinical team responsible for the patient should undertake a risk assessment prior to attempting MRSA suppression therapy.

Management of MRSA positive patients undergoing surgery

- Patients may start the decolonisation / suppression regimen without delaying surgery. This should ideally take place in the five days prior to the operation.
- For high risk operations and when surgery is not urgent, decolonisation with follow-up re-screening may be attempted with the aim of eradicating MRSA carriage prior to surgery. This will take longer.
- In either case the consultant surgeon should consider the risks and benefits involved, and determine the best course of action in discussion with the patient.

Alternatives for patients with intolerance or allergy to Chlorhexidine

Chlorhexidine intolerance due to excessive drying of the skin / skin irritation is not uncommon. Advice may be sought from Dermatology to get the skin back to optimum condition.

Mupirocin Sensitive MRSA	• Mupirocin 2% nasal ointment to nostrils three times daily for 5 days • Chlorhexidine Gluconate 4%solution as a body wash in bath/shower daily for 5 days • Chlorhexidine Gluconate 4% solution as a shampoo on days 1 and 4
Treatment for patients with damaged/broken skin	• Mupirocin 2% nasal ointment to nostrils three times daily for 5 days • Discussion with Dermatology and Microbiology Octenidine (Octenisan) is a suitable alternative to Chlorhexidine body wash where the patient is intolerant to Chlorhexidine. Available from Pharmacy please discuss with Pharmacist and or Microbiologist for how to use
Mupirocin resistant MRSA	• Neomycin may be used for Mupirocin resistant MRSA if the isolate is susceptible to Gentamicin.
Mupirocin and Neomycin/Gentamicin Resistant MRSA	For Mupriocin and Neomycin/Gentamicin resistant MRSA Prontoderm may be used Available from Pharmacy Please discuss with Pharmacist and/or Microbiologist for how to use

Patient Group Directive: Information on products and usage are available on the Medicines Management section of the intranet under Patient Group Directions;

Chlorhexidine gluconate body wash - MRSA Suppression

Mupirocin nasal ointment - MRSA Suppression

Failed MRSA suppression therapy
If suppression therapy fails, it is reasonable to perform a second or third course.

Subsequent courses are not recommended because of the low rate of success and the increased risk of developing resistance to the agents used.

Questions regarding MRSA screening or suppression therapy should be directed during working hours to the local Infection Prevention and Control Team.

5.9 Treatment of infection

Antimicrobial guidance is available on the intranet: http://intranet.lothian.scot.nhs.uk/NHSLothian/Healthcare/A-Z/amt/AntimicrobialGuidelines/Pages/default.aspx.

For UK guidance regarding treatment of MRSA infection consult:

- Guidelines for UK practice for the diagnosis and management of meticillin-resistant Staphylococcus aureus (MRSA) infections presenting in the community. (2008) http://jac.oxfordjournals.org/content/61/5/976.full.pdf+html
- Guidelines for the prophylaxis and treatment of meticillin-resistant Staphylococcus aureus (MRSA) infections in the UK. (2006). http://jac.oxfordjournals.org/content/57/4/589.full.pdf+html

Antibiotic prophylaxis in surgical patients

- Please refer to local guidelines for antibiotic prophylaxis in MRSA positive patients.
- Patients undergoing surgery who have had their MRSA successfully eradicated should still receive antibiotic prophylaxis as if MRSA positive to cover the risk of relapse.
- Systemic antibiotic therapy is appropriate when treating *infection* caused by MRSA, but should not be prescribed to *decolonise* patients without advice from a microbiologist.

Guidance can be found on the Antimicrobial Management Team website.

PVL-*S. aureus* infection treatment

- Health Protection Network (2014) Interim Advice for the Diagnosis and Management of PVL-associated *Staphylococcus aureus* infections (PVL-*S. aureus).* http://www.documents.hps.scot.nhs.uk/about-hps/hpn/pvl-guidance.pdf.

If advice regarding the clinical management of MRSA infection is still required it may be obtained from a medical microbiologist or infectious diseases physician.

6. Quick Reference Guide: MRSA

Organism:	Meticillin resistant *Staphylococcus aureus* (MRSA)
Signs & symptoms:	Patients may be colonised without any signs of infection. MRSA can cause a wide range of infections, e.g. wound infections, soft tissue infections, insertion site infections, bloodstream infections, endocarditis and osteomyelitis.
Transmission (spread):	Contact (direct and indirect) - MRSA is transmitted by direct skin-to-skin contact or contact with shared items or surfaces
Person to person spread possible?	Yes
Incubation period:	Variable
People most at risk:	Patients most at risk of acquisition • Patients who require frequent hospitalisation or who have been admitted from care homes/institutional setting or another hospital. • Patients with invasive devices, skin breaks, pressure sores, underlying diseases or recent antibiotic therapy. Persons most at risk of infection • Patients, who are colonised, have surgical wounds, pressure ulcers or invasive devices. Patients nursed in Intensive Care Units (ICU) have a higher risk of developing infection.
Treatment	Possible treatment options can be found in the relevant NHS Lothian antibiotic prescribing guidance found on Microguide or on the NHS Lothian intranet.
Suppression therapy	The decision to attempt MRSA suppression lies with the clinical team responsible for the patient. • For suppression regimens see section 5.8 • Change bed linen, nightwear and towels daily.
Key management & control measures (MUST DO'S):	• Complete the MRSA Clinical Risk Assessment (CRA) and follow national guidance for MRSA screening • Continue to apply Standard Infection Control Precautions (SICPS). Particular attention should be given to hand hygiene and use of PPE. • For confirmed MRSA cases implement Contact Transmission Based Precautions (TBP's), that is: o Isolate patient o Provide dedicated equipment o Enhanced cleaning of environment and equipment (ChlorClean 1000ppm) • Increase frequency of cleaning to twice daily - If isolation is not possible, refer to the NHS Lothian Isolation Prioritisation Policy and risk assess whether the patient can be managed safely out of isolation. Please discuss with the Infection Prevention and Control Team. • Document the risk assessment in the patient's notes.

	• Provide an: MRSA leaflet • Provide: wash your clothes at home leaflet

7. Panton Valentine Leukocidin (PVL) toxin producing *Staphylococcus aureus*

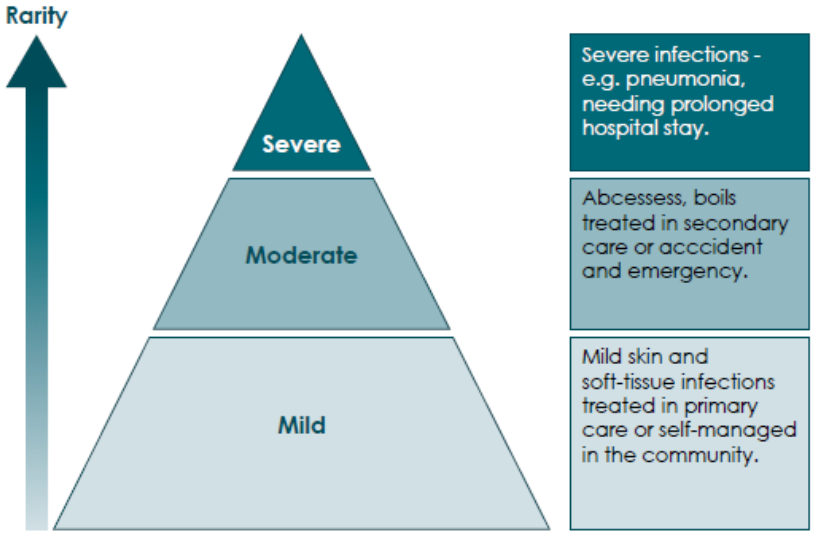
Staphylococcus aureus is a bacterium that commonly lives on healthy skin. About one third of healthy people carry it quite harmlessly, usually on moist surfaces such as the nostrils, armpits and groin. This is known as colonisation.

Some types of *Staphylococcus aureus* produce a toxin called Panton-Valentine Leukocidin (PVL) and they are known as PVL *Staphylococcus aureus*. PVL can also occur in MRSA.

Causative Organism	Panton-Valentine Leukocidin (PVL) *Staphylococcus aureus (PVL-SA)* Can be PVL-MRSA or PVL-SA
Clinical Manifestation	Commonly: • boils or skin abscesses (ranging from mild to severe – may be recurrent) • pneumonia (necrotising pneumonia) • blood stream infection (bacteraemia) • joint and bone infections (osteomyelitis) This can range from mild to life threatening.
Incubation Period	Variable
Period of Infectivity	• As long as PVL producing *Staphylococcus aureus* can be isolated from the patient's specimens. • PVL *Staphylococcus aureus* carried on your skin may be eliminated with a five day skin treatment (see MRSA suppression – section 5.8). • Suppression therapy is undertaken to reduce the chances of getting repeated infections and reduce the chances of spreading PVL *Staphylococcus aureus* to others.
Mode of Transmission	PVL producing *Staphylococcus aureus* is much more transmissible than *Staphylococcus aureus* that do not produce PVL. Discovery of secondary cases is common on identifying a carrier. Anyone can get a PVL *Staphylococcus aureus* infection. Infection can occur in fit, healthy people. PVL *Staphylococcus aureus* can be picked up by having: • skin-to-skin contact with someone who is already infected, for example close family or during contact sports, or

	• Contact with an item or surface that has PVL *Staphylococcus aureus* on it from someone else, for example shared gym equipment, shared razors, shared towels. • It is important that fluid or pus from infected skin is contained, because it has large numbers of PVL *Staphylococcus aureus* that can spread to others.
Reservoirs	Humans Pets Environment
Population at Risk	The following settings have a higher transmission risk from a colonised or infected individual: • household and sexual contacts; • contacts sports settings - e.g. rugby, judo, wrestling • closed community settings: - e.g. military camps, boarding schools, prisons; • care homes and healthcare settings (hospital wards) • household of close contact of a confirmed case
Vaccine	No
Notifiable organism	Yes

FIGURE 1: Clinical iceberg of Panton-Valentine leucocidin-associated infection - with permission from Shallcross LJ *et al* (2013)



(HPN, 2014, p5)

7.1 Treatment:

How is PVL *Staphylococcus aureus* treated?

- Boils and abscesses should be drained by incision by a doctor or nurse.
- Active infections should be treated with a course of antibiotics.
- In addition, the PVL *Staphylococcus aureus* carried on your skin may be eliminated with a five day skin treatment.

The Health protection Team will follow up community contacts as required.

Indications	Antimicrobial Choice	Comments
Non-suppurative minor skin and soft tissue. Including furnculosis, folliculitis, small abscesses/boils without cellulitis. PVL MRSA not suspected.	Flucloxacillin (orally if required)	Does not need systemic antibiotic treatment unless the patient is immunocompromised or deteriorating clinically. Incision and drainage is the optimal management for abscesses. Lesions should be covered. Advise good personal hygiene, in particular hand washing. Avoid sharing towels, cloths, personal care items. Patients should be advised to return to GP if the lesions not resolve or there is clinical deterioration.
Moderate infections including cellulitis and larger abscesses (especially >5cm). PVL MRSA not suspected.	Flucloxacillin Clindamycin Doxycycline Cotrimoxazole may also be used for penicillin allergic patients.	Incision and drainage is the optimal management for abscesses. Note *C. difficile* risk with use of clindamycin Review with laboratory antibiotic results when available.
PVL-MRSA suspected but not confirmed & hospital admission is not warranted.	Doxycycline (not for <12y) Rifampicin **&** Sodium Fusidate **OR** Trimethoprim Clindamycin	Resistance to Rifampicin and Fusidic acid may develop during treatment and these should not be used as single agents. Review with laboratory antibiotic results when available. Linezolid may be available on advice from local microbiologist or infectious disease doctor.
PVL-MRSA confirmed	Treatment guided by antimicrobial	Provide information to the patient – see Appendix 3.

Indications	Antimicrobial Choice	Comments
	susceptibility tests.	
Severe Infections with features of toxic shock, necortising fasciitis or purpura fulminans. Seek specialist advice from microbiology and surgical specialities as appropriate.	Refer to hospital. There may be a theoretical case for including two agents such as these agents to suppress toxin production; Linezolid combined with Clindamycin (high dose).	Treatment should be continued for 10-14 days until the patient has improved and is clinically stable. Seek specialist advice from microbiology or infectious diseases tam. Consult BNF for details on use of these antibiotics. **Early surgical debridement of infected tissue where appropriate.** Evidence from in-vitro synergy and the ability of linezolid and clindamycin to suppress PVL and alpha toxin production. Consider use of IV immunoglobulin using local protocols. Although antibactericidal there are concerns that concentrations just above the minimum inhibitory concentration (likely with poor penetration into necrotic tissue) flucloxacillin may increase PVL production as it does in-vitro (Stevens et al, 2007). **Intravenous flucloxacillin is not recommended**, even in combination with agents such as rifampicin or clindamycin.
Suspected community acquired PVL-related pneumonia Note: Standard empiric antimicrobial cover for non staphylococcal pathogens may be required until microbiology results are available	Start empiric antibiotics covering MRSA; Linezolid and high dose clindamycin. And if deteriorating or feartures of severe disease (e.g. septic shock) add IVIG 2g/kg + rifampicin 600mg/bd.	**Continue empiric antibiotic therapy for 48-72 hours or until culture results are available when targeted therapy can be consolidated;** Seek advice from local microbiologist or infectious disease doctors. There is evidence that the use of rifampicin and linezolid combined may reduce blood concentration of linezolid. **If no clinical improvements and increasing failure to ventilate;** Exclude complications (e.g. abscess, empyema) and no infections – consider second dose of IVIG. Re-evaluate for infection with antibiotic-resistant pathogen not covered by initial antimicrobial regimen.
Deep-seated	Seek specialist	Seek specialist advice.

Indications	Antimicrobial Choice	Comments
infections (e.g. osteomyelitis/ discitis)	advice	

HPN (2014), p11-13.

7.2 Suppression therapy

The aims of a topical suppression therapy include:

- reducing bacterial load
- managing hospital outbreaks where recurrent infections in different patients have occurred
- reducing the risk of infection in close contacts (household or sexual) when a case of necrotising pneumonia has been diagnosed (start without delay);
- Interrupting transmission during clusters or outbreaks in 'closed' communities.
- reducing risk of onward transmission (e.g. healthcare workers and those in closed communities).

Suppression therapy in neonates and children,

- Suppression therapy is more difficult and it is not standardised and should be discussed with the Infection Prevention and Control, or a clinician with experience in PVL MRSA or PVL SA management in neonates and children. .
- When required, nasal mupirocin (if the isolate is susceptible) or chlorhexidine may be used.
- Octenisan is an alternative to chlorhexidine, but this has a cosmetic licence and requires an individual risk assessment as the company cannot recommend its use in children under 3 years.
- Octenisan requires a contact time of at least one minute and may cause a temperature drop in neonates.

This treatment should not be used if there are any boils or skin lesions that are still active.

In patients with dermatological conditions it is important to seek dermatological opinions, if there are ongoing issues with skin integrity

The need for rescreening post suppression therapy should be based on local MRSA screening protocols. It may be appropriate for those patients who are vulnerable to infection (e.g. dialysis patients) or those who pose a risk of onward transmission (healthcare workers, those in closed communities).

Suppression therapy may not be successful and re-colonisation can occur.

For suppression therapy prescription information, please see section 5.8.

7.3 Healthcare Workers

Healthcare workers should contact Occupational Health if they have a suspected or known PVL positive MRSA or MSSA result. Outbreaks of infections involving healthcare workers have occurred (Thuong *et al.,* 2007).

7.4 PVL Outbreaks

If patients acquire a PVL infection in hospital, a Problem Assessment Group should be held which will include an investigation undertaken by the Infection Prevention and Control Team and implementation of appropriate control measures (as per quick reference guide – section 8).

If there are linked cases suggesting an outbreak or cross infection an Incident Management Team should be called as per Outbreak Management Guidance.

Screening of contacts and suppression therapy should be undertaken. This may include staff contacts after discussion with the Occupational Health Service since staff may be at risk of acquisition and can be a key link in PVL transmission. The staff screening policy is available through the HR Online website.

8.0 Quick Reference Guide: PVL

Organism:	Panton-Valentine Leukocidin (PVL) *Staphylococcus aureus*
Signs & symptoms:	Can be boils or skin abscesses and are occasionally associated with more serious infections of the lungs, blood, joints and bones.
Transmission (spread):	Contact (direct and indirect) – PVL *Staphylococcus aureus* is transmitted by direct skin-to-skin contact or contact with shared items or surfaces
Person to person spread possible?	Yes
Incubation period:	Variable
People most at risk:	The following settings have a higher transmission risk from a colonised or infected individual: • household and sexual contacts; • contacts in social/sports settings - e.g. rugby, judo, football • closed community settings: - e.g. military camps, boarding schools, prisons; • Care homes and healthcare settings (hospital wards).
Treatment	Treatment options can be found at http://www.documents.hps.scot.nhs.uk/about-hps/hpn/pvl-guidance.pdf
Suppression therapy	The decision to attempt PVL suppression therapy lies with the clinical team responsible for the patient and is determined by the antimicrobial susceptibility of the isolate. . • See section 5.8
Key management & control measures (MUST DO'S):	• For confirmed or suspected PVL *Staphylococcus aureus cases* implement Transmission Based Precautions (TBP's). • Patients with PVL *Staphylococcus aureus* MUST be isolated. • Hand hygiene – with alcohol based hand rub or soap and water. • Use appropriate personal protective equipment i.e. gloves, apron and use appropriate respiratory precautions if there is pneumonia. • Infected areas should be covered with clean, dry dressings or plasters and changed regularly and as soon as discharge seeps to the surface. • Dedicated patient equipment i.e. blood pressure cuff, thermometer, stethoscope etc. • Increased cleaning of the patient environment should be implemented using Chlor-Clean twice daily, with particular focus on high touch areas. • Treat all linen as infected and change daily. • Provide washing clothes at home leaflet • If an outbreak is suspected the Infection Prevention and Control Team will review.

9. References & Further Reading

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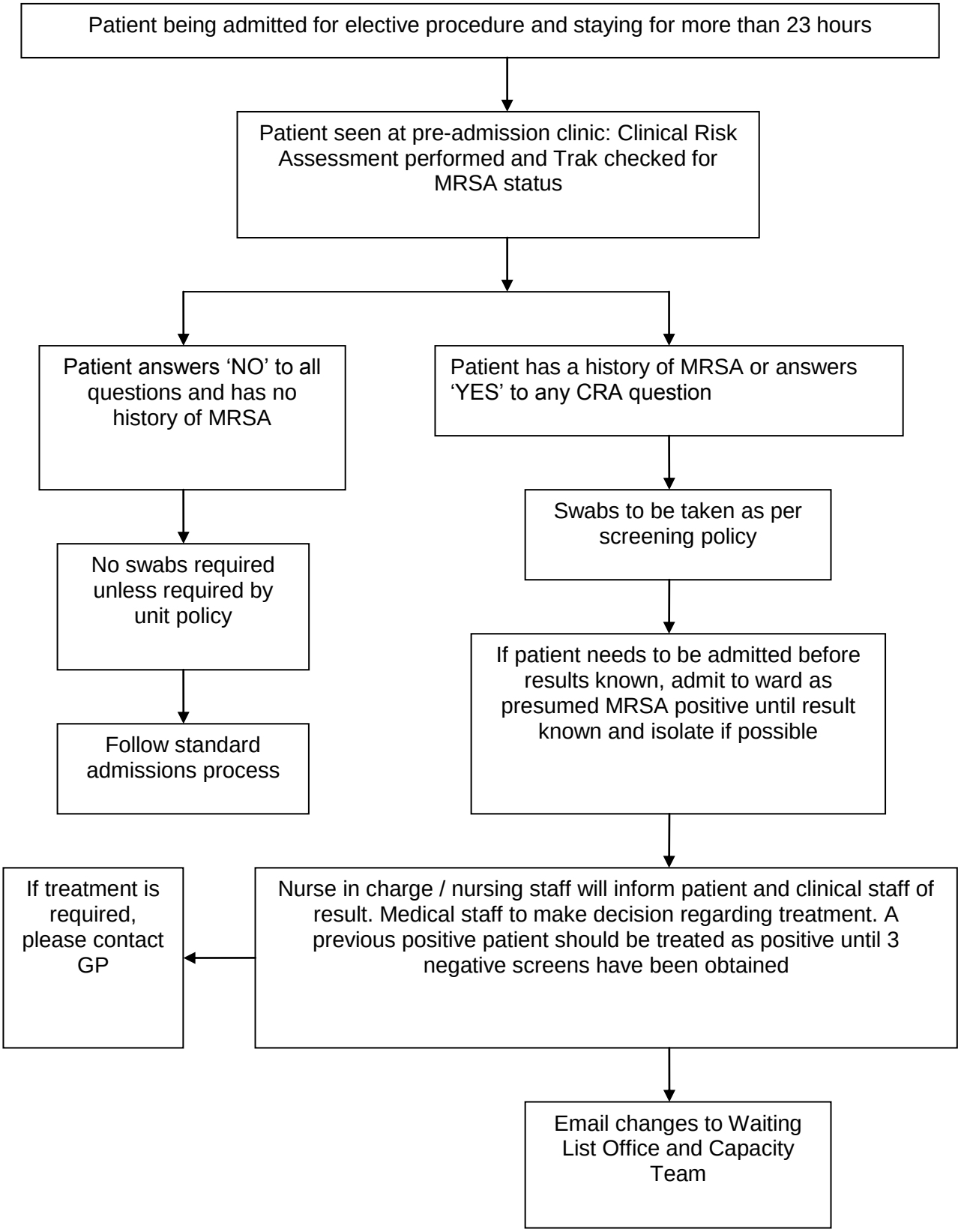
Appendix 1: MRSA Screening Pre-admission Flowchart



Appendix 2: MRSA Screening Admission and Transfer Flowchart